OIL SUPPLY SYSTEMS ABOVE 45kW OUTPUT

4.1 Oil Supply

4.1.1 General

The primary function of a system for handling fuel oil is to transfer oil from the storage tank to the oil burner at specified conditions of pressure, rate of flow, temperature (and therefore viscosity). The system should at all times deliver correctly filtered oil to the burners within the limits of pressure and temperature required for correct functioning of the equipment. The condition of the fuel required at the burner should be stated by the appliance/burner manufacturer.

There can be considerable variety in the choice of oil supply system, but correct design, pipe sizing, pressure and temperature control is most important if the system is to function satisfactorily.

When deciding upon the route by which fuel is to be transferred from the storage tank to the burner and its ancillary equipment, care must be taken to minimize the possibility of mechanical damage to the pipeline by avoiding points at which vehicular or other damage might be anticipated.

In addition to the methods of jointing domestic sizes and types of oil supply pipe, non-domestic oil supply pipes may be jointed (where appropriate to material) by brazing and/or welding.

4.1.2 Size of Oil Supply Pipes

The most economical size of pipeline should be chosen to be consistent with obtaining the required pressure conditions at the burners at all rates of flow. Where the burner pump requires a flooded suction, the pipe bore selected should be such that the frictional loss does not prevent compliance with this requirement.

The following factors should be taken into account when assessing pressure drop.

a) Viscosity, this is directly proportional to pressure drop. Assessments should take into account the effect of any heat loss from pipelines and the consequent increase in viscosity as the oil passes through the pipeline.

b) Flow conditions. Handling systems for fuel oil should be designed to provide streamline flow conditions where steady and accurately predictable pressure conditions are essential. (Velocity of flow not exceeding 2m/s is generally suitable for viscosities above 18cSt (centistokes)). Turbulent flow conditions should be avoided as a general rule, but may be acceptable with transfer or tank filling lines where close control of pressure drop or pressure conditions is not important.

c) Flow rate. Pressure drop under streamline flow conditions is directly proportional to the quantity of oil flowing. The effect of reduced flow rate subsequent to off-take and should be taken into account to ensure that variation in pressure does not cause excessive variation of flow through metering devices sensitive to pressure differentials (V-slot metering valves, etc). Special attention is necessary within ring main systems or within a gravity system serving several off-points.

d) Equivalent lengths of pipe. Pressure drop is directly proportional to the equivalent length of the pipeline that takes into account frictional losses due to valves, bends, filters, fittings etc.
4.1.3 Gravity Oil Supply Systems

A gravity oil supply system is one where the oil will flow directly from the storage or service tank to the oil burner(s). The outlet from the tank has to be above the level of the inlet to the oil burner and provide a positive head of oil to the burner at maximum flow and at all depths of oil in the tank. (See diagram 56a).

The maximum and minimum static heads imposed at the burner inlet will depend on the related depths of oil in the tank according to whether it is full or nearly empty. Either the burner system has to be capable of accepting these variations in head or the head has to be controlled by means of a constant-level control device, a pressure reducing valve or an intermediate/daily service tank (see diagram 56b) between the main tank and the burners.

The oil line should preferably fall continuously from the tank. Where this is not possible, air vents should be provided at high points. A stop valve should be fitted at the tank outlet, followed by a first-stage filter (see BS 5410 Part 2) in the supply pipe. A fire valve is to be installed in accordance with the requirements of BS 5410 Part 2 and interlocked with the smoke alarm/main fire alarm system. If deemed necessary, an oil cut-off valve, actuated by a sump switch in the boiler house floor or by other methods of leakage detection, should be installed.

Where the pipe supplies more than one off-take point or burner, it should be of such size that any variation in fuel pressure resulting from changes in the friction head loss does not exceed the limits of such pressure variation acceptable to the oil burning equipment at all flow rates.

Gravity Oil Supply System

Diagram 56a
Gravity Oil Supply to a Daily Service Tank (via a transfer pump)

Diagram 56b
4.1.4 Using a Transfer Pump

A transfer-pump pressurized “dead-leg” system is one where the oil flows by gravity, or is drawn by suction from the storage or service tank, to a transfer pump and is then pumped to the oil burning equipment. The incorporation of a pump will not affect the static head of oil imposed by the oil in the tank. The maximum static head when the tank is full should therefore be less than the maximum permitted inlet pressure at the oil burner. Where the maximum static head is too great, a constant-level control device, a pressure reducing valve or a service tank should be interposed between the storage tank and the pump.

The delivery pressure in the pipe from the pump should be controlled within the limits required for the satisfactory operation of the oil burners supplied at all dead-leg low flow rates, including zero flow rates.

This may be achieved by:

a) A constant-volume pump and a pressure control valve, so that oil flows in excess of that required by the oil burners is returned to the pump suction or preferably to the oil tank.

b) A variable-output pump controlled by a pressure-sensitive device that maintains the oil pressure at all required rates of flow.

In all such systems, the provision of a relief valve should be considered.

Where the pipe supplies more than one off-take point or burner, it should be of such size that any variation in fuel pressure resulting from changes in the frictional head losses does not exceed the limits of such pressure variation acceptable to the oil burning equipment at all flow rates.

To facilitate priming, the suction pipe should rise continuously to the burner and a suitable priming point should be provided at the high point.

A stop valve should be fitted at the tank outlet, followed by a first-stage filter in the supply pipe and a fire valve interlocked with the smoke alarm/main fire alarm system.

In view of the dependence of the system on the transfer pump and filter, it is normal practice to install duplicate items. This configuration is commonly referred to as a “Duplex pump system”.
Sub-Gravity (Suction) Oil Supply to a Daily Service Tank (via a transfer pump)

Diagram 57

4.1.5 Pumped Ring Main Oil Supply Systems (Gravity and Sub-Gravity)

In these systems, oil flows by gravity or under suction from a storage or service tank to a pump and then around a circulatory system. This comprises of a flow pipe up to the last burner served, and a return pipe to the pump suction or to the oil tank. The maximum static head when the tank is full should be less than the maximum permitted inlet pressure at the burner. Where the maximum static head is too great, a constant-level control device, a pressure reducing valve or a service tank should be installed between the storage tank and the pump.

The pressure in the ring main should be controlled, within the limits required for the satisfactory operation of the oil burners supplied, at all flow rates and under “zero” draw-off conditions. This may be achieved by either:
a) A pressure control device of suitable size fitted on the downstream side of the last burner served; or

b) A vertical loop on the return line to the tank (where the burners only require a low inlet oil pressure).

The flow rate of the pumped oil circulating in the ring main needs to be in excess of the combined total burner requirements to ensure that the correct pressure at the inlet to the burner is maintained satisfactorily by the pressure control device over the range of flow rate required. Spill-type burners may have special requirements in this respect.

The burner manufacturer should be consulted regarding sizes for the pump and the ring main system.

High points of the ring mains should be fitted with air vents.

Pressure regulating valves should be installed with isolating valves and with a bypass valve incorporating manual control, so that operation of the plant may continue if failure of the pressure regulating valve occurs.

Pressure gauges should be fitted at the pump outlet and immediately upstream of the pressure regulating valve and bypass valve.

A first-stage filter should be incorporated in the pump suction pipe, along with a fire valve interlocked with the smoke alarm/main fire alarm system.

A non-return valve needs to be fitted in the ring main return pipe before it enters the pump suction or the tank.

**Gravity Feed Low Pressure Ring Main**

**Diagram 58**