Rialtas na hÉireann
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Heating and Domestic Hot Water Systems for Dwellings – Achieving compliance with Part L & Energy Performance of Buildings Regulations 2019

Prepared by the Department of Housing, Planning and Local Government and the Sustainable Energy Authority of Ireland

housing.gov.ie

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1. Introduction

Part L of the Building Regulations is concerned with the conservation of fuel and energy in dwellings. Part L for dwellings, is supported by a Technical Guidance Document (TGD) L Dwellings 2019 which gives guidance on how to satisfy the energy performance provisions of the Building Regulations for new and existing dwellings.

The TGD quotes the regulatory requirements where relevant. These provisions are distinguished in the text by a grey background. In cases of doubt, however, it may be necessary to refer directly to the Building Regulations as amended.

The TGD was published in 2019 in support of the amendments to the Building Regulations, Statutory Instrument (S.I. No. 292 of 2019) and in support of the application of the European Union (Energy Performance of Buildings) Regulations 2019 (S.I. No 183 of 2019). Both S.I. came into force on 1st November 2019.

This guide covers conventional means of providing primary and secondary space heating and domestic hot water for dwellings in Ireland. This guide is the supporting document referred to in Building Regulations TGD L & Energy Performance of Buildings Regulations 2019 Dwellings Par 1.4.2.4 as a source of guidance on the means of complying with the requirements of the Building Regulations for space heating systems and hot water systems. The guide was prepared in consultation with relevant industry bodies.

The co-operation of the UK authorities (Department of Communities and Local Government) is gratefully acknowledged in allowing the use of the information in its publication “Domestic Heating Compliance Guide” for official use in Ireland.

For new dwelling requirements in Part L of the Building Regulations 2019, guidance is provided on the design limits for building services systems referred to in Section 1 of Building Regulations 2019 TGD L- Dwellings. For existing dwellings, guidance is provided on reasonable provision for the installation or replacement of controlled services as referred to in Section 2 of Building Regulations 2019 TGD L-Dwellings.

This supporting document identifies standards of provision that meet the guidance for systems in new build and in those in existing buildings when work is being undertaken. The levels of performance for new and existing dwellings differ only where practical constraints arise in existing dwellings while it is recognized that the guide covers a range of frequently occurring situations but alternative means of achieving compliance may be possible. The status of alternative provisions is explained in the ‘The Guidance’ section at the front of the Technical Guidance Documents.

This guide also references publications which include information on good practice for design and installation over and above the minimum regulatory provision.

1.1 How to use this guide

This guide covers compliance with the requirements of the Building Regulations 2019, Part L for conventional space heating systems and hot water service systems in dwellings.

The guide comprises four self-contained fuel-based sections, and five specialist technology-specific sections. Each fuel-based section addresses all the requirements applicable to primary and secondary space heating and hot water service technologies for the particular fuel. The specialist technology-specific sections provide further guidance on the minimum provisions for particular specialised space heating and hot water service technologies. The structure of the guide is illustrated in Figure 1 and is as follows:

Fuel-based sections:

- Section 2 Gas-fired primary and secondary space heating and hot water service
- Section 3 Oil-fired primary and secondary space heating and hot water service
- Section 4 Electric primary and secondary space heating and hot water service
- Section 5 Solid-fuel primary and secondary space heating and hot water service

Specialist technology-specific sections:

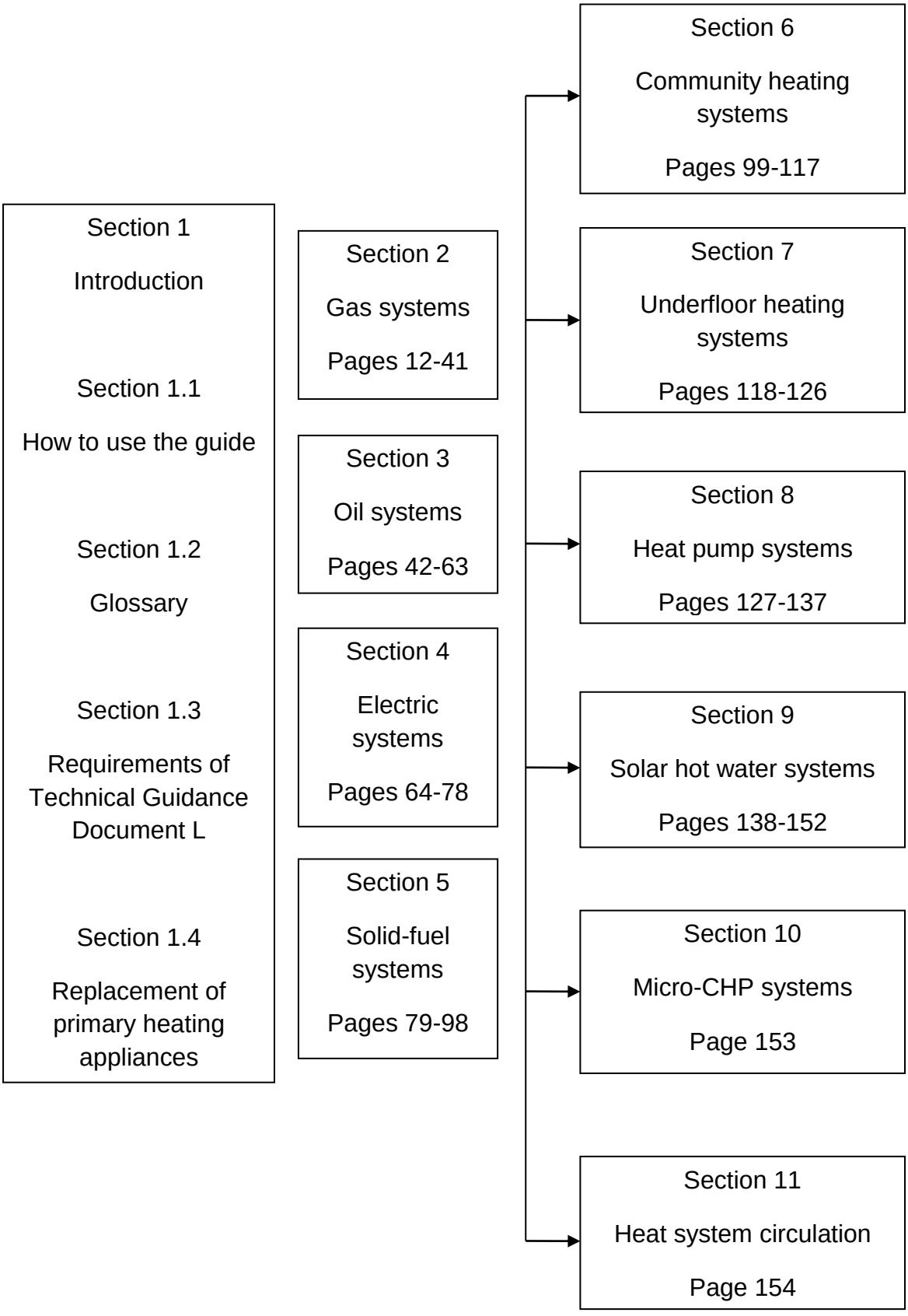
- Section 6 Community heating
- Section 7 Underfloor heating
- Section 8 Heat pumps
- Section 9 Solar water heating
- Section 10 Micro-CHP (Combined Heat and Power)

For any particular application, the relevant fuel-based section and/or specialist technology-specific section must be read in conjunction with all elements of this introduction section:

- 1. Introduction
- 1.1 How to use this guide
- 1.2 Glossary
- 1.3 The Building Regulations 2019 requirements and the guidance in Technical Guidance Document L – Dwellings 2019
- 1.4 Replacement of primary heating appliances

For each type of space heating or hot water service system, guidance on the minimum provisions needed to comply with Part L is supported by commentaries in ‘Supplementary information’. They are useful when interpreting the minimum provisions and, in some cases, provide links to best practice guidance. They do not specify minimum provisions.

Figure 1 How to use Heating and Domestic Hot Water Systems for Dwellings- Achieving Compliance with Part L 2019



1.2 Glossary

DEAP	An acronym for Dwelling Energy Assessment Procedure, which is the national methodology for calculating the energy rating of dwellings
Minimum provision	In this document 'minimum provision' refers to the provisions needed to demonstrate compliance of space heating and hot water service systems installed in dwellings with the Building Regulations 2019 energy efficiency requirements.
Supplementary information	The commentaries labelled 'Supplementary information' may be useful when interpreting the minimum provisions and, in some cases, provide links to best practice guidance.
Technical Guidance Document L (TGD L)	Section 1 of TGD L Dwellings 2019 gives guidance on how to satisfy the Building Regulations energy efficiency requirements when building new dwellings. Effective from 1st November 2019. Section 2 of TGD L Dwellings 2019 gives guidance on how to satisfy the Building Regulations energy efficiency requirements when carrying out work in existing dwellings. Effective from 1st November 2019.
The Building Regulations	S.I. No. 497 of 1997 as amended by the Building Regulations (Part L Amendment) Regulations (S.I. No. 183 of 2019) ensure: the health, safety, welfare and convenience of people in and around buildings and reasonable provision for the conservation of fuel and power and access to and use of buildings by providing functional requirements for building design and construction and

	ensure: - the application of a methodology for the calculation of the energy performance of buildings on the basis of the general framework set out in Annex I to the EPBD (recast); - the setting of minimum energy performance requirements for buildings and the application of these requirements to new buildings to achieve Nearly Zero Energy Buildings; - that when dwellings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet the minimum energy performance requirements set in accordance with Article 4 in so far as this is technically, functionally and economically feasible.

1.3 The 2019 Building Regulations requirements and the guidance in TGD L Dwellings 2019, Sections 1 and 2

The Building Regulations relevant to the Conservation of Fuel and Energy in Dwellings are repeated for easy reference at the front of TGD L Dwellings 2019 in the 'Guidance Section', which can be viewed on https://www.housing.gov.ie/.

For new dwellings the provision of heating and hot water services systems has to be considered as part of the overall design of the building. For heating and hot water services systems works in existing dwellings provision can be considered in isolation. Both sections of the TGD L Dwellings 2019 refer to this publication as the source of detailed guidance on reasonable provision.

1.4 Replacement of primary heating appliances

In order to comply with these requirements, **replacement appliances** providing primary space heating and/or hot water in existing dwellings should meet the following conditions:

- Oil or gas boilers installed as replacements in existing dwellings should have a minimum seasonal efficiency of 90%, where practicable.
- For fully pumped hot water-based central heating systems utilising heat pumps, the seasonal space heating energy efficiency should not be less than the minimum requirement in accordance with Ecodesign regulations.
- Replacement storage heaters should have a heat retention not less than 45% measured according to I.S. EN 60531:2000.
- For fully pumped hot water-based central heating systems utilising a biomass independent boiler, the boiler seasonal efficiency should be not less than 77% as specified in the DEAP manual and the associated HARP database maintained by SEAI (www.seai.ie/harp).

Space heating systems should be effectively controlled so as to ensure the efficient use of energy by limiting the provision of heat energy use to that required to satisfy user requirements, insofar as is reasonably practicable. The aim should be to provide the following minimum level of control:

- Automatic control of space heating on the basis of room temperature, e.g. room thermostat, thermostatic radiator valves;
- Separate and independent automatic time control of space heating and hot water, and
- Shut down of boiler or other heat source when there is no demand for space (or water) heating from that source, e.g. boiler interlock.

Controls for replacement heat pumps should be the same as for new heat pumps.

2. Gas-fired space heating and hot water systems

This section provides guidance on the specification of gas-fired space heating and hot water systems in dwellings.

All gas appliances should be installed by a competent person and in accordance with I.S. 813:2014 and CER Criteria document "**The Regulation of Gas Installers With Respect To Safety**". All installers of gas appliances must be a registered gas installer. The installation should be carried out to the manufacturer's instructions and should comply with all other relevant parts of the Building Regulations and, for wet systems, local authority guidelines.

2.1 Scope of guidance

The guidance in this section applies to systems fuelled by natural gas and liquid petroleum gas (LPG); any requirements specific to either fuel type are identified.

The following types of gas-fired heating systems are addressed:

- Wet central heating systems.
- Range cookers with integral central heating boilers.
- Warm air heating systems.
- Fixed independent space heating devices.

Where appropriate, it may be necessary to refer to other sections in this guide covering community heating, underfloor heating, heat pumps, solar water heating and micro-CHP.

2.2 Key terms

Flue gas heat recovery	means a device which pre-heats the domestic hot water supply by recovering heat from the boiler's flue emissions.
Weather compensation	means a control function which maintains internal temperatures by varying the flow temperature from the heat generator relative to the measured outside air temperature.
Load compensation	means a control function which maintains internal temperatures by varying the flow temperature from the heat generator relative to the measured response of the heating system.
Automation	means a control function which automatically adjusts time and temperature settings based on occupancy detection and/or stored data from user adjustments over time.
Optimisation	means a control function which starts the boiler operation at the optimum time to achieve the set point temperature at the start of the occupancy period.

2.3 Gas-fired wet central heating systems

This section provides guidance on the specification of gas-fired wet central heating systems for dwellings that, if followed, will satisfy the energy efficiency requirements of the Building Regulations 2019.

Terminology and applicability of guidance to different scenarios in new and existing dwellings

The guidance in this section applies to the following situations:

a) The specification of central heating systems in new dwellings – this situation is referred to in this section as a **new system**.

b) The specification of central heating systems in existing dwellings where previously space heating was not provided by central heating – this situation is also referred to in this section as a **new system**

c) The specification of a replacement central heating system and/or component in existing dwellings where central heating is already installed – this situation is referred to in this section as a **replacement system**.

In situations (a) and (b) above, the guidance for compliance of **new systems** (in new and existing dwellings) with Part L 2019 is the same.

In situation (c) above that is for replacement systems in existing dwellings, the guidance for compliance with Part L 2019 is as for **new systems**, unless otherwise stated in the relevant section.

Gas-fired central heating systems which are provided as **new systems** or **replacement systems** in dwellings should meet the following conditions:

a) The boiler should have a minimum efficiency (as defined by its HARP value) as given in Table 1 (row a).

AND

b) The minimum provisions for system circulation as given in Table 1 (row b) need to be met.

AND

c) The minimum provisions for hot water storage and labelling of storage vessels as given in Table 1 (row c) need to be met.

AND

d) The minimum provisions for system preparation and water treatment as given in Table 1 (row d) should be met.

AND

e) The system should be commissioned in accordance with the minimum provisions given in Table 1 (row e).

AND

f) The minimum provisions for boiler interlock, zoning and time control and temperature control of the heating and hot water service circuits as described in Table 2 should be met. An acceptable alternative to these is any boiler management system that delivers the specified zoning, timing and temperature and boiler interlock control provisions. When gas boilers are installed as part of a **replacement system**, the minimum level of system controls should be provided, as described in Table 2, unless they are already installed and fully operational. If an individual component of the control system is being replaced in an existing system, for example a room thermostat, it is not necessary to upgrade the system to meet the minimum requirements.

AND

g) Pipework should be insulated as described in Table 3.

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate)			
	Minimum provision for new systems in existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
a. Minimum acceptable efficiency	a. The boiler efficiency should be not less than 90% (HARP value). b. The boiler ErP efficiency for boilers installed in existing dwellings should not be less than 90% (HARP value). c. The boiler efficiency for heating boilers that are combined with range cookers should be as defined in the section of this guide 'Section 2.3 Gas-fired range cookers with integral central heating boilers' of this guide.	The seasonal efficiency of the new equipment should be as defined for **new systems** where practicable.	**Guidance on identifying the HARP efficiency for an appliance** The Heating Appliance Register of Performance Database is available online (www.seai.ie) and includes regularly updated information on most available boilers as well as many which are no longer in production. **Appendix 1** gives the approved procedure for establishing where exceptional circumstances exist. This follows the criteria set out in the Guide to the Condensing Boiler Installation Assessment Procedure for Existing Dwellings. Systems with condensing boilers should be designed to have low primary return water temperatures, preferably less than 55°C, to maximise condensing operation. Low return water temperatures can be obtained through techniques such as weather compensation and the use of low temperature heat emitters (for example correctly-sized radiators and underfloor heating elements). See Appendix B. Low temperature heat emitters will also be compatible with low temperature heat generators, such as heat pumps, that might be installed as replacements in the future.

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate (continued)			
	Minimum provision for new systems in existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
b. System circulation	a. Systems for space heating and domestic hot water primary circuits should have fully pumped circulation b. If the boiler manufacturer's instructions advise installation of a bypass, an automatic bypass valve should be provided in conjunction with any requirements for a minimum pipe length specified in the manufacturer's instructions	As defined for **new systems**. When boilers are replaced, existing systems with semi-gravity circulation should be converted to fully pumped circulation.	

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
c. Hot water storage	• Vented copper hot water storage vessels should comply with the heat loss and heat exchanger requirements of BS 1566-1:2002+A1:2011 • Unvented hot water storage systems products should: o comply with I.S. EN 12897:2016; or o be certified by the Irish Agrément Board; or o be certified by another accredited body as complying with Building Regulations	As defined for **new systems.**	**Insulation of primary stores** Because of the higher than normal storage temperatures in primary stores it is very important that these are well insulated **Standards** BS 1566-1: 2002+A1:2011 Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods I.S. EN 12897:2016 Water supply. Specification for indirectly heated unvented (closed) storage water heaters BS 3198:1981 Copper hot water storage combination units for domestic purposes

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	• Standing heat losses should be restricted as defined in TGD-L sections 1.4.4 for new dwellings and 2.2.4 for existing dwellings. • All hot water storage vessels should carry a label with the following information: o type of vessel (vented, unvented, combination unit or thermal store); o nominal capacity in litres; o standing heat loss in kWh/day;	As defined for **new systems.**	

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	○ heat exchanger performance in kW; ○ vented copper hot water cylinders should carry clear labelling on the product; ○ reference to product compliance with relevant standard (e.g. BS 1566-1:2002+A1:2011, I.S. EN 12897:2016) and logos of accreditation bodies as required; ○ vented cylinders which are not of copper construction should be labelled as complying with the heat loss and heat exchanger requirements of BS1566-1:2002+A1:2011.		

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
d. System preparation and water treatment	a. Central heating systems should be thoroughly cleaned and flushed out before installing a new boiler. b. During final filling of the system, a chemical water treatment formulation should be added to the primary circuit to control corrosion and the formation of scale and sludge. Reasonable provision would be to follow the guidance on how to prepare and commission systems given in BS 7593:2019. c. Installers should also refer to the boiler manufacturer's installation instructions for appropriate treatment products and special requirements for individual boiler models.	As defined for **new systems.**	**Standards** BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems Limescale can be controlled by the use of chemical limescale inhibitors, combined corrosion and limescale inhibitors, polyphosphate dosing, electrolytic scale reducers or water softeners. The relevant standard for water treatment is BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems. BS 7593:2019 notes that "naturally soft waters of low alkalinity or those supplied via a base-exchange resin softener have an increased potential for corrosion, and, if they are used in any central heating system, a corrosion inhibitor specifically formulated for the purpose should be added and properly maintained."

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	d. Where the mains water hardness exceeds 200 parts per million, provisions should be made to treat the feed water to water heaters and the hot water circuit of combination boilers to reduce the rate of accumulation of lime scale. e. For solar thermal systems, see section 9.		Manufacturers should be consulted for advice, paying particular attention to dosage levels. Special radiator valves are available that will seal off the radiator as well as the heating circuit to prevent loss of inhibitor when removing a radiator for service or maintenance. A filter can also be fitted to the central heating circuit to help maintain the efficiency and reliability of the system.

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
e. Commissioning	a. On completion of the installation of a boiler/or a hot water storage system, together with associated equipment such as pipework, pumps and controls, the equipment should be commissioned in accordance with the manufacturer's instructions. These instructions will be specific to the particular boiler and/or hot water storage system. b. The installer should give a full explanation of the system and its operation and maintenance requirements to the user, including the manufacturer's user manual where provided.	As defined for **new systems.**	

Table 1 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of gas-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	This should include: • the making of adjustments to the timing and temperature control settings; • what routine maintenance is needed to enable operating efficiency to be maintained at a reasonable level through the service life(lives) of the system(s) and • the operation and maintenance of renewable energy systems.		

Table 2 Minimum provisions for control of gas-fired central heating systems in new dwellings*(and in existing dwellings where appropriate)		
System Control	**Recommended provision for new systems**	**Recommended provision for existing systems**
a. Boiler interlock	• Boiler-based systems should have boiler control interlock in which controls are wired so that when there is no demand for either space heating or hot water the boiler and pump are switched off. • The use of Thermostatic Radiator Valves (TRVs) alone does not provide an interlock.	As defined for **new systems.**
b. Space heating zones	• Dwellings with a total usable floor area of greater than 100m^2 should be provided with at least two space heating zones each having separate temperature controls.	As defined for **new systems.** For larger dwellings, e.g. where floor area exceeds 100 m^2, independent temperature control on the basis of two independent zones will generally be appropriate. Separate and independent time control for space heating should be provided. Independent time control of space heating zones may be appropriate where independent temperature control applies e.g. where the space heating system is replaced.
c. Water heating zones	• All Dwellings should have a separate hot water zone in addition to space heating zones. • A separate hot water service zone is not required if the hot water is produced instantaneously such as with a combination boiler.	As defined for **new systems.** Where practical, independent time control of the water heating zone may be appropriate e.g. where the space heating system is replaced.

Table 2 Minimum provisions for control of gas-fired central heating systems in new dwellings*(and in existing dwellings where appropriate) (continued)		
d. Time Control of space and water heating	Time control of space and water heating should be provided by: i. A full programmer with separate timing to each circuit or ii. Two or more separate timers providing timing control to each circuit; or iii. Programmable room thermostat(s) to the heating circuit(s), with separate timing of the hot water circuit. Where hot water is produced instantaneously, such as with a combination boiler, time control is only required for heating zones.	As defined for **new systems** except where only the hot water cylinder is being replaced in a replacement system and separate time control for the hot water circuit is not present. In this case it is acceptable to have a single timing control for both space heating and hot water.

Table 2 Minimum provisions for control of gas-fired central heating systems in new dwellings*(and in existing dwellings where appropriate) (continued)		
System Control	**Recommended provision for new systems**	**Recommended provision for existing systems**
e. Temperature control of space heating	Separate temperature control of zones within the dwelling, should be provided, using: i. Room thermostats or programmable room thermostats in all zones; or ii. A room thermostat or programmable room thermostat in the main zone and individual radiator controls such as Thermostatic Radiator Valves on all radiators in the other zones; or iii. A combination of (i) and (ii) above.	For **replacement systems** where only the hot water cylinder is being replaced and where hot water is on a gravity circulation system, a thermostatic cylinder thermostat should be installed.
f. Temperature control of hot water service system	• Domestic hot water systems should be provided with a cylinder thermostat and a zone valve or three-port valve to control the temperature of the hot water. • Where more than one hot water circuit exists. Each should have separate temperature controls. • The use of non-electric hot water controllers does not meet this requirement. Also in some circumstances, such as thermal stores, a zone valve is not appropriate; a second pump could be substituted as the zone valve.	Thermostatic control that shuts off the supply of heat when the desired storage temperature is reached.

*****An acceptable alternative to these controls is any boiler management control system that meets the specified zoning, and temperature and boiler interlock control requirements.

Table 3 Minimum provisions for insulation of pipes serving gas-fired central heating systems

Minimum provision	**Supplementary information**
In new systems pipes should be insulated as follows (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly: • Primary circulation pipes for heating and hot water circuits should be insulated wherever they pass outside the heated living space or through voids which communicate with and are ventilated from unheated spaces. • Pipes and ducts which are incorporated into wall, floor or roof construction should be insulated. • Primary circulation pipes for hot water service circuits should be insulated throughout their length, subject only to practical constraints imposed by the need to penetrate joists and other structural elements. • All pipes connected to hot water storage vessels (primary flow and return), including the vent pipe, should be insulated for at least 1m from their points of connection to the cylinder (or they should be insulated up to the point where they become concealed). • If secondary circulation is used, all pipes kept hot by that circulation should be insulated.	**Insulation for pipework in unheated areas** Extra provision may need to be made to protect central heating and hot water pipework in unheated areas against freezing. Further guidance is available in: • BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C. • BRE Report No 262 Thermal insulation: avoiding risks, 2001 edition. Where insulation is labelled as complying with the Heating and Domestic Hot Water Systems for dwellings-Achieving Compliance with Part L it must not exceed the following heat loss levels: **Pipe* diameter (OD) — Maximum permissible heat loss** (W/m)** 8mm — 7.06 10mm — 7.23 12mm — 7.35 15mm — 7.89

Table 3 Minimum provisions for insulation of pipes serving gas-fired central heating systems (continued)	
Minimum provision	**Supplementary information**
For **replacement systems**, whenever a boiler or hot water storage vessel is replaced in an existing system, any pipes (in the situations above) that are exposed as part of the work or are otherwise accessible should be insulated as recommended in this guide (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly – or to some lesser standard where practical constraints dictate.	22mm 9.12 28 mm 10.07 35mm 11.08 42mm 12.19 54mm 14.12 ***** The maximum permissible heat loss applies to all pipe materials (i.e. steel, copper, plastic and other). ** In assessing the thickness of insulation required to meet the provision, standardised conditions should be used in all compliance calculations based in this instance on a horizontal pipe at 60ºC in still air at 15ºC.

