Ecoflo UV Design guide

The Ecoflo biofilter with an integrated UV disinfection unit (DiUV) is a tertiary treatment system with disinfection. It consists of a primary/septic tank, an effluent filter, an Ecoflo biofilter and an integrated UV disinfection unit (DiUV). All information relative to any other component of the septic installation by Premier Tech, can be found in the Installation Guides of these products available at *PT-WaterEnvironment.com/ProSpace*. Following is the information needed to design the UV disinfection unit (DiUV) in an Ecoflo biofilter or in a separate container.

1. General Description of the System

The Ecoflo biofilter is a biofiltration system designed to treat domestic septic tank effluent to an extremely high level before final dispersal. A typical Ecoflo system consists of:

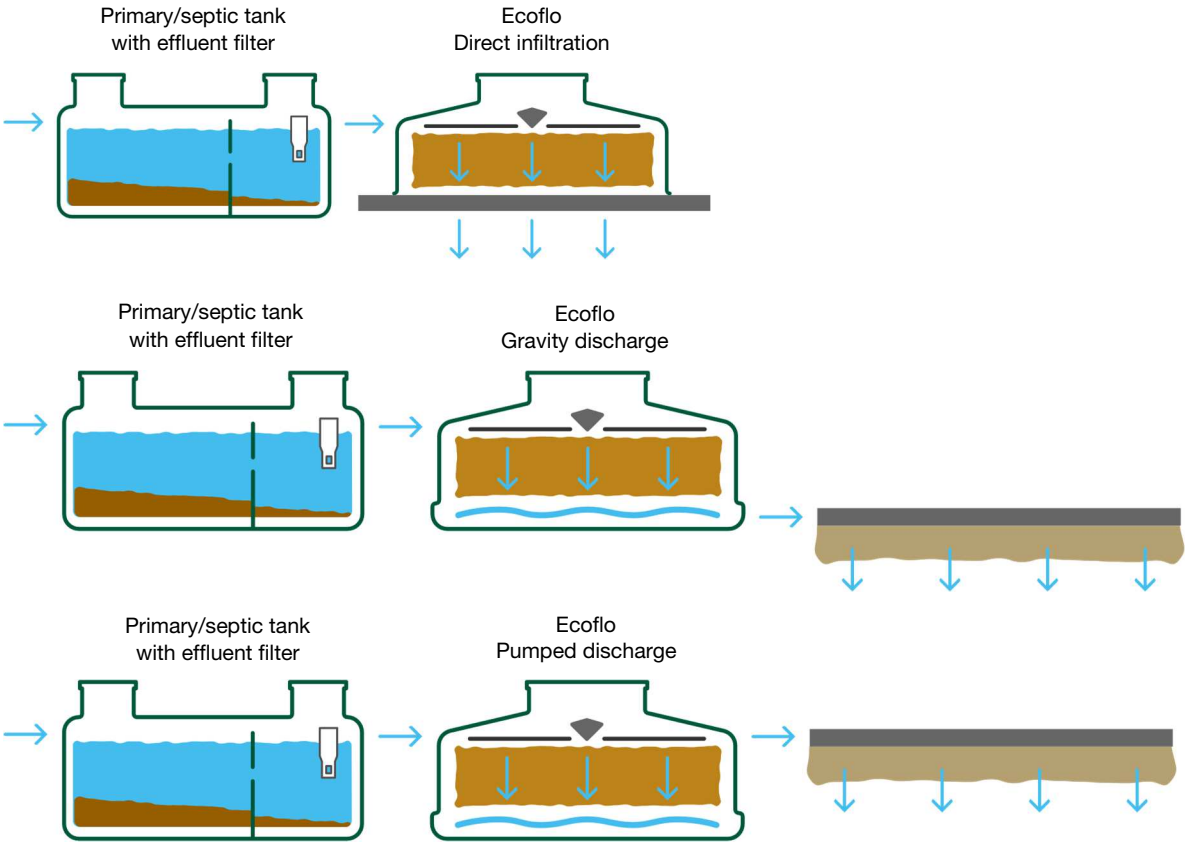
- Septic/Primary tank with a commercially-rated effluent filter connected to the tank outlet pipe;
- Ecoflo biofilter where advanced treatment occurs due to physical, chemical and biological processes that are optimized in the 100% natural fibrous organic filtering media. The Ecoflo biofilter can housed into different types of tanks (fiberglass, concrete, polyethylene);
- Site specific: final effluent dispersal system, or,
- As needed additional treatment to further reduce fecal coliforms prior to final dispersal or discharge of treated effluent.

