Engineering Design, Plans, and Specifications for an Air-Assisted Filter Backwash System at the Thomas Hill Energy Center Water Treatment Plant

submitted January, 2009



Project Summary

This project involves the addition of air-assisted backwash to five sand filters at AECI's water treatment plant at the Thomas Hill facility. It is anticipated that air-assisted backwash will improve the cleaning of the sand filter media while shortening the backwash time and using less water.

Existing Filters

Five cylindrical steel filters are each 10.5' in diameter and 86.6 ft² in area. A nominal plant flow rate of 900 gpm results in a filter loading rate of 2.08 gpm/ft². With one filter out of service and at maximum plant flow of 1,050 gpm, the filter loading rate is 3.03 gpm/ ft². Flow through an individual filter ranges from 180 to 260 gpm.

Filter media consists of 3' of sand directly on a FlexKleen Mark III synthetic underdrain system, manufactured by EnviroQuip. FlexKleen nozzles (illustrated below) are designed to accommodate air scour and do not require the use of support gravel.





DNR Design Guide on Air-Assisted Backwash

DNR's Design Guide for Community Water Systems contains the following section pertaining to air scour (emphasis added).

H. Air Scouring. Air scouring may be considered in place of surface wash based on the following standards: (I) Air scouring controls must allow the operator to control the air and water flow rates and duration. Provide manual over-ride to the automated backwash controls for backwashing the filters including air scour. Automated backwash controls shall not automatically start filter backwash. Filter backwashing must be initiated manually; (II) Air flow for air scouring the filter must be 3 - 5 cubic feet per minute per square foot of filter area when the air is introduced in the underdrain; a lower air rate shall be used when the air scour distribution system is placed above the underdrains; (III) A method for avoiding excessive loss of the filter media during backwashing must be provide; (IV) Air scouring should be followed by a fluidization wash to restratify the media: (V) Air must be free from contamination; (VI) Air scour distribution system should be placed at or below the media and supporting bed interface; if placed at the interface, the air scour nozzles shall be designed to prevent media from clogging the nozzles or entering the air distribution system; (VII) Piping for the air distribution system shall not be flexible hose which may collapse when not under pressure and shall not be relatively soft material which may erode at the orifice opening with the passage of air at high velocity; (VIII)Air delivery piping shall not pass down through the filter media unless a minimum of two (2) anti-seepage collars, six (6) inches apart are provided in each pipe. The anti-seepage collars shall extend three (3) inches out from the pipe and be continuous around the entire circumference of the pipe. No arrangement in the filter design shall allow short circuiting between the applied unfiltered water and the filtered water; (IX) Consideration should be given to maintenance and replacement of air line; (X) When air scour is provided, the backwash water must be variable and should not exceed eight (8) gallons per minute per square foot unless operating experience shows that higher rate is necessary to remove scoured particles from the filter media surfaces; (XI) The filter underdrain shall be designed to accommodate air scour piping when the piping is installed in the underdrain; and (XII) Subparagraph (4) (C) 1.J. must be followed when backwashing filters.

Adding Air

Gary Haggard of nozzle manufacturer EnviroQuip provided information on the use of the FlexKleen nozzles with air-assisted backwash. Air can be introduced anywhere beneath the filter floor. No air distribution piping is required, as the air should quickly self-distribute into a 2 - 3" blanket. Gary warned that a deeper air blanket could cause damage. All of the air should enter the 3/16" holes on the side of the nozzles' tailpipes, rather than the bottom of the tailpipes.

While DNR specifies 3-5 scfm/ft² of filter area, EnviroQuip recommends 2 scfm/ft² of filter area, with a maximum of 3. Therefore, we have selected a flow rate of 3 scfm/ft² of filter area, which corresponds to an air flow of 260 scfm.

Compressed Air Supply

Large quantities of compressed air are provided for the power plant operations at Thomas Hill Energy Center. Four large compressors (~7,000 scfm) feed six service air receivers and two large air dryers. The air dryers are about 50 feet from the water treatment filters. With anticipated air requirements for filter backwash of 260 scfm for about five minutes per day, the air requirements are negligible.



Assuming air supply pressure of 100-110 psi, the graph above indicates that a 1.5" air line would be expected to be able to supply almost 500 scfm of air.

