

State Water Resources Control Board

Division of Drinking Water

June 17, 2015

Ms. Cyndi Benson
Harmsco Filtration Products
P.O. Box 14066
North Palm Beach, Florida 33408

Dear Ms. Benson:

Conditional Acceptance of the Harmsco Potable Water Cartridge Filtration System as an Alternative Filtration Technology

PACE Analytical Services, Inc. was hired by Harmsco Filtration Products to perform cartridge filtration seeding studies. PACE Analytical Services Inc. employed IBR Laboratories as a subcontractor to perform the studies. On February 8, 2011 and May 9, 2014, IBR Laboratories conducted and provided results for several cartridge filtration studies. The challenge studies were conducted using 2.0-micron fluorescing latex spheres as a surrogate for *Cryptosporidium* oocysts. The challenge test results provided the basis for granting *Giardia* and *Cryptosporidium* removal credit for the product. Virus removal efficiency was not studied.

The study results were reviewed by the Water Treatment Committee (WTC) of the California State Water Resources Control Board (SWRCB), Division of Drinking Water. Based on our review and pursuant to Section 64653(e)(1), Chapter 17, Title 22, *California Code of Regulations*, the WTC will accept the use of the Harmsco cartridge filtration products HC/40-LT2, HC/90-LT2 and HC/170-LT2 as an alternative filtration technology for water suppliers serving a population of less than or equal to 500 persons because virus removal was not tested as part of the studies. In addition, as specified under Section 64653(g), a supplier serving greater than 500 persons may request a waiver to comply with the requirements to use an alternative filtration technology that has demonstrated 90 percent virus removal. The request shall be based on a watershed sanitary survey conducted within 12 months of the date of the request, and the watershed sanitary survey shall demonstrate a lack of virus hazard in the watershed.

Based on the results of testing, the WTC has determined that the HC/40-LT2, HC/90-LT2 and HC/170-LT2 cartridge filters can be used as an alternative filtration technology to meet the physical removal requirements of the California Surface Water Treatment Rule (SWTR) (California Code of Regulations, Title 22, Division 4, Environmental Health Chapter 17, Article 2, Section 64653(f)), as well as the Federal Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rules (LT1ESWTR, LT2ESWTR), for use on any approved surface source water when used as the core of a complete and well designed, constructed and operated filtration system. Two HC/90-LT2 and two HC/170-LT2 individual cartridge filters were challenge tested using 2.0-micron fluorescing latex spheres as a surrogate for *Cryptosporidium* oocysts.

The products tested were the MUNI 90-MP housing with the HC/90-LT2 filter at 65 gpm and the MUNI-1-2FL-304 housing with the HC/170-LT2 filter at 100 gpm. The MUNI 40-MP housing with the HC/40-LT2 filter (30 gpm capacity) was not tested. The cartridge filter and housing for the MUNI 40-MP and MUNI 90-MP are of the same material and have the same inner and outer cartridge filter diameter. The only differences are the height of the filter and housing. The WTC therefore will accept the HC/40-LT2 filter as achieving the same level of treatment as the HC/90-LT2 filter and housing.

The WTC hereby accepts the list of filter items in Table 1 as an alternative filtration technology for compliance under the California SWTR, LT1ESWTR and the LT2ESWTR.

Municipal Filter Housing Model	Harmsco Cartridge (LT2 Filter) Model	No of Cartridges	Max Flow Rate gpm (LPM)
MUNI 40-MP	HC/40-LT2	1	30 (113)
MUNI 90-MP	HC/90-LT2	1	65 (246)
MUNI-1-2FL-304	HC/170-LT2	1	100 (378)
MUNI-3-3FL-304	HC/170-LT2	3	300 (1,135)
MUNI-5-4FL-304	HC/170-LT2	5	500 (1,892)
MUNI-8-6FL-304	HC/170-LT2	8	800 (3,028)

Notes: MUNI = Municipal Housing; MP = Municipal product; #FL = Flange diameter (inches); LT2 = Long-term 2 rule HC = Harmsco cartridge; 304 = 304 stainless steel; HC/# = pleated surface area for a 5 um pre-filter

Based on the fluorescent microsphere challenge test, the WTC credits the HC/40-LT2, HC/90-LT2 and HC/170-LT2 cartridge filters with the capability of removing at least 2-log *Cryptosporidium* oocysts and 2.5-log *Giardia lamblia* at least 95 percent of the time for treating surface water when operated under the same conditions at which the testing at the IBR Laboratories was conducted. As such, your technology can be used in public water systems serving a population of less than or equal to 500 persons, or public water systems that have requested and qualified for the waiver for virus removal demonstration as specified under Section 64653(g), in the State of California.

