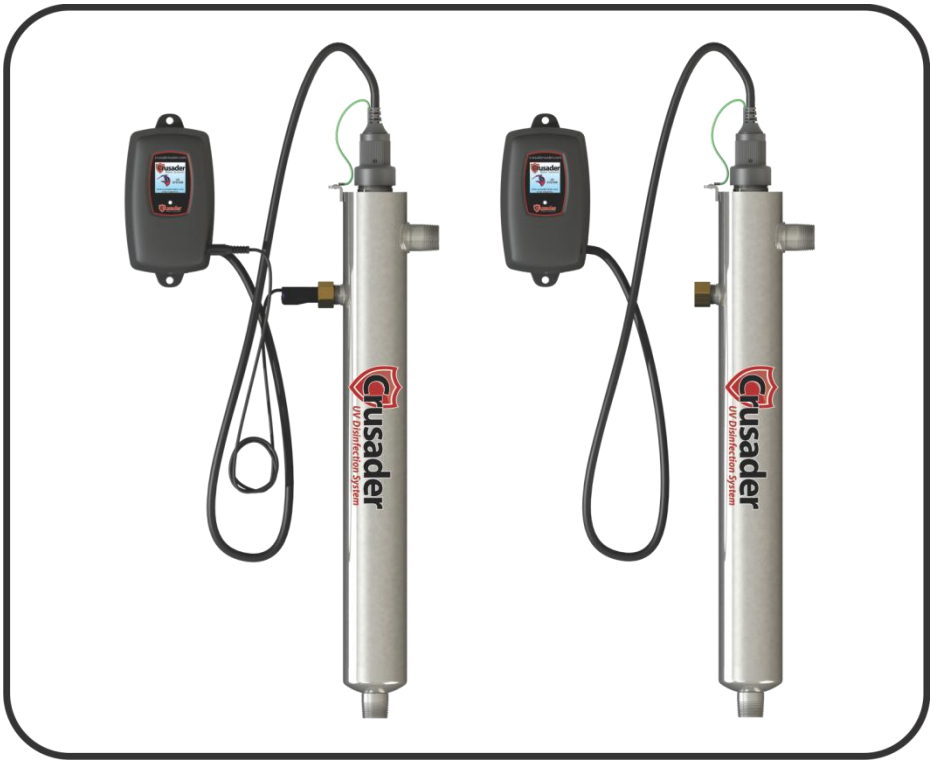
Crusader UV Disinfection System OWNERS MANUAL

Operation & Installation Instructions



CWS5-031, CWS5-061, CWS5-101, CWS5-151, CWS5-201, CWS6-061, CWS6-101, CWS6-151, CWS6-201

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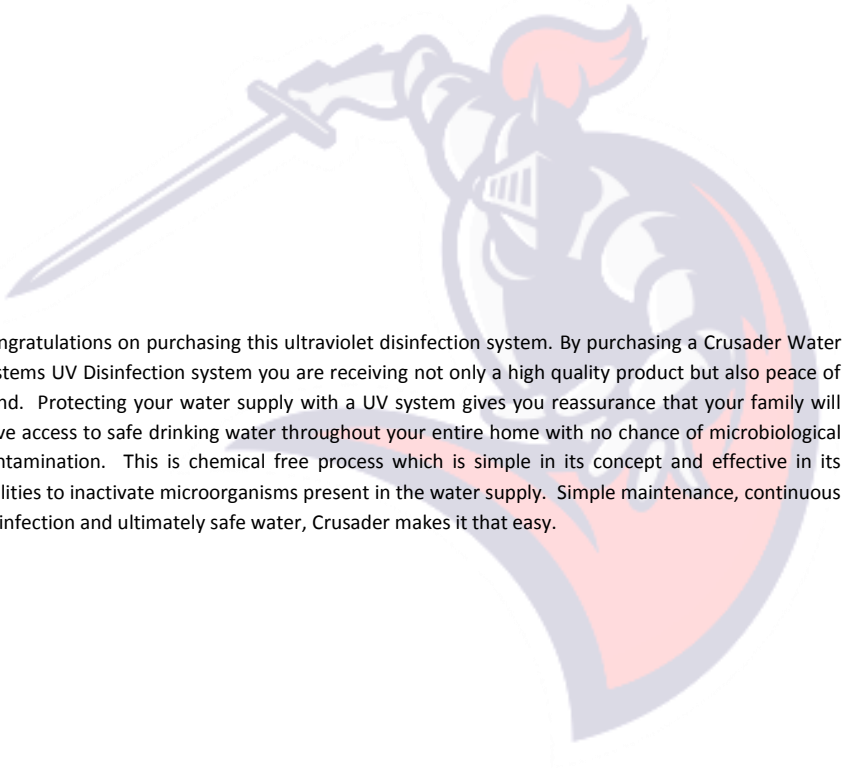

Congratulations on purchasing this ultraviolet disinfection system. By purchasing a Crusader Water Systems UV Disinfection system you are receiving not only a high quality product but also peace of mind. Protecting your water supply with a UV system gives you reassurance that your family will have access to safe drinking water throughout your entire home with no chance of microbiological contamination. This is chemical free process which is simple in its concept and effective in its abilities to inactivate microorganisms present in the water supply. Simple maintenance, continuous disinfection and ultimately safe water, Crusader makes it that easy.

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Safety Considerations

Although your UV system has been manufactured to the highest safety standards, extreme care must be followed when operating and/or maintaining your system.

1. Whenever you are servicing this equipment, always disconnect the power cord from the electrical outlet.
2. As the energy given off by the UV lamp can be harmful to your eyes and skin, NEVER look directly at an illuminated UV lamp without adequate eye protection and always protect your skin from direct exposure to the UV light.
3. To ensure the system provides adequate disinfection, ALWAYS replace any component (lamp and sleeve) with a genuine manufacturer's replacement part.
4. Do not operate the unit if it has any damaged or missing components.
5. To avoid possible electrical shock, use only with a properly grounded electrical outlet.
6. Never perform any maintenance to the system unless you are comfortable in doing so. Contact the manufacturer for service instructions if required.
7. Do not use this system for any purpose other than what it was intended for. Misuse of this system could potentially cause harm to the user.
8. Your system is intended to be installed indoors and away from leaking plumbing. DO NOT plug the unit in if the system or any of the components are wet.
9. The disinfection system should be directly installed into a ground fault circuit interrupter (GFCI). If the use of an extension cord is required, the cord must be manufactured with a minimum of 16 gauge wire and care should be taken to avoid potential tripping hazards.
10. We recommend that a licensed plumber or certified technician perform the installation

Before You Begin

Before you begin, you'll need the following:

Tools

- Pipe cutter, hacksaw or other specialized tools required to cut into your existing plumbing (e.g. if you have PEX piping)
- Soldering tools (torch, flux, emery cloth and solder)
- Wrench (for tightening fittings)

Other Materials

- Inlet/outlet connections
- Teflon™ tape

Water Quality Parameters:

UV disinfection is extremely effective against microorganisms but only if the UV light can pass through the water it needs to treat. This means that the quality of your water is very important in order to ensure complete disinfection.

