APPLICATION GUIDE

SUBJECT:
No. 2 Fuel Oil Piping

APPLIES TO:
Hydronic (Hot Water) and Steam Boilers

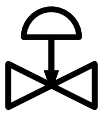
INTRODUCTION:

Designing and installing a functional fuel delivery system will ensure a safe and reliable boiler plant.

The packaged boiler will typically be supplied with a factory mounted fuel oil burner pump. This is a gear style constant volume pump using the fuel train and nozzle resistance to pressurize the fuel for atomization. Adequate fuel oil supply pressure and volume to the inlet of the pump is required for proper operation, up to a maximum of 3 psi (0.21 bar) per NFPA 31. Refer to the Installation, Operation and Maintenance Manual (IOM) for the maximum vacuum pressure. An important consideration is that the required fuel oil supply flow rate will be greater than the consumption flow rate, with unburned oil sent back in the return pipe. Therefore, the fuel oil delivery system must be sized for the supply rate, not the consumption rate.

OIL PIPING COMPONENTS:

Understanding oil specific components and their use is crucial to proper operation. The following are some common components typically found in fuel oil systems:



Fusible Link Valve - This is a fire safety device that automatically shuts off the flow of oil to the boiler in the event of a fire.

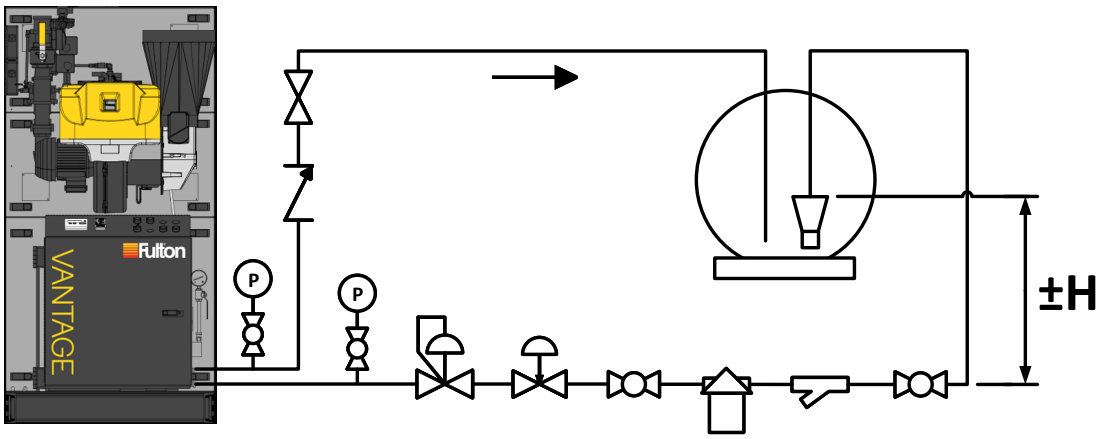
Step Down Regulator - Typically installed in the oil supply piping to the boiler, the purpose is to reduce the oil pressure supplied to the burner pump.

Foot Valve - This valve is installed inside the oil reservoir tank and is responsible for maintaining prime, preventing oil from draining back into the tank.

Back Pressure Regulator - Used in a flooded loop system at the end of the supply header and upstream of the return header back to the oil tank. It maintains upstream supply header pressure.

SINGLE BOILER OIL PIPING:

For individual boilers, it is permitted to use the on-board oil burner pump to circulate fuel oil directly from a nearby tank provided line size and tank proximity are acceptable. The tank may be above or below grade relative to the boiler, the difference in height combined with the line size are factors in determining the maximum equivalent length of oil piping. Refer to the boiler IOM for boiler specific equivalent lengths. Ensure appropriate strainers and oil filtration are installed. Refer to the following diagram for a simplified oil system with one boiler circulating oil from a tank.

