RAINWATER HANDBOOK

Systems and Components for Optimal-Performance Rainwater Harvesting

low-profile high-volume water storage cistern under rooftop landscape

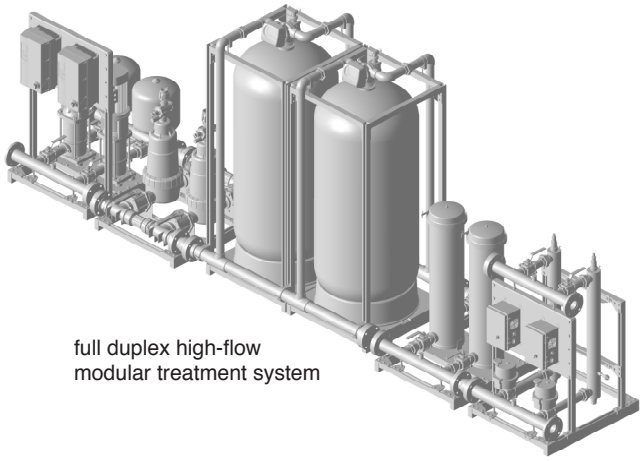
Conservation Technology

Conservation Technology

INTRODUCTION

HISTORY: Conservation Technology components have built thousands of rainwater harvesting systems throughout North America for more than twenty years. We are experts in stormwater management and water reuse.

OPTIMAL COMPONENTS: Most components we supply are optimized for rainwater harvesting – we rarely re-purpose generic products designed for other applications. Our patented DoubleTorus tank is the largest high-strength underground polyethylene tanks made in North America. Our unique Aqua System Controller can operate the most complex rainwater harvesting systems without custom programming. Our US-made tank diffusers outperform the latest German technology.



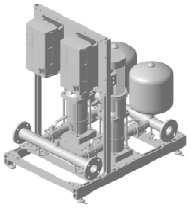
full duplex high-flow
modular treatment system

OPTIMAL SYSTEMS: In addition to selling individual components, we provide complete system solutions with all required components, including engineering design support and on-site commissioning. Our RainCavern and X-Box engineered modular storage systems provide affordable high-capacity storage on any site. Our modular skids make it possible to build mechanical systems of any size from stock modules while greatly simplifying installation, maintenance, and future modification. We also supply advanced membrane bioreactor technology for graywater recycling and can incorporate this technology with our rainwater harvesting systems to provide potable-quality water with a simple low-energy process train.

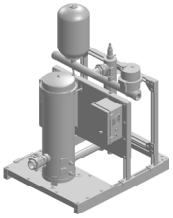
CONTENTS:

Prefiltration

Storage



Pumping



Treatment Skids

Control

Accessories

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Basket Filters

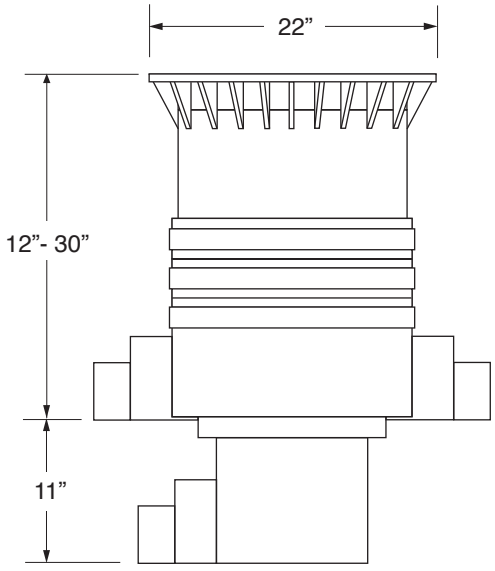
Basket Filters are high-rate mechanical filters designed to extract organic debris and particulates from either rooftop or surface rainwater. They are installed underground and include a telescopic accessway that is adjusted to match the pipe inverts. Rainwater enters through either of the top ports, flows down through a large screened filter basket, and flows out through the bottom port. The second top port serves as an overflow in the event the filter basket become full the water flow rate exceeds the capacity of the filter.

Two models are available: *Basket-150* for roofs up to 5,000 square feet and *Basket-200* for roofs up to 12,000 square feet. The maximum roof area per filter should be reduced 50% for seasonally dry climates intense rainfall.

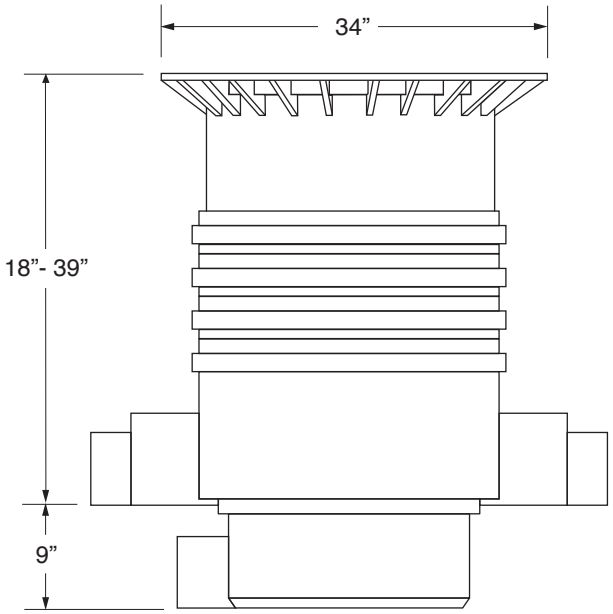
Basket filters are simple to install and can provide virtually 100% recovery efficiency. The filter basket is easily accessible, and except for periods of heavy leaf fall, rarely needs cleaning. Even when the bottom of the basket is covered with debris, the large sidewall surface area allow substantial flow.

PHYSICAL CHARACTERISTICS

Model	Inlet	Outlet	Overflow	Diameter	Invert in	Invert out	Max Area
Basket-150	4” or 6”	4” or 6”	4” or 6”	22”	12” -30”	23” - 41”	5000 ft^2
Basket-200	6” or 8”	6”	6” or 8”	34”	18” - 39”	27” - 48”	15000 ft^2



Basket-150



Basket-200

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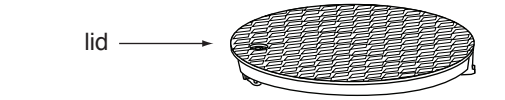
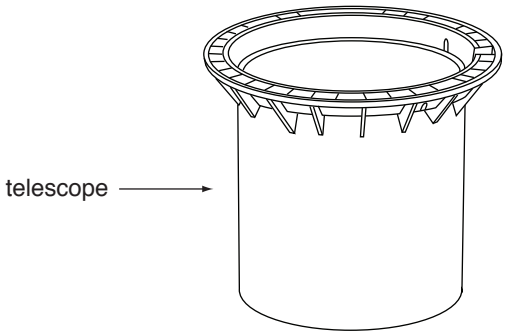
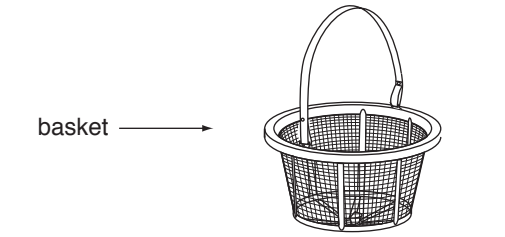
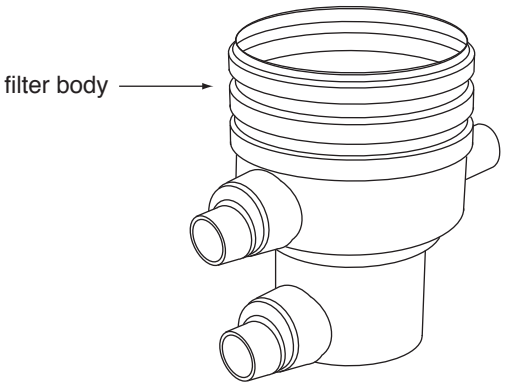
COMPONENTS

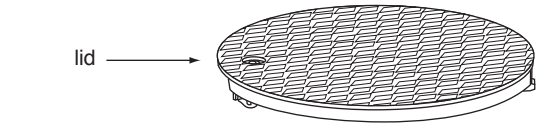
Construction of the Basket-150 and Basket-200 is the same except for the size of the parts and the construction of the basket (plastic on the small filter; stainless-steel on the large filter). Optional cast-iron lids are available for either size.

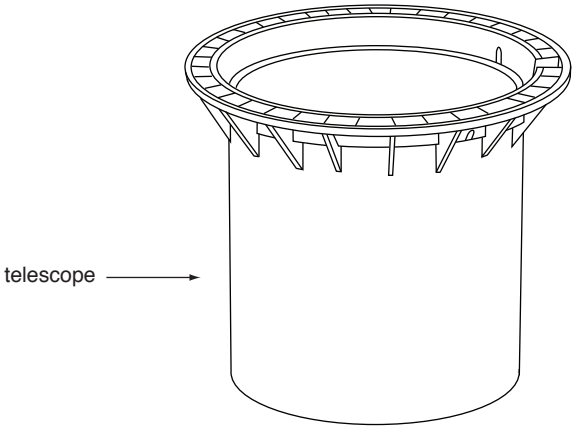


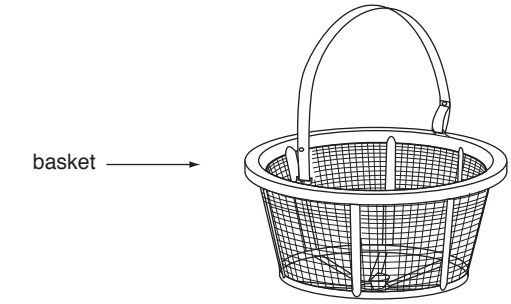


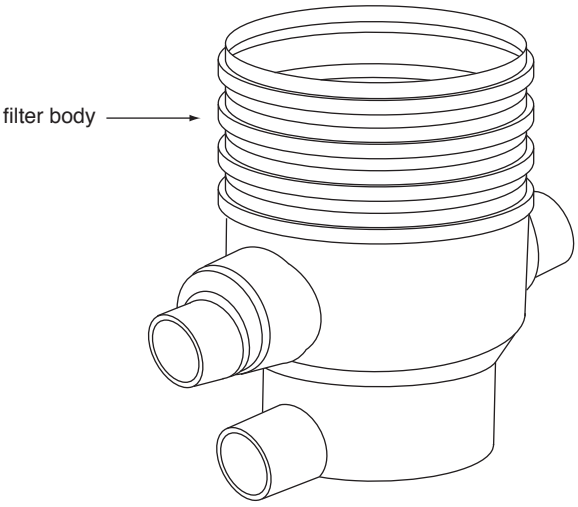












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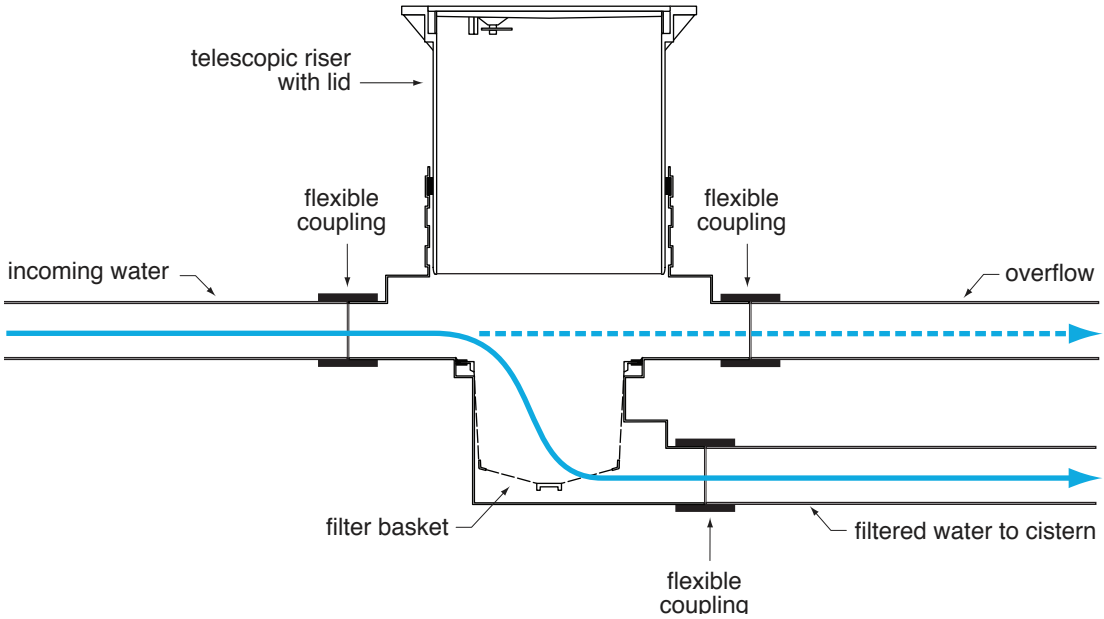
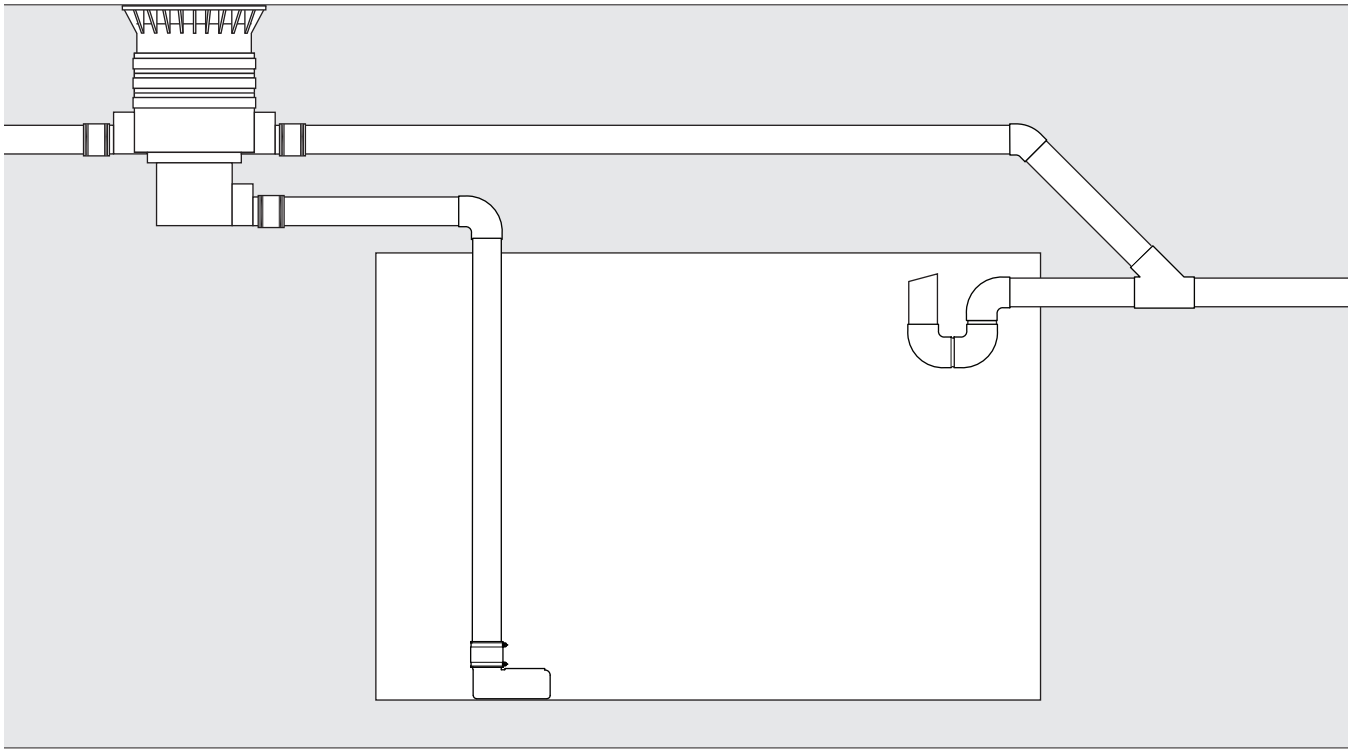
OPERATION

Water from the roof enters through one of the top ports, flows through the basket, and exits at the bottom port. If the basket is clogged or the cistern cannot handle the hydraulic flow, unfiltered water overflows through the second top port. The filter has no direction, so either top port can be the inlet or overflow.



INSTALLATION

In the example below, filtered water flows from a Basket Filter into an underground storage tank. The overflow pipe from the filter merges with the overflow pipe from the tank.



Conservation Technology

Cascade Filters

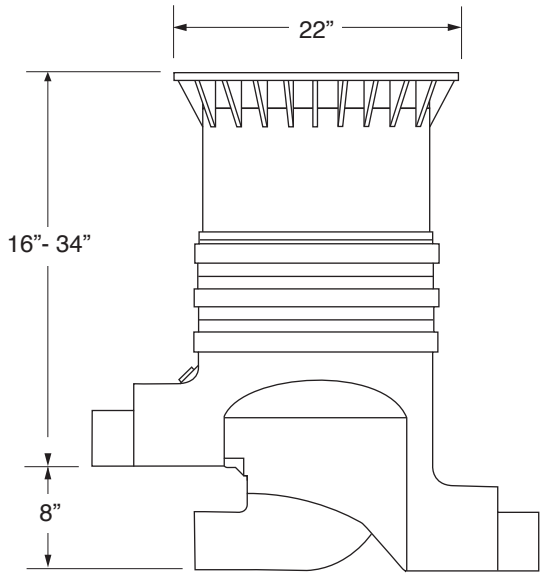
Cascade Filters are high-rate mechanical filters designed to extract organic debris and particulates from either rooftop or surface rainwater. They are installed underground and include a telescopic accessway that is adjusted to match the incoming pipe invert. Rainwater enters through the top port, cascades over and through a curved horizontal, multi-layer filter element, and exits through the bottom port on the same side. Debris that cannot pass through the filter element is washed through the bottom port that is opposite the inlet.

