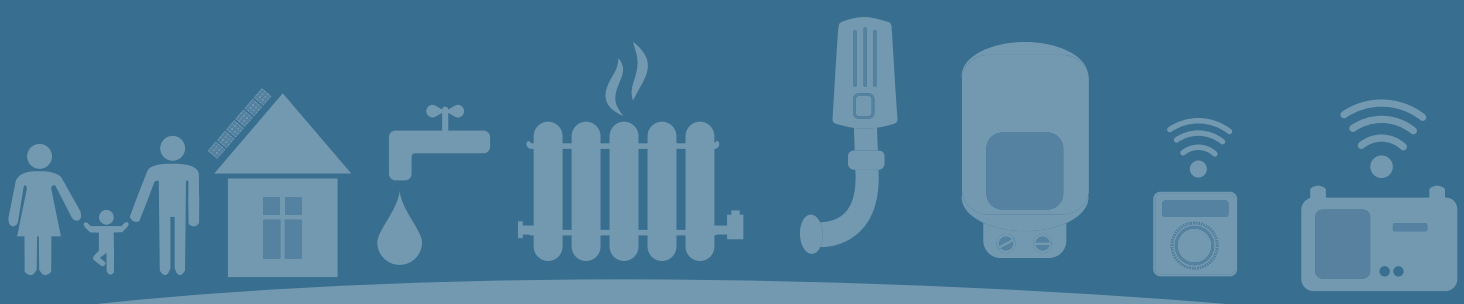
INSTALLING HEATING CONTROLS WITH GAS OR OIL BOILERS IN DWELLINGS

Guidance on how to comply with Part L of the Building Regulations from June 2022 (England) and November 2022 (Wales)



Version 1

INTRODUCTION

This guide supports the 2021 edition of Approved Document L, Volume 1: Dwellings for England, which relates to work carried out from 15 June 2022. It also applies to the 2022 edition of this document for Wales which relates to work carried out from 23 November 2022. The focus of the guide is on controls for gas and oil fired wet central heating installations with radiators in dwellings.

Following the recommended system layouts in this document will provide confidence that designs and installations are in accordance with the guidance and should therefore comply with the relevant parts of the Building Regulations. However, it should be noted that the official guidance does not cover all circumstances and any proposed variation should be agreed with the relevant building control body.

For further information contact BEAMA Heating Controls via email: BRegs@beama.org.uk

BEAMA is the UK trade association for manufacturers and providers of energy infrastructure technologies and systems.

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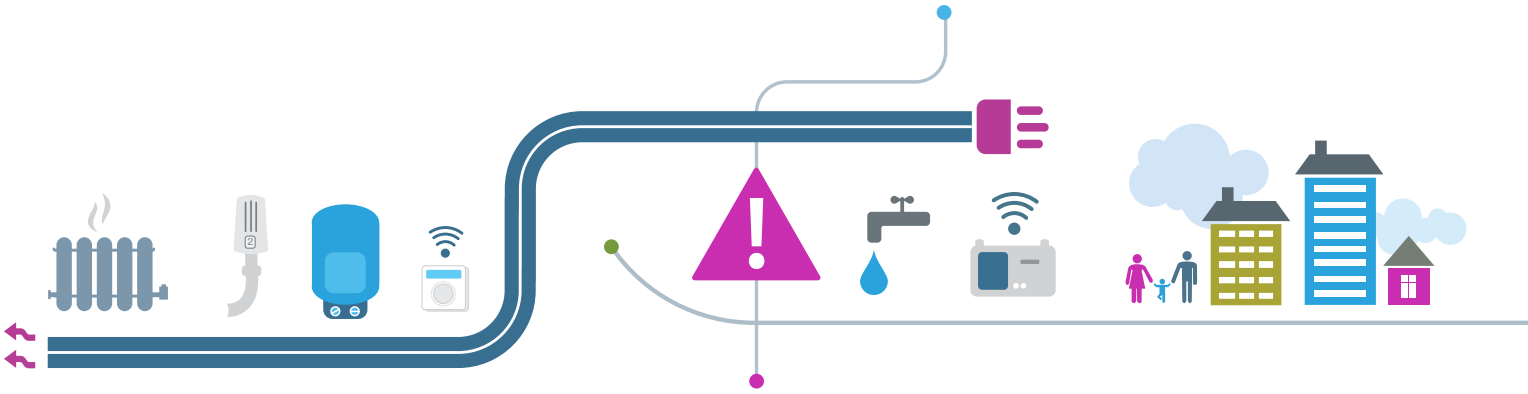
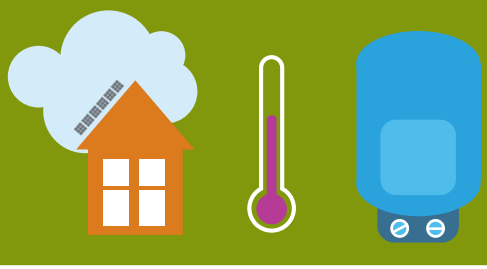
CONTENTS

1. **The legal requirements in Part L** 4
   - New for 2022 5
   - Quick Guide – Required number of heating zones 5
   - Quick Guide – Heating and hot water control requirements 6
2. **Gas combination boilers – Additional measures for existing dwellings.** 8
3. **Practical application of 'Boiler Plus' measures with gas combination boilers** 10
4. **Example System Layouts** 11



1. The legal requirements in Part L

It is important for all installers to be aware of the legal requirements that apply for both new heating systems and gas or oil boiler replacements and what these mean in practice. The table below provides a quick guide to these:

The requirement	What this means in practice
Reasonable provision shall be made for the conservation of fuel and power in buildings by providing fixed building services which:	
ARE ENERGY EFFICIENT TO A REASONABLE STANDARD; 	Gas boilers have a minimum efficiency of 92% (as defined by ErP). Oil boilers have a minimum efficiency of 91%, or 86% if a combi boiler. A heat loss calculation is carried out for the dwelling to ensure that the new or replacement boiler is not significantly oversized. Full heating systems (boiler, radiators and pipework) installed in a new or existing dwelling should be sized to operate at a maximum flow temperature of 55°C.
HAVE EFFECTIVE CONTROLS; 	The heating and hot water system should have controls installed that, at least, meet the minimum standards set out in this guide
ARE COMMISSIONED BY TESTING AND ADJUSTING AS NECESSARY TO ENSURE THEY USE NO MORE FUEL AND POWER THAN IS REASONABLE IN THE CIRCUMSTANCES. 	Boiler central heating output set to match the calculated heat loss. System flushed, cleaned and inhibitor added in accordance with BS 7593. System balanced. The Benchmark checklist (or equivalent) completed, and commissioning notice given to building control.