The following graph indicates that, even at a flow as high as 500 scfm, a pressure drop of less than 5 psi through one hundred feet of 1.5" air line would be expected. (The filters are about one hundred feet from the air supply.)



note: applied pressure = 100 psig

Existing Backwash Protocol

Filters are currently backwashed based on loss of head. (Specifically, when a filter has six feet of water above the media surface.) This tends to occur every three or four days. A backwash cycle is manually initiated, then controlled by SCADA as follows:

inlet valve closes
outlet valve closes
surface wash pumps turn on
backwash pump turns on (takes a couple minutes to reach full flow of 1,500 gpm)
surface wash pumps turn off
backwash pumps turn off
inlet valve opens
waste rinse valve opens
filter effluent is wasted until turbidity < 0.2 NTU

A complete backwash cycle takes a filter out of service for 60 to 75 minutes and uses about 25,000 gallons of water from the clearwell.

Proposed Backwash Protocol

Backwash protocol will change with the addition of air scour. Certainly, the protocol will evolve over time, but the following general, untimed guidelines are provided as a kickoff point for further refinement.

- 1. inlet valve closes
- 2. outlet valve closes
- 3. filter to waste until water level is at least 6" below washwater troughs
- 4. filter-to-waste valve closes
- 5. air valve opens to initiate air scour
- 6. air scour operates for approximately 4 minutes
- 7. air valve closes
- 8. media is allowed to settle for 1 2 minutes
- 9. backwash pump turns on and is ramped up to 700 gpm*
- 10. backwash pumps run until washwater turbidity < 10 NTU
- 11. backwash pumps turn off
- 12. inlet valve opens
- 13. waste rinse valve opens
- 14. filter effluent is wasted until turbidity < 0.2 NTU
- 15. filter returns to service

* DNR guidelines state that backwash rates must be variable and should not exceed a maximum of 8 gpm/ft² when air scour is provided.

Plans



Specifications

Air piping shall be 1.5" carbon steel.

Solenoid Valves: 1-1/2" Asco Red Hat 8210G56: or approved equal (AC power) Ball Valves: 1.5" Watts Series B6000 bronze ball valve or approved equal Pressure Regulator: 1-1/2" Fairchild # 100512 (2-100psig) or approved equal Air Filter: 1.5" Numatics Filter Model #F50B-12 A or approved equal Flow Meter: 1-1/2" UFM Insite Meter IS-500 SCFM-12-F-F or approved equal equipment literature is appended



Pilot Operated General Service Solenoid Valves

Brass or Stainless Steel Bodies 3/8" to 2 1/2" NPT



Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage
- High Flow Valves for liquid, corrosive, and air/inert gas service
- Industrial applications include:
 - Car wash Laundry equipment
 - Air compressors Industrial water control
 - Pumps

Construction

Valve Parts in Contact with Fluids							
Body	Brass 304 Stainless Steel						
Seals and Discs	NBR or PTFE						
Disc-Holder	PA						
Core Tube	305 Stainless Steel						
Core and Plugnut	430F Stainless Steel						
Springs	302 Stainless Steel						
Shading Coil	Copper Silver						

Electrical

0	Wa	att Ratin Consi	g and Po umption	wer	Spare Coil Part Number				
Standard Coil and			AC		General Purpose Explosionp				
Class of Insulation	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC	
F	-	6.1	16	40	238210	-	238214	-	
F	11.6	10.1	25	70	238610	238710	238614	238714	
F	16.8	16.1	35	180	272610	97617	272614	97617	
F	-	17.1	40	93	238610	-	238614	-	
F	-	20	43	240	99257	-	99257	-	
F	-	20.1	48	240	272610	-	272614	-	
Н	30.6	-	-	-	-	74073	-	74073	
Н	40.6	-	-	-	-	238910	-	238914	
Standard V	Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50								

Hz). 6, 12, 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required.

Solenoid Enclosures

Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I. **Optional:** RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9. (To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B057, 8210B058, and 8210B059, which are not available with Explosionproof enclosures.) *See Optional Features Section for other available options.*





Nominal Ambient Temp. Ranges

RedHat II/
RedHatAC: $32^{\circ}F$ to $125^{\circ}F$ ($0^{\circ}C$ to $52^{\circ}C$)RedHat IIDC: $32^{\circ}F$ to $104^{\circ}F$ ($0^{\circ}C$ to $40^{\circ}C$)RedHatDC: $32^{\circ}F$ to $77^{\circ}F$ ($0^{\circ}C$ to $25^{\circ}C$)

(104°F/40°C occasionally)

Refer to Engineering Section for details.

