

Legionella & Opportunistic Organisms | Risk Management, Treatment, Monitoring & Testing

Health Care and Hospital – Premise Plumbing for existing buildings



Waterline Technology®

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Waterline Technology Overview

Specialist in Drinking Water Since 1983

- Manufacturer of the filtration cartridge solutions for the Multi-Barrier system
 - Pre Treatment Filtration
 - Particle Size distribution analysis to determine micron size requirement for particulate reduction to prevent short life of CMF technology
 - CMF™ Charged Membrane Filtration
 - Electro Absorptive Technology
 - Microbial Retention
 - Increases UVT
 - Sub micron filtration (especially colloidal materials)
 - Provides NTU reduction <.1 ntu
 - Patented Sealing designs to prevent operator error
- All Products Made in USA



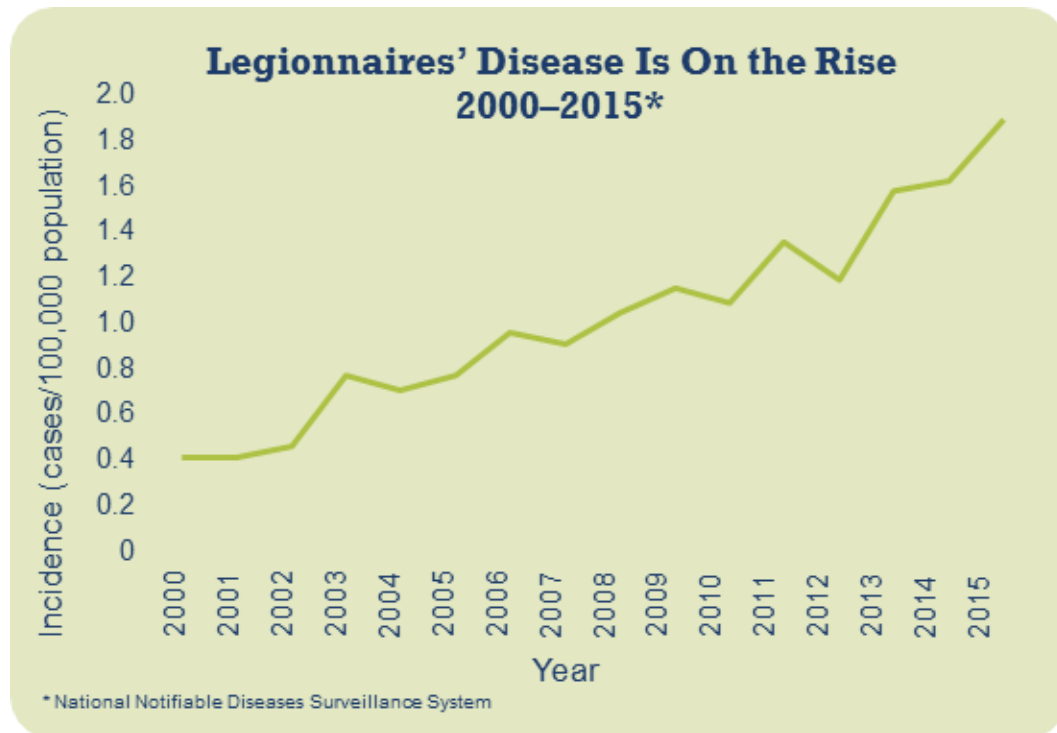
Legionnaires' Disease (LD) is on the Rise 2000-2015

CMS reports that outbreaks are higher in long term care facilities and hospitals.

