

Installer Guide: Condensate discharge pipe installation

January 2021 Issue 2.0



In April 2005 revisions to the Building Regulations came into force, stating that all replacement gas or oil boilers must be a condensing type. The introduction of condensing boilers has been fundamental in reducing the UK's carbon emissions. In 2010 and again in 2018 the UK experienced prolonged spells of sub-zero temperatures down to minus 20 centigrade and below in many areas. This resulted in a significant increase in the number of calls to boiler manufacturers and heating engineers from householders with condensing (high efficiency) boilers where the condensate discharge pipe had frozen and become blocked with ice causing the boiler to shut down. **In the vast majority of cases such problems occur where the condensate discharge pipe is located externally to the building for some part or all of its length and has not been insulated correctly.**

British Standards, Building Regulations and industry guidance currently advise on how condensate discharge pipes should, be run either internally or externally, or a combination of both. This document gives guidance on how to install the pipes in order to reduce the possibility of freezing.

However, in certain circumstances this guidance may not be sufficient to prevent freezing in extreme conditions with widespread and prolonged sub-zero temperatures.

With the UK weather patterns showing more "extremes" in future due to the effects of global climate change, the following guidance updates previous recommendations on condensate discharge pipe installation. In addition to this guidance all other technical requirements for condensate discharge installation given in British Standard BS 6798:2014, or in boiler manufacturers' installation instructions should still be followed.

******Boiler Manufacturer's Warranty Information**

It should be noted that where the manufacturer's instructions have not been followed then the boiler warranty may not be valid.

Note - the Benchmark Commissioning checklist supplied with the boiler and detailed in the manufacturer's instructions requires the heating engineer commissioning the installation to confirm that the condensate drain has been fitted correctly.

Summary of main requirements

Internal Condensate Pipe Discharge Connection -Where an installer is fitting a new or replacement boiler, the condensate discharge pipe should be connected to an internal "gravity discharge point" such as;

- An internal soil stack (preferred method)
- Internal kitchen or bathroom waste pipe such as washing machine, sink, basin, bath or shower waste. (See diagrams for recommended connection points)
- External pipes from sink wastes or washing machine outlets should be a minimum of 30mm internal diameter, insulated with a minimum of 13mm that is waterproof, UV resistant material, terminated below the grid but above the water line.
- A suitable drain/leaf guard should be fitted to prevent wind chill and debris entering the grid.
- The end of the waste pipe should be cut at 45 degrees where it terminates into the grid to help reduce the potential for the pipe to freeze and the insulation should run to the tip of the pipe.
- Ensure the pipe insulation is sealed to the wall to help prevent freezing and wind chill. (see photo)

Condensate Pumps

Where it is not possible to connect the boiler condensate discharge pipe to an internal "gravity discharge point" then the installer should use a condensate pump connected to a suitable internal connection point such as an internal soil stack (preferred method), internal kitchen or bathroom waste pipe such as a sink, basin, bath or shower waste.

Existing Installations

When servicing or repairing a boiler the heating engineer should check any boiler installations especially those that have external condensate drains to see if they can be terminated internally or upgraded to the latest guidance. Note - The responsible person (home owner) should be advised and it is recommended that the installer completes the responsible persons frozen condensate information leaflet as a suitable means for advising the work that is required. See annex A

This guidance should be followed in conjunction with manufacturer's instructions where work is carried out to "upgrade" the condensate discharge system to reduce the risk of freezing in extreme conditions and it is recommended that the condensate pipe is identified with a suitable label or marking, and highlighted to the consumer, even if the responsible person does not go ahead with the upgrade so as to allow easier identification in the future.

Manufacturer's Instructions

Manufacturer's instructions must be followed for the correct connection of the condensate discharge pipe from the boiler as this may vary due to the design of the boiler. For example, a visible air break and trap is not required if there is a trap with a minimum condensate seal of 75 mm incorporated into the boiler.

Internal Pipe Run In Unheated Spaces

Internal condensate drainage pipes run in unheated areas such as lofts, basements and garages should be treated as external connections and a minimum thickness of 13mm of pipe insulation should be fitted. Weather proof materials may not be necessary but should be assessed by the installer.

Internal Condensate Pipe Discharge Termination

Internal condensate discharge pipework must be a minimum of 19mm ID (typically 22mm OD) plastic pipe or as per manufacturer's instructions and this should "fall" a minimum of 45mm per metre away from the boiler, taking the shortest practicable route to the termination point.

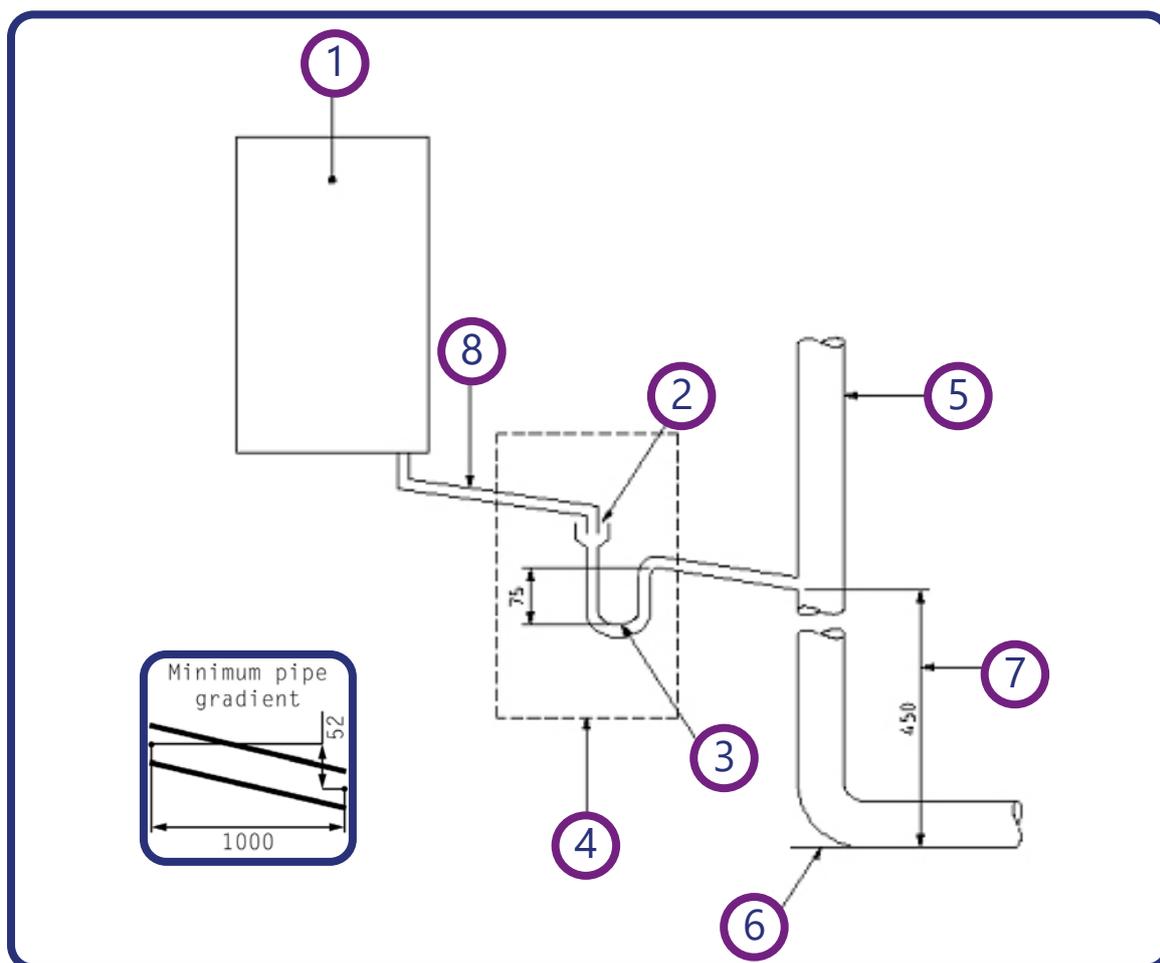
(45mm as per BS6798, 52mm per metre as per industry practice is specified in the following diagrams)

