

ENGINEERING ANALYSIS



GAG Sim / Tech Filter :

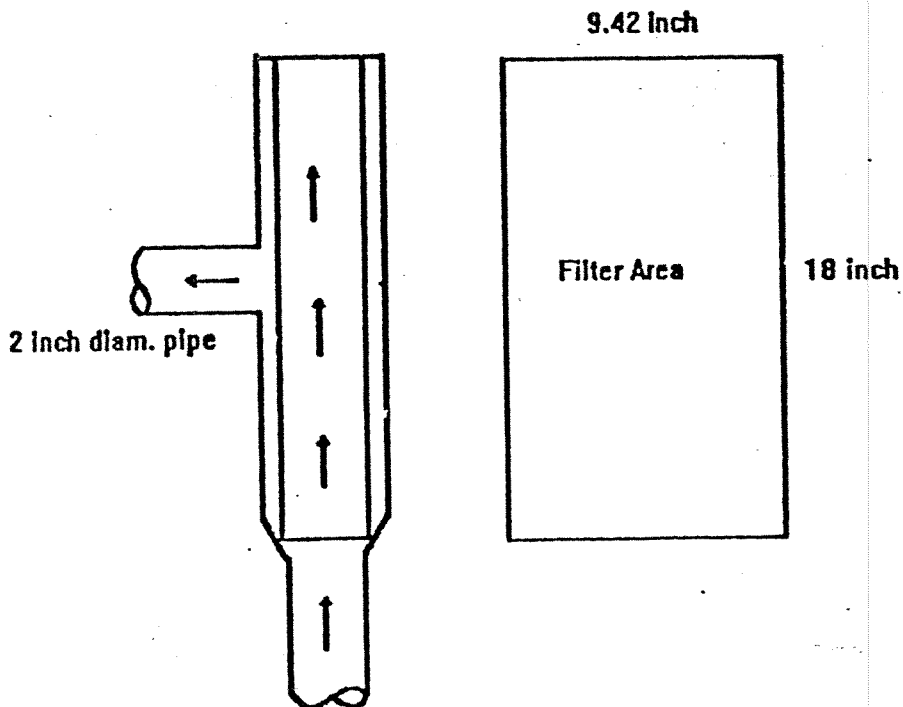
4/12/97

Attached is the calculated fluid head loss through the Sim / Tech Filter at a flow rate of 80 gpm. The results indicated a head loss of 0.21 psi .

Yours truly,

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GAG Sim / Tech Filter - Head loss Calculation

Assume velocity through 2 in. diam. line discharging from filter is 8 ft/sec max following good plumbing design practice.

Area of 2 in diam pipe is 0.0218 sq ft

$$0.0218 \text{ sq ft} \times 8 \text{ ft/sec} \times 60 \text{ sec} / 1 \text{ min} \times 7.48 \text{ gal / cu ft} = 78.3 \text{ gpm (use 80 gpm max)}$$

Filter is 3 in diam by 18 in high. This is a sheet 9.42 in by 18 in. 169.56 sq in: in area.

Filter is 41% open area. 41% of 169.56 sq in. is 69.52 sq in. (0.483 sq ft).

Holes in filter are 1/16 in. Area of hole is 0.00307 sq in.

$$69.52 / 0.00307 = 22645 \text{ holes in filter}$$

$$80 \text{ gpm} = 10.7 \text{ cu ft / min} = 0.178 \text{ cu ft / sec}$$

$$0.483 \text{ sq ft open area}$$

$$0.178 / 0.482 = 0.37 \text{ ft / sec velocity through open area}$$

Assume a submersible effluent pump with a capacity of 80 gpm at 10 ft of head. 10 psi or 23.25 ft dead headed.

Calculate flow through the 1/16 in. orifice holes.

$$Q = 19.636 C d_1 \sqrt{h} \quad d_1 / d_2 \text{ less than } .3$$

$$d_1 = 0.0625 \text{ in.}$$

$$d_2 = 3 \text{ in.}$$

$$d_1 / d_2 = 0.02 \text{ which is less than } .3$$

$$h = 13.25 \text{ ft (23.25 ft capacity - 10 ft resisting head)}$$

$$Q = 19.636 \times 0.61 \times (0.0625)^{1/2} \times (13.25)^{1/2} = 0.17 \text{ gpm flow capacity each hole}$$

$$\text{Need } 80 \text{ gpm} / 0.17 \text{ gpm} = 470 \text{ holes to pass required flow (have 22645 holes available)}$$

