Unit 208: Central heating systems

Outcome 1 (part 1)

Types of domestic central heating systems installed in domestic dwellings

Legislation

Building Regulations part L: Conservation of fuel and power

BS EN 12828: Design of water based heating systems

BS EN 14336: Installation and commissioning of water based heating systems

BS 4422: Manufacture of radiators

CHeSS: Central Heating Efficiency System Specification (basic and best practice)

Legislation

Building Regulations part L: Conservation of fuel and power

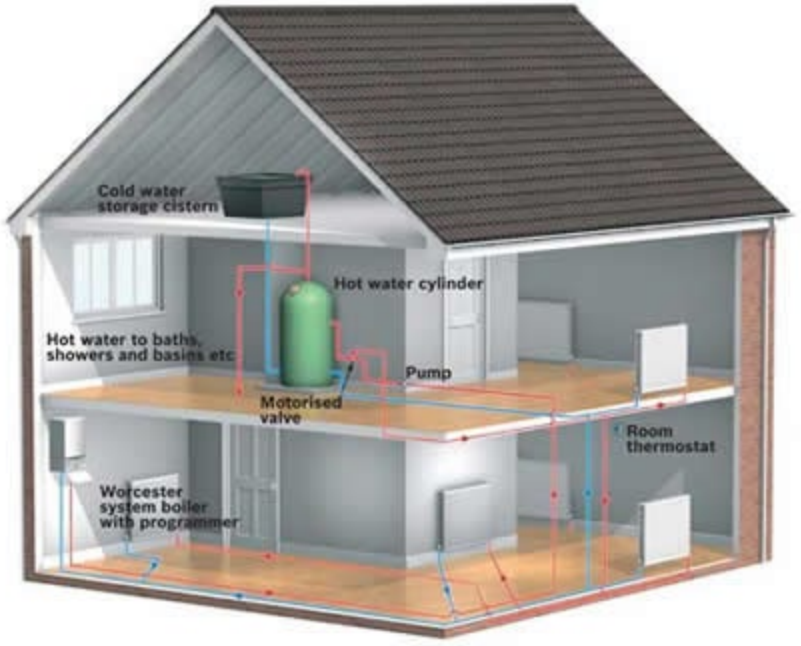
L1a: In new dwellings
L1b: In existing dwellings
L2a: In new, other than dwellings
L2b: In existing, other than dwellings

Domestic Heating Compliance Guide

Types of systems

The main purpose of central heating is to provide thermal comfort within a property. An open fire gives heat in one room but central heating can give heat in every room.

Thermal comfort is attained when the desired heat balance between the body and surroundings is met within the customer's economic constraints.



Types of systems

Full central heating

This allows all rooms in a property to be heated at the same time to a specific temperature set by the customer. This comfort temperature must be reached even when the outside temperature is -1^{0}C.

Selective central heating

This allows for some rooms in a property (parts of the property) to be heated at the same time to a specific temperature set by the customer. These rooms would be selected by the customer. This comfort temperature must be reached even when the outside temperature is -1^{0}C.

Types of systems

Background central heating

This can be the same as full or selective **but** this type of heating is installed mainly on cost basis. A smaller boiler or heat emitters may be used, which will only take the chill out of the rooms and heat the rooms to a lower temperature.

If a system cannot achieve the customer's desired comfort temperature when the outside temperature is -1^0C, the system would be classed as **background heating**.

Types of systems

Over the past 100 years the open fire in each room has developed and been replaced with:

Gravity hot water system

Pumped heating with gravity hot water

Fully pumped system

Central heating is now preferred to an open fire, as it heats up the whole property.

Types of systems

This development over the years has seen a change from the use of solid fuel to heat the system, to the use of gas, oil and electricity to heat the system.

The customer will be cost conscious, not only at the point of installation, but also with the running costs of the system.

- Maintenance
- Efficiency
- Performance
- Controls

Types of systems

Modern domestic central heating systems fall into two categories, which are based on the way the system is filled with water and the pressure that the system operates at.

Low pressure, open vented systems
These are fed from a feed and expansion cistern located at high level. These can be fully pumped or gravity systems.

Sealed, pressurised systems
These are fed directly from the mains cold water and incorporate an expansion vessel to take up the expansion of the heated water. This type of system is a more modern fully pumped or combination boiler system.