To minimise the risk of freezing during prolonged sub-zero conditions, an internal "gravity discharge point" such as an internal soil stack (preferred method), internal kitchen, utility room or bathroom waste pipe e.g. from a sink, basin, bath or shower should be adopted, where possible.

Note - A suitable permanent connection to the foul waste pipe should be used. Figures 1, 2(a), 2(b) show appropriate connection methods.

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

Figure 1 – Connection of condensate discharge pipe to internal soil and vent stack.
Note – Check manufacturer’s instructions to see if an air break is required.



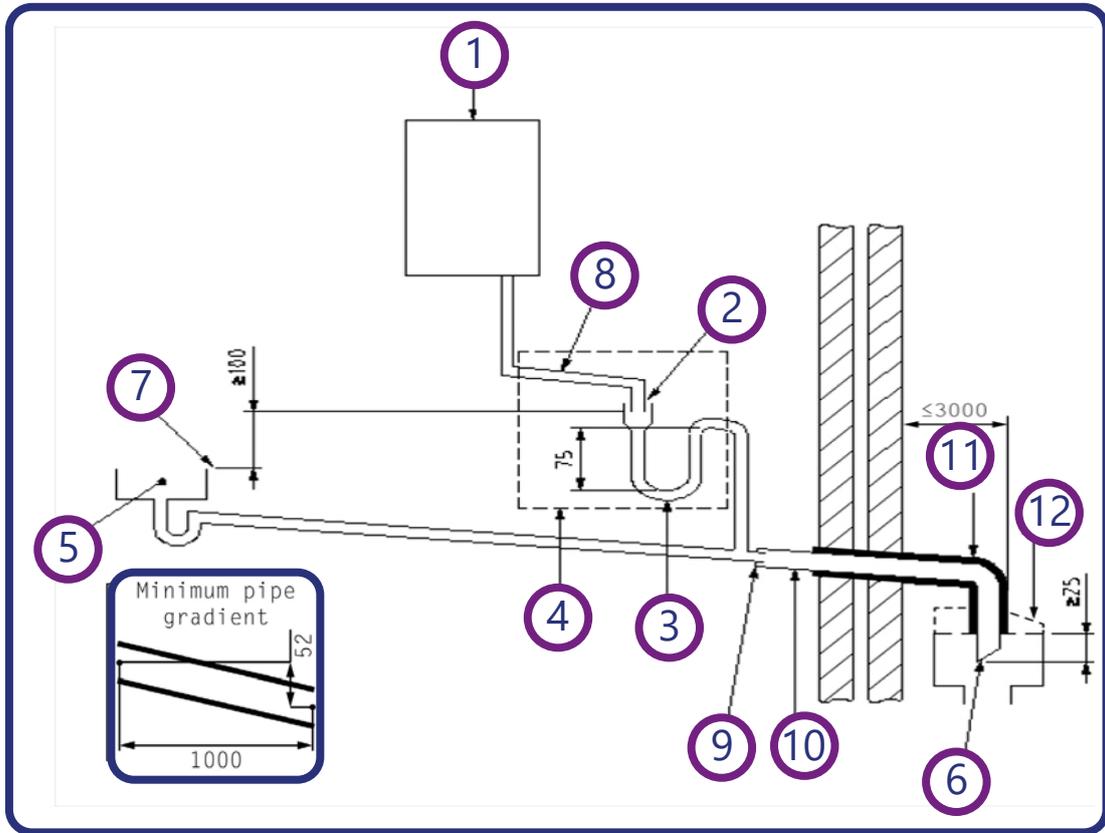
Key

- 1 Boiler
- 2 Visible air break
- 3 75 mm trap
- 4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 75 mm incorporated into the boiler
- 5 Soil and vent stack
- 6 Invert
- 7 450 mm minimum up to three storeys
- 8 Minimum internal diameter 19 mm

Internal Condensate Pipe Discharge Termination

Figure 2(a) – Connection of a condensate discharge pipe downstream of a sink, basin, bath or shower waste trap.

Note – Check manufacturer's instructions to see if an air break is required.



