Closed UV System Training

Conventional vs. Crossfire

Presented by UV Pure Technologies

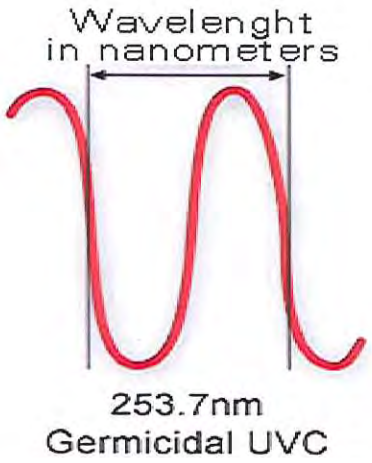
Topic Overview

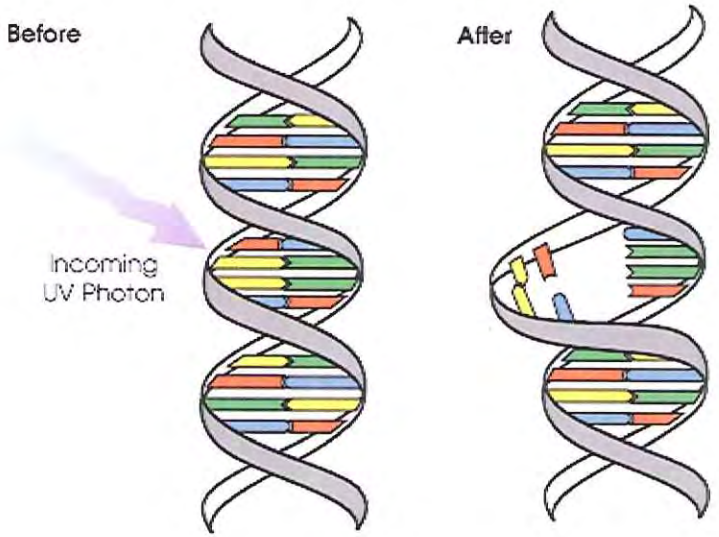
- Chlorine vs. UV
- How UV Disinfection Works
- Types of UV Bulbs
- Factors Influencing UV Dose
- Fouling – Hardness & Iron
- Crossfire Technology vs. Conventional
- Pre-Treatment Requirements
- Installation Requirements for Crossfire (H30)
  - Interfacing and controls
- Installation requirements for Crossfire (H15xs)
  - Interfacing and Controls

Chlorine Vs. UV

- Moving away from chlorination
  - Disinfection By-Products (THMs)
  - Safety concerns
  - Complexity vs. other disinfection technologies
- Advantages of UV
  - Easy to retrofit into existing chlorine applications
  - Lower cost with regards to capital and operational costs
  - User friendly and requires little training
  - Effective barrier to Crypto & Giardia
- Disadvantages of UV
  - No residual disinfection

How UV disinfection works





-UV causes the bonds of pyrimidine molecules (nucleic acids) found in DNA/RNA to instantly break apart (represented in yellow)

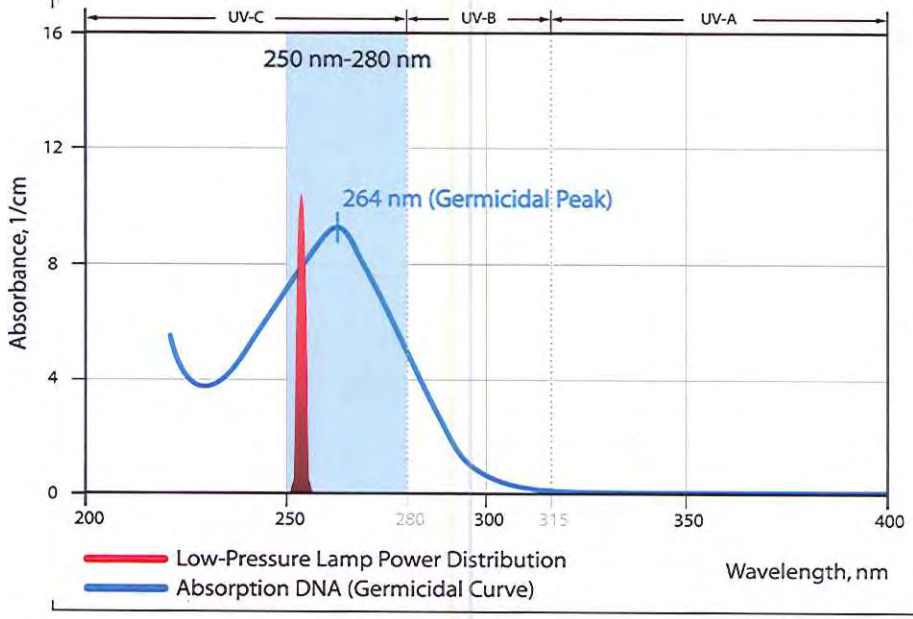
-Within micro-seconds, these molecules begin to bond to themselves, changing the cells DNA/RNA

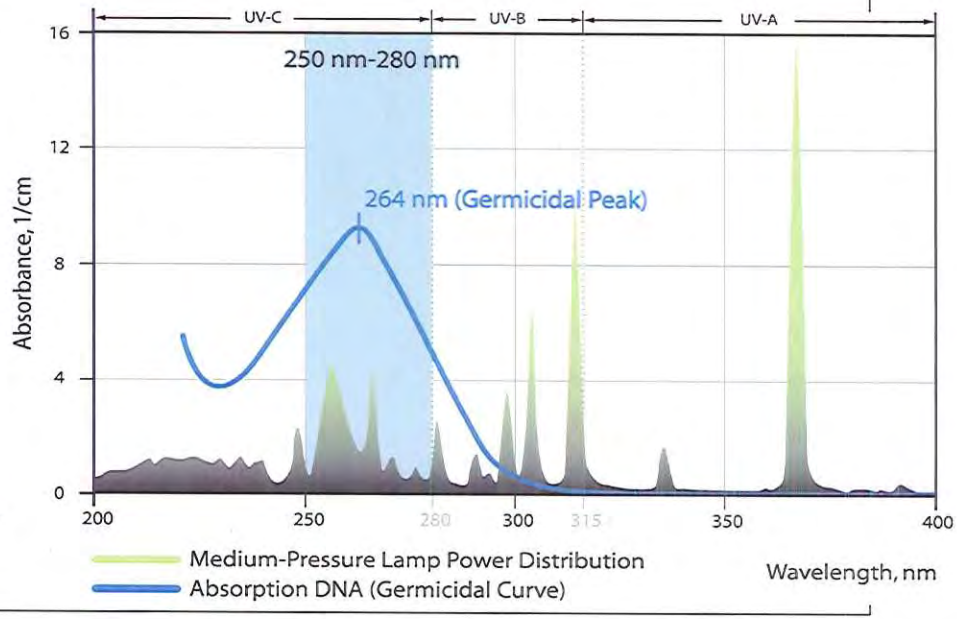
-The code for reproduction is disrupted and the UV altered DNA/RNA can not reproduce