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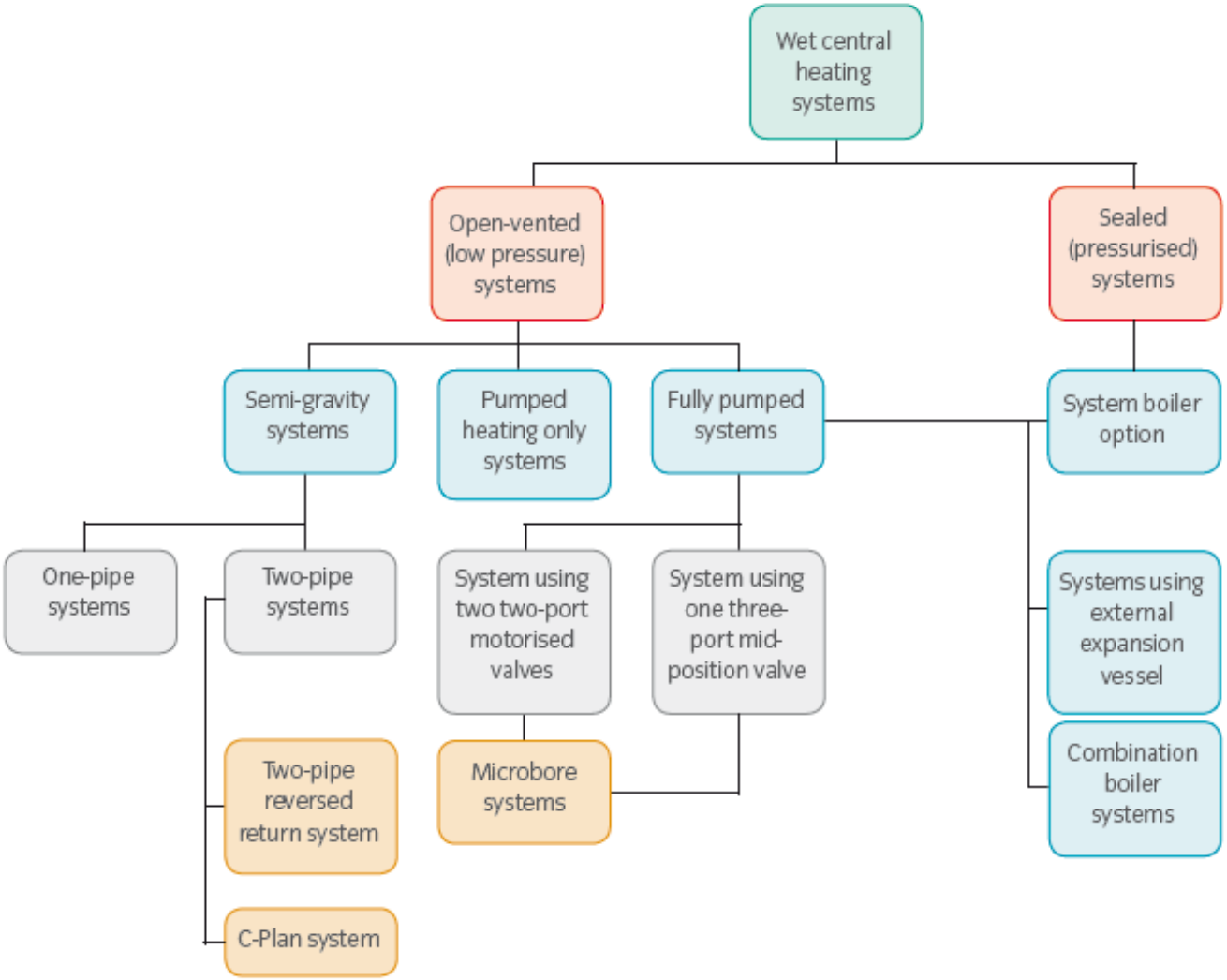
Types of systems



Types of systems

Gravity or semi gravity systems

These are older systems that use convection currents to circulate the water around the pipework. They usually have 28mm primaries associated with solid fuel boilers and the need for convection currents.

- One pipe semi gravity
- Two pipe semi gravity
- C plan semi gravity
- C plan plus semi gravity system
- Two pipe semi gravity with heat sink

Types of systems

Full gravity systems

These systems are no longer installed but you may come across them in older properties.

These offer background heating and use large diameter pipework that has to be laid at the correct fall to allow convection to work properly.

There was no pump in the system for either hot water or heating, so the heat-up time was lengthy.

Types of systems

Old and rarely seen now, but still in use in some older houses, are single feed or primatic hot water cylinders. There is **no** F&E to fill the primary circuit; this is done via the cold feed to the cylinder.

Because of this, **no** inhibitor can be added to this type of heating system. It is a gravity only system and cannot be converted to pumped or the air lock separating the two waters will be lost.

Types of systems

One pipe gravity system

This is an older but simpler system that consisted of a one pipe circuit going from, and returning to, the boiler. This circuit would be pumped but the flow and return stems to each radiator relied on gravity to heat them up. This meant the installation cost was cheaper due to only one ring pipe being installed.

A drawback of this system was: as the return water from each heat emitter entered the main ring, it would cool the flow water down to the following emitter. So, progressively each radiator was cooler than the one before.