Two models are available: the *Cascade-150* for roofs up to 5,000 square feet, and the *Cascade-200* for roofs up to 16,000 square feet. The maximum roof area per filter should be reduced 50% for seasonally dry climates with intense rainfall.

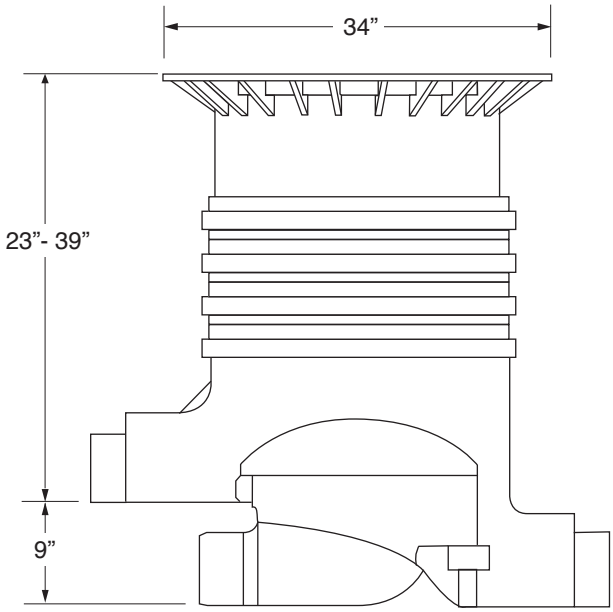
Cascade filters can provide 95%+ recovery efficiency. They are mostly self-cleaning and require only occasional manual cleaning. An optional internal sprayhead is available to further reduce maintenance In regions with high levels of dust or plant pollen.

PHYSICAL CHARACTERISTICS

Model	Inlet	Outlet	Overflow	Diameter	Invert in	Invert out	Max Area
Cascade-150	4” or 6”	4”	4” or 6”	22”	16” -34”	24” - 42”	5000 ft^2
Cascade-200	6” or 8”	6”	6” or 8”	34”	23” - 39”	32” - 48”	16000 ft^2



Cascade-150



Cascade-200

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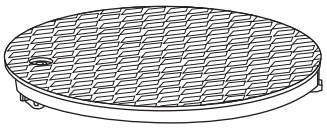
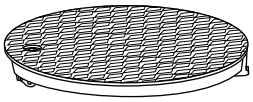
COMPONENTS

Construction of the Cascade-150 and Cascade-200 is the same except for the size of the parts and the construction of the basket (plastic on the small filter; stainless-steel on the large filter). Optional cast-iron lids are available for either size.

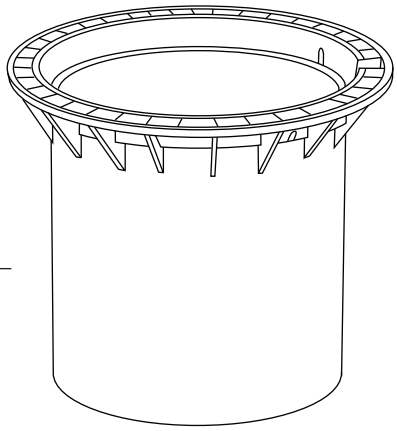
lid



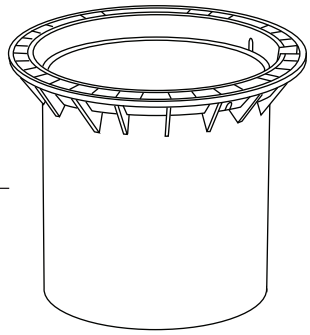
lid



telescope



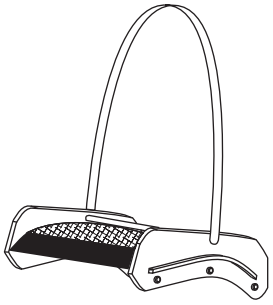
telescope



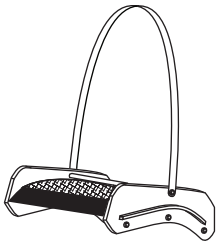
gasket

gasket

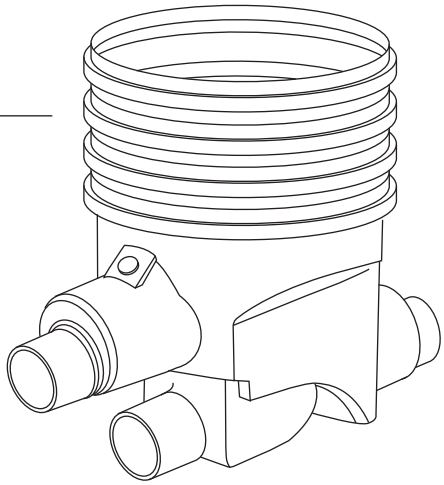
filter element



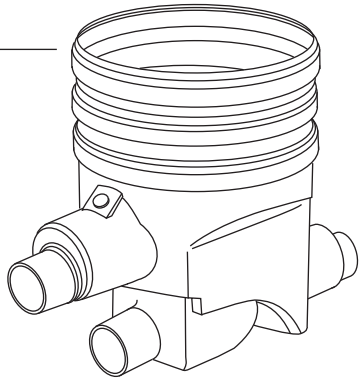
filter element



filter body



filter body



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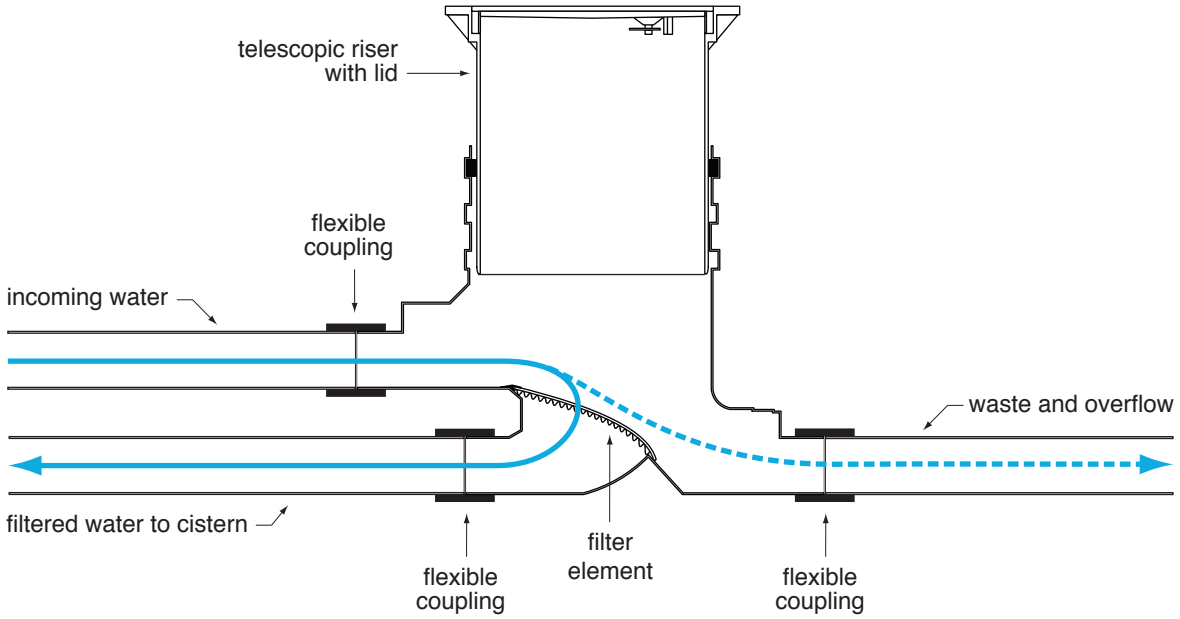
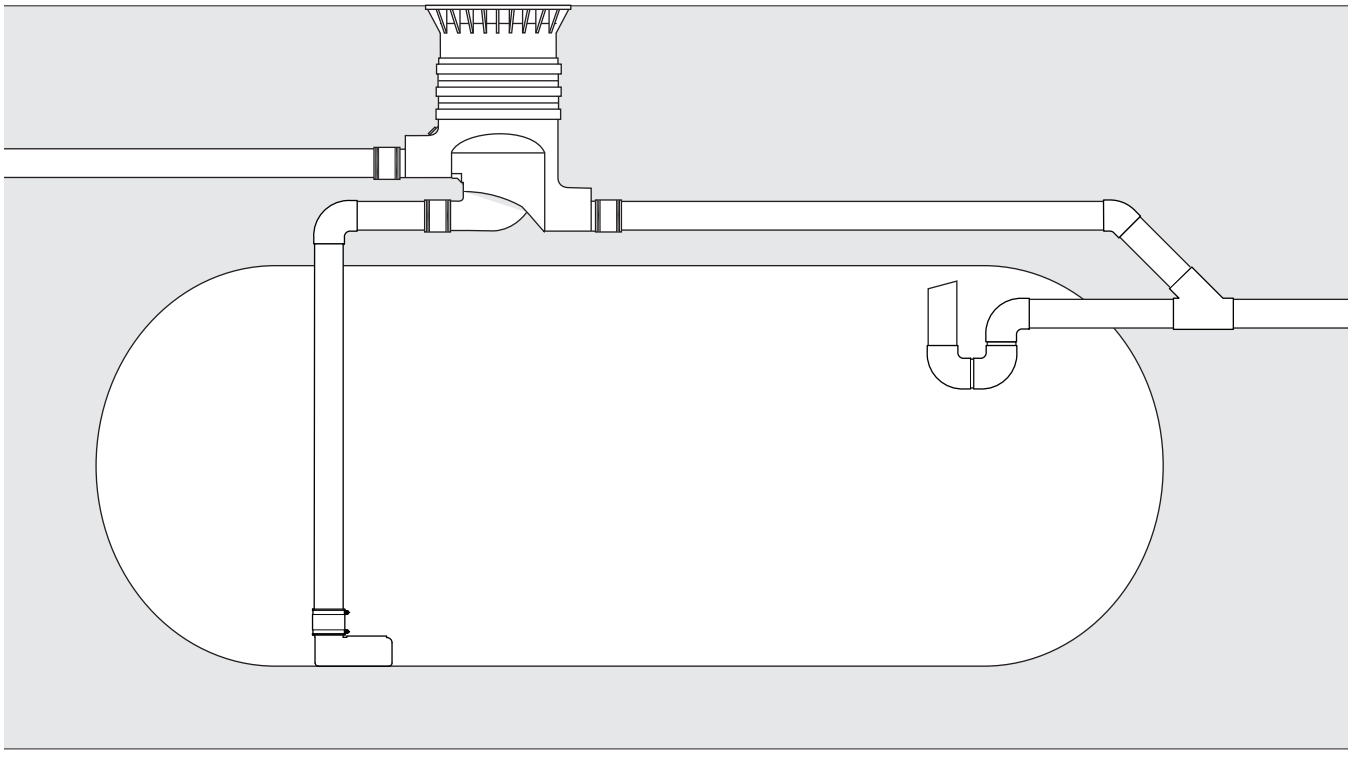
OPERATION

Water from the roof enters through the top port, flows through the filter element, and exits through the port below. Debris is washed off of the filter element and out the other bottom port. If the filter is clogged or the cistern cannot handle the hydraulic flow, unfiltered water overflows through the same bottom port.



INSTALLATION

In the example below, filtered water flows from a Cascade Filter into an underground storage tank. The waste and overflow pipe from the filter merges with the overflow pipe from the tank.



Vortex Filters

Vortex Filters are high-rate mechanical filters designed to extract organic debris and particulates from either rooftop or surface rainwater. They can be installed underground using an extension that can be cut to match a range of pipe inverts, or they can be installed above ground without the extension. Rainwater enters through the top port, circles the interior, and falls down the interior surface of a cylindrical filter element. Clean water is drawn through the filter element by capillarity and exits through the middle port. Waste drops through the open bottom of the filter element and exits through the bottom port.

Three models are available: *Vortex-100* for roofs up to 2.500 square feet, *Vortex-150* for roofs up to 5,000 square feet, and *Vortex-300* for roofs up to 30,000 square feet. The maximum roof area per filter should be reduced 50% for seasonally dry climates with intense rainfall.

Vortex filters can provide 85%+ recovery efficiency when installed perfectly plumb. They are mostly self-cleaning and require only occasional manual cleaning unless pollen levels are consistently high.

Vortex-100

Vortex-150

Vortex-300

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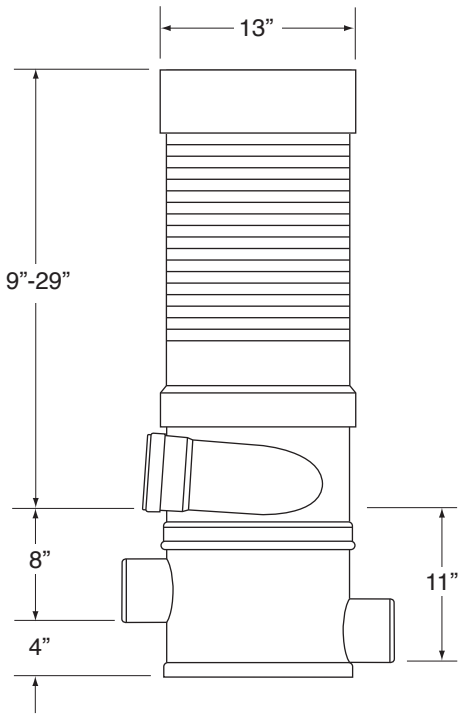
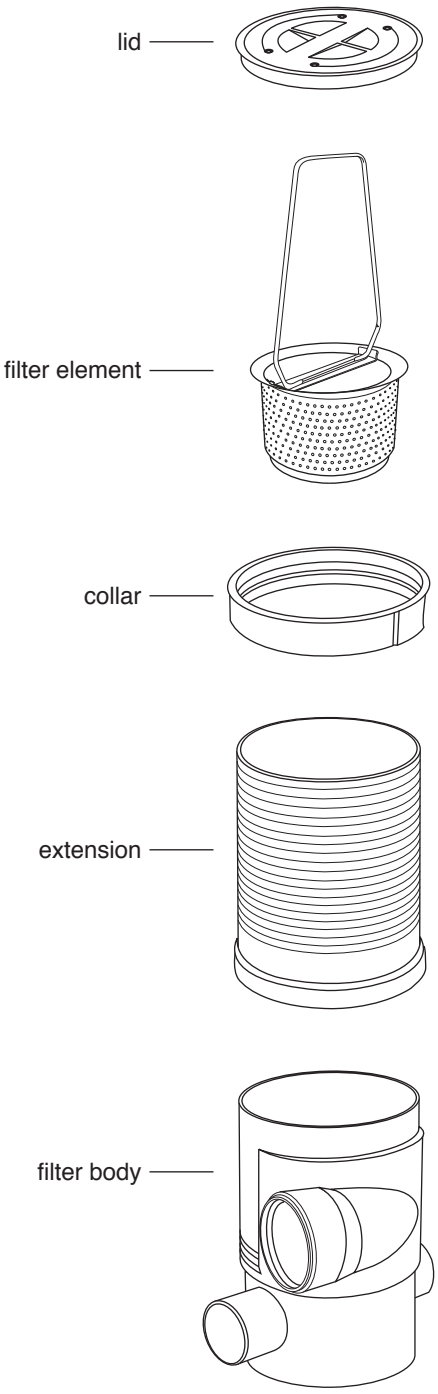
PHYSICAL CHARACTERISTICS

Model	Inlet	Outlet	Waste	Invert-Inlet	Invert-Outlet	Invert-Waste	Max Area
Vortex-100	4”	4”	4”	9” -29”	17” - 37”	20” - 40”	2500 ft^2
Vortex-150	6”	4”	6”	11” - 31”	23” - 33”	31” - 51”	5000 ft^2
Vortex-300	12”	8”	12”	20” - 75”	38” - 93”	32” - 48”	30000 ft^2

VORTEX-100: The Vortex-100 filter body consists of an upper section with a rainwater inlet and a lower section with both a clean water outlet and a waste outlet located on opposite sides. The two sections can be rotated independently. The inlet is a 100mm gasketed socket that accepts 4” SDR sewer pipe; the outlet and waste are 100mm spigots that can be connected to 4” pipe using 4” flexible couplings.