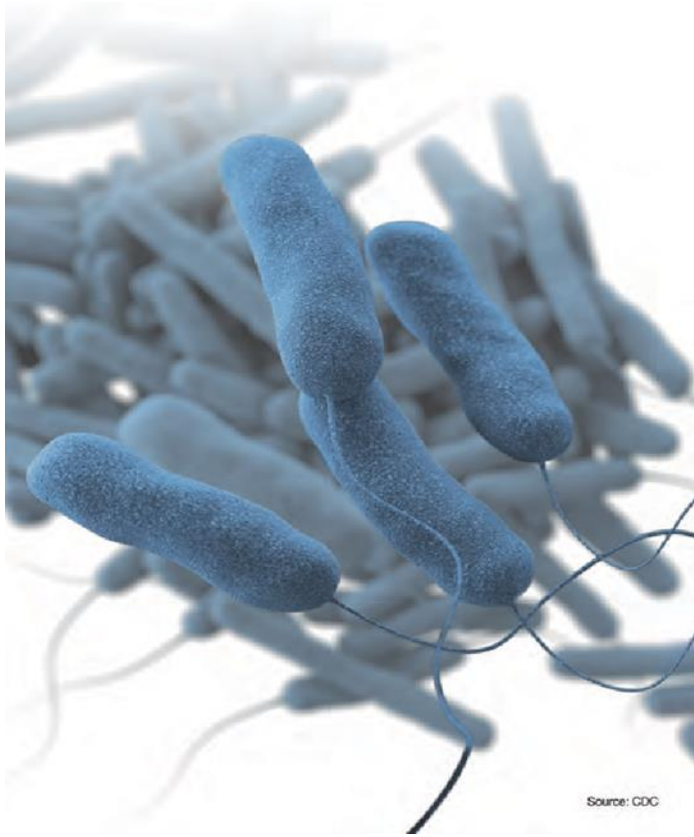
LD increased risk to occur in persons who inhale **aerosolized droplets** of water contaminated with the bacterium Legionella.

High Risk Population

- >50 years old
- Smokers
- Have Chronic disease
- Weakened Immune system



Legionella Ecology



Legionella pneumophila

- Found naturally in freshwater environments
- Has become health problem in building water systems
- Becomes Health Risk when:
 - Grows in numbers
 - Becomes aerosolized

Source: CDC

LD Premise Plumbing Risk Areas

Where can Legionella Grow/Spread?

Examples include:

- Hot and cold water storage tanks
- Water heaters
- Expansion tanks
- Electronic and manual faucets*
- Aerators
- Faucet | sprayers*
- Faucet flow restrictors
- Showerheads* and hoses
- Pipes, valves, and fittings
- Centrally-installed misters*
 - atomizers*, air washers* & humidifiers*
- Non-steam aerosol-generating
 - humidifiers*
- Infrequently used equipment
 - including eyewash stations*
- Ice machines*
- Hot tubs*
- Decorative fountains*
- Cooling towers*

*These devices can spread *Legionella* through aerosols or aspiration

External Building Factors \ LD Growth

- Changes in Municipal water quality
- Water main breaks / leaks
- Construction
 - Vibrations and changes in pressure
 - Dislodge biofilm & free Legionella into water
 - Release of dirt/sediment consumes disinfectant

