DON'T OVERLOOK THE OIL PIPING SYSTEM

The importance of the correct oil piping system cannot be overlooked when installing a new oil-burning unit, or when servicing an existing unit. There are two basic systems used when installing a new burner, referred to as a one-pipe system or a two-pipe system.

A one-pipe system (Figure #1) is used largely on smaller units and preferably when the oil tank is above the burner level. Using this system the air will have to be bled from the lines at the oil pump. If air gets into the lines it will keep recycling inside the oil pump until it is bled.

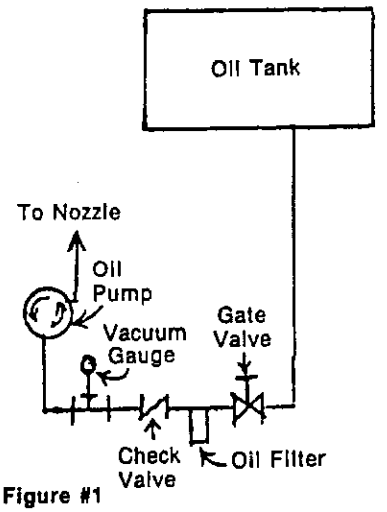

Figure #1

In the case of a one-pipe system, the oil lines may be sized according to the burner firing rate. The pumping capacity is immaterial because the unused oil is simply bypassed within the pump, we will only have to replace what oil is discharged through the nozzle. Using this system it is even more important we do not have any suction leaks as it may air bind the pump and can cause the pump to go bad prematurely.

As shown in Figure #1 a gate valve should be installed in the suction line before the filter to allow us to shut off the oil supply when cleaning or changing the oil filter. In the case of a tank being below the filter, it will prevent losing the prime. A check valve should be installed after the filter, especially when the filter is below the pump, to stop the flow of oil from the pump. Next a vacuum gauge is installed before the pump.

Enough attention cannot be brought to the importance of gauges in proper place. If there is a fear of blowing a pressure gauge, or a vacuum gauge leaking, a valve may be installed on the gauge shutting it off from the system. Without gauges, we have no way of telling if we are supplying the proper pressure or pulling the proper vacuum. An increase in the vacuum gauge is also a good indication of a dirty filter or clogged line. If we have a question as to the condition of the pump we may close the gate valve while the pump is running. If we do not pull at least 15" of vacuum we know the pump is at least weak.

Another desirable item not shown is a thermostatic cut off valve placed in the oil line. In the case of a fire the valve will shut off the oil supply to the burner.

The piping system is fine on smaller units, however, on larger commercial units it is desirable to have a two-pipe system (Figure #2).

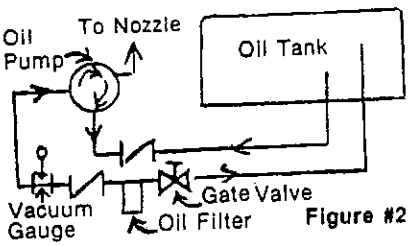

Figure #2

The oil burner pump will usually have a bypass plug which will have to be installed to use a two-pipe system. Be certain this plug is inserted in the pump before the burner is lit. This plug will be in the return side of the pump and blocks off the internal bypass port so the excess oil will be returned to the tank.

With this type of system air will pose less of a problem as the air will be returned to the tank along with the excess oil. Notice the suction line is longer, in the tank, than the return line. This is very important when we discuss air in the system. When the air is returned to the tank, it will rise to the top and go out the vent. If the lines were equal, or the suction line was above the return, we would pull air back into our suction line.

The piping on this system must be sized to the pump. The pump is returning the excess oil to the tank and not bypassing it internally. We may have a 100 gph pump on a

60 gph burner. In this case, we will pump 60 gph to the nozzle and 40 gph back through our return line.

The oil pump should be at least 1½ times the burner capacity to ensure sufficient oil at the nozzle and a steady pressure. Caution must be taken when examining an oil system to ensure the system is actually a two-pipe system. The only additional piece of equipment on a two-pipe system is a check valve in the return line. This is especially necessary if the tank, or oil piping is above the pump. If so, the check valve will permit cleaning of the filter without the oil running back through the pump.

In Figure #3, the return line of the burner pump is discharging into the supply line. This is recommended by some manufacturers but from a serviceman's point of view it is not desirable. What we are doing in essence is recycling the oil in the lines instead of the pump. This means the air will recirculate around from the return into the suction line and is very hard to bleed from the lines. The fastest way to bleed this system is to break the union on the return line. Cover the half of the union going into the suction line and let the air bleed from the return side of the pump. You must be very careful not to let any air into the covered end and be ready to shut off the pump. When the air is all bled, oil will be flowing rapidly out of the return line.