2.4 Gas-fired range cookers with integral central heating boiler

This section provides guidance on the specification of gas-fired range cookers with integral central heating boilers for space heating and hot water in dwellings.

Gas-fired range cookers with an integral central heating boiler which are provided in new or existing dwellings should meet the following conditions:

a) The appliance should have two independently controlled burners (one for the cooking function and one for the boiler) and the boiler should have a Seasonal Efficiency (HARP[1]) value in excess of 75%.

AND

b) Information about appliance performance should be included in the commissioning information given at completion. The manufacturer's declaration of appliance performance and HARP value should include the following words: "

- Seasonal efficiency (HARP) = xx%
- Case heat emission value = yy kW
- Heat transfer to water at full load = zz kW

The values are used in the Dwelling Energy Assessment Procedure (DEAP) for the energy rating of dwellings. The test data from which they have been calculated has been certified by {insert name and/or identification of Notified body}."

AND

c) The minimum provisions for gas-fired central heating systems with respect to the integral central heating boilers as given in Table 1 (rows b to e).

AN.

d) The minimum provisions for boiler interlock, zoning and time control and temperature control of the heating and hot water circuits with respect to the integral central heating boilers as given in Table 2 for gas-fired central heating systems. An acceptable alternative to these is any boiler management system that delivers the specified zoning, timing and temperature provisions.

When gas boilers are installed as a replacement for existing boilers, the minimum level of system controls should be provided, as described in Table 2, unless they are already installed and fully operational.

[1] Seasonal Efficiencies for appliances can be found in HARP database and in the national methodology for Building Energy Rating (DEAP) at www.seai.ie

If an individual component of the control system is being replaced in an existing system, for example a room thermostat, it is not necessary to upgrade the system to meet the minimum requirements.

AND

e) Pipework should be insulated as described in Table 3.

2.5 Gas-fired warm air heating

This section provides guidance on the specification of gas-fired warm air heating systems for dwellings.

Terminology and applicability of guidance to different scenarios in new and existing dwellings

The guidance in this section applies to the following situations:

a. The specification of gas-fired warm air heating systems in new dwellings – this situation is referred to in this section as a **new system.**

b. The specification of gas-fired warm air heating systems in existing dwellings where previously space heating was not provided by a warm air system – this situation is also referred to in this section as a **new system;**

c. The specification of a replacement warm air heating system and/or component in existing dwellings where warm air heating is already installed – this situation is referred to in this section as a **replacement system.**

Gas-fired warm air heating which is provided as a new system or replacement system in new or existing dwellings should meet the following conditions:

a) The minimum provisions for efficiency and installation set out in Table 4.

AND

b) The minimum provisions for system control set out in Table 5.

Table 4 Minimum provisions for efficiency and installation of gas-fired warm air heating systems		
	Minimum provision	**Supplementary information**
a. Efficiency	a. Gas-fired warm air units should meet the requirements, as appropriate to the design of the appliance, of: • I.S. EN 778:2009 or • I.S. EN 1319:2009 b. If a gas-fired circulator is incorporated in the warm air unit to provide domestic hot water, it should be able to deliver full and part load efficiency at least equal to that prescribed by BS EN 15502-1:2012+A1:2015 / BS EN 15502-2-1:2012+A1:2016 c. The manufacturer's declaration of appliance performance and efficiency value should include the following words: **Combined warm air unit and circulator** "This product has been assessed against the test methods set out in I.S. EN 778:2009* or I.S. EN 1319: 2009* {* as appropriate} and BS EN 15502-1:2012+A1:2015 / BS EN 15502-2-1:2012+A1:2016 * and certified as meeting those minimum requirements by {insert name and/or identification of Notified Body}."	**Standards** I.S. EN 778:2009 Domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 70kW, without a fan to assist transportation of combustion air and/or combustion products I.S. EN 1319:2009 Domestic gas-fired forced convection air heaters for space heating, with fan-assisted burners not exceeding a net heat input of 70 kW BS EN 15502-1:2012+A1:2015 Gas-fired heating boilers. General requirements and tests BS EN 15502-2-1:2012+A1:2016 Gas-fired central heating boilers. Specific standard for type C appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW

Table 4 Minimum provisions for efficiency and installation of gas-fired warm air heating systems (continued)		
	Minimum provision	**Supplementary information**
	Warm air unit alone "This product has been assessed against the test method set out in I.S. EN 778: 2009* or I.S. EN 1319:2009."	
b. Installation	a. The system should be installed in accordance with BS 5864:2019. b. Ductwork that is newly installed or replaced should be insulated in accordance with the recommendations of BS 5422:2009.	BS 5864:2019 Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases). Specification BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C

Table 5 Minimum provision for system controls for gas-fired warm air heating		
System	**Minimum provision**	
a. Warm air systems without water heating	**Time and temperature control**	Time and temperature control should be provided by either: i. Controls external to heater: time switch/programmer and room thermostat, or programmable room thermostat; or ii. Controls integrated in the heater – time-switch/programmer and room temperature sensor linked to heater firing and fan speed control.
	Zoning	• For new dwellings with a total usable floor area up to 100m^2, depending on the design and layout of the dwelling, control on the basis of a single zone will generally be satisfactory. If divided into two space heating zones, then one of which should be assigned to the living area. • New dwellings with a total usable floor area greater than 100m^2 should be provided with at least two space heating zones, each having temperature controls. Timing of the separate space heating zones can be achieved by:

Table 5 Minimum provision for system controls for gas-fired warm air heating (continued)		
System	**Minimum provision**	
		i. Multiple heating zone programmers; or ii. A single multi-channel programmer; or iii. Programmable room thermostats; or iv. Separate timers to each circuit; or v. A combination of (iii) and (iv) above. The provisions for zoning for replacement systems in existing dwellings should be as for new dwellings where practical.
b. Combined warm air and domestic hot water systems for installations	**Independent time control of both the heating and hot water circuits**	
	Pumped primary circulation to the hot water cylinder	
	Independent control of hot water production	Independent control of the hot water circuit should be achieved by means of a cylinder thermostat and a timing device, wired such that when there is no demand for hot water both the pump and circulator are switched off.

Table 5 Minimum provision for system controls for gas-fired warm air heating (continued)		
System	**Minimum provision**	
	Time control	i. Time control should be provided by use of: ii. A full programmer with separate timing to each circuit; or iii. Two or more separate timers providing timing control to each circuit; or iv. Programmable room thermostat(s) to the heating circuit(s), with separate timing of the hot water; or v. A time switch/programmer (two channel) and room thermostat.
	Space heating zoning	• New dwellings with a total usable floor area greater than 100m^2 should be provided with at least two space heating zones, each having separate temperature controls. The provisions for zoning for replacement systems in existing dwellings should be as for new dwellings where practical.

2.6 Gas-fired fixed independent space heating appliances

This section provides guidance on the specification of gas-fired fixed independent space heating appliances for dwellings.

Fixed independent space heating appliances may be installed as a means of primary or secondary space heating.

Gas-fired fixed independent appliances for primary-space heating

Gas-fired fixed independent space heating appliances in new and existing dwellings which are provided as the primary heat source should meet the following conditions:

a) The appliance should be one of the types described in Table 6.

AND

b) The efficiency of the appliance (gross calorific value) should be no less than 58%. The appliance manufacturer's declaration of appliance performance shall include the following words:

"The efficiency of this appliance has been measured as specified in {insert appropriate entry from Table 6} and the result is [x] %. The gross calorific value of the fuel has been used for this efficiency calculation. 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."

AND

c) In new dwellings each appliance should be capable, either independently or in conjunction with room thermostats or other suitable temperature sensing devices, of controlling the temperatures independently in areas that have different heating needs (e.g. separate sleeping and living areas). In existing dwellings, wherever practical, temperature controls should be upgraded to the standards required for new dwellings.

Table 6 Acceptable appliance types for fixed natural gas and LPG gas-fired space heaters for use as a primary heat source
National Standard designation (appliance type)
I.S. EN 1266:2002 Independent gas-fired convection heaters incorporating a fan to assist transportation of combustion air and/or flue gases.
BS 7977-1:2009+A1:2013 Specification for safety and rational use of energy of domestic gas appliances. Radiant/convectors.
IS EN 613:2000 Independent gas-fired convection heaters.
IS EN 13278:2013 Open fronted gas-fired independent space heaters.

Gas-fired fixed independent appliances for secondary-space heating

Gas-fired fixed independent space heating appliances which are provided as the secondary heat source in new or existing dwellings should meet both of the following conditions:

a) The appliance should be one of the types described in Table 7.

AND

b) The efficiency (gross calorific value) of the appliance should be no less than the value in Table 7 for that type of appliance. The appliance manufacturer's declaration of appliance performance shall include the following words:

"The efficiency of this appliance has been measured as specified in {insert appropriate entry from Table 7} and the result is [x] %. The gross calorific value of the fuel has been used for this efficiency calculation. 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."

Table 7 Acceptable appliance types and minimum appliance efficiencies for independent fixed natural gas and LPG gas-fired space heaters used as a secondary heat source		
National Standard designation (appliance type)	**Minimum efficiency % (gross calorific value)**	
	Gas	**LPG**
I.S. EN 1266:2002 Independent gas-fired convection heaters incorporating a fan to assist transportation of combustion air and/or flue gases.	72	73
BS 7977-1:2009+A1:2013 Specification for safety and rational use of energy of domestic gas appliances. Radiant/convectors.	63	64
I.S. EN 613:2000 Independent gas-fired convection heaters.	58	60
IS EN 13278:2013 Open fronted gas-fired independent space heaters.	45	46
(Inset live fuel effect) BS 7977-1:2009+A1:2013 Specification for safety and rational use of energy of domestic gas appliances. Radiant/convectors.	40	41
(Flueless) I.S. EN 14829:2007 Independent gas fired flueless space heaters for nominal heat input not exceeding 6kW.	Thermal efficiency requirements for this type of appliance are not specified as all the heat produced by the combustion process is released into the space to be heated. In DEAP the efficiency of these appliances is classed as 90% and an adjustment is made for ventilation in the space heating requirement calculation.	
(Flueless) BS EN 449:2002+A1:2007 Specification for dedicated liquefied petroleum gas appliances. Domestic flueless space heaters (Including diffusive catalytic combustion heaters).		

2.7 Gas-fired fixed decorative fuel-effect fires

This type of appliance is intended for decorative purposes and therefore a minimum thermal efficiency is not specified. Note that, for the purposes of DEAP, the efficiency of decorative fuel-effect fires is classed as 20% for use in the space heating requirement calculation; see Table 4a of DEAP.

In order to comply with the requirements of Part L 2019, gas-fired decorative fires in new and existing dwellings should meet the following conditions:

a) The appliance should meet the product standards specified in I.S. EN 509:2000 Decorative fuel-effect gas appliances.

AND

b) No more than one appliance should be installed per 100m^2 of dwelling floor area.

2.8 Gas-fire for secondary-space heating provided as part of a combined fire and back boiler unit

A combined fire and back boiler unit can only be installed as a replacement for an existing combined fire and back boiler unit, and then only when the criteria of the Condensing Boiler Installation Assessment procedure are satisfied as outlined in Appendix A of this document. In order to comply with the requirements of the Building Regulations 2019, the gas fire provided as a secondary heat source as part of a combined fire and back boiler unit, when provided as a replacement system in existing dwellings, should meet the following conditions:

a) The appliance should be one of the types described in Table 8. The manufacturer's declaration of appliance performance shall include the following words:

"The efficiency of this appliance has been measured as specified in {insert appropriate entry from Table 8} and the result is [x] %. The gross calorific value of the fuel has been used for this efficiency calculation. 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."

AND

b) The efficiency of the appliance (gross calorific value) should be no less than the value in Table 8 for that type of appliance.

Table 8 Minimum appliance efficiencies for gas fires used with back boilers		
National Standard designation (appliance type)	**Minimum efficiency % (gross calorific value)**	
(Inset live fuel effect) BS 7977-2:2003 Specification for safety and rational use of energy of domestic gas appliances. Combined appliances. Gas fire/back boiler.	**Gas**	**LPG**
	45	45
(All types except inset live fuel effect) BS 7977-2:2003 Specification for safety and rational use of energy of domestic gas appliances. Combined appliances. Gas fire/back boiler	63	64

Supplementary information – further guidance on gas-fired heating

Further guidance on gas-fired heating systems is available in the following publications:

Energy Efficiency Best Practice in Housing publications:

- CE30 Domestic heating by gas: boiler systems – guidance for installer and specifiers;
- CE51 Central heating system specifications (CHeSS);
- CE54 Domestic heating sizing method.

CORGI publications:

- Essential Gas Safety (GID1);
- Gas Cookers and Ranges – Domestic (GID2);
- Gas Fires and Space Heaters (GID3);
- Water Heaters (GID5);
- Central Heating – wet and dry (GID7);
- Wet Central Heating System Design Guide (WCH1);
- Warm Air Heating System Design Guide (WAH1).

Requirements relating to various aspects of the installation of condensing boilers are given in I.S. EN 813:2014.

3. Oil-fired space heating and hot water systems

This section provides guidance on the specification of oil-fired space heating and hot water systems in dwellings to meet the 2019 Building Regulations energy efficiency requirements.

All oil appliances must be installed by a suitably qualified person and the installation should be carried out in accordance with the manufacturer's instructions and comply with all other relevant parts of the Building Regulations.

3.1 Scope of guidance

The guidance in this section applies to systems fuelled by oil. The following types of oil-fired heating systems are addressed:

- Wet central heating systems.
- Range cookers with integral central heating boilers.
- Vaporising appliances providing secondary heating or hot water.
- Fixed independent space heating devices.

Where appropriate, it may be necessary to refer to the sections in this guide covering community heating, underfloor heating, heat pumps, solar water heating and micro-CHP.

3.2 Oil-fired wet central heating systems

This section provides guidance on the specification of oil-fired wet central heating systems for dwellings that, if followed, will satisfy the energy efficiency requirements of the 2019 Building Regulations.

Terminology and applicability of guidance to different scenarios in new and existing dwellings

The guidance in this section applies to the following situations:

a. The specification of central heating systems in new dwellings – this situation is referred to in this section as a **new system.**

b. The specification of central heating systems in existing dwellings where previously space heating was not provided by central heating – this situation is also referred to in this section as a **new system**.

c. The specification of a replacement central heating system and/or component in existing dwellings where central heating is already installed – this situation is referred to in this section as a **replacement system**.

In situations (a) and (b) above the guidance for compliance of **new systems** (in new and existing dwellings) with Part L is the same.

In situation (c) above, that is for **replacement systems** in existing dwellings, in most cases the guidance for compliance with Part L is as for **new systems**, unless otherwise stated in the relevant section.

In order to comply with the requirements of Part L, oil-fired central heating systems which are provided as **new systems** or **replacement systems** in dwellings should meet all of the following conditions:

a. The boiler should have a minimum efficiency (as defined by its HARP value) as given in Table 9 (row a).

AND

b. The minimum provisions for system circulation as given in Table 9 (row b).

AND

c. The minimum provisions for hot water storage and labelling of storage vessels as given in Table 9 (row c).

AND

d. The minimum provisions for system preparation and water treatment as given in Table 9 (row d).

AND

e. The system should be commissioned in accordance with the minimum provisions given in Table 9 (row e).

AND

f. The minimum provisions for boiler interlock, zoning and time control and temperature control of the heating and hot water service circuits as described in Table 10. An acceptable alternative to these is any boiler management system that delivers the specified zoning, timing and temperature and boiler interlock control provisions. When oil boilers are installed as part of a **replacement system,** the minimum level of system controls should be provided, as described in Table 10, unless they are already installed and fully operational.

   If an individual component of the control system is being replaced in an existing system, for example a room thermostat, it is not necessary to upgrade the system to meet the minimum requirements.

AND

g. Pipework should be insulated as described in Table 11.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate).			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
a. Minimum acceptable efficiency	a. The boiler efficiency should be not less than 90% (HARP value). **For range cooker boilers** b. The boiler efficiency for heating boilers that are combined with range cookers should be as defined in the section of this guide 'Section 3.3 Oil-fired range cookers with integral central heating boilers'.	The seasonal efficiency of the new equipment should be as defined for **new systems.**	**Guidance on identifying the HARP efficiency for an appliance** The Heating Appliance Register of Performance Database is available online (www.seai.ie) and includes regularly updated information on most available boilers as well as many which are no longer in production. **Appendix 1 of the Heating and Domestic Hot Water Systems- Achieving Compliance with Part L** gives the approved procedure for establishing where exceptional circumstances exist. This follows the criteria set out in the Guide to the Condensing Boiler Installation Assessment Procedure for Existing Dwellings.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
			Systems with condensing boilers should be designed to have low primary return water temperatures, preferably less than 55°C, to maximise condensing operation. Low return water temperatures can be obtained through techniques such as weather compensation and the use of low temperature heat emitters (for example correctly-sized radiators and underfloor heating elements). See Appendix B. Low temperature heat emitters will also be compatible with low temperature heat generators, such as heat pumps, that might be installed as replacements in the future.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
b. System circulation	a. Systems for space heating and domestic hot water primary circuits should have fully pumped circulation. b. If the boiler manufacturer's instructions advise installation of a bypass, an automatic bypass valve should be provided in conjunction with any requirements for a minimum pipe length specified in the manufacturer's instructions.	As defined for **new systems.** When boilers are replaced, existing systems with semi-gravity circulation should be converted to fully pumped circulation.	
c. Hot water storage	a. Vented copper hot water storage vessels should comply with the heat loss and heat exchanger requirements of BS 1566-1:2002+A1:2011. b. Unvented hot water storage systems products should: • comply with I.S. EN. 12897:2016;	As defined for **new systems.**	**Insulation of primary stores** Because of the higher than normal storage temperatures in primary stores it is very important that these are well insulated.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	• be certified by the Irish Agrément Board; or • be certified by another accredited body as complying with Building Regulations. c. Standing heat losses should be restricted as defined in TGD-L sub-section 1.4.4 for new dwellings and 2.2.4 for existing dwellings. d. All hot water storage vessels should carry a label with the following information: • type of vessel (vented, unvented, combination unit or thermal store); • nominal capacity in litres; • standing heat loss in kWh/day; • heat exchanger performance in kW;		**Standards** BS 1566-1:2002+A1:2011 Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods. I.S. EN 12897:2016 Water supply. Specification for indirectly heated unvented (closed) storage water heaters. BS 3198:1981 Copper hot water storage combination units for domestic purposes.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	• vented copper hot water cylinders should carry clear labelling on the product; • vented cylinders which are not of copper construction should be labelled as complying with the heat loss and heat exchanger requirements of BS1566-1:2002+A1:2011.		
d. System preparation and water treatment	a. Central heating systems should be thoroughly cleaned and flushed out before installing a new boiler. b. During final filling of the system, a chemical water treatment formulation should be added to the primary circuit to control corrosion and the formation of scale and sludge. Reasonable provision would be to follow the guidance on how to prepare and commission systems given in BS 7593:2019.	As defined for **new systems.**	**Standards** BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	c. Installers should also refer to the boiler manufacturer's installation instructions for appropriate treatment products and special requirements for individual boiler models. d. Where the mains water hardness exceeds 200 parts per million, provisions should be made to treat the feed water to water heaters and the hot water circuit of combination boilers to reduce the rate of accumulation of lime scale.		Limescale can be controlled by the use of chemical limescale inhibitors, combined corrosion and limescale inhibitors, polyphosphate dosing, electrolytic scale reducers or water softeners. The relevant standard for water treatment is BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems. BS 7593:2019 notes that "naturally soft waters of low alkalinity or those supplied via a base-exchange resin softener have an increased potential for corrosion, and, if they are used in any central heating system, a corrosion inhibitor specifically formulated for the purpose should be added and properly maintained." Manufacturers should be consulted for advice, paying particular attention to dosage levels. Special radiator valves are available that will seal off the radiator as well as the heating circuit to prevent loss of inhibitor when removing a radiator for service or maintenance. A filter can also be fitted to the central heating circuit to help maintain the efficiency and reliability of the system.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
e. Commissioning	a. On completion of the installation of a boiler/or a hot water storage system, together with associated equipment such as pipework, pumps and controls, the equipment should be commissioned in accordance with the manufacturer's instructions. These instructions will be specific to the particular boiler and/or hot water storage system. b. The installer should give a full explanation of the system and its operation and maintenance to the user, including the manufacturer's user manual where provided.	As defined **for new systems.**	Site commissioning of oil-fired appliances should always be carried out in accordance with manufacturers' instructions as it is critical for efficient operation. OFTEC branded forms are also provided for the use of OFTEC Registered Competent Persons and non-OFTEC branded forms are available for others carrying out oil-fired installation and commissioning works. To assist installers OFTEC oil appliance manufacturing members may provide forms CD/10 and CD/11 with their equipment.

Table 9 Minimum provisions for boiler efficiency, system circulation, hot water storage, system preparation and commissioning of oil-fired central heating systems in new dwellings (and in existing dwellings where appropriate) (continued)			
	Minimum provision for new systems in new and existing dwellings	**Minimum provision for replacement systems in existing dwellings**	**Supplementary information**
	This should include: • the making of adjustments to the timing and temperature control settings; • what routine maintenance is needed to enable operating efficiency to be maintained at a reasonable level through the service life(lives) of the system(s) and the operation and maintenance of renewable energy systems.		**Controlled Document CD/10 or OFTEC Boiler Passport** Installing engineers should complete OFTEC Form CD/10 or OFTEC Boiler Passport to show that they have completed the installation of an oil-fired appliance and controls and wet system commissioning prior to final appliance commissioning. **Controlled Document CD/11** Commissioning engineers of oil-fired appliances should complete OFTEC Form CD/11 to record and show that they have completed the commissioning of the appliance and that they have left it operating in a safe and efficient manner.

Table 10 Minimum provisions for control of oil-fired central heating systems in new dwellings* (and in existing dwellings where appropriate).		
System Control	**Recommended provision for new systems**	**Recommended provision for existing systems**
a. Boiler interlock	• Boiler-based systems should have boiler control interlock in which controls are wired so that when there is no demand for either space heating or hot water the boiler and pump are switched off. • The use of Thermostatic Radiator Valves (TRVs) alone does not provide an interlock.	As defined for **new systems.**
b. Space heating zones	**Dwellings with a total usable floor area of greater than 100m^2** should be provided with at least two space heating zones each having separate temperature controls.	As defined for new systems except where the boiler only is replaced, in which case reasonable provision for a space heating system would be to control one zone. For larger dwellings, e.g. where floor area exceeds 100 m^2, independent temperature control on the basis of two independent zones will generally be appropriate. Separate and independent time control for space heating should be provided.

Table 10 Minimum provisions for control of oil-fired central heating systems in new dwellings* (and in existing dwellings where appropriate) (continued)		
System Control	**Recommended provision for new systems**	**Recommended provision for existing systems**
		Independent time control of space heating zones may be appropriate where independent temperature control applies e.g. where the space heating system is replaced.
c. Water heating zones	• All Dwellings should have a separate hot water zone in addition to space heating zones. • A separate hot water service zone is not required if the hot water is produced instantaneously such as with a combination boiler.	As defined for **new systems.** Where practical, independent time control of the water heating zone may be appropriate e.g. where the space heating system is replaced.
d. Time control of space and water heating	Time control of space and water heating should be provided by: i. A full programmer with separate timing to each circuit; or ii. Two or more separate timers providing timing control to each circuit; or	As defined for **new systems** except where only the hot water cylinder is being replaced in a replacement system and separate time control for the hot water circuit is not present.