The Ecoflo biofilter system is based on simple, passive biofiltration principles. Once the wastewater has passed through the septic/primary tank, it then flows towards the Ecoflo biofilter where a unique combination of physical, chemical and biological interactions between the effluent and the 100% natural fibrous organic filtering media takes place to treat the effluent.

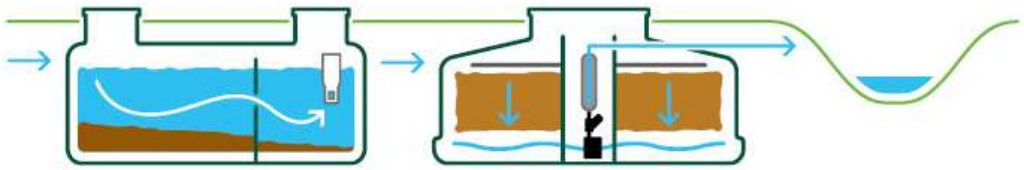
Inside the biofilter, a tipping bucket equally scatters the wastewater on specially designed plates which evenly distribute the wastewater on top of the filtering media. The wastewater then trickles through the 100% natural fibrous organic filtering media, where the wastewater is treated aerobically by bacteria fixed into the filtering media via an optimized water/air (oxygen) mass transfer process. Treated effluent is then disposed of either by gravity or pumped to final dispersal/infiltration into the ground.

The Ecoflo biofilter has been tested, certified and listed by the National Sanitation Foundation International as meeting the requirements of NSF/ANSI Standard 40, Class 1. The Ecoflo biofilter is certified for a hydraulic loading rate (HLR) applicable to the surface of filtering media of 700 L/m^2-d (17.2 Gpd/ft^2).

Installation diagrams



To further reduce fecal coliforms the Ecoflo biofilter can be coupled to the UV disinfection system DiUV. The operating principle of the DiUV Disinfection Unit is to expose microorganisms to ultraviolet rays. The dose depends on the time of exposure and the intensity of the rays. The flow to the DiUV is regulated to ensure a maximum exposure time. The DiUV can either be integrated in the pump vault located inside the Ecoflo biofilter unit (image below) or installed separately in another containment vessel.



2. Treated Effluent Quality

When treating domestic strength wastewater up to the design flows and loads, a properly maintained Ecoflo biofilter system will exceed the performance requirements of NSF Standard 40 Class 1. Actual test results established through analytical methods described in NSF/ANSI Standard 40 averaged 8 mg /L in $CBOD_5$ and 6 mg/L in TSS.

Parameters	Influent	Ecoflo effluent	Abatement	NSF Std 40 Avg, 30-day
TSS (mg/L)	180 ± 64	6 ± 4	97%	30
$CBOD_5$ (mg/L)	200 ± 88	8 ± 9	96%	25
pH	7.3	7.0		6-9
D.O. (mg/L)	0.9 ± 0.7	3.7 ± 2.2		
Temperature (C)	28 ± 3	27 ± 5		

To further reduce fecal coliforms the Ecoflo biofilter can be coupled to the UV disinfection system DiUV which is certified under BNQ standard NQ 3680-910. It ensures treated water to be released in compliance with local regulations protecting surface water and public health.

The Ecoflo biofilter has demonstrated to steadily contribute on average to log 2 abatement of fecal coliforms and the UV disinfection system to an additional log 4 abatement of fecal coliforms.

Certification program	Influent	Ecoflo Coco Effluent	UV disinfection (DiUV) Effluent
	Fecal Counts (log)		
ANSI/NSF Std 40 Class I	6.6	4.6	n.a
BNQ 3680-910 Annexe A (Equivalent to ANSI/NSF Std 40 Class I)	6.3	4.2	0.4

During the BNQ certification, concentration of the fecal coliforms of the DiUV effluent was in average of < 2 CFU/100 mL.