NEW FOR 2022

The Domestic Building Services Compliance Guide is no longer applicable, with all guidance and minimum standards now incorporated into Approved Document L, Volume 1: Dwellings (2021 edition).

When a boiler is replaced in an existing dwelling, each room should now be provided with thermostatic room controls to control the heating output in each room. For a system with radiators this can be achieved by adding thermostatic radiator valves (TRVs) to each radiator except any in the room where the central room thermostat is located.

Quick Guide – Required number of heating zones

	New dwelling		Existing dwelling			
			Full heating system		Boiler replacement	
	Less than 150m²	150m² or above	Less than 150m²	150m² or above	Less than 150m²	150m² or above
Number of heating zones	**1**	**2**	**1**	**2**	**1**	**1**

Notes

- Each zone should have an individual heating circuit with independent time and temperature control (e.g., a heating programmer and room thermostat for each zone.)
- One zone would typically cover the 'living area' and heating zones will often be divided to cover 'living' and 'sleeping' areas, or upstairs and downstairs. There are usually significant opportunities for energy saving by matching zones to the lifestyle of occupants (for example with home offices) and installers should look for opportunities to set up zones beyond the minimum requirements.
- A 2006 report by Nationwide showed that most four-bedroom detached houses fall into the category where two zones would be required, with the average floor area of such properties being 157m² (the average for a five-bedroom detached house was over 200m².) Older houses can be larger than modern ones, with the average of all pre-war detached homes being over 150m².
- Consideration should also be given to zoning of hot water in large properties if there are multiple storage cylinders being used.

Quick Guide – Heating and hot water control requirements

		New dwelling			Existing dwelling							
		Full heating system			Full heating system			Boiler replacement			HW cylinder replacement	Radiator replacement
		Gas combi boiler	Oil combi boiler	System or open vented boiler	Gas combi boiler	Oil combi boiler	System or open vented boiler	Gas combi boiler	Oil combi boiler	System or open vented boiler	System or open vented boiler	Any boiler
Heating circuit controls	Boiler interlock	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Room thermostat	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	Programmer	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Hot water (storage) circuit controls	Independent HW time control			✓			✓			✓	✓	
	Cylinder thermostat			✓			✓			✓	✓	
	Thermostatic controls in each room	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	One of: (a) flue gas heat recovery, (b) weather compensation, (c) load compensation, (d) smart control				✓			✓				

Notes

- Boiler interlock means that controls are wired so that when there is no demand for space heating or hot water the boiler and pump are switched off. Use of TRVs alone does not provide interlock.
- For each heating circuit, it would also be acceptable to control through means of individual networked radiator controls in each room on the circuit.
- There are some limited exceptions to the requirement for thermostatic controls in each room, for example single-storey open-plan dwellings where the living area is over 70% of the total floor area. More details are given in sections 5.20 and 5.21 of the Approved Document.
- Gravity-fed systems in existing homes should be upgraded to fully pumped when the boiler is replaced.
- For a radiator replacement, the requirement for 'thermostatic controls in each room' should only be considered as good practice. However, any new radiator(s) should be fitted with a TRV or equivalent unless fitted in a room with a room thermostat.
- Where a hot water cylinder replacement is designated as an 'emergency', rather than a planned replacement, the addition of boiler interlock and a separate timed hot water circuit can be considered as 'good practice' only. A cylinder thermostat should always be fitted with a replacement cylinder.
- Gas combination boilers should be selected that can modulate down to the typical heating load of the building.

Customer information

It is an additional legal requirement for installers to provide information, within five days of the work being completed, on how to use installed building services so that they can be operated efficiently. Information on the correct use of heating and hot water controls is an obvious part of this requirement to help occupants understand the best way to use the controls to maintain comfort and minimise energy use.

For both new and existing dwellings, operating and maintenance instructions should be provided with the following information on the heating controls:

- What they are and what they do.
- Where they are located.
- How to use them to optimise efficiency.
- Any maintenance requirements.
- Links to other documents such as user manuals.

2. Gas combination boilers – Additional measures for existing dwellings

The following requirements were introduced in England in 2018 and are generally referred to as 'Boiler Plus' requirements. They apply to gas combination boilers only and to any installation in an existing building whether it is a replacement boiler or a new heating system.

In these circumstances one of the following measures must also be installed:

1. Flue gas heat recovery

This is defined as *'a device which pre-heats the domestic hot water supply by recovering heat from the boiler's flue emissions.'* These devices are not part of a standard condensing boiler but may be built into some boilers or will be a separately supplied device. You should always check with the boiler manufacturer regarding compatibility and installation.

2. Weather compensation

For weather compensation two elements are required:

i. A means of measuring the local outdoor temperature. This can be either by a sensor fixed to an external wall of the property (in a position where it will not be affected by solar gain), or, with certain devices, by receiving location specific weather data (e.g. from an internet source.)

ii. A control functionality that varies the flow temperature from the boiler in relation to the measured outside temperature, thereby matching heating output to the heating load. This is achieved either by directly modulating the output of the heater (which requires some communication protocol between the boiler and the control; the boiler instructions will define which protocols are applicable) or by controlling the on/off operation of the heater.

In practice, this can be achieved by either directly connecting an outdoor temperature measuring device directly into the boiler (if this facility is available), by connecting to the boiler

a stand-alone weather compensator with an outdoor temperature measuring device, or by replacing the room thermostat and timer with a programmable room thermostat that incorporates weather compensation and is connected to, or incorporates, an outdoor temperature measuring device. System diagrams incorporating these options can be found below. Manufacturers' instructions for both boiler and controls should be consulted.