It is imperative that you have your water tested for at the least the parameters listed below. If the water exceeds the listed parameters Crusader strongly recommends that appropriate pretreatment equipment be installed (pretreatment will depend on parameters being treated):

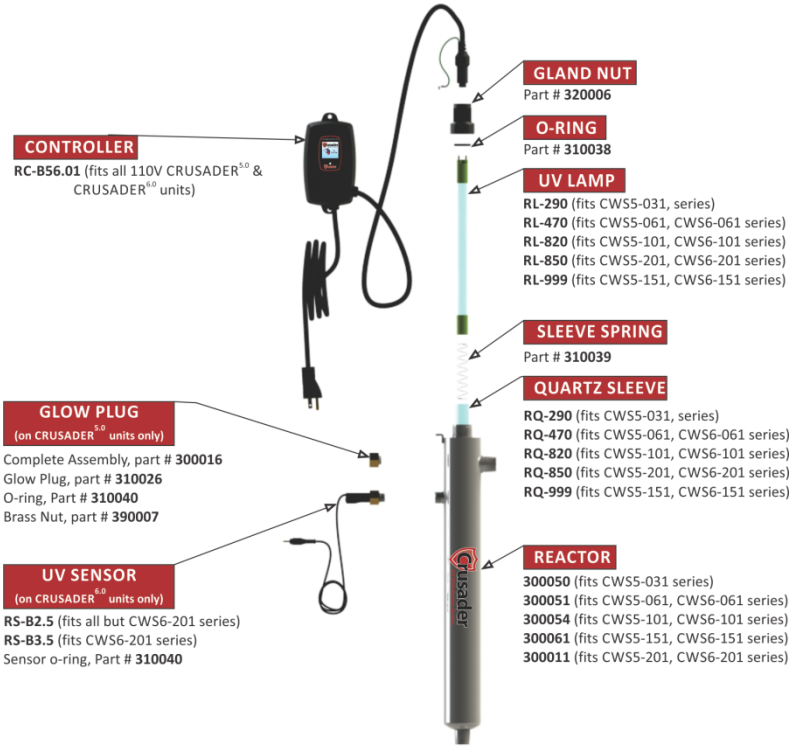
Hardness:	<7 gpg (120 mg/L) – if hardness level is 7 gpg or slightly below the quartz sleeve must be cleaned periodically in order to ensure efficient UV penetration; if above the water must be softened
Iron (Fe):	<0.3 ppm (0.3 mg/L)
Manganese (Mn):	<0.05 ppm (0.05 mg/L)
Turbidity:	< 1 NTU
Tannins (organics):	<0.1 ppm (0.1 mg/L)
UVT (transmittance):	>85% (Please contact Crusader if water has a UVT that is less than 80% for pre-treatment recommendations)

You can have your water tested at a private analytical laboratory or by your local dealer. It is always recommended to install pre-filtration of at least 5 microns prior to a Crusader UV disinfection system.

Assembly

Step 1: Unpack the system and ensure all the components are included with the system. Your system is shipped with the following components:

System Sizing



All Crusader UV systems are rated for a specific flow rate under specific water quality parameters. The equipment has been designed to ensure that the appropriate dose will be delivered provided all parameters are followed. **PLEASE NOTE** that the flow rate for each system can be higher or lower than what the system is rated for however this will change the dose level that the system will deliver. A lower flow is not a concern as the dose will increase however a higher flow rate will decrease the dose and therefore compromise the microorganism inactivation.

It is important to know the maximum flow rate that your water system delivers. If you do not have this information you can simply fill a 1 gallon bucket with water and time how long it takes to fill up. This will be the maximum flow rate for the home. Choose a Crusader system that is suitable.

PLEASE NOTE: It is always better to oversize your system then to undersize. For example, if your pump delivers 8 gpm it is recommended to install any of the Crusader 10 gpm systems. There will come a time where your home is using water at the pump's maximum capacity.

Location

Step 1: Find a suitable location to mount the UV reactor and the accompanying controller. In choosing your location ensure the controller is located within 5 feet of a ground fault circuit interrupter (GFCI) and that there is easy access to the main cold water line prior to any branch lines and before the hot water heater. If you have any other water treatment equipment, such as a softener or water filter, ensure that the UV is the last piece of treatment equipment. **PLEASE NOTE**: All Crusader UV disinfection systems are intended for indoor use only as they should not be exposed to the elements.

Step 2: Your system includes mounting hardware for both the UV reactor and the controller. If the supplied fasteners are not compatible with the structure in which you are mounting the device, please ensure you use the correct fasteners.

Step 3: To facilitate lamp removal, ensure there is enough space at the lamp connector end to safely remove the UV lamp and/or quartz sleeve (a space equal to the length of the unit will suffice) (see Figure 1.).

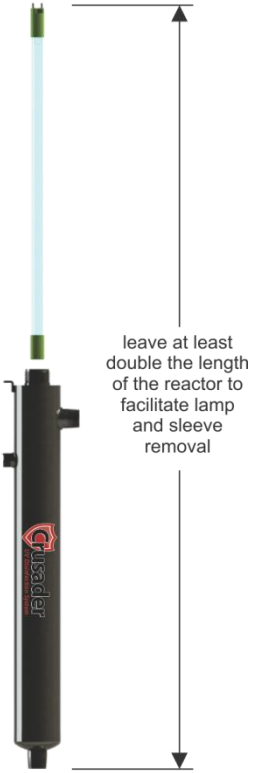


Figure 1. Lamp Removal Spacing

Installation

Step 1: The UV disinfection system should always be the last piece of treatment before the water branches off to the hot and cold water lines if the intent is for Point of Entry (POE) (see figure 2). If the intent for the UV system is for Point of Use (POU) the system should be the final step before the faucet.