<u>Three primary types of pyrimidine molecules affected by UV are:</u>
Cystosine (found in both DNA and RNA),
Thymine (found only in DNA), and
Uracil (found only in RNA)

Types of UV Bulbs

Type		Output		Lamp Life	Efficiency %UVC	Power Density	Bulb Temperature
Low Pressure, Low Output	(LPLO)	Monochromatic	(254 nm)	12,000	35%	1 W/cm³	40-50 °C
Low Pressure, High Output	(LPHO)	Monochromatic	(254 nm)	9,000	35%	2 W/cm³	90-150 °C
Amalgam		Monochromatic	(254 nm)	12,000	33%	2-3 W/cm³	90-150°C
Medium Pressure, High Output	(MPHO)	Broadband	(230-300 nm)	4,000	10%	30 W/cm³	600-800°C





UV Dose Calculation

UV Intensity

Quantity of UV per
Unit Area Falling on Surface

X

Residence Time

Contact Time in
UV Reactor

= **UV Dose**
mJ/cm^2

UV applications are designed to deliver a specific UV Dose for a given peak flow at a minimum %UV transmittance.

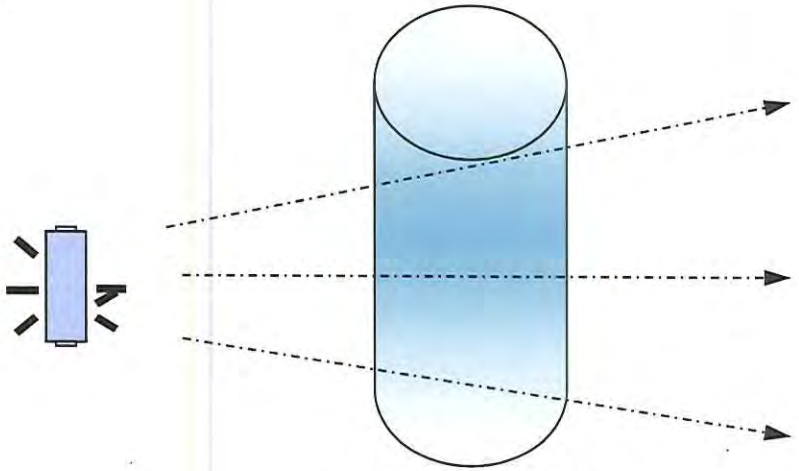
What are the operational factors that could influence (reduce) UV dosage rates?

Factors Influencing UV Dose

- Water Quality Factors
  - UV Transmittance (UVT)
  - Turbidity
  - Hardness & Water Chemistry – Quartz Sleeve Fouling
- Flow Rate
  - Faster Flow means decrease in UV Dose
  - Slower Flow means increase in UV Dose
- Lamp Age and Operating Temperature
  - UV Lamps lose output (UVI) over time
  - UV Lamps decrease in UV efficiency if not within temp range
- UVT can be improved dramatically with tannin removal

Water UV Transmittance (%UVT)

- The amount of UV light from a UV lamp that can transmit through a sample of water – usually reported for a path length of 1 cm.



UV Light transmitting through the water

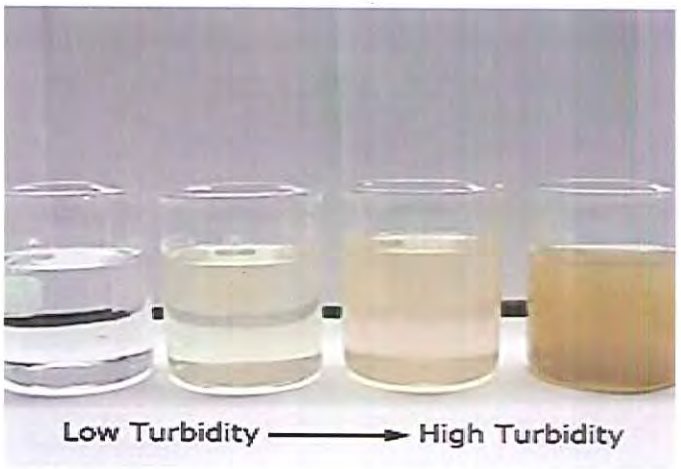
- UVT is expressed in percentage value, %UVT
- The higher the %UVT- the more UV Light transmitted through water

Distilled water **= 99 %UVT**

Tap Water **= 85-95% UVT**

Turbidity (NTU)

- Turbidity is a measure of Suspended Solids in the water
- It is expressed in Nephelometric Turbidity Units (NTU)
- Turbidity levels over 1 NTU can shield microorganisms from the UV lights, making the UV disinfection less effective