Table 10 Minimum provisions for control of oil-fired central heating systems in new dwellings* (and in existing dwellings where appropriate) (continued)		
System Control	**Recommended provision for new systems**	**Recommended provision for existing systems**
	iii. Programmable room thermostat(s) to the heating circuit(s), with separate timing of the hot water circuit. Where hot water is produced instantaneously, such as with a combination boiler, time control is only required for heating zones	In this case, it is acceptable to have a single timing control for both space heating and hot water.
e. Temperature control of space heating	Separate temperature control of zones within the dwelling should be provided, using: i. Room thermostats or programmable room thermostats in all zones; or ii. a room thermostat or programmable room thermostat in the main zone and individual radiator controls such as Thermostatic Radiator Valves on all radiators in the other zones; or iii. a combination of (i) and (ii) above.	For **replacement systems** where only the hot water cylinder is being replaced and where hot water is on a gravity circulation system, a thermostatic cylinder thermostat should be installed.
f. Temperature control of hot water service system	• Domestic hot water systems should be provided with a cylinder thermostat and a zone valve or three-port valve to control the temperature of the hot water.	A thermostatic cylinder thermostat should be installed.

Table 10 Minimum provisions for control of oil-fired central heating systems in new dwellings* (and in existing dwellings where appropriate) (continued)		
System Control	**Recommended provision for new systems**	**Recommended provision for existing systems**
	• Where more than one hot water circuit exists. Each should have separate temperature controls. • The use of non-electric hot water controllers does not meet this requirement. Also in some circumstances, such as thermal stores, a zone valve in not appropriate, a second pump could be substituted as the zone valve.	A thermostatic cylinder thermostat should be installed.

*****An acceptable alternative to these controls is any boiler management control system that meets the specified zoning, timing and temperature and boiler interlock control requirements.

Table 11 Minimum provisions for insulation of pipes serving oil-fired central heating systems

Minimum provision	Supplementary information
In new systems, pipes should be insulated as follows (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly: • Primary circulation pipes for heating and hot water circuits should be insulated wherever they pass outside the heated living space or through voids which communicate with and are ventilated from unheated spaces. • Pipes and ducts which are incorporated into wall, floor or roof construction should be insulated. • Primary circulation pipes for hot water service circuits should be insulated throughout their length, subject only to practical constraints imposed by the need to penetrate joists and other structural elements. • All pipes connected to hot water storage vessels (primary flow and return), including the vent pipe, should be insulated for at least 1m from their points of connection to the cylinder (or they should be insulated up to the point where they become concealed).	**Insulation for pipework in unheated areas** Extra provision may need to be made to protect central heating and hot water pipework in unheated areas against freezing. Further guidance is available in: • BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C; • BRE Report No 262 Thermal insulation: avoiding risks, 2001 edition. Where insulation is labelled as complying with the Heating and Domestic Hot Water Systems for dwellings-Achieving Compliance with Part L it must not exceed the following heat loss levels: **Pipe* diameter (OD)** — **Maximum permissible heat loss** (W/m)** 8mm — 7.06 10mm — 7.23 12mm — 7.35

Table 11 Minimum provisions for insulation of pipes serving oil-fired central heating systems (continued)	
Minimum provision	**Supplementary information**
• If secondary circulation is used, all pipes kept hot by that circulation should be insulated. For replacement systems, whenever a boiler or hot water storage vessel is replaced in an existing system, any pipes (in the situations above) that are exposed as part of the work or are otherwise accessible should be insulated as recommended in this guide (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly – or to some lesser standard where practical constraints dictate.	15mm 7.89 22mm 9.12 28mm 10.07 35mm 11.08 42mm 12.19 54mm 14.12 ***** The maximum permissible heat loss applies to all pipe materials (i.e. steel, copper, plastic and other). ** In assessing the thickness of insulation required to meet the provision, standardised conditions should be used in all compliance calculations based in this instance on a horizontal pipe at 60ºC in still air at 15ºC.

3.3 Oil-fired range cookers with integral central heating boilers

Oil-fired range cookers with integral central heating boilers for space heating and hot water in dwellings.

Note the guidance applies only to twin burner cooker boilers, which should not be confused with the type of range cooker described as a single burner 'dry heat' range cooker. The latter is intended to provide only a cooking function, is not included in DEAP calculations, and does not come within the scope of the 2019 Building Regulations energy efficiency requirements.

In order to comply with the 2019 Building Regulations energy efficiency requirements, oil-fired range cookers with an integral central heating boiler which are provided in new or existing dwellings should meet all of the following conditions:

a. The appliance should have two independently controlled burners (one for the cooking function and one for the boiler).

AND

b. The boiler should have a Seasonal Efficiency (HARP) value in excess of 75%. The manufacturer's declaration of appliance performance and HARP value should include the following words:
"

- Seasonal efficiency (HARP) = xx%
- Case heat emission value = yy kW
- Heat transfer to water at full load = zz kW

The efficiency values are used in the Dwelling Energy Assessment Procedure (DEAP) for the energy rating of dwellings. The test data from which they have been calculated has been certified by {insert name and/or identification of Notified body}".

AND

c. The minimum provisions for oil-fired central heating systems with respect to the integral central heating boilers as given in Table 9 (rows b to e).

AND

d. The minimum provisions for boiler interlock, zoning and time control and temperature control of the heating and hot water circuits with respect to the integral central heating boilers as given in Table 10 for oil-fired central heating systems. An acceptable alternative to these is any boiler management system that delivers the specified zoning, timing and temperature provisions.

When oil boilers are installed as a replacement for existing boilers, the minimum level of system controls should be provided, as described in Table 10 unless they are already installed and fully operational. If an individual component of the control system is being replaced in an existing system, for example, a room thermostat, it is not necessary to upgrade the system to meet the minimum requirements.

AND

e. Pipework should be insulated, as described in Table 11.

3.4 Continually burning oil-fired vaporising appliances providing secondary heating or hot water

This section provides guidance on the specification of oil-fired vaporising appliances providing heating or hot water for dwellings that, if followed, will satisfy the 2019 Building Regulations energy efficiency requirements.

The guidance does not apply to appliances which have been converted from another fuel (for example from solid fuel to oil).

In order to comply with the 2019 Building Regulations energy efficiency requirements, oil-fired vaporising appliances in new and existing dwellings should have the minimum provision of controls as given in Table 11a:

Table 11a Minimum provision of controls for continually burning oil-fired vaporising appliances

Appliance type	**Minimum provision**	**Supplementary information**
Manually operated appliance, e.g. room heater.	The integral manual controls as provided by appliance manufacturer.	Information about the use of controls should be clearly stated in the manufacturer's literature.
Electrically operated (modulating) appliance, e.g. room heater.	The integral and/or remote thermostatic controls as provided (or specified) by the appliance manufacturer.	
Automatic ON/OFF vaporising appliances		
a. Room heater providing (secondary) room space heating.	The integral thermostatic controls as provided by appliance manufacturer.	
b. Room heater providing domestic hot water and (secondary) room space heating.	The integral and/or remote thermostatic controls as provided (or specified) by the appliance manufacturer.	

3.5 Oil-fired fixed independent space heating appliances

This section provides guidance on the specification of oil-fired fixed independent space heating appliances for dwellings.

Fixed independent space heating appliances may be installed as a means of primary or secondary space heating.

Oil-fired fixed independent appliances for primary heating

Oil-fired fixed independent space heating appliances in new dwellings which are provided as the primary heat source should meet the following conditions:

a. The efficiency of the appliance (gross calorific value) should be no less than 90%. The appliance manufacturer's declaration of appliance performance shall include the following words:

   "The net efficiency of this appliance has been measured, and the result is [x] %. The test data from which it has been calculated has been certified by {insert name and/or identification of Notified Body}. The efficiency value, when converted to gross by use of the appropriate conversion factor from Table D2.2 in DEAP may be used."

AND

b. Each appliance should be capable, either independently or in conjunction with room thermostats or other suitable temperature sensing devices, of controlling the temperatures independently in areas that have different heating needs (e.g. separate sleeping and living areas).

Oil-fired fixed independent appliances for secondary heating

In order to comply with the 2019 Building Regulations energy efficiency requirements, oil-fired fixed independent space heating appliances in new dwellings which are provided as the secondary heat source should have a minimum efficiency (gross calorific value) of not less than 90%.

Supplementary information

Further guidance on oil-fired heating systems is available in the following publications:

Energy Efficiency Best Practice in Housing publications:

- CE29 Domestic heating by oil: boiler systems – guidance for installers and specifiers;
- CE51 Central heating system specifications (CHeSS);
- CE54 Domestic heating sizing method;

- OFTEC Technical Books 2, 3, 4 and 5 (see www.oftec.org);
- S.R. 50-1:202X: Code of practice – Heating systems in dwellings – Part 1: Water-based heating systems
- I.S. EN 12828:2003 Heating systems in buildings. Design for water-based heating systems
- BS 5410-1:2019 Code of practice for liquid fuel firing – Part 1 installations for space heating and hot water supply purposes for domestic buildings.

4. Electric heating systems

This section provides guidance on the specification of fixed electric heating systems for dwellings.

4.1 Scope of guidance

The guidance given in this section covers the following types of fixed electric heating systems:

- Electric boilers serving central heating systems.
- Electric warm air systems.
- Electric panel heaters.
- Electric storage systems including integrated storage/direct systems.

Portable, plug-in appliances are not covered by the Building Regulations or by this guide.

Where appropriate, it may also be necessary to refer to the other sections in this guide covering underfloor heating and solar water heating.

4.2 Electric boilers serving central heating systems in new and existing dwellings

This section provides guidance on the specification of electric boilers serving wet central heating systems for dwellings.

Terminology and applicability of guidance to different scenarios in new and existing dwellings

The guidance in this section applies to the following situations:

a. The specification of central heating systems in new dwellings – this situation is referred to in this section as a **new system**.

b. The specification of central heating systems in existing dwellings where previously space heating was not provided by central heating – this situation is also referred to in this section as a **new system.**

c. The specification of a replacement central heating system and/or component in existing dwellings where central heating is already installed – this situation is referred to in this section as a **replacement system.**

In situations (a) and (b) above the guidance for compliance of **new systems** (in new and existing dwellings) with Part L is the same.

In situation (c) above, that is for **replacement systems** in existing dwellings, in most cases, the guidance for compliance with Part L is as for **new systems** unless otherwise stated in the relevant section.

Electric boilers serving central heating as **new systems** or **replacement systems** in dwellings should meet the following conditions:

a. The minimum provisions for system circulation as given in Table 12 (row a) should be met.

AND

b. The minimum provisions for system preparation and water treatment, as given in Table 12 (row b) should be met.

AND

c. The system should be commissioned in accordance with the minimum provisions given in Table 12 (row c).

AND

d. The minimum provisions for boiler interlock, zoning and time control and temperature control of the heating and hot water service circuits as described in Table 12 (row d) should be met. An acceptable alternative to these is any boiler management system that delivers the specified zoning, timing and temperature (and, if applicable, boiler interlock) control provisions. When electric boilers are installed as replacement for existing boilers, the minimum level of system controls should be installed, as described in Table 12, unless they are already installed and fully operational. If an individual component of the control system is being replaced in an existing system, for example, a room thermostat, it is not necessary to upgrade the system to meet the minimum requirements.

AND

e. The minimum provisions for hot water storage and labelling of storage vessels as given in Table 13 need to be met.

AND

f. Pipework should be insulated, as described in Table 14.

Table 12 Minimum provisions for system circulation, system preparation and commissioning and system controls for electric wet central heating systems*			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
a. System circulation	a. Systems for space heating and domestic hot water primary circuits in new dwellings should have fully pumped circulation. b. If the boiler manufacturer's instructions advise installation of a bypass, then an automatic bypass valve should be used.	As defined for **new systems.** When boilers are replaced, existing systems with semi-gravity circulation should be converted to fully pumped circulation.	Limescale can be controlled by the use of chemical limescale inhibitors, combined corrosion and limescale inhibitors, polyphosphate dosing, electrolytic scale reducers or water softeners. The relevant standard for water treatment is BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems. BS 7593:2019 notes that "naturally soft waters of low alkalinity or those supplied via a base-exchange resin softener have an increased potential for corrosion, and, if they are used in any central heating system, a corrosion inhibitor specifically formulated for the purpose should be added and properly maintained." Manufacturers should be consulted for advice, paying particular attention to dosage levels.
b. System preparation and water treatment	a. Central heating systems should be thoroughly cleaned and flushed out before installing a new boiler. b. During final filling of the system, a chemical water treatment formulation should be added to the primary circuit to control corrosion and the formation of scale and sludge. Reasonable provision would be to follow the guidance on how to prepare and commission systems given in BS 7593:2019.	As defined for **new systems.**	

Table 12 Minimum provisions for system circulation, system preparation and commissioning and system controls for electric wet central heating systems* (continued)

	Minimum provision for new systems	Minimum provision for replacement systems	Supplementary information
	c. Installers should also refer to the boiler manufacturer's installation instructions for appropriate treatment products and special requirements for individual boiler models. d. Where the mains water hardness exceeds 200 parts per million, provisions should be made to treat the feed water to water heaters and the hot water circuit of combination boilers to reduce the rate of accumulation of lime scale.		Special radiator valves are available that will seal off the radiator as well as the heating circuit to prevent loss of inhibitor when removing a radiator for service or maintenance. A filter can also be fitted to the central heating circuit to help maintain the efficiency and reliability of the system.
c. Commissioning	**a.** Manufacturer's instructions for commissioning should be followed, and a commissioning record should be completed to show compliance. **b.** The installer should explain fully to the user how to operate and maintain the system in an energy-efficient manner, and leave behind any user manuals provided by manufacturers.	As defined for **new systems.**	

Table 12 Minimum provisions for system circulation, system preparation and commissioning and system controls for electric wet central heating systems* (continued)			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
d. Controls		As defined for **new systems.**	
d. 1. Boiler temperature control	The boiler should be fitted with a flow temperature control and be capable of modulating the power input to the primary water depending on space heating conditions.		
d. 2. Boiler interlock	If the boiler also supplies DHW, the system should have boiler control interlock in which controls are wired so that when there is no call for heat from either the space heating or hot water circuits (where appropriate) then the boiler and pump are switched off. The use of Thermostatic Radiator Valves (TRVs) alone does not provide interlock.		
d. 3. Zoning	**Dwellings with a total usable floor area of greater than 100m^2** should be provided with at least two space heating zones each having separate temperature controls.	As defined for **new systems.**	

Table 12 Minimum provisions for system circulation, system preparation and commissioning and system controls for electric wet central heating systems* (continued)			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
d. 4. Temperature control of space heating	Separate temperature control of zones within the dwelling should be provided, using: i. Room thermostats or programmable room thermostats in all zones; or ii. a room thermostat or programmable room thermostat in the main zone and individual radiator controls such as Thermostatic Radiator Valves on all radiators in the other zones; or iii. a combination of (i) and (ii) above.	As defined for **new systems.**	
d. 5. Time control of space and water heating	Time control of space and water heating should be provided by: i. A full programmer with separate timing to each circuit;	As defined for **new systems.**	

Table 12 Minimum provisions for system circulation, system preparation and commissioning and system controls for electric wet central heating systems* (continued)

	Minimum provision for new systems	Minimum provision for replacement systems	Supplementary information
	ii. Two or more separate timers providing timing control to each circuit; or iii. Programmable room thermostat(s) to the heating circuit(s), with separate timing of the hot water circuit.		

*****An acceptable alternative to these controls is any boiler management control system that meets the specified zoning, timing and temperature and boiler interlock control requirements.

Table 13 Minimum provisions for hot water storage for electric wet central heating systems		
	Minimum provision for new systems and replacement systems	**Supplementary Information**
a. Vented systems – including cylinders heated primarily by electricity	1. Vented copper hot water storage vessels should comply with BS 1566-1:2002+A1:2011 or BS 3198:1981. 2. Vented cylinders in materials other than copper should also be labelled as complying with the heat loss requirements of BS 1566:2002+A1:2011. 3. Electrically heated combination units should be insulated such that the heat loss does not exceed the value given by the formula 1.6 X (0.2 + 0.051$V^{2/3}$) kWh per 24 hours, where V is the nominal cylinder capacity in litres.	**Standards** BS 1566:2002+A1:2011 Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods. BS 3198:1981 Specification for copper hot water storage combination units for domestic purposes. I.S. EN 12897:2016 Water supply. Specification for indirectly heated unvented (closed) storage water heaters.
b. Unvented systems – including cylinders heated primarily by electricity	1. Products should either comply with I.S. EN 12897 or meet the requirements of TGD D " Materials and Workmanship". 2. Cylinders heated primarily by electricity should be insulated such that their heat loss does not exceed the value given by the formula 1.28 X (0.2 + 0.051$V^{2/3}$) kWh per 24 hours, where V is the nominal cylinder capacity in litres.	

Table 13 Minimum provisions for hot water storage for electric wet central heating systems (continued)		
	Minimum provision for new systems and replacement systems	**Supplementary Information**
c. Vented and unvented systems	1) Cylinders should either be factory fitted with or have provision for, two thermostatically controlled electrical heating elements or immersion heaters. 2) The lower element should be capable of heating up at least 85% of the cylinder contents. 3) The upper element should be capable of heating at least 60 litres of water. 4) The lower element should be connected so as to utilise the 'off-peak' electricity tariff and the upper for boost operation where possible. 5) The vessel should be designed such that following reheating to 60°C from the off-peak element, at least 80% of the contents can be drawn off at 45°C or above at a flow rate of 0.25l/s.	
d. Primary storage	1. Primary storage systems should meet the insulation requirements of the Hot Water Association Performance specification for thermal stores.	**Insulation of primary stores** Due to the higher than normal storage temperatures in primary stores, it is very important that these are well insulated.

Table 13 Minimum provisions for hot water storage for electric wet central heating systems (continued)		
	Minimum provision for new systems and replacement systems	**Supplementary Information**
	2. Unvented hot water storage products should comply with a relevant standard as set by an accredited test body such as Irish Agrément Board or equivalent.	
e. Labelling	All hot water storage vessels should carry a label with the following information: • type of vessel (vented, unvented, combination unit or thermal store); • nominal capacity in litres; • standing heat loss in kWh/day; • heat exchanger performance in kW; • vented copper hot water cylinders should carry clear labelling on the product such as a ErP Ecodesign and Energy Labelling Regulations; • vented cylinders which are not of copper construction should be labelled as complying with the heat loss and heat exchanger requirements of BS 1566-1:2002+A1:2011. • For labelling of hot water storage vessels in solar thermal systems, see Section 9.	

Table 14 Minimum provisions for insulation of pipes serving electric wet central heating systems

Minimum provision	Supplementary information
In new systems, pipes should, in the following cases, be insulated with insulation complying with the requirements of the Heating and Domestic Hot Water Systems for dwellings-Achieving Compliance with Part L (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly: • Primary circulation pipes for heating and hot water circuits should be insulated wherever they pass outside the heated living space or through voids which communicate with and are ventilated from unheated spaces. • Pipes and ducts which are incorporated into wall, floor or roof construction should be insulated. • Primary circulation pipes for hot water service circuits should be insulated throughout their length, subject only to practical constraints imposed by the need to penetrate joists and other structural elements. • All pipes connected to hot water storage vessels, including the vent pipe, should be insulated for at least 1m from their points of connection to the cylinder (or they should be insulated up to the point where they become concealed).	**Insulation for pipework in unheated areas** Extra provision may need to be made to protect central heating and hot water pipework in unheated areas against freezing. Further guidance is available in: • BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C. • BRE Report No 262 Thermal insulation: avoiding risks, 2001 edition. Where insulation is labelled as complying with this guidance, it must not exceed the following heat loss levels: **Pipe* diameter (OD) — Maximum permissible heat loss** (W/m)** 8mm — 7.06 10mm — 7.23 12mm — 7.35 15mm — 7.89 22mm — 9.12

Table 14 Minimum provisions for insulation of pipes serving electric wet central heating systems (continued)	
Minimum provision	**Supplementary information**
• If secondary circulation is used, all pipes kept hot by that circulation should be insulated For replacement systems, whenever a boiler or hot water storage vessel is replaced in an existing system, any pipes (in the situations above) that are exposed as part of the work or are otherwise accessible should be insulated as recommended in this guide (in line with the maximum permissible heat loss indicated in the Supplementary Information column) and labelled accordingly – or to some lesser standard where practical constraints dictate.	28mm 10.07 35mm 11.08 42mm 12.19 54mm 14.12 *The maximum permissible heat loss applies to all pipe materials (i.e. steel, copper, plastic and other). ** In assessing the thickness of insulation required to meet the provision, standardised conditions should be used in all compliance calculations based in this instance on a horizontal pipe at 60ºC in still air at 15ºC.

4.3 Electric heating systems (other than central heating using electric boilers)

The guidance given in this section covers the following types of fixed electric heating systems:

- Electric warm air systems.
- Electric panel heaters.
- Electric storage systems including, integrated storage/direct systems.

Portable, plug-in appliances are not covered by this guide.

Fixed electric heating systems (other than electric boilers) in new and existing dwellings should meet the following conditions:

a. Electric warm air systems should meet the minimum requirements for zone control and time and temperature control of the heating system as set out in Table 15 (row a).

b. Panel heaters should meet the minimum requirements for local time and temperature control of the heating system as set out in Table 15 (row b).

c. Storage heaters should meet the minimum requirements for charge control and temperature control of the heating system as set out in Table 15 (row c).

In existing dwellings, new or replacement storage heaters should have a heat retention not less than 45 % measured according to I.S. EN 60531:2000. They should incorporate a timer and electronic room thermostat to control the heat output that are user adjustable.

Table 15 Minimum provisions for primary and secondary electric heating systems (other than electric boilers)			
Electric Heating System	**Minimum provision**	**Minimum provision**	**Supplementary information**
a. Electric warm air systems	Time and temperature control, either integral to the heater or external.	Provide either: i. a time switch/programmer and room stat; or ii. a programmable room thermostat.	
	Zone control.	**Dwellings with a total usable floor area of greater than 100m^2** should be provided with at least two space heating zones each having separate temperature controls. Time control should be provided using: i. multiple heating zone programmers; or ii. a single multi-channel programmer; or iii. programmable room thermostats; or iv. separate timers to each circuit; or v. a combination of (iii) and (iv) above.	

Table 15 Minimum provisions for primary and secondary electric heating systems (other than electric boilers) (continued)			
Electric Heating System	**Minimum provision**	**Minimum provision**	**Supplementary information**
c. Panel heaters	Local time and temperature control.	Time control provided by a programmable time switch integrated into the appliance or a separate time switch. Individual temperature control provided by integral thermostats or by separate room thermostats or programmable room thermostats.	Panel heater systems provide instant heat.
c. Storage heaters	Charge control.	Automatic control of input charge should be provided.	Charge control is the ability to detect the internal temperature and adjust the charging of the heater accordingly.
	Temperature control.	Controls for adjusting the rate of heat release from the appliance should be provided, such as an adjustable damper or some other thermostatically controlled means.	

5. Solid-fuel heating systems

This section provides guidance on the specification of solid-fuel heating systems for dwellings.

5.1 Scope of guidance

The guidance given in this section covers the following types of solid-fuel heating appliances and systems used to deliver primary and secondary heating:

- Batch-fed open fires.
- Batch-fed and automatic-feed dry room-heaters/stoves.
- Batch-fed log and multi-fuel appliances.
- Automatic-feed pellet stoves.
- Batch-fed and automatic-feed room-heaters with boilers.
- Batch-fed cookers with boilers not exceeding 7.5kW.
- Batch-fed independent boilers and automatic-feed anthracite and wood-pellet independent boilers.
- Central heating systems using certain types of solid-fuel appliances.

Where appropriate, it may also be necessary to refer to the sections of this guide on community heating, underfloor heating, solar water heating and micro-CHP.

5.2 Solid-fuel appliances for primary heating

Solid-fuel appliances that are provided in new and existing dwellings for primary heating should have a minimum efficiency (gross calorific value) no less than that specified in Table 16 for that category of appliance.

Table 16 Solid fuel appliance categories and minimum efficiencies			
Category	**Appliance description**	**Minimum efficiency % (gross calorific value)**	**Feed**
B1	Open fire – inset	30	Batch
B2	Open Fire-freestanding convector	47	Batch
B3	Open fire – inset convector	45	
C1/2	Open fire and boiler (inset or freestanding	50	Batch
D1/2/3	Open fire + high output boiler (trapezium)	63	Batch
D4	Open fire + high output boiler (rectangle)	65	Batch
E1	Dry room heater (Dry stove)	65	Batch/automatic
E2	Logs only	65	Batch
E3	Multi-fuel	65	Batch
E4	Pellet stove	65	Auto
F	Room heater with boiler	67	Batch/automatic
G1	Cooker with boiler not exceeding 3.5kW	50 (boiler only)	Batch
G2	Cooker with boiler 3.5–7.5kW	60 (boiler only)	Batch
J1/2/3	Independent boiler (batch fed)	65	Batch
J4	Independent boiler – anthracite	70 rising to (above 20.5kW) 75	Auto
J5	Independent boiler-wood pellet	65	Auto

Supplementary information on solid fuel appliances

Minimum efficiencies

Individual manufacturer's efficiency figures may be higher than those indicated and should be used where independently certified against the harmonised European Standards now in place.