3. Load compensation

Load compensation operates in a similar way to weather compensation except that it measures the internal rather than external temperature. The control will incorporate a functionality that varies the flow temperature from the boiler in relation to the difference between the measured room temperature and the room thermostat set point. This is achieved by either directly modulating the output of the boiler (which requires some communication protocol between the boiler and the control; the boiler instructions will define which protocols are applicable) or by controlling the on/off operation of the boiler, providing that this varies the flow temperature from the boiler.

A load compensation control will usually replace the room thermostat in a dwelling and does not usually require an additional sensor.

4. Smart thermostat with automation and optimisation

For this category there are four clear functionalities that should be incorporated:

a. It must include a room thermostat, delivering both time and room temperature control, and therefore replacing any existing thermostat and programmer, or programmable room thermostat.

b. It must have the functionality to automatically adjust time and temperature settings based on either manual entries from the occupants or occupancy detection.

c. It must be capable of starting the boiler at the optimum time to achieve the set-point temperature at the start of the occupancy period (i.e. optimum start.) Implicit in this is some form of learning within the device.

d. It should allow operation parameters to be set and adjusted without physical access to the control interface, and should incorporate a communications capability that allows information to be exchanged internally or externally to the building (e.g. internet connectivity, Bluetooth etc.)

It should be noted that category 4a, 4b and 4c above are based on definitions within the regulation.

Category 4d is related to the need for the thermostat to be "smart" and is based on a general understanding of this term for a smart thermostat that was set out by BEIS under the Boiler Plus review. There are alternative forms of smartness in control devices that could also satisfy the functional requirements of the Building Regulations. For reference, the industry derived Functional Definitions for controls indicate which functions within a control could be classed as 'smart' and therefore meet this classification:

CLICK HERE TO FIND OUT MORE

3. Practical application of 'Boiler Plus' measures with gas combination boilers

Replacement boiler installations should follow the example layouts for gas or oil combination boilers in new dwellings as set out on page 12, with the following additions depending on which Boiler Plus option is taken:

FLUE GAS HEAT RECOVERY

Follow the layouts on **page 12.**

LOAD COMPENSATION

Replace the room thermostat or programmable room thermostat for one that incorporates load compensation functionality.

WEATHER COMPENSATION

Refer to options on **page 11.**

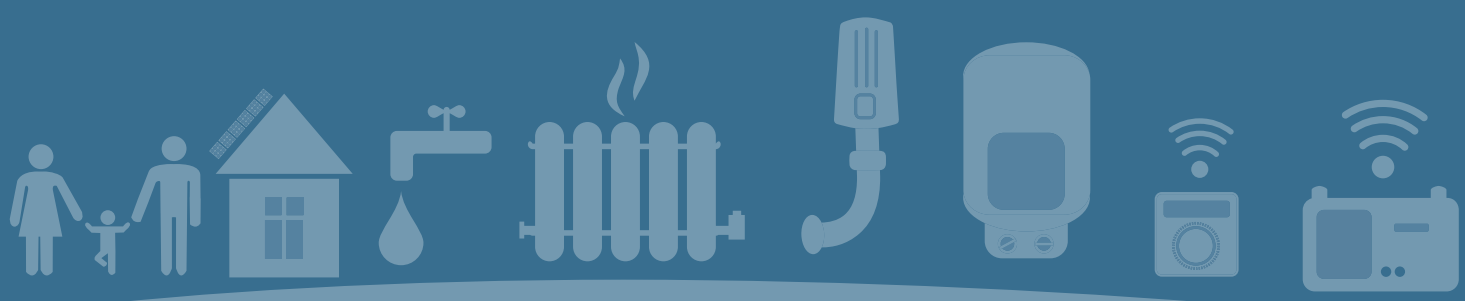
SMART THERMOSTAT

Replace the room thermostat or programmable room thermostat for one that incorporates the defined smart thermostat functionality.

Good practice:

- For optimum energy savings from the heating controls it would be best to install a smart thermostat that also incorporates either load compensation or weather compensation.

