# Technical Bulletin

## Installation Advice: Cascading up to 4 Greenstar Utility Oil Boilers

### Guidance for design and installation oil cascades

If oil boilers are used in non-domestic installations, then warranties may be adjusted accordingly. For heating and hot water systems which require an output above 70kW, multiple Greenstar Utility oil boilers, up to a maximum of 4, can be linked together in a cascade.

Installations greater than 45kW must comply with BS 5410-2.

This Technical Bulletin will help the designer and installer ensure they have an efficient and compliant installation.

### Initial assessment

Cascaded boilers give a flexible option and can help where access is limited to a boiler room or plant room. However floor footprint and service clearances must be taken into consideration. The requirements of the building regulations, BS5410-2 and all other local regulations and standards must be considered at the design stage.

### Hydraulic arrangement

For condensing boilers, design of the system flow rates should be based on ΔT 20ºC to give lower return temperatures. This may require re-balancing of the existing heating circuits for older systems operating at 82/71. It is generally accepted that older systems have radiators which are oversized, meaning that some systems could be re-balanced to 80/60.

Refer to Fig. 1: Cascade systems must use a low loss header or suitably sized buffer tank to give hydraulic separation and aid efficient control. Reverse returns must be used to ensure hydraulic balancing of the cascade. Where the load on the system can be significantly reduced by means of zone valves or TRV's, effective control must be used in order to control the output of the cascade to match the heating load. You should not rely on the boiler control thermostats to control the sequencing.

The following Low Loss headers can be considered:

| Part number | kW Output @ ΔT | | Sinus LLH | Volume | Dimensions (mm) | |
|---|---|---|---|---|---|---|
| | 11º (82/71) | 20º (80/60) | (W/H) | (Litres) | H/W/D | Connection size |
| 8-920-097-2 | 102 | 186 | 120/80 | 6.4 | 800x120x80 | 2" |
| 7-716-150-013 | 230 | 419 | 200x120 | 30.8 | 1450x200x120 | DN80 |

Each boiler must have a separate primary pump and non-return valve as shown in the hydraulic example. A filter in the secondary return is required.

### Open vented systems

For open vented systems using a single vent pipe, the open vent should be connected at the low loss header or buffer tank. You should ensure that there are no valves on the flow pipe between the boiler and the expansion pipe.

The cold feed can enter the common return to the boilers on the primary side of the low loss header and should incorporate an isolating valve.

Open vent and cold feed pipe sizes should be in accordance with the example sizes below:

Cold feed pipes for two boilers should be a minimum of 25mm bore and for 3 & 4 boilers they should be a minimum of 32mm bore.
Open vent pipes for individual boilers should have a minimum bore of 25mm. For 2 boilers they should have a minimum bore of 32mm. For 3 & 4 boilers they should have a minimum bore of 38mm.

Note: If isolation valves are included in the flow and return pipework in order to assist with servicing and maintenance, then each boiler must have a safety pressure relief valve rated at 3 bar installed between the boiler and isolation valve.

Each boiler should have a means of reading the temperature and pressure at the boiler.

### Sealed systems

For sealed systems, the main expansion vessel can be connected into the secondary return adjacent to the low loss header. Attention must be drawn to the requirements of the Water Regulations when connecting heating systems above 45kW in a "non-house" situation. This will generally require a method of filling and maintaining system pressure which incorporates an RPZ valve or air break. A filler loop does not give adequate protection and the use of an auto fill system will generally be required.

Each boiler must have a safety pressure relief valve rated at 3bar. If the static head exceeds 2.5 bar, the boilers should be separated from the system by a suitably sized plate heat exchanger in place of the Low Loss header. In these circumstances, both the primary and secondary sides of the system will require separate sealed system equipment and expansion vessels. We advise you contact Worcester Bosch Technical team for guidance.

Each boiler must have a means of reading temperature and pressure at the boiler.