Another important thing to remember is to install a check valve after the pump, in the return line, when utilizing a two-pipe system. This will enable you to replace the oil pump without the oil draining back through the return line, should it become necessary. A gate valve should never be installed on the discharge side of any pump (or return side) unless a relief valve is also installed to relieve the excess oil pressure should the valve be left closed accidently.

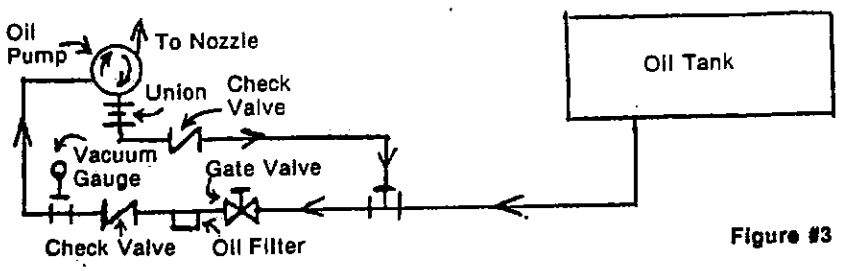

Figure #3

On multiple burner installations, the most desired system is the "Flooded Loop." Using this system requires auxiliary pumps and a back pressure regulator (See Figure #4).

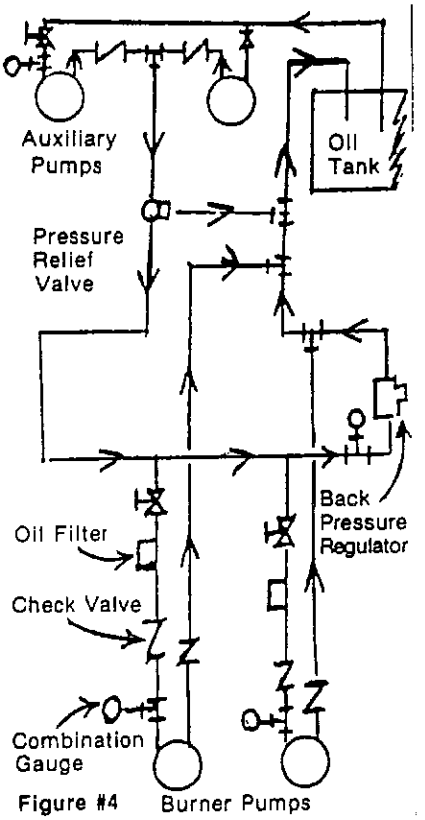

Figure #4

There should be two auxiliary pumps, one for stand by, each sized 1½ times the total pumping capacity of all the burner pumps. The pumps should be installed according to the diagram. Again, a gate valve should not be installed on the discharge side.

A gate valve and oil filter are installed before the auxiliary pumps so we do not lose the prime when we clean the filter. Another gate valve, and a 30 psi - 0 - 30" vac. gauge, are installed before the pump. The gate valve is there so we may close off one pump at a time and alternate them. The combination gauge will tell us if everything is operating normally on the suction side. An increase in vacuum tells us we have a dirty filter, clogged line, or some other restriction to the flow. A decrease in vacuum could mean the pipe is going bad, the oil tank is empty, or we have an air leak.

After the auxiliary pumps, we have two check valves. These prevent us from pumping against the pump not in use. They also will enable us to remove one pump, if necessary, while still running the other one.

Our next item is a pressure relief valve. This valve is there solely for the protection of the pumps and serves no regulatory function. This valve should be adjusted 10 psig above the back pressure regulator.

The last item in our loop is the back pressure regulator. This valve will be used to maintain a set pressure against the burner pumps, usually 5 psig or less. Too much pressure will damage the pump seals on the burner pumps. It is very important that the back pressure regulator be installed in the proper place -- after the supply line to each burner and before the return line from each burner. Our gauges will tell us if there is any problem developing within the oil system. For those who do not have a gauge downstream of a pump, you may install a valve on each gauge so it may be shut off. There is always the possibility of blowing a gauge and causing a large oil leak in the boiler room.

the advantage of the flooded loop is that you maintain a constant pressure on each burner regardless of how many are actually firing. If you are shut down for any period, you will not lose the prime because the auxiliary pump will be running continuously. You will have less of an air problem because the loop will always be full of oil.

Many old piping systems are similar to Figure #5. This is not a "Flooded Loop" as the oil from burner #1 is discharged into the supply of burner #2. Any air will be picked up by #2 burner if #1 burner discharges it. Also the pressure on each burner will differ depending on whether or not the burner in front of it is running. This type of piping can cause future service problems and should be avoided if at all possible.