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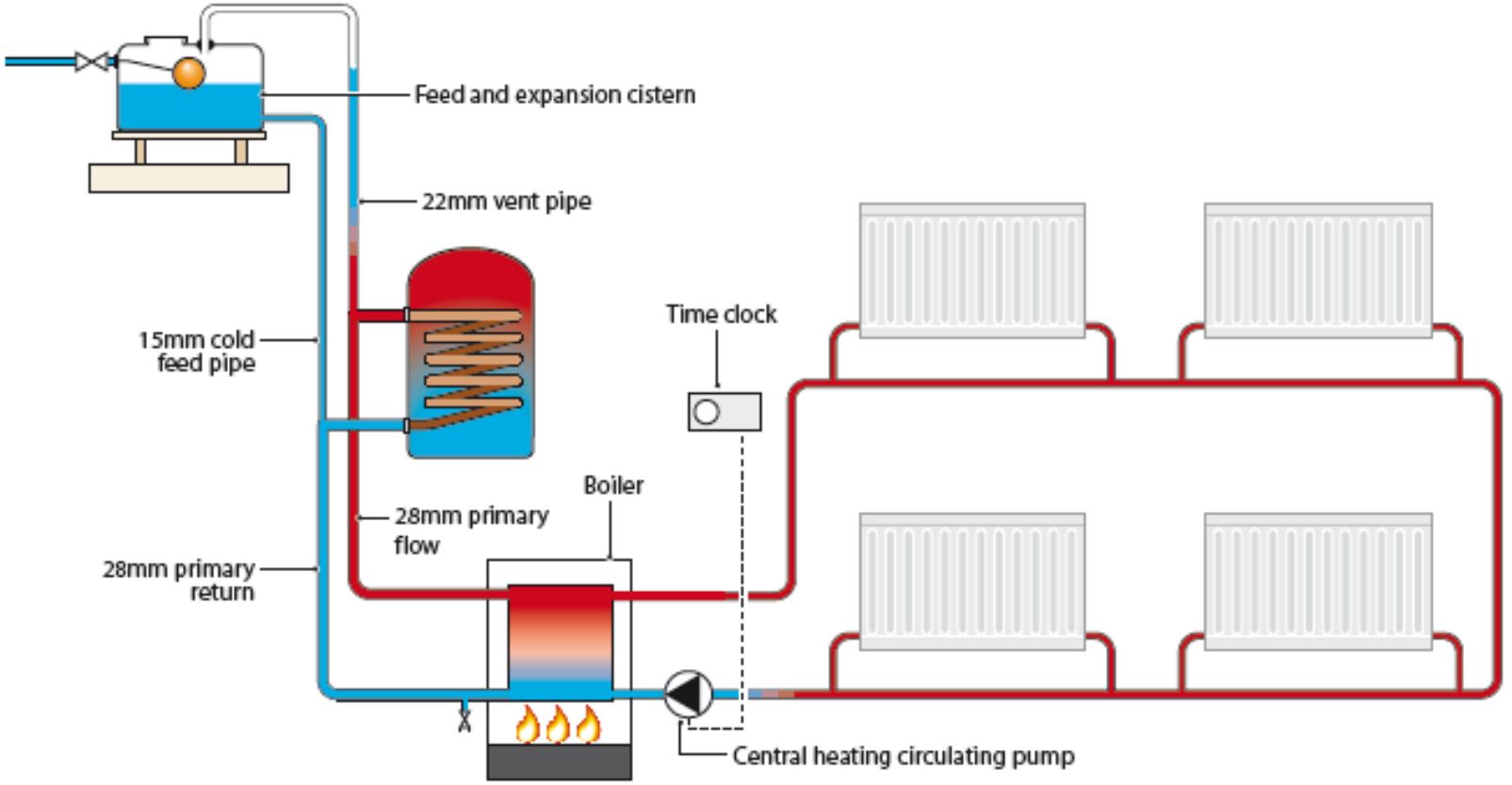
Types of systems

One pipe gravity system



Types of systems

One pipe gravity system

Advantages:

- Cheap to install

Disadvantages:

- Each radiator progressively cools down
- Only the main ring is pumped
- Uncontrolled room temperature
- Boiler could cycle
- Not compliant to Building Regulations part L
- Boilers connected to these systems are low efficiency

Types of systems

Two pipe semi gravity

This system has gravity circulation to the hot water circuit but pumped circulation to the heating circuit. Having separate pipes for the flow and return, water was forced into the heat emitters and the flow and return waters did not mix. This allowed the heat emitters to achieve the same temperature.

The control on the heating was sometimes by a room stat, which only witched off the pump. The hot water had no such control and was often very hot.