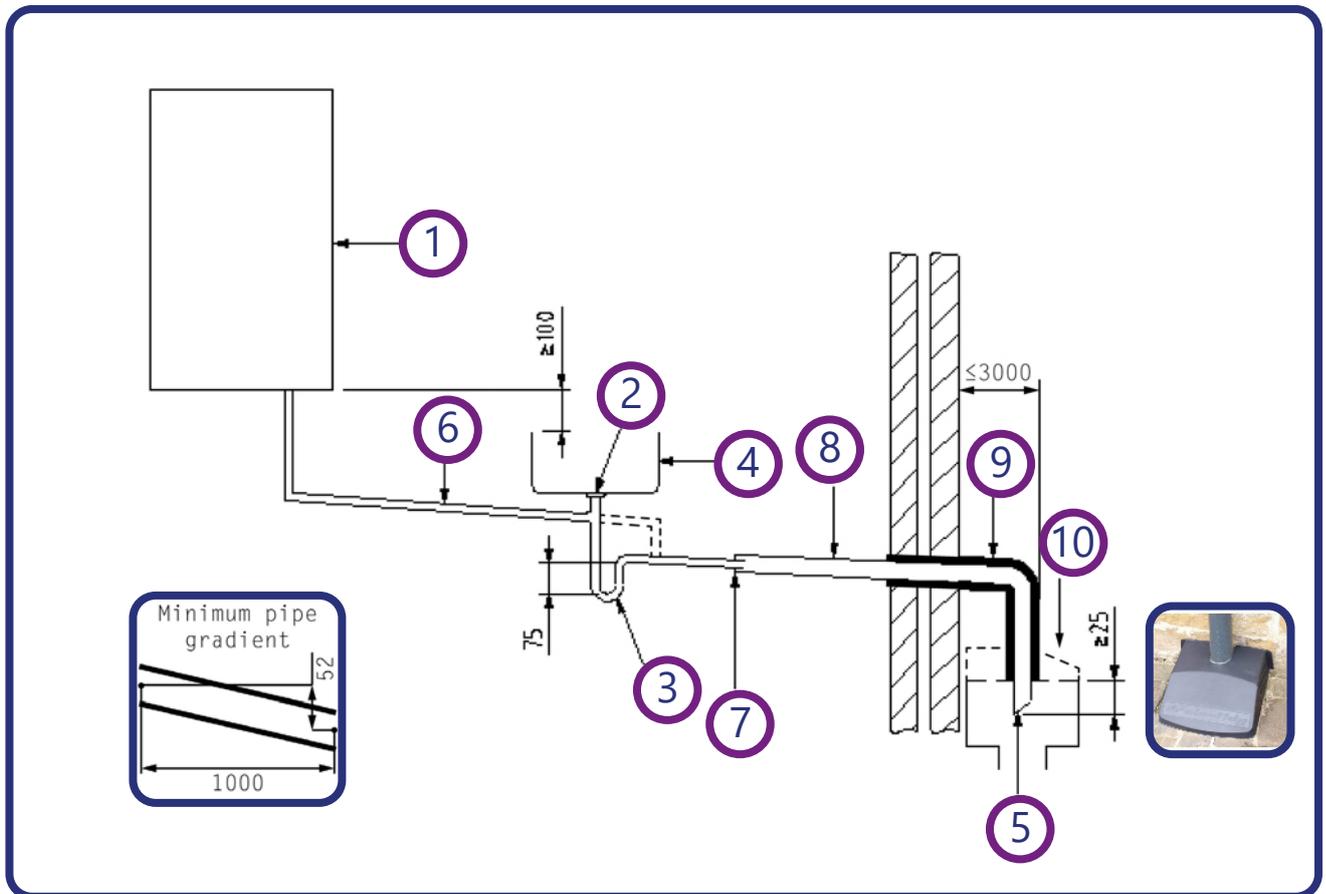
Key

- 1 Boiler
- 2 Visible air break
- 3 75 mm trap
- 4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 75 mm incorporated into the boiler. In this case the 100 mm is measured to the trap in the boiler.
- 5 Sink, basin, bath or shower
- 6 Open end of condensate discharge pipe direct into gully 25 mm min below grating but above water level; end cut at 45 °
Note – the maximum external condensate discharge length is 3 metres
- 7 Sink lip
- 8 Minimum internal diameter 19 mm
- 9 Pipe size transition
- 10 Minimum internal diameter 30 mm
- 11 UV resistant, Water/weather proof insulation
- 12 Drain cover/leaf guard

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

Internal Condensate Pipe Discharge Termination

Figure 2(b) – Connection of a condensate discharge pipe upstream of a sink, basin, bath or shower waste trap



Key

- 1 Boiler
- 2 Visible air break at plug hole – alternative connection can be below sink trap
- 3 75 mm sink, basin, bath or shower waste trap
- 4 Sink, basin, bath or shower with integral overflow
- 5 Open end of condensate discharge pipe direct into gully 25 mm min below grating but above water level; end cut at 45 °

Note – the maximum external condensate discharge length is 3 metres

- 6 Minimum internal diameter 19 mm
- 7 Pipe size transition
- 8 Minimum internal diameter 30 mm
- 9 UV resistant, Water/weather proof insulation
- 10 Fit drain cover/leaf guard

Internal Condensate Pipe Discharge Termination

The possibility of waste pipes freezing downstream of the connection point should be considered when determining a suitable connection point - e.g. a slightly longer pipe run to an internal soil stack may be preferable to a shorter run connecting into a kitchen waste pipe discharging directly through the wall to an external drain.

Note - Where "gravity discharge" to an internal termination is not physically possible (e.g. the discharge point is above the appliance location, or access is obstructed by a doorway), or where very long internal pipe runs would be required to reach a suitable discharge point, then a condensate pump should be used.