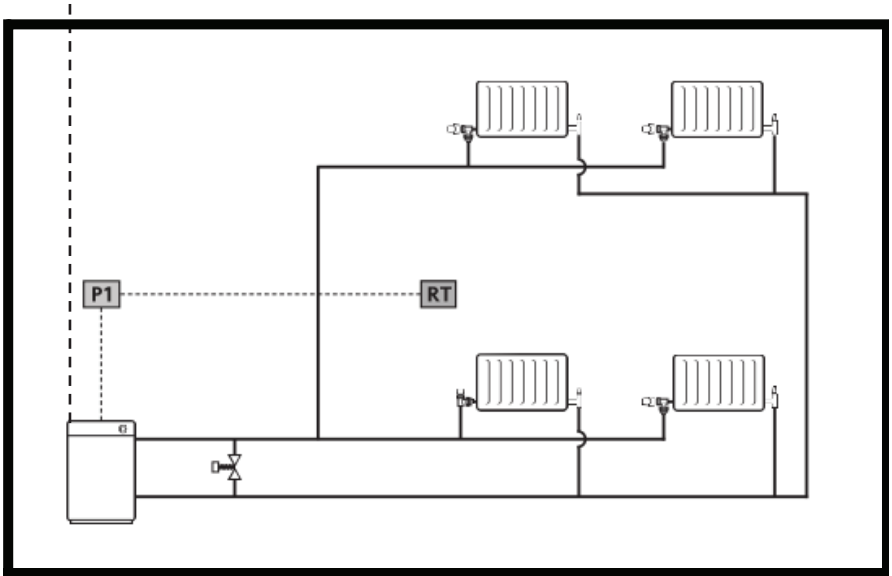
4.
EXAMPLE SYSTEM LAYOUTS



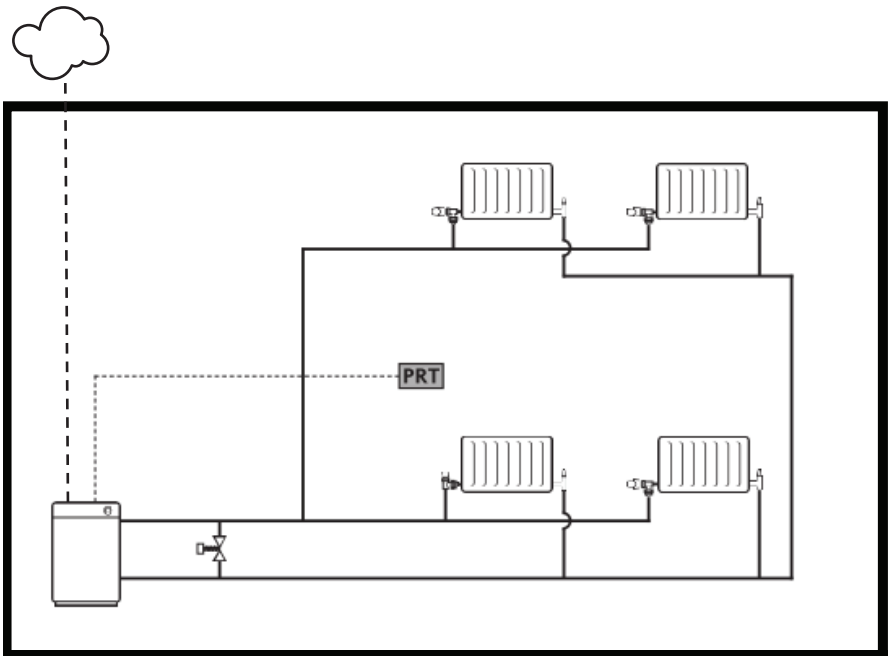
Weather compensation installation options to meet 'Boiler Plus' requirements