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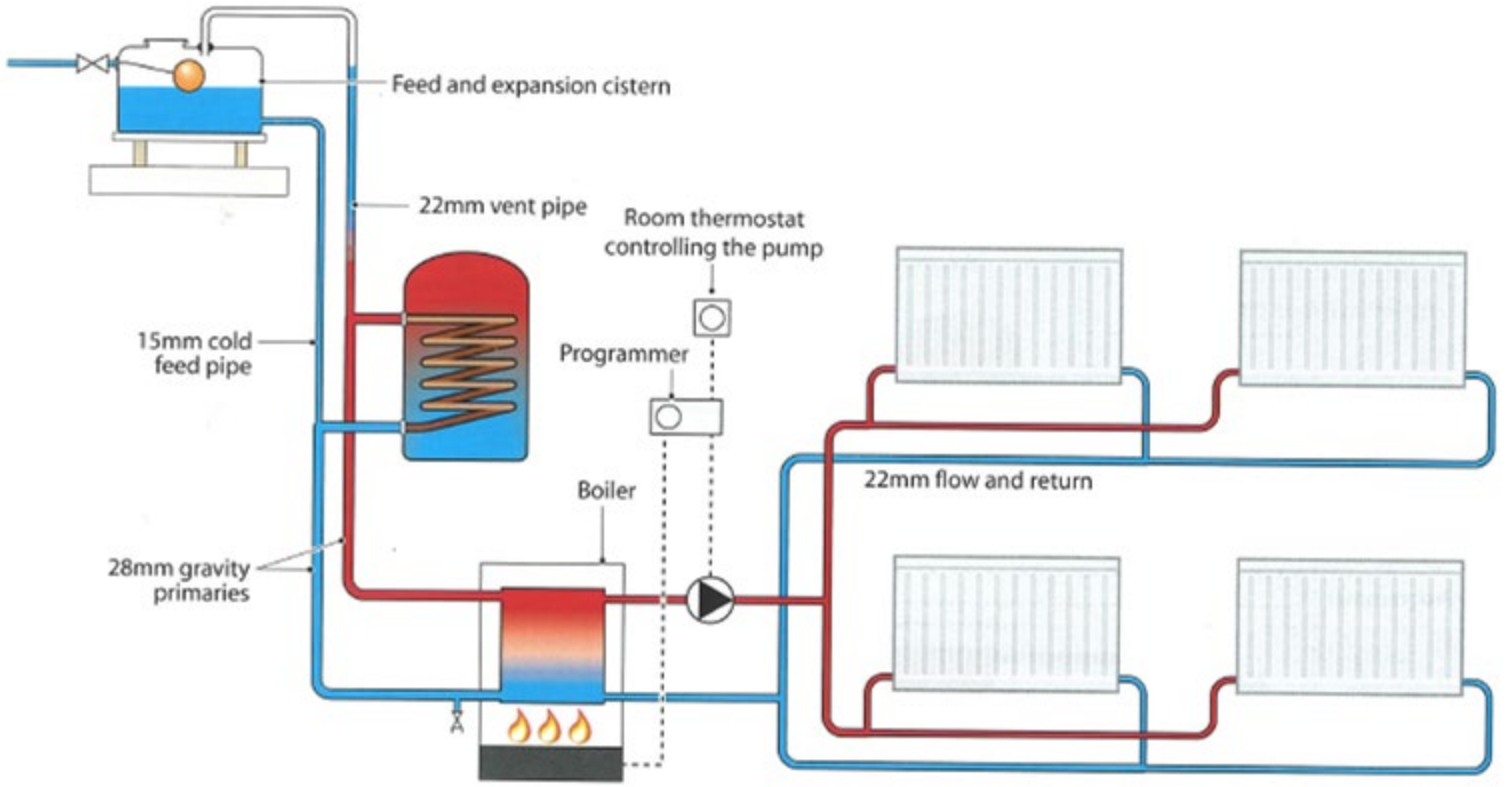
Types of systems

Two pipe semi gravity



Types of systems

Two pipe semi gravity

Advantages:

- All heat emitters reach the same temperature
- Two pipe system is quicker when heating up
- Cheaper to run

Disadvantages:

- Uncontrolled heat
- Boiler cycling
- Not compliant to Building Regulations part L
- Boilers connected to these systems are low efficiency

Types of systems

C plan two pipe semi gravity

An updated version of a two pipe semi gravity system that includes a cylinder thermostat and zone control on the hot water. The C plan plus includes a room thermostat, TRVs and zone control on the heating, as well as controls on the hot water.

The C plan plus is the minimum acceptable compliant system with Building Regulations part L1b and the Domestic Heating Compliance Guide, which states the system has to incorporate a thermo mechanical thermostat.

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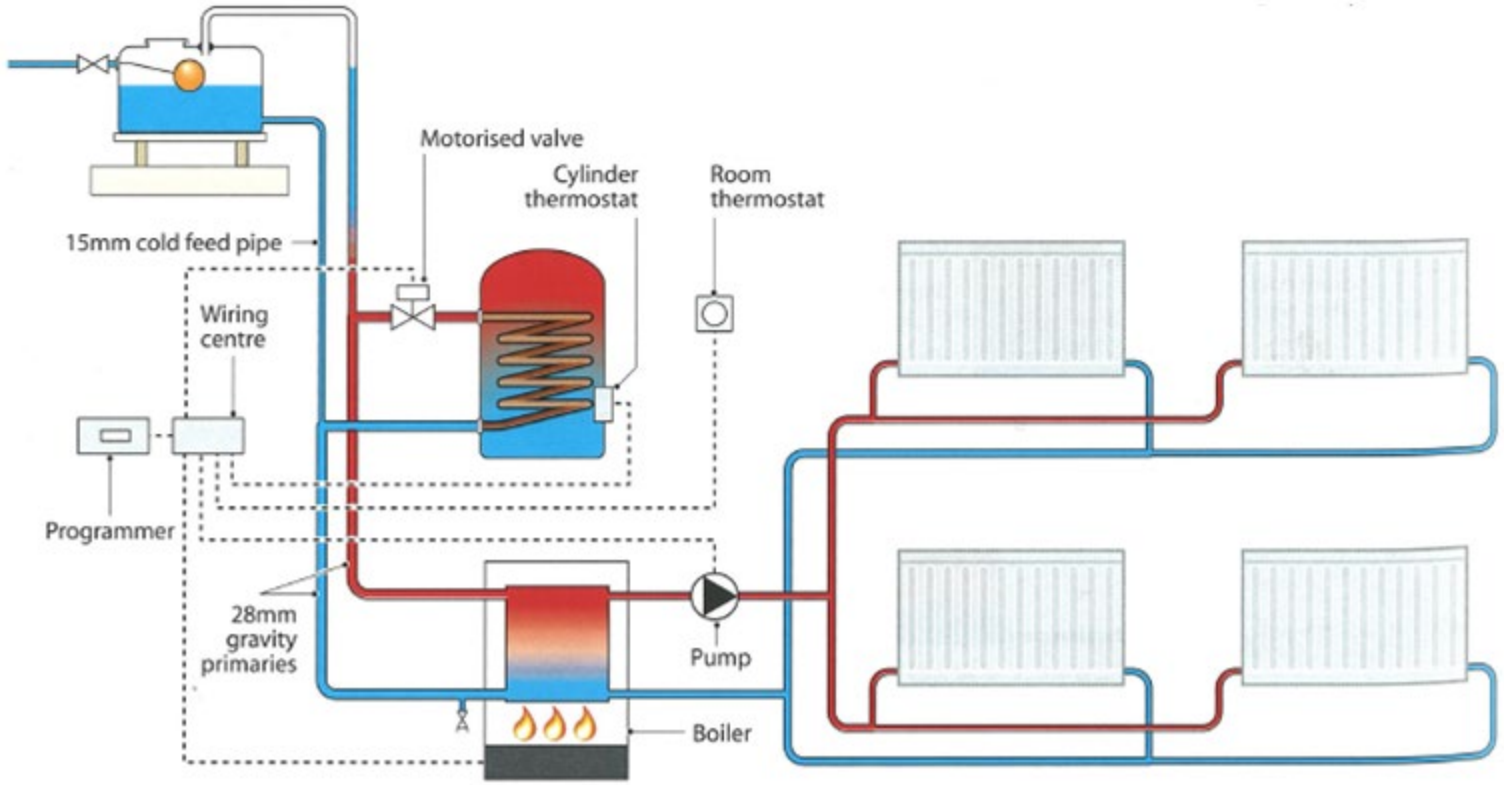
Types of systems