Step 2: Crusader strongly recommends that a 5 micron filter be installed **before** the UV system for a final polishing step before the water is disinfected.

Step 3: The reactor can be installed either horizontally or vertically using the clamps provided, however vertical installation is the preferred method with the inlet at the bottom (lamp connection at the top) as it allows any air that may be in the lines to be easily purged from the system.

Step 4: If the water supply flow rate is unknown, it is recommended that you use a flow restrictor so that the rated flow of your particular Crusader system is not exceeded and the UV dose is not compromised. The flow restrictor should be installed on the outlet port of the reactor.

Step 5: It is strongly recommended to have a licensed plumber connect the UV reactor to the water supply and may be a requirement depending on where you are located. If you are attempting this yourself, ensure you have all the necessary tools and fittings to accomplish this task.

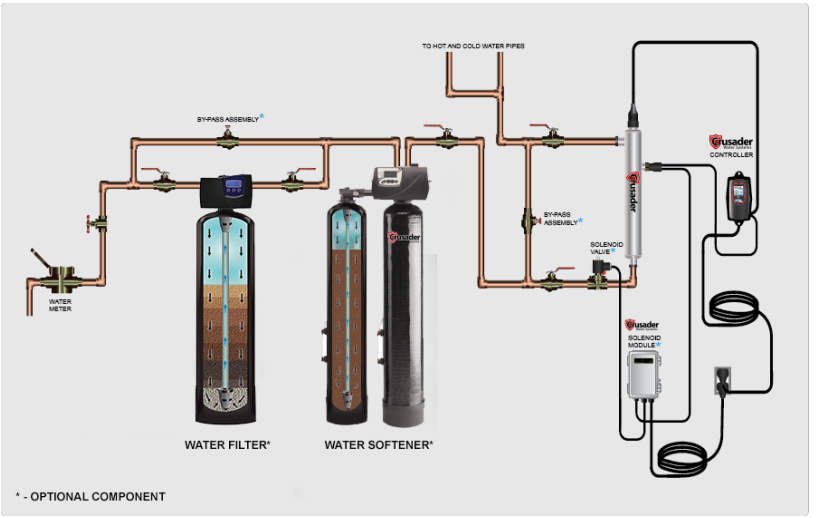


Figure 2. Recommended POE Installation

Step 6: Although there are many methods of installation, this manual will provide a recommended procedure using copper plumbing and standard soldering methods. Crusader recommends the use of unions, a by-pass assembly and shut-off valves as this will allow you to isolate and remove the UV reactor if necessary (this method is a recommended method only however it allows for the maximum convenience but it requires extra components and more time for installation. Please refer to Figure 3 for the recommended installation.

Figure 3. Recommended Installation

Step 7: Before you cut into the cold water line, measure and cut all piping as per the recommended layout. Once all the components are ready, start by installing the female adapters onto the ports of the reactor. To ensure a proper seal, the use of Teflon™ tape is recommended on all threaded connections.

Step 8: Next solder all the assembly together, including ball valves and unions and finally connected the by-pass assembly to the cold water feed line (water in and water out).

Step 9: You can now gently remove the quartz sleeve from its packaging being VERY careful not to touch the length with your hands. The use of cotton gloves (not included) is recommended for this procedure as oils from our hands can leave residue on the sleeve and lamp which can ultimately block the UV light from getting to the water. In the package, you will find a lubricated o-ring. Place the o-ring over the open-end of the sleeve as shown in Figure 4.

Figure 4. Quartz Sleeve Installation

Step 10: Carefully slide the sleeve into the reactor until you can feel it hit the opposite end of the reactor. Slightly push the sleeve in to feel it lock into the spring inside the reactor. Ensure that the o-ring is butted up against the reactor. Assemble the provided gland nut onto the threaded end of the reactor and tighten. The gland nut has a positive stop to avoid over-tightening, hand tighten ONLY. Install the provided stainless steel compression spring inside the quartz sleeve. This spring simply sits in the bottom of the quartz sleeve and works with the lamp and lamp connector to create the proper lamp alignment. **PLEASE NOTE:** DO NOT install a UV lamp inside the quartz sleeve without the sleeve spring in place.

Step 11: (Applies only if you have a UV sensor… Crusader$^{6.0}$) The UV sensor for the system is packaged in a separate plastic bag. Carefully remove the sensor from its packaging and insert the sensor into the UV sensor port (remove the protective cap on the UV reactor first). The sensor can only go in one way. Ensure that the flat portion of the UV sensor matches up with the half metal lip on the sensor port (flat portion should face the lamp connection end) (see Figure 5.). Ensure that the sensor is fully seated in the sensor port and then tighten (turning clockwise) the sensor nut. **PLEASE NOTE:** DO NOT over tighten the nut as this could damage the Teflon sensor body. Plug the male connector into the IEP port located on the right side of the controller, Figure 6, (make sure the controller is not plugged in as the sensor MUST be attached before power is applied to the controller.)

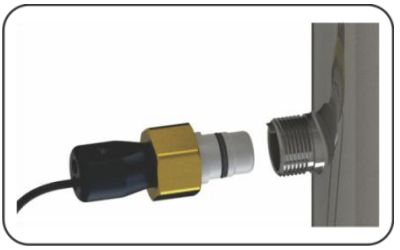


Figure 5. UV Sensor Installation

Figure 6. IEP Connection

Step 12: The reactor is now ready for water flow. When all plumbing connections have been completed you should check for any possible leaks. Slowly turn on the water supply and check for leaks. Make sure the by-pass valves are functioning properly and that the water is flowing through the reactor. The most common leak is from the o-ring not making a proper seal on the reactor. If this is the case turn the water off, drain the reactor, remove the o-ring, dry it and reapply silicon grease. Replace o-ring ensuring that it is properly sealed against the reactor and check again for leaks.

Step 13: The controller can now be mounted on the wall. The controller should always be above or beside the reactor to ensure that no moisture can deposit on any of the connections (see Figure 2.). Always mount the controller vertically. For safety purposes the controller should be connected to a ground fault circuit interrupter (GFCI) (also known as a ground fault interrupter (GFI)).

Step 14: You can now remove the UV lamp from its packaging being careful not to touch the lamp quartz with your hands. Again, the use of cotton gloves is recommended to avoid deposited oils on the lamp glass. Always hold the lamp by the ceramic ends. With the lamp outside of the reactor, affix the UV lamp to the lamp connector as shown in Figure 7.

