

Harmsco Filtration Product's Summary of EPA Report

*“Results of Bag and Cartridge Filtration Studies
Conducted at The U.S. EPA Test & Evaluation
Facility and at Field Locations in Minnesota
And Washington”*

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[Harmsco Filtration Products](#) offers filtration systems that have been proven to meet the stringent EPA Removal Standards for Cryptosporidium and Giardia. These filtration systems are targeted to one of the largest water filtration markets, the 35,000 communities that service less than 10,000 residents.

[Harmsco's](#) Filtration Systems have been successfully installed in numerous small and transient community water systems. **Contact a Customer Service Representative for test results available for several of these systems. (Graphs of log removal for PP-HC-170-1 in a HUR-170-HP housing are shown in Fig.3 & Fig.7)**

In May 2005 the EPA released the **Results of Bag and Cartridge Filtration Studies Conducted at the U.S. EPA Test & Evaluation Facility and at Field Location in Minnesota and Washington.**

“The purpose of these tests was to establish the performance of various bag filters and cartridge filters, singly and in combination, in meeting the standards mandated by the SDWA while qualitatively evaluating run times and the cost of filtration.”¹

The tests were all conducted with a Bag Filter followed by a Cartridge Filter. Several different combinations of bag and cartridge filters were tested to evaluate their performance in removing turbidity, particulate matter and 3 micron Polystyrene Beads. The tests were conducted at different flow rates, including the maximum design flow rate for the filter as specified by the manufacturer. The filters were tested with the challenge particulate during three periods over the filtration cycle.

[Harmsco's](#) 1-micron absolute filter was paired with 2 different bag filters. During 3 tests the bag filter split, but the [Harmsco](#) filter managed to maintain an over 2-log reduction in the worst case scenario and over 3-log in the other two instances

In the test where the bag did not fail the combination of [Harmsco's](#) 1 micron absolute filter and a bag filter had greater than a 3-log removal with 61 days run time and processed 18 million gallons of water. “The filter performed well when tested clean as well as when fouled, indicating that this combination may be less prone to breakthrough under high differential pressures.”¹

The only other combination of Bag and Cartridge filter that met the 3-log reduction had VERY short run cycles. The longest being only 34 minutes verses [Harmsco's](#) 61 days. (Review results in attached Table 4-2 from the EPA Report referenced)

¹ Results of Bag and Cartridge Filtration Studies Conducted at the U.S. EPA Test & Evaluation Facility and at Field Location in Minnesota and Washington

**Table 4-2
Summary of Bag and Cartridge Filter Runs in Series**

Run Number	Primary Housing	Secondary Housing	Average Turbidity (NTU)			Bead Studies					Run Length	Comments
			Inlet	In Between	Outlet	Filter Status	Injected beads/mL	Total Injected Beads	Total Recovered Beads	Log Removal		
1	GAF bag - 1 micron nominal	Cycon cartridge - 1 micron absolute	1.6	Not taken	Not taken	Clean	1.67E+06	8.35E+08	1.53E+05	3.74	32 minutes	Pressure drop reached 40 psi in 32 minutes.
2	GAF bag - 1 micron nominal	Cycon cartridge - 1 micron absolute	0.7	Not taken	Not taken	Clean	2.07E+06	1.04E+09	2.83E+04	4.56	34 minutes	Pressure drop reached 40 psi in 34 minutes.
3	GAF bag - 1 micron nominal	Cycon cartridge - 1 micron absolute	0.6	0.4	0.25	Clean	1.07E+05	5.35E+07	2.83E+04	3.28	22 minutes	Pressure drop reached 40 psi in 22 minutes.
4	GAF bag - 1 micron nominal	Harmsco cartridge - 1 micron absolute	0.2	0.2	0.1	Clean	1.65E+06	8.25E+08	4.42E+05	3.27	Incomplete after 15hrs 22min. Bag filter split.	Mill Creek water added. Pressure drop at stoppage was 1 psi.
5	GAF bag - 1 micron nominal	Harmsco cartridge - 1 micron absolute	0.15	0.13	0.1	Clean	1.88E+06	9.40E+08	3.46E+05	3.43	Incomplete after 15hrs 50 min. Bag filter split.	No Mill Creek water added. Pressure drop at stoppage was 1 psi.
6	GAF bag - 1 micron nominal	Harmsco cartridge - 1 micron absolute	~0.1	~0.1	~0.1	Clean	3.49E+06	1.75E+09	9.36E+06	2.27	Incomplete after 87hrs 33 min. Bag filter split.	No Mill Creek water added. Pressure drop at stoppage was 1 psi.
7	GAF bag - 1 micron nominal	Harmsco cartridge - 1 micron absolute	~0.1	~0.1	~0.1	Clean	1.84E+06	9.20E+08	8.54E+05	3.03	Approximately 320 hours	No Mill Creek water added. Pressure drop at stoppage was 35 psi.
8	Rosedale bag - 1 micron nominal	Cycon cartridge - 1 micron absolute	0.19	0.11	0.07	Not done. Insufficient run time.				-	Approximately 17 hours	No Mill Creek water added. Flow rate of 0gpm at stoppage.
9	UF Strainrite bag - 1 micron nominal	Harmsco cartridge - 1 micron absolute	0.10	0.10	0.09	Clean	2.78E+06	1.39E+09	9.00E+05	3.19	Run complete after 61 days.	No Mill Creek water added.
						Fouled	5.20E+06	2.60E+09	3.00E+05	3.94		
10	Strainrite bag (SWT1P2S8T)	Strainrite bag (HPM99-XCGD-2SS)	0.12	0.12	0.12	Clean	2.23E+06	1.12E+09	1.97E+06	2.75	Run complete after 15 days.	Tap Water
						Intermediate	3.48E+06	8.70E+08	3.59E+06	2.38		
						Fouled	3.44E+06	8.60E+08	2.31E+06	2.57		
11	Strainrite bag (SWT1P2S8T)	Strainrite bag (GBP1-2SB) in Rosedale housing	0.13	0.15	0.13	Clean	3.48E+06	8.70E+08	9.08E+05	2.98	Run stopped after 49 days. No change in Dp observed.	Tap Water
						Intermediate	3.44E+06	8.60E+08	1.24E+06	2.84		
						Intermediate	3.53E+06	8.83E+06	3.00E+06	2.47		
						Fouled	4.78E+06	1.20E+09	2.80E+06	2.63		