Carbon emission factors

Solid fuels include various forms of woods, coals, and manufactured solid fuels and, consequently, there is a range of associated CO_2 emission factors. CO_2 emission factors are as important as appliance efficiency when selecting a boiler. Table 17 shows the CO_2 emission factors for generic types of solid fuel recognised in DEAP (see also table 8 in the DEAP manual).

Table 17 CO_2 emission factors for generic types of solid fuel[1]

Solid fuel	CO_2 emission kg CO_2/kWh	Notes
House coal	0.361	Traditional coal. It burns with smoky flame.
Anthracite	0.361	A mineral fuel with high carbon content. Burns very cleanly.
Manufactured smokeless fuel	0.392	Mineral fuel usually made from anthracite.
Wood logs	0.025	Renewable wood logs either purchased or from own land.
Wood pellets in bags	0.025	Mechanically compressed sawdust.
Bulk wood pellets	0.025	As above, delivered in bulk.
Multi–fuel	0.369	A 'typical blend' of logs and mineral fuel as burnt by a typical householder on a multi-fuel stove.
Wood chips	0.025	Chipped wood, processed on-site.

[1]Reference DEAP manual 4.2.1

Some appliances can only burn a single type of fuel while others may be able to burn a range of types. The 'multi-fuel' category in Table 17 allows for the latter group, basing its CO_2 emissions on a typical blend of fuels used in that case.

Smoke control areas

Wood should always be seasoned to a moisture content not exceeding 20% to ensure maximum performance and limit the occurrence of condensation and deposits in the chimney system.

All solid-fuel appliances require appropriate soot-fire resistant chimneys discharging at high-level locations defined within TGD J 2014.

5.3 Central heating systems using certain types of solid-fuel appliances

This section provides guidance on the specification of fixed solid-fuel heating systems for dwellings.

The guidance covers the following types of solid-fuel appliances used to deliver primary heating as part of a central heating system:

- Batch-fed open fires with high-output boilers (appliance types D1–D4 in Table 16).
- Batch-fed and automatic-feed room heaters and stoves with boilers (appliance type F in Table 16).
- Batch-fed cookers with boilers not exceeding 7.5kW (appliance types G1 and G2 in Table 16).
- Batch-fed independent boilers and automatic-feed anthracite and wood-pellet independent boilers (appliance types J1–J5 in Table 16).

Unless otherwise stated, the guidance in this section applies equally to appliances that burn wood, wood pellets, house coal, manufactured smokeless fuels and anthracite.

Where appropriate, it will also be necessary to refer to the sections on community heating, underfloor heating, solar water heating and micro-CHP.

Terminology and applicability of guidance to different scenarios in new and existing dwellings

The guidance in this section applies to the following situations:

a. The specification of central heating systems in new dwellings – this situation is referred to in this section as a **new system.**

b. The specification of central heating systems in existing dwellings where previously space heating was not provided by central heating – this situation is also referred to in this section as a **new system.**

c. The specification of a replacement central heating system and/or component in existing dwellings where central heating is already installed – this situation is referred to in this section as a **replacement system.**

In situations (a) and (b) above the guidance for compliance of **new systems** (in new and existing dwellings) with Part L is the same.

In situation (c) above, that is for **replacement systems** in existing dwellings, in most cases, the guidance for compliance with Part L is as for **new systems** unless otherwise stated in the relevant section.

In order to comply with the requirements of Part L 2019, a central heating system using a solid-fuel appliance which is provided as a **new system** or **replacement system** in dwellings should meet all of the following conditions:

a. The appliance should be from the categories D, F, G and J as defined in Table 16.

AND

b. The appliance should have a minimum efficiency (gross calorific value) of no less than that specified in Table 16 for that category of appliance.

AND

c. The installer should confirm that the ratio of heat to room and heat to water is appropriate for the room and total property. This will require reference to installation practice guidelines, including calculation of room and property heat loss.

AND

d. The minimum provisions for system circulation as given in Table 18 (row a) need to be met.

AND

e. The minimum provisions for fuel storage should be met as given in Table 18 (row b).

AND

f. The minimum provisions for hot water storage and labelling of storage vessels as given in Table 18 (row c) need to be met

AND

g. The minimum provisions for system preparation and water treatment, as given in Table 18 (row d) should be met.

AND

h. The system should be commissioned in accordance with the minimum provisions given in Table 18 (row e).

AND

i. The minimum provisions for control of the heating and hot water circuits, as given in Table 19, should be met. An acceptable alternative to these is any boiler management control system that meets the specified zoning, timing and temperature requirements.

AND

j. Pipework should be insulated as described in Table 20

Supplementary information

Turn-down values (i.e. the ratio of high to low output)

- Turn-down ratios are generally very good (>10:1) for automatic-feed appliances with small firebeds.
- Turn-down ratios are less good with large batch-fed appliances unless these are used in conjunction with a hot water accumulator.
- Automatic appliances are likely to require less frequent refuelling. Automatic (e.g. electric or gas) ignition is now available for certain designs and reduces energy usage at times of low demand, allowing boiler interlock.
- Some boilers have both auto-ignition and fire-extinguishing features.

Link-up systems

It is possible to connect together two or more heating appliances with boilers (at least one of which can be solid-fuel fired), to maximise flexibility and efficiency. Both systems should be designed to appropriate installation codes and in accordance with manufacturer's instructions and installed by competent installers. See Section 11.7 in S.R. 54:2014 for further guidance.

Table 18 Minimum provisions for system circulation, fuel storage, hot water storage, system preparation and commissioning of solid fuel central heating			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
a. System circulation	a. Where boiler interlock is available, fully pumped circulation should be chosen. b. The manufacturer's instructions on the sizing and positioning of heat leak radiators should be followed. c. Solid-fuel appliances should not be fitted to sealed heating systems with expansion vessels, except where specifically permitted by the manufacturer or where a thermal storage interface device is used.	As defined for **new systems.**	Most solid-fuel central heating systems require a heat leak radiator to dissipate heat from the smouldering fire bed. This is commonly the bathroom towel rail, and a thermosiphon system may be used for this circuit. In some cases, a fully pumped system reduces efficiency and should not be used.
b. Fuel storage	Provision should be made for storage of reasonable quantities of fuel in a convenient and dry location. For wood, a fuel storage capacity of at least 1.5m^3 is required. The size of the storage will depend upon the requirement of the house	As defined for **new systems.**	No minimum quantity of fuel is specified for solid mineral fuel but bunkers greater than 250kg are preferred as below this householders are likely to pay a delivery premium.

Table 18 Minimum provisions for system circulation, fuel storage, hot water storage, system preparation and commissioning of solid fuel central heating (continued)			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
c. Hot water storage	a. Vented copper hot water storage vessels should comply with the heat loss and heat exchanger requirements of BS 1566-1:2002+A1:2011 or BS 3198:1981. b. Vented cylinders in materials other than copper should comply with the heat loss and heat exchanger requirements of BS 1566-1:2002+A1:2011. c. Unvented hot water storage systems products should: • comply with I.S. EN. 12897:2016; or • be certified by the Irish Agrément Board; or • be certified by another accredited body as complying with Building Regulations.	As defined for **new systems.**	**Primary hot water stores** These can have a major role to play in the installation of solid fuel. The main reason for their use is to store the heat generated during slumber periods but they also provide mains pressure hot water and possible frost protection (via electric immersion heaters) from a solid-fuel system. Domestic hot water outlet temperature is to be controlled at a safe level. Because of the higher than normal storage temperatures it is very important that these are well insulated. **Standards** BS 1566-1:2002+A1:2011 Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods.

Table 18 Minimum provisions for system circulation, fuel storage, hot water storage, system preparation and commissioning of solid fuel central heating (continued)			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
	d. Unvented systems should not be used with gravity circulation **Labelling of hot water storage vessels** e. All hot water storage vessels should carry a label with the following information**:** • type of vessel; • nominal capacity in litres; • standing heat loss in kWh/day; • type of vessel; • heat exchanger performance in kW.		BS 3198:1981 Specification for copper hot water storage combination units for domestic purposes. I.S. EN 12897:2016 Water supply. Specification for indirectly heated unvented (closed) storage water heaters.
d. System preparation and water treatment	a. Central heating systems should be thoroughly cleaned and flushed out before installing a new boiler.	As defined for **new systems.**	BS 7593 notes that “naturally soft waters of low alkalinity or those supplied via a base-exchange resin softener have an increased potential for corrosion, and, if they are used in any central heating system, a corrosion inhibitor specifically formulated for the purpose should be added and properly maintained.”

Table 18 Minimum provisions for system circulation, fuel storage, hot water storage, system preparation and commissioning of solid fuel central heating (continued)			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
	b. During final filling of the system a chemical water treatment formulation should be added to the primary circuit to control corrosion and the formation of scale and sludge. Reasonable provision would be to follow the guidance on how to prepare and commission systems given in BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems. c. Installers should also refer to the boiler manufacturer's installation instructions for appropriate treatment products and special requirements for individual boiler models. d. Where the mains water hardness exceeds 200 parts per million, provisions should be made to treat the feed water to water heaters and the hot water circuit of combination boilers to reduce the rate of accumulation of lime scale and the consequent reduction in energy efficiency.	As defined for **new systems.**	Manufacturers should be consulted for advice, paying particular attention to dosage levels. Special radiator valves are available that will seal off the radiator as well as the heating circuit to prevent loss of inhibitor when removing a radiator for service or maintenance. A filter can also be fitted to the central heating circuit to help maintain the efficiency and reliability of the system.

Table 18 Minimum provisions for system circulation, fuel storage, hot water storage, system preparation and commissioning of solid fuel central heating (continued)			
	Minimum provision for new systems	**Minimum provision for replacement systems**	**Supplementary information**
e. Commissioning	a. On completion of the installation of a boiler/or a hot water storage system, together with associated equipment such as pipework, pumps and controls, the equipment should be commissioned in accordance with the manufacturer's instructions. These instructions will be specific to the particular boiler and/or hot water storage system. b. The installer should give a full explanation of the system and its operation and maintenance to the user, including the manufacturer's user manual where provided.	As defined for **new systems.**	

Table 19 Minimum provisions for system controls for solid-fuel central heating systems in new and existing dwellings*			
System control	**Minimum provisions for new systems**	**Minimum provisions for replacement systems**	**Supplementary information**
All appliances, except open fires	Thermostatic control of the burning rate.	Thermostatic control of the burning rate based on temperature of water in the boiler where the appliance uses a boiler.	
Automatic-feed appliances			
Zoning	• **Dwellings with a total usable floor area of greater than 100m^2** should be provided with at least two space heating zones each having separate temperature controls. • Single-storey open-plan dwellings in which the living area is greater than 70% of the total floor area – sub-zoning of temperature control is not appropriate.	As defined for **new systems.**	
Time control of space and water heating	Time control of space and water heating should be provided by: i. A full programmer with separate timing to each circuit; or	As defined for **new systems.**	The level of sophistication should be appropriate to and compatible with the appliance. The highest levels are only appropriate to appliances with automatic ignition.

Table 19 Minimum provisions for system controls for solid-fuel central heating systems in new and existing dwellings* (continued)			
System control	**Minimum provisions for new systems**	**Minimum provisions for replacement systems**	**Supplementary information**
	ii. Two or more separate timers providing timing control to each circuit; or iii. Programmable room thermostat(s) to the heating circuit(s), with separate timing of the hot water circuit.		
Temperature control of space heating	Separate temperature control of zones within the dwelling, should be provided, using: i. room thermostats or programmable room thermostats in all zones; or ii. a room thermostat or programmable room thermostat in the main zone and individual radiator controls such as Thermostatic Radiator Valves (TRVs) on all radiators in the other zones; or iii. a combination of (i) and (ii) above.	As defined **for new systems.**	

Table 19 Minimum provisions for system controls for solid-fuel central heating systems in new and existing dwellings* (continued)			
System control	**Minimum provisions for new systems**	**Minimum provisions for replacement systems**	**Supplementary information**
Temperature control of hot water service system	• A cylinder thermostat and a zone valve or three-port valve to control the temperature of stored hot water should be fitted. • The use of non-electric hot water controllers does not meet this requirement. • Where permitted by the manufacturer, the cylinder thermostat should be wired to provide a boiler interlock.	A method of temperature control should be provided to prevent excessive tap water temperatures. As defined for **new systems.**	In some circumstances, such as thermal stores, a zone valve is not appropriate; a second pump could be substituted for the zone valve.

*An acceptable alternative to these controls is any boiler management control system that meets the specified zoning, timing and temperature and boiler interlock control requirements.

Supplementary information – controls for solid-fuel central heating

- Boiler interlock, provided by a wiring arrangement, to prevent the system from operating when there is no demand for heat, should only be fitted if recommended by the manufacturer.
- In some simple batch-fed or automatic appliances (without heat stores and/or without automatic ignition) it is not possible to switch off the heat output completely, however the appliance output can be lowered to a minimum to reduce fuel consumption.
- In most solid-fuel systems the room thermostat will switch off the pump, which in turn will cause the boiler to operate at minimum output.
- Some automatic solid-fuel systems can be fitted with weather compensation, and incorporate multi-zone control. It is important to seek guidance from the manufacturer, especially if the heating package is to include other fuels.
- Controls may be provided by any boiler management control system that meets the specified zoning, timing and temperature, and boiler interlock control requirements.
- The level of sophistication should generally be appropriate to and compatible with the appliance. The highest levels are only appropriate to appliances with automatic ignition.
- As far as it is practicable to do so when working on existing systems, controls should be upgraded to the levels defined for new systems.

Table 20 Minimum provisions for insulation of pipes serving solid-fuel central heating systems

Minimum provision	Supplementary information
In new systems pipes should, in the following cases, be insulated as follows (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly: • Primary circulation pipes for heating and hot water circuits should be insulated wherever they pass outside the heated living space or through voids which communicate with and are ventilated from unheated spaces • Pipes and ducts which are incorporated into wall, floor or roof construction should be insulated. • Primary circulation pipes for hot water service circuits should be insulated throughout their length, subject only to practical constraints imposed by the need to penetrate joists and other structural elements. • All pipes connected to hot water storage vessels (primary flow and return), including the vent pipe, should be insulated for at least 1m from their points of connection to the cylinder (or they should be insulated up to the point where they become concealed). • If secondary circulation is used, all pipes kept hot by that circulation should be insulated.	**Insulation for pipework in unheated areas** Extra provision may need to be made to protect central heating and hot water pipework in unheated areas against freezing. Further guidance is available in: • BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C. • BRE Report No 262 Thermal insulation: avoiding risks, 2001 edition. Where insulation is labelled as complying with the Heating and Domestic Hot Water Systems for dwellings-Achieving Compliance with Part L it must not exceed the following heat loss levels: **Pipe* diameter (OD) Maximum permissible heat loss** (W/m)** 8mm 7.06 10mm 7.23 12mm 7.35

Table 20 Minimum provisions for insulation of pipes serving solid-fuel central heating systems (continued)	
Minimum provision	**Supplementary information**
For **replacement systems**, whenever a boiler or hot water storage vessel is replaced in an existing system, any pipes (in the situations above) that are exposed as part of the work or are otherwise accessible should be insulated as recommended in this guide (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly – or to some lesser standard where practical constraints dictate.	15mm 7.89 22mm 9.12 28mm 10.07 35mm 11.08 42mm 12.19 54mm 14.12 ***** The maximum permissible heat loss applies to all pipe materials (i.e. steel, copper, plastic and other). **In assessing the thickness of insulation required to meet the provision, standardised conditions should be used in all compliance calculations based in this instance on a horizontal pipe at 60ºC in still air at 15ºC.

5.4 Solid-fuel appliances for secondary heating

Solid-fuel appliances in new and existing dwellings, which are provided for secondary heating and are not part of a central heating system, should have a minimum efficiency (gross calorific value) no less than specified in Table 16 for that category of appliance.

Supplementary information – solid-fuel appliances providing secondary heating

Minimum efficiencies

Individual manufacturer's efficiency figures may be higher than those indicated in table 16 and should be used where independently certified against the harmonised European Standards now in place.

Appliance types

Appliances which are most suitable for secondary space heating are summarised on the following page.

Appliance type	Notes
a. Open-fire with high output boiler, when used with 'link-up'	
b. Small solid-fuel room heaters (stoves), especially wood-fired	These can be a dedicated wood burner or burn logs in a multi-fuel appliance or use pellets. They can be matched with a main heating system fired by the same or a different primary fuel or off-peak electricity to reduce carbon emissions, especially wood-fired, with or without thermostatic control. Many designs can provide heating during power cuts. Mineral fuel appliances can be chosen but the attention of designers is drawn to the probable need to supply additional measures, as the carbon emission values of these tend to be high. Mineral fuel appliances may often have slightly higher efficiencies than their wood-burning counterparts. Multi-fuel room heaters can enable the user to burn renewable wood as well as an alternative to mineral fuels outside smoke control areas.
c. Small solid-fuel stoves with boilers	The efficiency of these can be higher than for dry appliances. They can be integrated with the primary wet heating system. Multi-fuel appliances enable the householder to burn renewable wood in smoke control areas.
d. Range cookers	Typically, these appliances are installed in a 'living area' and designed to provide some useful heat from their case into the living area. They vary in shape and size and can incorporate boilers connected to dual-fuel integrated systems (e.g. link-up). Multi-fuel versions are also available.
e. Where requested, open fires can be fitted	These do not have thermostatic control and have lower efficiencies. However, they are able to burn wood logs with correspondingly low net carbon emissions. It must be stressed that large open fires with large free face areas (see Note 1) usually have ventilation requirements well in excess of that available in a property built to modern standards of air tightness. This is likely to lead to severe operational problems unless special steps are taken to provide the required air supply. The use of such large (simple) open fires is penalised in the DEAP calculations. Note 1: The free-face area of an open fire is its open width times open height.

Controls for solid-fuel appliances providing secondary heating

Wherever possible, solid fuel appliances should have thermostatic control (these are usually integral to appliances in categories E, F and G). Controls should be appropriate to the level of sophistication of the appliance; automatic appliances can benefit from advanced controls.

Provision of fuel storage for solid-fuel appliances providing secondary heating

The quantity of fuel consumed by secondary heating appliances is likely to be less than 1 tonne per year. However, it should be stored in a dry and convenient location.

For further information on solid fuel appliances see Energy Efficiency Best Practice in Housing publication – CE 47 Domestic Heating by Solid Fuel: Boiler Systems.

Standards

I.S. EN 12809:2001+A1:2004+AC:2006/2007 Residential independent boilers fired by solid fuel. Nominal output up to 50 kW. Requirements and test methods.

I.S. EN 12815:2001+A1:2004/2006/2007 Residential cookers fired by solid fuel. Requirements and test methods.

I.S. EN 13229:2001+A1:2003+A2:2004+AC:2006/2007 Inset appliances including open fires fired by solid fuel. Requirements and test methods.

I.S. EN 13240:2001+A2:2004+AC2006/2007 Room heaters fired by solid fuel. Requirements and test methods.

I.S. EN 15250:2007 Slow heat release appliances fired by solid fuel. Requirements and test methods.

I.S. EN 15544:2009 One-off tiled/mortared stoves. Calculation method.

I.S. EN 14785:2006 Residential space heating appliances fired by wood pellets.

6. Community Heating Systems

This section provides guidance on the specification of Community Heating (CH) systems in dwellings that, if followed, will satisfy the minimum requirements of Part L of the Building Regulations.

The sections in Part L dealing with central heating and hot water systems also apply to Community Heating. Procedures for calculating the energy use and carbon emissions associated with Community Heating are included in the Dwelling Energy Assessment Procedure (DEAP).

6.1 Scope of guidance

The guidance in this section applies to CH systems. It covers CH using boilers as the heat source as well as those that use renewable heat sources such as biofuels, heat pumps and solar panels or Combined Heat and Power (CHP),

Guidance is provided for two scenarios:

- Where dwellings will be connected to a new CH scheme; and
- Where dwellings will be connected to an existing CH scheme.

Guidance given in the warm air heating or underfloor heating sections is also relevant to CH where these types of space heating systems are used with CH. The remainder of this section providing guidance on CH assumes that a radiator system is employed similar to that for gas-fired central heating systems.

6.2 Definition of Community Heating (CH)

Community Heating is defined as a system serving multiple dwellings from a central source within the boundaries of the site, i.e. full details of the heat sources and spaces served are available.

District heating is defined as a central system serving multiple dwellings from a system outside the boundaries of the site. Details of the performance of the system must be provided by the District Heating Scheme Operator.

The guidance in this document assumes that the CH distribution system uses hot water as the energy carrier. Hot water service systems may be generated centrally within each building or in individual dwellings.

Minimum provisions for connection of dwellings to a new CH scheme

In order to comply with the requirements, new CH systems to supply both new and existing dwellings should meet all of the following conditions:

a. The minimum provisions for system design to maximise the efficiency of heat generation and minimise energy use by pumps should be met as given in Table 21.

AND

b. Where the system uses low-carbon heat sources (e.g. CHP, biofuels, or heat pumps), the minimum provisions for the lead heat generator, should be met, as defined in Table 22.

AND

c. Where heating systems are to be installed for new dwellings, the minimum provisions for control of the system should be met as given in Table 23.

AND

d. The minimum provisions for hot water production, storage and treatment should be met as in Table 24 (rows a and b).

AND

e. The minimum provisions for the installation of heat meters should be met as given in Table 24 (row c).

AND

f. The minimum provisions for commissioning of the system should be met as given in Table 24 (row d).

AND

g. The minimum provisions for insulation of pipework should be met as given in Table 25.

Minimum provisions for connection of dwellings to an existing CH scheme

When new or existing dwellings are connected to an existing CH scheme the following conditions should be met:

a. Where existing CH systems are in need of replacement or improvement a specific study should be carried out to assess the economic and environmental benefits of a range of options, including the use of CHP and other renewable heat sources or CHP, especially where individual heating systems are being considered as an alternative to continuing with the CH system.

AND

b. If thermal energy is purchased from an existing district or community heating system an assessment of the carbon intensity of the scheme should be carried out. Emission factors should be determined based on the particular details of the scheme, but should take account of the annual average performance of the whole system (i.e. the distribution circuits and all the heat generating plant, including any CHP, and any waste heat recovery or heat dumping). The calculation of the Building Energy Rating should be carried out by a suitably qualified person, detailing how the emission factors were derived.

AND

c. The minimum provisions for control systems within dwellings should be met as given in Table 23.

AND

d. The minimum provisions for insulation of pipework should be met as given in Table 25.

Table 21 Minimum provisions for the design of new community heating systems to maximise efficiency of heat generation and minimise energy use by pumps		
	Minimum provision	**Supplementary information**
a. Boilers for CH	• Boiler-only community heating systems for new dwellings may be used provided that the Energy performance coefficient (EPC) and The Carbon Performance Coefficient (CPC) are no greater the Maximum Permitted Energy Performance Coefficient and the Maximum Permitted Carbon Performance Coefficient and the Renewable Energy Ratio for each dwelling is achieved in accordance with TGD L Sections 1.1 & 1.2 • Boilers should be selected to comply with the boiler efficiency requirements of the **Non-Domestic Building Services Compliance Guide.**	• When calculating the carbon emissions rating, the type and quantity of fuel used and also the electricity needed to operate the central plant and pumps should be taken into account. • For systems using condensing boilers: a) To achieve high boiler efficiency, return temperatures from radiator circuits should be selected lower than 50ºC. b) Where instantaneous plate heat exchangers are used to produce hot water in individual dwellings the return temperature selected should be less than 40ºC. c) Where hot water cylinders are used the coil size should be such as to require a flow rate that results in a nominal return temperature of less than 40ºC while meeting the required heat-up time. d) Where hot water is produced centrally (e.g. in each block of dwellings) return temperatures lower than 40ºC should be achieved.

Table 21 Minimum provisions for the design of new community heating systems to maximise efficiency of heat generation and minimise energy use by pumps (continued)		
	Minimum provision	**Supplementary information**
b. Controlling the sequencing and firing of boilers	c. For new community heating systems, the design temperature difference for the community heating primary circuit should be greater than 20°C. d. Variable volume control systems should be used to reduce the volume of water and the pressure difference required from the pumps under part load.	Setting occupation times is not generally possible for a group of dwellings and so optimum start controls are not a recommendation.
c. Minimising energy used by pumps	• For new CH systems, the design temperature difference for the CH primary circuit should be greater than 20ºC. • Variable volume control systems should be used to reduce the volume of water and the pressure difference required from the pumps under part load.	• Pumping energy can be minimised by optimizing operating temperatures and pipe sizes to reduce installed pump power. • To take full advantage of variable volume systems, variable speed pumps should be installed and controlled to deliver the required pressure difference to suit the load. • Further guidance is provided in BSRIA Application Guide AG 16/2002 – Variable-flow Water Systems: Design, Installation and Commissioning Guidance.