C plan two pipe semi gravity



Types of systems

C plan two pipe semi gravity

Advantages:

- All heat emitters reach the same temperature
- Two pipe system is quicker to heat up
- Compliant to Building Regulations L1b
- Full control on heating and hot water

Disadvantages:

- Not fully pumped
- Boilers fitted to this system tend to be lower efficiency

Types of systems

Two pipe semi gravity with heat sink
Used with solid fuels, which are not as controllable as gas or oil boilers. If gravity circulation stops due to the flow and return being the same temperature, the boiler is still producing heat. This can be dissipated through the heat sink without the boiler overheating.

The heat sink is generally a radiator with two lockshield valves.

The boiler thermostat on a solid fuel boiler is often as simple as an air damper, rather than an electrical control.

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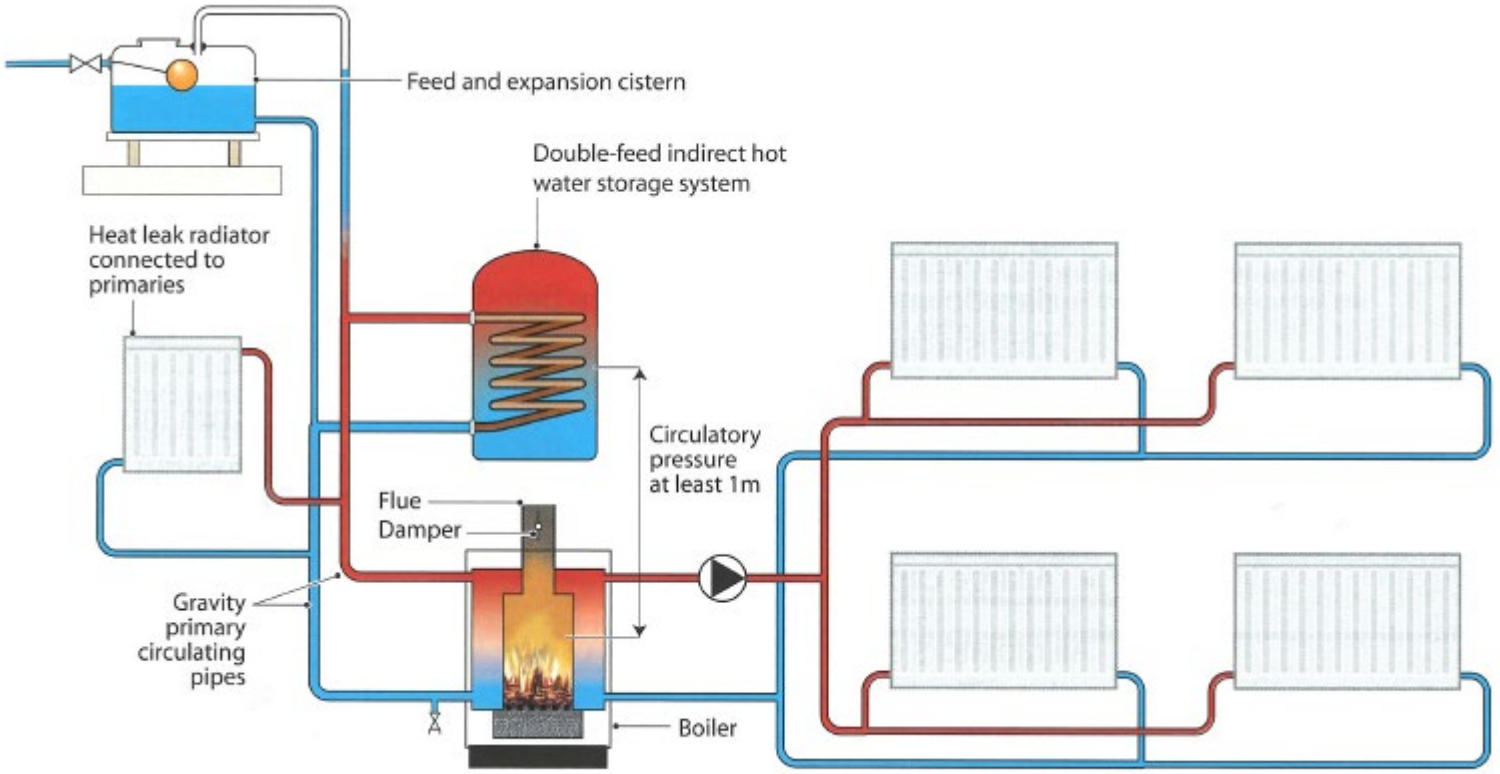
Types of systems