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12	Strainrite bag (SWT1P2S8T)	Strainrite bag (HPM99-CGD 2SS)	0.13	0.15	0.11	Clean	3.53E+06	8.83E+08	4.88E+06	3.26	Run complete after 34 days.	Tap Water
						Intermediate	3.46E+06	8.65E+08	5.38E+06	2.21		
						Fouled	4.78E+06	1.20E+09	3.39E+06	2.55		
13	Strainrite bag (SWT1P2S8T)	Strainrite bag (HPM97-CC-2SS)	~0.2	~0.2	~0.2	Clean	3.65E+06	1.83E+09	2.18E+07	1.92	Run complete after 192 days.	Tap Water
						Intermediate	1.80E+09	1.80E+09	4.00E+06	2.65		
						Crypto Clean	1.00E+06	5.00E+08	8.17E+05	2.70		
14	Strainrite bag (SWT1P2S8T)	Strainrite bag (HPM97-CC-2SS)	~0.2	~0.2	~0.2	Fouled	3.60E+06	1.80E+09	4.00E+06	2.65	Run stopped after 6.4 months to accommodate other	Tap Water
15	None	Strainrite bag (HPM97-CC-2SS)	5.00	NA	0.42	Clean	3.50E+06	1.75E+09	8.60E+07	1.31	Pressure of 35 psi reached in 5.5 hours.	Tap Water + Mill Creek Water
16	Rosedale PS520	Rosedale PS520	2.50	0.18	0.17	Clean	3.66E+06	1.83E+09	5.90E+06	3.49		Tap Water + Mill Creek Water
						Fouled	2.58E+06	1.29E+09	5.95E+06	3.34		
17	Rosedale GLR	Rosedale GLR	2.50	0.23	0.21	Clean	4.16E+06	2.08E+09	5.28E+06	3.60		Tap Water + Mill Creek Water
						Fouled	3.46E+06	1.73E+09	6.60E+06	2.42		
18	Rosedale PS520	Rosedale GLR	2.50	0.25	0.17	Clean	3.40E+06	1.70E+09	7.50E+06	3.36		Tap Water + Mill Creek Water
19	Rosedale GDV Rosedale PS520	Rosedale GLR	2.50	0.30	0.27	Clean	3.40E+06	1.70E+09	4.40E+06	3.59		Tap Water + Mill Creek Water
						Intermediate	3.30E+06	1.65E+09	1.30E+06	3.10		
						Fouled	3.20E+06	1.60E+09	2.11E+06	2.88		
20	Hayward PGF51	Hayward PGF51	2.50	0.45	0.37	Clean	4.86E+06	2.43E+09	2.54E+06	2.98		Tap Water + Mill Creek Water
						Fouled	2.62E+06	1.31E+09	1.20E+06	3.04		

Comments:

- 1) Cyturon cartridges fouled within ~30 minutes even when preceded by a 1 micron nominal bag filter at low turbidities (<2 NTU).
- 2) GAP bags have been prone to splitting. This may be as a result of the length of time the bags had been stored prior to use (~5 years). However, greater than 2 log removal has been achieved even with the split bag (Run 6). Runs 4 & 5 bead studies were done before the bags split.
- 3) Beads removal have been greater than 3 logs with GAP bags followed by Harmsco cartridge (except for Run 6).
- 4) Filter system has been automated completely to shut down when the pressure drop reaches 35 psi. The automated system collects all flow and pressure data for future analysis. This allows for the system to be run 24 hours/day, 7 days/week and should facilitate additional runs which would otherwise not be possible because of long run times (such as 320 hours for Run 7). Furthermore, this relates the experimental runs more closely to that likely to be experienced in the field.