The table below summarizes the results obtained at effluent of the Ecoflo biofilter combined to the UV disinfection system DiUV during the BNQ 3680-910 certification.

Parameters		Fecals (UFC/100 mL)
Influent	Mean	2 863 158 Geomean: 2 408 394
	St. Dev	1 551 416
	Minimum	500 000
	Maximum	7 900 000
	n	76
Effluent DiUV	Mean	2.3 Geomean: 2.2
	St. Dev	1.3
	Minimum	<2
	Maximum	10
	n	69

The Ecoflo biofilter system has demonstrated its robustness over the years. The system does not require any acclimation/start-up period to consistently provide effluent quality demonstrated in the table above, which makes it the perfect system for secondary or seasonal home applications or any other intermittent use applications in addition to dwellings occupied full time. Also, the Ecoflo biofilter system has been specifically developed and tested for cold climate applications. Treatment efficiency is not subject to significant variation with ambient air temperature fluctuation.

3. Wastewater System Component Design and Specification

3.1 System Configuration

The designer of an Ecoflo biofilter system will be responsible for proper configuration and sizing of the components of the system, pump and other peripheral component specifications as well as treated effluent dispersal or final disposal and construction details. Design shall comply with all requirements of local rules and regulations.

3.2 Design Flow

Applicable state and local regulations usually define the daily flow based on the number of bedrooms or the number of occupants with a defined flow per person per day.

3.3 Septic/Primary Tank

The size and configuration of the septic/primary tank shall be in accordance with the NSF listing (as applicable) or State or Local requirements. As per testing during NSF certification, primary/septic tank shall offer a minimum of 1.5 day of holding time. The septic tank, risers and lids must be watertight.

3.4 Effluent Filter

The effluent filter extends the life of any treatment system by keeping solids in the septic/primary tank. The effluent filter is especially important if the household is equipped with a sewage pump or any other appliance that may increase the suspended solids content in the wastewater and thereby jeopardize the long-term operation of the system and affect its performance. In situations where an effluent pump is required as part of the septic system, an effluent filter will also prevent solids from reaching the pump. No garbage disposal unit should be installed on your septic system.

Effluent filters to be used with the Ecoflo biofilter shall be NSF 46 certified have a minimal flow area of 9 in^2 and filter particles 1/16" and larger. While many different brands of effluent filters meet those specifications, Premier Tech highly recommends the use of the PL-122 effluent filter from Polylok.

3.5 Ecoflo Biofilter

The Ecoflo biofilter is a biofiltration system designed to treat domestic wastewater. Once the wastewater has passed through the septic/primary tank, it then flows towards the Ecoflo biofilter. Inside the biofilter, a central tipping bucket equally scatters the wastewater on both sides of the biofilter. Both sides are equipped with specially designed plates which evenly distribute the wastewater on top of the filtering media. The wastewater then trickles through the natural fibrous filtering media as its organic matter is decomposed by the microorganisms attached to the media. Finally, the treated effluent is returned back into the environment by infiltration in a soil absorption system provided certain conditions. Where and when applicable, the treated effluent may be required to go through another treatment system before being discharged. It is important to note that final effluent dispersal method is site specific.

The site-specific design will detail the final effluent dispersal method. Effluent may be – but not limited to – have piped outlet for gravity discharge to trench, pressurized system or other effluent dispersal method, as applicable.

Usually, the model and the number of Ecoflo biofilter are determined either by the number of bedrooms in a home or by the total domestic wastewater flow per day. The selection of the model also depends (without limitation) on the available space, the topography of the lot, depth of seasonal high groundwater table, as well as the type, permeability and depth of the natural soil on site.