Table 22 Minimum provisions for design of renewable and CHP heat sources where these are included in community heating systems		
	Minimum provision	**Supplementary information**
a. Low carbon heat sources		Community heating systems can be designed to use low carbon heat sources to meet all or part of the heat demand, which may enable some relaxation of the U-values that would otherwise be required.
b. Biofuels	Appliances must be designed to run on biofuels only, i.e. incapable of providing thermal energy from fossil fuels.	a. Where a building or development contains more than one dwelling, reasonable provision would be to show that: - every individual dwelling should meet the minimum provision for renewable energy technologies: a Renewable Energy Ratio of 0.2 represents 20 % of the primary energy from renewable energy technologies to total primary energy as defined and calculated in DEAP; or - the average contribution of renewable technologies to all dwellings in the building or development should meet that minimum level of provision per dwelling. b. Biofuels can be used to provide heat from boiler systems or as a fuel for CHP systems. Consideration should be given to operation and maintenance of the plant to ensure a long life and to prevent a later replacement by a conventional fuel system.

Table 22 Minimum provisions for design of renewable and CHP heat sources where these are included in community heating systems (continued)		
	Minimum provision	**Supplementary information**
		c. Where a biofuel boiler is to be used in conjunction with conventional heating boilers or electric heating a reasonable minimum proportion of the annual heat supply from biofuels would be 45% of the annual heat demand (space, hot water service and process heating). d. Where there are both common areas and individual dwellings in a building, reasonable provision would be to show that the average contribution of renewable technologies to all areas meets the minimum level of renewable provision to the individual dwellings and common areas combined. In this case, a proportion of the renewables should be provided to each area and individual dwelling in the building.
c. Combined heat and power (CHP)	CHP capacity should be optimised to meet the required economic and environmental objectives. The energy supplied by such a CHP plant would normally exceed the reasonable minimum level of energy provision from renewable energy technologies.	CHP capacity should be optimised to meet the required economic and environmental objectives. **a.** A reasonable minimum proportion of the annual heat supply from CHP would be 45% of the annual heat demand (space, domestic and hot water heating).

Table 22 Minimum provisions for design of renewable and CHP heat sources where these are included in community heating systems (continued)		
	Where CHP is used in conjunction with boiler plant, the control system should ensure as far as practicable that the CHP plant operates as the lead heat source.	**b.** To maximise the use of CHP heat over the year, consideration should be given to the use of thermal storage to meet peaks, especially in the early morning period. **c.** The procedure given in DEAP should be used to calculate the carbon emissions from CHP systems.
d. Heat pumps	In the case of electrically powered heat pumps, DEAP sets the procedure to calculate the renewable energy provision for use in the Renewable Energy Ratio.	a. Heat pumps can be used as a heat source for CH systems. Selection of operating temperatures to suit both efficient community heating systems and achieve high coefficients of performance is important if carbon emissions are to be reduced. This may lead to the use of underfloor heating and the provision of hot water service by other means. b. Where heat pumps are installed in conjunction with conventional heating boilers, a reasonable minimum proportion of the annual heat supply from the heat pump would be 45% of the annual space heating demand.

Table 22 Minimum provisions for design of renewable and CHP heat sources where these are included in community heating systems (continued)		
	Minimum provision	**Supplementary information**
		Where a building or development contains more than one dwelling, reasonable provision would be to show that: - every individual dwelling should meet the minimum provision for renewable energy technologies: a Renewable Energy Ratio of 0.2 represents 20 % of the primary energy from renewable energy technologies to total primary energy as defined and calculated in DEAP; or - the average contribution of renewable technologies to all dwellings in the building or development should meet that minimum level of provision per dwelling. Where there are both common areas and individual dwellings in a building, reasonable provision would be to show that the average contribution of renewable technologies to all areas meets the minimum level of renewable provision to the individual dwellings and common areas combined. In this case, a proportion of the renewables should be provided to each area and individual dwelling in the building.
e. Solar		Solar thermal panels can be used as the heat source for a centralised domestic hot water system.

Table 22 Minimum provisions for design of renewable and CHP heat sources where these are included in community heating systems (continued)		
	Minimum provision	**Supplementary information**
		Where a building or development contains more than one dwelling, reasonable provision would be to show that: - every individual dwelling should meet the minimum provision for renewable energy technologies: a Renewable Energy Ratio of 0.2 represents 20 % of the primary energy from renewable energy technologies to total primary energy as defined and calculated in DEAP; or - the average contribution of renewable technologies to all dwellings in the building or development should meet that minimum level of provision per dwelling. Where there are both common areas and individual dwellings in a building, reasonable provision would be to show that the average contribution of renewable technologies to all areas meets the minimum level of renewable provision to the individual dwellings and common areas combined. In this case, a proportion of the renewables should be provided to each area and individual dwelling in the building.

Table 23 Minimum provisions for controls systems within dwellings for community heating		
	Minimum provision for new systems	**Supplementary information**
a. Zoning	• **For new dwellings with a total usable floor area up to 100m²** , depending on the design and layout of the dwelling, control on the basis of a single zone will generally be satisfactory. If divided into two spacing zones with independent temperature control, then one of which should be assigned to the living area.	In single-storey open-plan dwellings in which the living area is greater than 70% of the total floor area, sub-zoning of temperature control is not appropriate.
b. Time control of space heating	• Time control of space heating should be provided within each dwelling connected to the CH system comprising: i. a full programmer; ii. separate timer providing timing control to space heating; or iii. programmable room thermostat(s) to the heating circuit(s).	Where the hot water is produced instantaneously, such as with a plate heat exchanger, time control is only required for space heating zones. Time control of domestic hot water heating using a cylinder is not considered essential for CH and could be a disadvantage with CHP-based systems, increasing the morning peak demand and hence causing more use of the boiler than necessary.
c. Temperature control of space heating	• Separate temperature control of zones within the dwelling, should be provided, using: i. room thermostats or programmable room thermostats in all zones; or	Control valves and TRVs should be two-port type to reduce flow rates under part-load.

Table 23 Minimum provisions for controls systems within dwellings for community heating (continued)		
	Minimum provision for new systems	**Supplementary information**
	ii. a room thermostat or programmable room thermostat in the main zone and individual radiator controls such as Thermostatic Radiator Valves (TRVs) on all radiators in the other zones; or iii. a combination of (i) and (ii) above.	Differential pressures across the control valves and TRVs should be controlled to maximum values to ensure that the control valves work effectively and maintain shut-off.
d. Temperature control of domestic hot water	• Temperature control of the domestic hot water service should be provided by means of two-port control valves either electrically operated or direct acting.	Where instantaneous heat exchangers are used the control valve should be selected to maintain steady temperatures (<±5ºC) for a range of draw-off rates and primary differential pressures. To reduce the incidence of scaling, the control valve should shut off the primary flow when there is no domestic hot water draw-off. A small intermittent flow is an advantage to maintain the temperature within the heat exchanger so as to provide more rapid heat-up.
e. Limitation of maximum flow rate into building or dwelling	The maximum design flow rate into the dwelling heating system should be limited by suitable control and balancing valves to maintain the overall balance in the network and to avoid excessive pumping energy.	

Table 24 Minimum provision for domestic hot water production, storage and water treatment, heat meters and commissioning for community heating		
	Minimum provision	**Supplementary information**
a. Hot water service production and storage	The hot water service system should be controlled using variable volume control principles and be designed to maintain low return temperatures in the primary CH circuit.	Hot water can be produced in four ways in CH systems: • in individual dwellings using indirect storage cylinders; • in individual dwellings using instantaneous plate heat exchangers; • centrally using storage calorifiers with either an indirect coil or an external plate heat exchanger; • centrally using an instantaneous plate heat exchanger. In selecting the system consideration should be given to: • the impact on return temperatures in the CH system; • the impact on flow rates in the CH system; • the impact on heat demand profiles and compatibility with the heat source; • standing losses from storage cylinders/ calorifiers and the impact on energy use; • the quality of service provided in terms of flow rate and temperature control;

Table 24 Minimum provision for domestic hot water production, storage and water treatment, heat meters and commissioning for community heating (continued)		
	Minimum provision	**Supplementary information**
		• the advantages of having local storage in terms of security of supply; • lifetime maintenance and replacement costs for components. Where the network is extensive and hot water production is centralised, a two-stage water heating system can be used to deliver low return temperatures. In this design the return water from the space heating circuit is used to pre-heat the cold feed to the domestic hot water.
b. Water treatment	A suitable system for introduction of water treatment chemicals into the CH system in a controlled manner with facility for monitoring of water quality should be provided.	A suitable long-term programme of water treatment is essential to preserve the life of the CH system by limiting internal corrosion. Additional chemical and physical treatment should be evaluated especially for larger systems, including: • removal of oxygen by physical means; • softened water supply; • side-stream filtration; • biocide.

Table 24 Minimum provision for domestic hot water production, storage and water treatment, heat meters and commissioning for community heating (continued)		
	Minimum provision	**Supplementary information**
c. Heat meters	Provision should be made in the design for including heat meters either at the time of installation or at a later date without major pipework changes.	
d. Commissioning	• The CH system should be commissioned so that the design volume flow rates are supplied to each dwelling and there is no excessive bypassing of water that would lead to higher pumping energy use. • The flow rates in individual heat emitters should be balanced using appropriate return temperatures or by using calibrated control valves. • The systems within the dwellings should be demonstrated to the resident and suitable information provided on the operation of the controls.	Where the central heat source includes a low-carbon heat source the control system should be proven by demonstrating that the low-carbon heat source will normally act as the lead heat source.

Table 25 Minimum provision for insulation of pipes for community heating systems (within dwellings and distribution pipework outside the dwelling)

Minimum provision	Supplementary information
In new systems pipes should, in the following cases, be insulated in accordance with the recommendations in this guide (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly: • Primary circulation pipes for heating and hot water circuits should be insulated wherever they pass outside the heated living space or through voids which communicate with and are ventilated from unheated spaces. • Primary circulation pipes for hot water service circuits should be insulated throughout their length, subject only to practical constraints imposed by the need to penetrate joists and other structural elements. • All pipes connected to hot water storage vessels, including the vent pipe, should be insulated for at least 1m from their points of connection to the cylinder (or they should be insulated up to the point where they become concealed). • If secondary circulation is used, all pipes kept hot by that circulation should be insulated.	**Insulation for pipework in unheated areas** Extra provision may need to be made to protect central heating and hot water pipework in unheated areas against freezing. Further guidance is available in: • BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C. • BRE Report No 262 Thermal insulation: avoiding risks, 2001 edition Where insulation is labelled as complying with the Heating and Domestic Hot Water Systems for dwellings-Achieving Compliance with Part L it must not exceed the following heat loss levels: **Pipe* diameter (OD)** — **Maximum permissible heat loss** (W/m)** 8mm — 7.06 10mm — 7.23 12mm — 7.35 15mm — 7.89

Table 25 Minimum provision for insulation of pipes for community heating systems (within dwellings and distribution pipework outside the dwelling) (continued)	
Minimum provision	**Supplementary information**
For replacement systems, whenever a boiler or hot water storage vessel is replaced in an existing system, any pipes (in the situations above) that are exposed as part of the work or are otherwise accessible should be insulated as recommended in this guide (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly – or to some lesser standard where practical constraints dictate.	22mm 9.12 28mm 10.07 35mm 11.08 42mm 12.19 54mm 14.12 ***** The maximum permissible heat loss applies to all pipe materials (i.e. steel, copper, plastic and other). ** In assessing the thickness of insulation required to meet the provision, standardised conditions should be used in all compliance calculations based in this instance on a horizontal pipe at 60ºC in still air at 15ºC
Insulation of community heating pipework (i.e. distribution pipes outside the dwelling)	
CH pipework should be insulated to the standards defined in I.S. EN 253:2019 for pre-insulated pipes or to an equivalent performance for conventionally insulated pipes.	CH pipework typically uses pre-insulated buried pipe systems. Minimum insulation thicknesses are defined in the EN standards. Where pipework is run above ground the pipe insulation performance should be at least as high as that used in the buried part of the system.

Table 25 Minimum provision for insulation of pipes for community heating systems (within dwellings and distribution pipework outside the dwelling) (continued)	
Insulation of community heating pipework (i.e. distribution pipes outside the dwelling)	
	Enhanced insulation standards should be evaluated where CH is supplied only from fossil-fuelled boilers or where flow temperatures over 100ºC are being used. **Designing for minimum heat losses from distribution pipework** Heat losses can be reduced by optimising operating temperatures in conjunction with the need to minimize pumping energy. Variable volume control systems will assist in maintaining low return temperatures. While some bypasses may be needed to maintain the system in a hot condition ready to meet the demand these should be controlled to the minimum flow needed. The use of temperature controlled bypass valves where the bypass only operates when flow temperature has dropped below a set level is recommended.

Supplementary information

Additional information is provided in the documents and standards listed below.

Energy Efficiency Best Practice Programme publication – GPG 234 Good Practice Guide	Guide to community heating and CHP – commercial, public and domestic applications. Available from the Carbon Trust
I.S. EN 13941:2009+A1:2010	Design and installation of pre-insulated bonded pipe systems for direct heating.
I.S. EN 14419:2009	District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Surveillance systems.
I.S. EN 253:2019	District heating pipes. Bonded single pipe systems for directly buried hot water networks. Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a casing of polyethylene.
I.S. EN 488:2019	District heating pipes. Bonded single pipe systems for directly buried hot water networks. Factory made steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.
I.S. EN 489:2009	District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.

7. Underfloor heating systems

This section provides guidance on the specification of underfloor heating systems in dwellings.

7.1 Scope of guidance

The guidance in this section covers systems that use hot water as the energy carrier and those that rely on electric heating elements. It should be used in conjunction with the guidance on central heating systems in the fuel-based sections of this guide on gas-fired, oil-fired, solid-fuel or electric heating systems.

Underfloor heating in new dwellings should meet all of the following conditions:

a. The minimum provisions for control of the system and safe operating temperatures as given in Table 26 should be met.

AND

b. The minimum provisions for floor insulation and system design to minimise distribution losses should be met as outlined in Table 27.

AND

c. For electric underfloor heating systems in new dwellings the minimum provisions for construction and controls as set out in Table 28 as applicable to the type of system.

Table 26 Minimum provisions for control of electric and wet underfloor heating systems		
Controls	**Minimum provision**	**Supplementary information**
a. System temperature controls (electric and wet floor heating systems)	All floor heating systems, should be fitted with suitable controls to ensure safe system operating temperatures, as follows: • A separate flow temperature high-limit thermostat is required for warm water systems connected to any high water temperature heat supply (i.e. operating at more than 60°C). • Mixed systems containing both radiators and floor heating, connected to a common high water temperature supply (i.e. operating at more than 60°C) should be provided with a separate means of reducing the water temperature to the floor heating system.	For optimum long-term efficiency, consider using weather compensating controllers with thermo-electric mixing valves.
b. Room temperature control (electric and wet floor heating systems)	• Each room should have its own temperature control device; however, it may be acceptable for adjacent rooms with similar function to share a thermostat or sensor, e.g. separate kitchen and utility areas. • Bathrooms or en-suites which share a heating circuit with an adjacent bedroom will provide heat only when the bedroom thermostat is activated. In such cases, the bathroom or en-suite areas should be fitted with an independent towel rail or radiator. • Weather compensating controllers should be installed.	Underfloor heating systems, particularly those embedded in screeds are characterised by slow response time and this should be considered in the system design.

Table 26 Minimum provisions for control of electric and wet underfloor heating systems (continued)		
Controls	**Minimum provision**	**Supplementary information**
c. Time control (electric and wet floor heating systems)	• **For new dwellings with a total usable floor area of up to 100m^2**, depending on design and layout of the dwelling, control on the basis of a single zone will generally be satisfactory. If divided into two space heating zones with independent temperature control, then one of which should be assigned to the living area. • **Dwellings with a total usable floor area of greater than 100m^2** should be provided with at least two space heating zones each having separate temperature controls. • **Single-storey open-plan dwellings in which the living area is greater than 70% of the total floor area** – sub-zoning of temperature control is not appropriate**.** • **Thick screed floor heating systems (>65mm)** should have facilities for automatic setback of room temperature to a lower level at night or during unoccupied periods.	Facilities for automatic setback of room temperature to a lower level at night or during unoccupied periods are recommended for both electrical and warm water systems.
d. Boiler control (wet systems only)	Warm-water floor-heating system controls should be interlocked with the boiler and stored hot water temperature control to ensure that the boiler does not fire when there is no demand for heat for either space or water heating.	

Table 27 Minimum provisions for floor insulation and minimising distribution losses of wet and electric underfloor heating systems		
Floor insulation and design for reducing distribution losses	**Minimum provision**	**Supplementary information**
a. Exposed ground floors	i. Ground floors on earth, or suspended floors in contact with outside air should be insulated to limit downward heat loss to not more than 10W/m^2 resulting from thermal resistance of the applied floor finish. The floor should achieve a maximum U-value of 0.15 W/m^2K. ii. When heat output is not known, but the floor finish is specified, the extra amount of system thermal insulation may be calculated using the sum of the thermal resistance of the floor finish and the thermal resistance of the underlying heated layer, all multiplied by a factor of 10. iii. Supplementary floor heating system thermal insulation may be supplied independently or added to the statutory floor insulation requirement. iv. Notwithstanding (iii) above, floor heating systems intended for cyclical operation or installed over unheated rooms should be separated from the structural floor by a layer of thermal insulation of at least 1.25m^2 K/W thermal resistance, and installed below the heated plane.	

Table 27 Minimum provisions for floor insulation and minimising distribution losses of wet and electric underfloor heating systems (continued)		
Floor insulation and design for reducing distribution losses	**Minimum provision**	**Supplementary information**
b. 1. Intermediate floors (with heated rooms below): Wet systems	Intermediate floors with heated rooms below, complying with both Part L and Part E of the Regulations, should have a separating layer of system thermal insulation to comply with IS EN1264, Part 4, where the minimum thermal resistance is given as not less than R = 0.75m^2 K/W.	Thermal insulation of party floors is essential because the floor/ceiling is directly coupled to the heating elements.
b. 2. Intermediate floors (with heated rooms below): Electric systems	Intermediate floors with heated rooms below, complying with both Part L and Part E of the Regulations, should have a separating layer of system thermal insulation where the minimum thermal resistance is given as not less than R = 0.5m^2 K/W.	
c. System design to minimize distribution losses	i. Underfloor heating distribution boards or warm water distribution manifolds should be located centrally between the rooms being heated, thus minimising the length of interconnecting services. ii. Service pipes should be insulated or routed via conduits to reduce distribution losses where there is a risk of overheating the room or floor finish as a result of the presence of hot water service pipes in transit to more distant rooms, and/or avoidable energy loss.	

Table 27 Minimum provisions for floor insulation and minimising distribution losses of wet and electric underfloor heating systems (continued)		
Floor insulation and design for reducing distribution losses	**Minimum provision**	**Supplementary information**
d. System commissioning and corrosion protection - Control of oxidation, biofilm, scale and sludge in warm water heating systems	i. Commissioning warm water floor heating systems should be carried out in accordance with IS EN 1264. Even where plastic tubes contain oxygen gas barriers, the control of corrosion in mixed product heating systems must be addressed carefully. ii. After testing and flushing with clean water, the system circulating fluid should be treated with a suitable corrosion inhibitor approved by the tube manufacturer and complying with BS 7593:2019, SR 50-1 (to be published) or DIN 4726:2017, and applied strictly in accordance with the additive manufacturer's instructions.	IS EN 1264 Water based surface embedded heating and cooling systems. Installation. BS 7593:2019 Code of practice for treatment of water in domestic hot water central heating systems. SR50-1 to be published. DIN 4726:2017 Warm water surface heating systems and radiator connecting systems. Plastic piping systems and multi-layer piping systems.

Table 28 Minimum provisions for construction and control of electric underfloor heating systems			
Minimum provision			**Supplementary information**
c. 1. Electric storage systems with individual room or programmable thermostats but without low tariff anticipatory controls	**Construction**	i. Electric cable underfloor heating low-tariff night energy storage systems should have a 65mm minimum thickness screed for correct operation. ii. Principal rooms containing 80% floor area should be assigned to low-tariff heating cables and 20% of the floor area should be assigned to direct acting perimeter heating cables in order to maximise energy efficiency.	**a.** Other areas should be assigned as low tariff heating cables only (subject to heat requirements). **b.** Bathrooms and separate kitchens may have direct acting heating cables (subject to heat requirements.
	Controls	i. Anticipatory controllers should be installed controlling low-tariff input charge with external temperature sensing and floor temperature sensing. ii. Programmable room thermostats with over-ride feature should be provided for all direct acting zones of the system with air and floor temperature sensing capabilities to be used individually or combined.	Anticipator controllers (i.e. weather compensators) reduce night energy storage as a function of external temperature.

Table 28 Minimum provisions for construction and control of electric underfloor heating systems (continued)			
Minimum provision			**Supplementary information**
c. 2. Electric cable, direct acting (non-storage) systems with individual room timer / thermostat control in screeded floors	**Construction**	i. Direct acting electric underfloor heating cables should be installed within screeds of thickness not exceeding 60 mm. ii. All heated floors should be insulated to the requirements shown in Table 27 above.	
	Controls	iii. Programmable room thermostats with manual over-ride feature for all heating zones with air and floor temperature sensing capabilities to be used individually or in combination.	
c. 3. Electric cable, direct acting with individual room timer/thermostat control in timber floors	**Construction**	i. Direct acting electric underfloor heating cables installed below floor boards in voids between floor joists should be provided with insulation to comply with Part L1 (and Part E) requirements and the effects of any floor covering in accordance with Table 27 above.	

Table 28 Minimum provisions for construction and control of electric underfloor heating systems (continued)			
Minimum provision			**Supplementary information**
	Controls	ii. Programmable room thermostats with manual over-ride feature should be provided to control space temperature and limit floor void temperature for safety and comfort in each area.	
c. 4. Under-tile electric floor heating systems	**Construction**	i. Direct acting electric underfloor or under plaster heating cables should be provided with a pre-fabricated mattress (or equal) format, of thickness less than 4mm encapsulated in tile bedding adhesive or mortar, below a ceramic or other equivalent floor finish on a thermally resistive insulation layer as defined in Table 27 row 1 (ii).	
	Controls	ii. Programmable room thermostats with manual over-ride feature should be provided to control space temperature and limit floor void temperature for safety and comfort in each area.	

8. Heat pump systems

This section provides guidance on the specification of heat pump systems in dwellings.

Definition of a heat pump
A heat pump is a device that takes heat energy from a low-temperature source and upgrades it to a higher temperature at which it can be usefully employed for heating and/or hot water. Heat pumps may supply all or part of the space-heating load.

8.1 Scope of guidance

The guidance in this section applies to the following types of heat pump technologies:

Heat pump type	Warm (or hot) water systems	Warm air systems
Ground Source Systems (GSHP) Heat energy is extracted from the ground using closed-pipe loops buried horizontally in trenches or in vertical boreholes that are connected back to the GSHP. The fluid circulating in the closed loop is normally a water/ propylene glycol antifreeze mixture or acceptable equivalent but some direct acting GSHPs use refrigerant. Open loops may also be used to collect water from an aquifer and discharge via a separate aquifer downstream of the water table flow; systems of this type normally require permits from the Environmental protection Agency. Heat extracted from the ground may be supplied to a dwelling either by a water-based heating system (ground to water heat pumps) or by an air distribution system (ground to air heat pumps).	Ground to water	Ground to air
Water Source Systems (WSHP) Heat energy is extracted indirectly from a water source using closed pipe loops as a heat exchanger. The closed loop is connected back to the water from the water heat pump. The water source may be a lake, pond or river or other stable water source. The fluid circulating in the closed loop will normally be water but a water/propylene glycol or acceptable equivalent antifreeze mixture may be used, depending on operating temperatures. Open loops may also be used subject to the permits being obtained from the Environmental Protection Agency. Heat may be supplied to the dwelling by a water-based heating system (water to water heat pumps) or by an air distribution system (water to air heat pumps).	Water to water	Water to air

Heat pump type	Warm (or hot) water systems	Warm air systems
Air Source Systems (ASHP) Air source heat pumps extract heat directly from the ambient air. Heat is supplied to the dwelling by a water-based heating system (air to water heat pumps) or by an air distribution system (air to air heat pumps). Air to air heat pumps may be single package or split systems.	Air to water	Air to air
All heat pump systems are at their most efficient when the source temperature is as high as possible, the heat distribution temperature is as low as possible and pressure losses in air and water systems are kept to a minimum. If installed in a new dwelling, heat pumps should use refrigerants complying with the provisions of EU Directive 2037:2000. Heat pumps should be CE marked in accordance with the relevant EU Directives where applicable, e.g. machinery safety, low voltage, pressure equipment, electromagnetic compatibility. If summer cooling is provided by the heat pump, it is recommended that condensate drainage from the fan coil units is provided. The outdoor unit can create a certain level of noise and in certain conditions, depending on the site limitations consideration should be given to location of units to minimise any potential noise impact. Most heat pump manufacturers have a “quiet level” function that can be activated, limiting the noise produced within certain time schedules. In relation to ducted systems, setting fan speeds and balancing of air flow is critical for correct operation, conservation of energy and to minimise noise. Proper ducting systems must be used and to minimise required fan power and ensure correct airflow with reduced noise. Rigid metal, plastic or a bespoke system with manifolds / foam EPE ducting should be considered.		