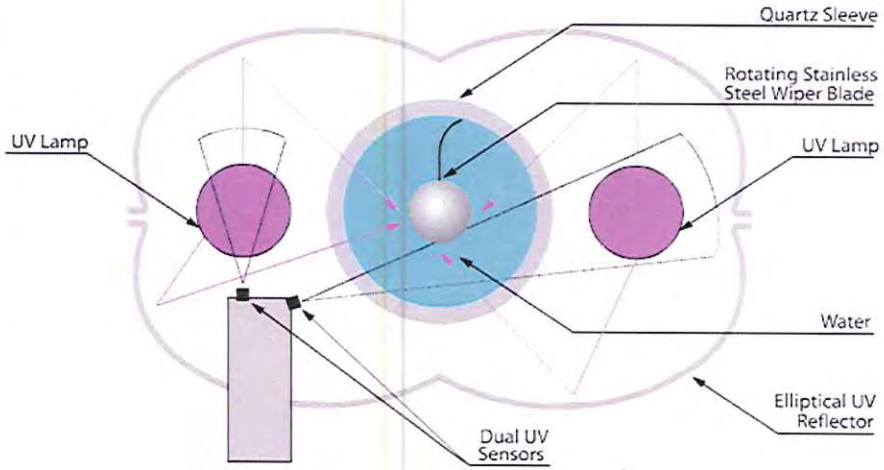


Hardness & Iron

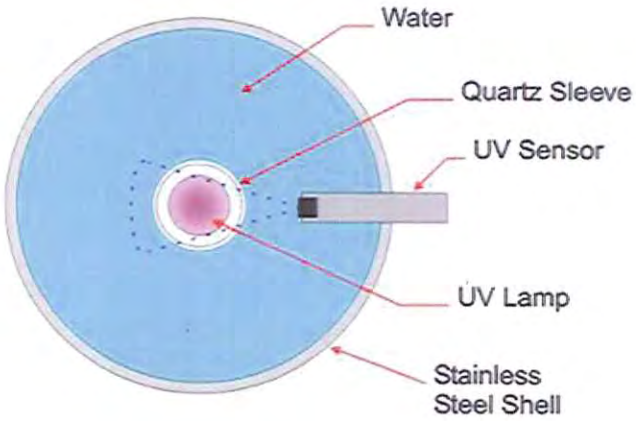
- High level of Hardness (>120 ppm) and Iron can contribute to significant Fouling and Scaling of the Quartz Sleeve
- UV Transmittance and overall disinfection performance is reduced by fouling

- The presence of bacteria accelerates the rate of iron and hardness fouling (very common in wastewater/reuse)

Crossfire Technology Versus Conventional UV Design



Crossfire Technology



Conventional Technology

Broadest Range of Pre-treatment Conditions

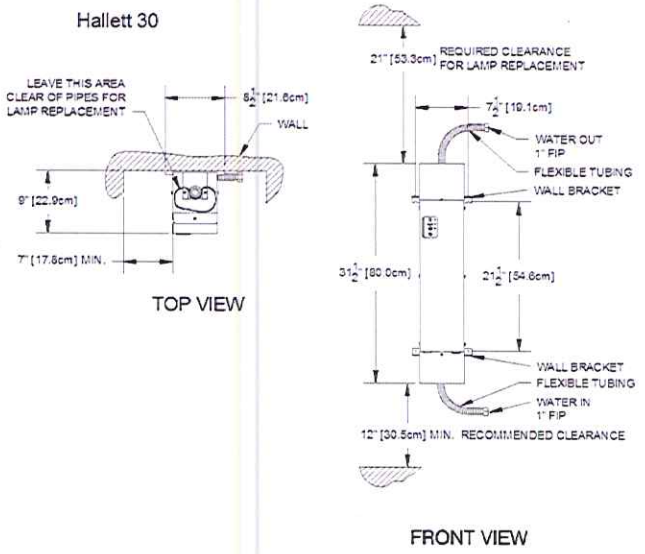
	Conventional UV	Crossfire Technology
Hardness	< 85 ppm	Up to 855 ppm
Iron	<.3 mg/l	Up to 3 mg/l
No/Low Flow	Overheating – lower UV intensity	No Effect – 100% UV intensity
UVT	Must be 75% to over 90% to achieve advertised dose	As low as 50% for "real world" effectiveness
Flow Control	Flow Restrictor is an option – may not be safe	All UV Pure potable water systems have flow restrictors – Safe!

Crossfire Pre-Treatment Requirements

	Min	Max
Hardness	0	50 Grain (855 mg/L)
Iron	0	3 mg/L
Manganese	0	0.5 mg/L
% UV Transmittance	75%	100%
pH	6.00	9.00
TDS	0	1000 mg/L
Water Temperature	1°C - 34° F	38°C - 100° F
Air Temperature	7°C - 45° F	38°C - 100° F
Turbidity	0 NTU	1NTU
Water Pressure	5 PSI	100 PSI

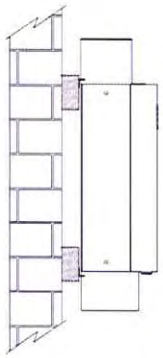
- **Min. 5 micron filter installed before UV unit**
- Removal or minimization of gas or air bubbles using good air traps (gas or air typically from iron removal filters etc.)
- Important for the UV Transmittance (UVT) to be above the specified limit, if unsure have the water tested for UVT.

Ensure sufficient clearance for maintenance & lamp replacement

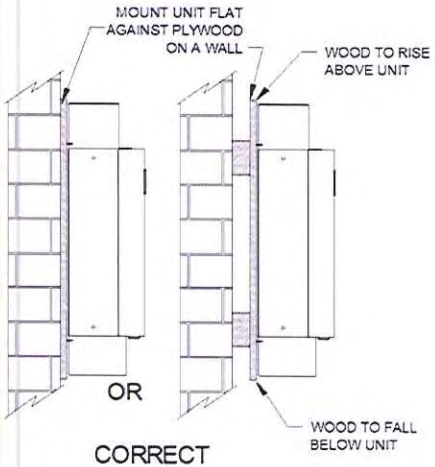


- Ensure sufficient clearance from the top of the unit to the ceiling.
- Will ensure easy in place lamp replacement.
- Ensure sufficient clearance from the bottom casting to the floor.
- Will ensure easy in place wiper maintenance.