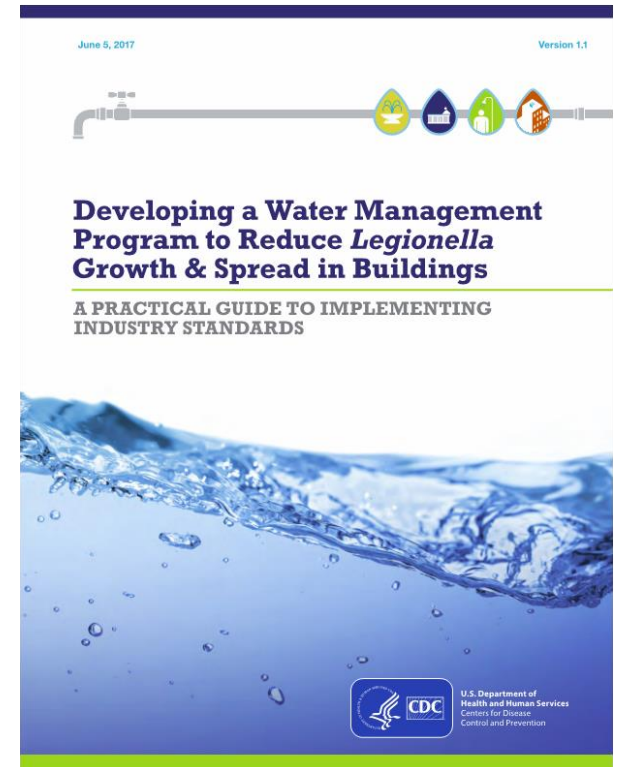
Internal Building Factors \ LD Growth

- **Biofilm** : shields organisms from disinfectant | provides food & shelter to grow
- **Scale & Sediment**: Consumes disinfectants
- **Water Temperature fluctuations**: Optimum growth 77-108 degrees F, can still grow outside these temperatures
- **Water Pressure Changes**: Can dislodge biofilm which colonizes downstream devices
- **pH**: Outside the disinfectants optimum range (greater pH reduces disinfectant efficiency)
- **Inadequate Disinfectant**: Does not kill all | small amounts colonize within premise plumbing to larger numbers
- **Water Stagnation**: Encourages growth
 - Dead legs
 - Unused fixtures
 - Reduced building occupancy

Water Management Plan Do you have | need one?

The **CDC** has developed a “**Practical Guide to Implementing Industry Standards**” using the **ASHRAE 188 Standard to Reduce Legionella Growth & Spread in Buildings!**

CMS has issued a Memorandum (6/2/17) “Requirements to Reduce Legionella Risk in Health Care Facility Water Systems to Prevent Cases & Outbreaks of Legionnaires’ Disease (LD)”
CMS states Non Compliance can result in citations and loss of participation.
Will be conducting surveys of healthcare facilities for compliance!



<https://www.cdc.gov/legionella/maintenance/wmp-toolkit.html>

Legionella & Opportunistic Microbes

Treatment Solutions

The US EPA has completed a Scientific Literature Review of technologies for Legionella Control in Premise Plumbing <https://www.epa.gov/ground-water-and-drinking-water/technologies-legionella-control-premise-plumbing-systems>

Chemical Injection of Disinfectants: State Drinking Water Primacy Agencies consider this “Secondary Disinfection” at the facility as treatment & can classify them as a “Public Water System” subject to Safe Drinking Water Regulations!

- Disinfection By-Products, Changes in Water Quality, Corrosion, Contact time and low flow/use plumbing devices are all negative issues for this control technology

Point of Use / End Point Filtration: Properly designed membrane filters can provide end point protection and high levels of Legionella and other opportunistic organisms reduction for high risk areas/patients/wards within a healthcare facility.

- End point protection is recommended for devices that create aerosols!
Especially in high risk areas/population groups
- Maintenance of devices is critical and needs to be documented
- No Chemical, easy to maintain and high LRV reduction

Legionella & Opportunistic Microbe Monitoring for Non Chemical Treatment

Monitoring for Incoming Supply Disinfectant residual levels:

- Positive management decision, but will not control 100%
- Residual levels from public water can quickly be consumed by internal plumbing issues.

Temperature: Increasing in the temperature of hot water supply will help greatly to reduce the problem. However, increased temperature reduce disinfectant levels.

- >120 degrees F can cause scalding issues.
- Stagnant/low flow hot water lines gradual reduction of water temperature

Flushing of Lines: Unoccupied rooms/areas and low use devices should be periodically flushed to remove stagnant water

Public Notice from Public Water Supplier: While these notices are always after the FACT stored water and ice should be dumped and storage tanks, ice makers, beverage machines, and other devices storing water should be not be used during boil order alerts and sanitized after alert has been lifted!

Legionella & Opportunistic Microbe Testing

Legionella testing: No federal regulations *require routine testing*. If outbreak has occurred the CDC and State Primacy agencies will most likely require testing to determine source of outbreak and proof problem has been addressed.