Outdoor temperature measuring device connected directly to the boiler

= local *outdoor sensor or internet weather data*

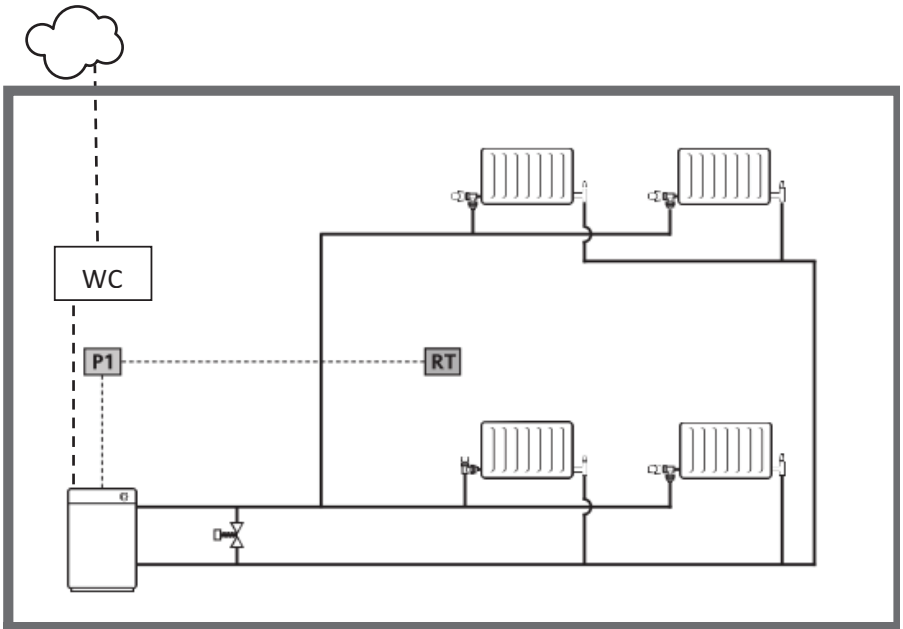


Programmer, room thermostat and thermostatic radiator valves

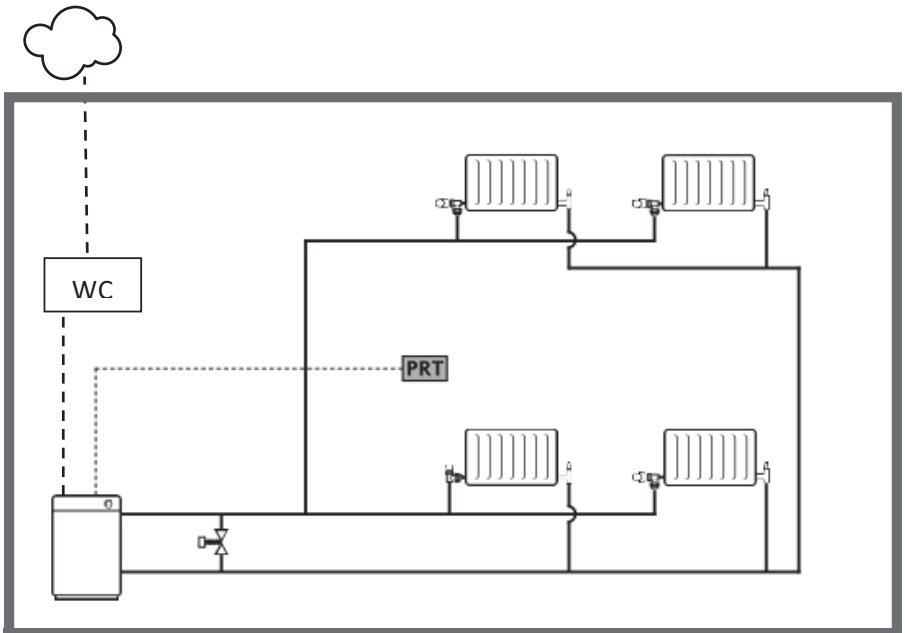


Programable room thermostat and thermostatic radiator valves

Stand-alone weather compensator with an outdoor temperature measuring device

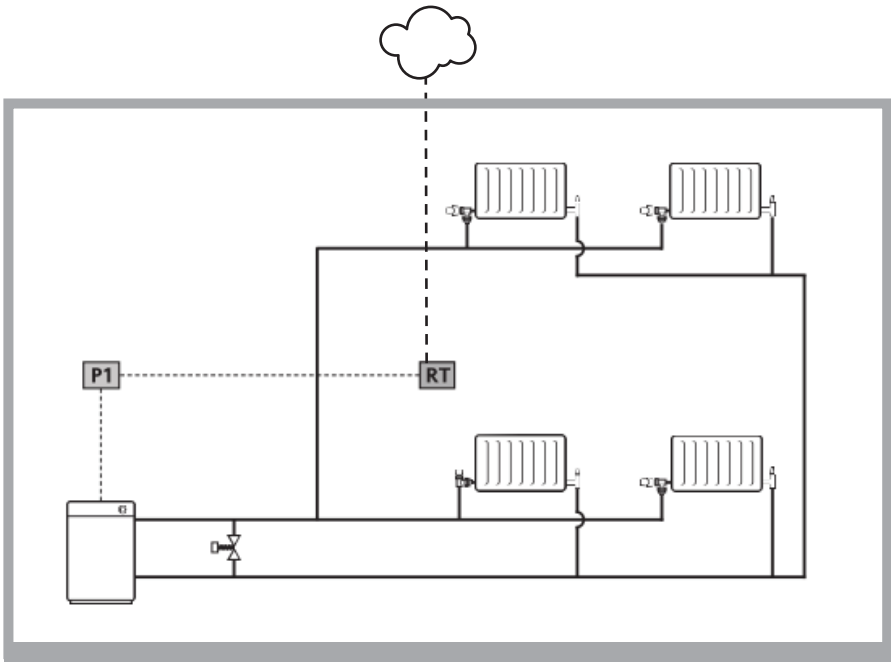


Programmer, room thermostat and thermostatic radiator valves

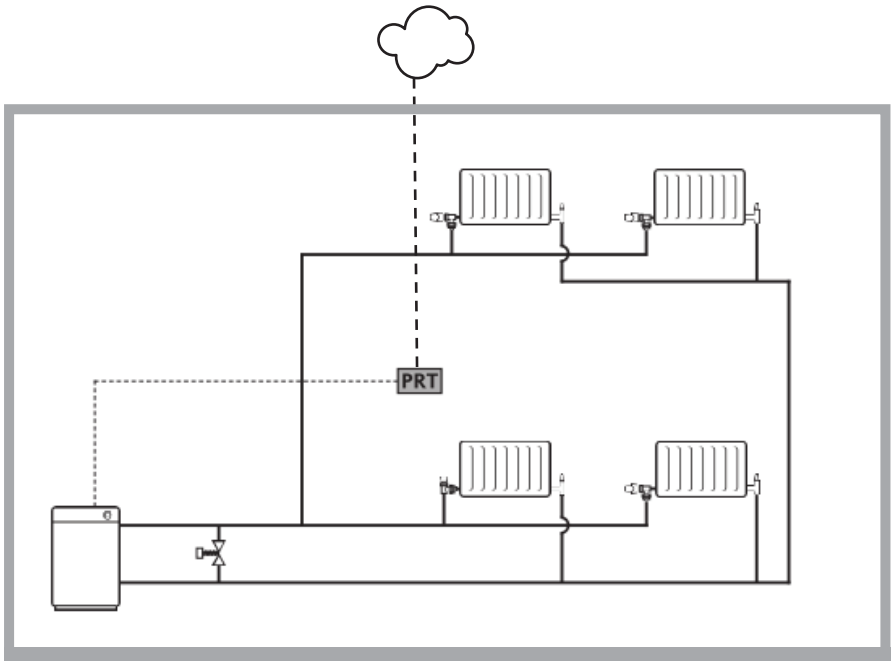


Programable room thermostat and thermostatic radiator valves

Room thermostat with weather compensation, connected to, or incorporates, an outdoor temperature measuring device



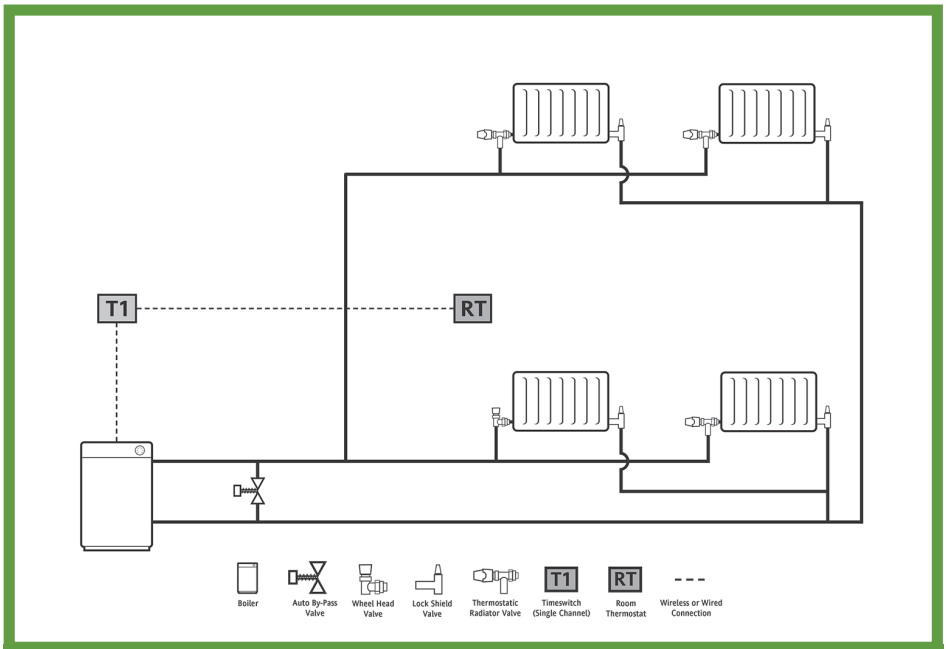
Programmer, room thermostat and thermostatic radiator valves