External waste pipes

Pipes from kitchens, utility rooms, washing machines or bathrooms such as sink, basin, and bath or shower waste outlets should be:

- Insulated with waterproof UV resistant material.
- Terminated below the grid but above the water line and a drain/leaf guard fitted.
- The waste pipe should be cut at 45 degrees where it terminates into the grid and insulated to the tip of the pipe. (See insulation section for guidance on suitable materials).
- A minimum thickness of 13mm insulation is recommended for 32mm OD pipe
- seal the insulation to the wall, and if the insulation is non-continuous then seal the separate sections of insulation together, including elbow joints. This helps to prevent freezing and wind-chill. See example



Condensate Pumps

Use of a Condensate Pump to an Internal Termination

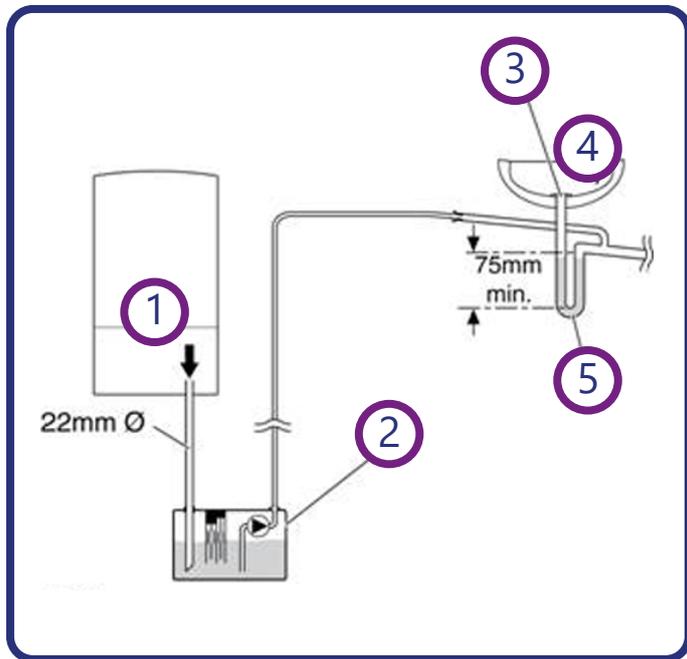
Condensate can be removed using a proprietary condensate pump, of a specification recommended by the boiler or pump manufacturer. In order to minimise the risk of freezing during prolonged sub-zero spells, one of the following methods internal to the property for terminating the boiler condensate pump to a foul water discharge point should be adopted such as an internal soil stack (preferred method), internal kitchen, utility room or bathroom waste pipe such as sink, basin, and bath or shower waste. Figure 3 shows a typical connection method.

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

Internal Condensate Pipe Discharge Termination

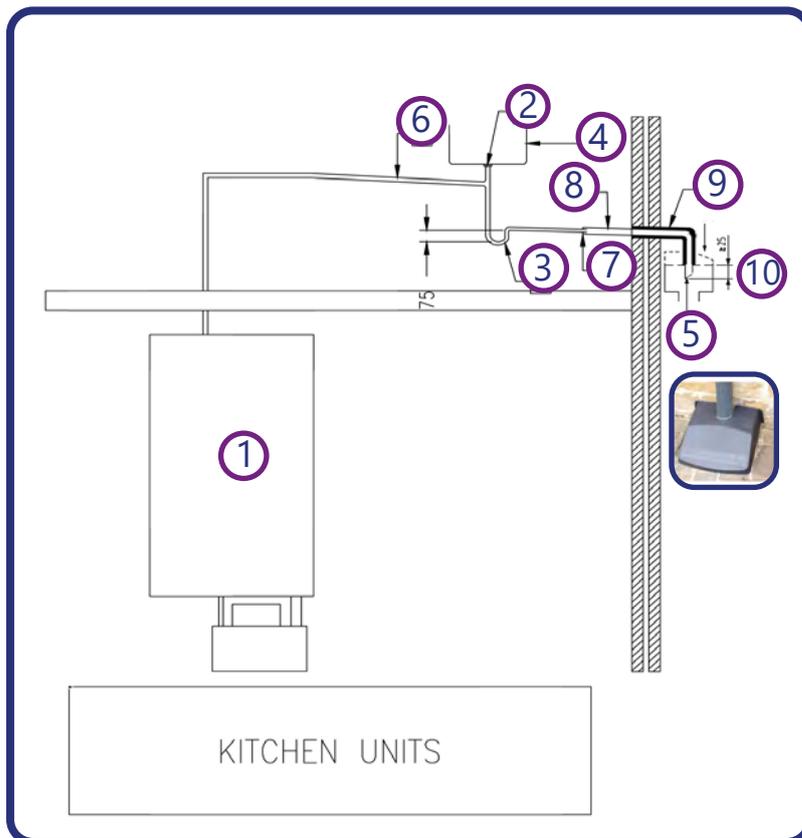
Figure 3 – Connection of a condensate pump - typical method (NB manufacturer's detailed instructions should be followed).

Note – Any external pipe work should be insulated, pipe cut at 45 degrees and a drain/ leaf guard fitted.



Key

- 1 Condensate discharge from boiler
- 2 Condensate pump
- 3 Visible air break at plug hole
- 4 Sink or basin with integrated overflow
- 5 75mm sink waste trap



Key

- 1 Boiler
- 2 Visible air break at plug hole
- 3 75 mm sink, basin, bath or shower waste trap
- 4 Sink, basin, bath or shower with integral overflow
- 5 Open end of condensate discharge pipe direct into gully 25 mm min below grating but above water level; end cut at 45 ° Note – the maximum external condensate discharge length is 3 metres
- 6 Minimum internal diameter 19 mm
- 7 Pipe size transition
- 8 Minimum internal diameter 30 mm
- 9 Water/weather proof insulation
- 10 Fit drain cover/leaf guard

External Connections

Only fit an external boiler condensate drain connection if an internal gravity or pumped connection is **impractical** to install.

The pipe work from the boiler should be of a minimum 19mm ID or as per manufacturer's instructions and the condensate discharge pipe shall be run in a standard drainpipe material, e.g. poly (vinyl chloride) (PVC), un-plasticized poly (vinyl chloride) (PVC-U), acrylonitrile butadiene-styrene (ABS), polypropylene (PP) or chlorinated poly (vinyl chloride) (PVC-C).

Note - Fixing centres for brackets should be a maximum of 300mm for flexible pipe and 500mm for solid pipe and manufacturer's recommendations should be followed.

The condensate pipe should be run internally as far as possible before going externally and the pipe diameter should be increased to a minimum of 30mm ID (typically 32mm OD) before it passes through the wall. The angle of the pipe should slope downwards by at least 3 degrees as it passes through the wall to assist in maintaining a good velocity as the condensate exits the building.