Approvals

CSA certified. RedHat II meets applicable CE directives. *Refer to Engineering Section for details.*



Specifications (English units)

			Operating Pressure Differential (psi)			Man	Max Eluid						Watt Rating/						
Pine	Orifice	Cv			Max. A	C		Max. D	C	Tem	Fluia p. °F	Bras	ss Body		Stainle	ss Steel B	ody	Insula	tion (7)
Size	Size	Flow	Min	Air-Inert	Water	Light Oil @	Air-Inert	Water	Light Oil @	10	DC	Catalog	Const.	UL ©	Catalog	Const.	UL ®	40	DC
NOBM/	INTERPORT INTERPORT AND A CONTRACT AND A																		
3/8	3/8	1.5	1	150	125	-	40	40	-	180	150	8210G073 3	1P		82106036 ③	1P		6 1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	82106093	5D	-	-	-	-	10 1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	82106001	6D	0	-	-	-	6 1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	82106006	5D	0	-	-	-	17 1/F	-
1/2	7/16	22	1	150	125	-	40	40	-	180	150	8210G015 3	2P		82106037 3	2P		6 1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	82106094	5D	•	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40		175	150	-	-		82106087	7D		17.1/F	11.6/F
1/2	5/8	4	5	200	150	125	125	100	100	180	150	82106002	60	0		-		6.1/F	11.6/F
1/2	5/8	4	5	200	300	300	125	- 100	- 100	175	100	82100002	50					17 1/E	
1/2	3/4	4	5		300		-	300	-	180	125	82106227	50	0	-	-		17.1/F	40.6/H
3/4	5/8	4	0	150	150	125	40	40	-	175	120	-	- 50		82106088	7D		17.1/F	40.0/11
3/4	3/0	4.J 5	5	125	125	125	100	40	75	180	150	82106000		-	02100000	10	•	6.1/E	11.0/T
3/4	3/4	5	0	120	120	120	100	90	75	180	150	82106009	80	0	-	-	-	0.1/F	11.0/F
3/4	3/4	65	5	250	150	100	125	125	125	180	150	82100033	11D	0	-			6 1/E	11.0/T
2/4	2/4	6	0	230	150	100	200	120	120	100	77	02100000 02100006 @ +	100	0	-		-	0.1/1	20.6/
2/4	2/4	6	0	- 250	- 200	200	200	100	100	- 200		8210B020 @ +	10F 40D	-	-	-	-	-	30.0/H
3/4	3/4	10	0	350	300	200	-	-	-	200	-	0210G020 @ +	40P	•	-	-	-	10.1F	-
	1	13	0	- 150	-	-	100	100	80	-	11	8210B054 ‡	310	-	82100089	150	-	-	30.6/H
	1	13		150	125	125	-	-	-	180	-	82106054	41D	•	82106089	450	•	10.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G004	12D	0	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G027 ‡	42P	•	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G078 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B055 ‡	32D	-	-	-	-		30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G055	43D	•	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G008	16D	0	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B056 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G056	44D	•	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G022	18D	•	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	•	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	•	-	-	-	6.1/F	11.6/F
NORMA	ALLY OPE	N (Open	when a	le-energiz	ed), NBR	Seating (PA I	Disc-Holde	r, except a	as noted)										
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G033	23D	•	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G011 ® 9	39D	•	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G034	23D	•	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G030	37D	•	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G012 ® 9	39D	•	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G035	25D	•	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G038	38D	•	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C013	24D	•	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G013	46D	•	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B057 @ @	34D	•	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D014	26D	•	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G014	47D	•	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B058 6 10	35D	•	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D018	28D	•	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G018	48D	•	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B059 @ 10	36D	•	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D032	29D	•	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G032	49D	•	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210 103	30P	•	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	•	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210 104	27P	•	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	•	-			16.1/F	-
	, .		, <i>"</i>				1	1		1.50				-	I	1	I		L

① 5 psi on Air; 1 psi on Water.

② Valve provided with PTFE main disc.

avalve provides ultrer main usc.
 avalve includes Ultem (G.E. trademark) piston.
 a) Letter "D" denotes diaphragm construction; "P" denotes piston construction.
 a) Safety Shutoff Valve;

 General Purpose Valve.
 Refer to Engineering Section (Approvals) for details.

[®] Valves not available with Explosionproof enclosures.

 $\ensuremath{\textcircled{O}}$ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.

(8) AC construction also has PA seating.

No disc-holder.

Stainless steel disc-holder.# Must have solenoid mounted vertical and upright.