Note: VA Directive 1061 requires routine testing of 10 samples of hot and 10 of cold water each quarter for VA Facilities at ELITE Certified Labs! Cost >\$150.00 / sample

Legiolert test detects *Legionella pneumophila* in water samples. produce a brown color indicator. The Legiolert test detects *Legionella pneumophila* at 1 organism in 100 mL within 7 days. Costs \$80.00 <https://www.idexx.com/water/products/legiolert.html>

Pseudalert detects *Pseudomonas aeruginosa* at 1 cfu per 100 mL water sample within 24 hours. Costs \$60.00
<https://www.idexx.com/water/products/pseudalert.html>

Legionella - Testing | Argument for Abolishment of Routine Testing

International Journal of Environmental Research and Public Health | Article states:

There is also huge variability in Legionella test results for the same water sample when conducted at different laboratories. However, many guidelines still recommend the testing of water systems.

This commentary argues for the removal of routine Legionella monitoring from all water distribution guidelines. This procedure is **financially consuming and false negatives may result in managers being over-confident with a system or a control mechanism.**

Instead, the presence of the pathogen should be assumed and focus spent on managing appropriate control measures and protecting high-risk population groups.

<https://doaj.org/article/94110fd811bf4bb687c77f15dac4c8f5>

CMF POU/POE Technology

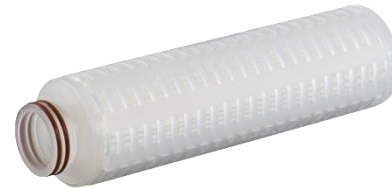
Microbiological Challenge Test Results

CMF 2500 Series Filter System

Organism	Challenge	CMF	
MS2 bacteriophage *	$10^7/100\text{mL}$	>3.0 LRV	
Live Cryptosporidium**	$5 \times 10^5/\text{L}$	5.16 LRV	Note: None detected in effluent samples
RT Bacteria*	$10^7/100\text{mL}$	>99.99 LRV	
Legionella*	$10^7/100\text{mL}$	>99.9 LRV	

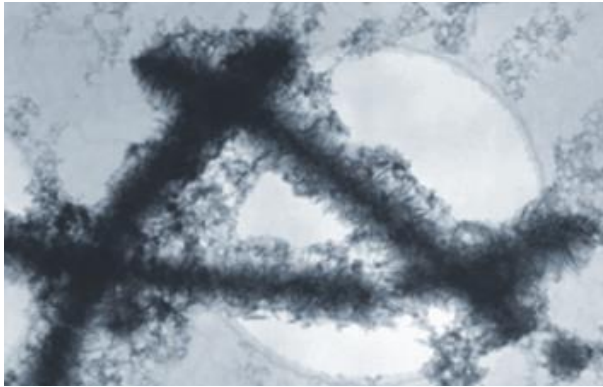
- Test conducted by BCS Laboratories, Gainesville, FL
- ** Test conducted by U.S. EPA T & E Facilities, Cincinnati, OH

For use on hot water up to 200 degree F
Flow rates from 2-40 gpm per cartridge available.



CMF POU/POE Cartridge Filtration Structure

Structure of Media



Based on the mineral pseudoboehmite, $\text{AlO}(\text{OH})$.

Each gram of alumina fiber has a surface area of greater than 500 square meters. The active fibers are 2 nm in diameter and approximately 250 nm in length

The crystal structure of the mineral creates a natural electrokinetic potential of Al^{+++} on the surface of the fiber.