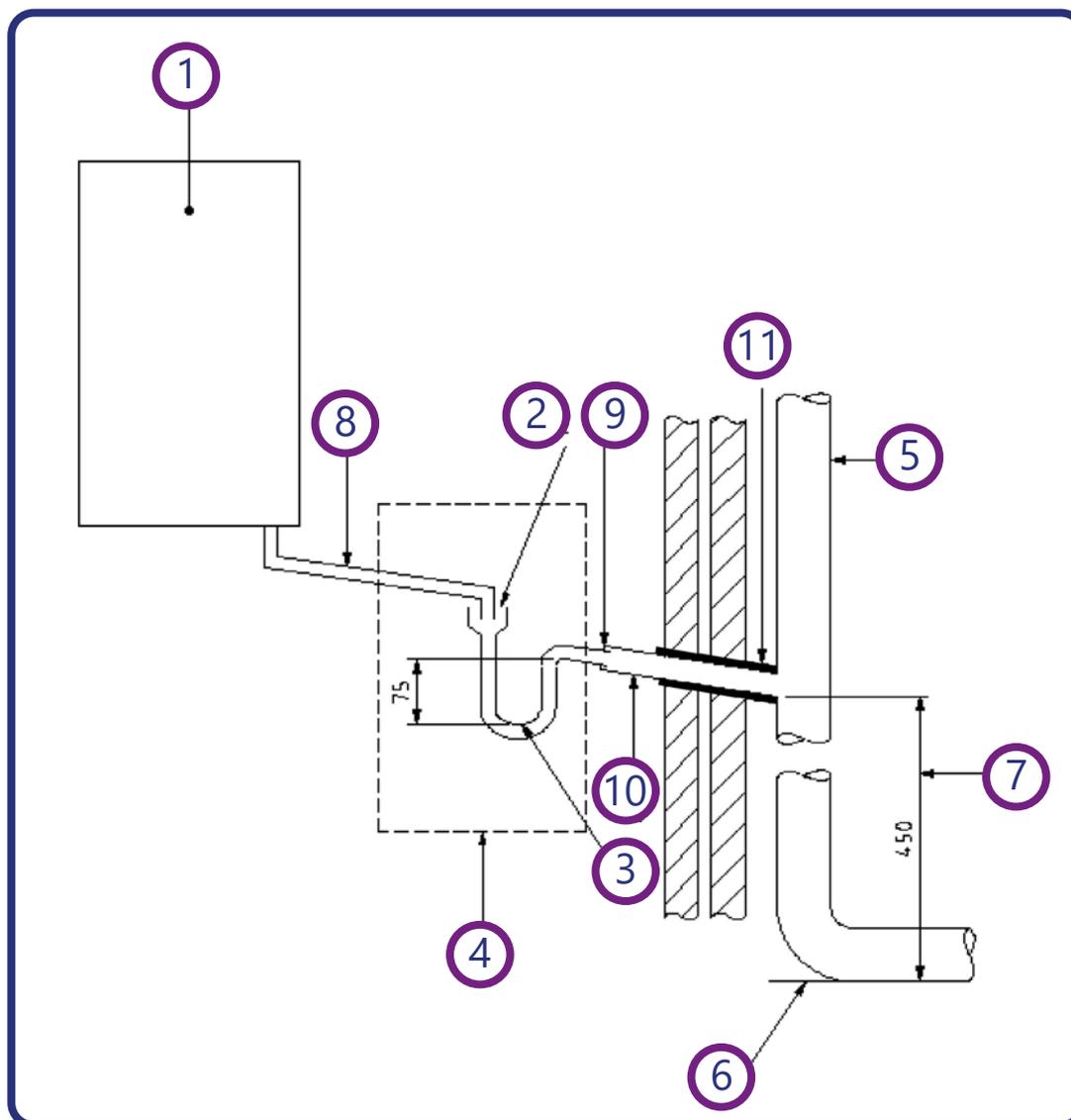
The external pipe run should be kept as short as possible to a maximum of 3 metres, taking the most direct and "most vertical" route to the discharge point, with no horizontal sections in which condensate might collect.

Note- In extreme weather conditions condensate discharge pipes have been found to freeze with in the cavity wall of the building where no cavity wall insulation is installed. The installer should assess the risk of freezing of an externally fitted condensate discharge pipe prior to installation and add insulation to condensate pipe to ensure it does not freeze inside the cavity wall. BS6798 advises a minimum pipe size of 30mm ID through the wall and should slope downwards by 3 degrees to maintain a good flow.(see diagrams)

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

External Connections

Figure 4 – Connection of condensate discharge pipe to external soil and vent stack



Key

- 1 Boiler
- 2 Visible air break
- 3 75 mm trap
- 4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 75mm incorporated into the boiler.
- 5 Soil and vent stack
- 6 Invert
- 7 450mm minimum upto three storeys
- 8 Minimum internal diameter 19 mm
- 9 Pipe size transition point
- 10 Minimum internal diameter 30mm
- 11 UV Resistant, Water/weather proof insulation

Alternative Solutions

Cold weather protection methods approved or endorsed by boiler manufacturers and/or service organisations may be adopted if these are considered suitable by the parties involved. It is the responsibility of the manufacturer of these products to ensure they have completed the necessary testing or calculations to ensure the product offers suitable protection to prevent the condensate pipe from freezing. The product manufacturer should provide information as to what level of external temperature and for what time period the product can protect against sub-zero temperatures, i.e. -15°C for 48 hours.

Insulation Materials

Insulation used for external condensate pipes, sink or washing machine waste pipes should have an outer coating that is weather proof, and UV resistant. A minimum of 13mm thick insulation is recommended for 32mm external pipes.

Use of Air Breaks In Condensate Discharge Pipes

Heating engineers should follow manufacturer's instructions on the use of air breaks in condensate discharge pipes. A visible air break is not required if the boiler condensate trap has a minimum condensate seal of 75mm incorporated into the boiler. Refer to manufacturer's instructions for air brake requirements for soakaways.

Auxiliary Syphon – Fitted Internally

Auxiliary siphons fitted inside the premises assist with the siting of the boiler where an external condensate pipe must be fitted. The storage capacity of the auxiliary siphon increases the volume of condensate discharge reducing the risk of freezing. A further reduction in the potential for the pipe to freeze is achieved when combined with the external insulation requirements.

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

Electric Trace Heating

Trace heating with an external thermostat can be fitted to the external condensate pipe to raise the temperature of the condensate pipe in freezing conditions. Trace heating takes the form of an electrical heating element run in physical contact along the length of the condensate pipe. The pipe is usually covered with thermal insulation to retain heat losses from the pipe. Heat generated by the element then maintains the temperature of the pipe. If such a system is used then the installation instructions of the trace heating manufacturer and any specific recommendations regarding pipe diameter, insulation, etc. should be followed. All other relevant guidance on condensate discharge pipe installation should also be followed.

