WHITEPAPER: UV DISINFECTION FOR

Whole House Water Disinfection

SINCE 1963 ATLANTIC ULTRAVIOLET CORPORATION®

The Issue: Contaminants in Water

The CDC boldly states in its report *Emerging Infectious Diseases* that low levels of microorganisms are not uncommon in many drinking water distribution systems and well water serviced homes.[1] While tap water in the United States is among the cleanest and safest in the world,[2] some faucets can be found discharging harmful microorganisms like *Legionella* and *P. aeruginosa*.

If household water is tainted in any way, using it for CPAP machines, nasal irrigation devices, portable humidifiers, contact lens cleaning, cleaning an open wound, or drinking can be a threat to health—especially for immune-compromised individuals.[1]

The elderly, infants, and young children are most susceptible to adverse reactions when waterborne pathogens attack the gastrointestinal system, causing symptoms such as diarrhea, stomach cramping, vomiting, and fever. In more extreme cases, severe illnesses may occur such as encephalitis, meningitis, myocarditis, hepatitis, and cancer.

Methods of Purifying Water

While the following methods are often used to purifiy water in homes, each has its disadvantages:

- **Boiling** is the most effective way of killing microorganisms in water, but it is hardly practical in supplying the water needs of a typical household.
- **Filtration** must be installed as part of your whole house water disinfection process, but it cannot inactivate many harmful microorganisms.
- **Distillation** uses filtration combined with other methods. It can be slow and energy consuming, making it impractical for most home uses.
- **Reverse Osmosis** removes contaminants by filtering them, using high pressure through a specialized membrane. The downside is that it removes some beneficial minerals like calcium and magnesium. It also results in higher water usage and more wastewater than other methods.

Ultraviolet disinfection is a safe, chemical-free, and low-maintenance method. When installed as the final step in your water treatment process, it provides microbe-neutralizing power to an entire home or commercial facility.

How UV-C Works

UV light is made up of three wavelength ranges (UV-A, UV-B, and UV-C). UV-C lamps produce rays at 254 nanometers, making harmful microorganisms unable to reproduce, and hence inactive. Unwanted microbes eventually die off, making water safer and healthier.

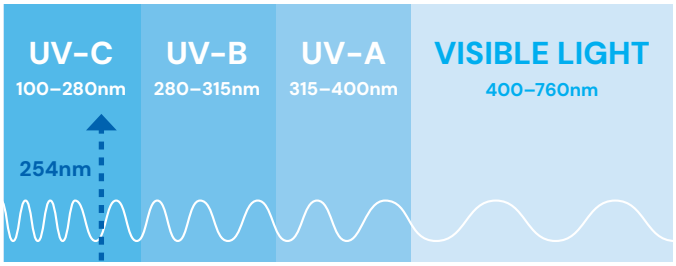

Figure 1: A Portion of the Electromagnetic Spectrum

Water Quality

UV purifiers are intended for use with water that is visually clear—not colored, cloudy, turbid, or having an obvious contamination source. Water quality plays a major role in the transmission of UV-C rays. In order to achieve the minimum UV transmission level of 85% per centimeter, do not exceed these maximum concentration levels:

Characteristic	Maximum Level
Turbidity	5 NTU
Manganese	0.05 mg/L
Total Suspended Solids	30 mg/L
Biological Oxygen Demand	30 mg/L
pH	6.5–9.5
Color	None
Hardness	6 gpg or 102.6 ppm
Iron	0.3 mg/L
Tannins	< 0.1 ppm (0.1 mg/L)

Table 1: Maximum Concentration Levels for UV Treatment

Effectively treating water with higher concentration levels (or a lower UV transmission) can be accomplished, but will require added measures to improve water quality. Contact our UV specialists at (631) 273-0500 for help.

UV-C Doses

A proper UV transmission level will ensure your water purifier delivers a UV-C dose of 30 mJ/cm^2, which is high enough to neutralize many harmful microorganisms commonly found in contaminated water supplies. Millijoules per square centimeter (mJ/cm^2) is the measurement of energy produced by germicidal UV lamps over a certain amount of time.

Microorganism	UV Dose (mJ/cm^2)
Giardia	100.0
Shigella	7.0
Cryptosporidium	5.8
Hepatitis A	8.0
E. coli	6.6
Salmonella	7.6
Rotavirus	24.0
Legionella	12.30
Pseudomonas aeruginosa	3.90

Table 2: UV-C Doses to Neutralize Waterborne Microbes

Sizing a UV Purifier

First, find your maximum flow rate in gallons per minute (GPM). Flow rates will depend on your water pressure, the size of your water lines, and the number and type of water outlets. A home with 3/4″ water pipes will generally have a maximum flow rate of about 7 GPM. Larger homes with 1″ pipes could reach 15 GPM or higher.

We recommend a 6 GPM purifier for homes with 1 bathroom, 12 GPM for 2–4 bathrooms, and 20 GPM for 5 bathrooms. If your flow rate is in between two models, purchase the larger size.

UV water purifiers for whole house disinfection will be installed at the point of entry to your home or facility, providing continuous disinfection to all water plumbed downstream of the UV purifier.

Installation

Location

Install the water purifier in a dry, well-lit area which provides enough room for routine maintenance. This includes a minimum distance of one chamber length from the chamber end, to allow for cleaning and/or changing of the lamp and quartz sleeve, as well as a minimum of 6” on the opposite end of the water purifier. Minimum clearance to the floor is usually between 18 and 30 inches.

