HEATBASE Ltd FACTSHEET 24
Condensate Discharge and flue problems

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Manufacturers Instructions and Standards relating to condensate disposal have altered since the original Condensing appliances were first specified in Building Regulations in 2005; this has been based on problems discovered and experienced by tens of thousands of people during prolonged cold spells. But unlike Gas boilers, Oil boilers have no failsafe mechanism to shut down the appliance in the event of a frozen or blocked condensate pipe. This means that an increased amount of condensate can build up within the boiler which can cause several problems. Additional condensate plume has to try to exit through the flue system which can lead to combustion difficulties and intermittent breakdowns. Eventually sufficient condensate may start to leak through the boiler seals which can cause corrosion of access bolts, mild steel heat exchangers and other items, as well as being a **Potential Safety Risk**. In some cases if sufficient condensate builds up, it may back up or drip into the primary heat exchanger where the moisture will boil and turn to steam due to the higher temperatures; steam has a much larger volume than normal flue gases or condensate plumes and if this happens the boilers flue and flue ways cannot cope with the increased volume of gases and it will lead to increased combustion chamber pressures, gases forcing their way through seals as well as combustion issues, breakdowns and damage due to acidic moisture backing into the mild steel primary heat exchanger. Although still not fully specified, if condensate from the discharge pipe, flue or condensate plume comes into contact with the oil supply line and associated equipment, the acidic moisture will can corrode the oil line or components and lead to fuel leakage. If there is evidence that this is happening, it is a **Potential Environmental Risk.**

Condensate Discharge Pipe

The advice below is taken from HHIC (Heating and Hot water Industry Council) Condensing boiler industry guidance, it is referenced for Guidance and Best Practice by OFTEC, BS5410-part1:2019, and some Oil boiler manufacturers and its purpose is to give guidance in order to reduce this risk of freezing. However, in certain circumstances this guidance may still not be sufficient to prevent freezing in extreme conditions with widespread and prolonged sub-zero temperatures. Although some Manufacturers Instructions still specify much less onerous requirements (which can lead to problems and shorter boiler life expectancy), we are obliged to check condensate to these requirements and **any condensate discharge system that does not meet these requirements could be classed as a Fail, Not to Current Standards and a Potential Safety Risk:**

All condensate pipework should incorporate a "Trap" and be made of corrosion resistant, non-permeable pipe such as plastic pipe, copper and steel pipe is not suitable. Any condensate pipe work located in an un-heated space such as a loft or garage should be classed as external pipework.

Wherever possible, the condensate discharge pipe should be connected to an internal "gravity discharge point" such as an internal soil stack (preferred method) or to an internal kitchen or bathroom waste pipe such as a sink, bath or shower waste. Condensate pipework internally should be a minimum of 22mm, any pipework should be adequately supported to prevent sagging, with fixing centres of no more than 300mm for flexible pipe and 500mm for rigid pipe, have adequate fall and incorporate as few bends as possible, any external waste pipes that also incorporate a condensate discharge pipe should be a minimum of 35mm and wherever possible should not exceed 3m in length (or the diameter of the pipe should be increased to 42mm), it should be insulated with Weather resistant and UV stable lagging with a minimum wall thickness of 19mm, internal pipe lagging is not suitable. The pipe should be terminated below the drain grid, but above the water level. The end of the waste pipe should be cut at an angle of 45 degrees where it terminates to reduce the potential for the pipe to freeze, and a suitable drain/leaf guard should be fitted. If a "gravity discharge" cannot be achieved, a condensate pump could be used to achieve connection to the above.

If a separate external condensate discharge is the only available option, then internal pipework should be run as far as possible before exiting the building, and the pipework diameter should be increased to 35mm 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. Any pipework should be adequately supported to prevent sagging, with fixing centres of no more than 300mm for flexible

pipe and 500mm for rigid pipe, have adequate fall and incorporate as few bends as possible, any external pipework or pipework in an un-heated space should be a minimum of 35mm and wherever possible should not exceed 3m in length (or the diameter of the pipe should be increased to 42mm), it should be insulated with Weather resistant and UV stable lagging with a minimum wall thickness of 19mm, internal pipe lagging is not suitable.

If discharging into a drain or gully, the pipe should be terminated lower than the drain grid, but above the water level. The end of the waste pipe should be cut at an angle of 45 degrees where it terminates to reduce the potential for the pipe to freeze, and a suitable drain/leaf guard should be fitted.

If discharging into an external Soil stack, Rainwater hopper or rainwater pipe (only if part of a combined rainwater and foul water), Appliance manufacturers instructions should be followed to see if an Air-break is also required.

If discharging into a septic tank or cess pit advice must be sought from the appliance manufacturer to see if they allow this type of connection.

If discharging into a purpose made soakaway it must be a minimum of 500mm from the building foundations and any other services such as water, gas and electric supplies, be filled with limestone chippings to neutralise acidic condensate but can only be used if the ground material is free draining. **It must not be used if there is clay soil or poor draining soil.**

Problems associated with Condensing boilers, their flues and condensate plume.

There are many problems and complaints about modern condensing boilers regarding their flue systems, especially the nuisance factor regarding the dispersal of condensate plumes; even when they have been installed in a manner better than British Standards and manufacturers state. They can and do linger around the owners' property as well as being blown into neighbours gardens and patio areas.

Modern Standard efficiency boilers have a flue gas temperature that at its maximum should be 260 degrees C, but under normal circumstances will average between 180 and 200 degrees C as it leaves the flue terminal. Since heat rises, and the gases are much lighter and hotter than external ambient temperatures; waste flue gases easily disperse and cause very few problems when installed correctly. Even during adverse weather conditions, problems are minimal due to the higher temperature of the gases.

High efficiency condensing boilers are another matter. They usually have a maximum flue gas temperature of 100 degrees C and are usually much lower; often between 50 and 70 degrees C. Even during periods of good weather this can cause problems as the gases are so "cool" and much heavier due to the amount of moisture they contain, that the "plume" can hang around the flue terminal which can then lead to problems as the waste exhaust gases are drawn back into the burners own air supply; this is commonly known as vitiation (this gives similar symptoms of an internal flue gas leak). This can lead to problems with dirty photocells, damage to nozzle tips which can then lead to complete or intermittent boiler breakdowns. As well as the burner suffering from intermittent lockouts due to erratic combustion, if waste gases are drawn back into the burners own air supply it can also cause problems with metal fatigue and/or distortion of baffles inside the boilers heat exchanger. During colder weather the problem can be even worse as the gases rapidly cool upon leaving the flue terminal, making them even cooler and heavier than before, add a foggy day, snow or heavy or drizzling rain and it becomes worse again!

Plume management kits can be purchased from most boiler manufacturers which **may** help alleviated the problems of vitiation and in some cases help with the nuisance factor of the plume. The main benefit is that it increases the distance between the termination of the flue gases and the point at which air for combustion enters and therefore reduces the chance of vitiation. Although they are still a room sealed appliance, the downside is they are no longer a true balanced flue as the exhaust is positioned away from the air intake and so can still suffer from prevailing wind conditions! Vertical discharge balanced flues used to help with the dispersal of products of combustion but can now cause more problems with modern condensing boilers; as the gases are cooling even further during the additional distance they need to travel before exiting the flue terminal, they become even cooler and more saturated with moisture, which further reduces the buoyancy of the plume making vitiation more likely!