Correct Mounting



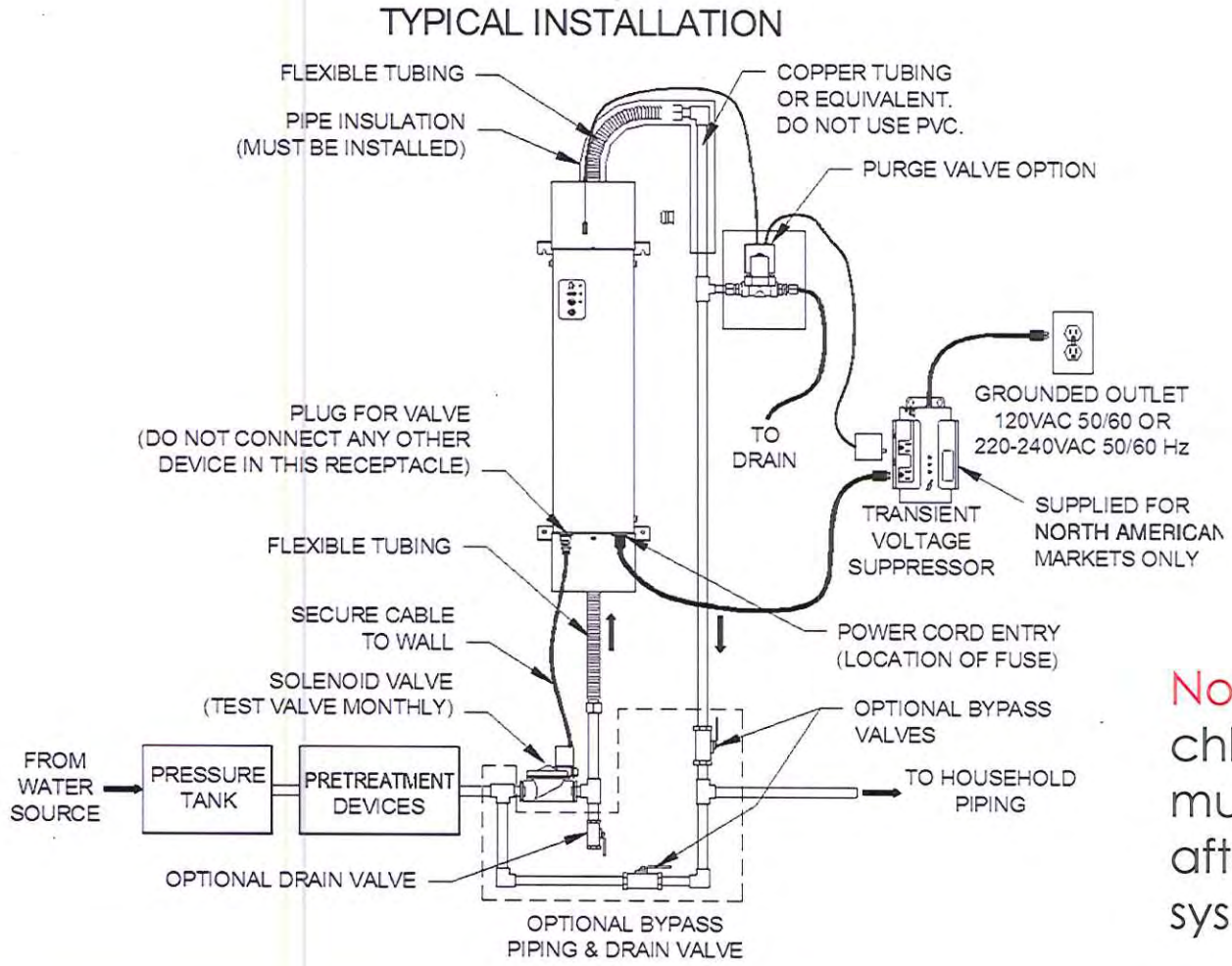
INCORRECT MOUNTING



CORRECT MOUNTING

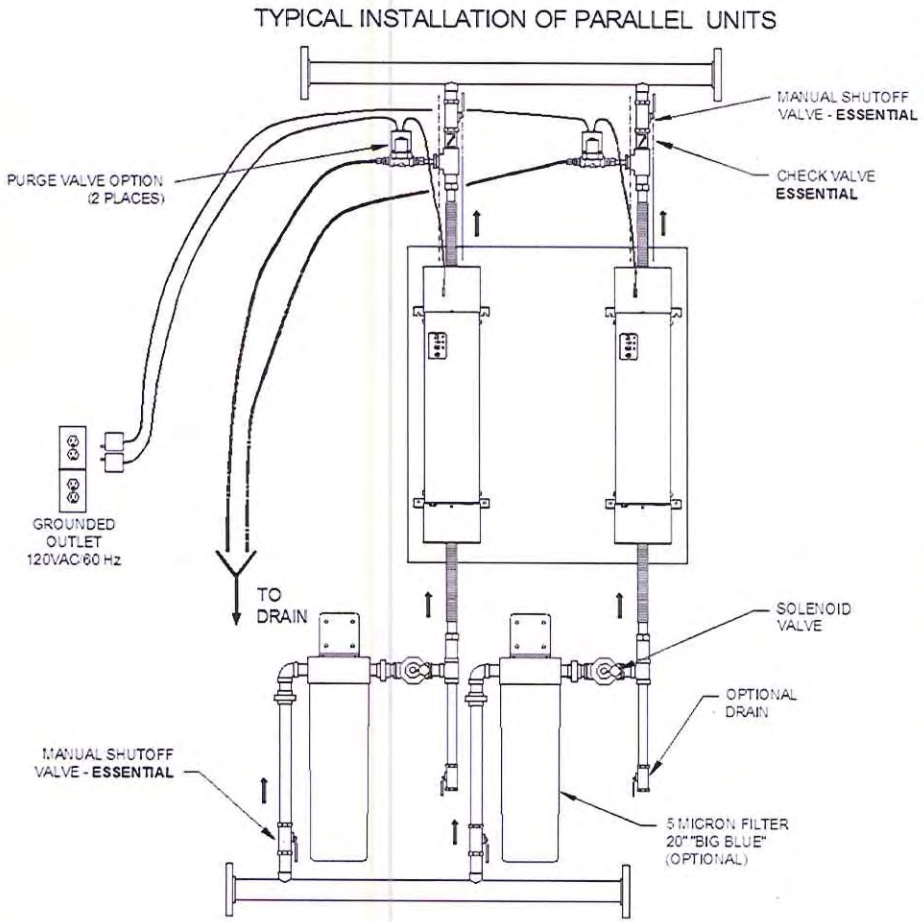
- The back of the units must be covered
- Prevents drafts or debris from entering the unit
- Ensures a flat even mounting surface

Typical Hallett Installations



Note: If using chlorine, it must be used after the UV system.