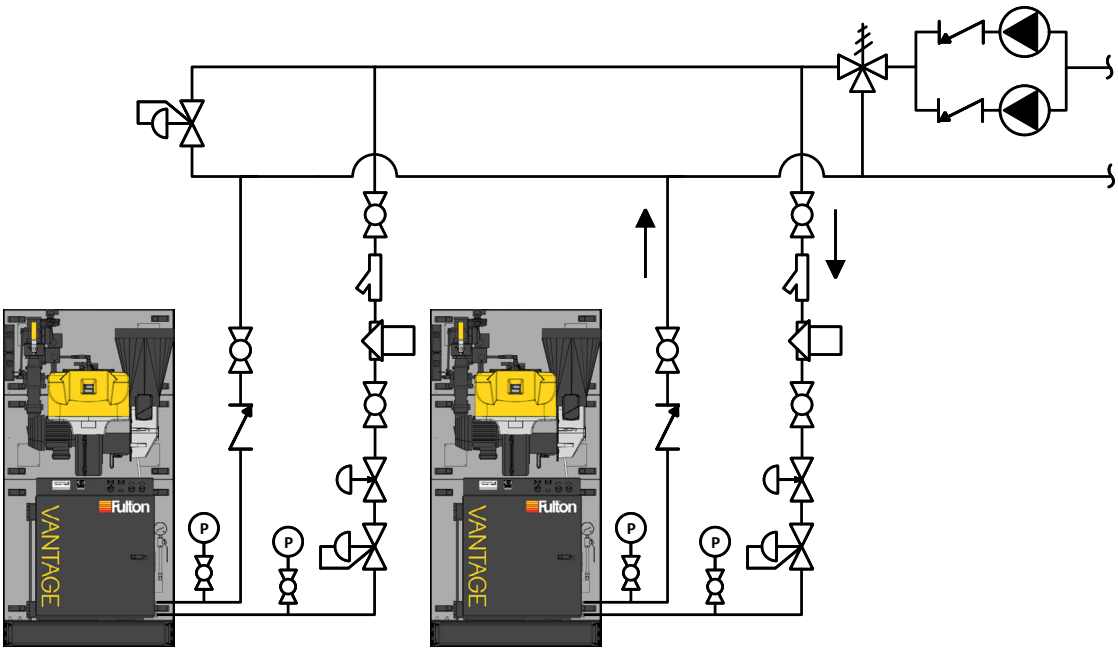


MULTIPLE BOILER OIL PIPING USING A FLOODED LOOP:

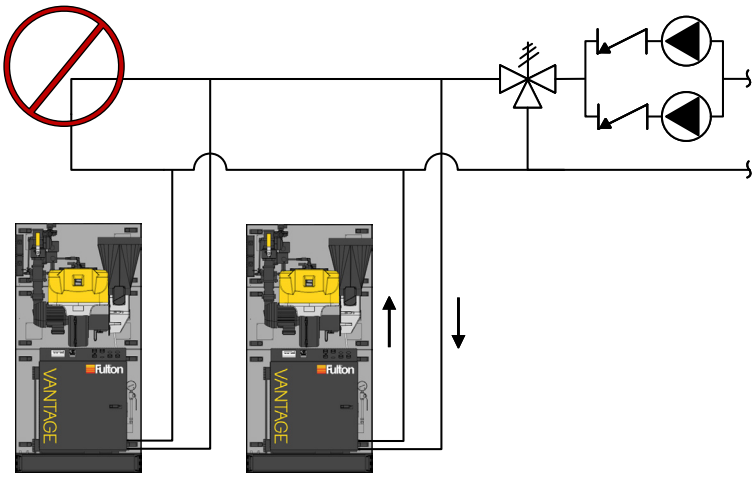
A flooded loop style system should be used in a system with multiple boilers. As shown in the diagram below, this includes a transfer pump or pump set to circulate oil from the oil tank through the loop. During a call for heat, each boiler will circulate the necessary oil from the loop and return unburned fuel to the return line to be circulated back to the tank. Ensure appropriate strainers and oil filtration are installed. The recommended oil transfer pump sizing should be 1.5 to 2 times the required fuel oil supply rate for all burners in the system.

For example, a system with two (2) VTG-5000DF, each boiler requires 150 gallons per hour (GPH). The transfer pumps should be sized to deliver 450 GPH to 600 GPH to ensure adequate fuel oil supply. If instead, the pumps were sized for only the consumption of 36.1 GPH per boiler, the fuel supply system would be inadequate to operate even a single boiler.

The back pressure regulator is required in a flooded loop to maintain supply header pressure upstream of the regulator. The return header should be sized for minimal pressure drop, as close to 0 PSI as permitted. This allows unconsumed fuel to be returned back to the tank with little resistance.



AVOIDING COMMON MISTAKES:



A missing backpressure regulator can lead to operational issues with the fuel oil delivery system.

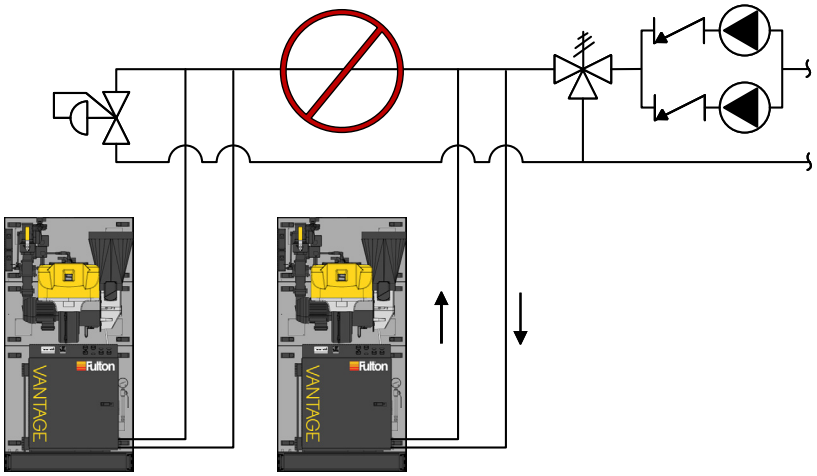
Omitting the backpressure regulator will cause fuel oil to take the path of least resistance through the return header, instead of feeding the individual burner pumps, leading to insufficient oil supply to the burners.

