Flushing Skid

The vendor stated in an email that flowrate was calculated using the following.

$$Q = \frac{Re \times \nu \times D}{21220}$$

Re = Reynold's no
ν = kinematic viscosity
D = Pipe bore.

The BP process engineer questioned this formula and this is how I demonstrated that it was correct:

$$Re = \frac{\rho d v}{\mu} = \frac{d v}{\nu} \qquad (1)$$

$$Q = Av \Rightarrow v = \frac{Q}{A} \qquad (2)$$

Sub (2) into (1):

$$Re = \frac{d\,Q}{\nu A} \qquad (3)$$

$$A = \frac{\pi d^2}{4} \Rightarrow Re = \frac{4 \times Q \times \cancel{d}}{\pi d^{\cancel{2}} \nu}$$

$$= \frac{4\,Q}{\pi d \nu} = \frac{4}{\pi} \cdot \frac{Q}{d\nu} \qquad (4)$$

m^3/s

m $\quad m^2/s$

∴

However, it is more common for ν to be recorded in centiStoke (Cst), Q to be recorded in l/min and diameter in mm.

$$\nu : \quad 1\ Cst = 1 \times 10^{-6}\ m^2/s$$
$$Q : \quad 1\ l/min = 1.67 \times 10^{-5}\ m^3/s$$
$$d : \quad 1\ mm = 1 \times 10^{-3}\ m$$

Therefore $\frac{Q}{d\nu}$ in non-standard units $= \frac{1.67 \times 10^{-5}}{1\times10^{-3} \times 1\times10^{-6}}$

$$= 16700$$

So sub into (4) $\Rightarrow$ $Re = \frac{4}{\pi} \cdot 16700 \cdot \frac{Q}{d\,\nu}$

l/min

mm

Cst

$$= 21263 \cdot \frac{Q}{d\,\nu}$$

$$= \frac{21263\, Q}{d\,\nu}$$

Therefore $Q = \frac{Re \cdot \nu \cdot d}{21263}$

Simples.