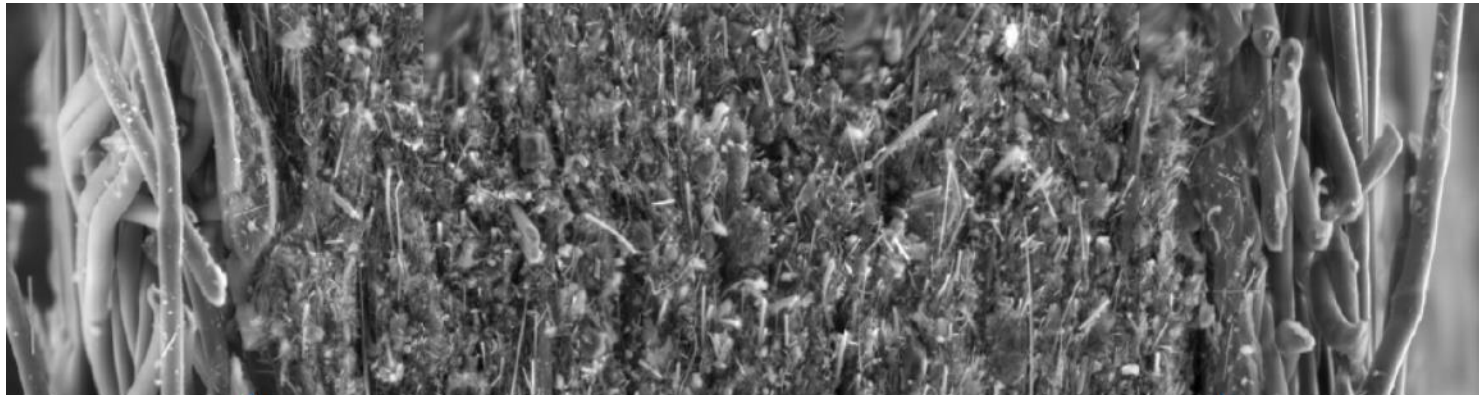
- Therefore not a electrostatic charge, but instead a charge potential -5-9.5 pH range

CMF POU/POE Cartridge Filtration

Active layer details

- CORE IS THE ACTIVE LAYER MEDIA OF CHARGED FIBERS
- SPUNBOND LAMINATE ON TOP/BOTTOM OF MEDIA BINDS CHARGED FIBERS - FOR STRENGTH AND PLEAT SUPPORT

Creates tortuous flow path to with very low pressure drop



Active Layer:

- **Has approx. 400 layers of charged fibers**

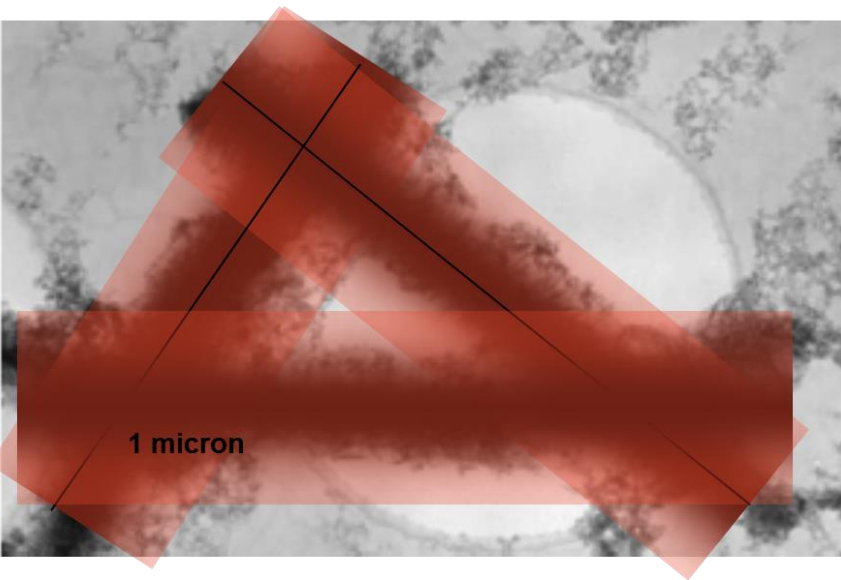
CMF POU/POE Cartridge Filtration

Zeta Potential > 51 millivolt

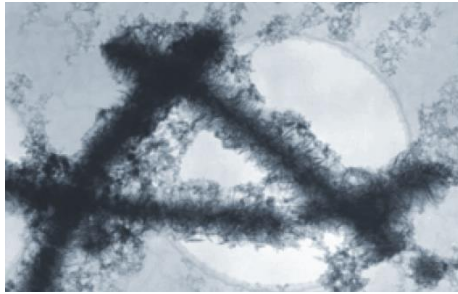
Effective Pore size

The pore size of the media is engineered such that the charge field covers the entire void volume of every pore within the media.