Table 2 provides the pathogen removal credit assigned by SWRCB to the filtration components in Table 1 and Table 3 presents the operating and quality control values that the Harmsco filtration system cannot exceed as a condition of this acceptance.

Target Organism	¹Removal Credit	^{2, 4}Removal Credit
<i>Giardia lamblia</i>	2.5-log	3.0-log
<i>Cryptosporidium</i> oocysts	2.0-log	2.5-log
³ Virus	0-log	0-log

1. Removal credit is based on a single LT2 cartridge operation.
2. Removal credit is based on LT2 cartridges installed in series.
3. No challenge testing was conducted for virus removal.
4. Regardless of removal credit, each plant is required to provide a minimum of 0.5-log *Giardia* and 4-log virus inactivation.

Parameter	Value
Maximum Flow Rate & Filter Flux Rate of Primary Filtration System	See Table 4 for flow rates. Maximum filter flux rate: 0.80 gpm/ft ² (32.6 L/m ²)
Max Differential Pressure (as measured across the final filter)	30 psid (2.068 bar); replace with new LT2 filter
Filter Change Out Frequency	Per manufacturer requirement or at least once per year.
^{1,2} Turbidity Performance Standards	0.3 NTU 95% of the time Not to exceed 1.0 NTU
Additional Design Criteria	1. Pressure relief valve to protect filter cartridge from an excessive pressure surge. 2. Filter to waste for 10 minutes after cartridge installation. 3. Means to measure the pressure drop across each filter. 4. Pre-filtration is highly recommended when source water turbidities are 1 NTU or greater.

1. For sources with low influent turbidity (i.e. <0.3 NTU), filtered water turbidity and differential pressure trends must be monitored and evaluated regularly to ensure filter cartridge(s) remains integral.
2. At the discretion of the local regulatory agency, it may allow the use of this technology and establish a site-specific turbidity performance standard greater than what is listed in Table 3 but less than 1.0 NTU when sub-micron particles are identified as the primary cause for elevated turbidities in the treated water.

Specifications for the Harmsco filter housing and filters are provided in Table 4 below.

Filter Housing Model	No. of Cartridges	Filter Housing Height (in)	Service Height (in)	Floor Space (sq. ft.)	Pleated Media Area (sq. ft.)	Max Flow Rate gpm (LPM)	Max Flux Rate (gpm/ft²)
MUNI-40 MP	1	19.5	35	15" x 15"	37.5	30 (113)	0.80
MUNI-90 MP	1	29.9	51	15" x 15"	81.25	65 (246)	0.80
MUNI-1-2FL-304	1	48	77	1.6	125	100 (378)	0.80
MUNI-3-3FL-304	3	64	98.5	4.5	375	300 (1,135)	0.80
MUNI-5-4FL-304	5	74	98.5	8.5	625	500 (1,892)	0.80
MUNI-8-6FL-304	8	84	104.5	14	1,000	800 (3,028)	0.80

Filter Model	O.D. inches	I.D. inches	Molding I.D. inches	Length inches	Max Change Out Pressure psid (bar)	Pleated Media Area (ft²)	Max Flow/Filter (gpm)
HC/40-LT2	7.75	2.75	4.0	9.62	30 (2.068)	37.5	30
HC/90-LT2	7.75	2.75	4.0	19.50	30 (2.068)	81.25	65
HC/170-LT2	7.75	2.75	4.0	30.75	30 (2.068)	125	100

Below in Tables 5-8 are the test results for the HC/170-LT2 and HC/90-LT2 cartridge filtration demonstration study at different filter head losses:

Table 5: HC/170-LT2 (11691-3) – Test Date: February 8, 2011						
	Flow, gpm (Flux Rate, gpm/ft ²)	Differential Pressure, psid	Influent Particles/L 2 micron	Effluent Particles/L 2 micron	Percent Reduction	Log Reduction
Run 1	100 (0.80)	8	7,100	2	>99.9	3.6
Run 2	100 (0.80)	15	6,600	1	>99.9	3.8
Run 3	100 (0.80)	30	7,550	1	>99.9	3.9