There are many different models of Ecoflo biofilter and each model has different characteristics. The letters and numbers associated with the Ecoflo® Coco Filter specify the model's characteristics, as presented in the following table with model **EC7-500P (PACK)** as reference:

EC7 refers to the Ecoflo® model	**EC7 = Ecoflo EC7 Series**
P refers to the material of the shell	C = Concrete F = Fibreglass **P = Plastic (Polyethylene)**
500 refers to the daily flow capacity	**500 = Capacity of 500 US gallons per day** 600 = Capacity of 600 US gallons per day 700 = Capacity of 700 US gallons per day 750 = Capacity of 750 US gallons per day 1050 = Capacity of 1050 US gallons per day 1200 = Capacity of 1200 US gallons per day 1350 = Capacity of 1350 US gallons per day
P refers to final dispersal method	G = Gravity **P = pumped**
PACK refers to configuration of the primary/septic tank and biofilter	**PACK = one-piece monobloc configuration** No mention = In line
DiUV refers to addition of a UV disinfection unit integrated or in a separate container	**DiUV = with UV disinfection unit.** No mention = Stand alone Ecoflo

Therefore, according to this nomenclature, EC7-500-P-P-PACK refers to an Ecoflo system with a filtering medium made of coconut husk fragments. The shell is made of polyethylene, the daily flow capacity is 500 US gal/d, there is an integrated pump, the bottom of the unit is watertight, and the primary/septic tank and biofilter are combined in one monobloc configuration. The two following tables displays all the Ecoflo biofilter models available on the market:

	Polyethylene Biofilter Shell	**Concrete Biofilter Shell**
Closed Bottom – Gravity discharge	EC7-500-P-G (stand alone or PACK) EC7-600-P-G (stand alone or PACK) EC7-750-P-G (stand alone or PACK) EC7-1050-P-G EC7-1350-P-G	EC7-500-C-G EC7-600-C-G EC7-700-C-G EC7-750-C-G EC7-1200-C-G
Closed Bottom - Pumped discharge	EC7-500-P-P (stand alone or PACK) EC7-600-P-P (stand alone or PACK) EC7-750-P-P (stand alone or PACK) EC7-1050-P-P EC7-1350-P-P	EC7-500-C-P EC7-600-C-P EC7-700-C-P EC7-750-C-P EC7-1200-C-P

Product line

ECOFLO			REWATEC SPECIALIZED TREATMENT OPTIONS	
Hydraulic Capacity	Size	Model	Integrated UV disinfection (DiUV)	UV disinfection (DiUV) in separate tank
POLYETHYLENE				
500 US gal/d	2.8	EC7-500-P-G/P	✓	✓
		EC7-500-P-G/P-PACK	✓	✓
600 US gal/d	3.4	EC7-600-P-G/P	✓	✓
		EC7-600-P-G/P-PACK	✓	✓
750 US gal/d	4.1	EC7-750-P-G/P	✓	✓
		EC7-750-P-G/P-PACK	✓	✓
1,050 US gal/d	5.7	EC7-1050-P-G/P	✗	✓
1,350 US gal/d	7.3	EC7-1350-P-G/P	✗	✓
CONCRETE				
500 US gal/d	2.8	EC7-500-C-G/PDV	✓	✓
600 US gal/d	3.4	EC7-600-C-G/P	✓	✓
750 US gal/d	4.1	EC7-750-C-G/PDV	✓*	✓
1,200 US gal/d	6.5	EC7-1200-C-G/PDV	✗	✓

Consult the Technical Data Sheets at *PT-WaterEnvironment.com/ProSpace* for additional information on these models, such as built-in storage and dosing capacities, dimensions, weight, etc.

The table below summarizes the principal design criteria for the Ecoflo biofilter.

ECOFLO	
HLR	17.2 USG/ft^2-d
OLR	60g $DBOC_5$/m^2-d
FM height	26 in
Loading rate per volume of filtering media	8.05 USG/ft^3-d

The following table summarizes the system's capacity depending on the different Ecoflo® biofilter models.

Ecoflo® Coco Filter EC7 Model Series	Filtering media Surface (ft^2)	Maximum Flow rate capacity (USG/d)
500	30	Up to 500
600	41	up to 600
750	44	up to 750
1050	61	up to 1050
1200	70	up to 1200
1350	79	up to 1350

Suggested uplift restraint configuration for each Ecoflo biofilter is presented in their respective installation guide. For Ecoflo biofilter units housed into locally provided concrete tank, buoyany calculation shall be performed by designer to assure adequate tank uplift restraint when any part of the tank is below the estimated seasonal high-water table.