Table 29 Minimum provisions for warm (and hot) water heat pumps (ground to water, water to water and air to water systems)		
Minimum provision		**Supplementary information**
a. Supply water temperatures and/or efficiency	**Underfloor heating** Supply water temperatures to the underfloor heating system should be in the range 30ºC to 40ºC for new buildings.	See section 7 of this guide on underfloor heating.
	Radiators High-efficiency radiators with high water volume should be utilized. Supply water temperature to the radiators should be in the range 40ºC to 55ºC.	Space heating may be sized to meet all or part of the space heating load. Secondary heating will be required if the heat pump is sized to meet part of the space heating load.
	Fan coil units Supply water temperature to the fan coil units should be in the range 35ºC to 45ºC.	Fan coil units may be utilised for heating only or for winter heating and summer cooling.
b. Installation and commissioning	i. The water distribution system should be arranged for reverse return operation to maximise efficiency and ease commissioning and future maintenance. ii. Pipework not contributing to the space heating should be insulated to prevent heat loss following the guidance in note 1 at the end of this table.	• A pressurised water distribution system with expansion vessel is recommended. • Constant water flow should be maintained through the heat pump. • Pipe sizes should be in accordance with the manufacturer's recommendations.

Table 29 Minimum provisions for warm (and hot) water heat pumps (ground to water, water to water and air to water systems) (continued)		
Minimum provision		**Supplementary information**
	iii. If summer cooling is provided by the heat pump, all water distribution pipework should be insulated to prevent condensation following the guidance in note 1 at the end of this table. iv. External pipework between the dwelling and the ground heat exchanger should be insulated following the guidance in note 1 at the end of this table. v. The ground loop water circuit should be protected with an antifreeze solution and inhibitor as recommended by the heat pump manufacturer. vi. Ground loops should be cleaned with a cleaning fluid and biocide as part of the commissioning process. vii. The internal water distribution circuit should contain an inhibitor and may be protected by an antifreeze solution as recommended by the heat pump manufacturer.	**Installation** • Installation should be carried out by an installer approved by the manufacturer and a person qualified to carry out such work. • If during installation access to the refrigeration circuit is needed, a competent refrigeration and air conditioning engineer should carry out the work. • Exposed refrigeration pipework should be insulated and enclosed in protective trunking to limit accidental damage. • Installation of the dwelling's water distribution system should be undertaken by a competent central heating specialist. **Guidance and standards** I.S. EN 378:2016 Refrigerating systems and heat pumps. Safety and environmental requirements.

Table 29 Minimum provisions for warm (and hot) water heat pumps (ground to water, water to water and air to water systems) (continued)		
Minimum provision		**Supplementary information**
	viii. Ground loops should be filled with a heat transfer fluid. Installers should also refer to the equipment manufacturer's installation instructions for appropriate treatment products and special requirements for individual appliance models.	TR30 Guide to good practice – heat pumps, 2013. Microgeneration Certification Scheme standard MIS 3005 - Requirements for MCS contractors undertaking the supply, design, installation, set to work, commissioning and handover of microgeneration heat pump systems. DECC
c. Domestic hot water	For full heating the heat pump should be capable of supplying water in the range 60ºC to 65ºC. If the heat pump is not capable of supplying water at these temperatures, supplementary heating should be provided and controlled as described in other sections of this guide. Controls should include an auxiliary heating regime to 60°C or more for disinfection purposes. The domestic hot water system should include a tank thermostat and a time clock to optimise the time taken to heat the water.	The heat pump may be utilised for all or part of the DHW load. During the DHW heating period the heat pump may not necessarily be providing heated water to the space heating system.

Table 29 Minimum provisions for warm (and hot) water heat pumps (ground to water, water to water and air to water systems) (continued)		
Minimum provision		**Supplementary information**
d. Controls	a. Heat pump unit controls should include: • Control of water pump operation (internal and external as appropriate); • Control of water temperature for the distribution system; • Control of outdoor fan operation for air-to water units; • Defrost control of external airside heat exchanger for air-to-water systems; • Protection for water flow failure; • Protection for water high temperature; • Protection for high refrigerant pressure; • Protection of airflow failure on air-to-water units. b. External controls should include: • Weather compensation or internal temperature control; • Timer or programmer for space heating. c. Minimum heat pump flow rates or volume requirements should be met. If all zones are thermostatically controlled, then a buffer would be an acceptable method of compliance. d. For larger dwellings e.g. where floor area exceeds 100 m^2, independent temperature control on the basis of two	The recommended provision for existing systems is as defined for new systems.

Table 29 Minimum provisions for warm (and hot) water heat pumps (ground to water, water to water and air to water systems) (continued)		
Minimum provision		**Supplementary information**
	independent zones will generally be appropriate. In certain cases, additional zone control may be desirable, e.g. zones which experience significant solar or other energy inputs may be controlled separately from zones not experiencing such inputs. e. Separate and independent time control for space heating and for heating of stored water should be provided. Independent time control of space heating zones is appropriate where independent temperature control applies. f. The domestic hot water system should have temperature control e.g. a tank thermostat, and time control to optimise the time taken to heat the water. Controls should include an auxiliary heating regime to 60°C or more for disinfection purposes. g. The heat pump may be utilised for all or part of the DHW load. During the DHW heating period the heat pump may not necessarily be providing heated water to the space heating system.	
Note 1: The recommended insulation thickness for heating and distribution pipes should be 1.5 times the diameter of the pipe. This is based on standard insulation materials with a reference thermal conductivity of 0.04 W/mK. Refer to TIMSA guidance for detailed guidance on pipe insulation thickness.		

Table 30 Minimum provisions for warm air heat pumps (ground to air, water to air and air to air systems)		
Minimum provision		**Supplementary information**
a. Installation	• Minimum clearances adjacent to all airflow paths, as recommended by the manufacturer, should be maintained. • Pipe sizes should be in accordance with the manufacturer's recommendations. • The refrigerant pipework on split systems should be insulated in line with manufacturer's recommendations. • If summer cooling is provided by the heat pump, provision should be made for condensate drainage from the indoor terminal units. • For ground-to-air and water-to-air systems all external pipework between the dwelling and the external heat exchanger should be insulated by following the guidance in the TIMSA guide available at www.TIMSA.ORG.UK. • For ground-to-air and water-to-air systems constant water flow should be maintained through the heat pump.	• Installation should be carried out by an installer approved by the manufacturer and a person qualified to carry out such work. • Installation that requires access to the refrigeration circuit, or the connection of split systems, should be carried out by a suitably qualified refrigeration and air conditioning engineer.
b. Controls	a. Heat pump unit controls should include: • Control of room air temperature (if not provided externally); • Control of outdoor fan operation for air-to-air units;	

Table 30 Minimum provisions for warm air heat pumps (ground to air, water to air and air to air systems) (continued)		
Minimum provision		**Supplementary information**
	• Defrost control of external airside heat exchanger for air-to-air systems; • Control for secondary heating (if fitted) on air-to-air systems; • Control of external water pump operation for ground-to-air and water-to-air systems; • Protection for high refrigerant pressure; • Protection for indoor air flow failure; • Protection for external air flow failure on air-to-air units; • Protection for water flow failure on ground-to-air and water-to-air systems. b. External controls should include: • Weather compensation or internal temperature control; • Timer or programmer for space heating. c. Minimum heat pump flow rates or volume requirements should be met. If all zones are thermostatically controlled, then a buffer would be an acceptable method of compliance.	

Supplementary information – further guidance on heat pumps

- EU Directives for: Machinery Safety; Low Voltage; Pressure Equipment; Electromagnetic Compatibility.
- Sustainable Energy Authority of Ireland: DEAP 4.2.1 Manual Guide.
- Sustainable Energy Authority of Ireland: A Homeowner's Guide to Heat Pump Systems.
- DEFRA/Carbon Trust Energy Technology List – Heat Pumps (www.eca.gov.uk).
- I.S. EN 14511:2018 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.
- ISO 13256:1998 Water-source heat pumps – testing and rating for performance: Part 1 – Water-to-air and brine-to-air heat pumps and Part 2 – Water-to-water and brine-to-water heat pumps.
- I.S. EN 15450:2007 Heating systems in buildings. Design of heat pump heating systems.
- I.S. EN 15316: 2008 Energy Performance of Buildings – Method for calculation of system energy requirements and system efficiencies.
- Best Practice Programme: Good Practice Guide 339, Domestic Ground Source Heat Pumps, Design and Installation of Closed-loop System.
- I.S. EN 378:2016 Specification for Refrigerating Systems and Heat Pumps. Safety and environmental requirements.
- TIMSA – HVAC Compliance Guide - Revised Feb 2018. Available from www. TIMSA.ORG.UK.
- Microgeneration Certification Scheme standard MIS 3005 Requirements for contractors undertaking the supply, design, installation, set to work, commissioning and handover of microgeneration heat pump systems. Available from www.microgenerationcertification.org/mcs-standards/installer-standards.
- Microgeneration Certification Scheme standard MIS 3007 Requirements for MCS contractors undertaking the design, supply, installation, set to work, commissioning and handover of a heating system containing a micro-cogeneration package. Available from www.microgenerationcertification.org/mcs-standards/installer-standards. Microgeneration Certification Scheme 021 Heat emitter guide for domestic heat pumps. Available from http://www.microgenerationcertification.org/mcs-standards/installer-standards.

- Design of low-temperature domestic heating systems – A guide for system designers and installers. FB59, IHS BRE Press. Available from www.brebookshop.com.
- Energy Efficiency Best Practice in Housing publication: CE 82 Domestic ground source heat pumps: design and installation of closed-loop systems.
- HVCA TR30 Guide to good practice: Heat pumps.

9. Solar water heating

This section provides guidance on the specification of solar water heating for dwellings.

9.1 Scope of guidance

The guidance in this section covers solar systems with a collector area of less than 20m^2 and solar heated water storage of less than 440 litres. It does not cover systems intended to contribute exclusively to space heating or systems providing heat exclusively to heat swimming pools. It should be used in conjunction with the guidance on water heating contained in the fuel-based sections of this guide.

Solar water heating in new and existing dwellings should meet the following conditions:

a. The minimum provisions for collector certification, identification and testing as specified in Table 31 (row a).

AND

b. The minimum provisions for selection of transfer fluid in the collector primary loop as given in Table 31 (row b).

AND

c. The minimum provisions for circulation pump power as given in Table 31 (row c).

AND

d. The minimum provisions for heat-exchanger sizing as given in Table 31 (row d).

AND

e. The minimum provisions for control of the system as given in Table 31 (row e). Where work is carried out in a dwelling that already has a solar hot water system it is recommended that the system control is upgraded in line with the minimum provisions for systems in new dwellings.

AND

f. The minimum provisions for solar pre-heated water storage as given in Table 31 (row f). Where work is carried out in a dwelling that already has a solar hot water system it is recommended that the insulation is upgraded in line with the minimum provisions for systems in new dwellings.

AND

g. The minimum provisions for storage of solar pre-heated water as given in Table 31 (row g).

AND

h. The minimum provisions for system labelling and commissioning, as given in Table 32 (rows a and b).

AND

i. The minimum provisions for insulating pipes in a solar primary system, as given in Table 33.

Table 31 Minimum provisions for solar water heating		
Minimum provision		**Supplementary information**
Allowance for collector shading	No minimum provision.	Solar collectors should be sited in unshaded locations wherever possible. Where this is unavoidable or in cases of significant or heavy shading or significant variance to the optimum orientation and tilt (i.e. normal pitch roofs facing between SE and SW), then an allowance for the loss of performance should be made when sizing the collector area according to the factors indicated in DEAP Appendix H.
a. Solar collector certification	Collectors should be independently certified to comply with all tests, safety, thermal performance reporting and identification according to I.S. EN 12975:2006.	Copies of the full test report should be included in handover material.
b. Primary circuit fluid	The transfer fluid in the collector primary loop should be chosen so as not to deposit lime scale, sludge, ice or other solids that could either restrict circulation, or impair the rate of heat transfer within the absorber.	In secondary systems measures to reduce the formation of lime scale should be considered so that performance is not significantly affected.
c. Circulation pump power	The electrical input power of the primary pump in the solar system should be less than 50W or 2% of peak thermal power of the collector, whichever is higher.	

Table 31 Minimum provisions for solar water heating (continued)		
Minimum provision		**Supplementary information**
d. Heat-exchanger sizing	The heat exchanger between a solar primary and secondary system should be sized as follows: • Systems with flow rates of greater than or equal to 0.5 litres per minute per m^2 of collector – no less than $0.2m^2$ of heat exchanger area must be provided per $1m^2$ of solar collector net absorber area. • Systems with flow rates less than 0.5 litres per minute per m^2 of collector – no less than $0.1m^2$ of heat exchanger area must be provided per $1m^2$ of solar collector net absorber area.	Heat exchangers should be sized to ensure a low return temperature to the solar collector. Heat transfer in a solar heat exchanger is complicated by the variability of flow rates and flow temperatures as compared to heat exchangers used for auxiliary heat sources.
e. System control	Solar domestic hot water system controls should be fitted to: i. maximise the useful energy gain from the solar collectors into the system's dedicated storage; ii. minimise the accidental loss of stored energy by the solar domestic hot water system, whether originating from solar collectors, cold intake or auxiliary heat sources; iii. ensure that hot water produced by auxiliary heat sources is not used when adequate grade solar pre-heated water is available;	

Table 31 Minimum provisions for solar water heating (continued)		
Minimum provision		**Supplementary information**
	iv. provide a means of control consistent with the solar system being inherently secure against the adverse effects of excessive primary temperatures and pressures; v. where a separate domestic hot water heating appliance is pre-heated by a solar system, then this appliance should be controlled, where possible, such that no extra heat is added if the target temperature is already satisfied from the pre-heat vessel.	
f. Solar preheated water storage	For new or replacement solar heated water storage the minimum provisions are as follows: a. Vented copper hot water storage vessels should comply with the heat loss and auxiliary heating heat exchanger requirements of BS 1566-1:2002+A1:2011. b. Unvented hot water storage systems products should: • comply with I.S. EN 12897:2016; or • be certified by the Irish Agrément Board; or • be certified by another accredited body as complying with Building Regulations.	Vented copper hot water cylinders should carry clear labelling on the product. Vented cylinders which are not of copper construction should be labelled as complying with the heat loss and heat exchanger requirements of BS 1566. Due to the higher than normal storage temperatures in primary stores it is very important that these are well insulated.

Table 31 Minimum provisions for solar water heating (continued)		
Minimum provision		**Supplementary information**
g. Storage of solar preheated water	The ratio of solar heated water storage volume to collector area should be specified as follows: i. The dedicated solar storage volume, V_s, should be at least 25 litres (or equivalent heat capacity) per net m^2 of the solar collector absorber area. ii. Alternatively, V_s should be a volume (or equivalent heat capacity) which is equivalent to at least 80% of the daily hot water demand, V_d, (as defined by DEAP).	Collector area is measured as effective aperture or net absorber area, whichever is smaller. If a solar domestic hot water system is to be used in conjunction with an auxiliary heated thermal store, this will often operate at a higher temperature than domestic hot water only solar stores. The expected higher temperatures of auxiliary heated domestic hot water thermal stores and lack of stratification, particularly with combined thermal stores with open pumped circuits, would suggest that a separate pre-heat storage vessel should be considered wherever possible.

Table 32 Minimum provisions for labelling, commissioning and documentation for solar hot water systems		
	Minimum provision	**Supplementary information**
a. Labelling of solar collectors and hot water stores	a. All solar collectors should have a visible and durable label displaying all information required according to I.S. EN12975:2006 and S.R. 50-2:2012, and including at least the following: • name of manufacturer; • collector type; • serial number; • year of production; • gross area of collector; • aperture area of collector; • net absorber area of collector; • maximum operation pressure; • stagnation temperature at 1000W/m^2 and 30ºC; • volume of heat transfer fluid; • weight of empty solar collector;	In addition to the minimum provision for labelling of hot water storage vessels, labelling with the following information is also recommended: • total net fluid content of secondary volume normally heated by each heat exchanger, where present (±1.0 litre); • the type, fluid content, maximum pressure and surface area of all heat exchangers).

Table 32 Minimum provisions for labelling, commissioning and documentation for solar hot water systems (continued)		
	Minimum provision	**Supplementary information**
	• labelling of solar heated water storage vessels within solar domestic hot water systems. b. All hot water storage vessels should carry a label with the following information: • manufacturer's name; • nominal overall capacity in litres; • dedicated solar capacity in litres • standing heat loss in kWh/day; • type of vessel; • auxiliary heating heat exchanger performance in kW (where present); • solar heating heat exchanger performance in kW.	
b. Commissioning	a. A signed and dated commissioning certificate should be completed to confirm the equipment has been correctly installed and to record key safety and operational features.	

Table 32 Minimum provisions for labelling, commissioning and documentation for solar hot water systems (continued)		
	Minimum provision	**Supplementary information**
	b. As a minimum, the commissioning certificate shall record the following details of the solar system: • net or aperture area of solar collector; • minimum ambient temperature without freeze damage to components; • location and method of controlling overpressure; • location of the electrical isolating switch; • type of circulation fluid; • circulation rate of collector circuit; • location of device for protection of overheating solar heated water.	A signed commissioning certificate, certifying that the equipment is safe, legal and fit for its intended purpose, should be handed over to the owner of the dwelling. A separate certificate is required to cover the installation and commissioning of the hot water storage vessels and appliances within a solar DHW system. A commissioning technician should be a competent person who can personally testify by signature and date that the equipment has been commissioned.
c. Documentation	No minimum requirement	Information concerning the solar domestic hot water system should be provided to the owner of the dwelling. The documentation should include: • user's manual;

Table 32 Minimum provisions for labelling, commissioning and documentation for solar hot water systems (continued)		
	Minimum provision	**Supplementary information**
		• warranty information; • a recommended maintenance schedule; • commissioning certificate; • full contact details of the installer.

Table 33 Minimum provision for insulation of pipes for solar hot water systems	
Minimum provision	**Supplementary information**
In new systems, pipes should, in the following cases, be insulated with insulation (in line with the maximum permissible heat loss indicated in the Supplementary Information column), and labelled accordingly: • All pipes of a solar primary system should be insulated throughout the length of the circuit. • Primary circulation pipes for heating and hot water circuits should be insulated wherever they pass outside the heated living space or through voids which communicate with and are ventilated from unheated spaces. • All pipes connected to hot water storage vessels, including the vent pipe, should be insulated for at least 1m from their points of connection to the cylinder (or they should be insulated up to the point where they become concealed). • Heat loss values should not exceed the values in the Supplementary information column.	The insulation should be suitably rated for the maximum foreseeable pipe temperature applicable; external insulation should also be resistant to vermin attack and climatic degradation. In a dwelling that already has a solar hot water system it is recommended that the insulation is upgraded in line with these minimum provisions where significant work, such as change of solar storage, is carried out. A fully-filled or drainback solar hot water system can have a pipe service temperature of 150°C. The insulation material should be specified to accommodate this temperature. An EPDM based rubber would normally be a minimum requirement for such an application. Any insulation specified should be better than 0.044 W/(m.K) at 40°C mean and the insulation diameter should be 87% of the pipe diameter. **Insulation for pipework in unheated areas** Extra provision may need to be made to protect central heating and hot water pipework in unheated areas against freezing. Further guidance is available in: • BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range of –40°C to +700°C. • BRE Report No 262 Thermal insulation: avoiding risks, 2001 edition.

Table 33 Minimum provision for insulation of pipes for solar hot water systems (continued)	
Minimum provision	**Supplementary information**
	Insulation labelled as complying with Part L must not exceed the following heat loss levels: **Pipe* diameter (OD)** **Maximum permissible heat loss** (W/m)** 8mm 7.06 10mm 7.23 12mm 7.35 15mm 7.89 22mm 9.12 28mm 10.07 35mm 11.08 42mm 12.19 54mm 14.12 *The maximum permissible heat loss applies to all pipe materials (i.e. steel, copper, plastic and other). ** In assessing the thickness of insulation required to meet the provision, standardised conditions should be used in all compliance calculations based in this instance on a horizontal pipe at 60ºC in still air at 15ºC.

Supplementary information on solar water heating

- Microgeneration Certification Scheme standard MIS 3001 Requirements for contractors undertaking the supply, design, installation, set to work, commissioning and handover of solar heating microgeneration systems.
- Energy Efficiency Best Practice in Housing publications:
    - CE131 Solar water heating systems. Guidance for professionals, conventional indirect models.
    - CE51 Central Heating System Specifications (CHeSS).
- CIBSE Solar heating design and installation guide.
- NSAI S.R. 50-2:2012 Building Services – Code of Practice – Part 2: Thermal Solar Systems.

Glossary of standards relevant to solar hot water heating

BS 7431:1991	Method for assessing solar water heaters. Elastomeric materials for absorbers, connecting pipes and fittings.
BS 6785:1986	Code of practice for solar heating systems for swimming pools.
I.S. EN12977-3:2012	Performance characterisation of stores for solar heating systems.
I.S. EN 12977-2:2012	Thermal solar systems and components. Custom built systems. Test methods.
I.S. EN12977-1:2012	Thermal solar systems and components. Custom built systems. General requirements.
IS EN ISO 9488:1999	Solar energy. Vocabulary.
I.S. EN 12976-2:2006	Thermal solar systems and components. Factory made systems. Test methods.
I.S. EN 12976-1:2006	Thermal solar systems and components. Factory made systems. General requirements.
I.S. EN 12975-2:2006	Thermal solar systems and components. Solar collectors. Test methods.
I.S. EN 12975-1:2006	Thermal solar systems and components. Solar collectors. General requirements.
ISO 9553:1997	Solar energy – methods of testing preformed rubber seals and sealing compounds used in collectors.
BS 3734-1:1997	Rubber – tolerances for products – Part 1: Dimensional tolerances.
BS 903-0:2012	Physical testing of rubber – Part 0: General.
BS 6920:2014	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water.
ISO/TR 10217:1989	Solar energy – water heating systems – guide to material selection with regard to internal corrosion.
BS 8000:2014	Workmanship on construction sites.
BS 7206:1990	Specification for unvented hot water storage units and packages.
BS 7671:2018	Requirements for electrical installations – IET wiring

	regulations.
BS 1566-1:2002+A1:2011	Copper indirect cylinders for domestic purposes.
BS 4814:1990	Specifications for expansion vessels using an internal diaphragm for sealed hot water heating systems.
BS 7074:1989	Application, selection and installation of expansion vessels and ancillary equipment for sealed hot water systems.
BS 5422:2009	Methods of specifying thermal insulation materials on pipes, ductwork and equipment in the temperature range of –40ºC to 700ºC.
BS 5449:1990	Specification for forced circulation hot water central heating systems for domestic premises.
I.S. EN 12831:2017	Energy performance of buildings – method for calculation of the design heat load.
I.S. EN 12828:2003	Heating systems in buildings – Design for water-based heating systems.
BS 6701:2016+A1:2017	Telecommunications equipment and telecommunications cabling – Specification for installation, operation and maintenance.
BS 5970:2012	Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of -100 degrees C to +870 degree C - Code of practice.
BS 6700:2006	Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Specification.

10. Individual domestic (micro) combined heat and power

This section provides guidance on the specification of micro-combined heat and power (CHP) systems for dwellings.

The following publication may be referred to: Appendix N of the Dwelling Energy Assessment Procedure (DEAP) for the energy rating of dwellings.

10.1 Scope of guidance

This section provides guidance on the specification of micro-combined heat and power (micro-CHP) packages for dwellings to meet relevant energy efficiency requirements in the Building Regulations.