Calculate head loss through filter sheet

K sharp-edged pipe entrance = 0.5

K sharp-edged pipe exit = 1

Total K = 1.5

v = 0.37 ft / sec

g = 32.2

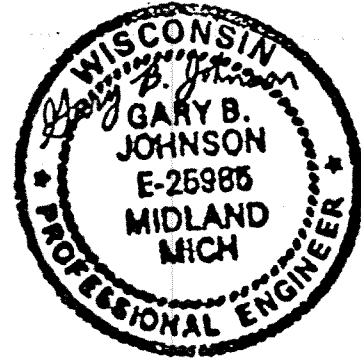
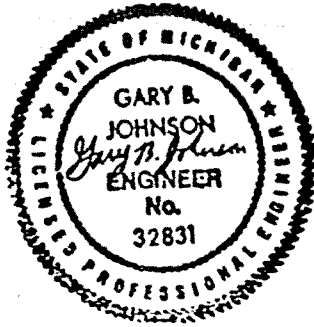
$$H \text{ loss} = K (v)^2 / 2g$$

$$H \text{ loss} = 1.5 (0.37)^2 / 64.4 = 0.0032 \text{ ft} = 0.0014 \text{ psi}$$

Calculate H loss entering 2 in. pipe

$$H \text{ loss} = 0.5 (8)^2 / 64.4 = 0.497 \text{ ft} = 0.21 \text{ psi}$$

Total Head loss through filter system is 0.0032 ft + 0.497 ft = 0.5002 ft or 0.21 psi



TEST DATA

GAG SIM/TECH FILTER

Technical test data of pressure, flow rate, and burst strength of SIM/TECH FILTER assembly.

Pump used for test:

1/3 hp Goulds WEO311L 1750 RPM

Head height: 10ft. @ 80 gpm

15ft. @ 60 gpm

20ft. @ 36 gpm

Pump discharge is 2" to 2" inlet of filter assembly. Water is discharged from filter through a 2" outlet.

The following tests were performed using a calibrated gauge 0-60 psi (calibration data sheet attached - gauge #Go-972). Flow rate was also measured in gallons per minute using a stop watch and barrel. Barrel size was such that .5833 inches equals 1 gallon of water. Time and inches of water were calculated to achieve flow rate. Pressure readings were taken from filter assemblies optional pressure switch location. The outlet of filter assembly is 2'4" above the pumps discharge outlet. No additional head height was calculated for this test.

First test

Pressure on filter assembly with no filter installed is 1 psi @ 84 gpm;

Pressure on filter assembly with filter installed is also 1 psi @ 84 gpm

Second Test -open screen (filter)

1. 1 psi = 84 gpm

2. 1 psi = 84 gpm

3. 1 psi = 83.5 gpm

1 psi = 83.83 gpm average

Third Test -25% plugged screen (filter)

1. 1.3 psi = 83.1 gpm

2. 1.3 psi = 82.7 gpm

3. 1.3 psi = 82.7 gpm

1.3 psi = 82.8 gpm average

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Fourth Test -50% plugged screen (filter)

1. 1.3 psi = 84.0 gpm
 2. 1.3 psi = 82.3 gpm
 3. 1.3 psi = 83.1 gpm
-
- 1.3 psi = 83.1 gpm average

Fifth Test -75% plugged screen (filter)

1. 1.4 psi = 82.3 gpm
 2. 1.4 psi = 82.3 gpm
 3. 1.4 psi = 82.3 gpm
-
- 1.4 psi = 82.3 gpm average

Sixth Test -95% plugged screen (filter)

1. 1.8 psi = 78.8 gpm
 2. 1.8 psi = 80.5 gpm
 3. 1.8 psi = 80.1 gpm
-
- 1.8 psi = 79.8 gpm average

HEADER SIMULATION

Pressure readings were also taken with 1 1/4" pvc pipe with forty-four 1/4" holes. Readings were 4.5 psi @ 63.4 gpm. No head pressure was calculated with this reading as readings were done at same elevation of filter assembly.

Burst test was performed on filter assembly. At 220 psi, filter assembly ruptured at the threaded cap and 4" tee at the top of unit. The gauge used was a calibrated 0-300 psi.(calibration data sheet attached-gauge #68)

Pressure and gpm readings were taken on filter with installed optional sock. Readings were 1.3 psi @ 80.5 gpm, open filter readings without sock were 1 psi @ 83.83 gpm.

 4-10-97

Arnold W. Koteskey
Level II quality verifier
certificate of qualification attached

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