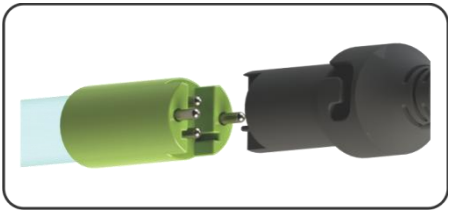


Figure 7. UV Lamp Connection

Step 15: Carefully insert the UV lamp into the reactor sliding it inside the quartz sleeve located inside the reactor (do not drop the lamp into the reactor). Affix the lamp connector into the gland nut by inserting the connector into the nut and turning the connector approximately ¼ turn to lock the connector to the gland nut.

Figure 8. Quick Disconnect Connector

Step 16: Affix the captive ground screw to the ground lug on the UV reactor to ensure proper grounding continuity.

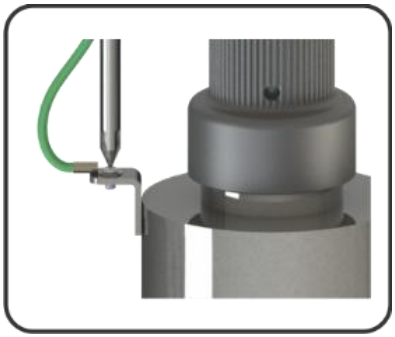


Figure 9. Ground Screw Connection

Step 17: Your system is now ready to be plugged into the appropriate GFCI protected outlet. Plug the unit in and refer to the "System Disinfection" section before any water is allowed to flow through the system.

System Disinfection

Now that the system is installed you will need to disinfect the lines throughout the entire home or facility. To accomplish this, please follow these simple steps:

Step 1: Before performing this task, check to make sure that there are no "dead ends" in the lines throughout the home as these can harbor bacteria. Also ensure that the UV system is powered-up and ready for operation before you start this disinfection process.

Step 2: Remove the cartridge from the filter sump and fill with 1-2 cups of household bleach (most household bleaches are 5.25% chlorine). Replace filter sump and slowly turn on the water supply.

Step 3: Go to each location in the home or facility (including outdoor taps) and run some water until chlorine can be detected (by smell). Ensure all faucets, dishwasher, shower heads, washing machine, toilets, showers, refrigerators, etc. are all checked. Once the chlorine is detected at each location close all faucets and let the chlorine sit in the lines for a minimum of 30 minutes.

Step 4: After 30 minutes, reinstall the filter cartridge into the filter sump and then flush the chlorine solution by opening all faucets and let them run until chlorine can no longer be detected (by smell). Your home has now been completely disinfected with your Crusader UV system ready to inactivate any microorganisms that enter the home.

PLEASE NOTE: This procedure must be performed following any time the UV is shut down for service, without power, or is inoperative for some reason in order to avoid possible contamination of the water lines.

Cleaning the Quartz Sleeve

Depending on the water quality, the quartz sleeve may require periodic cleaning. At a minimum, the quartz sleeve should be cleaned on an annual basis. The following steps outline a basic cleaning procedure.

Step 1: If the system has an inlet shut-off valve, shut this valve off to prevent water flow through the system. If there is no inlet shut-off valve, turn off main water inlet valve (and turn of water pump if you have one).

Step 2: Disconnect power cord of UV system from electrical outlet.

Step 3: Release water pressure by opening a downstream faucet and close the outlet shut-off valve if the installation incudes one (if there is no outlet shut-off valve, be prepared for water leakage from the system as the head pressure in the system will cause water to flow back through the outlet plumbing and through the reactor).

Step 4: Remove the captive ground screw from the ground lug on the UV reactor.

Step 5: Remove the lamp connector from the reactor (gland nut) by pushing the lamp connector in and turning it ¼ turn counter-clockwise (gently pull on the lamp cable to ensure the connector is seated properly).

Step 6: Pull lamp out of reactor still attached to connector.

Step 7: Remove the gland nut from the reactor exposing the end of the quartz sleeve.

Step 8: Carefully remove the quartz sleeve by gently twisting and pulling the quartz sleeve out of the reactor and remove the o-ring.

Step 9: Using a soft, lint-free cloth or towel wipe the sleeve down using CLR® or LIME-A-WAY® (or other commercial scale cleaner) to remove any scaling or iron deposits that may be on the outside of the quartz sleeve. Be careful not to get any moisture or liquids on the inside of the sleeve.

Step 10: Wipe the sleeve with separate dry cloth.

Step 11: Once the sleeve is cleaned replace the o-ring and slide the sleeve back into the reactor following the steps outlined on page 9 of the manual.

Cleaning the UV Sensor

Depending on the water quality, the UV sensor may require periodic cleaning. At a minimum, the UV sensor should be cleaning on an annual basis. The following steps outline a basic cleaning procedure.

Step 1: If the system has an inlet shut-off valve, shut this valve off to prevent water flow through the system. If there is no inlet shut-off valve, turn off main water inlet valve (and turn of water pump if you have one).

Step 2: Disconnect power cord of UV system from electrical outlet.

Step 3: Release water pressure by opening a downstream faucet and close the outlet shut-off valve if the installation incudes one (if there is no outlet shut-off valve, be prepared for water leakage from the system as the head pressure in the system will cause water to flow back through the outlet plumbing and through the reactor).

Step 4: Place something under the reactor to catch any water that may come out of the reactor during the removal of the UV sensor.

Step 5: Unscrew (counterclockwise) sensor nut from the reactor and pull the sensor slowly out of the sensor port.

Step 6: Holding the sensor in your hand wipe the flat portion (sensor face) of the sensor with isopropyl alcohol using a clean lint-free cloth.

Step 7: Replace sensor as per instructions on page 9 of the manual.

Operation

The Crusader system comes with a feature laden controller that incorporates both the lamp driver (ballast) and control features in one water-tight case. **CAUTION:** Prior to performing any maintenance on your UV system, you must always disconnect the power.

