

STATE OF CONNECTICUT DEPARTMENT OF PUBLIC HEALTH  
DRINKING WATER SECTION

**GUIDELINES FOR INSTALLING AND MAINTAINING ULTRAVIOLET LIGHT  
TREATMENT UNITS FOR THE PRIMARY DISINFECTION OF GROUNDWATER  
PUBLIC WATER SYSTEMS**

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**Authority:** Regulations of Connecticut State Agencies (RCSA) Section 19-13-B102(d)(2) requires approval from the Department of any treatment prior to installation. Discretion in the application of these guidelines is allowable except as required by regulation.

**Applicability:** Ultraviolet light treatment units, referred to as UV units, may be considered for approval by the Drinking Water Section (DWS) for installation on groundwater public water systems (PWS) as a means of primary disinfection. The following guidance is provided in the interest of facilitating the approval process:

1. The sources of supply to be treated by the UV unit should be groundwater not under the direct influence of surface water.
2. Confirmation should be made that the source of bacteriological contamination is originating solely from the source(s) of supply. If the source of bacteriological contamination is originating anywhere other than the source(s) of supply (i.e cross connections, etc.), then UV disinfection would not be appropriate for primary disinfection of the source(s) and would not be recognized as such by the DWS.
3. UV units should be certified to NSF/ANSI Standard 55 for Class A units or approved equal.
4. The water quality entering the UV unit should, at a minimum, meet the criteria of the next section, *Prerequisite Water Quality Criteria*.

**Prerequisite Water Quality Criteria:** Water to be treated by the UV unit should be sampled and analyzed by a State certified environmental laboratory for the minimum water quality parameters shown below:

*Bacteriological Quality:* UV units will only provide disinfection to bacteriologically contaminated water which passes through the unit. To determine if the UV unit would provide effective primary disinfection, water samples should be collected from the following locations specified and analyzed for total coliform bacteria:

1. From a raw source water sampling point (prior to any existing water treatment systems and storage tanks) located as close to the water source as reasonably possible and prior to the location where the UV unit is proposed to be installed.
2. From a sampling point after each existing water treatment system (if applicable).
3. From a sampling point in the water distribution system that is farthest from the source(s) of supply.

*Other Water Quality Parameters:* Certain water quality characteristics of the water to be disinfected by the UV unit may impair the UV unit's ability to provide effective disinfection. To determine if the source water quality characteristics will be amenable to effective UV disinfection, a water sample should be collected from a raw source water sampling point. The raw water sampling point should be prior to any existing treatment systems and storage tanks and prior to the proposed location of the UV unit. The sample should be analyzed, at a minimum, for the parameters shown in Table 1 in addition to any other parameters required by the manufacturer. The test results should be below the maximum allowable limits as specified in Table 1 or those of the manufacturer. If water treatment equipment is

STATE OF CONNECTICUT DEPARTMENT OF PUBLIC HEALTH  
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---

currently installed on the water system, additional water samples should be collected after each individual piece of treatment equipment that the water passes through and analyzed, at a minimum, for the parameters shown in Table 1. All testing should be conducted within 30 days prior to seeking approval for installation of the UV unit. Each set of water quality test results should clearly indicate the location of the sampling point from which the sample was collected.

Table 1

Parameter	Maximum Allowable Limit
Iron	0.3 mg/L
Manganese	0.05 mg/L
Color	15 color units
Turbidity	1.0 NTU
Hardness	120 mg/L (as CaCO <sub>3</sub> )
Hydrogen Sulfide	Non-Detectable
Total Suspended Solids	10 mg/L
Iron Bacteria	None

UV units should not be considered effective for primary disinfection if the water quality entering the UV unit does not meet the maximum allowable limits specified in Table 1 or as required by the manufacturer. If necessary, a pretreatment system, or additional treatment equipment, to reduce the levels of these parameters to below the maximum allowable limits may be proposed for installation. However, until a DWS approved pretreatment system has been installed and demonstrated to be effective in reducing the levels of the parameters to below the maximum allowable limits, the use of a UV unit should not be considered an acceptable means of primary disinfection. As a result, PWS's seeking approval for UV units with pretreatment needs should recognize that if the approved pretreatment system does not adequately pretreat the source water, they may be required to propose additional pretreatment equipment, alternative pretreatment equipment, or an alternative means of primary disinfection.

**Guidelines for Installation:** The following guidelines should be followed when installing UV units. Figure 1 shows the typical installation recommendations for a single UV unit.

*For single UV unit installations:*

1. All water supplied to consumers should be continuously treated by the UV unit. No bypass lines should be installed around the UV unit for servicing/routine maintenance of the UV unit (i.e. sleeve cleaning, lamp replacement, etc.) unless the installation of a second approved UV unit is installed and operational on the bypass line.
2. A 5-micron pre-filter (or smaller if required by the manufacturer) should be installed on the supply line to the UV unit.