Two pipe semi gravity with heat sink



Types of systems

Two pipe semi gravity with heat sink

Advantages:

- Compliant with Building Regulations part L

Disadvantages:

- Restricted heat control
- Only used on open vented systems
- Overheating possible
- Can be expensive

Types of systems

Fully pumped systems

These are modern systems that use a pump to circulate the heated water around the hot water and heating circuits. This is controlled by installing a cylinder thermostat, room thermostat and programmer, along with either two zone valves or a three port mid-position valve.

These systems offer better control, design and boiler type. The boiler position no longer needs to be lower than the cylinder.

Heat-up times are much quicker and therefore make the system more economical on fuel and operating costs. Boilers can be fueled from natural gas, LPG or oil.

Types of systems

Pumped central heating

These are older type systems that do not have any provision for hot water but serve some heat emitters around the property. The cold feed and vent pipe can be taken from the boiler (four tapping boiler) or from the pipework.

It is generally a two pipe system with a circulator to assist the heat-up time.

The controls consist of a timer, boiler thermostat and possibly a room thermostat, heating all rooms to a controlled, comfortable temperature.

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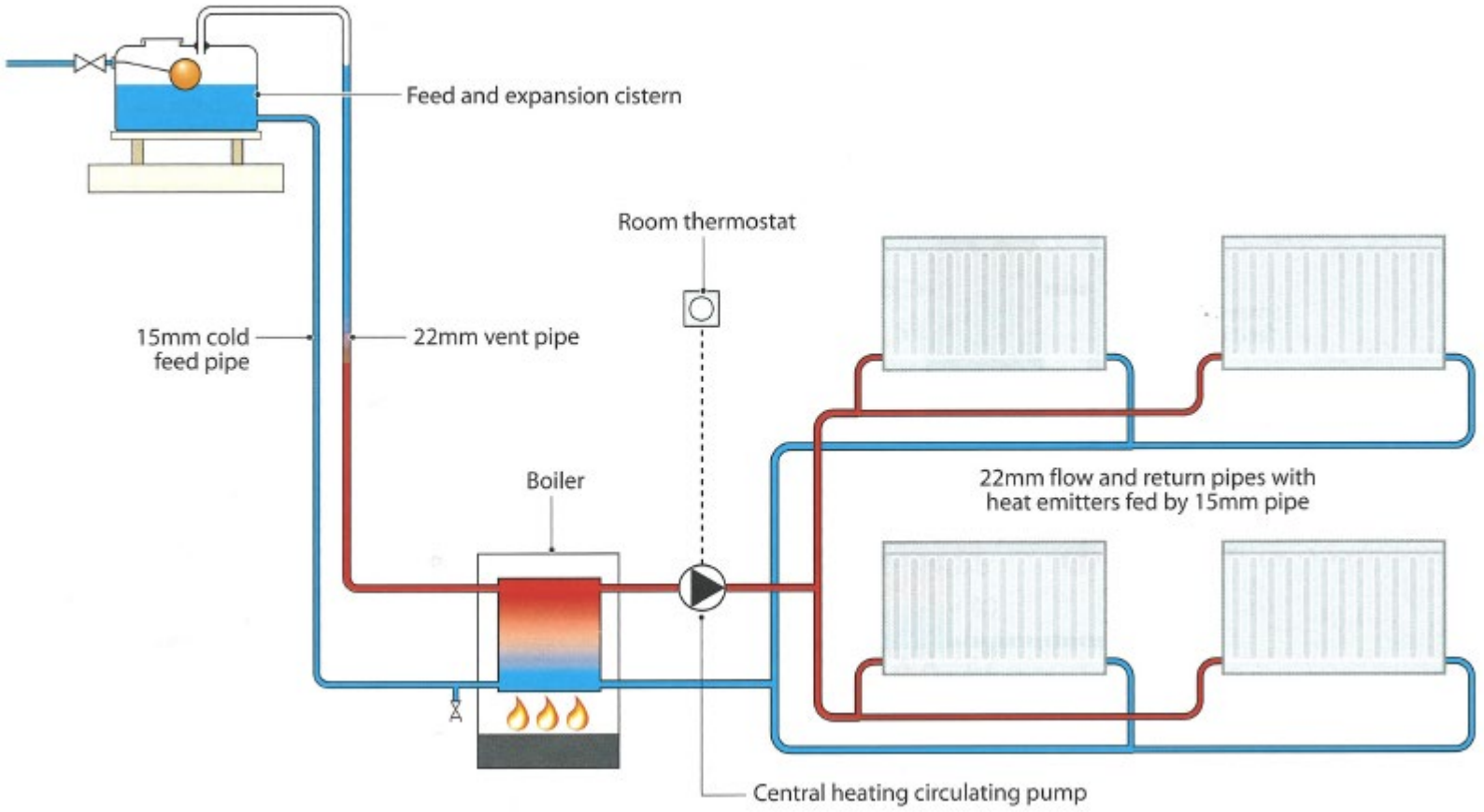
Types of systems