Crusader$^{5.0}$ & Crusader$^{6.0}$ Controller

This controller features a power factor corrected, constant current lamp driver with a universal power input. A full colour LCD screen provides the user with a detailed description of the system's performance in addition to providing any applicable fault messages and system diagnostics. The controllers used in both the Crusader$^{5.0}$ and Crusader$^{6.0}$ are identical. The difference is that the Crusader$^{6.0}$ series of products includes a UV intensity monitor. All Crusader$^{5.0}$ and Crusader$^{6.0}$ controllers include an "infinite expandability port" located on the right side of the controller. Simply plug in an optional UV sensor module into the expandability port of a Crusader$^{5.0}$ controller and the system will now monitor the UV intensity of the system!

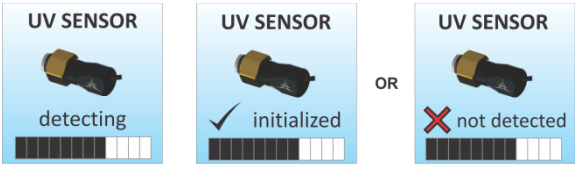
Crusader[5.0] & Crusader[6.0] Power-up Sequence

Upon start up, the 5.0 & 6.0 controller will run through a diagnostic start-up and the sequence will be displayed as follows on the colour LCD:

Home Screen | starting diagnostic check | lamp preheats, then starts

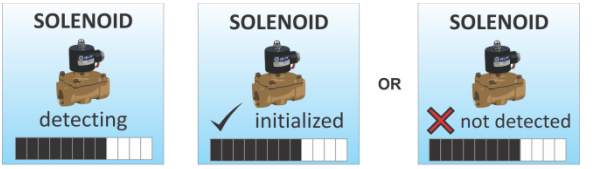
Next, the controller checks for the installation of any optional modules that may be installed on the system. It first checks to see if a module is installed and then either initializes the module to function with the controller or returns a "not detected" screen and moves on to the next module. The screens will appear as follows:

UV Sensor Module Check



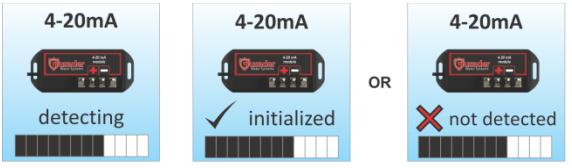
detecting the presence of a UV sensor | if sensor is present, returns this screen | if sensor is not present, returns this screen

Solenoid Module Check



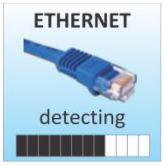
detecting the presence of a solenoid module | if solenoid module is present, returns this screen | if solenoid module is not present, returns this screen

4-20 mA Module Check

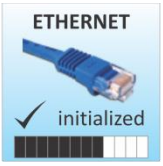


detecting the presence of a 4-20mA module | if 4-20mA module is present, returns this screen | if 4-20mA module is not present, returns this screen

Ethernet Module Check

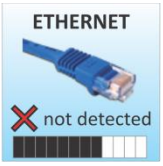


detecting the presence of a ethernet module



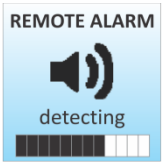
if ethernet module is present, returns this screen

OR

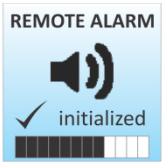


if ethernet module is not present, returns this screen

Remote Alarm Module Check



detecting the presence of a remote alarm module

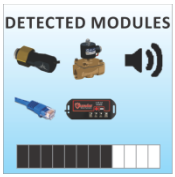


if remote alarm module is present, returns this screen

OR

if remote alarm module is not present, returns this screen

Once the controller has finished checking for the installation of all available modules a single screen is displayed showing which specific modules are installed and activated on this particular system. **Please Note:** If the corresponding module icon is not displayed on this screen, then that module is not installed on this system. If you believe this module is installed correctly, recheck the applicable connections to ensure a solid connection point and then restart the controller. The controller then continues to optimize the lamp efficiency by waiting 60 seconds to allow the lamp to reach its optimum output. Finally, a final "start-up complete" screen is displayed. These screens will appear as follows:



Crusader[5.0] Operational Screens

On Crusader[5.0] systems (without the UV monitor), the default screen shows the **Crusader Home Screen**. At any point during operation the user is able to scroll through the **Crusader Home Screen, Lamp life remaining** and **QR Code/Contact Info** screens by simply pressing the button located on the front of the controller.

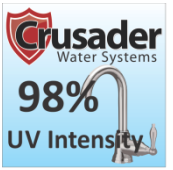
Home Screen

press button once

press button twice

Crusader[6.0] Operational Screens

On systems that have the UV module installed (and on all Crusader[6.0] systems), the default screen shows the **% UV Intensity**. At any point during operation the user is able to scroll through the **% UV Intensity**, **Lamp life remaining** and **QR Code** screens by simply pressing the button located on the front of the controller.



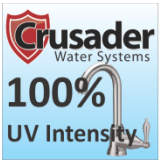
Home Screen

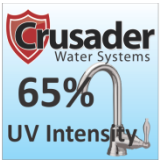
press button once

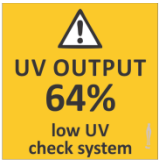
press button twice

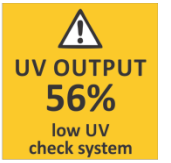
Crusader[6.0] % UV Intensity

If your system is equipped with a UV sensor the % UV Output screens will indicate the level of UV intensity that is being detected within the reactor by the sensor. This will always be visible on the Home Screen of the controller. Things that can affect the % UV Output are poor water quality, scaling of the quartz sleeve and/or sensor, lamp failure, expired lamp life and sensor failure. The following screens show the % UV Output dropping on a monitored system.

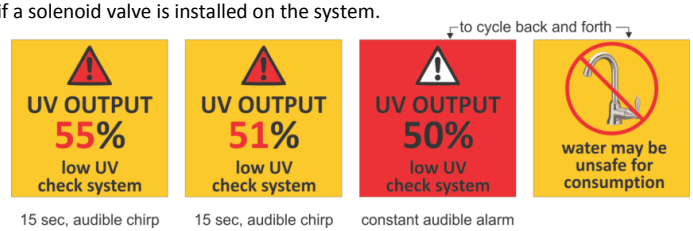








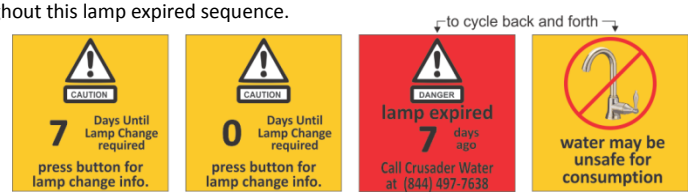
Once the UV output drops below 56%, the numbers and warning sign switch to red and a 15 second intermittent audible chirp is given off by the ballast. When the output drops below 51%, the display switches to a solid red and a constant audible signal is provided. The screens alternate between this solid red screen and another screen indicating “water may be unsafe for consumption”. At this point, the controller also provides a signal to de-activate the solenoid valve, shutting off the flow of water if a solenoid valve is installed on the system.



