Horizontal gas flow

As for the vertical flow the gas equation use an average z and temperature over the length of the flow. Neglecting the kinetic energy the equation is:

$$p_1^2 - p_2^2 = 1.007E-4\frac{\gamma_g f_f z_a T_a q^2 L}{d^5} \tag{3-61}$$

Using the following for a Reynolds Number to get f_f

$$N_{\mathrm{Re}} = 20.09\frac{\gamma_g q}{d\mu} \tag{3-62}$$

in oilfield units.

But in low pressure, high rate line the kinetic energy can be significant. In this case use the following which accounts for this:

$$p_1^2 - p_2^2 = 4.195E-6\frac{\gamma_g z_a T_a q^2}{d^4}\left(\frac{24 f_f L}{d} + \ln\frac{p_1}{p_2}\right) \tag{3-63}$$

This equation most be solved iteratively.

For vertical or inclined well we can rewrite equation 2-18:

$$p_2^2 = e^s p_1^2 + 2.685E-3\frac{f_f (q z_a T_a)^2}{d^5 \sin\theta}\left(e^s - 1\right) \tag{3-64}$$

$$s = \frac{.0375\gamma_g L \sin\theta}{z_a T_a} \tag{3-65}$$

Using the same Reynolds number as the horizontal flow.

Homework

1) A gas sales line has a pressure of 600 psi, what does the outlet pressure of the gas separator have to be to deliver 1.2 mmscfpd of gas into the line if it is one mile away. The gas should be delivered at 50 psi above the pipeline.
The gas has a gravity of .63 with a viscosity of .02 cp, and a temperature of 120 ^{o}F exiting the separator. The flowline is 2 3/8" tubing.