ASCO

Specifications (Metric units)

<u> </u>			Operating Process Differential (bar)			Max.						Watt Rating/							
								Man D	0	Flu	id	Brea	. Dedu		Otoinlas	o Oto al Da	d	Class	of Coil
Pipe	Orifice	Kv Flow			IVIAX. A	تا 		Max. D	U	Tem). U	Bras	SS BODY		Stainles	SS Steel Bo	ay	Insula	lion @
Size (ins.)	Size (mm)	Factor (m3/h)	Min.	Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU	AC	DC	Catalog Number	Const. Ref. ④	UL © Listing	Catalog Number	Const. Ref. 4	UL © Listing	AC	DC
NORMA	RMALLY CLOSED (Closed when de-energized), NBR or PTFE @ Seating																		
3/8	10	1.29	1	10	9	-	3	3	-	82	65	8210G073 3	1P	•	8210G036 3	1P	٠	6.1/F	11.6/F
3/8	16	2.57	0	10	10	-	3	3	-	82	65	8210G093	5D	0	-	-	-	10.1/F	11.6/F
3/8	16	2.57	0.3	14	10	9	9	7	7	82	65	8210G001	6D	0	-	-	-	6.1/F	11.6/F
3/8	16	2.57	0.3	21	21	21	-		-	79	-	8210G006	5D	0	-	-	-	17.1/F	-
1/2	11	1.89	1	10	9	-	3	3	-	82	65	8210G015 3	2P	•	8210G037 3	2P	•	6.1/F	11.6/F
1/2	16	3.43	0	10	10	-	3	3	-	82	65	8210G094	5D	0	-	-	-	10.1/F	11.6/F
1/2	16	3.43	0	10	10	9	3	3	-	79	65	-	-	-	8210G087	7D	•	17.1/F	11.6/F
1/2	16	3.43	0.3	14	10	9	9	7	7	82	65	8210G002	6D	0	-	-	-	6.1/F	11.6/F
1/2	16	3.43	0.3	21	21	21	-	-	-	79	-	8210G007	5D	0	-	-	-	17.1/F	-
1/2	19	3.43	0.3	-	21	-	-	21	-	82	52	8210G227	5D	0	-	-	-	17.1/F	40.6H
3/4	16	3.86	0	10	10	9	3	3	-	79	65	-	-	-	8210G088	7D	•	17.1/F	11.6/F
3/4	19	4.29	0.3	9	9	9	/	6	5	82	65	8210G009	9D	0	-	-	-	6.1/F	11.6/F
3/4	19	4.29	0	10	10	-	3	3	-	82	65	82106095	41D	0	-	-	-	10.1/F	11.6/F
3/4	19	5.57	0.3	17	10	1	9	9	9	82	65	8210G003	110	0	-	-	-	6.1/F	11.b/F
3/4	19	5.14 5.14	0	-	-	-	14	12	12	-	20	0210B020 @ +	10P	-	-	-	-	-	30.0/П
3/4	19	0.14 11.14	0	24	21	14	- 7	- 7	-	93	-	0210G020 @ +	40P	•	-	- 15D	-	10.15	- 20.6/⊔
1	25	11.14	0	10	9	9	-	-	-	82	20	82106054	41D	-	82100089	45D	-	- 16.1/F	30.0/H
1	25	11.14	03	10	10	7	a	q	Q	82	65	82106004	12D		-			6 1/F	11.6/F
1	25	11.14	0.0	21	16	8	-	-	-	93	-	82106027 +	42P			-	-	20 1/F	-
1	25	11.57	0.7	21	21	21	-	-	-	79	-	82106078 @	13P	-	-	-	-	17 1/F	-
1 1/4	29	12.86	0	-	-	-	7	7	6	-	25	8210B055 ±	32D	-	-	-	-	-	30.6/H
1 1/4	29	12.86	0	10	9	9	-	-	-	82		8210G055	43D	•	-	-	-	16.1/F	-
1 1/4	29	12.86	0.3	10	10	7	9	9	9	82	65	8210G008	16D	0	-	-	-	6.1/F	11.6/F
1 1/2	32	19.29	0	-	-	-	7	7	6	-	25	8210B056 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	32	19.29	0	10	9	9	-	-	-	82	-	8210G056	44D	•	-	-	-	16.1/F	-
1 1/2	32	19.29	0.3	10	10	7	9	9	9	82	65	8210G022	18D	•	-	-	-	6.1/F	11.6/F
2	44	36.86	0.3	10	9	6	3	3	3	82	65	8210G100	20P	•	-	-	-	6.1/F	11.6/F
2 1/2	44	38.57	0.3	10	9	6	3	3	3	82	65	8210G101	21P	•	-	-	-	6.1/F	11.6/F
NORMA	LLY OPEN	l (Open wi	nen de-e	energized),	, NBR Sea	ating (PA Dis	c-Holder, e	except as	noted)										
3/8	16	2.57	0.0	10	10	9	9	9	6	82	65	8210G033	23D	•	-	-	-	10.1/F	11.6/F
3/8	16	2.57	0.3	17	14	14	17	14	14	82	82	8210G011 8 9	39D	•	-	-	-	10.1/F	11.6/F
1/2	16	3.43	0	10	10	9	9	9	6	82	65	8210G034	23D	•	-	-	-	10.1/F	11.6/F
1/2	16	2.57	0	10	10	7	9	9	6	82	65	-	-	-	8210G030	37D	•	10.1/F	11.6/F
1/2	16	3.43	0.3	17	14	14	17	14	14	82	82	8210G012 ® 9	39D	•	-	-	-	10.1/F	11.6/F
3/4	19	4.71	0	10	10	9	9	9	6	82	65	8210G035	25D	•	-	-	-	10.1/F	11.6/F
3/4	16	2.57	0	10	10	7	9	9	6	82	65	-	-	-	8210G038	38D	•	10.1/F	11.6/F
3/4	19	5.57	0.3	-	-	-	17	14	14	-	82	8210C013	24D	•	-	-	-	-	16.8/F
3/4	19	5.57	0.3	1/	14	14	-	-	-	82	-	8210G013	46D	•	-	-	-	16.1/F	-
1	25	11.14	0	9	9	9	-	-	-	82	-	8210B057 6 10	34D	•	-	-	-	20/F	-
1	20	11.14	0.3	- 10	- 10	-	9	9	9	-	82	8210D014	20D	•	-	-	-	-	10.8/F
1 1/4	20	10.06	0.3	10	10	9	-	-	-	02 02	-	02100014	47D 25D	•	-	-	-	10.1/F	-
1 1/4	29	12.00	03	9	9	9	-	-	-	02	82	8210D018	280		-	-	-	20/F	- 16.8/E
1 1/4	29	12.00	0.3	10	10	9	-	-	-	82	-	82106018	48D		-	-	-	- 16 1/F	
1 1/2	32	19.20	0.0 0	a 10	۰ <i>0</i>	0 0		-		82	-	8210B050 @ @	360					20/F	
1 1/2	32	19.29	0.3	-	-	-	9	9	9	-	82	8210D032	29D		-	-	-	-	16.8/F
1 1/2	32	19,29	0.3	10	10	9	-	-	-	82	-	8210G032	49D	•	-	-	-	16.1/F	-
2	44	36,86	0.3	-	-	-	9	9	9	-	65	8210 103	30P	•	-	-	-	-	16.8/F
2	44	36.86	0.3	9	9	9	-	-	-	82	-	8210G103	50P	•	-	-	-	16.1/F	-
2 1/2	44	38.57	0.3	-	-	-	9	9	9	-	65	8210 104	27P	•	-	-	-	-	16.8/F
2 1/2	44	38.57	0.3	9	9	9	-	-	-	82	-	8210G104	51P	•	-	-	-	16.1/F	-
@ 0.2 h	or on Air	0.0 hor on	Watar			1			@ Values p		abla u	with Explosionprov	of analoguu						