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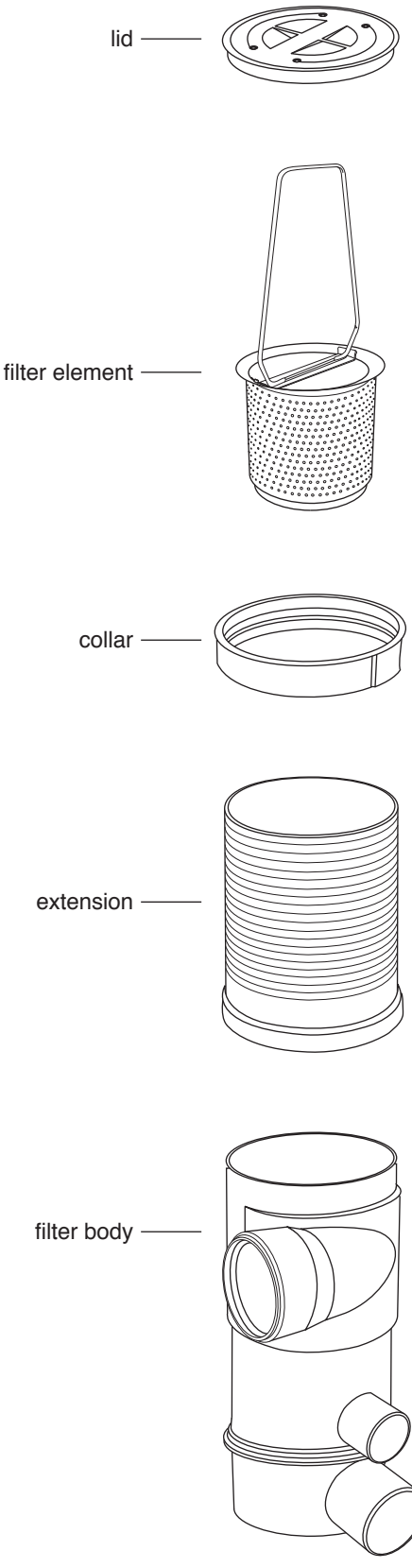
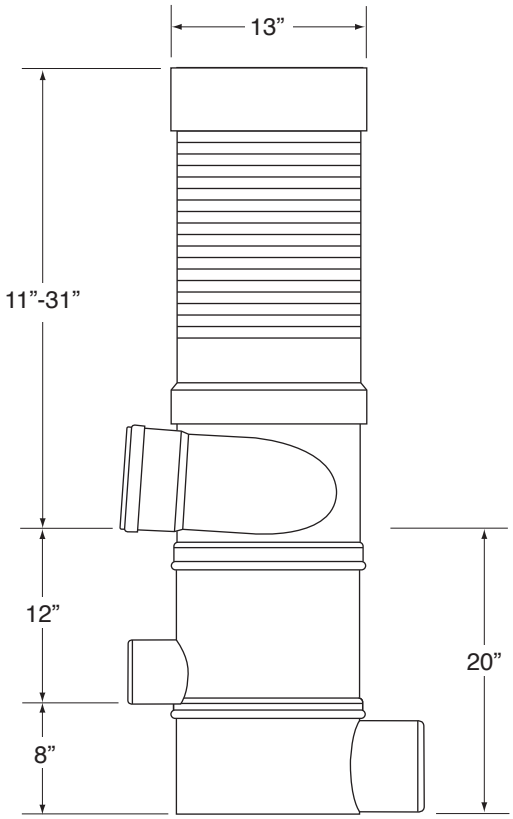
VORTEX-150: The Vortex-150 filter body consists of an upper section with a rainwater inlet, a middle section with a clean water outlet, and a lower section with a waste outlet. All three sections can be rotated independently. The inlet is a 150mm gasketed socket that accepts 6” SDR pipe; the clean water outlet is a 100mm spigot that can be connected to a 4” pipe using a 4” flexible coupling, and the waste outlet is a 150mm spigot that can be connected to 6” pipe using a 6” flexible coupling.





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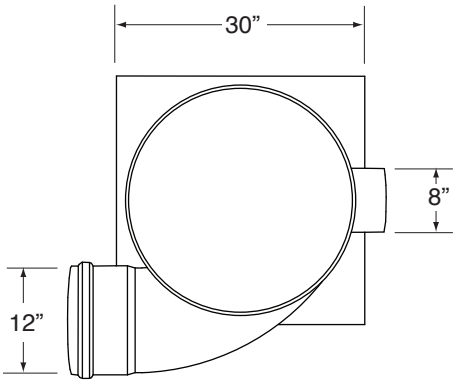
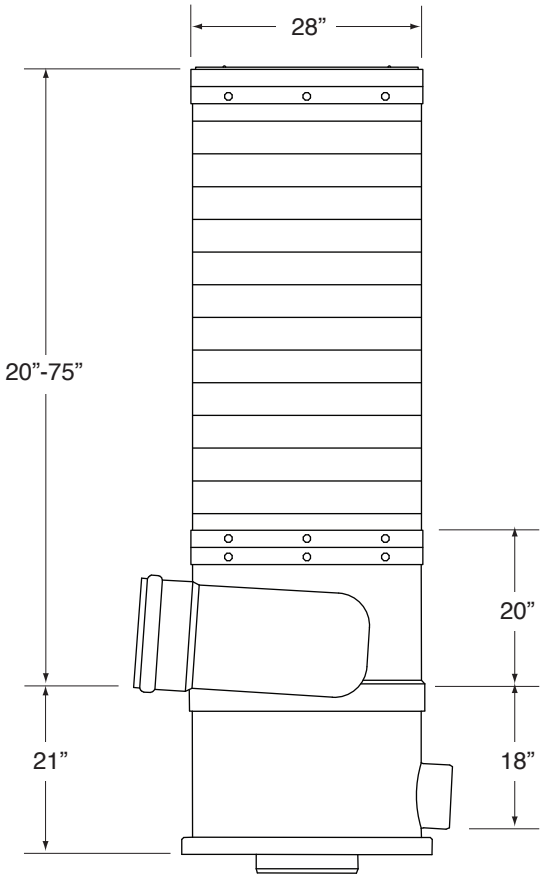
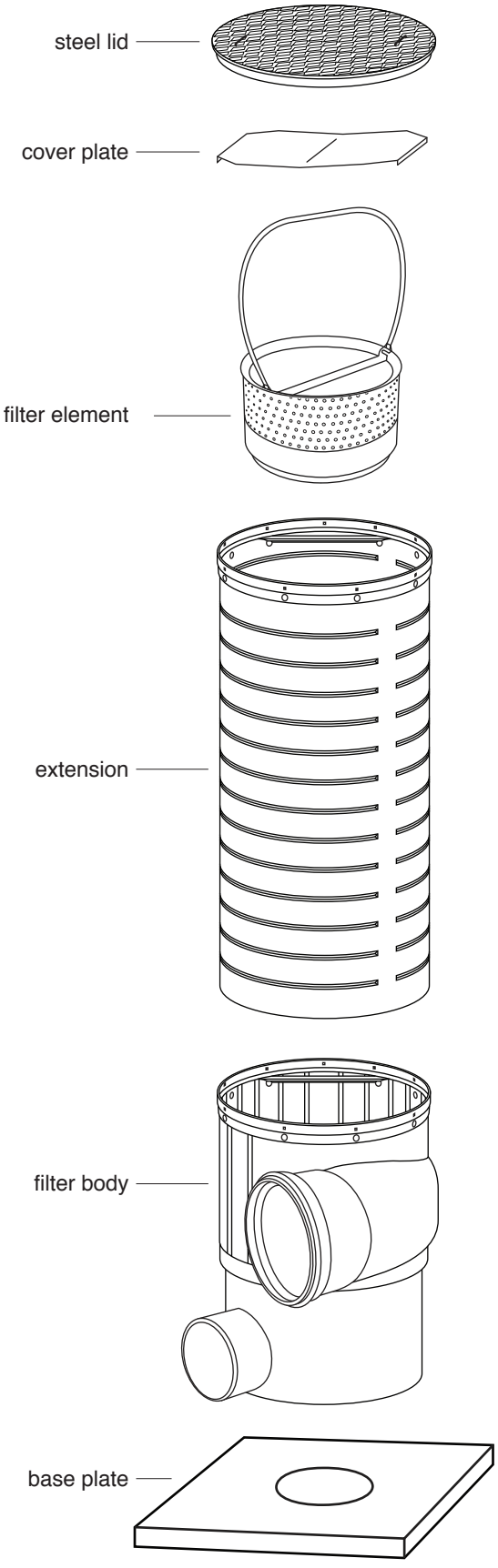
VORTEX-300: The Vortex-300 filter body consists of an upper section with a rainwater inlet and a lower section with a clean water outlet at the side and a waste outlet at the bottom. Both sections can be rotated independently. The inlet is a 300mm gasketed socket that accepts 12” SDR pipe; the clean water outlet is a 200mm spigot that can be connected to 8” pipe using an 8” flexible coupling, and the waste outlet is a 300mm spigot that can be connected to a 12” pipe using a 12” flexible coupling.

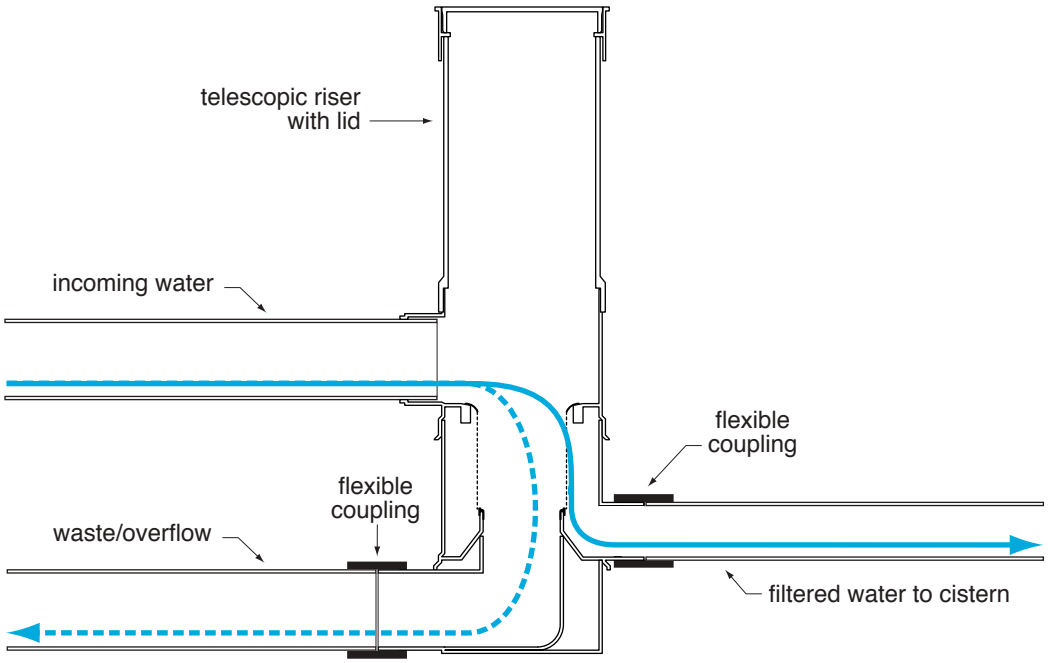






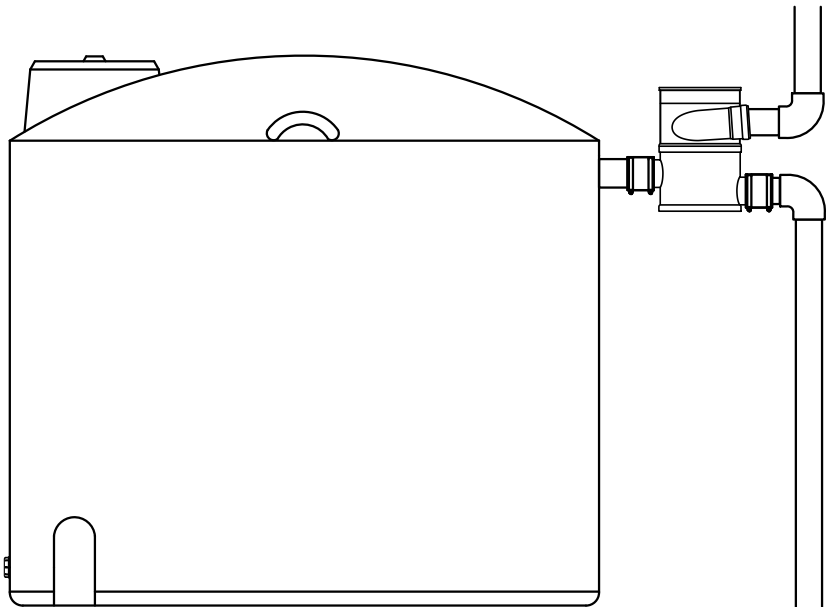
OPERATION

The illustration shows the operation of the Vortex-150, but operation of the Vortex-100 and Vortex-300 is similar. Rainwater enters through the top port, circles the interior, and falls down the interior surface of a cylindrical filter element. Clean water is drawn through the filter element by capillarity and exits through the middle port. Waste drops through the open bottom of the filter element and exits through the bottom port If water cannot flow through the filtered water outlet because the tank is full or the flow rate exceeds the hydraulic capacity of the pipe, rainwater falls through the filter to the bottom port.



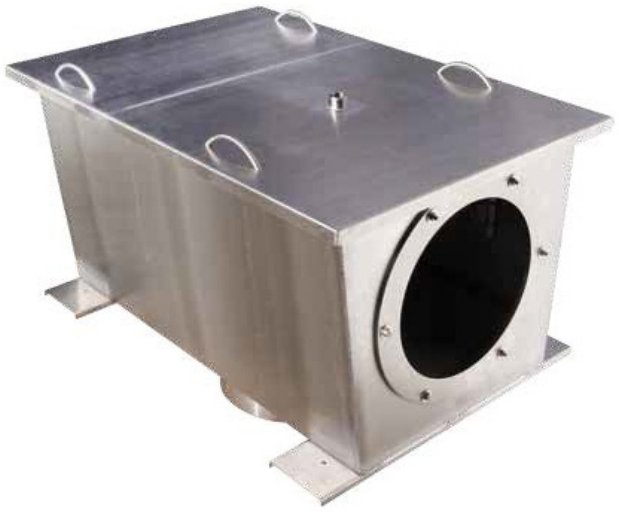
INSTALLATION

In this example, filtered water flows through the center outlet of a Vortex-100 filter and waste flows through the bottom outlet of the filter. When the water level within the tank reaches the height of the filtered inlet water pipe, any additional water entering the filter flows directly to the waste outlet. This eliminates the need for a separate tank overflow.



OPTIMAX FILTERS

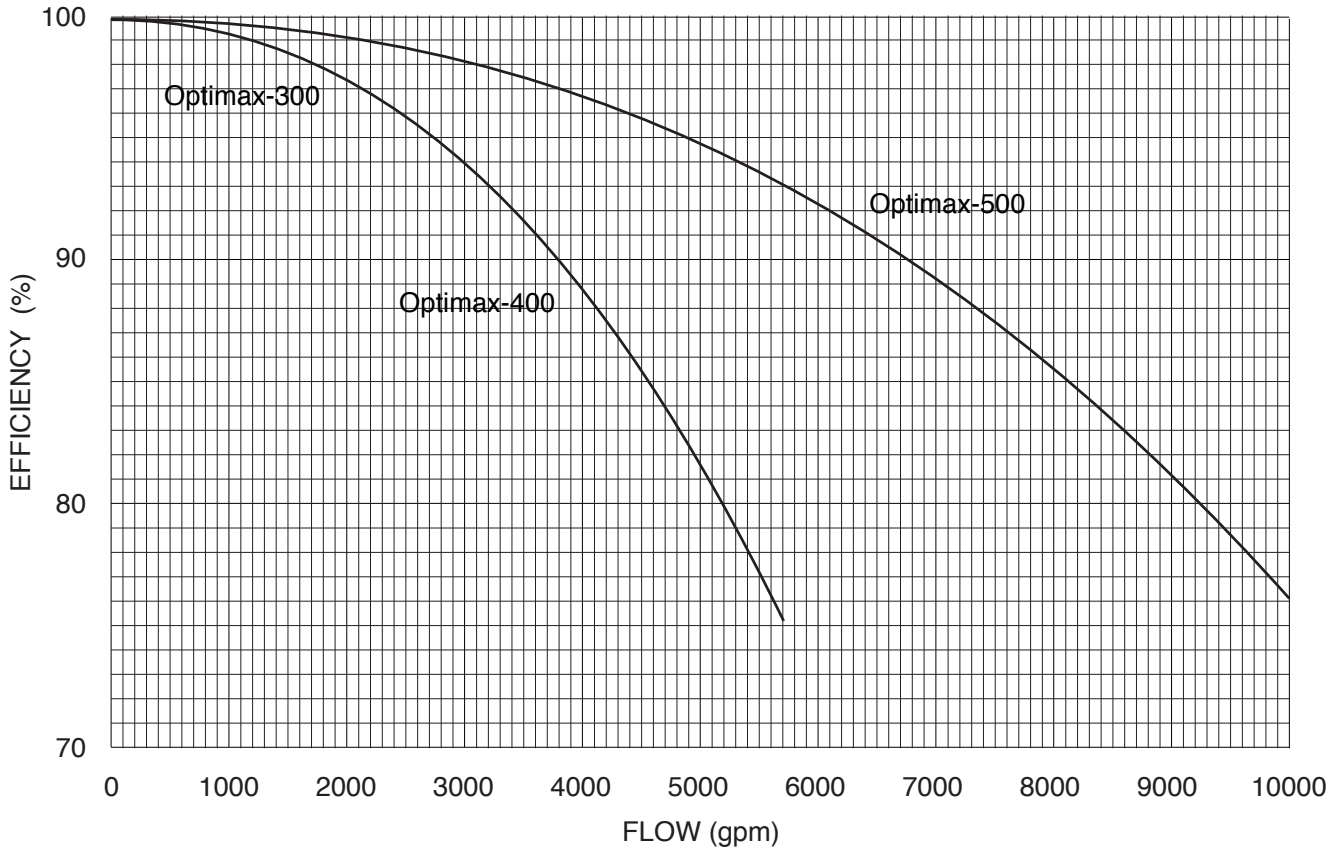
Optimax Filters are high-rate mechanical filters that extract particulates from rainwater collected from large commercial or industrial roofs before the water reaches a cistern. Rainwater enters through one end of the housing and flows onto a flat stainless-steel screen that traps all particles larger than 350 microns. Filtered water passing through the screen flows out through the bottom port; trapped particles are washed through a waste/overflow port opposite the inlet. For optimal efficiency, an internal spray system operated by the rainwater pumping and control system keeps the screen surface clean.