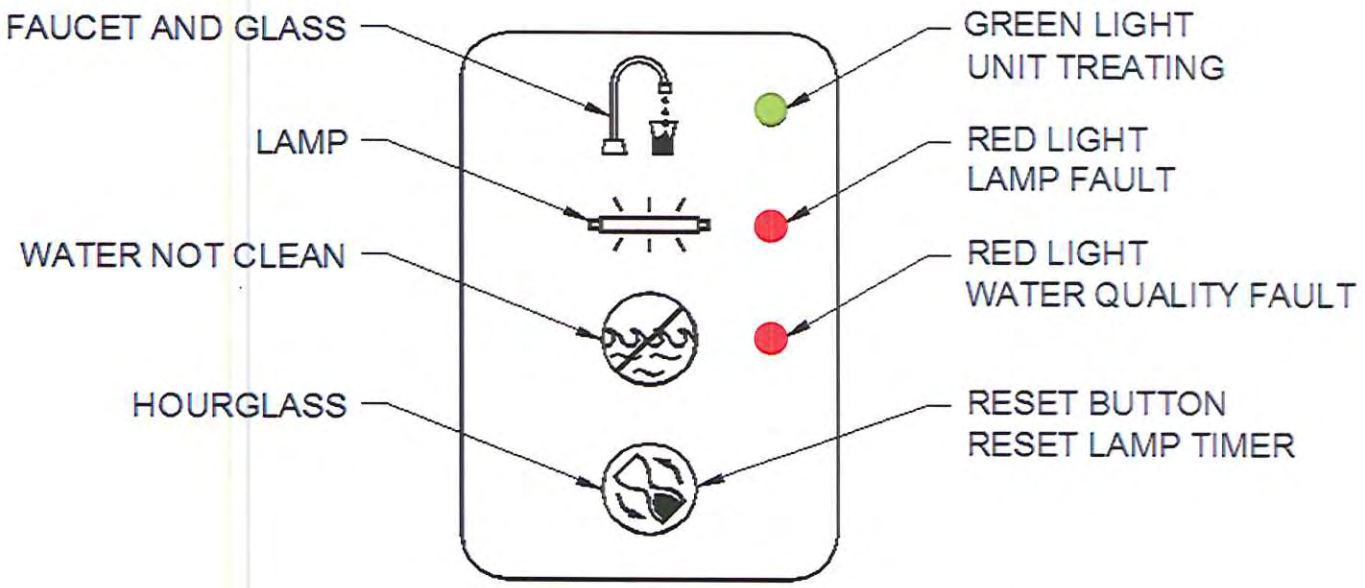
Installing Parallel Units



- Manual Shutoff valves and check valves essential
- Each unit has its own shutoff valve (if in use).
- Consider optional drain valves for each unit.

Interfacing & Controls

Display Panel – Provides visual status



- Press Reset button for 1 second to silence alarm for 24 hours & to cycle wiper
- Hold for 6 seconds to reset lamp counter

Interfacing & Controls

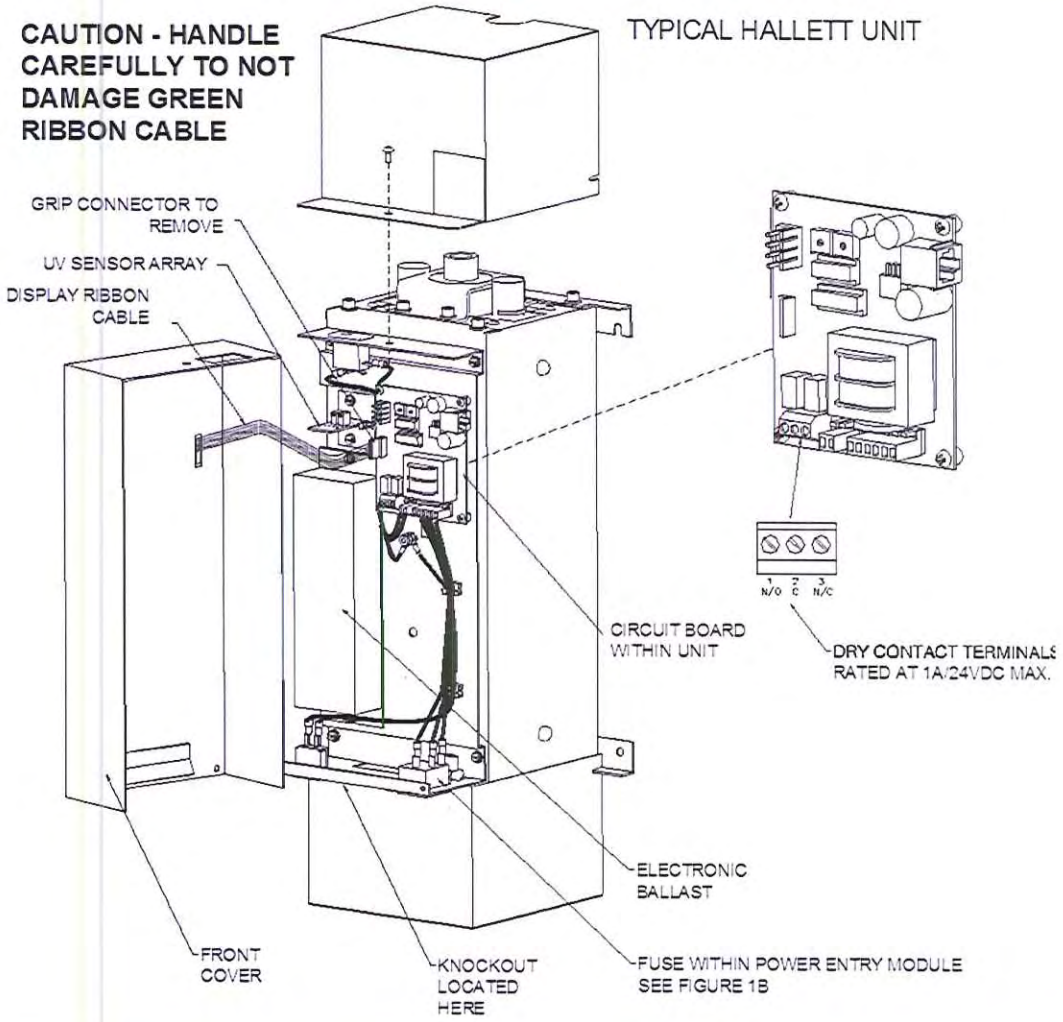
Built in External Alarm Contact

- All units are equipped with an external "dry" contact for remote alarms or auto-dialers and can be wired either normally open or normally closed
- The contact is referred to as a "System Run" condition
- The status of the contact changes when the unit changes from a normal to alarm condition
- There is a knockout provided at the base of the front cover for cable entry