⊕ 0.3 bar on Air; 0.0 bar on Water.
@ Valve provided with PTFE main disc.
@ Valve includes Ultem (G.E. trademark) piston.
@ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
@ ○ Safety Shutoff Valve; ● General Purpose Valve. *Refer to Engineering Section (Approvals) for details.*

Stainless steel disc-holder.
4 Must have solenoid mounted vertical and upright.

8210R1



Dimensions: inches (mm)

Const. Ref.		н	К	L	Р	w		
1*	ins.	3.85	3.00	1.91	3.41	1.69		
	mm	98	76	49	87	43		
2*	ins.	4.17	3.25	2.28	3.63	1.69		
-	mm	106	83	58	92	43		
5	ins.	3.84	2.31	2.75	3.28	2.28		
	mm	98	59	70	83	58		
6*	ins.	3.38	1.94	2.75	2.80	2.28		
	mm	86	49	70	71	58		
7	ins.	4.19	2.50	2.81	3.47	2.39		
	mm	106	64	71	88	61		
8	ins.	4.13	2.47	2.81	3.44	2.29		
	mm	105	63	71	87	58		
q*	ins.	3.66	2.10	2.81	2.96	2.28		
	mm	93	53	71	75	58		
10*	ins.	5.25	Х	2.81	4.59	2.31		
	mm	133	Х	71	117	59		
11*	ins.	4.16	2.66	3.84	3.52	2.75		
	mm	106	68	98	89	70		
12	ins.	5.64	3.15	3.75	4.01	3.36		
12	mm	143	80	95	102	85		
13	ins.	4.44	3.22	3.75	4.19	5.81		
10	mm	113	82	95	106	147		
15*	ins.	5.34	Х	3.75	4.47	3.84		
10	mm	136	Х	95	114	98		
16	ins.	5.64	3.15	3.66	4.01	3.56		
	mm	143	80	93	102	90		
18	ins.	6.11	3.30	4.38	4.16	3.92		
	mm	155	84	111	106	100		
20*	ins.	7.33	3.71	5.06	4.57	4.87		
	mm	186	94	129	116	124		
21*	ins.	7.33	3.71	5.50	4.57	4.87		
	mm	186	94	140	116	124		
23	ins.	4.35	2.65	2.75	3.79	2.28		
	mm	110	67	70	96	58		
24	ins.	5.06	X	3.78	4.44	2.75		
	mm	129	Х	96	113	70		
25	ins.	4.64	2.81	2.81	3.94	2.28		
	mm	118	71	71	100	58		
26	ins.	6.53	X	3.75	4.91	3.19		
	mm	166	X	95	125	81		
27	ins.	8.22	X	5.50	5.47	4.87		
	mm	209	Х	140	139	124		
28	ins.	6.53	Х	3.66	4.91	3.19		
	mm	166	X	93	125	81		
29	ins.	7.03	Х	4.38	5.06	4.40		
	mm	179	Х	111	129	112		
* DC dimensions slightly larger. IMPORTANT: Valves may be mounted in any								