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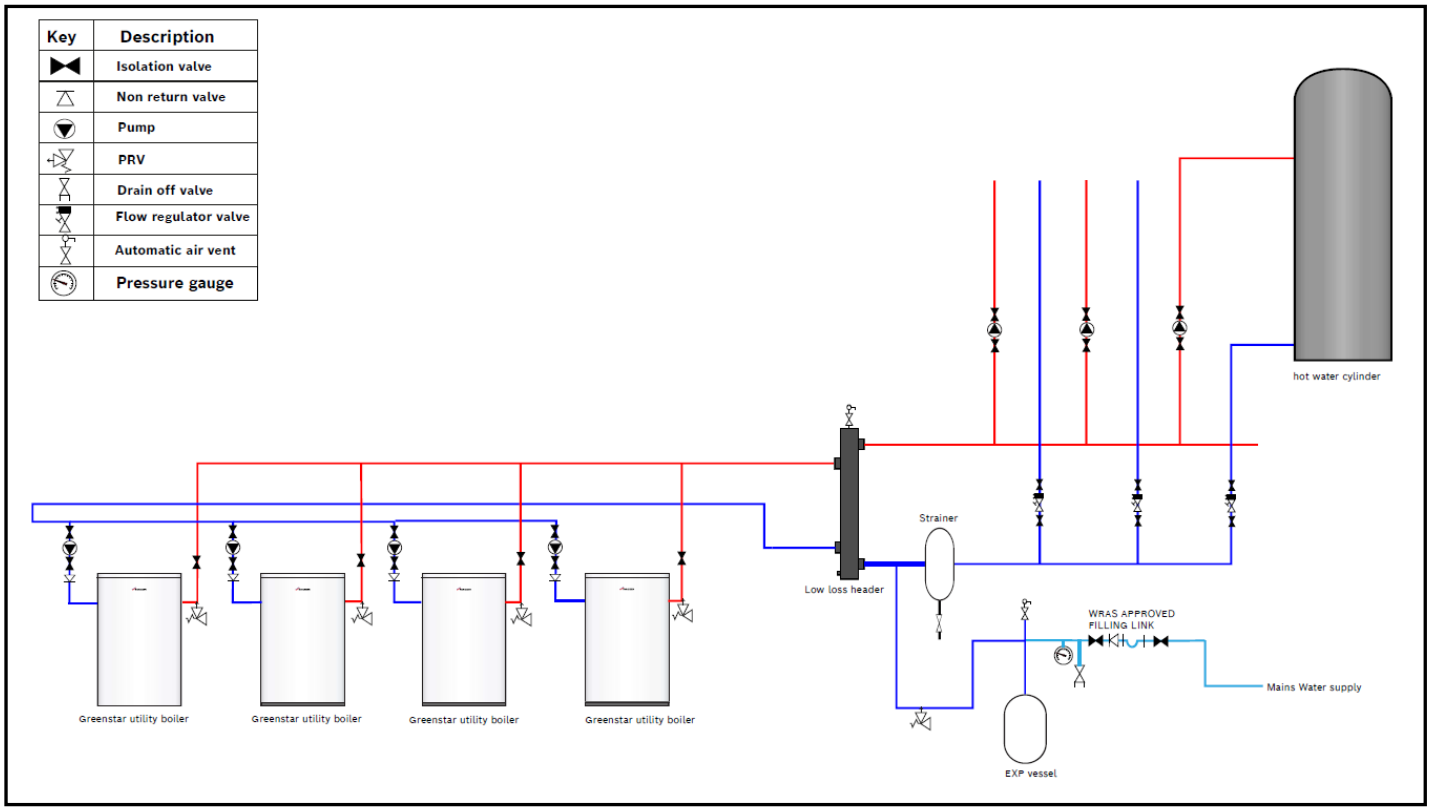


*Fig. 1) Example of a sealed system arrangement using reverse return connections from the boilers to the low loss header.*

## Flue systems

The boilers must be served by individual flue systems. Combined flue systems are not recommended for the use with Greenstar oil fired boilers.