The guidance covers micro-CHP systems with an electrical output less than 5 kWe which are:

- heat-led;
- capable of exporting electricity to the grid; and
- controlled in such a way as to avoid heat dumping.

British Standards

IS EN 15316-4-4:2017 Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Heat generation systems, building-integrated cogeneration systems.

Other documents

Appendix N of DEAP 4.2.1 Method to evaluate the annual energy performance of micro-cogeneration heating systems in dwellings.

BSRIA BG 2/2007 CHP for existing buildings: Guidance on design and installation.

Microgeneration Certification Scheme standard MIS 3007-2 Requirements for contractors undertaking the design, supply, installation, set to work, commissioning and handover of a domestic hot water system containing an electricity-led micro-cogeneration package.

I.S. 10101:2020 National Rules for Electrical Installations.

Connecting a microgeneration system to a domestic or similar electrical installation (in parallel with the mains supply), Best Practice Guide, the Electrical Safety Council.

11. Heating system circulators

11.1 Scope of guidance

This section provides guidance on the specification of heating system glandless circulators, both standalone and integrated in products, to meet relevant energy efficiency requirements in the Building Regulations.

11.2 Circulators

Heating system glandless circulators up to 2.5 kW, provided with new systems or as replacements in existing systems in dwellings, should meet the minimum standards for energy efficiency in Table 34.

Table 34 Recommended minimum standards for heating system glandless circulators

Minimum provision	Supplementary information
In accordance with European Commission Regulation No 622/2012 (amending 641/2009) implementing Directive 2005/32/EC with regard to Ecodesign requirements for glandless circulators up to 2.5 kW: a. From 1 January 2013, standalone glandless circulators, other than those specifically designed for primary circuits of thermal solar systems and of heat pumps, should have an Energy Efficiency Index (EEI) no greater than 0.27. b. From 1 August 2015, standalone glandless circulators and glandless circulators integrated in products should have an Energy Efficiency Index (EEI) no greater than 0.23.	

Appendix A: Guide to the Condensing Boiler Installation Assessment Procedure for Existing Dwellings

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1. Introduction

Technical Guidance Document Part L & EPBR 2019 Regulation 8(d) requires that space and water heating systems in dwellings be energy efficient, with efficient heat sources and effective controls. More specifically, Regulation 8(e) provides that oil or gas fired boilers must achieve a minimum seasonal efficiency of 90 %. This Section gives guidance for Condensing Boiler Installation Assessment Procedure for Existing Dwellings and radiator sizing for various heat generators.

Under the revised Building Regulations Part L (S.I. No. 259 of 2011):
After the 1st December 2011, gas fired and oil boilers in new dwellings must meet a minimum seasonal efficiency of 90% and where gas fired and oil boilers are being installed as replacements in existing dwellings, those boilers must meet a minimum seasonal efficiency of 90% where practicable.

This revision of the Building Regulations imposed no requirement in relation to solid fuel boilers.

This Guide contains the detailed guidance referred to in Paragraph 2.2 of Technical Guidance Document L – Dwellings to assess specific situations where the provision of condensing boilers is not practicable. It will be included as an Appendix in the document “Heating and Domestic Hot Water Systems for Dwellings – Achieving compliance with Part L & EPBR 2019”, when published. The Condensing Boiler Installation Assessment Procedure is to be used in cases where it is expected that the installation of a condensing boiler as a replacement boiler in an existing dwelling may not be practicable. “Practicable" is taken to mean “capable of accomplishment after taking into consideration the existing state of technology and economic feasibility for the facility involved”.

This Guide has been written to help heating installers carry out a condensing boiler installation assessment, using the abovementioned procedure.

Throughout this Guide the term “householder” in the case of non-owner occupied dwellings shall be understood to connote the owner of the dwelling or their agent.

This Guide must not be interpreted as a set of regulations or restrictions on installation practice, nor does it prevail over relevant installation standards or more specific instructions given by boiler manufacturers. The completed boiler installation however must be installed in accordance with Part J of the Building Regulations.

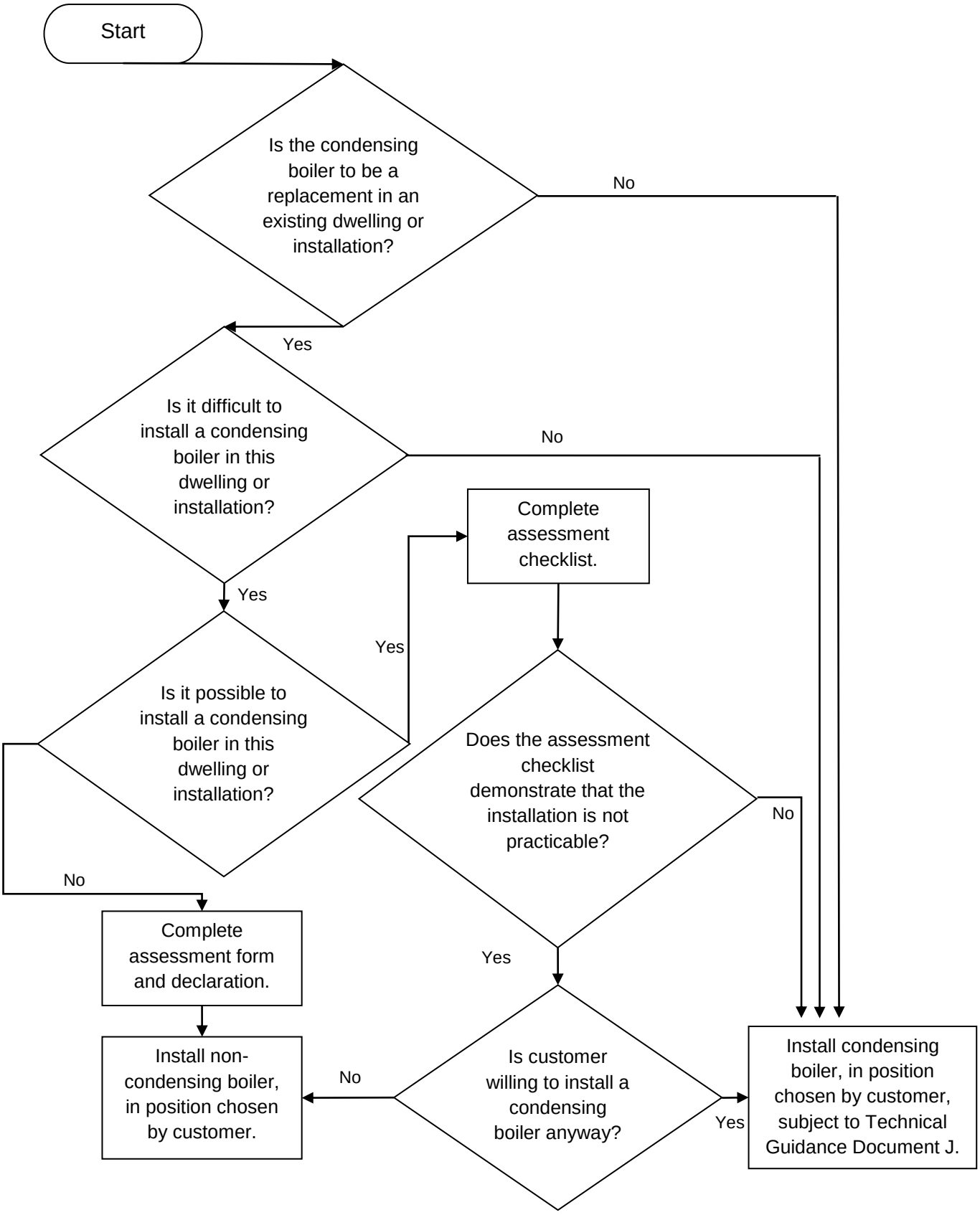
2. Possible installation difficulties

It is sometimes more difficult to install a condensing boiler as a replacement to a non-condensing boiler because:

- The flue gases discharged from the flue terminal are cooler and less buoyant, and usually form a visible ‘plume’. They may cause wetting of surfaces too close to the terminal, or nuisance to neighboring property, or to people passing nearby.
- An existing flue designed for a non-condensing boiler is unsuitable for a condensing boiler (and vice versa), and the flue for a condensing boiler must not be shared with any non-condensing appliance.
- A liquid condensate forms within the boiler, and must be discharged to a suitable drain or soak away.

There are a number of methods to overcome these difficulties, and the assessment procedure and associated guidance is based on estimation of the practicability of these methods.

3. Outline of the assessment procedure



4. Purpose of the assessment procedure

Where installation of a condensing boiler is expected to be difficult, an assessment should be carried out to see if a non-condensing boiler would be accepted as reasonable provision in the circumstances.

In this case a correctly completed assessment form (see Sect. 11) is used to show whether or not the use of a condensing boiler should be considered not to be practicable. The form is also downloadable from the Department of Housing, Planning and Local Government website at www.housing.gov.ie. It is not necessary to complete the form if a condensing boiler with a seasonal efficiency of 90% or greater is to be fitted.

The assessment gives a YES/NO answer to whether it is impracticable to fit a condensing boiler in a particular building for a specified fuel (natural gas, LPG, or oil). If the answer is ‘NO’, then a condensing boiler must be fitted unless some other way can be found to demonstrate that such a course of action would not be practicable in the particular circumstances. If the answer is ‘YES’ then either a condensing or non-condensing boiler may be fitted. Whatever the answer, the boiler does not have to be fitted in the position shown on the assessment form, which will have been chosen for least cost without regard for householder preference. The complete boiler installation should however be installed in accordance with Part J of the Building Regulations.

Completed assessment forms should be retained by the householder, since they may be helpful when the house is sold.

The rest of this Guide provides additional information on how to undertake an assessment and complete the form. It provides important information on what should, or should not, be taken into consideration, especially concerning arrangements for extended flues and condensate drains. In all cases the installation of a boiler must be undertaken by a competent person, observing regulations and manufacturer’s instructions.

5. How to carry out the assessment

- The simplest way to carry out the assessment is to imagine the building is empty, without furniture and fittings, and the householder is not present. The householder should specify the fuel to be used (natural gas, LPG, or oil). The task is to find the most practicable option for installing a condensing boiler, taking into account the position of the existing boiler if there is one.
- Some boiler positions and flue terminal positions are excluded from the assessment, as shown in Table 1.

  These options are NOT to be considered for the assessment procedure. However, this does not necessarily mean they contravene standards or regulations, and in some cases they may be acceptable to the householder.
- If there is no difficulty in installing a condensing boiler, it is not necessary to complete the form and no further action is required. A condensing boiler should be installed, in any position chosen by the householder subject to compliance with Part J of the Building Regulations.
- In rare cases, it will not be possible to install a condensing boiler anywhere in the dwelling. Complete the form, explaining why, and sign the declaration. Such cases are unusual, and apply only when there are no positions where a condensing boiler could be installed, even with an extended flue (horizontal or vertical, inside or outside the building). One example is a flat where an existing boiler is connected to a shared flue and it is not possible to pierce an external wall for structural reasons (e.g. pre-stressed or ‘glass’ wall).
- In nearly all cases it will be possible to install a condensing boiler, though with varying levels of difficulty and cost. All feasible options should be considered for whichever fuel has been chosen by the householder, in all the locations that would meet regulations and have not been listed as excluded in Table 1.
- The flue terminal position must meet the requirements given in Building Regulations Part J and the specifications referred to below.
- The assessment form is completed for the installation option that gives the most practicable option. It is necessary to show that all feasible options have been considered, and that the form shows the best scoring option. Any additional forms used to assess other options should be attached when the final, signed form is made available to the customer.
- When the assessment score total exceeds or equals 3, this is evidence that installation of a condensing boiler is not practicable and it is reasonable to install a non-condensing boiler instead of a condensing boiler. The validity of the assessment is also restricted to the chosen fuel for the new boiler.

It is not acceptable, for example, to determine that it is not practicable to install an oil boiler but then to install a non-condensing gas boiler.

- Once the assessment is complete:
  - If the completed form indicates that it is not practicable to install a condensing boiler (for the chosen fuel shown on the form), it is open to the client to choose either a condensing or non-condensing boiler. However, since a condensing boiler is preferable, the householder should be invited to consider that alternative. Where a non-condensing boiler is chosen, the householder should be encouraged to choose an efficient boiler.
  - If the completed form indicates that it is practicable, a condensing boiler should be installed.
- Whether a condensing or non-condensing boiler is fitted, it need not be in the position shown on the assessment form.
- Completed forms should be left with the householder in case they are required for building control compliance purposes or when the dwelling is sold.
- For the full legal requirements, and guidance on compliance, refer to the Building Regulations Part L, and to the current edition of Technical Guidance Document L. These also give advice on how to deal with special cases such as historic buildings.

If an existing boiler is being replaced, see Checklist 1.

If there is no existing boiler, see Checklist 2.

Table 1 Installation options to be EXCLUDED from the assessment

Flue options for new boiler NOT to be considered	**Comment**
Flue and terminal positions that do not comply with Technical Guidance Document J of the Building Regulations.	All installations must meet statutory requirements.
A shared flue, unless specially designed to be shared by condensing boilers.	Existing shared ducts are usually unsuitable for connection to condensing boilers.
A flue passing through a wall or floor that must not be pierced for structural reasons.	An example is a pre-stressed or 'glass' wall in a block of flats.
An internal flue extension exceeding 4m (ignoring the part that passes through a loft/attic space).	Where an internal flue extension will need to penetrate a roof, the length of flue required passing through the loft attic space is excluded. See section 8.
A flue that passes through another dwelling, or another building in different ownership, or another fire compartment.	Applies particularly to flats where flue routes to suitable terminal positions may be limited.
A vertical flue pipe visible on the outside of the building facing the main approach direction (usually the front). This refers only to the flue pipe, not the flue terminal (a terminal may be positioned on any side of the building).	A vertical flue on the front of the building is likely to be aesthetically unacceptable to many customers.

Boiler positions NOT to be considered		Comment
Gas boilers:	where the boiler or extended internal flue is in a: • Lounge; • lounge/dining room; • principal living room that does not include a kitchen area.	It is acceptable to install a gas boiler in any room other than the principal living room. See section 9.
LPG boilers:	where the boiler or extended internal flue is in a: • lounge; • lounge/dining room; • principal living room that does not include a kitchen area; • cellar or basement.	
Oil boilers:	the only positions that ARE to be considered are: • a kitchen; • a kitchen/dining room; • a utility room; • a purpose-made boiler room. And only where they are on the ground floor or in a basement. All other positions are NOT to be considered.	Oil boilers are larger, heavier and more suited to installation on ground floors or basements. Therefore suitable locations are more restricted than for gas boilers. See section 9.

Checklist 1

If an existing boiler is to be replaced, the questions to be asked are:

a. Can a new condensing boiler be fitted in the same position as the existing boiler, without a flue extension?

b. Can the existing boiler position be retained and an extended horizontal flue connected to a terminal on the same or adjacent wall?

c. If the existing boiler position is retained, can a vertical extended flue be installed? (Not on the front of the building – see Table 1).

d. Can a non-balanced extended flue be used where the flue outlet would direct flue products to a permissible position?

e. Can the boiler be moved within the same room, possibly to an internal wall, to achieve satisfactory flue and drain connection?

f. Where the existing boiler is connected to a shared flue it will generally not be possible to connect the new boiler to the existing flue system, and other flue options must be considered. When considering other flue options, particularly in flats, wall construction may prohibit penetration (e.g. pre-stressed walls).

g. Can the boiler be moved to another room to achieve satisfactory flue and drain connection?

h. Can an internal boiler position (i.e. not on an outside wall) be used? Is it necessary to have an internal vertical flue which penetrates the roof? Connection to a suitable drain point may be more difficult in this case.

i. Can the boiler be installed in an attic or loft area (gas/LPG boilers only)? If this is considered for the actual installation, special requirements for access will apply.

j. Is there a suitable outbuilding? If this is considered for the actual installation, connection to services will be more difficult and frost protection necessary.

Checklist 2

If there is no existing boiler, the questions to be asked are:

a. Can a new condensing boiler be installed, without a flue extension?

b. Can an extended horizontal flue be installed, connected to a terminal on the same wall as the boiler, or an adjacent wall?

c. Can a vertical extended flue be installed? (Not on the front of the building – see Table 1)

d. Can a non-balanced extended flue be used where the flue outlet would direct flue products to a permissible position?

e. When considering flue positions, particularly in flats, wall construction may prohibit penetration (e.g. pre stressed walls).

f. Can an internal boiler position (i.e. not on an outside wall) be used? Is it necessary to have an internal vertical flue, which penetrates the roof? Connection to a suitable drain point may be more difficult in this case.

g. Can the boiler be installed in an attic or loft area (gas/LPG boilers only)? If this is considered for the actual installation, special requirements for access will apply.

h. Is there a suitable outbuilding? If this is considered for the actual installation, connection to services will be more difficult and frost protection is necessary.

6. Flue terminal siting

It is necessary to site a condensing boiler flue terminal such that the plume of wet flue products does not impinge on or significantly affect the use of the dwelling and also the neighbouring buildings.

- For the purposes of the Condensing Boiler Installation Assessment Procedure the flue terminal should be sited so as to satisfy the guidance given in Technical Guidance Document J to the Building Regulations.

- The installation should also be installed in accordance with I.S.813:2014 for gas installations and in accordance with BS 5410-1:2019 for oil burning appliances up to 45 kW.

- The position of the terminal should be such as to minimise the risk of nuisance from pluming to adjacent properties or the re-entry of combustion products through openable windows, vents etc. of opposite or adjacent properties.

7. Extended flue lengths

When considering extended flues, the following rules apply:

- When considering flue lengths, use the actual length NOT the equivalent length (which has an allowance for the resistance of bends and fittings).

- Distances are measured from the boiler flue outlet connection.

- Where separate flue and air ducts are used, the measurements apply to the flue duct.

- Extended flues are to be installed in accordance with Technical Guidance Document B.

- Extended flues must be longer than 2m to qualify as an extended flue.

- Extended flues that need to be longer than 4m need not be considered EXCEPT where the flue passes through a loft or attic space. In measuring the flue run, ignore any length that runs through the loft/attic space and from the roof to the flue terminal. See figure 1.

- Where an extended flue route is required it must pass to the outside without going through another dwelling or building (in different ownership).

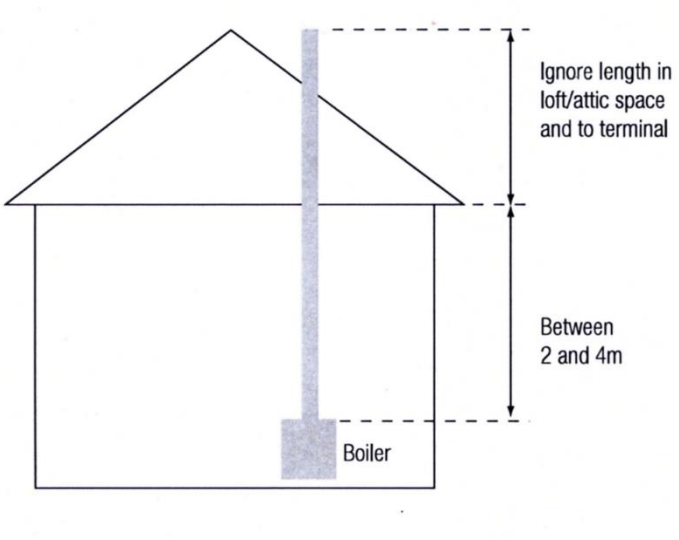


Figure 1. Extended flues in loft/attic

8. Boiler location

If an extended flue cannot be fitted to a boiler in the current boiler position, a solution is to move the new boiler to a location where the terminal siting restrictions are less restrictive. A change of boiler location is often necessary where a condensing boiler is to replace an open flue or back boiler, often mounted in an internal position away from an outside wall. For the assessment procedure, where a boiler is moved within the same room no additional consideration need be taken. When it is moved to another room 1 point is added in the assessment form.

Examples:

- No points apply if a floor standing boiler in a kitchen is replaced with a wall hung condensing boiler in the same kitchen.
- 1 point is added to the assessment total when a back boiler is replaced and the only feasible option is to install a condensing boiler in a different room.

It should be noted that when considering boiler locations for the purposes of the assessment procedure, obstacles such as furniture and fitments must be ignored. All boiler locations should be considered except those listed in Table 1.

Note that once the assessment is complete the boiler can be installed in any location to meet householder preferences provided it meets regulations and manufacturer's installation requirements.

9. Connection of condensate drain

All condensing boilers require connection to a drain to dispose of the condensate. Connections are typically to:

- internal stack pipe;
- waste pipe;
- external drain, or gully;
- rainwater hopper that is part of a combined system i.e. sewer carries both rainwater and foul water;
- purpose made soakaway.

Where no suitable drain point is available a soakaway can be considered. The soakaway should be located as close as possible to the boiler but clear of the building foundations (at least 1m and more if possible) and not in the vicinity of other services such as gas, electricity or water connections. The external pipe work must be kept to a minimum and not more than 3m in length. The pipe may be taken below or above the ground level. Any external condensate pipe work must be insulated to minimise the risk of freezing.

10. Assessment Form

Calculation and Declaration Form											
This form may be used to show that it is not practicable to install a condensing boiler for the purposes of complying with Part L of the Building Regulations.											
1	Address of property to be assessed:										
2	Dwelling type (tick one only)	Flat ☐		Mid-Terrc. ☐		End Terrc. ☐		Semi-D. ☐		Detached ☐	
3	Existing boiler fuel (tick one only)	Ntrl Gas ☐		LPG ☐		Oil ☐		Solid fuel ☐		None ☐	
4	New boiler fuel (tick one only)	Ntrl Gas ☐			LPG ☐			Oil ☐			
5	Existing boiler type (tick one only)	Wall Mounted ☐			Back Boiler ☐			Floor standing ☐			
6	Existing boiler position (tick one only)	Kitchen ☐	Utility Room ☐		Garage ☐	Living room ☐		Bedroom ☐		Other ☐	
7	Is the most practical option to install the boiler in another room?	Yes ☐			No ☐			N/A (no existing boiler) ☐			
8	If Yes to section 7, state new boiler position.	Kitchen ☐	Utility Room ☐		Garage ☐	Living room ☐		Bedroom ☐		Other ☐	
	Assessment of the practicality of installing a condensing boiler										Yes =**1**, No = **0**
9	Is the dwelling a flat or mid-terraced building?										
10	If a condensing boiler can be installed, but only in a different position from the existing boiler, is this position in another room (see table 1)?										
11	For the chosen boiler position, is an extended flue required (>2m)? **Note:** see table 1 for flue options not to be considered.										
12	Will a condensate pump or soakaway be necessary?										
13	**Total Assessment Score:**										
If score is 3 or greater then the installation of a condensing boiler may be deemed not to be practicable.											

14	**Declaration Form** (tick one box only)
Option A ☐	I declare that the boiler is being replaced under manufacturer's or installer's guarantee, within three years of the original installation date, OR
Option B ☐	I declare that there are no feasible condensing boiler installation options (as defined by the assessment procedure) because:
Option C ☐	I declare that I have considered all feasible boiler installation options in the property above, and that the option defined in sections 9 to 12 of this form produces the lowest total score.

Signed:	Date:
Name (in capitals):	Status (agent or installer):

Notice to the householder.

Where option **A** has been ticked, a like-for-like replacement boiler is reasonable.

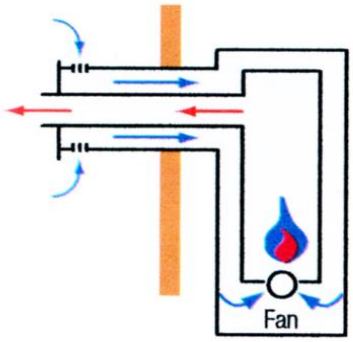
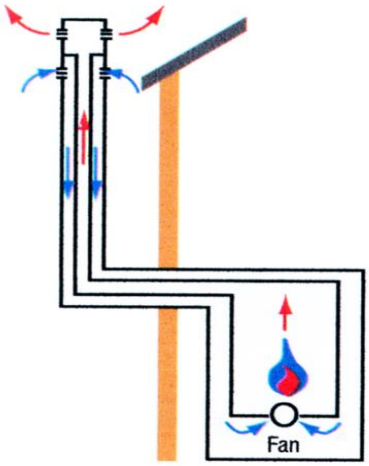
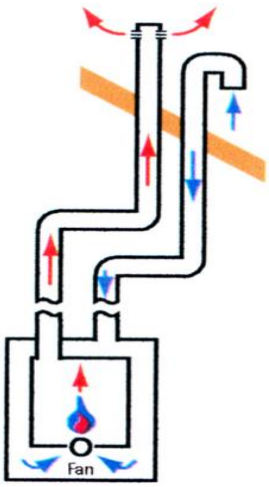
Where option **B** has been ticked OR option **C** has been ticked AND the total assessment score in section 13 is 3 or greater, this document may be used as evidence that installation of a condensing boiler has been assessed as not practicable. Nevertheless you may choose to exceed the Building regulations requirement if a suitable installation option can be found.