Optimax filters are made from heavy-gauge stainless steel in three sizes: *Optimax-300* with 12" ports for roofs up to 30,000 square feet *Optimax-400* with 16" ports for roofs up to 60,000 square feet and *Optimax-500* with 20" ports for roofs up to 100,000 square feet.

PERFORMANCE

The graph below shows the recovery efficiency at varying flow rates. Optimax filters extraordinarily efficient, providing more than 98% filtered water recovery in light rainfall, more than 95% recovery during moderate rainfall, and more than 90% recovery during intense rainfall. The Optimax 300 and Optimax 400 share the same filter body so they share the same performance curve, but the Optimax-300 can only operate at the far left of the curve due to hydraulic limitations of 12" pipe. Optimax-300/400 curve is based on test data; Optimax-500 curve is estimated.



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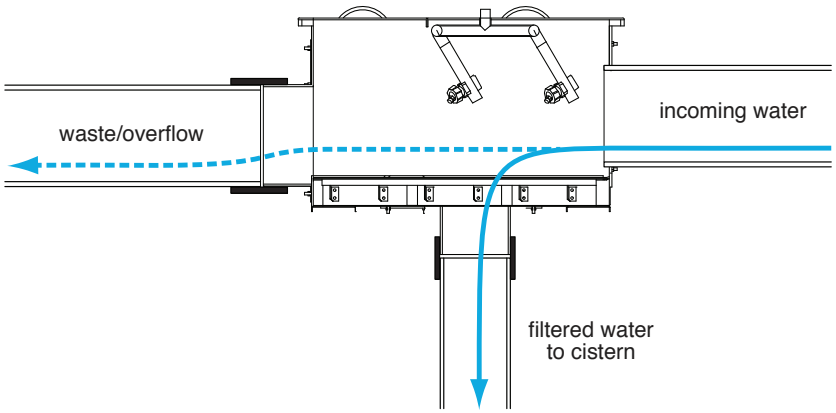
OPERATION

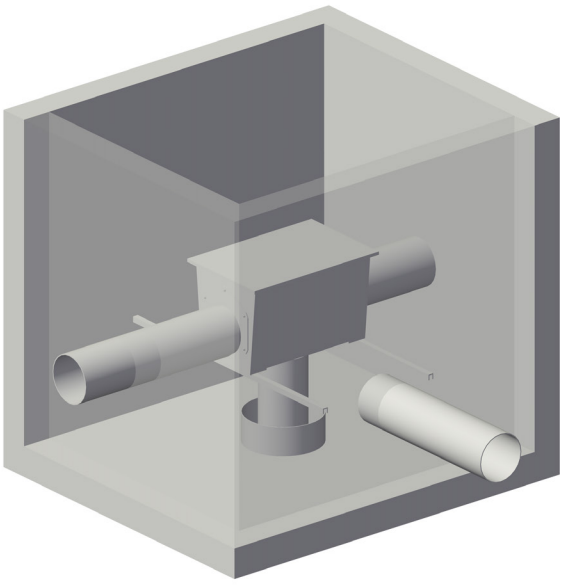
Sprayheads are mounted on the underside of one half of the Optimax lid. A flexible high-pressure hose is attached to the lid and connected to a solenoid valve fed by a rainwater system pump capable of delivering at least 20 gpm at 40 psi. Depending on the capabilites of the rainwater system controller, rinsing can be triggered by a timer or by rainwater flow. Nearly all of the rinse water is recaptured by passing through the screen.



INSTALLATION

For above-ground installation such as within the basement of a building, the inlet pipe is inserted through the gasketed inlet flange and the filtered water and waste pipes are attached to the outlet pipe collars using flexible rubber connectors as shown above. Since Optimax filters are not suitable for direct burial, when used underground they must be protected with a concrete or plastic vault. Although installation within a vault can be identical to above-ground installation, the invert differential between the inlet and clean water outlet can be problematic. This differential can be significantly reduced by installing the filter within a flooded vault as illustrated. The filtered water enters the vault via a diffuser at the bottom, then rises and overflows through a pipe penetrating the sidewall of the vault just below the screen level. This design can significantly improve water quality because fine solids that pass through the filter screen will settle to the bottom of the vault from where they can be periodically removed.

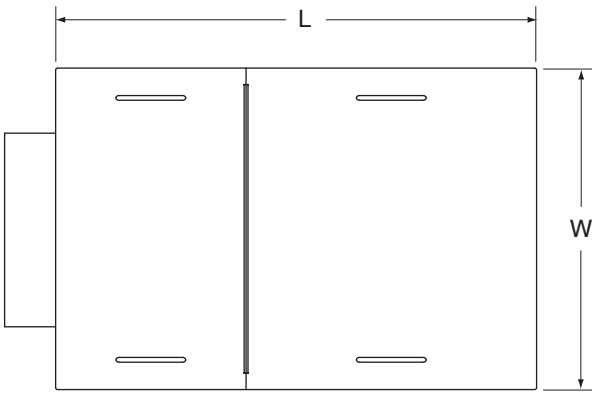
Optimax filter suspended in flooded concrete vault with inlet pipe at rear, waste/overflow pipe at left, and fitered water pipe at right. Diffuser at tank bottom prevents stirring sediment.

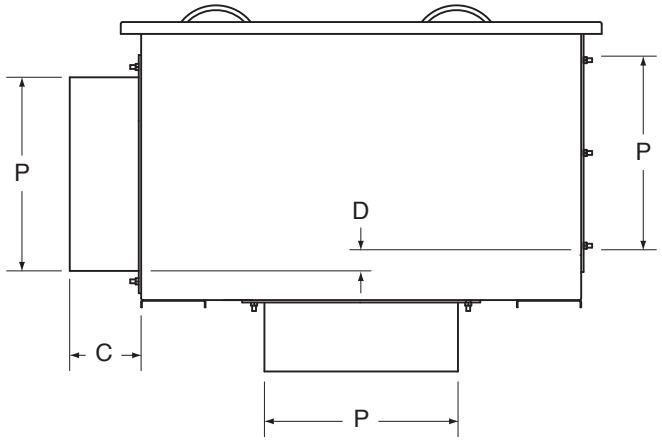


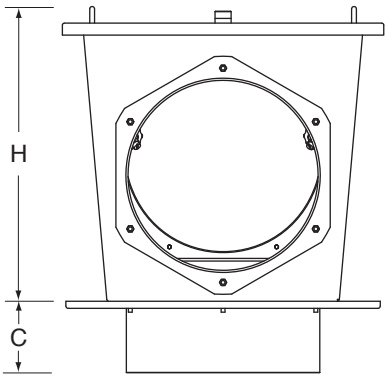
Conservation Technology

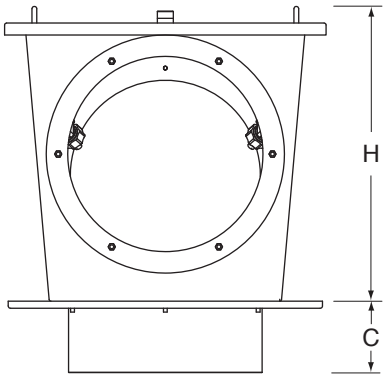
DIMENSIONS

Model	Pipe-P	Collar-C	Drop-D	Length-L	Width-W	Height-H	Area
Optimax-300	12”	6”	2”	40”	27”	24”	30,000 ft^2
Optimax-400	16”	6”	2”	40”	27”	24”	60,000 ft^2
Optimax-500	20”	8”	2”	62”	31”	28”	100,000 ft^2







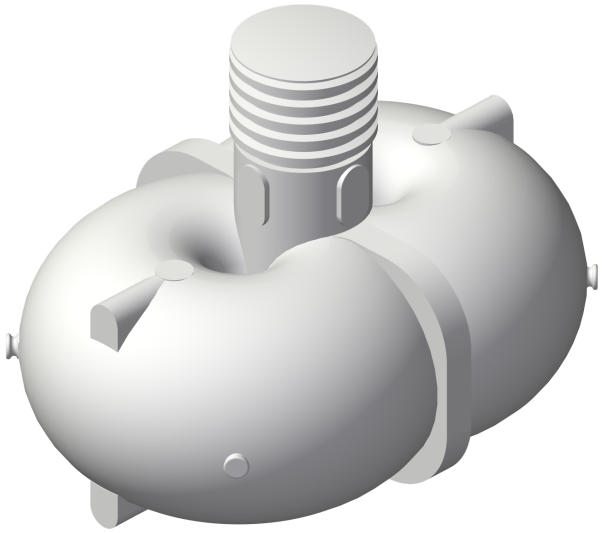


Conservation Technology

DoubleTorus

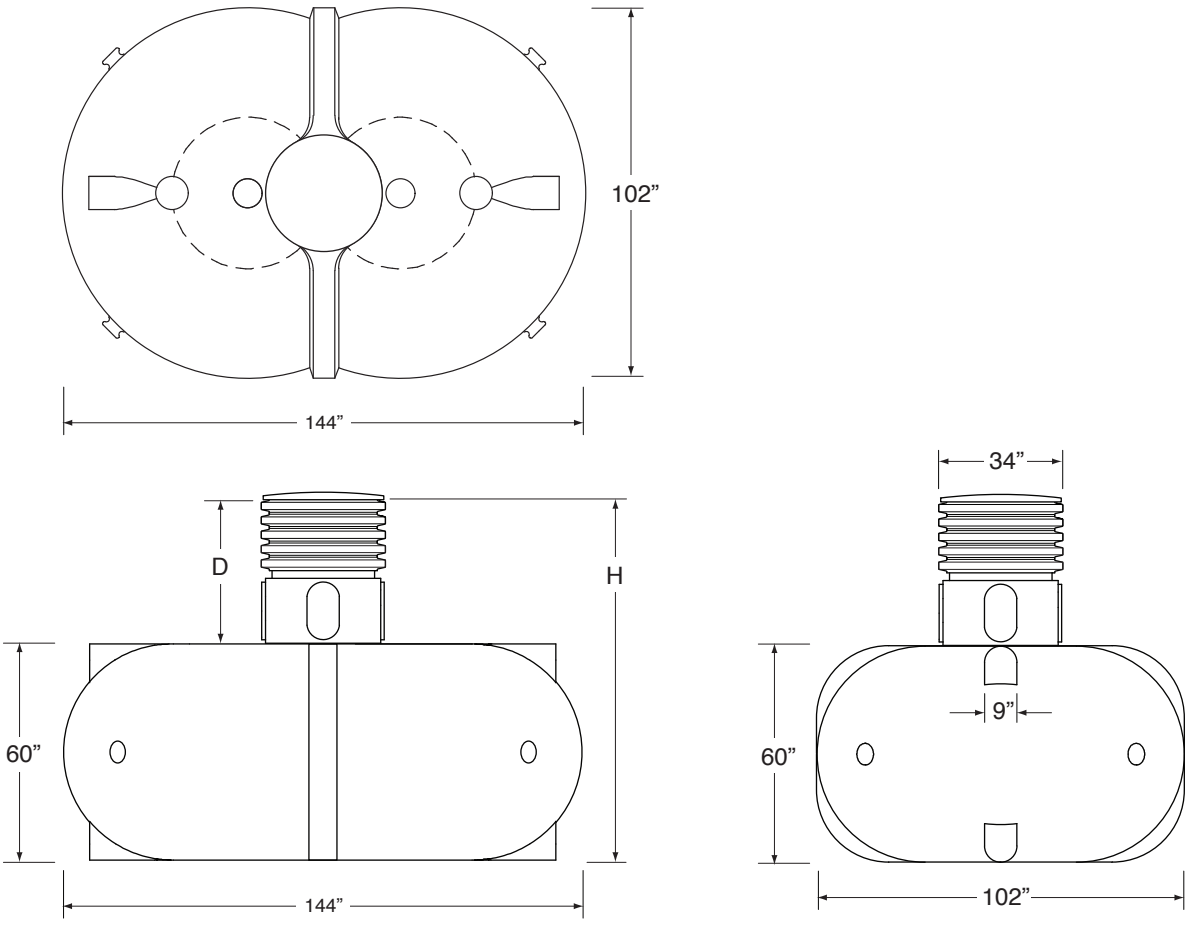
DoubleTorus is a high-strength underground tank made in the shape of a two-holed donut or “torus” with a single center rib. Unlike typical ribbed plastic tanks, the resulting tank has a smooth bottom with no places for debris to accumulate. The absence of ribs also makes the 2500 gallon volume virtually 100% usable. Side knobs are provided for lifting and temporary anchoring.

A dome bolts onto the top of the tank, leaving a 24” diameter accessway into the tank. The dome can be mounted in any direction and has sufficient space for an internal filter and controls. A 30” diameter adjustable riser slides over the dome and provides ample room for access. Both the dome and riser have gasketed lids. Large flat surfaces on the dome, the top of the tank, and the ends of the tank facilitate connection to 4” or 6” pipes.



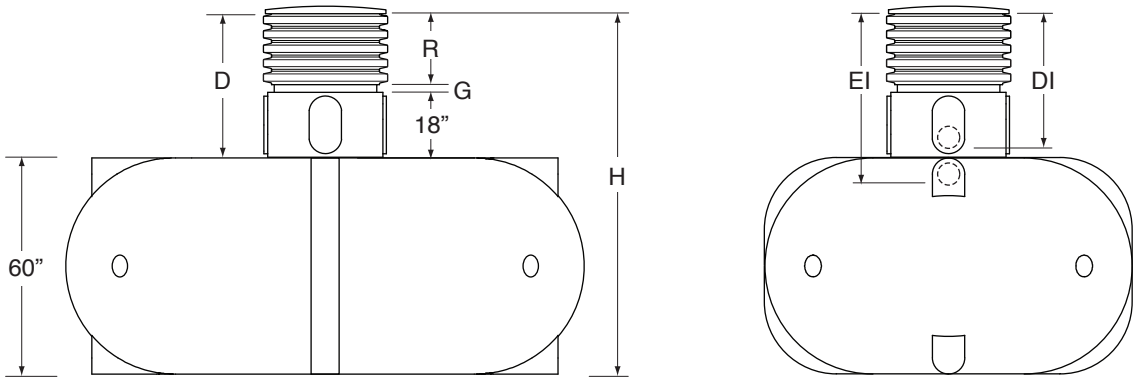
PHYSICAL CHARACTERISTICS

Model	Capacity	Length	Width	Height (H)	Depth (D)	Access	Weight
DoubleTorus-2500	2500 gal	144”	102”	90” - 105”	30” - 45”	24”	900 lb



Conservation Technology

BURIAL DEPTH AND PIPE INVERTS



Tank Dimensions				Pipe Invert at Dome (DI)		Plpe Invert at End (EI)	
Depth (D)	Riser (R)	Gap (G)	Height (H)	4” PVC	6” PVC	4” PVC	6” PVC
30”	12”	-	90”	19” - 27”	21” - 27”	36” - 38”	38”
31”	12”	1”	91”	20” - 28”	22” - 28”	37” - 39”	39”
32”	12”	2”	92”	21” - 29”	23” - 29”	38” - 40”	40”
33”	12”	3”	93”	22” - 30”	24” - 30”	39” - 41”	41”
34”	16”	-	94”	23” - 31”	25” - 31”	40” - 42”	42”
35”	16”	1”	95”	24” - 32”	26”’ - 32”	41” - 43”	43”
36”	16”	2”	96”	25” - 33”	27”-33”	42” - 44”	44”
37”	16”	3”	97”	26” - 34”	28” - 34”	43” - 45”	45”
38”	20”	-	98”	27” - 35”	29” - 35”	44” - 46”	46”
39”	20”	1”	99”	28” - 36”	30” - 36”	45” - 47”	47”
40”	20”	2”	100”	29” - 37”	31” - 37”	46” - 48”	48”
41”	20”	3”	101”	30” - 38”	32” - 38”	47” - 49”	49”
42”	24”	-	102”	31” - 39”	33” - 39”	48” - 50”	50”
43”	24”	1”	103”	32” - 40”	34” - 40”	49” - 51”	51”
44”	24”	2”	104”	33” - 41”	35” - 41”	50” - 52”	52”
45”	24”	3”	105”	34” - 42”	36” - 42”	51” - 53”	53”