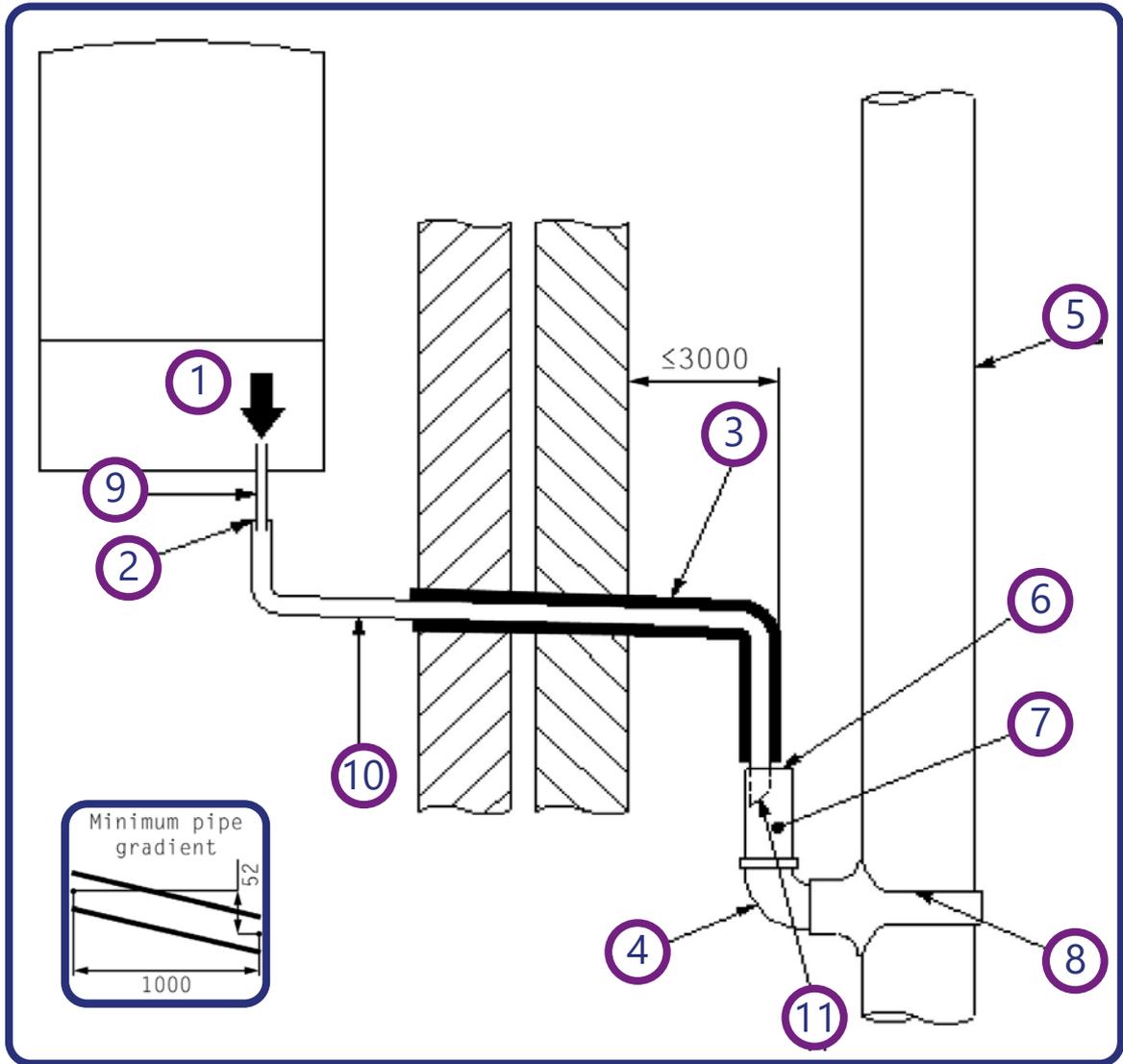
Connecting to a rain water downpipe/External Soil Stack

When an external soil stack or rain water downpipe is used as the termination (NB only permissible if this downpipe passes to a combined foul and rainwater drainage system) an external air break must be installed between the condensate discharge pipe and the downpipe to avoid reverse flow of rainwater/sewage into the boiler should the downpipe itself become blocked, flooded or frozen.

Figure 5 shows a suitable connection method. Pipe insulation should be fitted.

External Connections

Figure 5 – External termination to rainwater downpipe (NB only combined foul/rainwater drain)



Key

- 1 Condensate discharge pipe from boiler
- 2 Pipe size transition point
- 3 Water/weather proof insulation
- 4 43mm 90° male/female bend
- 5 External rain water pipe into foul water
- 6 External air break
- 7 Air gap
- 8 68mm PVCu strap on fitting
- 9 Minimum internal diameter 19mm
- 10 Minimum internal diameter 30mm
- 11 End cut at 45°