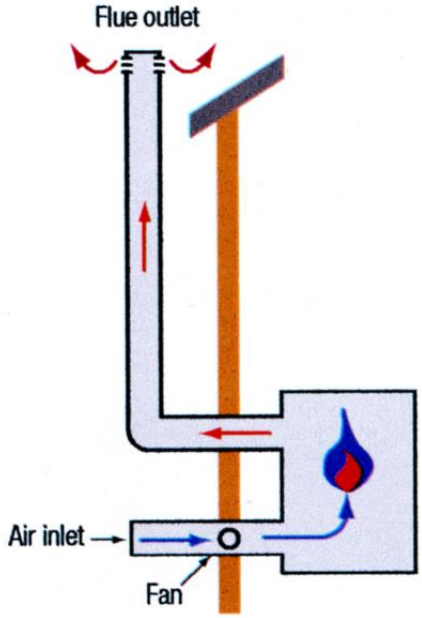
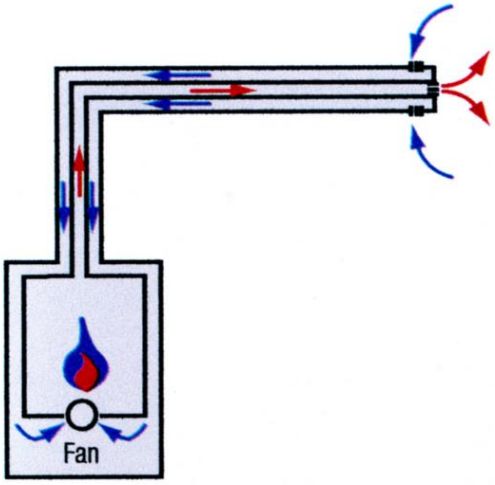
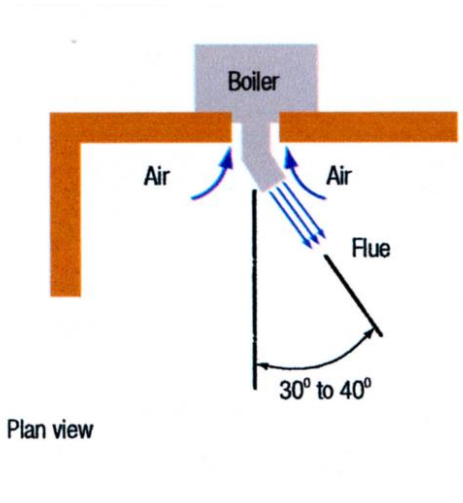
Condensing boilers are more efficient and therefore save on fuel costs and cause less harm to the environment

You should retain this form. It may be required when you sell your home.

11. Typical flue types

The following flue options are typical of what is available but other flue options may be considered provided that they meet regulations.

Straight through-the-wall terminal A normal balanced flue terminal mounted directly behind a boiler on an outside wall.	
External concentric vertical flue The air inlet and flue outlet are adjacent and the terminal would normally be mounted at high level. Flue is mounted externally to the building.	
Twin-pipe extended flue The air inlet and flue outlet can be adjacent or separated but the flue outlet would normally be mounted at high level. The air and flue pipes can have separate terminals or meet with a concentric terminal.	

Non-balanced extended flue A flue system used with some gas boilers where the air intake and the flue outlets can be positioned in different wind pressure zones, described as type 'C5'in boiler standard IS EN 483. Separate ducts are used for air intake and flue products. Typically the flue products would discharge at a higher level than the air inlet position. This option is only available for some boilers, which require special certification for use in this way. Also specially designed flue components must be used which have been approved by the boiler manufacturer.	
Extended horizontal flue The flue and air pipes either concentric or twin are extended horizontally from the boiler to the external wall. Whilst in many cases this would be connected to a wall terminal, it could also connect to an external concentric vertical flue.	
Plume diverter terminal A wall terminal that directs all the flue products at an angle. The terminal will usually direct the products at an angle greater than 30^{o}. It is particularly useful where a terminal needs to be sited in an internal corner. A plume diverter terminal can usually be sited closer to the corner than a standard wall terminal.	

12. Condensate drain connections

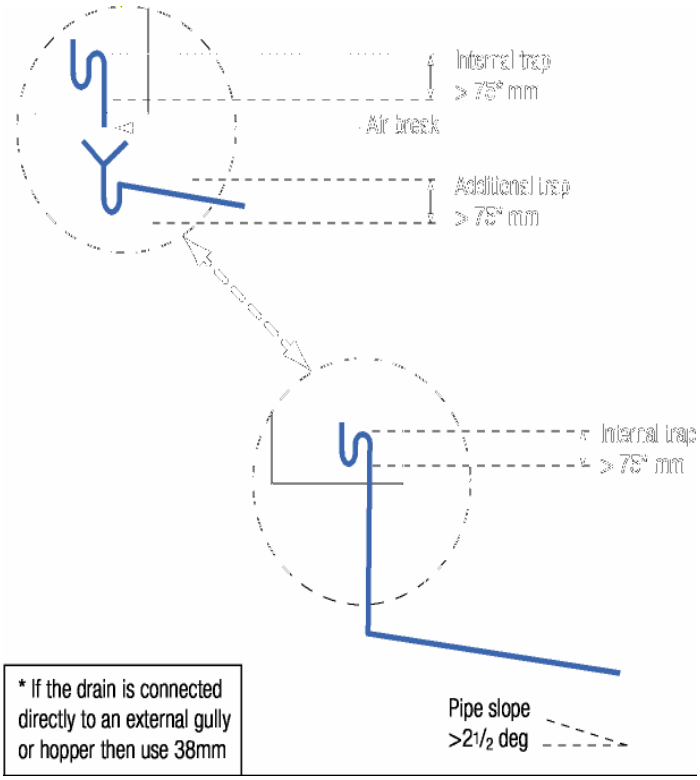
CONDENSATE DRAIN POINTS

During normal operation of the boiler condensate will be formed in the heat exchanger and flue. The condensate formed depends on many factors, although over four litres a day is not untypical. This condensate is slightly acidic, with a pH of between 3 and 6, similar to tomato juice, and must be disposed of correctly.

Suitable drain points:

- internal stack pipe

Figure 2 Condensate trap alternatives



- waste pipe;
- external drain, or gully;
- rainwater hopper that is part of a combined system, i.e. sewer carries both rainwater and foul water;
- purpose made soakaway.

Where possible connections should always be made to internal drain points (stack pipe or waste pipe). External termination points are more likely to become blocked by, for example, freezing, leaves or general debris.

CONDENSATE DRAIN PIPE INSTALLATION

Condensate traps Building regulations require a trap in the pipe whether it is terminated directly to the outside or before it connects to another waste pipe. If the drain pipe is taken directly to a gully or rainwater hopper, a water seal of no less than 38mm is required. When connected to another waste pipe the water seal must be at least 75mm, to prevent foul smells entering the dwelling. Many boilers include a trap within the boiler to prevent combustion products entering the drain; however, this may not have a sufficient seal depth to meet the building regulations. Unless the manufacturer's instructions state otherwise an additional trap of either 38mm or 75mm, depending on the intended connection, will be required with an air break between the traps (see Figure 2).

Condensate pipe length should be kept as short as possible – externally run condensate drainpipes should be limited to 3m to reduce the risk of freezing. When an appliance is to be installed in an unheated location such as a garage, all condensate drains should be considered as external.

Condensate pipe fall at least $2^1/2$ deg away from the boiler.

Bends should be kept to a minimum. Similarly the number of fittings or joints external to the dwelling needs to be minimised in order to reduce the risk of condensate being trapped.

Fixing Must be adequate to prevent sagging. A maximum spacing of 0.5m for horizontal and 1.0m for vertical sections should be adequate.

Pipe sizes Follow boiler manufacturer's instructions. If there are no guidelines then a minimum nominal diameter of 22mm should be used when run internally in a dwelling and a larger diameter is recommended for externally run pipe to reduce the risk of freezing (at least 32mm nominal diameter).

Pipe material The drainpipe material should be resistant to acid as the condensate is slightly acidic. Suitable materials for the condensate drainage pipe are plastics as used for standard wastewater plumbing systems or cistern overflow pipes (copper and mild steel pipes and fittings must not be used).

Condensate siphons Many boilers have a siphon fitted as part of the condensate trap arrangement. This provides intermittent discharge of the condensate which will significantly reduce the risk of condensate freezing where part of the pipework is run externally. If an appliance does not include a siphon then external pipework is best avoided to reduce the risk of freezing. If this is not possible then external pipework should have a minimum nominal diameter of 32mm.

Condensate pumps Where a boiler is sited in basement or a drain point cannot be reached by gravity a condensate pump can be considered. Suitable units are now becoming available. Pump manufacturer's instructions must always be followed.

CONDENSATE DRAIN TERMINATION

Connection to internal stack (preferred) The stack to which the condensate pipe is to be connected must be in a material that is resistant to condensate, such as the plastic materials suggested for condensate pipes.

Check whether the boiler incorporates a trap with a minimum condensate seal of 75mm. If this trap has a seal of less than 75mm, then an additional trap of 75mm must be fitted. In this case a visible air break is necessary between the boiler and the additional trap. (Figure 3).

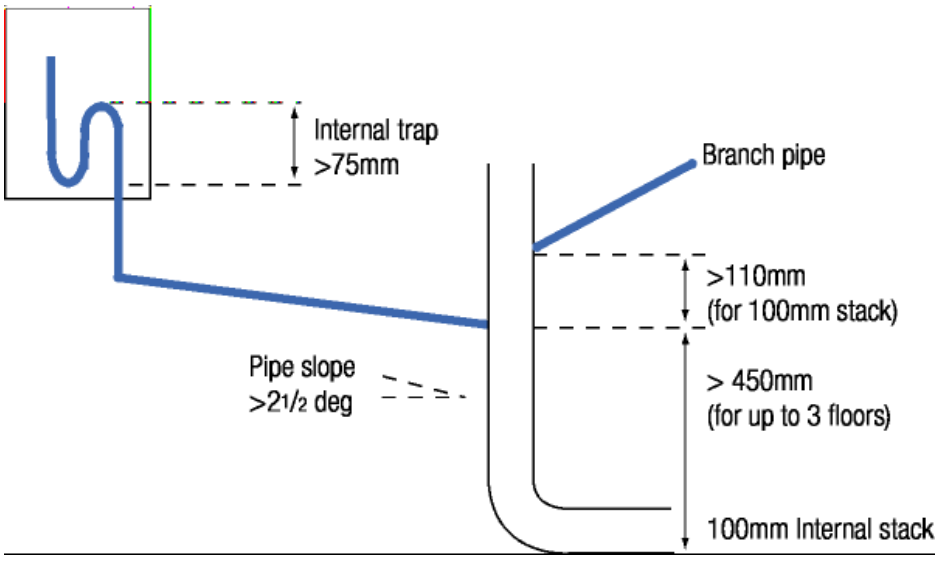
The condensate drainpipe should not discharge into the stack lower than 450mm above the invert of the tail of the bend at the foot of the stack for single dwellings of up to 3 storeys. If this is not visible then the height should be measured from the lowest straight section of stack that is visible. For multi storey buildings this distance should be increased.

The connection to the stack should not be made in a way that could cause cross flow into any other branch pipe, or from that branch pipe into the condensate drainpipe. This can be achieved by maintaining an offset between branch pipes of at least 110mm on a 100mm diameter stack and 250mm on a 150mm diameter stack.

Connection to external stack If the termination is to be to an external stack then in addition to the requirements for connecting to an internal stack, extra care is necessary in order to reduce the risk of the drain becoming blocked due to the condensate freezing. The length of pipe external to the dwelling should be kept as short as possible and not more than 3m. Any trap in the drainpipe must be fitted within the dwelling. In exposed locations the pipe should be protected with waterproof pipe insulation.

Connection to internal waste pipe: Termination can be made via an internal discharge branch, such as connections to a kitchen sink, washing machine or dishwasher drain. This is likely to be the most convenient method of connection and hence most frequently used.

Figure 3 Condensate connection to internal stack



It can be connected upstream or downstream of sink waste trap (or other machine connection). If practical it should be connected to the upper part of the pipe wall. If it is connected upstream of sink waste trap, then an air break is necessary between the sink trap and the boiler trap. This is usually provided by the sink waste pipe itself as long as the sink has an integral overflow. (Figure 4).

If the drain is connected downstream of the sink waste trap, and the boiler does not have an integral trap with a seal of at least 75mm, then an additional trap of at least 75mm must be fitted. An air break must be included between the traps. (Figure 5).

The trap and airbreak should be above the level of the sink to prevent flow from the sink into boiler or airbreak.

Connection to washing machine drains are preferable to a kitchen sink as this reduces the amount of solid waste and fats in the drain branch that could cause blockage or restriction at the point where the condensate drain is connected.

Connection to external drain point If the condensate drain cannot be connected to an internal drain then direct connection to an external gully or rainwater hopper can be considered.

A rainwater hopper must be connected to a combined system i.e. sewer carries both rainwater and foul water. The open end of the pipe should be terminated in the gully or rainwater hopper below the grid level but above the water level. Condensate should not be disposed of in ‘grey water’ systems i.e. systems that reuse water (except water from toilets) used in the home.

Figure 4 Connection to internal sink waste (upstream of sink trap)

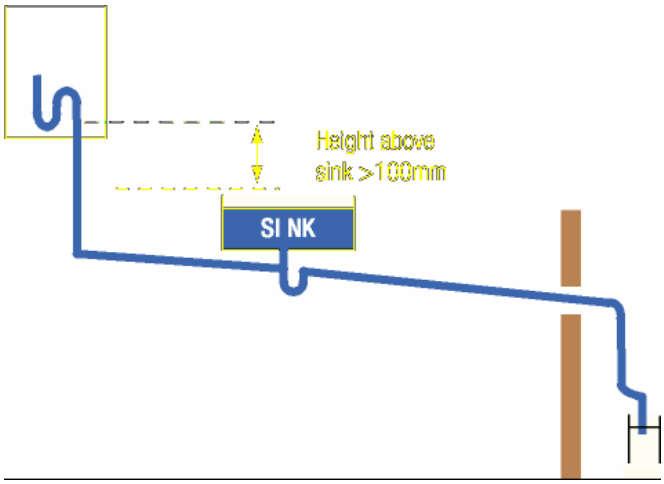


Figure 5 Connection to internal sink waste (downstream of sink trap)

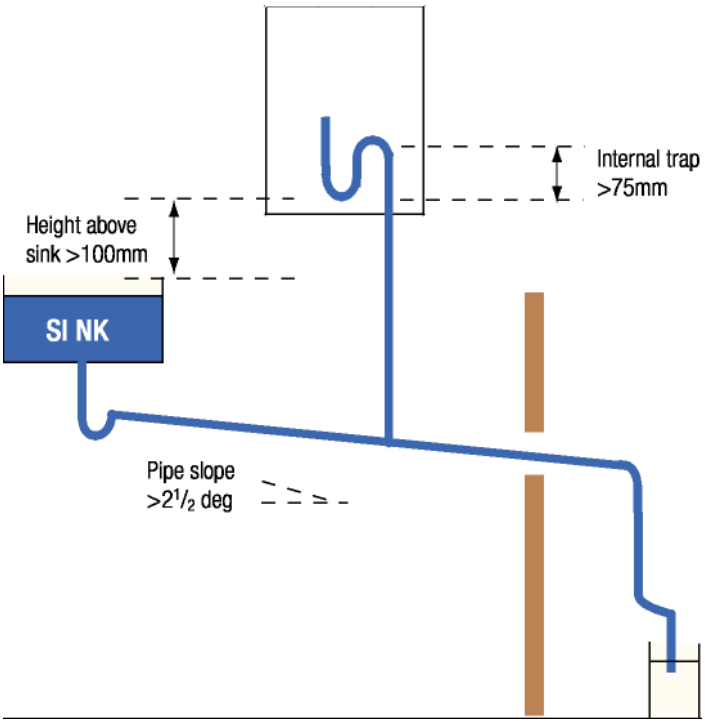
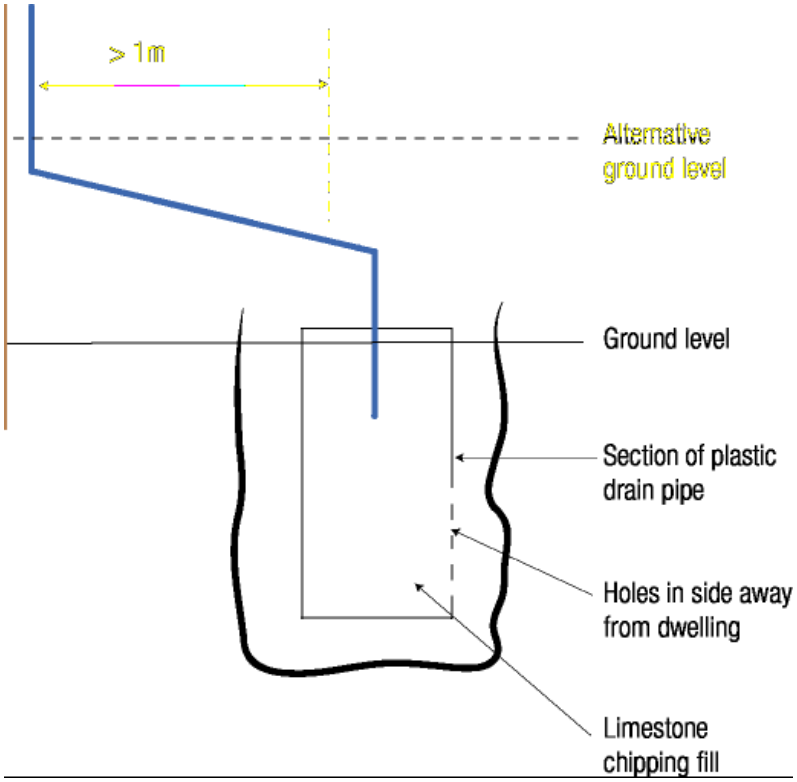


Figure 6 Suggestion for condensate soakaway drain



Connection to soakaway If none of the previous solutions are possible then a purpose made soakaway can be used. The soakaway should be located as close as possible to the boiler but clear of the building foundations and not in the vicinity of other services such as gas, electricity or water connections. The position and presence of a soakaway must be taken into account when carrying out a risk assessment for installation of an oil storage tank. The external pipework must be kept to a minimum and not more than 3m in length. The pipe may be taken below or above the ground level.

An example of a suitable design of soakaway is shown in Figure 6. The necessary size for a soakaway depends to a large extent on the soil conditions although unlike a rainwater soakaway the soil does not have to accommodate large water volumes over short periods. A size approximately 200mm in diameter and 400mm deep, filled with limestone chippings, will normally be sufficient.

Appendix B: Guide to the radiator sizing for various heat generators

The following appendix gives details on how to size a radiator for a room with an example heat loss of 500W. This example details how to size the radiators for heat generators with varying flow and return temperatures.

Radiator selection

Radiator outputs are typically based on a water-to-air temperature difference ΔT 50°C in manufacturer's product catalogues.

The higher the ΔT value, the higher the radiator output will be. Traditional gas or oil non-condensing boilers operate with higher flow and return temperatures 82/71°C, while condensing boilers operate at lower flow and return temperatures 65/55°C, to increase their efficiency. Heat pumps normal operating temperatures are 45/40°C, to increase their efficiency – see examples below on how to size radiators for various heat generators.

$$\Delta T = \frac{(flow\ temperature + Return\ temperature)}{2} - Room\ Tempetature$$

- Traditional gas or oil non-condensing boilers, flow and return temperatures 82/71℃ and room temperature 20℃:

$$\Delta T = \frac{(82 + 71)}{2} - 20$$

$$\Delta T = 56.5°C$$

- Condensing boilers, flow and return temperatures 65/55°C and room temperature 20°C:

$$\Delta T = \frac{(65 + 55)}{2} - 20$$

$$\Delta T = \ 40°C$$

– Heat pump technology, flow and return temperatures 45/40°C and room temperature 20°C:

$$\Delta T = \frac{(45 + 40)}{2} - 20$$

$$\Delta T = \ 22.5°C$$

The reduced temperature difference reduces the output of the radiator. Many radiator manufacturers supply information for radiator output based on a ΔT value of 50°C. Table B1 is an example of typical information detailed in a radiator manufactures radiator catalogue:

Table B1: Radiator sizes and outputs

Radiator Height (mm)	Radiator Length (mm)	Heat Output at ΔT 50 °C	
		Watts	BTU
450	400	424	1446
	500	535	1827
	600	647	2208
	700	758	2585
	800	869	2966
	900	980	3344
	1000	1092	3725
	1100	1203	4106
	1200	1314	4483
	1400	1536	5242
	1600	1760	6004

Where radiators are to be installed for different ΔT values, the stated radiator outputs must be multiplied by a conversion factor to account for the different ΔT value. Manufacturers should be asked to provide conversion factors for different ΔT values.

The following table is an example of conversion factors to be applied to outputs quoted at ΔT 50°C. Radiator manufacturers supply specific conversion factors for their specific products and these should be requested by the designer:

Table B2: Example of Radiator conversion factors

ΔT°C	Multiply Output
20	0.304
30	0.515
40	0.748
45	0.872
50	1.000
55	1.132
60	1.268

The conversion factor allows the calculation of the radiator output where the operating temperatures result in a ΔT value different to that of the stated ΔT 50°C. As the ΔT value reduces, larger radiator dimensions will be required to achieve the same heat output. Check with radiator manufacturer for specific conversion factors.

If a room had a calculated heat loss of 500W the following are examples detail how to select a suitably sized radiator for the space.

As detailed above:

- Traditional gas or oil non-condensing boilers, 82/71℃ and room temperature 20℃, has a $56.5°C\ \Delta T$

Using Table B2 you need to calculate the factor for $56.5°C\ \Delta T$ and as the table is only in increments of $5°C\ \Delta T$,then take factor of 60 ΔT°C and multiply output of 1.268 from Table B2.

$$1.268\ \div 60 = 0.021$$

$$0.021\ x\ 56.5 = 1.186$$

Therefore, to achieve the target of 500 Watts output for the room, we need to select a radiator from Table 1 with an output of at least:

$$500\ \div 1.186 = 421\ Watts$$

Selecting a radiator size of 424 Watts (400mm L x 450mm H) from Table B1 and multiply the calculated multiply output of 1.186

$424\ x\ 1.186 = 502$ Watts

The radiator selected will give an output of 502 Watts for a room with a heat loss of 500 Watts.

- Condensing boilers flow and return temperatures 65/55°C and room temperature 20°C, has a $40°C\ \Delta T$

Using Table B2 you need to use the factor $40°C\ \Delta T$ of 0.748

Selecting a radiator size of 758 Watts (700mm L x 450mm H) from Table B1 and multiply the calculated multiply output of 0.748

$758\ x\ 0.748 = 566$ Watts

The radiator selected will give an output of 566 Watts for a room with a heat loss of 500 Watts.

- Heat pump technology, 45/40°C and room temperature 20°C, has a $22.5°C\ \Delta T$

Using Table B2 you need to calculate the factor for $22.5°C\ \Delta T$ and as the table is only in increments of $5°C\ \Delta T$, then take factor of 20 ΔT°C and multiply output of 0.304 from Table B2.

$0.304\ \div 20 = 0.015$

$0.015\ x\ 22.5 = 0.342$

Selecting a radiator size of 1536 Watts (1400mm L x 450mm H) from Table B1 and multiply the calculated multiply output of 0.342

$1536\ x\ 0.342 = 525$ Watts

The radiator selected will give an output of 525 Watts for a room with a heat loss of 500 Watts.

Table B3 below illustrates the changes in ΔT and how this effect the radiator sizes for varying flow and return temperatures

Table B3: Changes in radiator sizes with varying temperature differences

System type	$\Delta T\ °C$ of heating systems	Radiator output at ΔT 50°C (W)	Radiator output adjusted for system ΔT (W)	Radiator Size (L x H - mm x mm)
Traditional gas or oil non-condensing boilers	56.5	424	502	400 x 450
Condensing boilers	40	758	566	700 x 450
Heat pump	22.5	1536	525	1400 x 450

The heat is measured in Watts (W) or British Thermal Units (BTUs) [1W = 3.412 BTU]

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