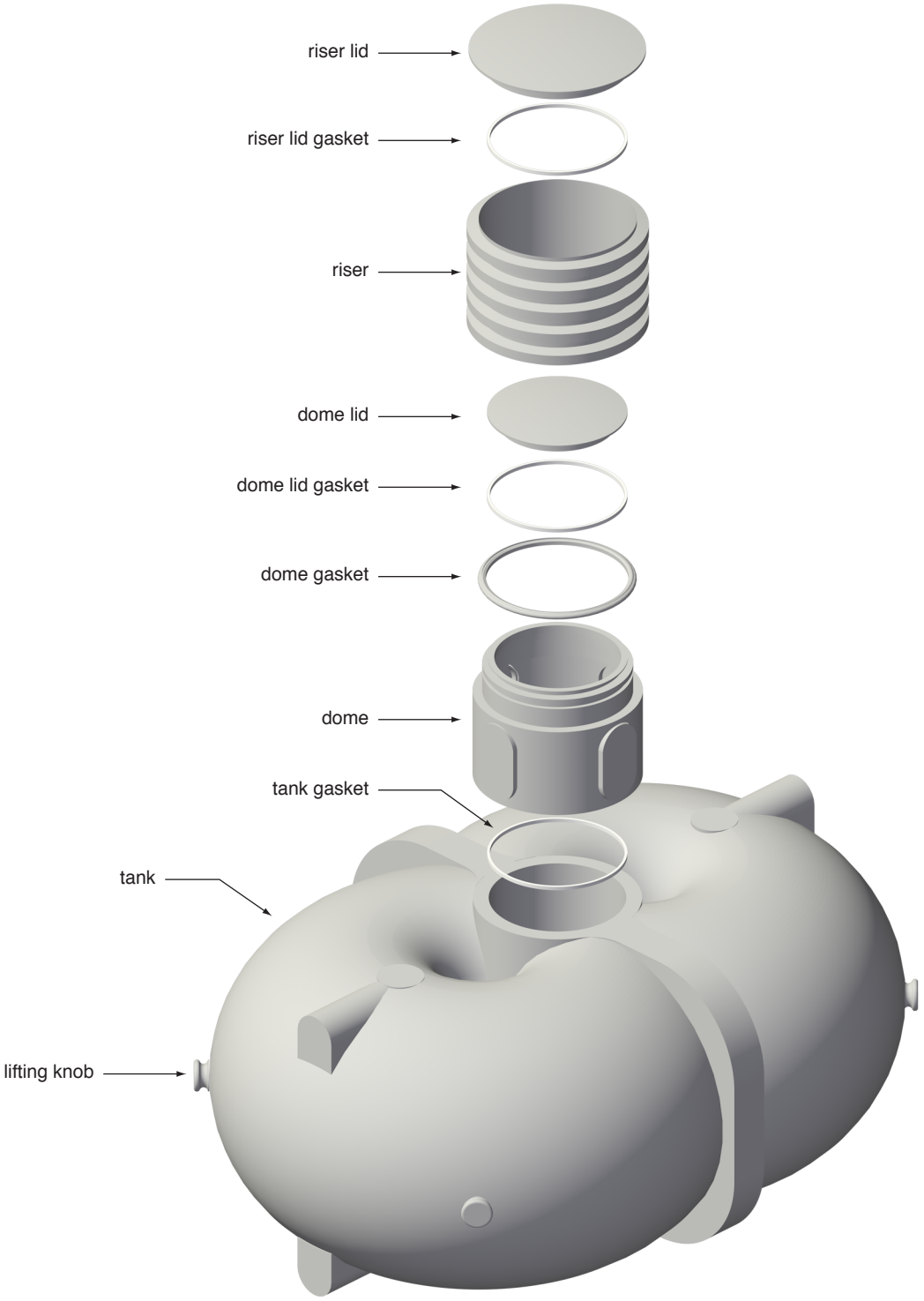
NOTES:

- use only recommended fill
- minimum burial depth = 30” or frost depth
- maximum burial depth = 45” (insulate on top if frost depth is greater)
- minimum excavation depth = H + 6”
- longer risers available to raise lid above ground level
- use ring gaskets in dome: drill 5” hole for 4” ring gasket; drill 7” hole for 6” ring gasket
- use bulkhead fittings in bottom of tank

Conservation Technology

COMPONENTS

The main body of the DoubleTorus is made in one piece of 5/8” thick food-grade virgin polyethylene. A heavy duty “dome” is bolted to the tank with 24 stainless-steel bolts and the tank-to-dome joint is sealed with a gasket. A double-wall 30” diameter riser slides over the dome and is sealed with a gasket inserted into a groove in the dome. This connection provides both height and tilt-angle adjustment and isolated the tank and dome from earth movement above. Both the dome and the riser have gasketed lids.



Conservation Technology

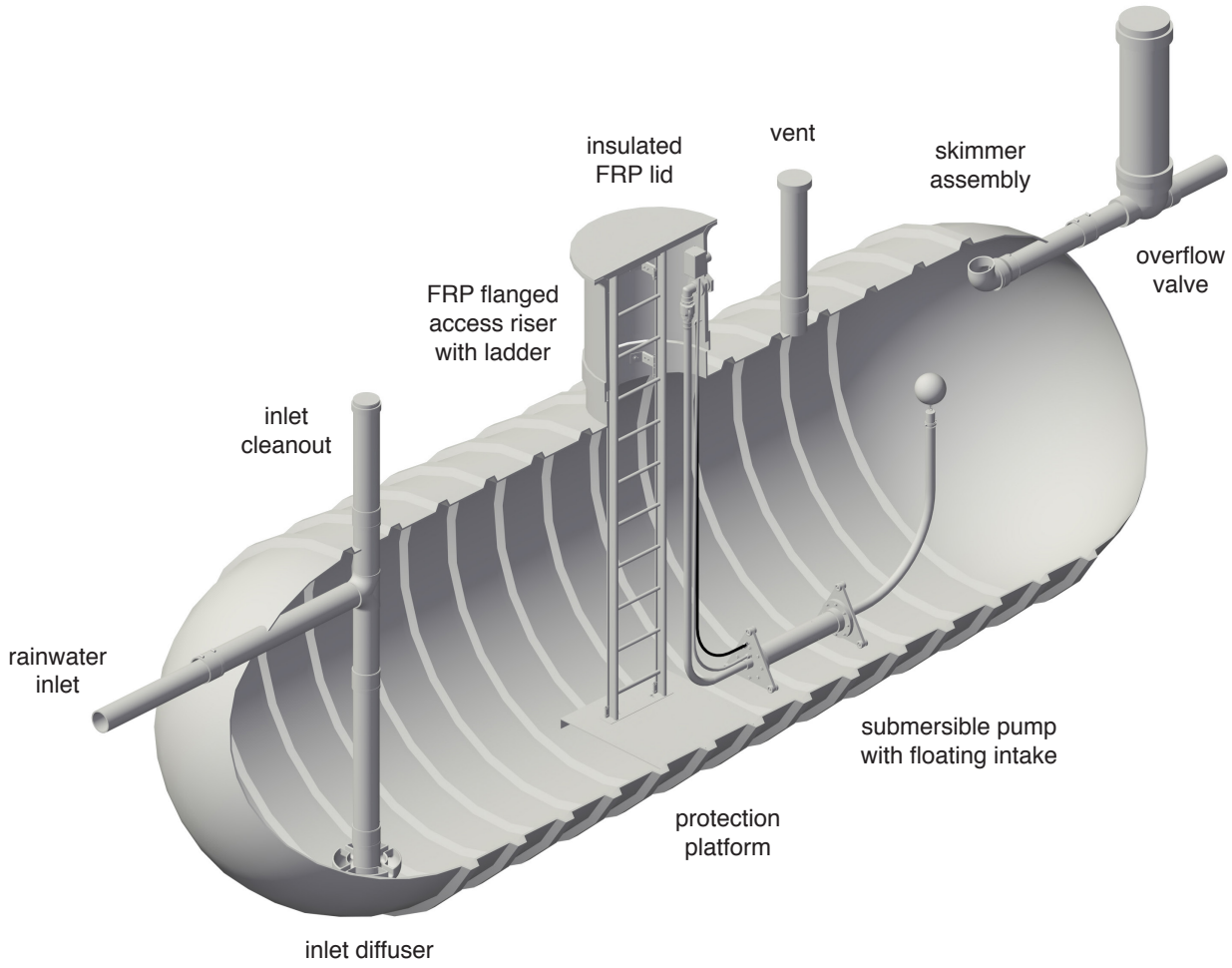
RainSub

The *RainSub* is a high-strength ribbed cylindrical tank made of fiber-reinforced plastic (FRP) fully equipped with ports and accessories optimized for rainwater harvesting. Sizes range from 4,000 to 50,000 gallons with diameters from 6 to 12 feet. Standard features include a 36" diameter flanged FRP accessway with bolted insulated FRP lid to provide easy entry for personnel and equipment; an FRP ladder mounted on an impact-absorbing platform, an inlet system with a drop pipe, diffuser, and cleanout; an an outlet system with an internal skimmer and external overflow valve; a top vent port to equalize air pressure; and a complete ballast system with straps and turnbuckles and precast concrete deadmen to simplify installation and prevent flotation.

RainSub with standard accessway and ports

SYSTEM COMPONENTS

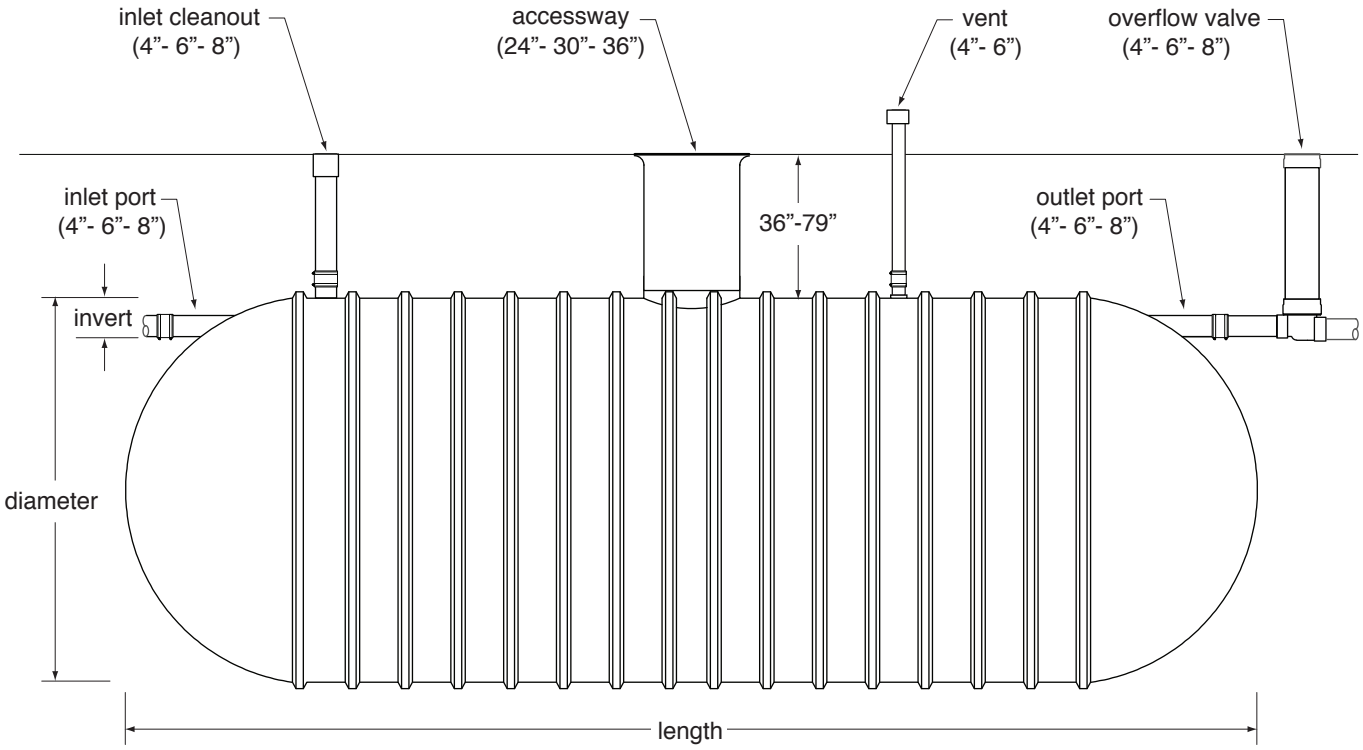
RainSub tanks are shipped with prefabricated stub-outs for the access riser, inlet, inlet cleanout, and outlet. The access riser and lid, ladder, inlet cleanout riser and cap, vent riser and cap, diffuser assembly, skimmer assembly, and external overflow valve are attached in the field using supplied fittings, flexible couplings and bonding materials.



Conservation Technology

PHYSICAL CHARACTERISTICS

Following are dimensions for the most common RainSub configurations. The size and location of the accessway, ports, and vent can be changed as required, and the height of each can be adjusted during installation to match field conditions. FRP straps and heavy-duty galvanized steel turnbuckles (not shown) are provided to anchor the tank to pre-cast reinforced concrete deadmen to secure the tank during the backfill process and to prevent flotation. Where vehicle traffic is possible, the inlet cleanout, accessway, and overflow valve must be protected by cast iron or other traffic-rated frames and covers that float above.



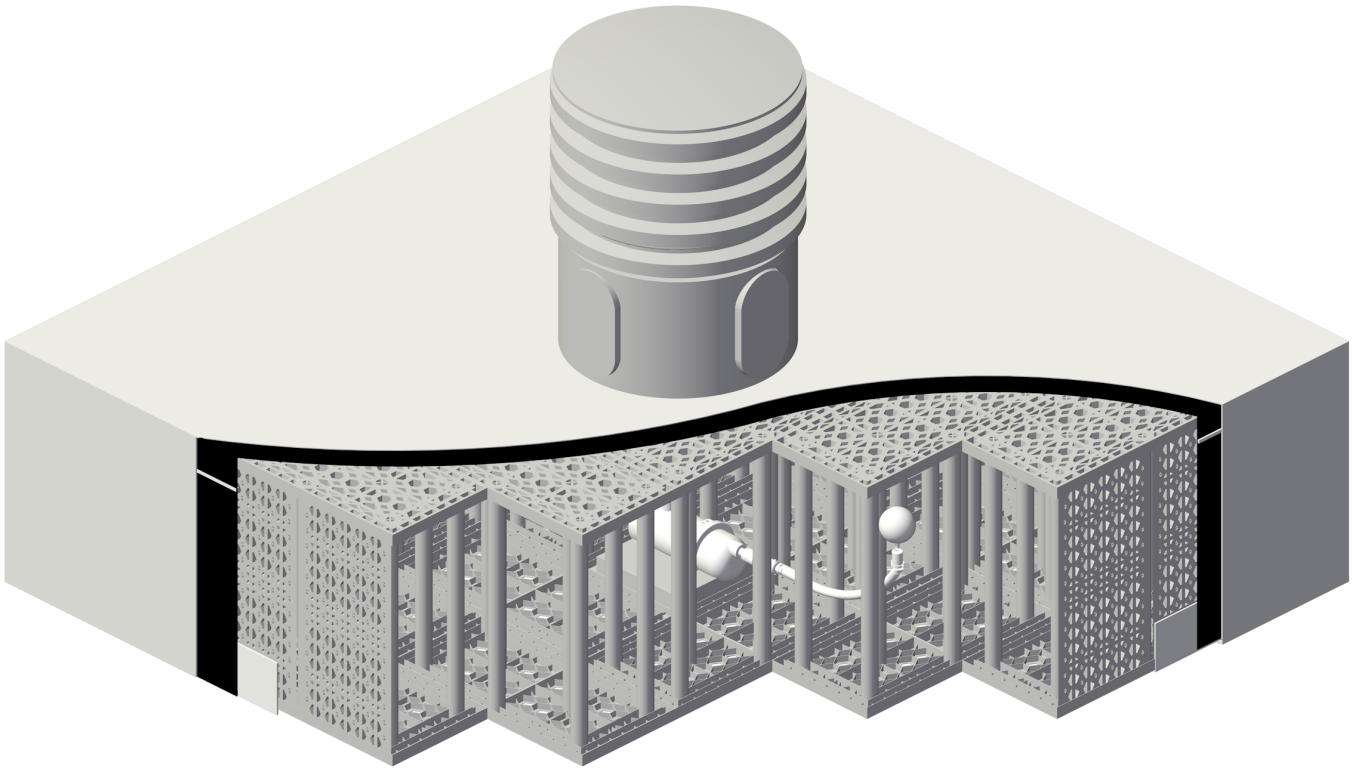
STANDARD CONFIGURATIONS								
Model	**Gallons**	**Diameter**	**Length**	**Ports**	**Riser**	**Vent**	**Invert**	**Weight**
RainSub-0406	4000	6’-0”	21’-11”	4”	36”	4”	10”	2200
RainSub-0506	5000	6’-0”	26’-5”	4”	36”	4”	10”	2600
RainSub-0608	6000	7’-8”	20’-7”	4”	36”	4”	10”	2600
RainSub-0808	8000	7’-8”	26’-1”	6”	36”	4”	10”	3400
RainSub-1008	10000	7’-8”	31’-7”	6”	36”	4”	13”	4200
RainSub-1208	12000	7’-8”	37’-1’	6”	36”	4”	13”	5100
RainSub-1510	15000	10’-0”	29’-6”	8”	36”	6”	13”	6600
RainSub-2010	20000	10’-0”	37’-9”	8”	36”	6”	16”	8600
RainSub-2510	25000	10’-0”	47’-7”	8”	36”	6”	16”	11100
RainSub-3010	30000	10’-0”	55’-10”	8”	36”	6”	16”	13200
RainSub-4010	40000	10’-0”	73’-8”	8”	36”	6”	16”	17900
RainSub-5012	50000	11’-11”	68’-1”	8”	36”	6”	23”	20000

Conservation Technology

RainCavern

The *CT RainCavern* is not a tank in the traditional sense, but rather an underground chamber created by a series of open plastic modules wrapped in a waterproof membrane and then backfilled with earth. Each module consists of bottom plate, a top plate, and eight reinforced structural columns that can be assembled in minutes with only a rubber mallet. Sidewalls are installed only around the perimeter of the system, leaving the interior completely open. Large access risers permit entry into the system for inspection and cleaning. Submersible pumps, prefilters, and controls can be installed within the modules and access risers.