The charge field removes the negatively charged, submicron particles while larger particles are captured within the fiber structure of the media

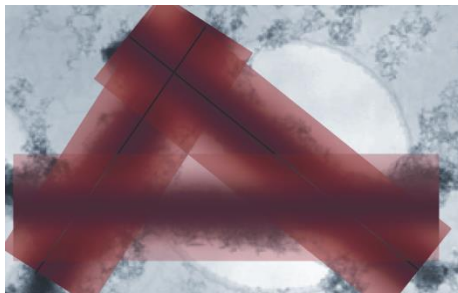


CMF POU/POE Cartridge Filtration Mechanical Filtration & Electro-Adsorption



Contaminant retention & filtration

- The combination of mechanical, and electroabsorptive technology makes this a unique filtration media.
- Unlike traditional filters and membranes that rely on pore size for exclusion, the CMF media retains the contaminants within the media structure!



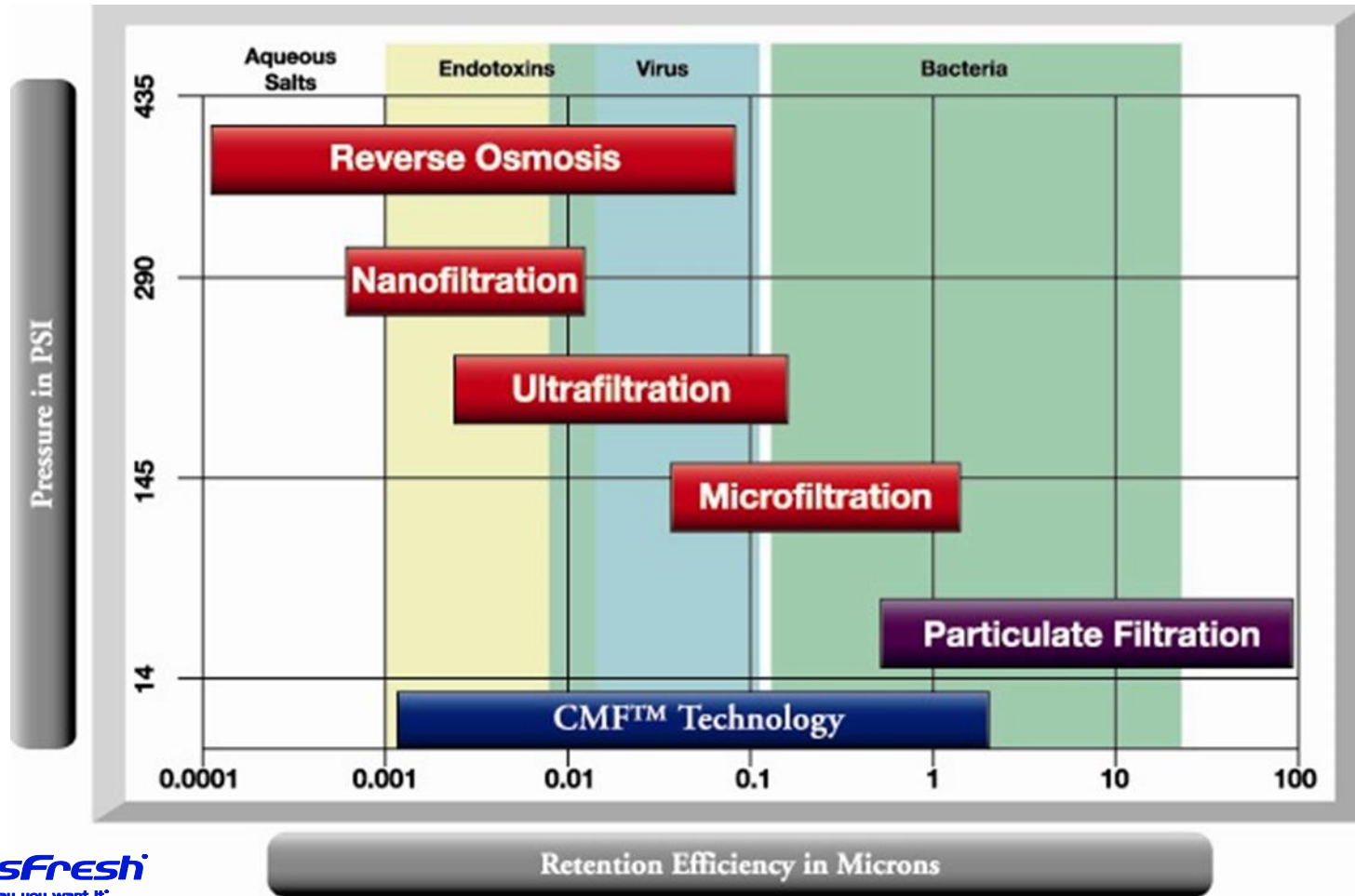
Results:

- Sub micron particles – organic and inorganic
- Biologic materials – virus, bacteria, protozoan cysts and more
- Colloids
- Low pressure drop reduces energy costs

NOTE: Non discriminatory sub micron filtration. Particulate reduction pre treatment is highly recommended!

CMF POU/POE Cartridge Filtration

Provides a retention efficiency that approaches Nano filtration at low pressure requirements



Disposal Issues – Microbial filters

Antimicrobial Additive

- Spent elements and cartridges that remove microbes could become a bio hazard.
- CMF filters have Agion® Silver Zeolite Ions media blended throughout the raw material at time of production for microbial control.
 - This provides a treated article protection which allows cartridges to be disposed of as normal waste.



Filtration Production Process

Quality Control

- Quality Control Relative Value (QCRV)
 - Established on flat sheet material
- Non Destructive Performance Testing (NDPT)
 - Every CMF Charged membrane filter undergoes this testing
 - Reverse Bubble Method
 - Certificate of Compliance Issued for End User
 - Pass/ Fail based upon raw material QCRV
- Production of Cartridges and QC is performed at an ISO Certified Plant by Fortune 500 Company



TMI Faucet / Shower Medical Grade POU Filters | Membrane Technology

Medical Shower or Sink Filters for Legionella and other Opportunistic Organisms.



Faucet / Shower POU Filters Quick Change Design

Medical Shower or Sink Filters for Legionella and other Opportunistic Organisms.



AlwaysFresh
Water the way you want it®



Faucet / Shower POU Filters

Features Benefits

- > log 7 reduction of bacteria
- > log 4 reduction of fungi
- 0.2 micron microfiltration membranes
- CE Medical Class I (s) marked
- Tracking and tracing label for easy replacement administration
- Non-return valve prevents contamination during replacement
- Easy to filter replacement,
- Special key prevents unwanted change-outs
- Less waste, and therefore more environmentally-friendly
- Extended service life – up to 40 % longer than the market standard 70 day life
- Ergonomically design

AlwaysFresh
Water the way you want it™



Key Guidelines links

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[ASHRAE Standard 188: Legionellosis: Risk management for building water systems \(ANSI approved\) 2015.](#)

Department of Veterans Affairs. [Prevention of healthcare-associated *Legionella* disease and scald injury from potable water distribution systems. VHA Directive. 1061;2014..](#)

CDC. [Guidelines for preventing health-care-associated pneumonia, 2003: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee \(HICPAC\)\(<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>\).](#)

CDC. [Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee \(HICPAC\) \(<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm>\)](#)

