Contributed by UV Pure Technologies, Inc.

Figure 1. Conventional Ultraviolet System, "Light in a Pipe"

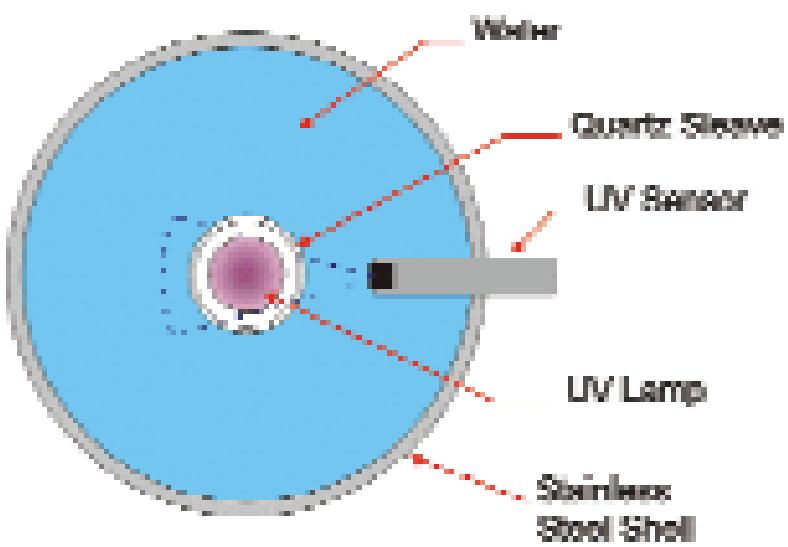
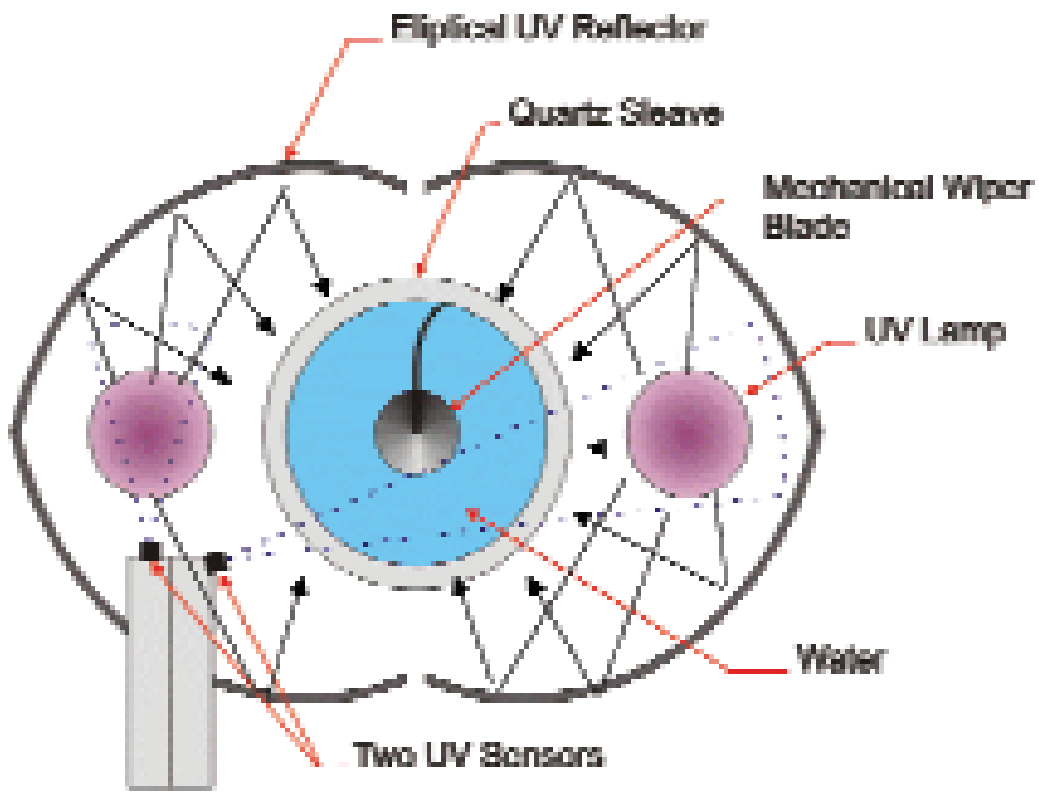


Figure 2. Hallett Crossfire Technology



Ultraviolet System Design

Innovative System Created to Address Conventional System Issues

Conventional ultraviolet (UV) systems may face problems such as quartz fouling, false alarms, loss of dose in high or low water temperature situations, difficult lamp changes and messy quartz cleaning or breakage.

Conventional systems are like a "light in a pipe" (see Figure 1). The UV bulb is surrounded by a quartz tube inside a stainless steel pipe. Water flows around the quartz inside the pipe. NSF/ANSI 55 class A units add a sensor that is mounted in a stainless water tight holder that looks through a quartz window, through the water and the quartz tube at the lamp. If it senses a drop in UV energy of greater than a preset percent, the unit alarms and may activate an optional solenoid valve to shut down the flow.

A Toronto, Canada, company—UV Pure Technologies, Inc.—developed "next-generation" NSF/ANSI 55 Class A Hallett drinking water purification systems incorporating patented Crossfire™ ultraviolet technology to aid in overcoming some of the issues dealers may face with conventional systems. The systems are targeted at residential and commercial applications as well as small communities of approximately 2,000 homes requiring less than 1 mgd of treated flow rates.