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---

3. Shut-off valves should be installed on the supply side and the discharge side of the pre-filter.
4. Shut-off valves should be installed on the supply side of the UV unit (no greater than 4 feet from the UV unit) and on the discharge side of the UV unit (no greater than 4 feet from the UV unit and prior to any consumer taps or branch lines).
5. A flushing port should be located on the discharge line of the UV unit prior to the discharge side shut-off valve described in item 4 above.
6. The UV unit should be installed in a manner to maintain flow and pressure requirements in the water distribution system. The flow rate entering the UV unit should not exceed the maximum flow rate specifications as recommended by the manufacturer to maintain the required dose. A flow meter should be installed on the supply line to the UV unit. Multiple identical UV units installed in parallel are allowed to maintain flow and pressure requirements of the distribution system if necessary.
7. The UV unit should be equipped with an audible and visual alarm that will alert a person in charge of the water system and UV unit when the intensity of the UV unit drops below the manufacturer's normal operating range. The alarms should be located in an area where an intensity failure will provide immediate notification to the person in charge of the water system and UV unit. If the UV unit will be installed in an unattended location (i.e. basement, utility room, etc.) a remote alarm should be installed in an area that is occupied by personnel familiar with the alarm and the procedure to report the alarm to the certified operator or person in charge of the water system and UV unit.
8. The UV unit should be installed on a designated electrical circuit and equipped with a solenoid operated automatic emergency water shut-off valve that will shut off the water supply to the UV unit in the event of a loss of power supply to the UV unit or a drop in dosage below the minimum required level of 40 mJ/cm<sup>2</sup>. When power is not being supplied to the UV unit, the valve should be in a closed (fail-safe) position.
9. A flow or time delay mechanism wired in series with the well or service pump should be provided to permit a sufficient time for tube warm-up per manufacturer's recommendations before water flows from the unit upon startup.
10. At a minimum, smooth-nosed, chrome plated or stainless steel water sampling taps should be installed in the following locations to monitor source water quality and performance of the UV unit:
  - a. Raw water line of each water source
  - b. After each individual piece of pre-treatment equipment that the water passes through.
  - c. After the UV unit

These sampling taps should not be used for purposes other than the collection of water samples, should have the discharge end of the tap pointing in a downward direction, and should be in an easily accessible area with adequate clearance (minimum of 12 inches) below the tap for sampling containers.

11. UV units installed vertically should have the water outlet located at the top to allow the chamber to completely fill with water and maximize water exposure to the UV lamp. Similarly, UV units installed horizontally should have the water outlet directed upward. Manufacturer's installation

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DRINKING WATER SECTION

**GUIDELINES FOR INSTALLING AND MAINTAINING ULTRAVIOLET LIGHT  
TREATMENT UNITS FOR THE PRIMARY DISINFECTION OF GROUNDWATER  
PUBLIC WATER SYSTEMS**

---

guidelines should be followed in determining the correct orientation of installation for each particular UV unit.

**Maintenance, Oversight, and Monitoring Recommendations:**

1. Prior to performing any routine maintenance or repair activities (i.e. sleeve cleaning, lamp replacement, etc.) on the UV unit that would render the unit inoperable or ineffective for water disinfection purposes, the following procedure should be followed:
  - a. The water supply shut-off valves on the supply and discharge side of the UV unit should be closed.
  - b. Perform necessary maintenance/repair work on the UV unit in accordance with manufacturer's procedures.
  - c. Following maintenance/repair work ensure that the UV unit is operating and light intensity has stabilized to an effective level for disinfection purposes.
  - d. Open the water supply shut-off valve on the supply side of the UV unit.
  - e. Open the flushing port on the discharge side of the UV unit and flush water through the device to waste for a minimum of three minutes.
  - f. Close the flushing port.
  - g. Open the water supply shut-off valve on the discharge side of the UV unit and return water service to consumers.
2. Replacement parts including, at a minimum, one replacement lamp, one quartz sleeve, and one pre-filter should be available on-site at all times.
3. The pre-filter should be replaced with a new pre-filter at regular intervals as recommended by the manufacturer and no less than every three months.
4. UV lamps should be replaced at frequencies recommended by the manufacturer and no less than annually.
5. The UV unit should be inspected daily to ensure the unit is operating and the light intensity is within acceptable limits for effective disinfection. A log sheet should be maintained to record daily inspections. A minimum dose of 40 mJ/cm<sup>2</sup> should be maintained at all times. The following, at a minimum, should be recorded on the log sheet: daily checks of satisfactory bulb intensity including intensity readings if a bulb intensity meter is provided, dates of all UV lamp replacements, dates of all pre-filter replacements, routine maintenance procedures, repair services, and any alarms or malfunctions of the UV unit should also be recorded on the log sheet. Log sheets should be maintained on-site at the location of the UV unit installation and should be made available to the DWS upon request. Monthly summaries of daily satisfactory bulb intensity checks and readings (if a bulb intensity meter is provided) should be submitted to the DWS no later than nine days following the end of each month on a form prescribed by the DWS.
6. For seasonal water systems: UV units that are operated on a seasonal basis should be inspected and cleaned prior to use at the start of each operating season. All pre-filters should be replaced prior to start up of the water system if the UV unit has been shut down more than three months. The wells and water system should be disinfected with a chlorinating agent certified to NSF/ANSI Standard 60 prior to placing the water system back into operation for public use.

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DRINKING WATER SECTION

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TREATMENT UNITS FOR THE PRIMARY DISINFECTION OF GROUNDWATER  
PUBLIC WATER SYSTEMS

Figure 1  
Single UV unit installation

