

# Pump suction pipeline design

The root cause of many pump problems and failures can be traced to poor upstream, suction-side, pipeline design. Common problems to avoid are:

- Insufficient fluid pressure leading to cavitation within the pump.
- Narrow pipes and constrictions producing noise, turbulence and friction losses.
- Air or vapour entrainment causing noise, friction and loss of performance.
- Poor installation of pipework and other components.

## Cavitation

A liquid's boiling point corresponds to the temperature at which its vapour pressure is the same as the pressure of its environment.

If the pressure of the liquid at any point in the pump is lower than its vapour pressure, it will boil, forming vapour bubbles within the pump. The formation of bubbles leads to a loss in throughput and increased vibration and noise but the big danger is when the bubbles pass on into a section of the pump at higher pressure. The vapour condenses and the bubbles implode, releasing, locally, huge amounts of energy. This is known as cavitation and can be very damaging, causing severe erosion of the pump's components.

To avoid cavitation, you need to match your pump to the fluid, system and application.

## Turbulence and Friction

Pumps work most efficiently when the fluid is delivered in a surge-free, smooth, laminar flow. Any form of turbulence reduces efficiency and increases wear and tear on the pump's bearings, seals and other components.

There should be at least 5 pipe diameters' worth of straight piping connecting to the pump. Never connect an elbow, reducer, valve, or strainer within this final run of pipework. If you connect an elbow directly to the pump flange, the liquid is effectively centrifuged towards the outer curve of the elbow and not directed into the centre (the eye) of the impeller. This creates stress on the pump's bearings and seals which often leads to wear and premature failure.

Sometimes, it's just not possible to make provision for a sufficient settling distance in the pipework before the pump. In these cases, use an inline flow conditioner or straightener.

It's standard practice to employ suction-side piping one or two sizes bigger than the pump inlet - you should certainly never use any piping that is smaller than the pump's inlet nozzle.

It also makes sense to keep the run of pipework to a minimum by positioning the pump as close as possible to the fluid source.

Larger pipework means that you'll need a reducer before the pump inlet. The best solution is to use an eccentric reducer orientated to eliminate the possibility of air pockets.

## Air or Vapour Entrainment

It's best to keep air or vapour out of the pipework. Entrained gases cause a loss in pump performance, increase noise, vibration and component wear and tear. It's therefore important to position the feed pipe correctly in the tank or vessel. It should be fully submerged. If it's too close to the surface of the fluid, the suction creates a vortex, drawing air (or other vapours) into the liquid and through the pumping system. In shallow tanks or ponds, it may be advisable to use a baffle arrangement to protect the feed pipe from air entrainment.

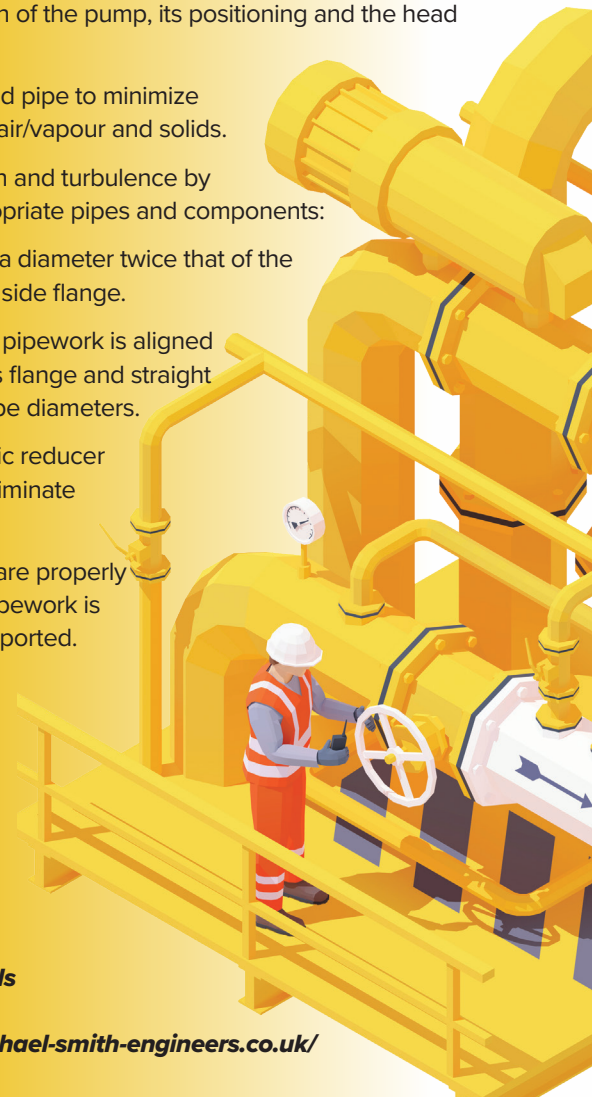
## Installation

Obviously, pumps should be securely located - but so should the pipework. Don't use one to support the other. All other components *must be just as securely located and create no stresses or strains on any other parts of the system.*

## Summary

Problems in suction side pipework often have damaging consequences for the system pump and can be avoided by following these guidelines:

- Ensure that conditions do not favour cavitation. This requires careful selection of the pump, its positioning and the head pressure.
- Position the feed pipe to minimize entrainment of air/vapour and solids.
- Minimize friction and turbulence by choosing appropriate pipes and components:
- Use pipes with a diameter twice that of the pump's suction side flange.
- Ensure that the pipework is aligned with the pump's flange and straight for at least 5 pipe diameters.
- Use an eccentric reducer orientated to eliminate air pockets.
- Ensure pumps are properly installed and pipework is adequately supported.



**For further details**

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