position, except as noted in specifications table.



Const. Ref. 13



W ΠŤ ſГТ н NPT BOTH ENDS

Const. Ref. 5-9, 11, 20, 21, 23, 25, 37,38





Dimensions: inches (mm)

Const. Ref.		Н	K	L	Р	w
20	ins.	8.22	Х	5.06	5.47	4.87
30	mm	209	Х	129	139	124
21	ins.	5.25	Х	3.75	4.44	3.25
51	mm	133	Х	95	113	83
32	ins.	5.69	Х	3.66	4.69	3.25
02	mm	145	Х	93	119	83
33	ins.	6.06	Х	4.38	4.94	3.91
	mm	154	Х	111	125	99
34	ins.	6.91	Х	3.75	6.09	3.25
04	mm	176	Х	95	155	83
35	ins.	7.34	Х	3.66	6.34	3.25
	mm	186	Х	93	161	83
36	ins.	7.66	Х	4.38	6.56	3.91
	mm	1.95	Х	111	167	99
37	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
38	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
39	ins.	5.42	2.31	2.75	4.86	3.80
	mm	138	59	70	123	97
40	ins.	5.20	3.29	2.81	4.50	2.28
-10	mm	132	83	71	114	58
41	ins.	5.13	3.10	3.75	4.32	3.25
	mm	130	79	95	110	83
42	ins.	6.43	4.40	3.93	5.62	3.25
	mm	163	112	100	143	83
43	ins.	5.57	3.35	3.66	4.57	3.25
	mm	142	85	93	116	83
44	ins.	5.90	3.57	4.38	4.79	3.91
	mm	150	91	111	122	99
45	ins.	5.26	3.17	3.75	4.38	3.84
	mm	134	81	95	111	98
46	ins.	4.95	3.10	3.84	4.31	2.75
	mm	126	79	98	110	70
47	ins.	6.43	3.59	3.75	4.81	3.52
	mm	163	91	95	122	90
48	ins.	6.43	3.59	3.66	4.81	3.73
	mm	163	91	93	122	95
49	ins.	6.91	3.75	4.38	4.96	4.40
	mm	176	95	111	126	112
50	ins.	8.13	4.15	5.06	5.37	4.87
	mm	207	105	129	136	124
51	ins.	8.13	4.15	5.50	5.37	5.18
	mm	207	105	140	136	132
IMPORTA position,	NT: Va except	alves ma as note	ay be m ed in sp	ounted ecificati	in any ons tabl	le.





Const. Ref. 12, 16, 18





2/2 SERIES 8210 2-WAY



Dimensions: inches (mm)



Model 100

High Flow Pressure Regulator





Operating Principles

The Model 100 High Flow Pressure Regulator is designed for use in control systems requiring unusually high flow capacities. Like many of the Fairchild regulators, the compensating action of the inner valve assembly of the Model 100 allows complete stabilization of downstream pressure.

This high quality unit, which operates as efficiently on shop air as on dry instrument air, offers unusual versatility and economy. The Model 100 is capable of providing precise control of set point and good sensitivity under high flow conditions, and is the ideal choice for many demanding applications, including main header regulator control, large nip roll loading, and clutch brake operation.