Table 6: HC/170-LT2 (11691-4) – Test Date: February 8, 2011						
	Flow, gpm (Flux Rate, gpm/ft ²)	Differential Pressure, psid	Influent Particles/L 2 micron	Effluent Particles/L 2 micron	Percent Reduction	Log Reduction
Run 1	100 (0.80)	7	7,850	1	>99.9	3.9
Run 2	100 (0.80)	15	6,050	1	>99.9	3.8
Run 3	100 (0.80)	32	9,300	2	>99.9	3.7

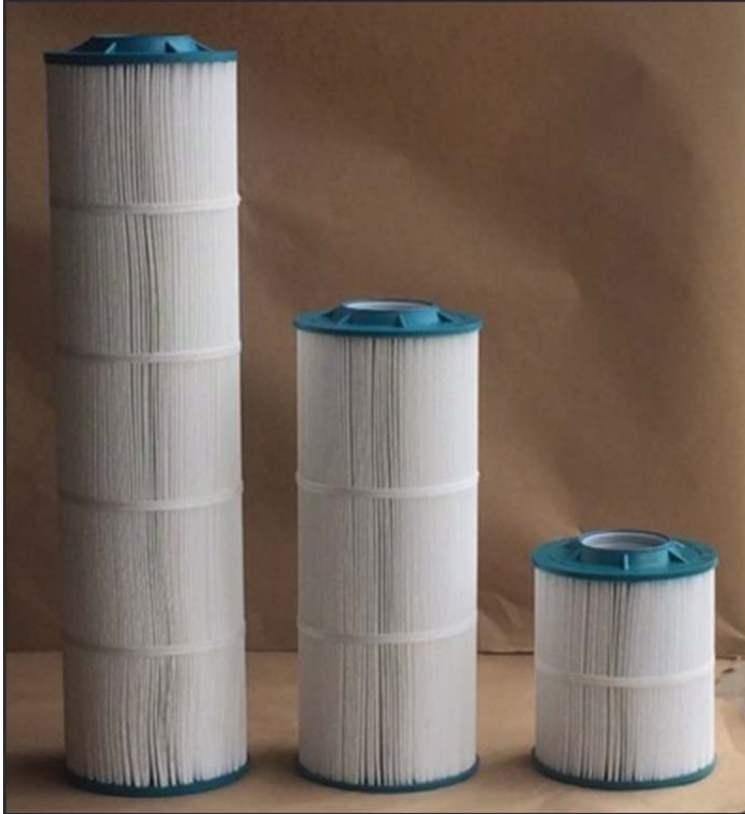
Table 7: HC/90-LT2 (037897) – Test Date: May 9, 2014						
	Flow, gpm (Flux Rate, gpm/ft ²)	Differential Pressure, psid	Influent Particles/L 2 micron	Effluent Particles/L 2 micron	Percent Reduction	Log Reduction
Run 1	65 (0.80)	1.5	11,300	0.3	>99.9	4.5
Run 2	65 (0.80)	15	10,100	3.0	>99.9	3.5
Run 3	65 (0.80)	30	11,400	1.7	>99.9	3.8

Table 8: HC/90-LT2 (037898) – Test Date: May 9, 2014						
	Flow, gpm (Flux Rate, gpm/ft ²)	Differential Pressure, psid	Influent Particles/L 2 micron	Effluent Particles/L 2 micron	Percent Reduction	Log Reduction
Run 1	65 (0.80)	2.4	9,300	0.6	>99.9	4.2
Run 2	65 (0.80)	15	9,000	0.6	>99.9	4.2
Run 3	65 (0.80)	30	12,200	2.3	>99.9	3.7

It should be noted that, as specified in Chapter 8 of USEPA's *Long Term 2 Enhanced Surface Water Treatment Rule Toolbox Guidance Manual*, a 1-log factor of safety for a single filter and 0.5-log factor of safety for multiple filters in series is applied to the allowable removal credit over that demonstrated by challenge testing because bag and cartridge filters cannot have their integrity directly tested; hence, there are no means of verifying their removal efficiency during routine use. And it is our understanding that the primary filters (HC/40-LT2, HC/90-LT2 & HC/170-LT2 final filters) are to be used once and then discarded (no backwashing; no chemical clean in place).

On the next three pages, pictures of the LT2 filter cartridge and filter housings are shown.

