PIPE SIZING

Friction loss in steel pipe lines

When a fluid has to be transferred from one point to another by pipe it is usually at a required flow rate. It is common to have an available head in the form of a pump or reservoir to drive the fluid through the pipe. When the fluid flows through the pipe there is a resistance to the flow due to friction forces and this produces a pressure or energy loss termed head loss. If the pipe diameter is too small, the predicted head loss will exceed the available head and there will be a significant reduction in flow until the loss equals the available head. If the pipe diameter is too large the magnitude of the loss will be less and the flow will exceed the designed flow rate.

The selection of pipe diameter is therefore important in the balance between available head flow and flow rate.

Calculation

This is a reasonably simple calculation and what is required is:

1. Friction loss charts for various pipe coatings NB. the smoother the pipe surface the lower the friction loss
2. Information on friction loss caused by various fittings in the pipe line
3. Establish needs in terms of:
   - Flow velocity (Metres per second)
   - Flow capacity (litres per second/minute)
   - Pipe size either given or requested
   - Total length of pipeline
   - What fittings/valves will be used in the above line

Example

1. Establish type of pipe that will be used (ie. uncoated, coated or galvanised)
2. Obtain information in Calculation 3 as above
3. Assuming the following data given:
   - Uncoated pipe
   - Flow rate = 5 litres per second
   - Pipe size = 80mm NB
   - Total length of pipeline = 1 000 metres
   - Fittings = 1 sluice valve, two 90 degree bends (also 80mm)
4. Establish additional length of the line which will be created by fittings in the line. To do this, look at the chart Loss of head.
   - Select factors for sluice valve (6) and two 90 degree bends (2 x 18 = 36)
   - Now use formula to establish extra metres:
     \[ \text{Extra metres} = \text{Factor} \times \text{fitting diam. in mm} \]
     \[ = 1 \text{ 000} \]

Example Case:

a. Sluice valve = 6 x 80 = 0.48 metres
     \[ 1 \text{ 000} \]

b. Two 90 degree bends = 36 x 80 = 2.88 metres
     \[ 1 \text{ 000} \]

Total additional lengths of the line is therefore

1 000 metres + 3.36 metres or 1 003.36 metres

5. Consult the friction loss chart for uncoated pipe
   - Select 5 litres per second on bottom scale
   - Trace the vertical line to the point where it crosses the 80mm pipe size line
   - Read off value opposite this crossing point on the left hand scale. In this instance it will read 17.5mm per metre
   - Take the total length of the line (1 003.36m) multiply by the friction loss (17.5mm) = 17 558.8 mm or 17.56m
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