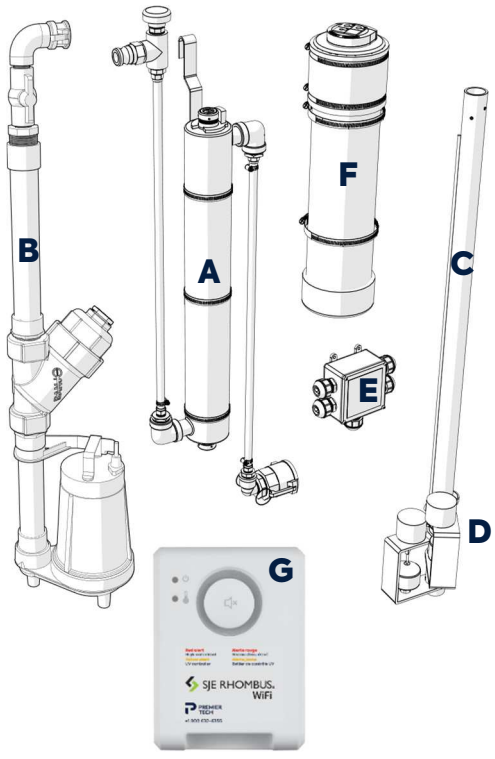
Please contact your local Premier Tech representative for model availability and approvals in your area.

3.6 UV Disinfection Unit DiUV

The UV disinfection unit (DiUV) is designed to lower the fecal coliform concentration to below 200 UFC/100 ml/L[1]. The operating principle of the UV disinfection unit (DiUV) is to expose the micro-organisms to ultraviolet (UV) rays.

The dose depends on the operating time and the intensity of the rays. The flow rate entering the unit ensures maximum exposure time and the quartz sleeve is kept clean to optimize the intensity of the rays.

UV disinfection unit components



A - UV unit
- Includes the UV lamp and the quartz sleeve;
- Exposes the water to UV rays;
- Equipped with quick disconnects for easy retrieval of the lamp.
- Inlet and outlet pipe are 3/8'' diameter made of silicone to resist heat from the UV.

B - Pump assembly
- Provides pressurized water to the UV unit;
- Equipped with a banjo filter;
- Equipped with an entry valve that can isolate the UV unit during servicing.
- 1.5'' PVC pipe.

C - Float tree
- Pre-wired to the pump assembly and the junction boxes;
- Manages the pumping events;
- Detects high water levels.

D - Alarm float
- Warns the homeowner of an abnormal situation in the septic installation;

E - Junction box
- Protects electrical connections;

F - Watertight box
- Houses the UV controller;

G - WI-FI alarm box.

[1] The maximum concentration for tertiary treatment systems with UV disinfection must be divided by a factor of 10 to take into account the reactivation of fecal coliforms after disinfection.

The following table lists the technical specifications of the DiUV.

Model	DiUV
Maximum instantaneous flow	9.7 L/min (2,56 USG/min)
Flow limiter	No, already calibrated in factor
Total daily flow	Up to 3 686 USG/d
Power supply	120 V AC, 60 Hz, 1.5 A
Type of UV lamps	1 UV lamp UV, low pressure/high performance (254 nm) UV lamp
UV dose	32.1 mJ/cm² @ 52.5% UVT at maximum flow at the end of the lamps' operational lifetime
UV lamp operational lifetime	9 000 hours (12 months) – to be replaces every 12 months
Operation pressure	0 to 690 kPA (0 to 100 lb/in²)
Operation temperatures	Ambient: 0°C to 50°C (32 F to 122 F)

A drinking water test is recommended, but not mandatory. Drinking water should respect the following levels:

Water Quality and Minerals	Level
Iron	< 0.3 ppm (0.3 mg/L)
Hardness	< 7 gpg (120 mg/L)
Manganese	< 0.05 ppm (0.05 mg/L)
Tannins	< 0.1 ppm (0.1 mg/L)

3.7 Influent Pumping Station (when applicable)

When wastewater cannot be conveyed by gravity between the house and septic tank, a pumping station is then required. Like the septic tank, the pumping station must be watertight. Premier Tech recommends sending approximately 7 to 15 gallons per dosing event to the septic tank depending of the Ecoflo biofilter model. We also recommend a ball-valve on the septic tank feeding line to decrease the speed of water at the septic tank inlet and prevent hydraulic overloads.