Crusader[5.0] & Crusader[6.0] Lamp Countdown Sequence

The Crusader[5.0] & Crusader[6.0] counts down the number of days until a lamp change is required. The operation is as follows:

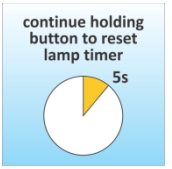
Once the lamp has seven days remaining until a lamp change is required, the screen changes to a yellow caution screen. At this point, an audible chirp is given off by the ballast to draw your attention to the pending lamp change condition. When the controller passes the zero day threshold, the screen changes to solid red and cycles between a red “lamp expired” screen and a “water may be unsafe for consumption” screen. The same intermittent audible chirp is heard throughout this lamp expired sequence.



At any point during this sequence, the audible chirp can be deferred by holding the controller button down for a period of five seconds. The screen shown below will appear for five seconds indicating that the audible defferal has been activated and then the system switches back to the current lamp change or lamp expired screen. This audible deferral will last for seven days after which then the alarm will sound once again. This audible deferral feature can be activated as many times as you wish. **PLEASE NOTE:** During the condition of lamp expiration and audible deferral, the water may be unsafe for consumption and should not be consumed without another form of disinfection.

Crusader[5.0] & Crusader[6.0] Lamp Countdown Reset Sequence

After changing the lamp on the Crusader[5.0] & Crusader[.0] systems, the controller must be reset in order for the system to begin its countdown function on the newly installed lamp. To perform this reset, you must firmly depress the button on the front of the controller and then manually plug the power cord back into the wall outlet initiating power to the unit. Keep holding down the button for five seconds until you hear an audible chirp indicating the controller has reset the internal timer. Release the switch and the lamp countdown feature has now been reset. The following two screens will be displayed during this process.



Crusader[5.0] & Crusader[6.0] Failure Modes

The Crusader controller continuously monitors your UV system and if there is a problem with the system the controller will provide both a visual and audible signal indicating the specific fault that may be adversely affecting the operation of your system. The fault conditions are listed in a priority sequence as follows:

LAMP FAILURE: If at any time during the operation of the system, the UV lamp fails to be illuminated, the controller will return both an audible and visual signal indicating lamp failure. In addition, a constant audible buzzer will sound during lamp failure.

UV SENSOR FAILURE: Assuming the system has a UV Sensor installed, if at any time during the operation of the system, a UV sensor fails, the controller will return both an audible and visual signal indicating sensor failure. For sensor failure, the controller will cycle between “sensor failure” and “water may be unsafe for consumption” screens as an added precaution. In addition, a constant audible buzzer will sound during sensor failure.

SOLENOID MODULE FAILURE: Assuming the system has an optional Solenoid Module installed, if at any time during the operation of the system, a solenoid valve fails to operate, the controller will return both an audible and visual signal indicating solenoid failure. In addition, an intermittent (15 sec) audible buzzer will sound during solenoid failure.

4-20 mA MODULE FAILURE: Assuming the system has an optional 4-20 mA Module installed, if at any time during the operation of the system, a 4-20 mA module fails, the controller will return both an audible and visual signal indicating a 4-20 mA failure. In addition, an intermittent (15 sec) audible buzzer will sound during a 4-20 mA failure.

REMOTE ALARM MODULE FAILURE: Assuming the system has an optional Remote Alarm Module installed, if at any time during the operation of the system, a remote alarm module fails, the controller will return both an audible and visual signal indicating remote alarm failure. In addition, an intermittent (15 sec) audible buzzer will sound during remote alarm failure.

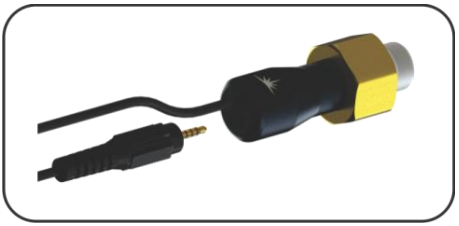
ETHERNET MODULE FAILURE: Assuming the system has an optional Ethernet Alarm Module installed, if at any time during the operation of the system, an Ethernet module fails, the controller will return both an audible and visual signal indicating Ethernet failure. In addition, an intermittent (15 sec) audible buzzer will sound during Ethernet failure.

Crusader$^{5.0}$ & Crusader$^{6.0}$ QR Codes

A **QR code** (abbreviated from Quick Response code) is a type of matrix barcode (or two-dimensional code) first designed for the automotive industry. Crusader uses the QR code to store a link to a specific page on our website. Users with a camera phone equipped with the correct reader application can scan the image of the QR code and over a wireless network connect to a Crusader web page in the phone's browser. Crusader's QR webpage has information on how to purchase replacement components as well as a helpful video directory on system servicing (i.e. How to change a UV lamp or quartz sleeve). To access the QR code on the Crusader$^{5.0}$ or Crusader$^{6.0}$ controller simply press the control button twice and the QR code screen will appear as follows:

Crusader[5.0] & Crusader[6.0] Expansion Modules

As shown earlier in this manual, the Crusader[5.0] and Crusader[6.0] controller incorporate an "**Infinite Expandability Port**" (**IEP**) on the controller. It is through this port and via a custom communication protocol that the UV sensor and all expanison modules are connected. Each module (including the sensor) comes with both a male and female connection. To activate the device, you simply need to connect the first device (does not matter which device it is) to the controller and all subsequent devices are then connected into the female end of the other device. This "daisy chain" method allows for a truly modular approach and is extremely user friendly. An example of this "daisy chain" is shown below.



The following optional expansion modules are available for use on your Crusader[5.0] and Crusader[6.0] controllers. Contact your authorized distributor for purchasing information.

REMOTE ALARM MODULE: Allows for a signal to be connected to a remote monitor such as a buzzer, light, alarm system, PLC, etc., via a pair of contacts. In normal operation the OK and COM contacts will be connected, and in a fault condition (Low UV, Lamp fail, Power Fail), the Fault and COM contacts will be connected. Maximum Contact Rating is 1A-120VAC/VDC (uses 16-22 AWG).