Cross Section Model 100 Regulator Detail Drawing

General Information

- Can be set within 1/2" (1.27 cm) of water. Responds to equally minute changes in downstream pressure.
- Venturi-type aspirator tube to aid stability to minimize downstream pressure droop under flowing conditions.
- Balanced supply valve to minimize effect of supply pressure variation.
- Control Chamber isolates the control diaphragm.
- Operates equally well on shop air or clean, dry instrument air.
- May be serviced and maintained without removal from line.
- Mounting Bracket available

336-659-3400 • www.fairchildproducts.com

Outline Dimensions



Specifications

Flow Capacity	In excess of 1500 SCFM (2550 m³/HR) (100 psig, [7.0 BAR], (700 kPa) supply, 1 1/2" NPT Conn. 40 psig, [2.8 BAR], (280 kPa) setpoint
Exhaust Capacity	44 SCFM (75 m³/HR) for downstream pressure 5 psig, [.35 BAR], (35 kPa) above 20 psig set pressure
Maximum Supply Pressure	250 psig, [17.0 BAR], (1700 kPa)



Mounting Bracket

Part Number: 10308 (sold separately)



Specifications

Sensitivity	0.5" (1.27 cm) Water Column
Supply Pressure Effect	Less than 0.1 psig, [.007 BAR], (.7 kPa) per 100 psig, [7.0 BAR], (700 kPa) change
Ambient Temperature Limit	-40°F to +200°F (-40°C to +93.3°C)



Typical Application

A Model 100 Regulator is used to pressurize a water storage tank which supplies water to a test stand run. Water supply pressure to test stand must be adjustable and, when set to the desired value, must remain stable and at a nearly constant value. When a pressure drop to a lower pressure level setting is required, the Model 100 must exhaust the air pressure in the tank as quickly as possible to avoid unnecessary delay awaiting tank pressure to assume the lower pressure setting.



Service Information

A Service Kit is available for the Model 100. Please see the *Fairchild Model 100 High Flow Pressure Regulator Installation, Operation and Maintenance Instructions*, IS-10000100.

Catalog Information

	-				L
Press	ure Rang	e			
psig	[BAR]	(kPa)			
0-10	[0-0.7]	(0-70)	2		
0.5-30	[0.035-2]	(3.5-200)	3		
1-60	[0.07-4]	(7-400)	4		
2-100	[0.14-7]	(14-700)	5		
2-150	[0.14-10]	(14-1000)	6		
Pipe S	bize				
1" NPT				08	
1 1/2" N	NPT			12	
Optio	ıs				
Tapped	Exhaust				E
Non-Re	lievina				N
Tampor	Proof				-





precision pneumatic & motion control

Fairchild Industrial Products Company 3920 West Point Boulevard • Winston-Salem, NC 27103 phone: 336-659-3400 • fax: 336-659-9323 sales@fairchildproducts.com • www.fairchildproducts.com

CS-10000100 Rev. Q 11/05 Litho in USA

UNIVERSAL® Flow Monitors Inc.



INSITE[®] Series PX - IS Flow Rate Indicators and Switches



ITTIME FIOW MELEIS

- Fluid is always in sight
- Direct reading English or Metric
- Mount in any position
- Plumb with threaded pipe
- Pressure drop only 4 PSI at full scale flow
- Electric switches available
- Cost effective

General Description

DIRECT READING scales are offered for liquid in GPM or LPM, and for air (at 90 PSI) in SCFM or SLPM.

Maximum liquid flow is 3 GPM (20 LPM) to 50 GPM (200 LPM).

Maximum air flow is 50 SCFM (1400 SLPM) to 500 SCFM (14000 SLPM).

(For other units consult factory.)

EASY TO READ because of the large diameter knife-edged piston. The piston edge remains visible even through cloudy liquids.

PUT IN ANYWHERE

Horizontally, vertically, or in between. A spring-loaded piston is used instead of a gravity float. Straight pipe runs are not required, either before or after the meter.

PIPE IT RIGHT IN

The durable metal end fittings (available in various materials) are threaded directly to male NPT pipe. PVC end fittings are also available for applications that aggressively attack metals. Straight threaded fittings are optional at special request.

LITTLE POWER LOSS

Maximum pressure drop at full scale flow is only 4 PSI. It does not increase beyond rated flow because the tube I.D. opens up to easily pass twice the rated maximums.

EASY MAINTENANCE

By unscrewing the O-ring-sealed outlet fitting, all working parts (there are only three) are easily removed. The shaft, spring, piston and the large tapered bore make for easy cleaning.

HOW IT WORKS:

Fluid moves the piston against the spring enough to pass a given flow around the piston periphery. The edge of the piston is visible through the transparent tube. Its position is read from a printed scale on the tube.