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

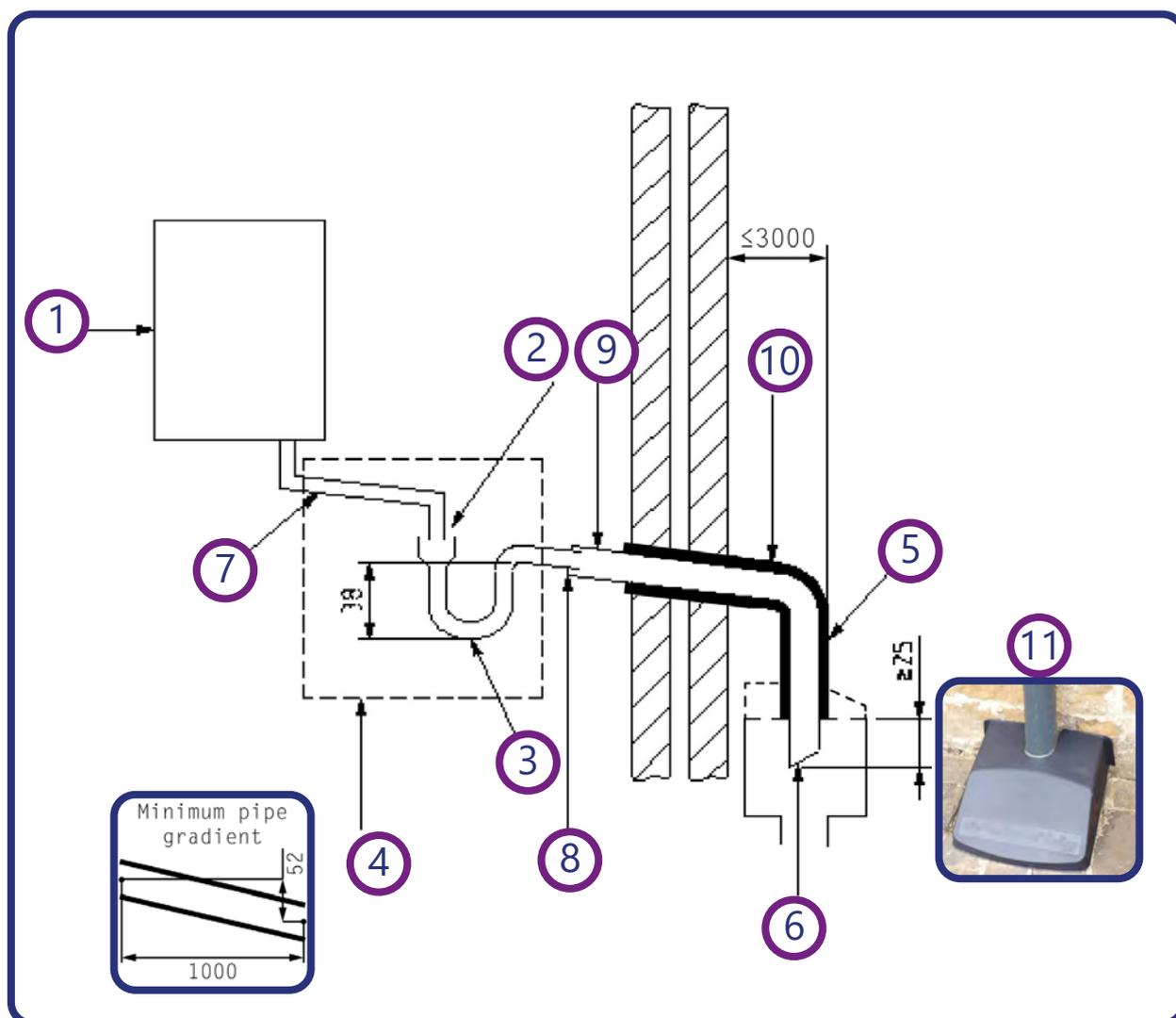
External Termination of the Condensate Pipe

Where the condensate discharge pipe is terminated over an open foul drain or gully, the pipe should terminate below the grating level, but above water level, in order to minimise “wind chill” at the open end. Pipe drainage and resistance to freezing will be improved if the termination end of the condensate pipe is cut at 45 degrees as opposed to a straight cut, and insulated to the tip of the pipe.

The use of a drain cover (such as those used to prevent blockage by leaves) **must** be fitted to offer further protection from wind chill. Figure 6 (following page) shows a suitable connection method. Where the condensate drain pipe terminates in a purpose-designed soakaway (see BS 6798:2014 or boiler installation manual for soakaway design requirements) any above-ground section of condensate discharge pipe should be run and insulated as described above. Figure 7 (following page) shows a suitable connection method and installation criteria.