Pump tank must have adequate venting to avoid buildup of harmful gases, air lock and corrosion. This can be accomplished using a separate vent pipe on the pump chamber or septic tank, by using a vented lid, or by connecting to the main building vent stacks.

Buoyancy calculation for pump tank should be performed when necessary.

Premier Tech offers several models of pumping stations (PSA-240, PSA-240L, PSA-240H, PSA-240NP, PSX-240) please consult Premier Tech Pumping Station Promotional Guide which can be found at *PT-WaterEnvironment.com/ProSpace*.

It is the designer responsibility to make sure that pumping stations configuration and sizing meet State Local requirements.

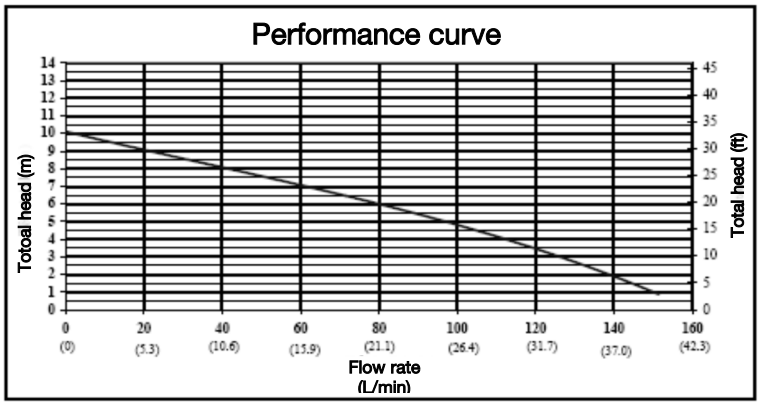
3.8 Discharge Pump

As presented in table above, some Ecoflo® Coco biofilter models housed into either concrete or polyethylene shells include a discharge pump vault. It allows to pump the final treated effluent towards the site specific final dispersal method or UV disinfection system DiUV. The integrated pump vault includes a pump, a float tree on which, an ON/OFF float, and alarm float are attached and an alarm box.

The pump provided with those models presents the following characteristics:

Champion Pump model CPE4
0.4 HP
6.2 Amps
1 phase, 60 Hz, 115 V
The pumping unit uses 0.25 kWh per day.

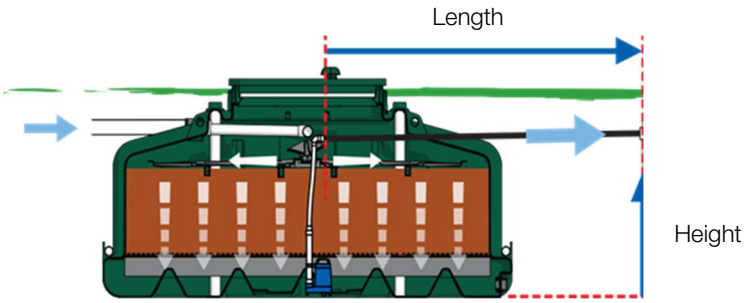
The figure on the right represents the performance curve of the pump supplied with the Ecoflo® biofilter and the integrated UV disinfection system. Curve was obtained with clear water, the pump might not perform as well with wastewater. If you have questions about the interpretation of this curve, please do not hesitate to contact Premier Tech.



The **maximum length of the pressurized pipe (flexible pipe)** starting from the pump with a pipe measuring 25 mm (1") or 38 mm (1.5") in diameter depends on the pressure head (i.e., the difference in gradient between the base of the pump and the end of the pressurized pipe). The following table indicates the different pressurized pipe lengths allowed.

Height of the pressure head	4,5 m (15')	3 m (10')	1,5 m (5'
Maximum Ø 25 mm (1") pipe length	30 m (100')	30 m (100')	30 m (100')
Maximum Ø 38 mm (1,5") pipe length*	30 m (100')	30 m (100')	30 m (100')

* Does not apply to EC-2.8-C-P model



3.9 Final Dispersal

The final dispersal system must be designed in accordance with State or Local regulations and Premier Tech guidelines.