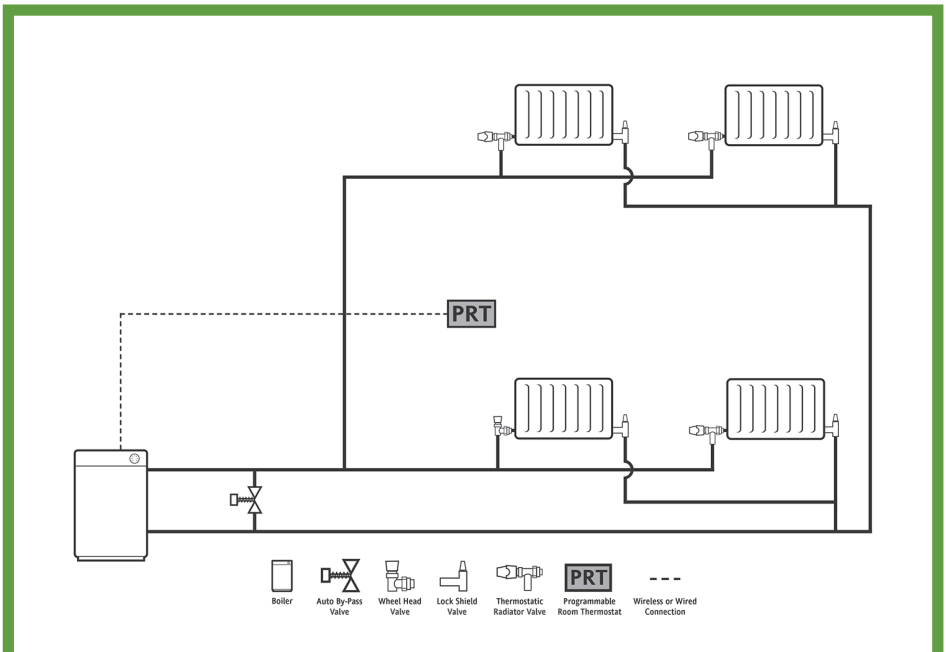
Programable room thermostat and thermostatic radiator valves