Pre-Treatment Devices

As shown in the diagram on the next page, your water purifier should always be installed after any other treatment devices such as deionizers, water softeners, carbon/sediment filters, pressure tanks, pumps, and reverse osmosis systems. This practice eliminates the possibility of the purified water being re-contaminated by bacteria in any of these units.

Additional Considerations

- Use of metal pipe is recommended for connecting to both the purifier inlet and outlet 12” past the first elbow (to avoid degradation of exposed plastic pipe).
- Always use a mounting bracket and never leave a UV water purifier’s plumbing connections to support its weight. Atlantic Ultraviolet water purifiers are designed to mount horizontally.
- Install a drain pan under the water purifier for added protection against leaks.
- Always connect the purifier to the cold water line, with the water temperature between 50 and 100°F (10–37°C).

Disinfecting the “Downstream” Plumbing

Before completing the plumbing connections to the water purifier, it is a good practice to disinfect the plumbing between the purifier and point of use. This is done by introducing chlorine or other disinfectant solution into the purifier chamber; 100 ppm of chlorine is suggested. With the disinfectant in the purifier chamber, turn the germicidal ultraviolet purifier on. Open the “downstream” outlet until a chlorine or disinfectant solution odor is noticed. Close the outlet and allow the disinfectant to remain in the plumbing for three (3) hours. Flush the plumbing with germicidal ultraviolet purified water; allow the water to run for a minimum of 5 minutes prior to use (to ensure no chlorine or disinfectant smell can be detected). This will allow the chlorine or disinfectant solution to be flushed from the pipes.

Table 3: Comparison of UV Water Purifier Models

Feature	Minipure®	Mighty Pure®	Sanitron®
Flow Rate (GPM)	6–9	3–20	3–40
Min. Clearance (Lamp/Quartz)	22–29"	16–49"	17–50"
Min. Clearance (Gland Access)	6"	6"	6"
Lamp Indicator LEDs	✓		
Point of Use Models	✓	✓	✓
Point of Entry Models	✓	✓	✓
Sight Port	✓	✓	✓
Drain Fitting		✓	✓
Dual-Action Wiper			✓
UV Monitor		Optional	Optional
Audio Alarm	Standard	Optional	Optional
Solenoid Valve	Optional	Optional	Optional
Flow Control Valve	Optional	Optional	Optional

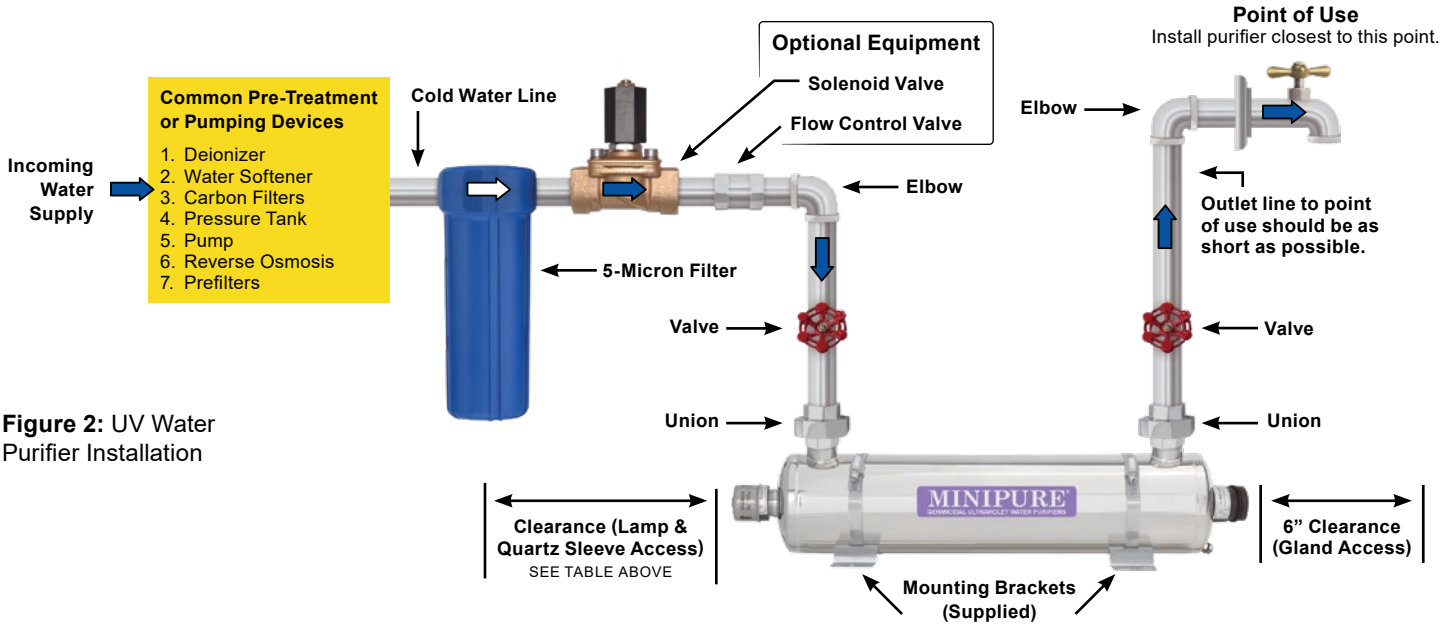

Figure 2: UV Water Purifier Installation

Sources

1. CDC. "(Mis)perception and Use of Unsterile Water in Home Medical Devices, PN View 360+ Survey, United States." *Emerging Infectious Diseases*, Vol. 29, No. 2. February 2023. wwwnc.cdc.gov/eid/article/29/2/22-1205_article
2. Environmental Performance Index. "Sanitation & Drinking Water." https://epi.yale.edu/measure/2024/H2O

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