

Aqua Environment Inc. Technical Note

TANK FILL TIME WITH FLOW LIMITING ORIFICE

Flow limiting orifices such as the Aqua Environment model 796 are used as safety devices to prevent extreme flow and line whipping that could occur from high pressure lines in the event of hose breakage, fittings separating etc. They are also used to prevent excessively fast fills of small tanks such as SCBA tanks. It is recommended that orifices be used where flexible fill hoses are used to guard against hose breakage or a connector coming loose. A .047" diameter orifice in a line used to fill a single SCBA or SCUBA tank will substantially reduce hose whip (although not completely) without increasing fill times excessively.

Tank fill times with orifices will be longer than with an open line. Approximate fill time due to the orifice restriction can be calculated from the following equation.

$$T = 0.15 V_t / (P_u D^2)$$

where

T = fill time in minutes

V_t = volume of tank being filled in SCF (standard cubic Feet)

P_u = pressure upstream of the orifice in PSI which is the same as the pressure the tank is to be filled to.

D = diameter of the orifice in inches.

For example, the time to fill a 4500 PSI, 80 standard cubic foot SCBA tank with a .040" orifice in the line is:

$$T = 0.15 \times 80 / (4500 \times .040^2) = 1.65 \text{ minutes}$$

Typically actual fill times will be slightly longer due to other restrictions in the system.