In a Hallett, the water flow iteslf is inside a thick wall quartz tube (see Figure 2). Two lamps are mounted in air outside the quartz tube, and reflectors focus UV light into the water column from 360 degrees. Two UV sensors, also mounted in air, monitor

About the Contributor
UV Pure Technologies Inc. is based in Toronto and Dallas and can be reached at 888-407-9997; www.puresafewater.com. The company is rapidly growing it's distributor and dealer footprint in North America. Dealers and distributors are supported with lead generation programs, sales training and training of certified technicians.

lamp output and water transmittance separately. An automatic wiper blade inside the quartz tube keeps the tube from fouling due to minerals or biofilm. The unit is self cleaning and needs no water softener or other metal removal devices to prevent fouling.

The following are some of the issues dealers may face with ultraviolet systems and how this technology may be able to help.

Quartz Fouling—Messy Cleaning Jobs and Breakage

A major problem is caused by the quartz tube being located in the water flow. It commonly becomes fouled with minerals or biofilm, which may prevent transmittance of enough UV energy through the tube to deactivate pathogens and cause the UV system to go into alarm. Cleaning the quartz is a difficult and messy job often requiring acid and complete disassembly of the system. Frequently, the quartz tube, which is very fragile, breaks during this process. If a lamp should break during the cleaning process it is possible to have mercury released from the lamp into the UV chamber, which would then leach mercury into the drinking water for years to come.

UV Pure's self-cleaning system prevents quartz fouling and eliminates service headaches. Stainless steel squeegee blades rotate to clean minerals and other contaminants from fouling the quartz. Hallett systems can operate in hardness levels of more than 100 grains and more than 5 mg/L of iron with no fouling. This means no draining and disassembly to clean quartz and eliminates the risk of quartz or lamp breakage.

Sensors to Pinpoint Problems

Single sensor technology causes false alarms and does not pinpoint problems. Conventional systems use a single sensor mounted in the water column. This sensor "sees" UV energy, which is affected by five variables.

- The window of the UV sensor can foul because it is in the water column.
- The water itself may be less than fully transparent to UV light due to turbidity or "color" caused by organics like tannins or chemicals
- The quartz tube may become fouled by minerals reducing transparency to UV light
- The UV lamp will decrease its UV output over time.
- Cold water will reduce the air temperature around the lamp, causing a significant drop in UV energy; low flow or no-flow situations raise the water temperature—the unit is like a little water heater with the lamp on and no water flowing—which raises the operating temperature of the lamp and causes a significant drop in UV output. When this happens, UV output does not return to normal for several minutes after the water starts to flow again, resulting in only partial disinfection.

The single sensor "sees" the sum of all of these effects, and if the output has dropped by the set percent, the unit will alarm or shut down. But it cannot tell an operator or owner what caused the problem, so fixing the unit is trial and error.

The Hallett systems' dual sensors are mounted in air so they cannot foul. Crossfire technology uses two sensors that measure lamp output and water transmittance continuously as separate data. The onboard computer can discriminate among problems telling an operator whether a lamp's output is dropping or if an alarm is due to low transmittance through the water

column. This system eliminates false alarms. The sensor data is available remotely via an RJ-45 port that connects an optional digital diagnostic tool and remote monitor.

Design and UV Shadowing

Inefficient design and UV shadowing may reduce the deactivation of pathogens. Because UV energy radiates in only one direction—from the lamp outward—and is absorbed by the interior walls of the "pipe," pathogens are exposed to only a single pass of UV radiation. Small particles in the water stream also can create shadows that protect viruses and bacteria in the water stream.

In the Crossfire technology, reflectors pass UV energy through the water column many times and from all directions, providing at least twice the efficiency of other technology. There is no UV shadowing, ensuring that pathogens cannot travel through the system without exposure to deactivation.

Difficult Lamp Replacement

The lamps in a conventional "light in a pipe" are located inside the quartz tube in the water, which is inside a sealed stainless steel pipe. It is possible that replacing a lamp could require disassembly of the system, water shut down and draining the system. This could be time consuming and messy.

Lamps mounted in air are easy to change, and output is not affected by water temperature. Because the lamps are mounted outside the water column in air, replacing them literally is a one or two-minute job. The lamps are air cooled by convection and operate at optimum temperature regardless of water temperature. So even in cold water applications or no-flow situations every drop of water is deactivated at full lamp output. This eliminates irritating "middle-of-the-night" false alarms that can be caused by increased water temperature during long no-flow periods.

The Hallett systems are engineered as fail safe. Every system has a normally closed solenoid valve with a built-in manual override included. On board lightening arrestors protect the ballast and integrated circuits. The electronic ballast is designed to accommodate brownouts and power spikes. A set of dry contacts is available on every system, which can enable remote alarms or auto dialers to send a signal that the solenoid valve has shut off the water.

Each system includes flexible stainless inlet and outlet hoses with FIP union connections that eliminate the need for time-consuming hard piping. There also is no need for a piped-in bypass because the solenoid valve includes a manual override. The units' small footprint makes installation convenient, too.

Hallett NSF/ANSI class 55A systems are available in both 13.3 gpm and 30 gpm. Multiple systems installed in parallel with common headers are in use treating commercial and community applications with flow requirements of up to 1 mgd. WQP

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