Engineering Analysis

03/01/2022

New Septic Solutions Filter:

Attached is the calculated fluid head loss through New Septic Solutions filter at flow rate of 50 gpm. The result is a head loss of 1.92 ft (.831 psi).

Sincerely,

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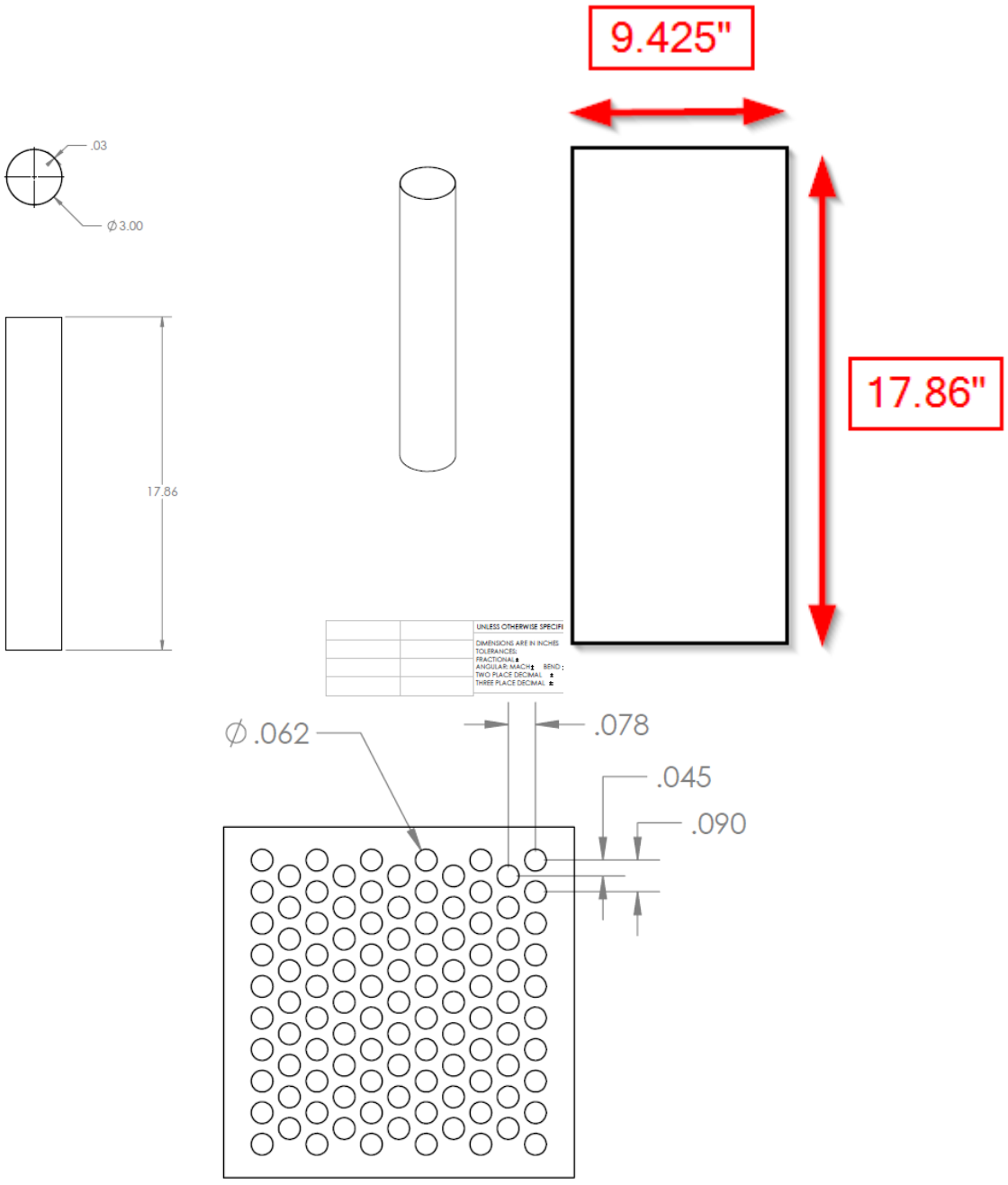
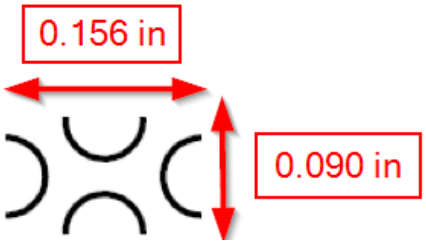
DICKSON CONSULTING
Mechanical Design & Manufacturing

Find Velocity Though Screen Holes





Area of representative square within mesh

$0.156\ in * 0.090\ in = 0.01404$ sq in

Area within holes in representative square

$2 * \pi * 0.031^2 = .006038\ sq\ in$

% Open area is open:

$$\frac{0.006038}{0.01404} = 43\%$$

Filter is 43% open area.

Area of filter = $9.425\ in * 17.86\ in = \ 168.33\ sq\ in$

Filter has 43% open area. 43% of 168.33 is 72.38 sq in (0.503 sq ft) open area

Holes in filter are 0.062 in diameter (0.031 in radius). Area of holes is .00301 sq in

$\frac{72.38}{.00301} = 24047$ holes in filter

$50\ gpm = \ .111\ cubic\ feet\ per\ second$

$\frac{0.111\ cu\ ft\ per\ sec}{0.503\ sq\ ft} = 0.221$ ft / sec velocity through open area

Calculate Flow Through the 0.062" Screen Holes

Assume a submersible effluent pump with a capacity of 50 gpm at 18 ft of head. 10 ft or 4.33 psi ft dead headed.

Q = 19.636 * C * dl^2 (h)^1/2 d1/d2 less than .3

D1 = 0.062 in

D2 = 3 in

D1 / D2 = 0.020 which is less than .3

H = 8 ft (18 ft capacity – 10 ft resisting head)

$Q = 19.636 * .61 * 0.062^2 * 8^{\frac{1}{2}} = 0.13023\ gpm$ flow capacity per screen hole

Need $\frac{50\ gpm}{.13\ gpm} = 385$ holes to pass required flow (have 24047 holes available).

Calculate Head Loss Through Filter Sheet

K sharp-edge pipe entrance = 0.5

K sharp-edged pipe exit = 1

Total K = 1.5

Vel = 0.221 ft/s

G = 32.2 ft/ s^2

$$H\ loss = \frac{K(v)^2}{2g}$$

$$H\ loss = 1.5 * \frac{0.221^2}{2 * 32.2} = 0.00114 = ft = 0.0005\ psi$$

Calculate H loss entering 1.140" Pipe.

$$Inlet\ Area = \left(\frac{D}{2}\right)^2 * \pi = \left(\frac{1.140}{2} in\right)^2 * \pi = 1.021\ in\ sq = 0.00709\ sq\ ft$$

$$50\frac{gal}{min} = 0.00709\ sq\ ft * 60\frac{sec}{min} * 7.48\frac{gal}{cu\ ft} * Vel\frac{ft}{sec}$$

Vel = 15.7 ft / sec

$$H\ loss = 0.5 * \frac{\left(Vel\frac{ft}{s}\right)^2}{2 * 32.2\frac{ft}{\sec^2}}$$

$$H\ loss = 0.5 * \frac{\left(15.7\frac{ft}{s}\right)^2}{2 * 32.2} = 1.92\ ft = 0.831\ psi$$

Total head loss= 1.92 ft [0.831 psi]