3.10 Alarm And Electrical Connections

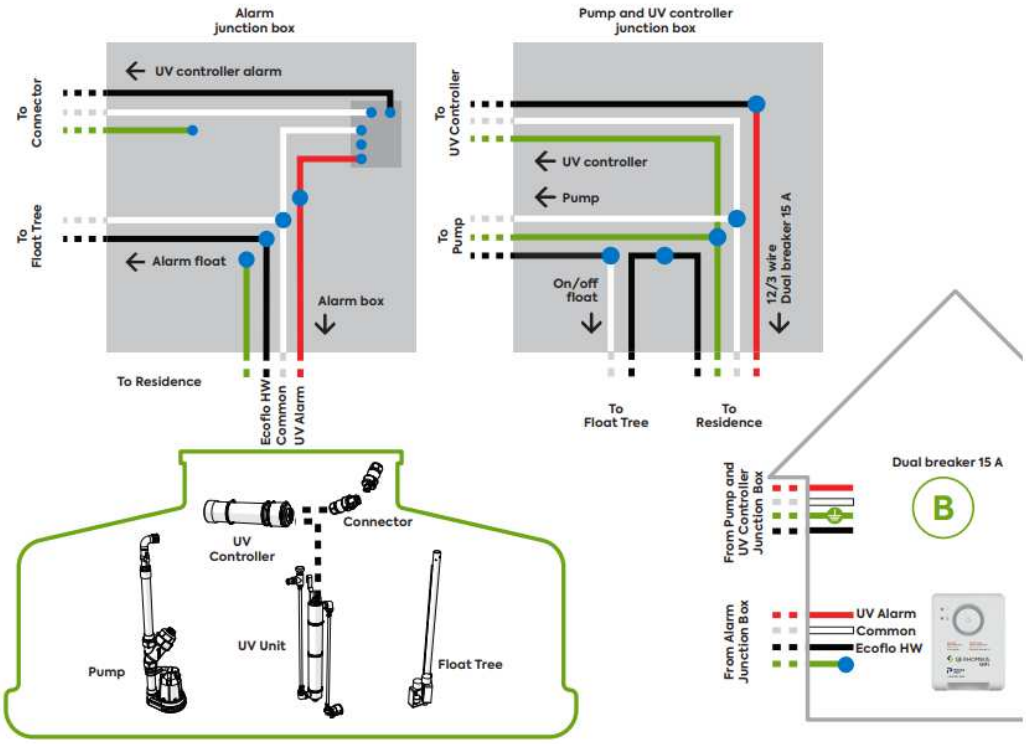
The electrical connections in the residence must be performed by a licensed electrician. The electrician responsible for the electrical hookups must respect all regulations and standards that apply where the installation is being performed.

The power of the integrated classic UV disinfection unit (DiUV) as well as the Ecoflo biofilter must be connected to a protected circuit using a Class A breaker. Do not connect any else to these breakers (appliances, etc.).

The Wi-Fi alarm box must be installed inside the dwelling where a failure alarm will easily be heard. The alarm box can also be installed in a building where temperature will not drop below the freezing point. The alarm box provided with the integrated classic UV disinfection unit (DiUV) has terminals that will allow the UV disinfection unit and the Ecoflo biofilter to be both connected to the same alarm box. It is important to respect the wiring plan (see next page) and to correctly identify each equipment. To configure and activate the Wi-Fi function, please refer to the quick guide provided with your alarm box or contact Premier Tech's after sales service team at 1 800 632-6356.

Provided and prewired with the integrated classic UV disinfection unit (DiUV) are two three-strand cables to connect the electrical components to the residence. One is to be used to connect the alarm junction box to the alarm box in the residence. The other one is to be used to power up the integrated classic UV disinfection unit (DiUV) and the Ecoflo biofilter.

The final dispersal system must be designed in accordance with State or Local regulations and Premier Tech guidelines.



Do not forget the municipal inspection, if one is required.

If you have any questions or comments,
please do not hesitate to contact us at 1-800-632-6356
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do not hesitate to contact Premier Tech at +1 800 632-6356.

PREMIER TECH

PT Water and Environment

+1 800 632-6356
info.ptwe.na@premiertech.com
PT-WaterEnvironment.com

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