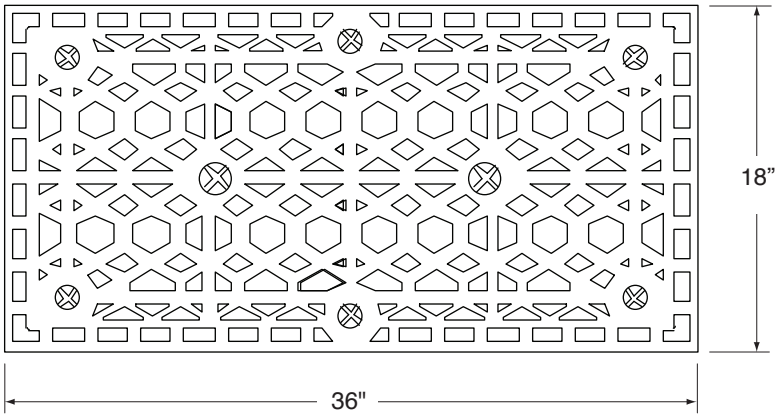
Standard modules measure 18” wide by 36” long by 36” tall and creates a void space with a volume of 98 gallons. Modules are arranged in square or rectangular patterns to create storage systems with virtually limitless capacity. For pedestrian traffic the cover depth can be as little as 24”, permitting very shallow excavations not possible with tank systems, or as deep as 68”, a depth that would crush many plastic tanks. For vehicle traffic, the cover depth can be as little as 32”. Half-height modules are available to build very shallow systems, and modules can be double-stacked for high volume storage with a limited footprint.

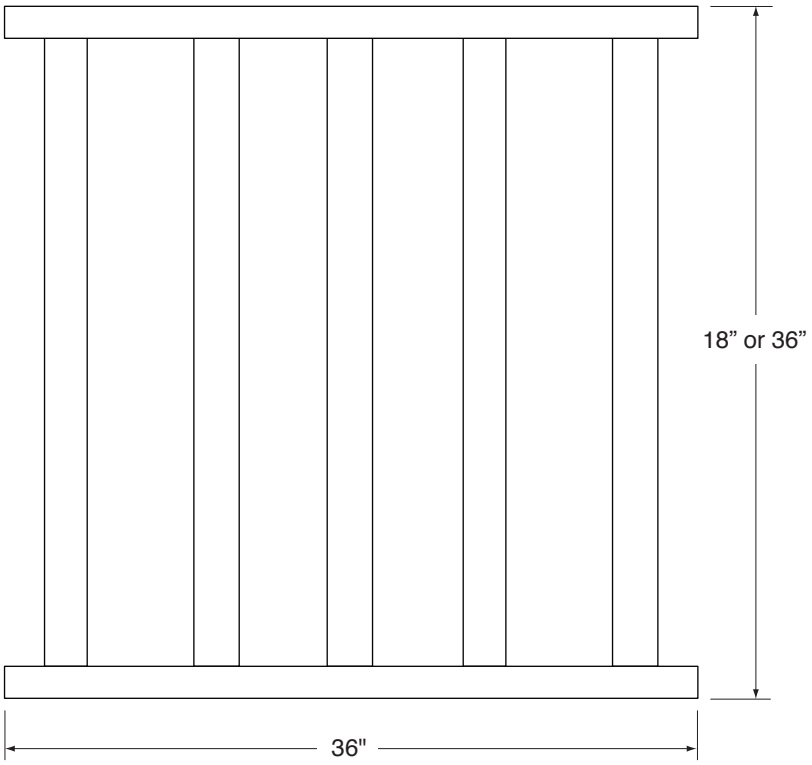


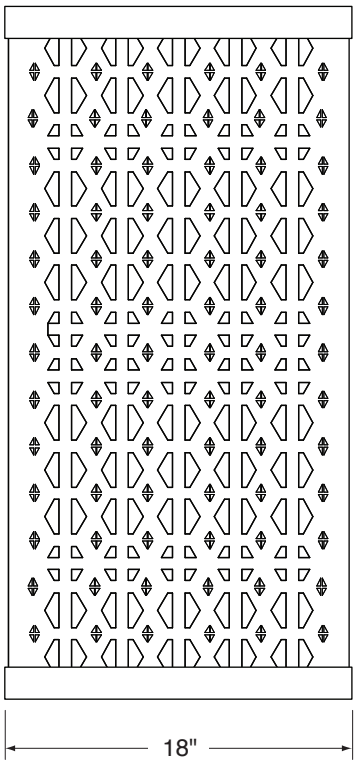
view into RainCavern system showing modules sealed with waterproofing membrane sandwiched between two layers of protection mat, adjustable access riser system, Amphibian pump with floating intake

Conservation Technology

DIMENSIONS

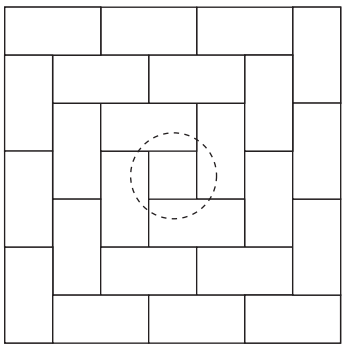






Dimensions	Capacity	Modules
7’-6” x 7-’6”	1200 gal	12
10’-6” x 10’-6”	2400 gal	24
13’-6” x 13’-6”	3900 gal	40
16’-6” x 16’-6”	5900 gal	60
19’-6” x 19’-6”	8300 gal	84
22’-6” x 22’-6”	11000 gal	112

stock sizes (many other sizes and shapes are possible)



layout pattern (10.5’ x 10.5’)

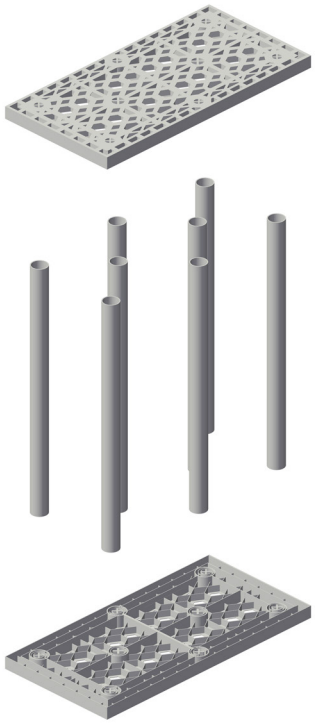
Conservation Technology

MODULE ASSEMBLY

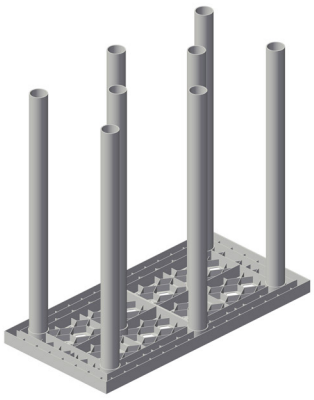
Each module is built from two top/bottom plates and eight support columns. No adhesives or fasteners are used. Modules must be assembled on a hard, flat surface so that the columns can be driven into place with a mallet. Do not assemble over the waterproofing liner!

For rapid assemby, follow the simple three-step process shown below. Since the sidewalls used for perimeter modules fit within a groove in the top/bottom plates, they must be installed before the columns are driven into the sockets.

As modules are assembled, set them side-by-side on a flat surface. Since the columns are precision-cut to length, if the columns are fully seated in the sockets, all of the heights will be identical.

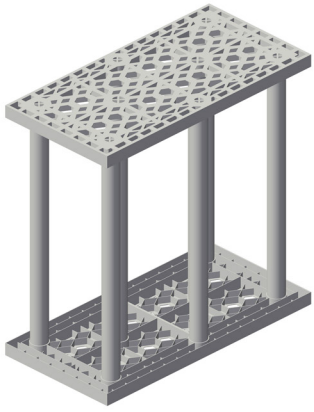


exploded view of parts required to build one module



STEP 1: insert the support columns into the sockets of an inverted top/bottom plate.

STEP 2: Flip the assembly and insert the support columns into the sockets of the second top/bottom plate.

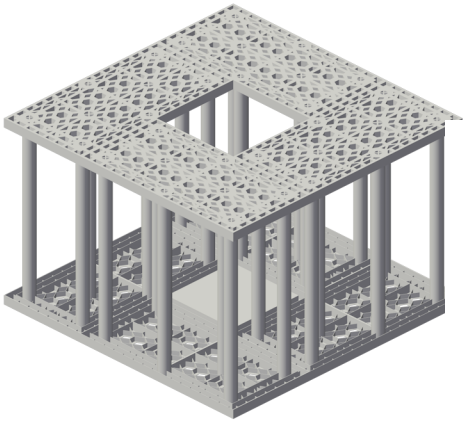


STEP 3: Using a rubber mallet, firmly strike the top surface over each column to drive the columns into the sockets.

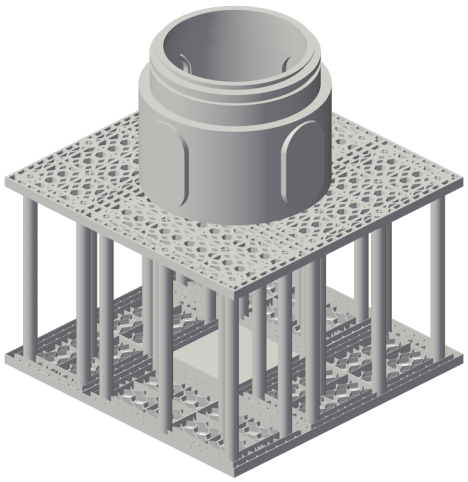
Conservation Technology

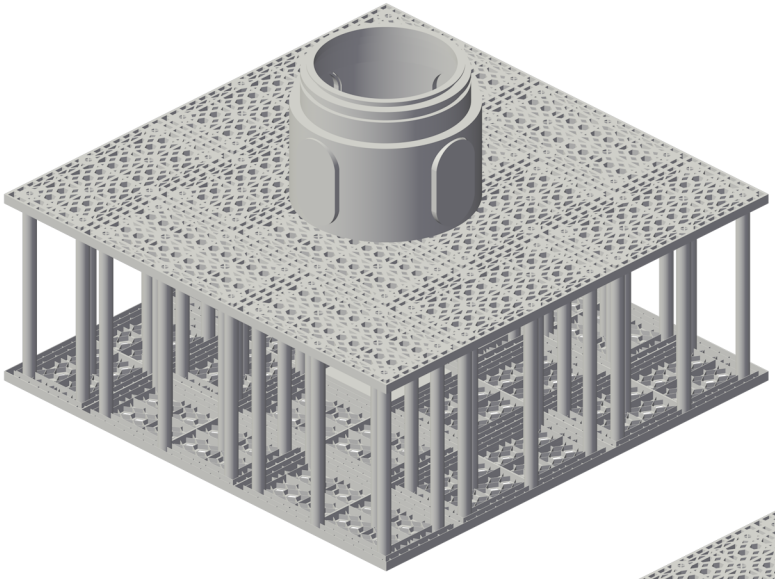
SYSTEM LAYOUT

Arrange four modules end-to-side around the bottom platform to create a half-module open space.

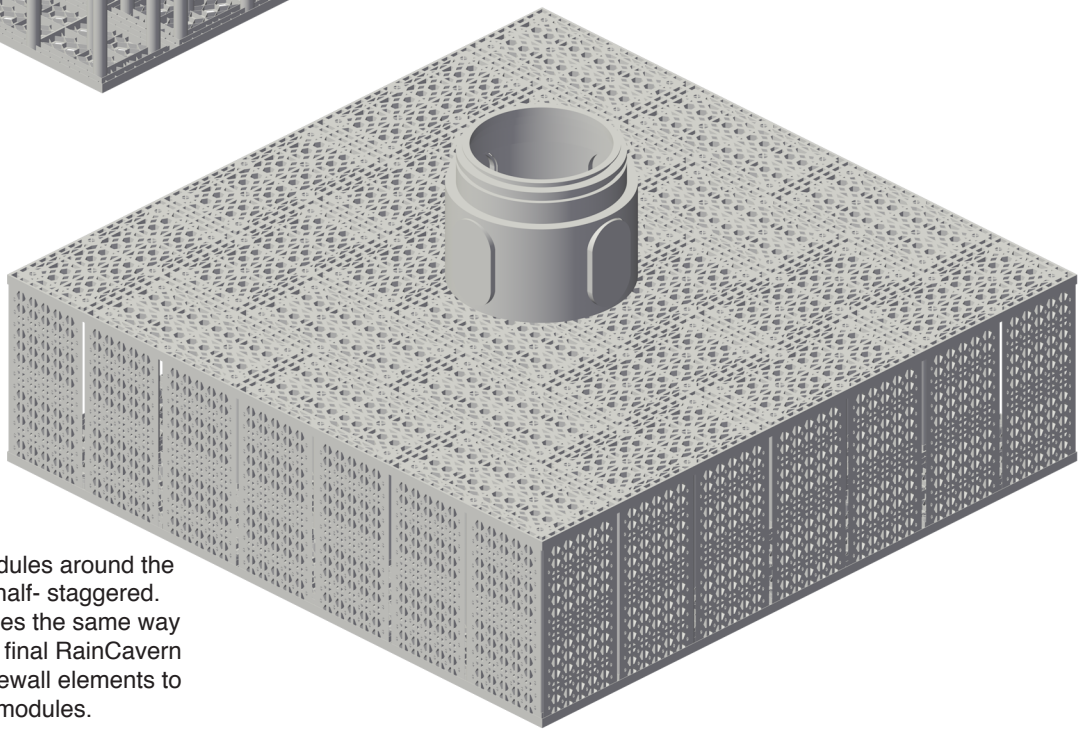


Drop the access dome into the square hole to temporarily hold the proper shape.





Place eight more modules around the perimeter with joints half staggered against the core modules.

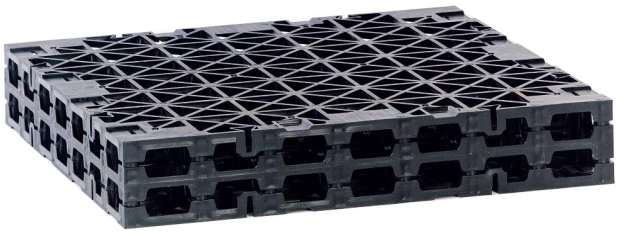


Place twelve more modules around the perimeter with joints half- staggered. Continue adding modules the same way as needed to reach the final RainCavern dimensions, adding sidewall elements to the outermost modules.

Conservation Technology

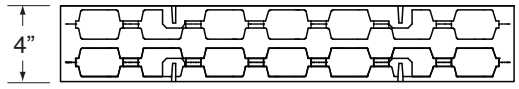
X-BOX

X-Box is a high-strength plastic structure that can be installed under green roofs to provide uninterrupted drainage, to delay stormwater release, to provide high-volume water storage, or to create lightweight topographic relief. Standard heights are 4”, 6”, 8”, 10”, and 12” (16” and 24” are available on special order), but modules can be stacked to create unlimited heights in two-inch increments. Modules can be joined horizontally with locking butterfly connectors and vertically with alignment pins to create complex three-dimensional shapes without the positioning, wind uplift, or flotation issues of geofoam.