Gas or oil combination boiler installations in new dwellings

Dwellings up to 150m²

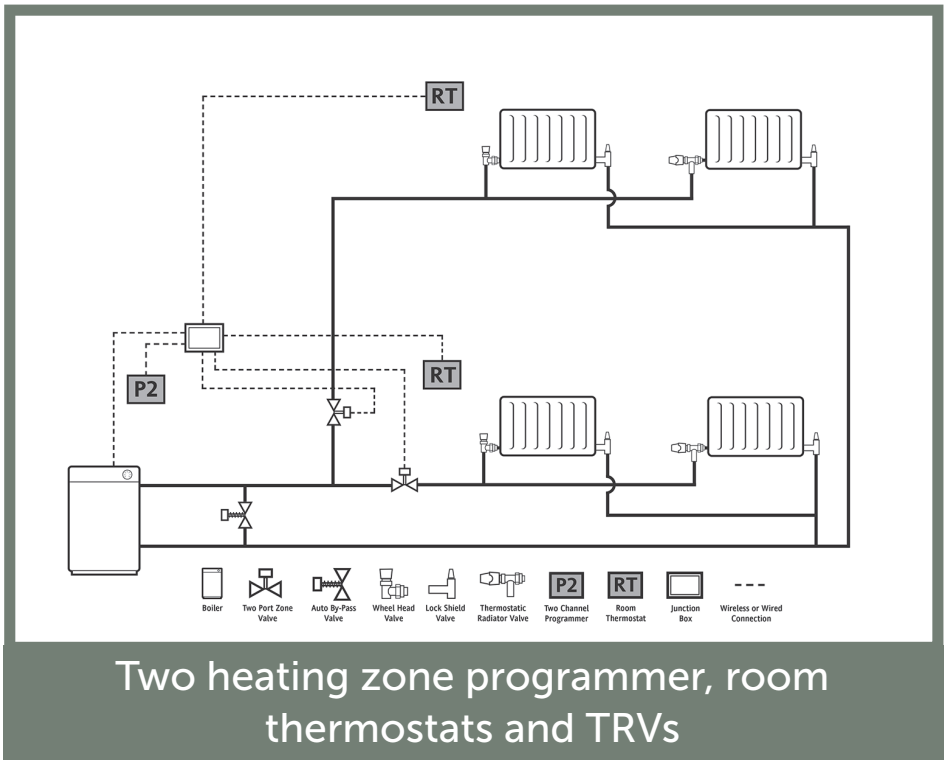


Timeswitch, room thermostat and TRVs

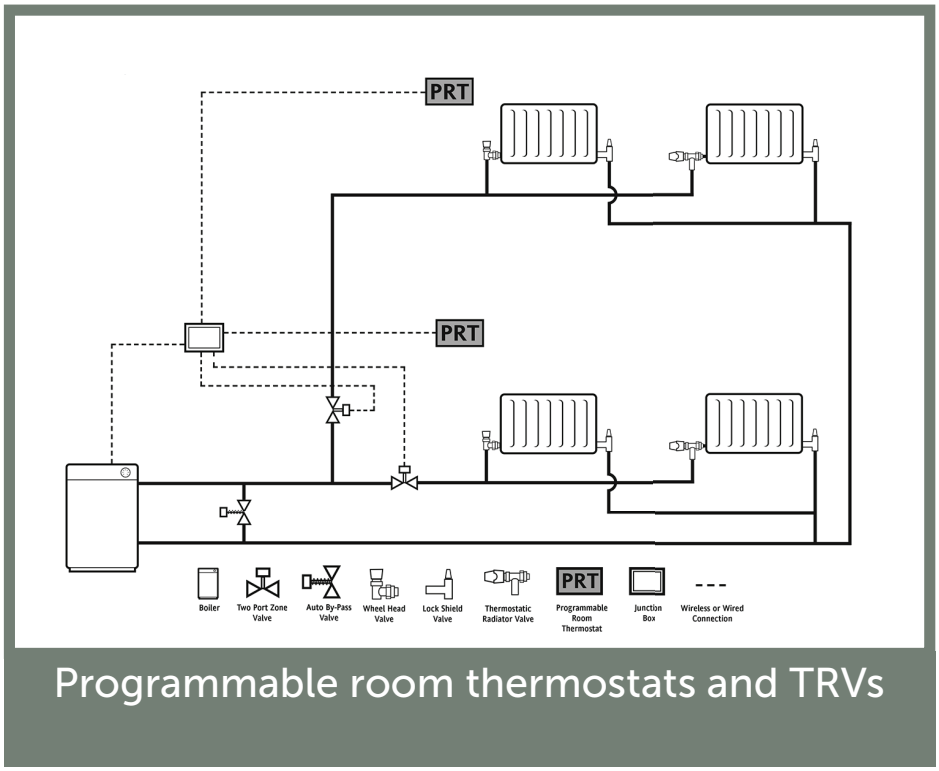


Programmable room thermostat and TRVs

Dwellings over 150m^2



Two heating zone programmer, room thermostats and TRVs



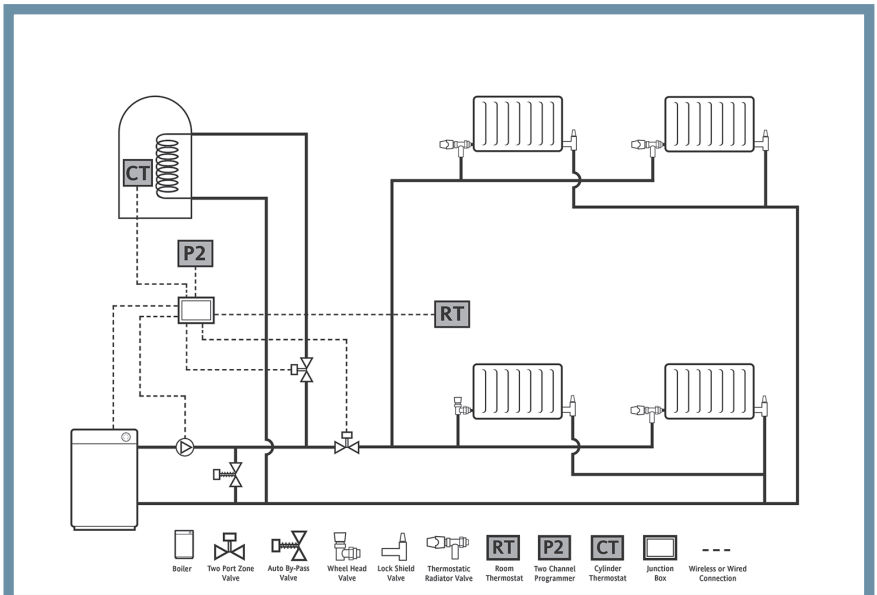
Programmable room thermostats and TRVs

Note:

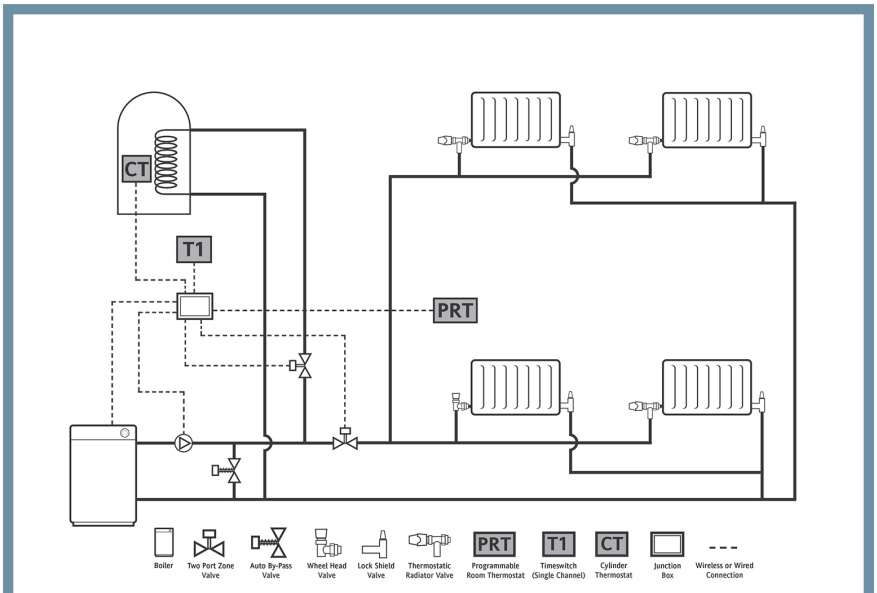
- For dwellings over 150m^2 separate heat zones could also be achieved through the use of individual networked thermostatic radiator controls and a central smart control that offers zoning.

Boilers with a hot water cylinder installed as part of a new heating system in dwellings up to 150 m² AND Boilers with a hot water cylinder installed as a replacement in all existing buildings

