# Appendix 4 –
# Rudimentary Slot Flow Derivations

The most rudimentary derivation for infinite parallel plates is for the well-known lubrication relationship where:

$$Q = \frac{-\left(\frac{dP}{dx}\right)\ell w^3}{12\mu}$$

where:

Q.....volumetric flow rate, $m^3$/second
P ..... pressure, Pa
x .....coordinate in the direction of one-dimensional flow, m
w.....aperture, m
ℓ.....flow distance, m
μ ..... dynamic viscosity of Newtonian fluid, Pa·s

We can also write Darcy's law for one dimensional flow of a Newtonian fluid as:

$$Q = \frac{k\left(\frac{dP}{dx}\right)\ell w}{\mu}$$

Equating, we have:

$$Q = \frac{k\left(\frac{dP}{dx}\right)\ell w}{\mu} = \frac{-\left(\frac{dP}{dx}\right)\ell w^3}{12\mu} \rightarrow kw = \frac{w^3}{12}\ m^3$$

$$kw = \frac{1}{12} \times \frac{1}{9.8\times10^{-16}}\frac{md}{m^2} \times \frac{1\ ft}{0.3048\ m} \times (w\ m)^3 \ldots \quad = 2.79\times10^{14} w^3\ md - ft$$