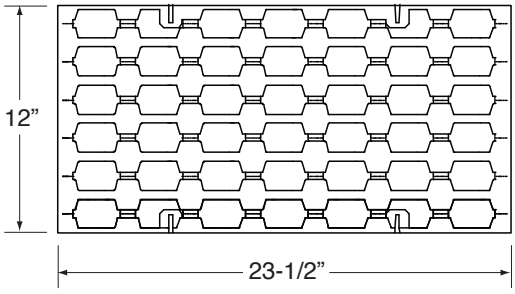


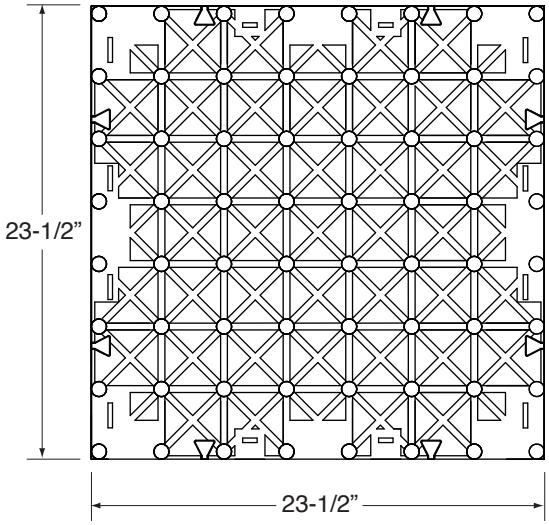
All X-Box modules have 64 full-height support columns, making them significantly stronger than other low-profile modules. With a 50-year long-term load capacity of 4,000 lb/sf, they can support pre-cast walls, planters, and other rooftop hardscapes, freeing the designer from roof drainage and stormwater management constraints.

PHYSICAL CHARACTERISTICS



(also available 6”, 8”, and 10”)





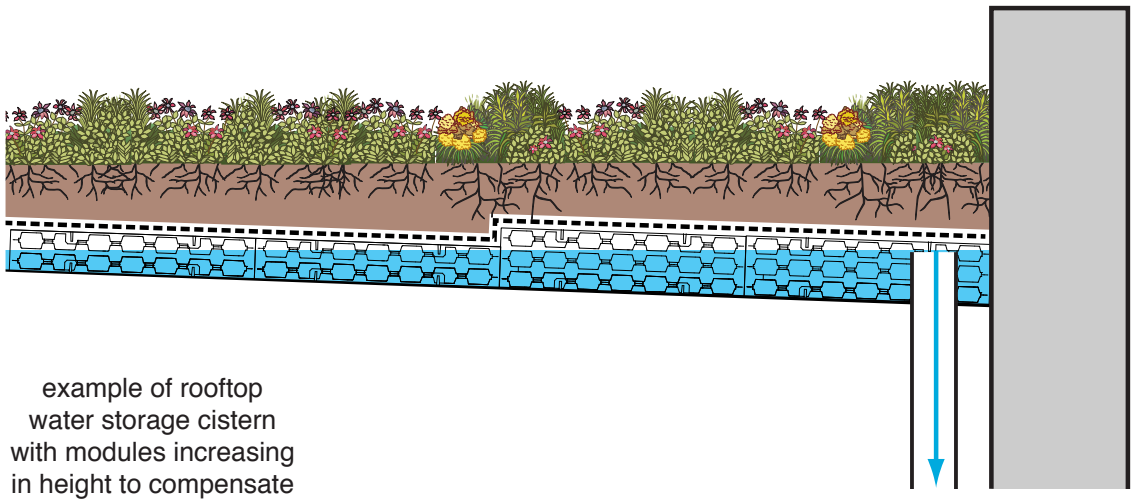
Property	US	Metric
Base	23.5” x 23.5”	60cm x 60cm
Height	4”, 6”, 8”, 10”, 12”	10cm, 15cm, 20cm, 25cm, 30cm
Unit Water Storage*	0.6 gal/in/ft^2	x 13.7 l/cm/m^2
Unit Weight*	0.25 lb/in/ft^2	0.045 kg/cm/m^2
Short-Term Load Capacity	13,500 lb/ft^2	650 kN/m^2
Long-Term (50 year) Load Capacity	4,000 lb/ft^2	200 kN/m^2

* Example: for 6” modules, water storage = 6” x 0.6 gal/in/ft^2 = 3.6 gal/ft^2 and weight = 6” x 0.25 lb/in/ft^2 = 1.5 lb/ft^2

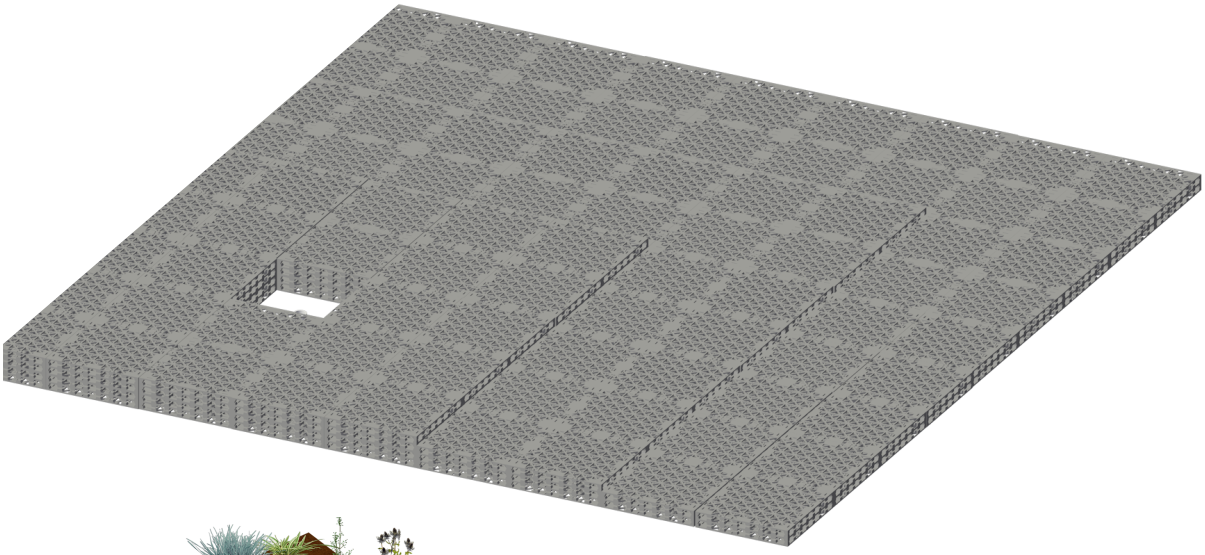
Conservation Technology

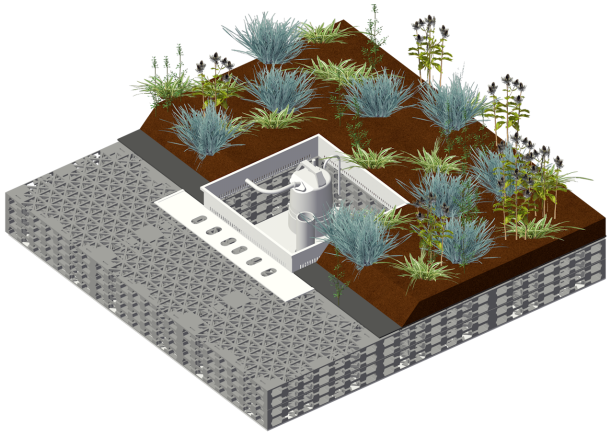
ROOFTOP CISTERN

The X-Box is ideal for creating a low-profile rainwater cistern under a green roof. First a durable ponding membrane, for example a sheet of EPDM rubber, is placed over the primary waterproofing and lapped up the parapet walls. Then modules are placed on the ponding membrane, completely covering the surface. Since X-Box modules are available in 2” increments of height and typical roofs slope 1/4” per foot towards the roof drains, the module height should be increased by 2” every eight feet (four modules) to maximize water storage capacity while leveling the green roof. Lastly, a standpipe over the drain is set to the desired water-retention height. In freezing climates the standpipe should be designed to be removed in the winter. A special abrasion-resistant pump that draws down to one-eight inch makes it possible to irrigate the roof above.



example of rooftop water storage cistern with modules increasing in height to compensate for the slope to drain





detail showing module omitted to create an access cavity, standpipe, and special low-suction pump

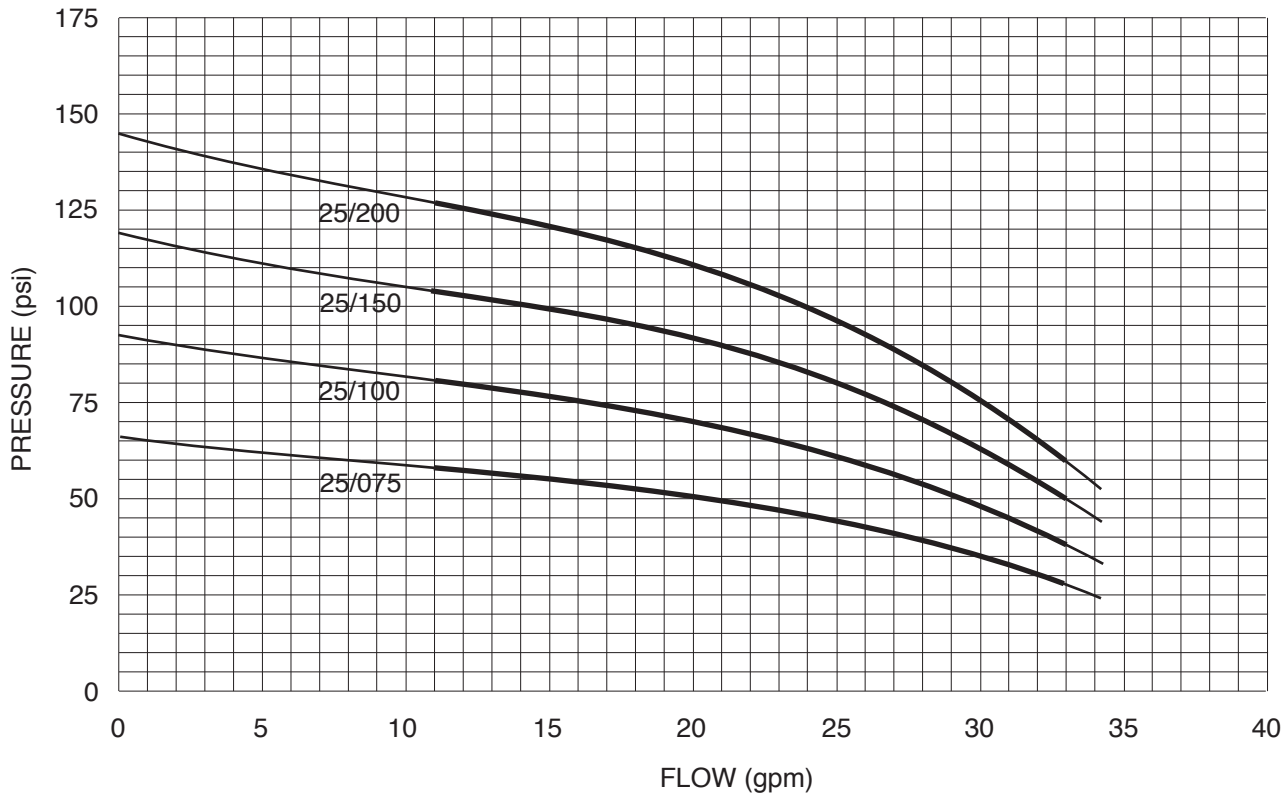
AquaGeyser Pumps

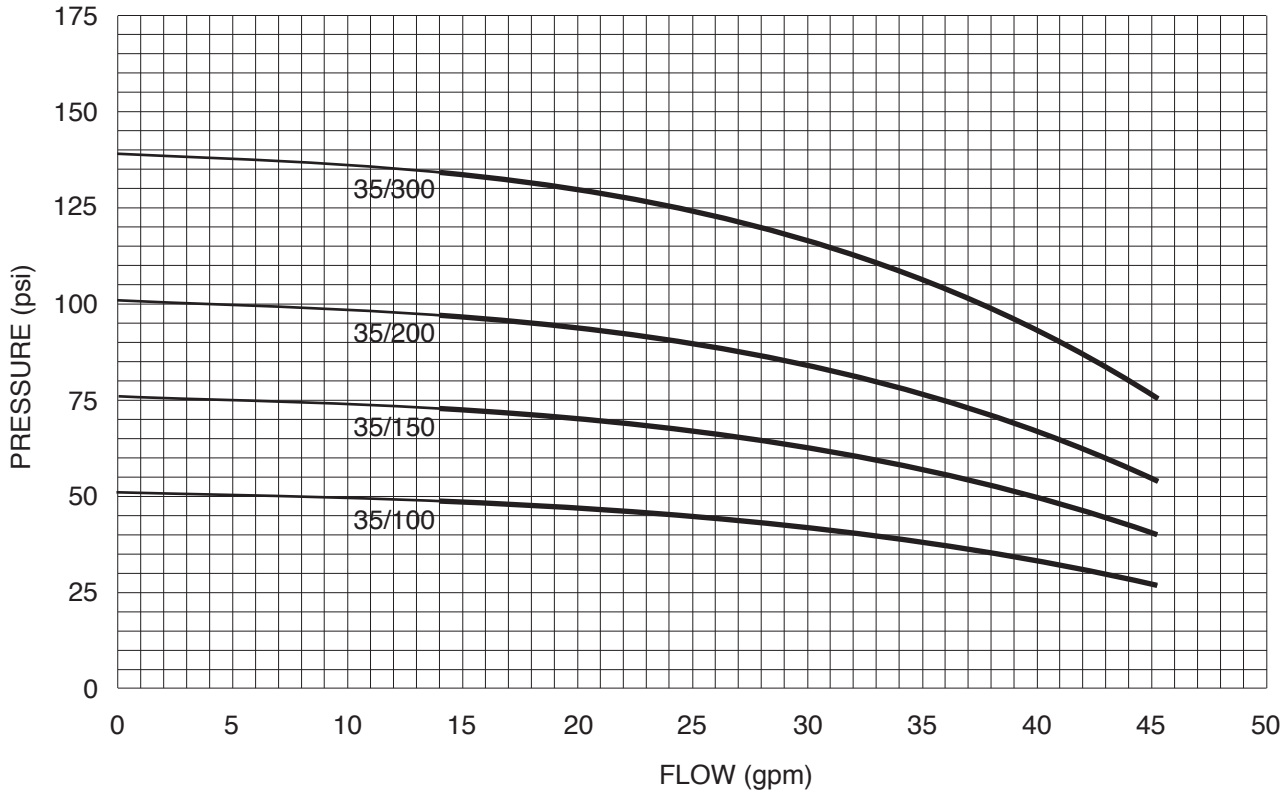
CT AquaGeyser Pumps are high-efficiency stainless-steel turbine pumps encased within PVC flow-inducing sleeves with optimal dimensions for motor cooling. Unique triangular end plates with rubber bumpers provide stable support on any surface and are easily removed for pump maintenance. A flexible floating intake assembly at one end draws clean water from just under the water surface. A flexible discharge assembly at the other end conveys the pressurized water to a quick-connect fitting at the top of the tank, and a rope harness restrains pump movement. The entire assembly can be inserted or removed through a 20" or larger accessway without entering the tank.

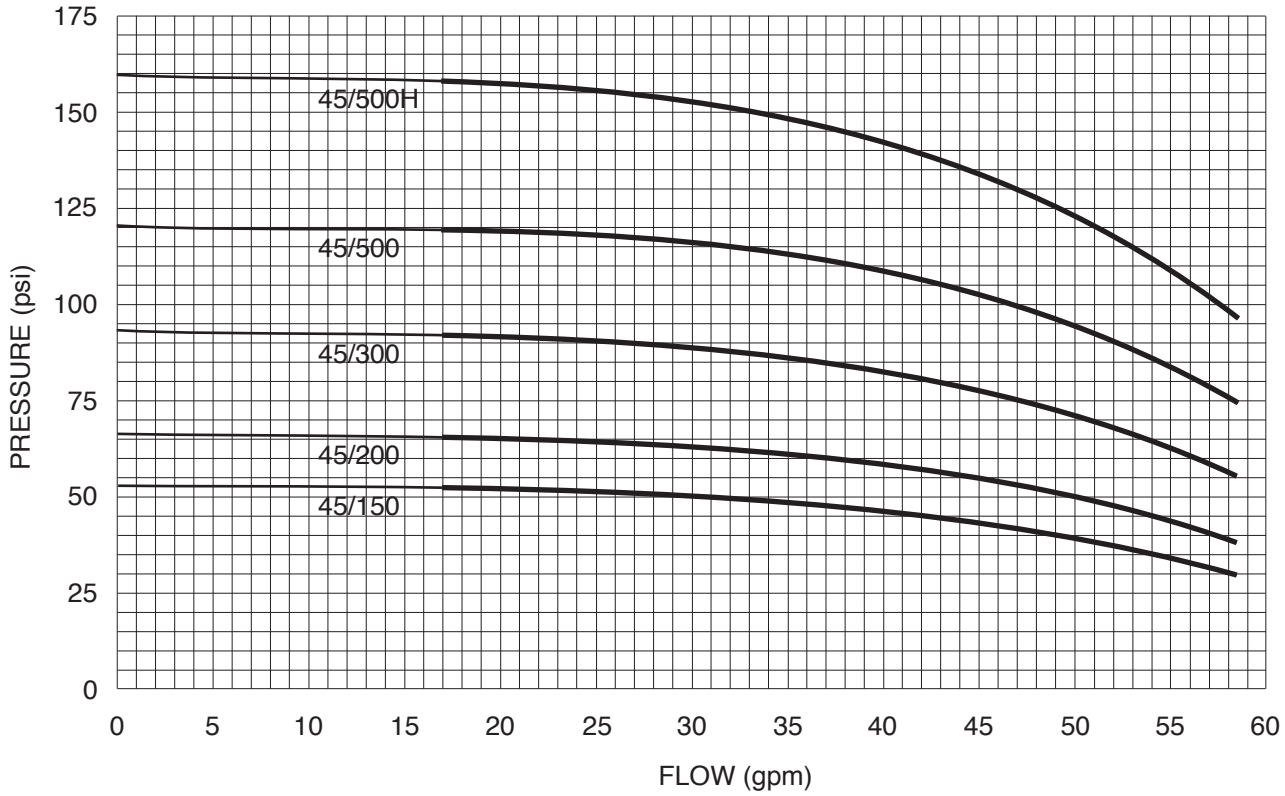
Other features include thrust-stop rings that permit horizontal installation for optimal water extraction, grit-resistant bearings that minimize wear when pumping recycled water, built-in stainless-steel discharge check valves that maintain prime and simplify duplex pump installations, air-bleeder fittings to clear trapped air, and stainless-steel inlet and outlet fittings for durability.