Interfacing & Controls

CAUTION - HANDLE CAREFULLY TO NOT DAMAGE GREEN RIBBON CABLE

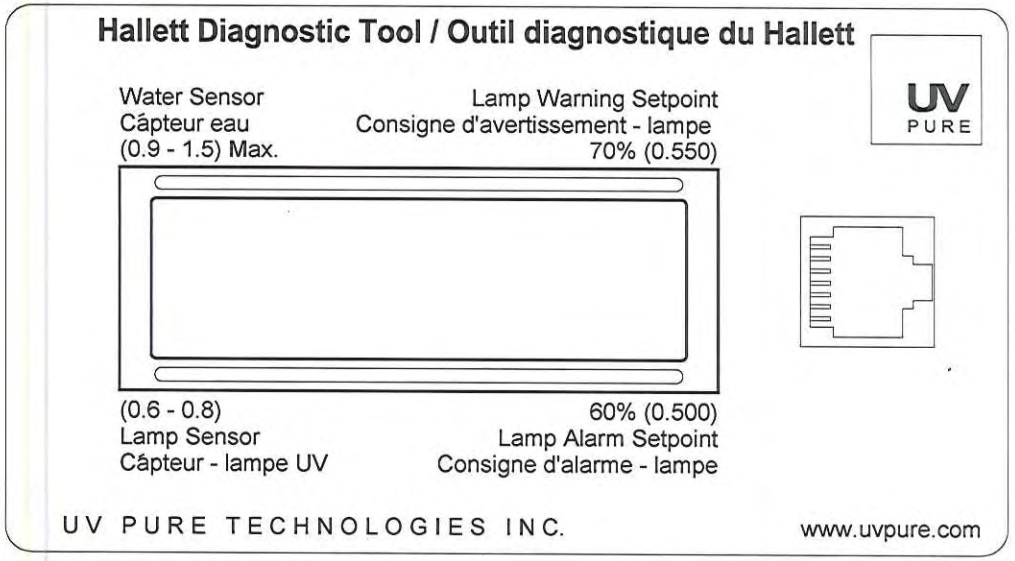
TYPICAL HALLETT UNIT



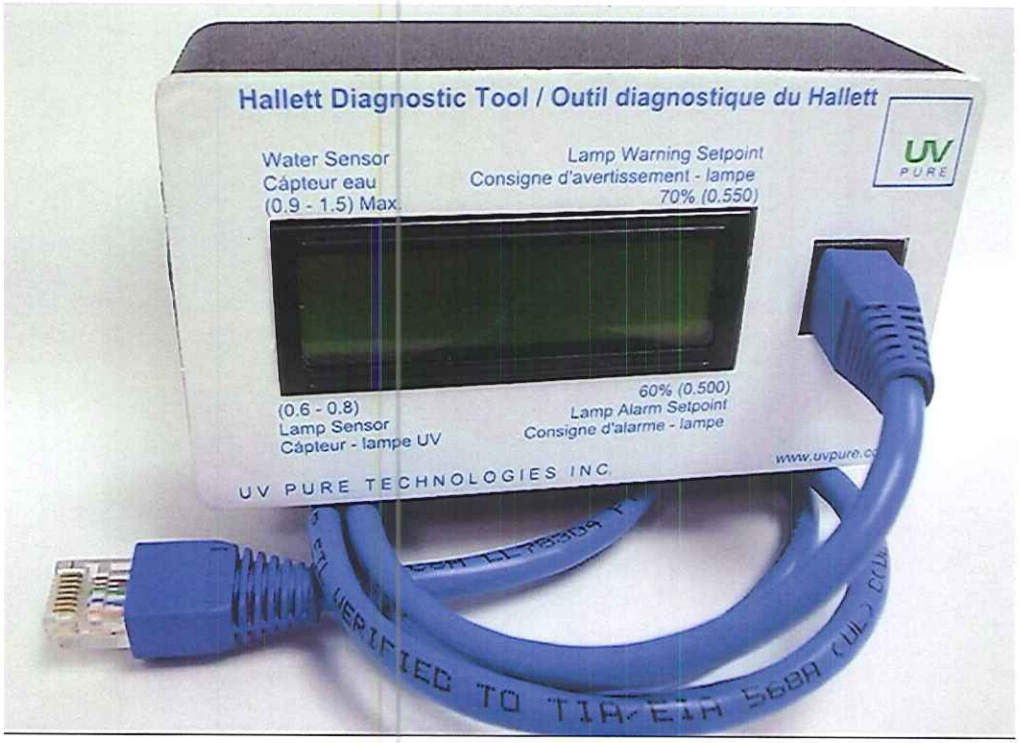
Interfacing & Controls

Hallett Diagnostic Tool (HDT)

- Primarily used to read sensor outputs for troubleshooting
- Can easily be used for Re-Calibrating UV sensors in the field
- Easiest way to verify wiper motor operation. (Change in water sensor value)