2 port valve control

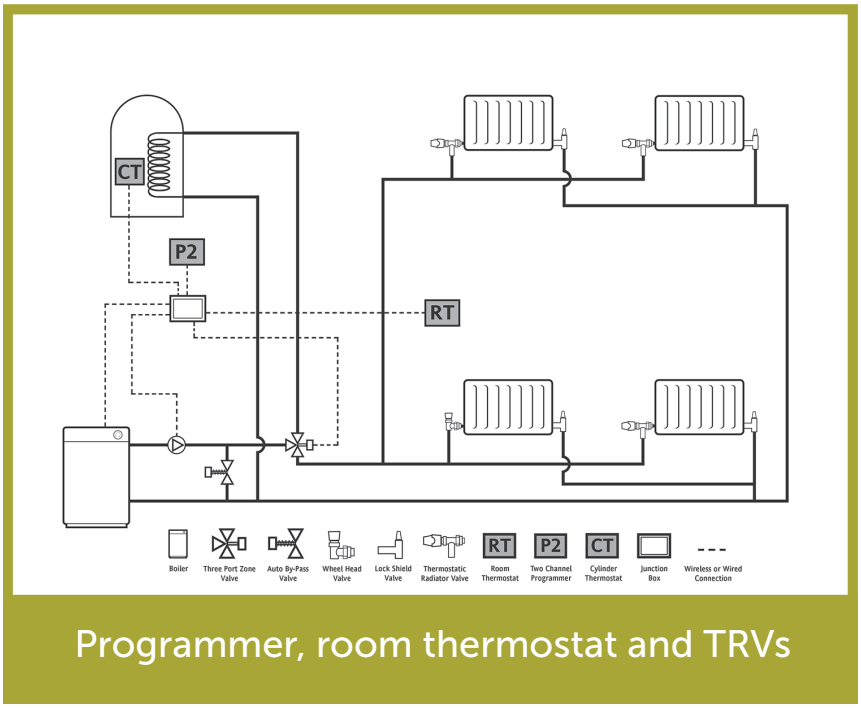


Programmer, room thermostat and TRVs

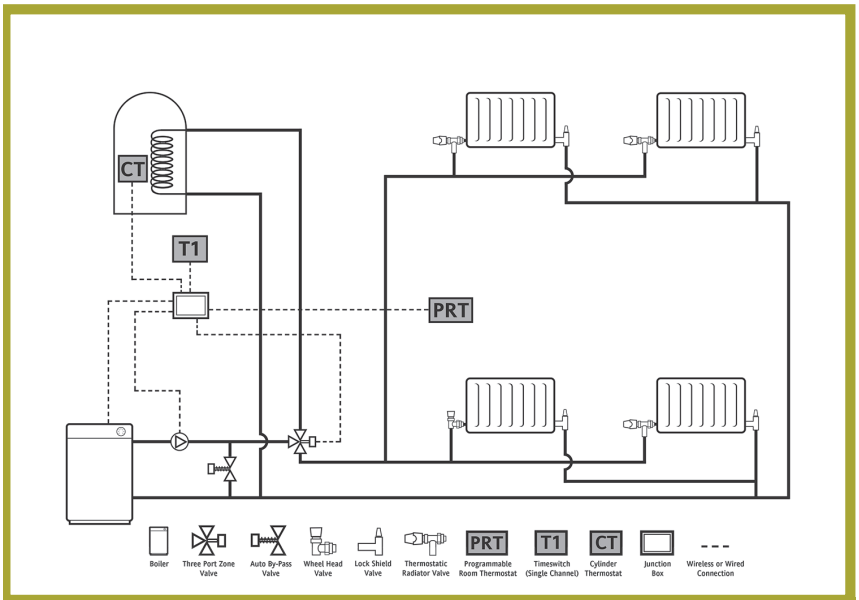


Programmable room thermostat and TRVs

3 port valve control



Programmer, room thermostat and TRVs

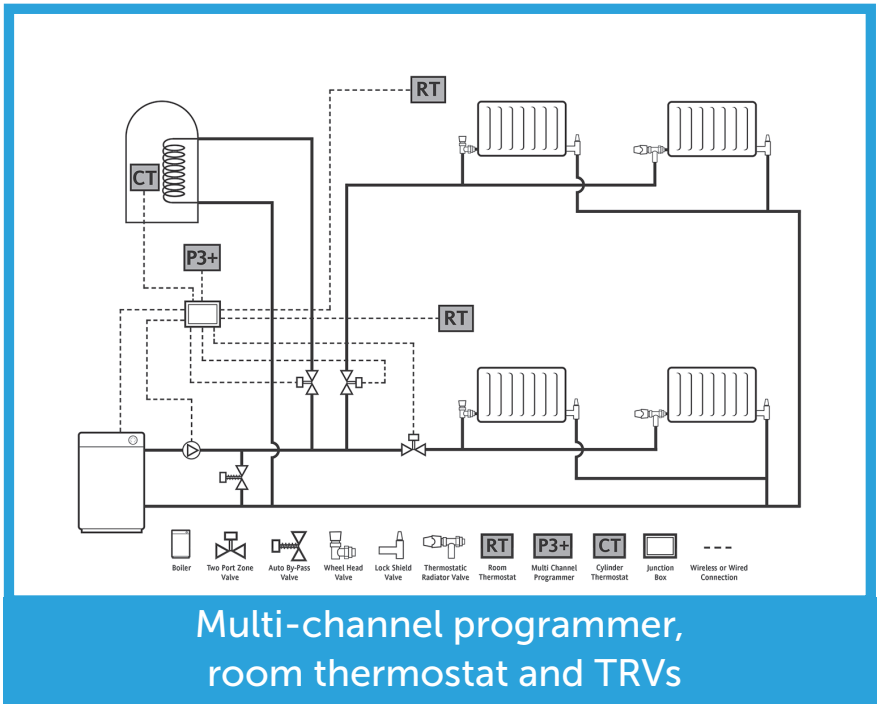


Programmable room thermostat and TRVs

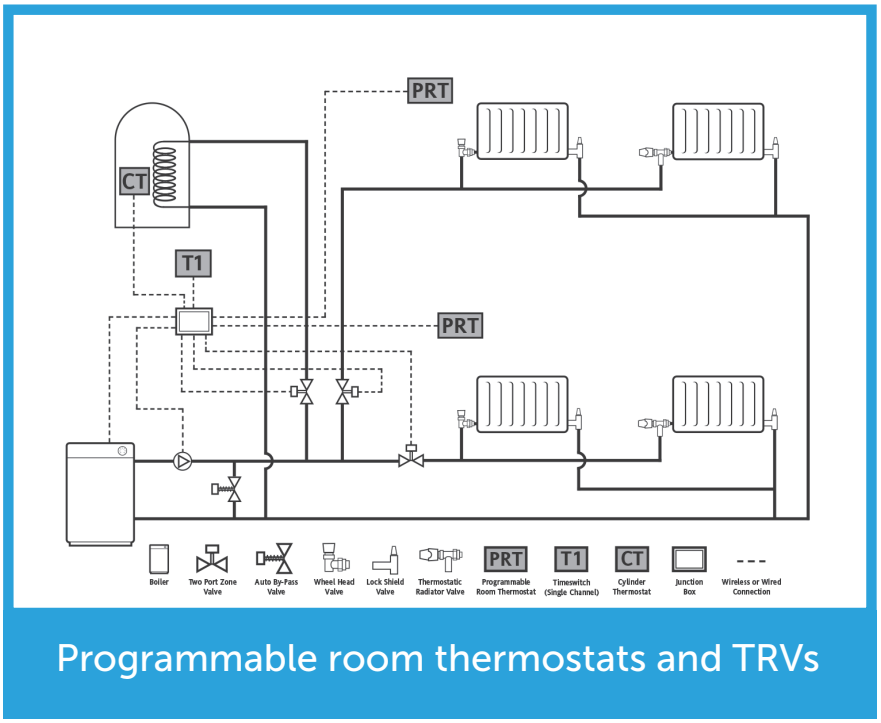
Note:

- Manufacturers are increasingly offering intelligent solutions, e.g. cylinder thermostats may be temperature sensors and junction boxes may be system wiring centres.

Boilers with a hot water cylinder installed as part of a new heating system in dwellings over 150 m²



Multi-channel programmer, room thermostat and TRVs



Programmable room thermostats and TRVs

Note:

- Manufacturers are increasingly offering intelligent solutions, e.g. cylinder thermostats may be temperature sensors and junction boxes may be system wiring centres.

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