Pumped central heating



Types of systems

Fully pumped mid-position valve – Y plan system
The three port mid-position valve controls the flow of water to the hot water cylinder and heating circuit. The valve reacts to the room thermostat and cylinder thermostat.

The system has an automatic bypass valve, which connects the flow and return pipe.

The bypass opens if the system pressure increases when circuits close down due to them reaching temperature. This allows water to flow through the boiler – stopping **lock out**, and it also prolongs the circulator life.

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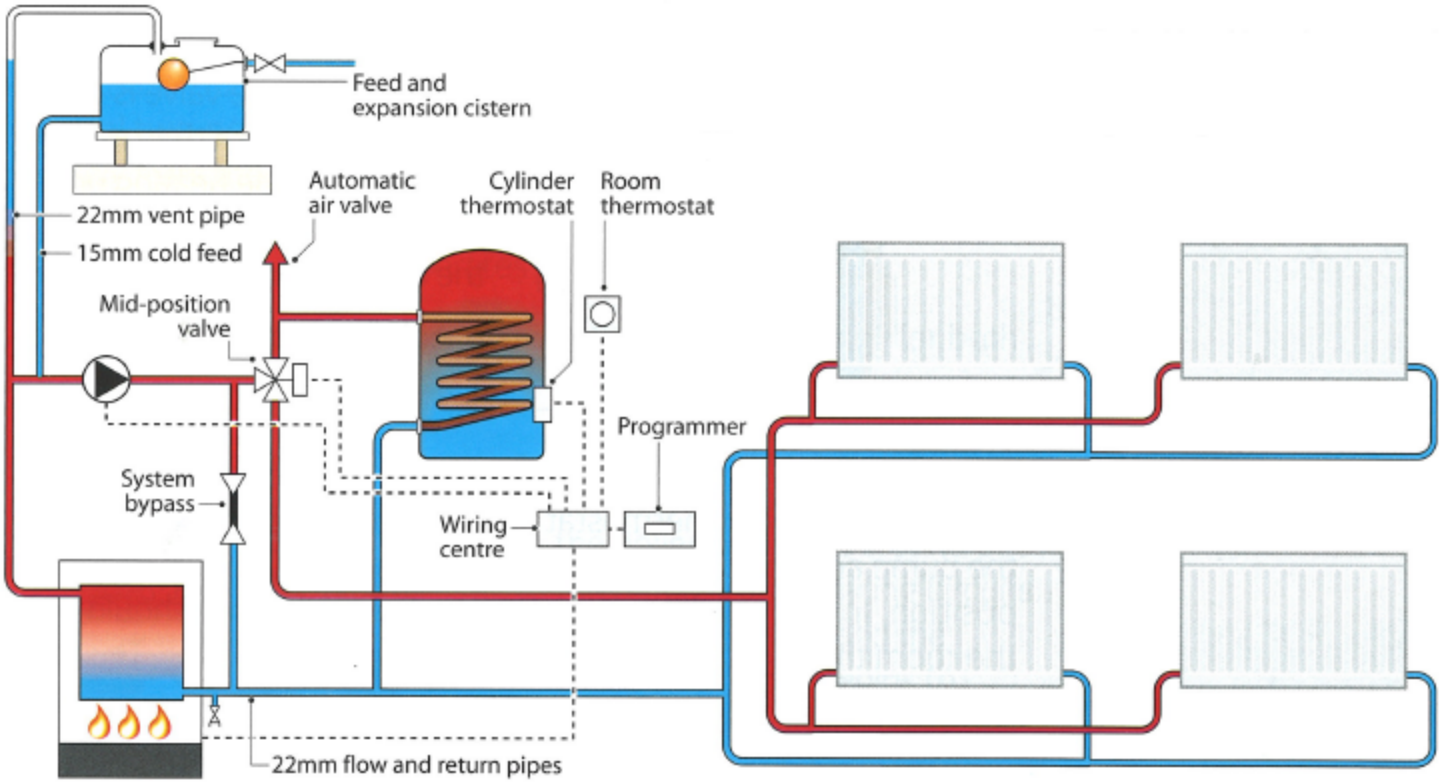
Types of systems

Fully pumped mid-position valve – Y plan system



Types of systems

Fully pumped two, two port valves – S plan system
This system uses one zone valve to control the hot water, which is activated by the cylinder thermostat; and a second zone valve, which is activated by the room thermostat. The zone valve acts as an isolator, closing the flow of water off.

If a property is over 150m^2 an additional heating zone valve should be fitted, allowing independent control of upstairs and downstairs.

As with the Y plan, an automatic bypass is fitted to the system.