External Connections

Figure 6 – External drain, gully or rainwater hopper



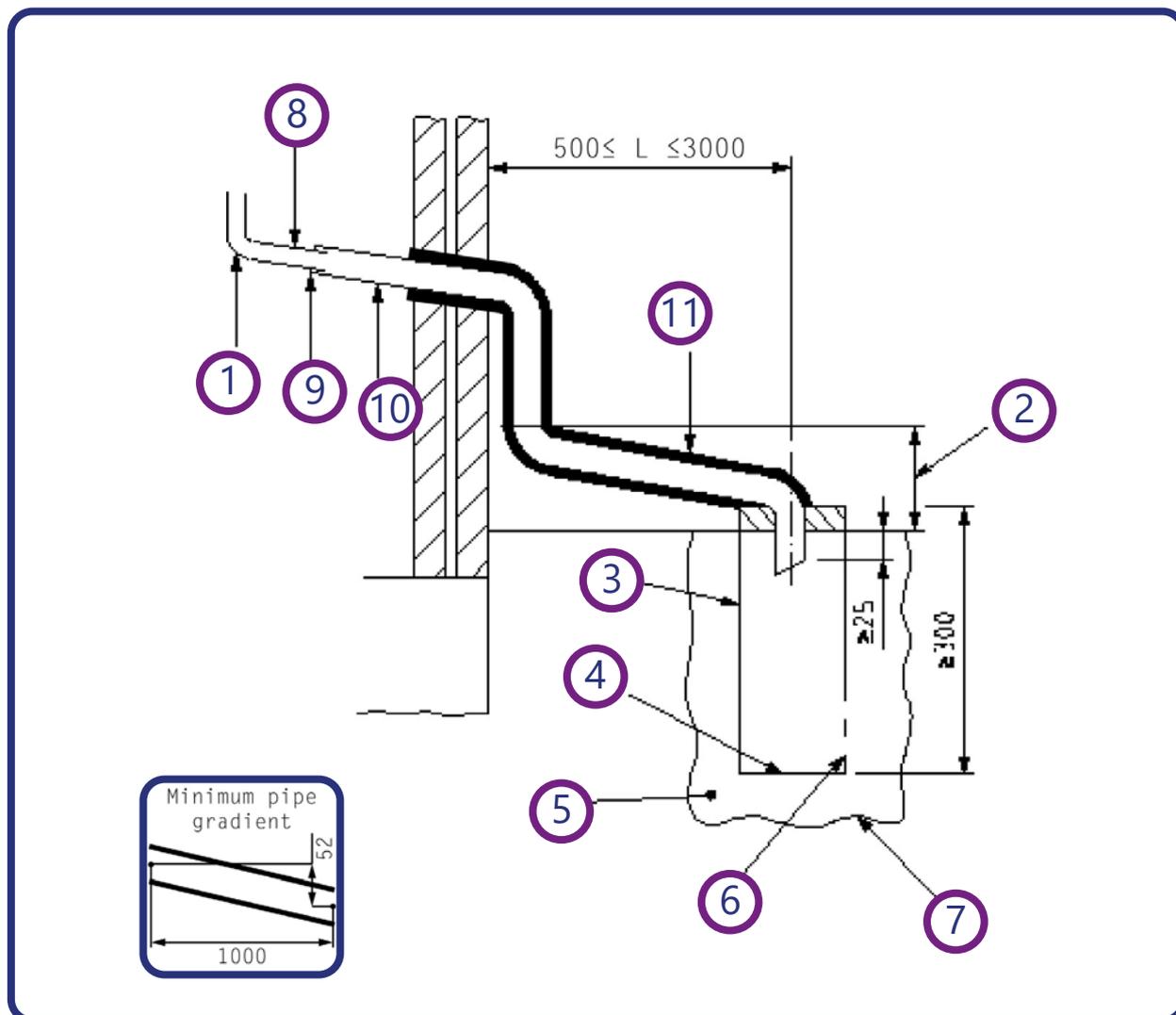
Key

- 1 Boiler
- 2 Visible air break
- 3 38mm minimum trap
- 4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 38 mm incorporated into the boiler – refer to manufacturers instructions
- 5 External length of pipe 3 m maximum
- 6 Open end of condensate discharge pipe direct into gully 25 mm min below grating but above water level; end cut at 45 °
- 7 Minimum internal diameter 19 mm
- 8 Pipe size transition point
- 9 Minimum internal diameter 30 mm
- 10 Water/weather proof insulation
- 11 Fit drain cover/leaf guard

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

External Connections

Figure 7 – Example of a purpose made soakaway



Key

- 1 Condensate discharge pipe from boiler
- 2 Ground (this section of the condensate discharge pipe may be run either above or below ground level); End cut at 45°
- 3 Diameter 100 mm minimum plastic tube
- 4 Bottom of tube sealed
- 5 Limestone chippings
- 6 Two rows of three 12 mm holes at 25 mm centres, 50 mm from bottom of tube and facing away from house
- 7 Hole depth 400 mm minimum by 300 mm diameter
- 8 Minimum internal diameter 19 mm
- 9 Pipe size transition point
- 10 Minimum internal diameter 30 mm
- 11 Water/weather proof insulation

Unheated Areas in Buildings

Internal condensate drainage pipes run in unheated areas such as lofts, basements and garages should be treated as external connections and insulated accordingly. Weather proof materials may not be necessary but where separate sections of insulation join together, including elbow joints then these should be connected together to prevent them coming apart with a suitable material to help prevent freezing and wind chill.

Use of Air Breaks In Condensate Discharge Pipes

Installers should follow the manufacturer's instructions on the use of air breaks in condensate discharge pipes, including soakaways. A visible air break and trap is not required if the boiler condensate trap has a minimum condensate seal of 75 mm incorporated into the boiler.

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

Note – Annex a details remedial actions for householders which can be taken if a condensate discharge pipe freezes. This may result in requests for alteration to condensate discharge pipework, in which case the guidance above should be followed.

Frozen Condensate Information Leaflet –Our customer information guide on frozen boiler condensate discharge is also available for download. It includes a condensate assessment form, for engineers to complete and advice to customers during extreme cold weather conditions. www.hhic.org.uk/resources.

Dear Householder,

Your heating engineer has noted that your boiler condensate discharge pipe may be at risk of freezing in prolonged, and extreme cold weather conditions. In recent years we have seen temperatures as low as -20*c in some parts of the UK.

The concern is that your pipe runs externally or in an unheated space for at least some of its length and is liable to freeze in these extreme temperatures as it is not installed in line with the latest guidance, to help guard against freezing. If your pipe freezes, it will cause your boiler to go into “shut off” at a time when you need your heating and hot water the most.

Your heating engineer will advise you on the solutions available to reduce the risk of your pipe freezing, including running the discharge pipe to an internal drainage point (the preferred method), or installing one of the available products designed to give you added protection against freezing conditions. They will also clearly identify the external condensate discharge pipe for your future reference and may apply an identification label or tape.

Your Engineer has identified the potential for your boiler to freeze in extreme conditions as the following:

Risk category	Explanation	Engineer selection
RED	High risk of freezing- TAKE ACTION	<input type="checkbox"/>
AMBER	Medium risk of freezing- Strongly advise action to be taken	<input type="checkbox"/>
GREEN	Low risk but some improvement required	<input type="checkbox"/>

Work required:

Name: _____

Company: _____

Telephone: _____

Email: _____

Manufacturers Instructions must be referred to when installing boiler condensate discharge pipes

Customer advice in extreme cold weather conditions

If appropriate, it may be advisable to operate the boiler temperature at a higher flow temperature as this would decrease the amount of condensate generated and reduce the freezing potential during the cold spell. This is achieved by turning the boiler thermostats to a high setting. During this situation the radiator surfaces will be hotter than normal and the boiler efficiency will be slightly reduced.

The customer should return the boiler thermostat back to its normal position after the extreme cold spell has ended.

Thawing Frozen Condensate Pipes

Below is an explanation of what you would need to do to resolve the problem in the event that the pipe was to freeze:

1. Locate the blockage

The Condensate discharge pipe usually freezes at the most exposed points outside, such as the open end of the pipe, at a bend or elbow, or where there is a dip in the pipe where condensate can collect.

2. Thaw the Frozen Pipe

The Condensate can be thawed in a number of ways. By applying a hot water bottle, a microwaveable heat packs around the blockage or by pouring warm water onto the pipe. It is important that you do not use boiling water. Please take care if your condensate discharge pipe is not easily reached from ground level, and do not put yourself at any undue risk without seeking assistance or engaging a professional heating engineer—also be aware that if you are pouring water onto the pipe this can also quickly freeze on the ground, causing a slip hazard.

3. Reset/ Restart the boiler

Once the frozen blockage has been cleared, the boiler will usually need to be reset, and advice on how to do this can be found in the user instructions manual for your boiler. Normally this will involve simply pressing a reset button on the front of the boiler, or in some cases by isolating the electrical supply to the boiler and switching it back on

Customer information: Frozen boiler condensate discharge

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Condensing Boiler

Guidance and advice for customers- endorsed by the Heating and Hotwater Industry Council, HHIC

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