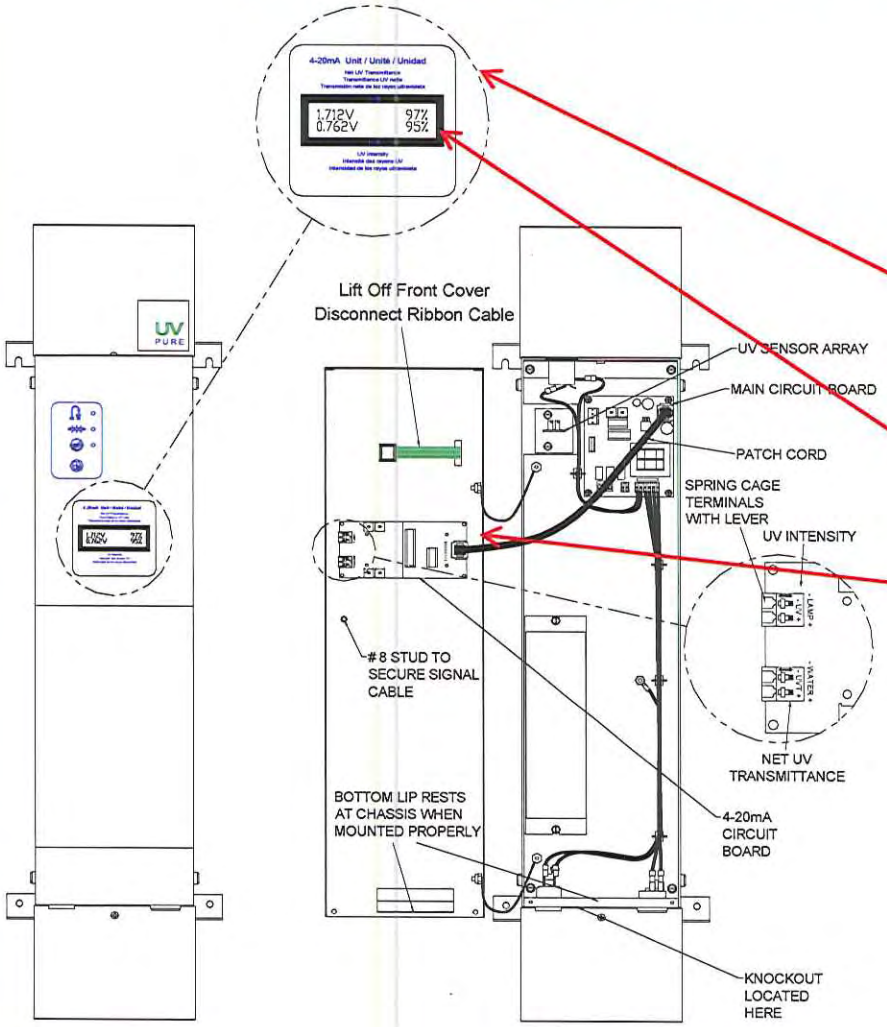


Hallett Diagnostic Tool (HDT)



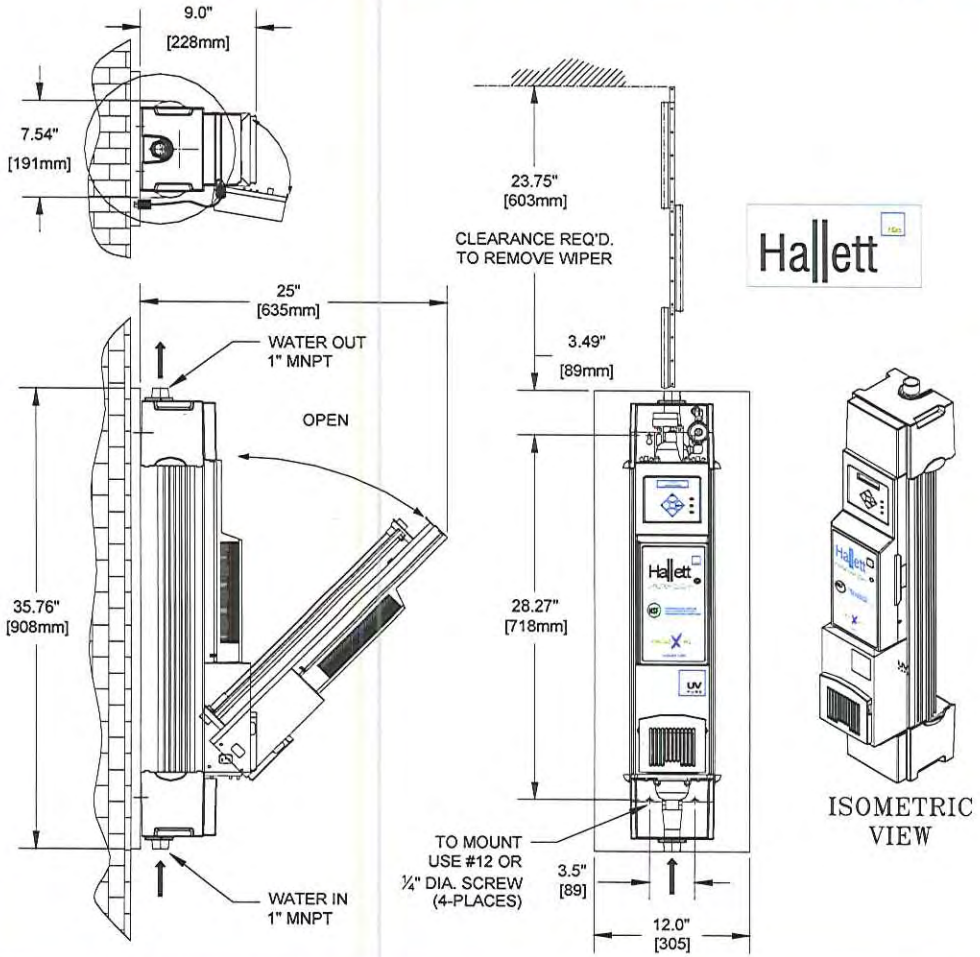
Simply plugs into right side of unit using an RJ45 Plug

The Optional 4-20mA Unit



- Built in LCD display, indicates both water and lamp sensor values.
- Displays both the Net UVT % and Lamp Intensity %
- Second circuit board added behind the display with easy output connections.

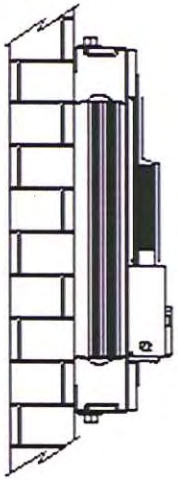
Ensure sufficient clearance for maintenance & lamp replacement



ISOMETRIC VIEW

- Ensure sufficient clearance from the rear of the unit to the front.
- Will ensure easy in place lamp replacement
- Ensure sufficient clearance from the top casting to the ceiling
- Will ensure easy in place quartz and wiper maintenance