SOLENOID CONNECTION MODULE: Allows the integration of a NORMALLY CLOSED line voltage solenoid valve. Simply affix the module's supplied bare lead cord to the solenoid valve, connect the power cable to the electrical outlet, and the male IEP connector to the female IEP port on the controller. **PLEASE NOTE:** When this device is connected to a Crusader[5.0] system (without the UV module), then the solenoid will close on a lamp failure mode only. When used on a Crusader[6.0] system, the solenoid will close when the UV level drops below 50%. Also note that in cases where emergency use of untreated water is required, the controller can be placed into a manual override mode allowing for the flow of water in an alarm condition.

4-20 mA MODULE: Allows for a 4-20mA signal transfer of the UV output to a remote device such as a data logger or computer. Simply plug the supplied cable into any female IEP connections. Two screw terminals are supplied to connect the wire that leads to the receiving end of the signal. As the distance required is unknown, no wire is supplied with this system, however 16-22 AWG is required.

ETHERNET MODULE: Allows for all controller functions to be connected to a computer via an Ethernet cable. This module is currently in development and is not available at this point-in-time.

Warranty Registration

It is imperative that you complete the warranty registration process. This not only registers your UV disinfection system for the provided manufacturer's warranty, but also allows the factory to provide you with any important product updates or technical bulletins concerning your product. The registration process is a simple process by filling out the attached warranty card. Please ensure that ALL information is filled in, including a valid e-mail address. **PLEASE NOTE:** This information is for the sole purpose of technical support for your disinfection system and will not be used, or sold, to any other organization for any other purpose.

Crusader UV Disinfection System	CRUSADER EQUIPMENT SPECIFICATIONS CRUSADER 6.0, Residential UV systems			
MODEL	**CWS6-061 CWS6-06-12V CWS6-06-24V**	**CWS6-101 CWS6-10-24V**	**CWS6-151**	**CWS6-201**
Crusader Flow Rate (@ 16 mJ/cm^2 @ 95% UVT)	11 GPM 41 lpm 2.5 m^3/hr.	**20 GPM** [1] 77 lpm [1] 4.6 m^3/hr. [1]	**30 GPM** [2] 113.6 lpm [2] 6.8 m^3/hr. [2]	**39.2 GPM** [2] **150 lpm** [2] **8.9 m^3/hr.** [2]
CrusaderFlow Rate (@ 30 mJ/cm^2 @ 95% UVT)	6 GPM 22.7 lpm **1.4 m^3/hr.**	11 GPM 41 lpm 2.5 m^3/hr.	15 GPM 56.8 lpm 3.4 m^3/hr.	**21 GPM** **79 lpm** **4.8 m^3/hr.**
Crusader Flow Rate (@ 40 mJ/cm^2 @ 95% UVT)	4.4 GPM 17 lpm 1.0 m^3/hr.	8.3 GPM 31 lpm 1.9 m^3/hr.	12 GPM 45.4 lpm 2.7 m^3/hr.	16 GPM 59 lpm 3.6 m^3/hr.
Port Size	**¾" MNPT**	**¾" MNPT**	**1" MNPT**	**1" MNPT**
Electrical	90-265V/50-60Hz.			
Plug Type	North American, NEMA 5-15, 3-wire for all 110V			
Lamp Watts	22	39	50	42
Power (watts)	30	49	62	51
Replacement Lamp	RL-470	RL-820	RL-999	RL-850
Replacement Sleeve	RQ-470	RQ-820	RQ-999	RQ-850
Reactor Dimensions	2.5 x 21.3" (6.4 x 54.2 cm)	2.5 x 35.2" (6.4 x 89.5 cm)	2.5 x 40.0" (6.4 x 101.6 cm)	3.5 x 36.1" (8.9 x 91.7 cm)
Chamber Material	Polished 304 Stainless Steel, A249 Pressure Rated Tubing			
Controller Dimensions	6.8 x 3.6 x 3" (171.5 x 92.1 x 76.2 mm)			
Operating Pressure	0.7-10.3 bar (10-150 psi)			
Operating Water Temperature	2-40° C (36-104° F)			
UV Intensity Monitor	Yes			
Solenoid Output	Yes, but requires optional solenoid module			
4-20 mA Output	Yes, but requires optional 4-20 mA module			
Lamp Change Reminder (audible & visual)	Yes			
Lamp-Out Indicator (audible & visual)	Yes			
Shipping Weight	4.2 kg. (9.3 lbs.) 5 kg. (9 lbs.) cubed	6.8 kg. (15.0 lbs.) 7 kg. (15 lbs.) cubed	8.0 kg. (17.6 lbs.) 8 kg. (17 lbs.) cubed	7.5 kg. (16.5 lbs.) 10 kg. (22 lbs.) cubed

Note: 1. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to **13.6 gpm** (50 lpm) (3.1 m^3/hr.) for 3/4" port

2. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to **22.1 gpm** (84 lpm) (5.0 m^3/hr.) for 1" port