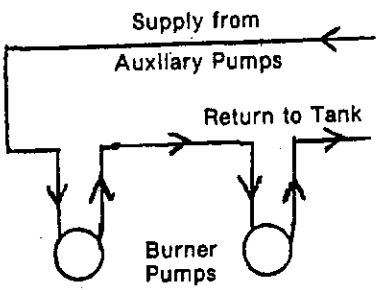

Figure #5

Heavy oil systems differ slightly because we have two objectives which must be met with the piping system -- maintaining oil pressure and oil constant temperature. Even though the oil heaters are thermostatically controlled, the actual temperature will differ according to flow. We also must keep the oil close to the nozzle hot to obtain a good ignition upon light off. It must be remembered that if the oil is being returned through the metering valve it will be in the low-fire position during off periods (Figure

#6). This means we will be circulating a minimum amount of oil. Many times not enough to maintain warm oil at the nozzle.

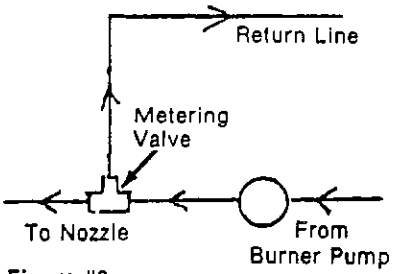

Figure #6

Somewhere before the metering valve, as close as possible, another pressure relief valve may be added. This valve must be set higher than the necessary high-fire oil pressure and should be the lowest set valve in the system. This will ensure enough of the hot oil being recirculated and should maintain a more constant oil temperature.

In the case of a burner with an integral pump and heaters, this relief valve should be between the heaters and the metering valve and set so the oil will be relieved in sufficient quantity as to keep the lines warm to this point.

Some heavy oil burners do not incorporate integral pumps but rely on the pressure in the loop to supply the operating pressure. A typical example is shown in Figure #7.

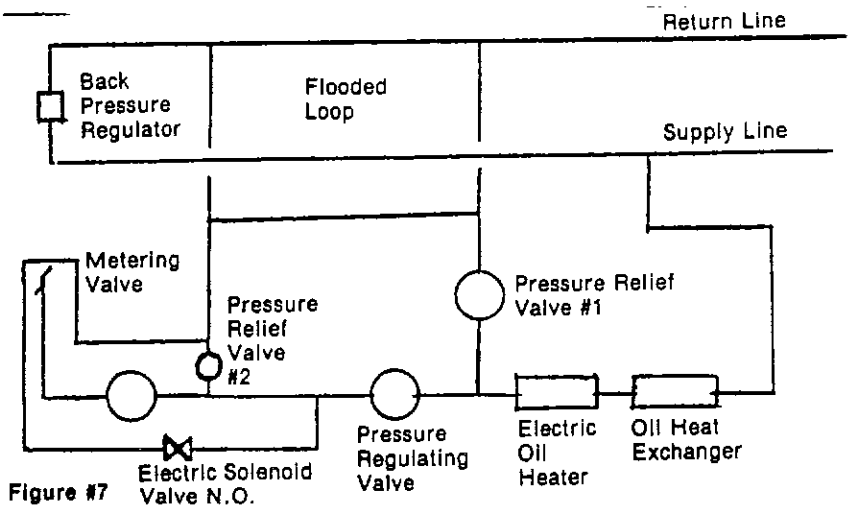

Figure #7

As an example, we will set the back-pressure regulator in Figure #7 at 100 psig. Relief valve #1 is only used as protection against overheating causing high pressure in the oil lines. This valve should return very little, if any, oil during normal operation.

The Pressure Regulating Valve will reduce the 100 psig to a pressure slightly higher than our high fire operating pressure, possibly 75 psig. The balance of the excess pressure will be relieved by Pressure Relief Valve #2, lowering our final pressure to around 60 psig. This will ensure warm oil circulation up to the metering valve.

The electric solenoid valve is a normally open valve and closes when the main oil valve opens. It's sole purpose is to keep the nozzle lines warm by circulating hot oil through the oil tracer lines, these are the lines going around the line to the nozzle. The main oil valve would be close to the nozzle, in this case after the metering valve.

The same rule applies to oil heaters as pumps. No gate valve on the discharge side of a heater unless the heater is equipped with a pressure relief valve. This is to protect against a possible rupture to the heater due to overheating and an increase in pressure.

If a system is equipped with an electric heater as well as a heat exchanger, the electric heater must always be after the heat exchanger. There are two reasons for this. First, you do not want the electric heater to run any more than necessary because it is more expensive to operate. Secondly, the electric heater will maintain a more constant temperature than the heat exchanger which is our main goal with heavy oil. Viscosity changes with temperature. Atomization changes with viscosity.

The oil supply system is very important and cannot be taken lightly. Especially at a time when burner conversions are so popular, we have to be certain that the existing system will accommodate the new burners. If not, it will pay in the end to make the necessary changes at the time of installation to avoid future callbacks.