Quick Guide to Insite Models

INSITE Inline Flow Meters for Water, Compressed Air, and Nitrogen Gas

Visual indication and verification of flow rate used in cooling water and process water applications. Visual indication of Compressed Air and Nitrogen. Some applications include compressor output verification, tool usage and leak detection, blanketing and purging.

INSITE Inline Flow Meters for Ultra Pure Water

See Page 3

Visual indication of Ultra Pure water flow rate on tools, Deionized water return lines and UPW wetbench returns.

Note: For other applications please consult our factory.



Inline Flow Meters

Ultra Pure Water Insite Series

For Ultra Pure Water indication of flow rate to tools, on deionized water returns, and UPW returns

- Class 1000 cleaning available
- Electro polished stainless steel shaft and spring available
- PVDF (Kynar) end fittings
- Kalrez® seals

Typical Applications:

Deionized Water Ultra Pure Water Distilled Water Demineralized

Construction Materials

Clear Polysulphone Tube and Piston Flow Indicator 316 Stainless Steel Spring and Shaft Viton[®] or Kalrez[™] Seals End Fitting Materials offered:

PVDF and 316 Stainless Steel

Specifications

Maximum Flow Ranges	5GPM(20LPM) - 50GPM(200LPM)						
Process Connection Sizes (NPTF) Small Tube: 1/2", 3/4", &							
	Large Tube: 3/4", 1", 1-1/2"						
Note: Consult factory for S.A.E. St	raight Threads, JIS, Unions, etc. connections.						
Required Pipe Diameters	None						
Pressure Drop	4 PSI @ full scale flow						
Accuracy	± 5% of full scale flow						



For higher temperatures and pressures consult factory.



HOW TO ORDER FLOW METERS: Select appropriate symbols, and build an ordering code as shown.







Inline Flow Meters

Flow Indication of Water, Compressed Air, or Nitrogen

Typical Applications:

- Cooling Water Process Water Weld Water Compressed Air Nitrogen Blanketing & Purging
- Scrubber Water Potable Water Condensate (Water) Ground/Pond Water Pool Water

Construction Materials

Clear PVC Tube and Piston Flow Indicator

Optional Clear Polysulfone Tube and Piston Flow Indicator

316 Stainless Steel Spring and Shaft

Viton[®] Seals

End Fitting Materials offered: Brass, Aluminum, 316 Stainless Steel, & PVC

Specifications

Maximum Flow RangesFor liquids:	3GPM(20LPM) 50GPM(200LPM)
For Air or Gas (@ 90 PSI): 50SCFM(4005	SLPM) - 500SCFM(140000SLPM)
Process Connection Sizes (NPTF)	Small Tube: 1/2", 3/4", & 1"
	Large Tube: 3/4", 1", & 1-1/2"
Note: Consult factory for S.A.E. Straight Thr	eads, JIS, Unions, etc. connections
Required Pipe Diameters	None
Pressure Drop	
Accuracy	± 5% of full scale flow

Temperature & Pressure

	FLUID Temp.			Max. Pressure					
	(°F)	(°C)		PSIG	BAR	PSIG	BAR		
Γ		PVC							
	70	21		200	13.79	100	6.90		
	100	38		100	6.90	50	3.45		
	125	52		75	5.17	35	2.41		
	150	65		50	3.45	25	1.72		
	POLYSULFONE								
	230	110		250	17.24	125	8.62		

For chemical compatibility consult factory.



Universal Flow Monitors, Inc.



HOW TO ORDER FLOW METERS:

Select appropriate symbols, and build an ordering code as shown.

EXAMPLE:								
PX - 30 GPM - 8 - F - F								
	SPECIAL OPTIONS:							
	(No Symbol = None) IS1 = Installed with One Switch Kit IS2 = Installed with Two Switch Kit ST = Stainless Steel Identification Tag BVB = Brass ball valve and pressure gauge BVS = Stainless steel ball valve and pressure gauge FL = LED Switch Indicator Light							
	SEAL MATERIAL							
	F = Viton Consult factory for other materials							
	FITTING MATERIAL							
	D = Aluminum F = Brass I = 316 stainless steel V = PVC* *PVC tube material (series PX) only							
	PORT SIZE (NPT)							
	MAX FLOW SIZE & UNITS							
	(Consult factory for calibrated increments) WATER AIR							
	SMALL SERIES							
	GPM LPM SCFM SLPM 3 - - - 5 20 50 1400 10 38 100 (PVC=90) 2500 15 15 55 135 3600							
	LARGE SERIES							
	GPM LPM SCFM SLPM 20 75 200 5500 30 110 300 8000 40 150 400 11000 50 200 500 14000							
	TUBE MATERIAL PX = PVC (3 to 50 GPM)							



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