Correct Mounting



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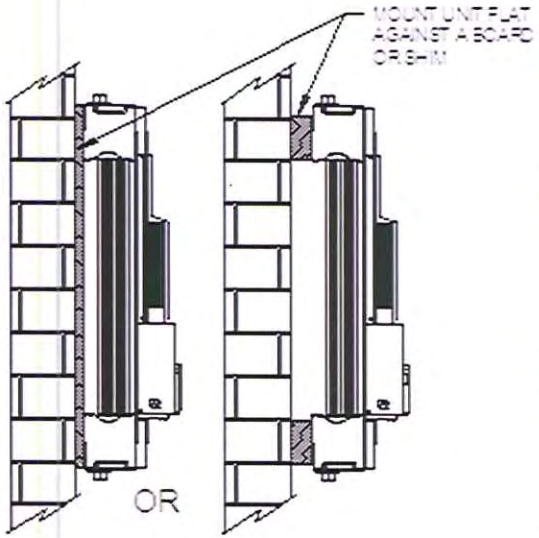
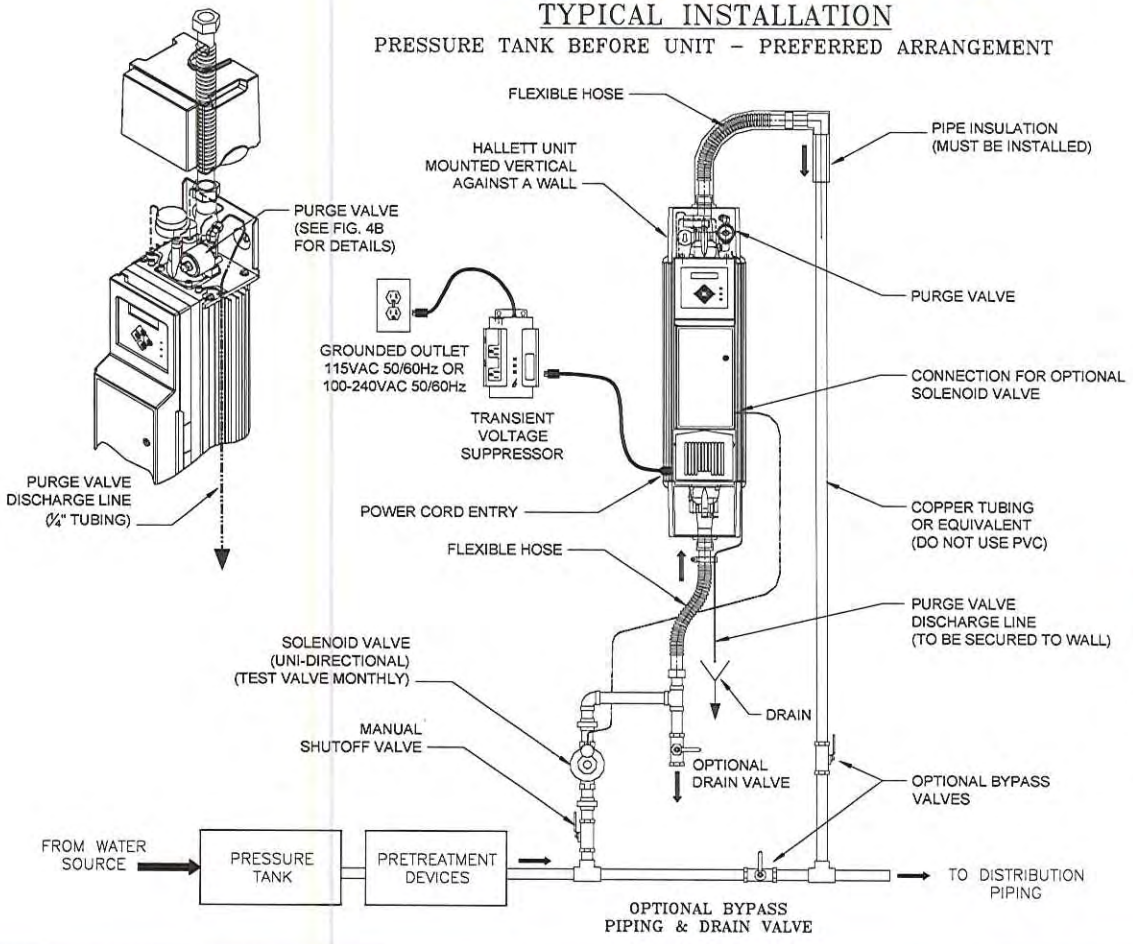


CORRECT
MOUNTING

- New style units (no vent in the back)
- Do not want to mount directly to the wall
- Can be mounted either to shims or board.
- Board is preferred if being mounted below grade.

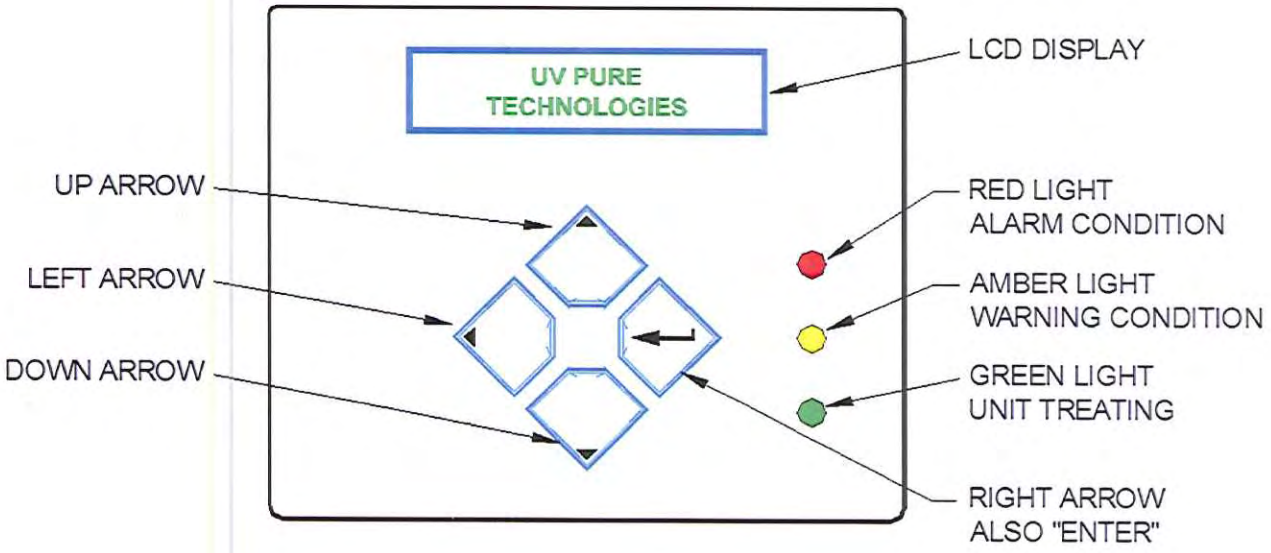
Typical Hallett 15xs/Upstream Installations



Note: If using chlorine, it must be used after the UV system.

Interfacing & Controls

Local 2 Line LCD Display & Operator Interface



Interfacing & Controls

External Alarm Contact

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- The contact is referred to as a "System Run" condition
- The status of the contact changes when the unit changes from a normal to alarm condition
- There is a knockout provided at the base of the unit for cable entry

Remote Start / Stop

- All units equipped with the ability to remain on standby until remote signal starts UV lamps
- Ideal for situations requiring only periodic disinfection of water
- Starts and stops of lamps should be limited to 2 per day
- There is a knockout provided at the base of the unit for cable entry

Thank You

Pure, safe water.

UV PURE

Always.™