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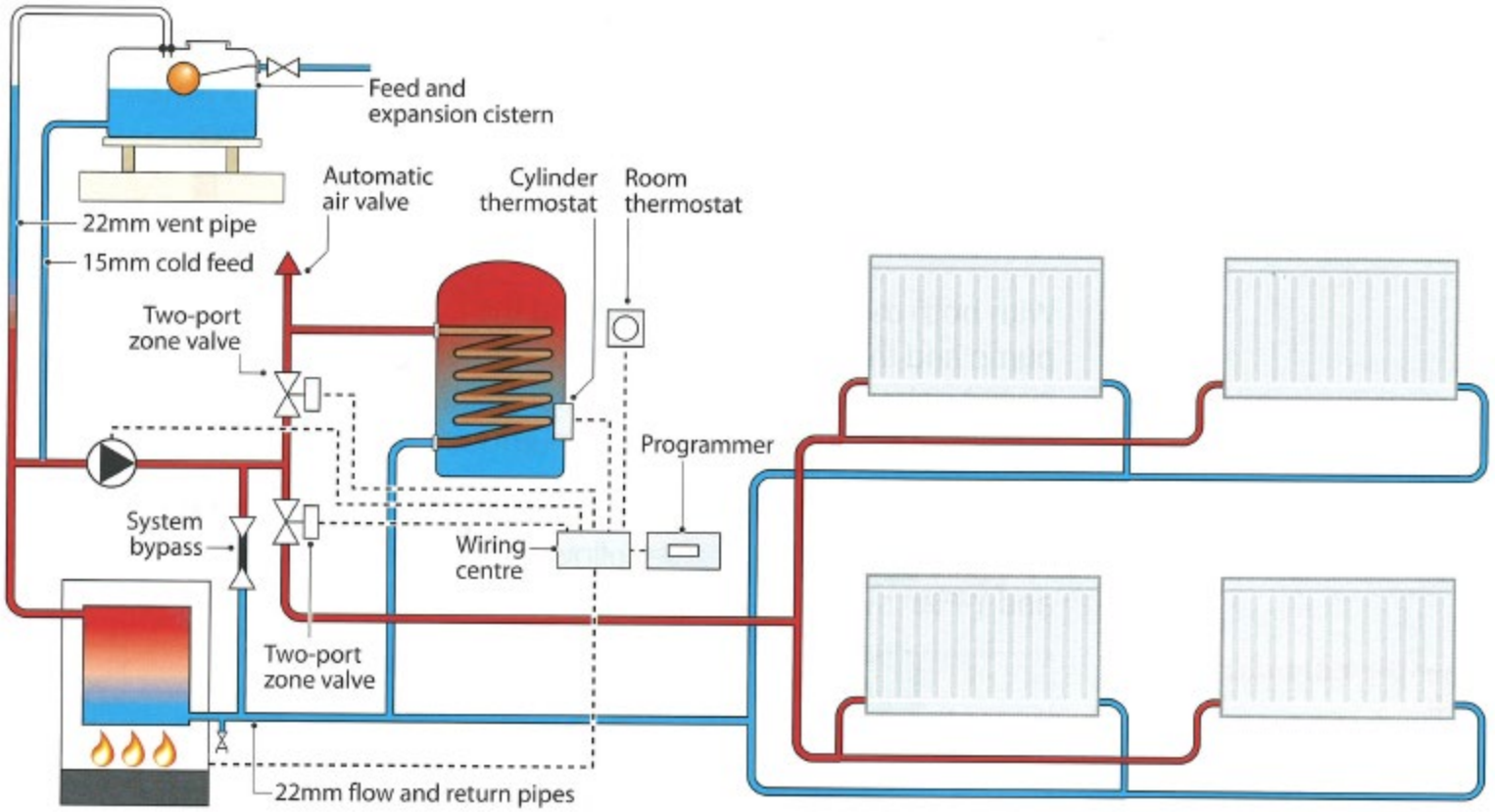
Types of systems

Fully pumped two, two port valves – S plan system



Types of systems

	Y plan	S plan
Full thermostatic control	✓	✓
Building Regulations compliant	✓	✓
Recommended for larger properties		✓
Can be used with sealed systems	✓	✓
Can be used with system boilers	✓	✓
Can be zoned		✓
Boiler interlock	✓	✓

Types of systems

Locking out

This is a protection system within a boiler. A thermostat shuts the boiler down if it detects the flow is above 85^0C and therefore stops it from overheating.

Aeration

This is a big cause of corrosion within a central heating system. Air plus iron equals rust: rust is iron oxide that produces magnatite, which is the black sludge. Aeration also causes system noise and – in extreme cases – can burn the circulator out.

Types of systems

Sealed system

This system is not open to atmosphere and incorporates a sealed expansion vessel, which replaces the feed and expansion cistern of the open system.

A filling connection needs to be installed, along with a detachable filling loop. This allows a point at which the system can be filled under mains pressure. To prevent the possibility of back siphonage of central heating water into mains water, a double check valve needs to be installed.

On both of the filling loop connections a means of isolation also needs to be fitted. The Water Regulations clearly state that this loop needs to be disconnected after the system has been charged to the correct pressure.

Types of systems

Sealed system

A pressure relief valve will need to be installed. This allows the system to discharge pressure to a safe location if required.

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Types of systems

Sealed system