Side view of each approved LT2 filter.



HC/170-LT2
100 gpm

HC/90-LT2
65 gpm

HC/40-LT2
30 gpm

Top view of each approved LT2 filter – Filter Identification Markings.

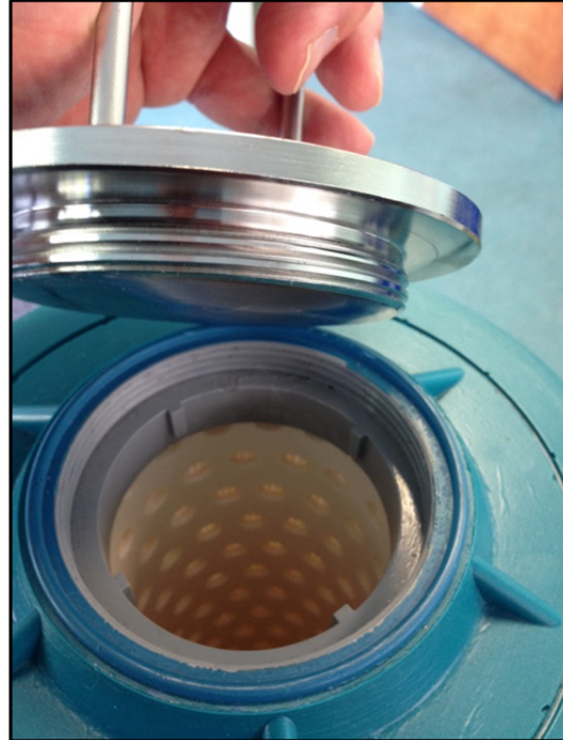


HC/170-LT2
100 gpm

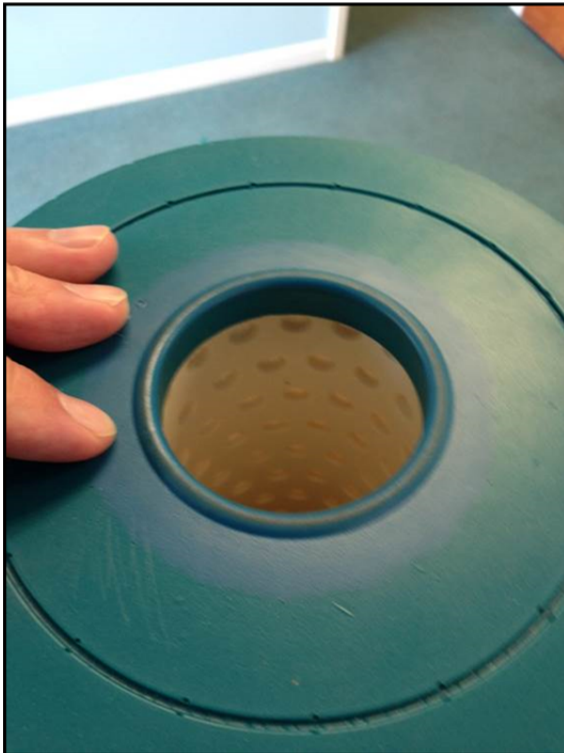
HC/90-LT2
65 gpm

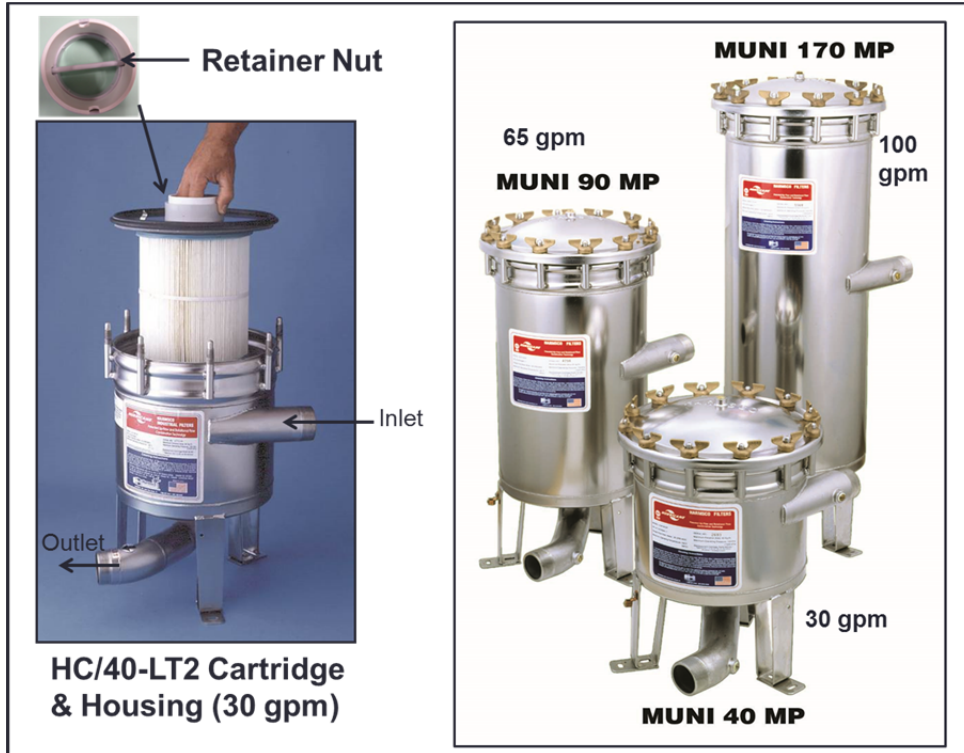
HC/40-LT2
30 gpm

HC/170-LT2 Cartridge with lifting handle



Cartridge Bottom – plastisol (pliable PVC) – inner softer material for proper sealing





Filter housings for the HC/170 – LT2 Cartridge

Conditional Acceptance

Approval for the design and use of your technology in any drinking water application will be handled on a case-by-case basis by the Division of Drinking Water (DDW) district offices or by local primacy agencies (LPA) and is granted through the domestic water supply permitting process. Information such as shop drawings and specifications may be requested to aid in the development of the water supply permit. A commissioning period to assess performance on start-up may be required in an effort to ensure that the final system functions as expected. The DDW district office or LPA is responsible for evaluating the source water quality to be treated, and they will set the overall removal and inactivation requirements that must be met for a given source water.

The minimum log removal requirements established by the SWTR, LT1ESWTR and LT2ESWTR are to be met using multiple treatment barriers. Design engineers proposing to use your alternative filtration technology should be aware that the minimum log removal requirements established by the surface water treatment rules and the water supply permit are to be met using multiple treatment barriers. Your technology is recognized as being one component in this multiple barrier approach.

After any alternative filtration technology installation has been in operation for one year, a report outlining the performance of the installation is to be submitted by the water utility to the DDW or LPA as required by Section 64653(i), Title 22, California Code of Regulations. This report is due within 60 days after the first year of operation. The