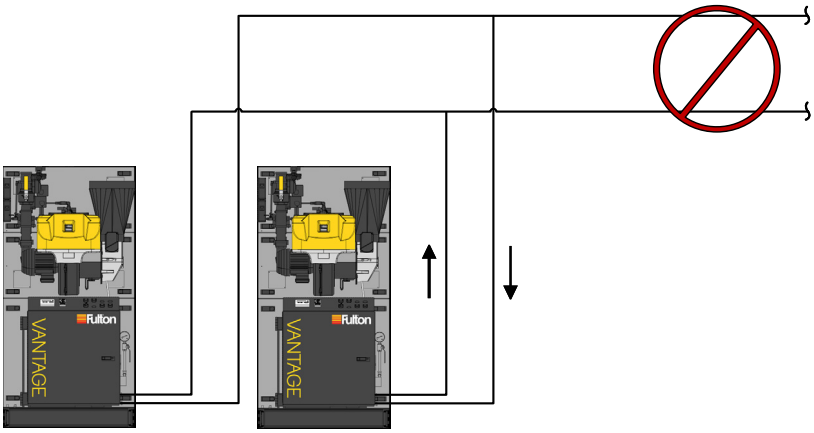
It can also lead to the supply header draining back to the storage tank when the oil pump set shuts off, resulting in air issues during the next use.

It is important that the supply and return piping for each boiler are properly terminated within the appropriate respective headers.

If both the burner supply and return are terminated into the supply header, the burner pump return will need to overcome supply header pressure. If both are terminated in the return header, supply oil flow and pressure may be insufficient.

Either may result in insufficient fuel delivery.



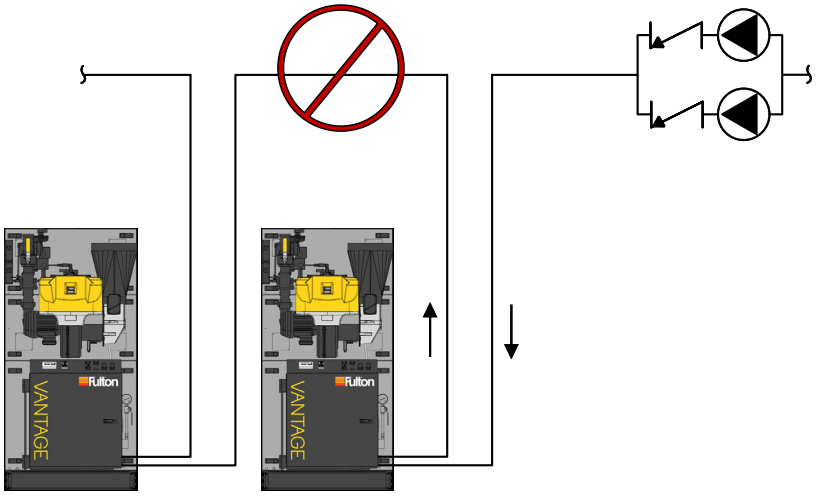


A system without transfer pumps will not be equipped to deliver oil to the boilers. The on board oil burner pumps may be used to circulate oil from a nearby tank for a single boiler application only.

Where a manifolded system is used, a transfer pump set is required for fuel oil delivery.

It is not acceptable to pump the fuel oil return from one boiler into the supply connection of another.

There are many reasons why this system will not provide reliable operation, including potential for insufficient fuel delivery volume and pressures to downstream boilers as well as inability to return unconsumed oil directly back to the tank.



IN SUMMARY:

1. When designing a flooded loop, size distribution transfer pump set for 1.5 to 2 times the maximum combined supply rate, not consumption, of all oil burner pumps.
2. Ensure the supply (inlet) side of the oil burner pump does not exceed 3 psi for compliance with NFPA 31.
3. Size the return oil piping for a low pressure drop, as close to 0 psi as the installation allows.
4. For troubleshooting purposes, install oil pressure gauges at the supply and return of each boiler as shown.
5. Always install appropriate strainers and oil filtration at each boiler.
6. Verify the foot valve is installed and confirm the supply side does not lose prime.