Crusader UV Disinfection System	CRUSADER EQUIPMENT SPECIFICATIONS CRUSADER$^{5.0}$, Residential UV systems				
MODEL	**CWS5-031 CWS5-03-12V CWS5-03-24V**	**CWS5-061 CWS5-06-12V CWS5-06-24V**	**CWS5-101 CWS5-10-24V**	**CWS5-151**	**CWS5-201**
Crusader Flow Rate (@ 16 mJ/cm^2 @ 95% UVT)	6 GPM 23 lpm 1.4 m3/hr.	11 GPM 41 lpm 2.5 m^3/hr.	**20 GPM** [1] 77 lpm [1] 4.6 m^3/hr. [1]	**30 GPM** [2] 113.6 lpm [2] 6.8 m^3/hr. [2]	**39.2 GPM** [2] **150 lpm** [2] **8.9 m^3/hr.** [2]
Crusader Flow Rate (@ 30 mJ/cm^2 @ 95% UVT)	3 GPM 11.4 lpm 0.7 m3/hr.	6 GPM 22.7 lpm **1.4 m^3/hr.**	11 GPM 41 lpm 2.5 m^3/hr.	15 GPM 56.8 lpm 3.4 m^3/hr.	**21 GPM 79 lpm 4.8 m^3/hr.**
Crusader Flow Rate (@ 40 mJ/cm^2 @ 95% UVT)	2.4 GPM 9.1 lpm 0.5 m3/hr.	4.4 GPM 17 lpm 1.0 m^3/hr.	8.3 GPM 31 lpm 1.9 m^3/hr.	12 GPM 45.4 lpm 2.7 m^3/hr.	16 GPM 59 lpm 3.6 m^3/hr.
Port Size	**½" MNPT**	**¾" MNPT**	**¾" MNPT**	**1" MNPT**	**1" MNPT**
Electrical	**90-265V/50-60Hz.**				
Plug Type	**North American, NEMA 5-15, 3-wire for all 110V**				
Lamp Watts	**15**	**22**	**39**	**50**	**42**
Power (watts)	**20**	**30**	**49**	**62**	**51**
Replacement Lamp	**RL-290**	**RL-470**	**RL-820**	**RL-999**	**RL-850**
Replacement Sleeve	**RQ-290**	**RQ-470**	**RQ-820**	**RQ-999**	**RQ-850**
Reactor Dimensions	**2.5 x 14.3" (6.4 x 36.4 cm)**	**2.5 x 21.3" (6.4 x 54.2 cm)**	**2.5 x 35.2" (6.4 x 89.5 cm)**	**2.5 x 40.0" (6.4 x 101.6 cm)**	**3.5 x 36.1" (8.9 x 91.7 cm)**
Chamber Material	**Polished 304 Stainless Steel, A249 Pressure Rated Tubing**				
Controller Dimensions	**6.8 x 3.6 x 3" (171.5 x 92.1 x 76.2 mm)**				
Operating Pressure	**0.7-10.3 bar (10-150 psi)**				
Operating Water Temperature	**2-40° C (36-104° F)**				
UV Monitor Port (upgradeability)	**No**	**Yes**			
Solenoid Output	**Yes, but requires optional solenoid module**				
4-20 mA Output	**Yes, but requires optional 4-20 mA module**				
Lamp Change Reminder (audible & visual)	**Yes**				
Lamp-Out Indicator (audible & visual)	**Yes**				
Shipping Weight	**3.3 kg. (7.3 lbs.) 3 kg. (7 lbs.) cubed**	**4.2 kg. (9.3 lbs.) 5 kg. (9 lbs.) cubed**	**6.8 kg. (15.0 lbs.) 7 kg. (15 lbs.) cubed**	**8.0 kg. (17.6 lbs.) 8 kg. (17 lbs.) cubed**	**7.5 kg. (16.5 lbs.) 10 kg. (22 lbs.) cubed**

Note: 1. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 13.6 gpm (50 lpm) (3.1 m^3/hr.) for 3/4" port
2. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 22.1 gpm (84 lpm) (5.0 m^3/hr.) for 1" port

Limited Warranty Statement:

Products manufactured by Crusader are warranted to the original user only to be free of defects in material and workmanship for a period as specified below. This warranty only applies to the original purchaser and is not transferable.

UV SYSTEMS

Ten (10) year Limited Warranty on the stainless steel reactors, from the date of original purchase, or installation (proper documentation required for verification).

ELECTRONICS

Three (3) year Limited Warranty on the ballasts and controllers, from the date of original purchase, or installation (proper documentation required for verification).

UV LAMPS, UV SENSORS & QUARTZ SLEEVES

One (1) year Limited Warranty on all Crusader ultraviolet lamps, UV sensors and quartz sleeves from the date of original purchase, or installation (proper documentation required for verification).

Crusader warrants that it will repair, replace or refund, at Crusader's sole option, any ultraviolet system or component that is defective in materials or workmanship for the period as outlined above, subject to the "Limitations of Warranty" as outlined below. Crusader's liability under this warranty shall be limited to repairing or replacing at Crusader's option, without charge, F.O.B. Crusader's factory or authorized service depot, any product that Crusader manufactures. Crusader will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Crusader are subject to the warranty provided by the manufacturer of said products and not by Crusader's warranty. Crusader will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Crusader's printed installation and operating instructions.

LIMITATIONS OF WARRANTY

This warranty does not apply to any of the following:

- Water Quality Parameters lie outside of the following ranges
    - Hardness > 120 mg/L (7 gpg)
    - Iron > 0.3 mg/L (ppm)
    - Manganese > 0.05 mg/L (ppm)
    - Tannins > 0.1 mg/L (ppm)
    - Turbidity > 1 NTU
    - Transmittance (UVT) < 75%
- A product that has been incorrectly installed according to the technical installation manual.
- A product that has been modified in any manner, unless approved by the manufacturer.
- A product where the serial number has been altered defaced or removed.
- Damage caused by the use of parts that are not compatible, suitable and/or authorized by Crusader for use with the product (e.g. non-original lamps or sleeves).
- Damage caused during shipment of the product.
- Water damage is found inside ballast housing or controllers.
- Product is installed outdoors in direct contact with the environment (rain).
- Product is installed in freezing temperatures.

- Product is used in conditions that exceed Crusader's specifications.

TO GET WARRANTY SERVICE

To obtain service under this warranty, you must first contact Crusader Customer Service at 844-497-7638 to obtain a Warranty Return Authorization. You will then need to return the product through the Crusader Dealer or Distributor where the product was originally purchased, together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the Dealer or Distributor will contact Crusader for instructions on returning the product. Any defective product to be returned to Crusader must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

CRUSADER WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY MADE BY CRUSADER WITH RESPECT TO THE PRODUCT, AND IS GIVEN IN LIEU OF ANY OTHER WARRANTY. TO THE EXTENT ALLOWED BY APPLICABLE LAW, ANY AND ALL EXPRESS OR IMPLIED WARRANTIES NOT SET FORTH HEREIN ARE WAIVED AND DISCLAIMED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE. CRUSADER LIABILITY UNDER THIS LIMITED WARRANTY IS LIMITED SOLELY TO THOSE LIABILITIES SET FORTH ABOVE. IN THE EVENT THAT ANY PROVISION OF THIS LIMITED WARRANTY SHOULD BE OR BECOME INVALID OR UNENFORCEABLE UNDER APPLICABLE LAW, THE REMAINING TERMS AND CONDITIONS HEREOF SHALL REMAIN IN FULL FORCE AND EFFECT AND SUCH INVALID OR UNENFORCEABLE PROVISION SHALL BE CONSTRUED IN SUCH A MANNER AS TO BE VALID AND ENFORCEABLE.

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