report is to include, as a minimum, results of all water quality tests performed, an evaluation of compliance with established performance standards under actual operating conditions, an assessment of problems experienced and corrective actions taken or needed, and a schedule for providing needed improvements. These reports should be comprehensive, detailing problems encountered during the first year of operation as well as during startup and commissioning. Production volume treated before terminal headloss, dates of filter changes, treatment performance issues (such as, submicron particles causing exceedances of turbidity performance standards), issues with seals and housing assemblies, etc. should be adequately covered in the report and should cover the period immediately following unpacking and installation (commissioning; troubleshooting) through the first year of production.

Any changes to any feature, formulation, part or product used in the (HC/40-LT2, HC/90-LT2 & HC/170-LT2) filters should be reported (in writing) to SWRCB in advance of making the changes to any production version of the LT2 filters sold in California. The detail of your written notification will be reviewed to determine if additional performance testing will be required. Consequently, the letter and its appendices should provide sufficient detail for the SWRCB WTC to render such a decision. Should additional testing be required, the SWRCB WTC will review all study protocols proposed to be used as a condition of accepting the final report. Upon reviewing the final report, the WTC will make a recommendation regarding acceptance of the identified changes to the design and/or operating criteria.

Should you have any questions, please feel free to contact Mr. Guy Schott at guy.schott@waterboards.ca.gov or by phone at (707) 576-2732 or Mr. Eugene Leung at eugene.leung@waterboards.ca.gov or by phone at (510) 620-3460.

Sincerely,

[Original Signed By]

Guy J. Schott, P.E.
Associate Sanitary Engineer
Technical Operations Section

[Original Signed By]

Eugene H. Leung, P.E.
Senior Sanitary Engineer
Technical Operations Section

cc: Water Treatment Committee