Room sealed flue options can use the standard Worcester flue kits following the guidance within the installation manual.

For open flue systems, the guidance within the installation manual and the requirements of BS5410-2 must be followed.

Open flue systems using third party flues should be sized and installed by a competent person with the necessary skills and experience.

## Ventilation

The requirements for ventilation within boiler rooms must follow the requirements of BS5410-2.

For open flue boilers with natural ventilation, 6.7cm$^2$ for each 1kW of boiler capacity are required at low level and 3.3cm$^2$ for each 1kW of boiler capacity are required at high level.

Openings must not be less than 120cm$^2$.

For room sealed boilers with natural ventilation 2cm$^2$ for each 1kW of boiler capacity are required both at high and low level.

The above figures represent standard situations and it is important that the full requirements of BS5410-2 are met and referred to.

## Oil supply

The oil supply arrangement must follow the requirements of BS5410-2. The Greenstar Utility boilers are suitable for operation with C2 Kerosene only. See Fig. 2, Fig. 3 and Fig. 4 for more information.

Galvanised tubing must not be used. The use of black iron or copper pipe is preferred.

## Wiring and controls

The electrical installation must be in compliance with BS 7671.

Burner run times should always remain greater than 2 minutes during normal operation.

A control system must be included that can be configured to switch boilers in and out as required to match the output as closely as possible to the load on the heating system.

You must consider how much reduction on load can occur due to controls such as zone valves, TRV's and ΔT between system, room and outside air temperatures.

Oil burners cannot modulate to accommodate a reduction in heating loads, consideration should be given as to how short cycling of the burner could be prevented. Including lower output boilers in the cascade could be considered.

Individual time and temperature control should be used for each circuit.

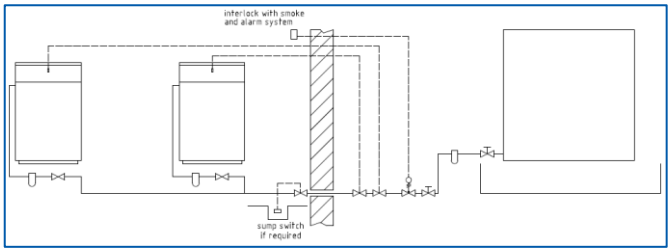


*Fig. 2) Example gravity oil supply arrangement*

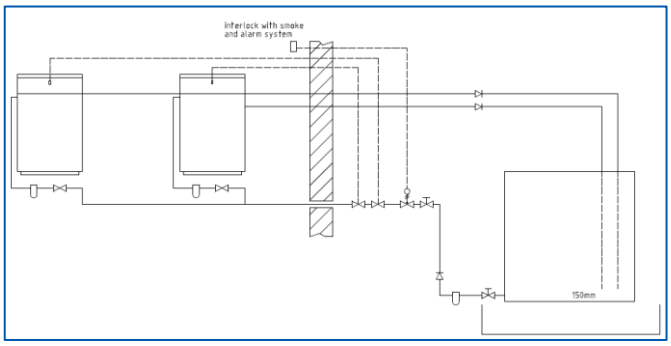


*Fig. 3) Example two-pipe oil supply*

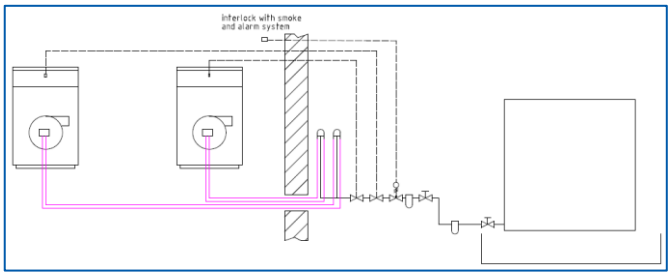


*Fig. 4) Example single pipe suction and de-aerator*