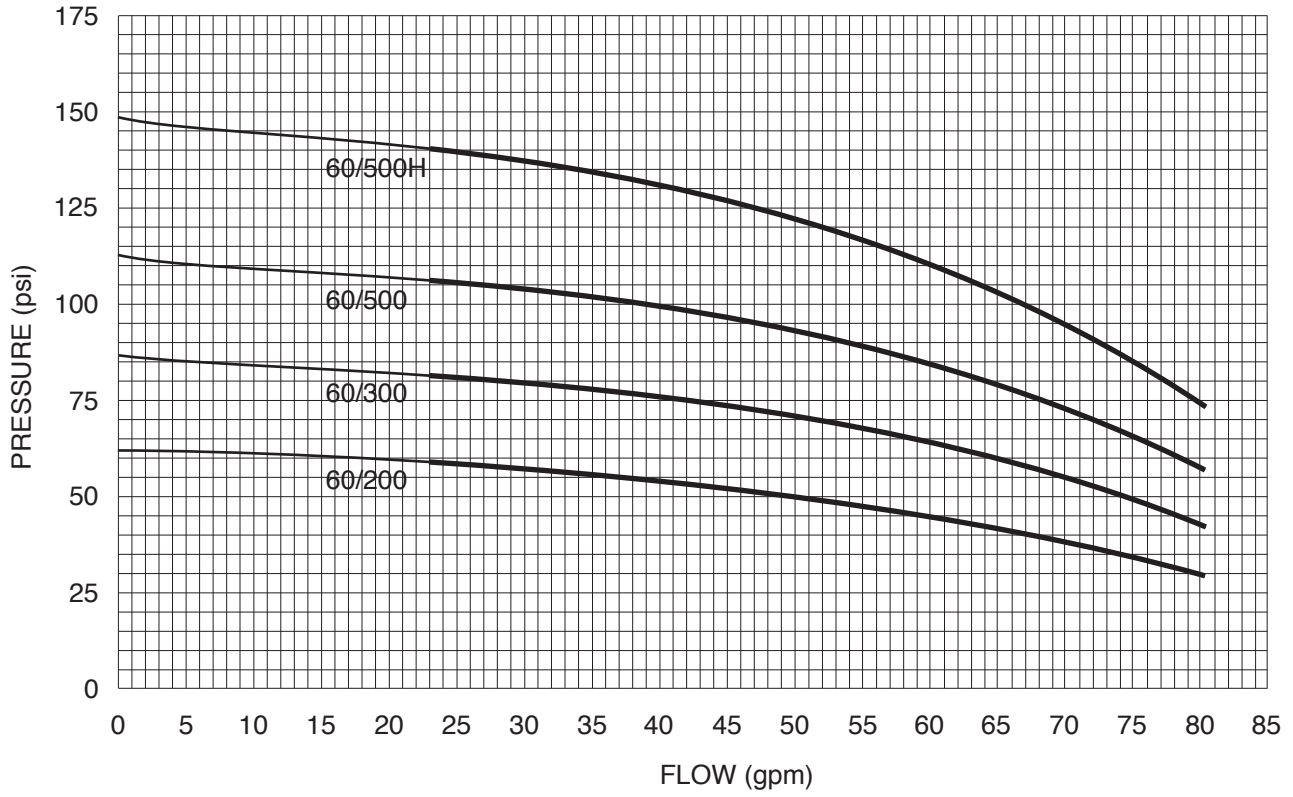
PERFORMANCE

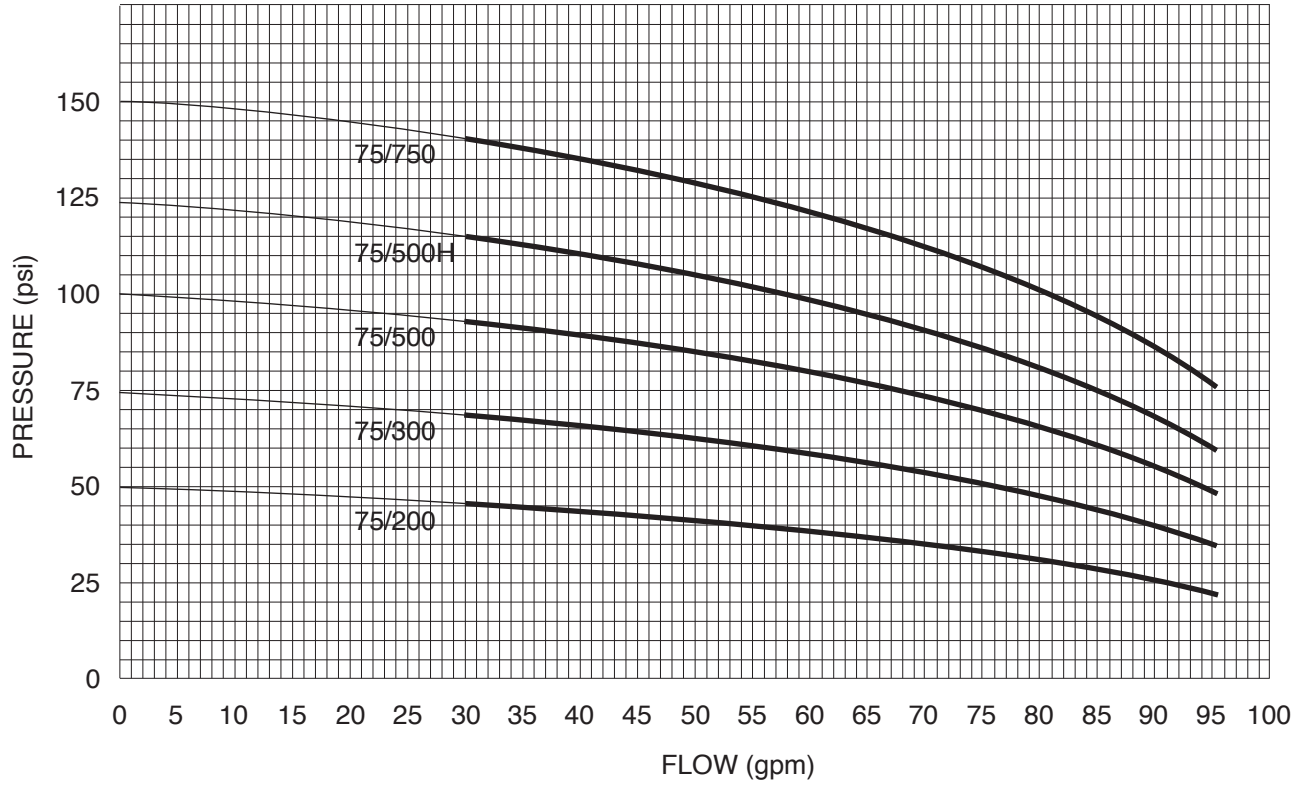
The six performance charts that follow show the hydraulic performance for standard series of AquaGeyser pumps grouped by peak design flow rates. The thick curves represent the recommended range of peak design flow rates, the first number of the pump designation identifies the peak design flow rate for optimal energy efficiency, and the second number identifies the motor horsepower.




175
150
125
100
75
50
25
0
PRESSURE (psi)
35/300
35/200
35/150
35/100
0
5
10
15
20
25
30
35
40
45
50
FLOW (gpm)


175
150
125
100
75
50
25
0
PRESSURE (psi)
45/500H
45/500
45/300
45/200
45/150
0
5
10
15
20
25
30
35
40
45
50
55
60
FLOW (gpm)


175
150
125
100
75
50
25
0
PRESSURE (psi)
60/500H
60/500
60/300
60/200
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85
FLOW (gpm)


150
125
100
75
50
25
0
PRESSURE (psi)
75/750
75/500H
75/500
75/300
75/200
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
FLOW (gpm)

SELECTING A PUMP

The table that follows summarizes the hydrauic characteristics of each AquaGeyser pump shown in the preceding performance charts. Although each pump can be efficiently operated at peak design flow rates anywhere between the minimum and maximum flow rates, it is best to select a pump series with an “optimal” gpm as close as possible to the peak design flow rate. Then use the relevant performance chart to select which pump in the selected series meets the peak design pressure requirement. For cascading duplex pumps, a standard feature of AquaDrive+ pump control panels, each pump can be sized to the average design flow as long as the capacity of both pumps is within the peak design flow. Pumps with other hydraulic characteristics are available on special order.

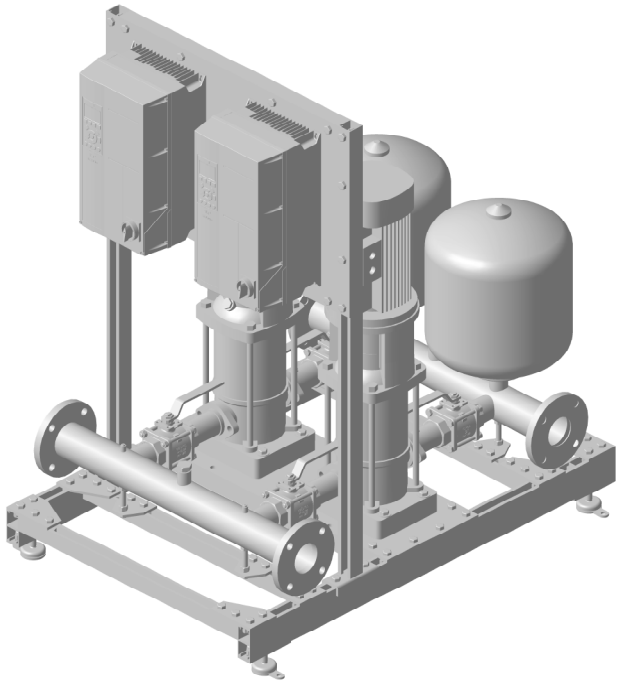
Standard pumps are designed for three-phase electrical power, with options of 208-240v or 460v. Single-phase pumps and other voltages are available on special order.

Model	Min	Max	Optimal	Power	Current*	Inlet	Outlet
AquaGeyser-25/075	11 gpm	33 gpm	25 gpm	0.75 hp	5.5/2.8 a	1.5”	1.5”
AquaGeyser-25/100	11 gpm	33 gpm	25 gpm	1 hp	6.4/3.2 a	1.5”	1.5”
AquaGeyser-25/150	11 gpm	33 gpm	25 gpm	1.5 hp	7.3/3.7 a	1.5”	1.5”
AquaGeyser-25/200	11 gpm	33 gpm	25 gpm	2 hp	8.7/4.4 a	1.5”	1.5”
AquaGeyser-35/100	14 gpm	45 gpm	35 gpm	1 hp	6.4/3.2 a	2”	1.5”
AquaGeyser-35/150	14 gpm	45 gpm	35 gpm	1.5 hp	7.3/3.7 a	2”	1.5”
AquaGeyser-35/200	14 gpm	45 gpm	35 gpm	2 hp	8.7/4.4 a	2”	1.5”
AquaGeyser-35/300	14 gpm	45 gpm	35 gpm	3 hp	12.2/6.1 a	2”	1.5”
AquaGeyser-45/150	17 gpm	58 gpm	45 gpm	1.5 hp	7.3/3.7 a	2”	2”
AquaGeyser-45/200	17 gpm	58 gpm	45 gpm	2 hp	8.7/4.4 a	2”	2”
AquaGeyser-45/300	17 gpm	58 gpm	45 gpm	3 hp	12.2/6.1 a	2”	2”
AquaGeyser-45/500	17 gpm	58 gpm	45 gpm	5 hp	19.8/9.9 a	2”	2”
AquaGeyser-45/500H	17 gpm	58 gpm	45 gpm	5 hp	19.8/9.9 a	2”	2”
AquaGeyser-60/200	23 gpm	80 gpm	60 gpm	2 hp	8.7/4.4 a	3”	2”
AquaGeyser-60/300	23 gpm	80 gpm	60 gpm	3 hp	12.2/6.1 a	3”	2”
AquaGeyser-60/500	23 gpm	80 gpm	60 gpm	5 hp	19.8/9.9 a	3”	2”
AquaGeyser-60/500H	23 gpm	80 gpm	60 gpm	5 hp	19.8/9.9 a	3”	2”
AquaGeyser-75/200	30 gpm	95 gpm	75 gpm	2 hp	8.7/4.4 a	3”	2”
AquaGeyser-75/300	30 gpm	95 gpm	75 gpm	3 hp	12.2/6.1 a	3”	2”
AquaGeyser-75/500	30 gpm	95 gpm	75 gpm	5 hp	19.8/9.9 a	3”	2”
AquaGeyser-75/500H	30 gpm	95 gpm	75 gpm	5 hp	19.8/9.9 a	3”	2”
AquaGeyser-75/750	30 gpm	95 gpm	75 gpm	7.5 hp	25/13.2 a	3”	2”

* Maximum current for 208/240v or 460v three-phase motors, respectively.

Vertical Pump Skids

CT Vertical Pump Skids are optimized to meet the most demanding requirements of water re-use systems. Each consists of one or two super-efficient muti-stage vertical pumps mounted on a compact stainless-steel skid. Every part in contact with water is stainless steel, including one or two hydropneumatic tanks mounted directly on the discharge manifold.

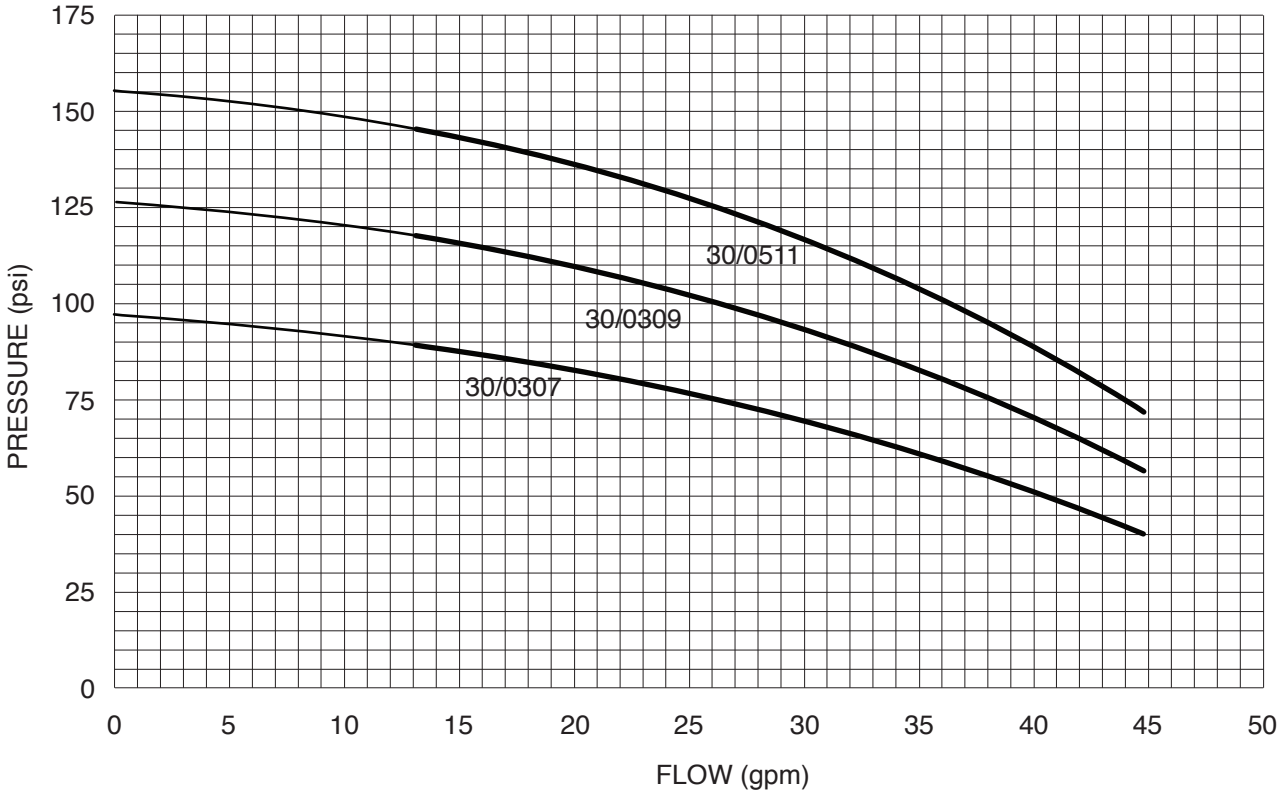


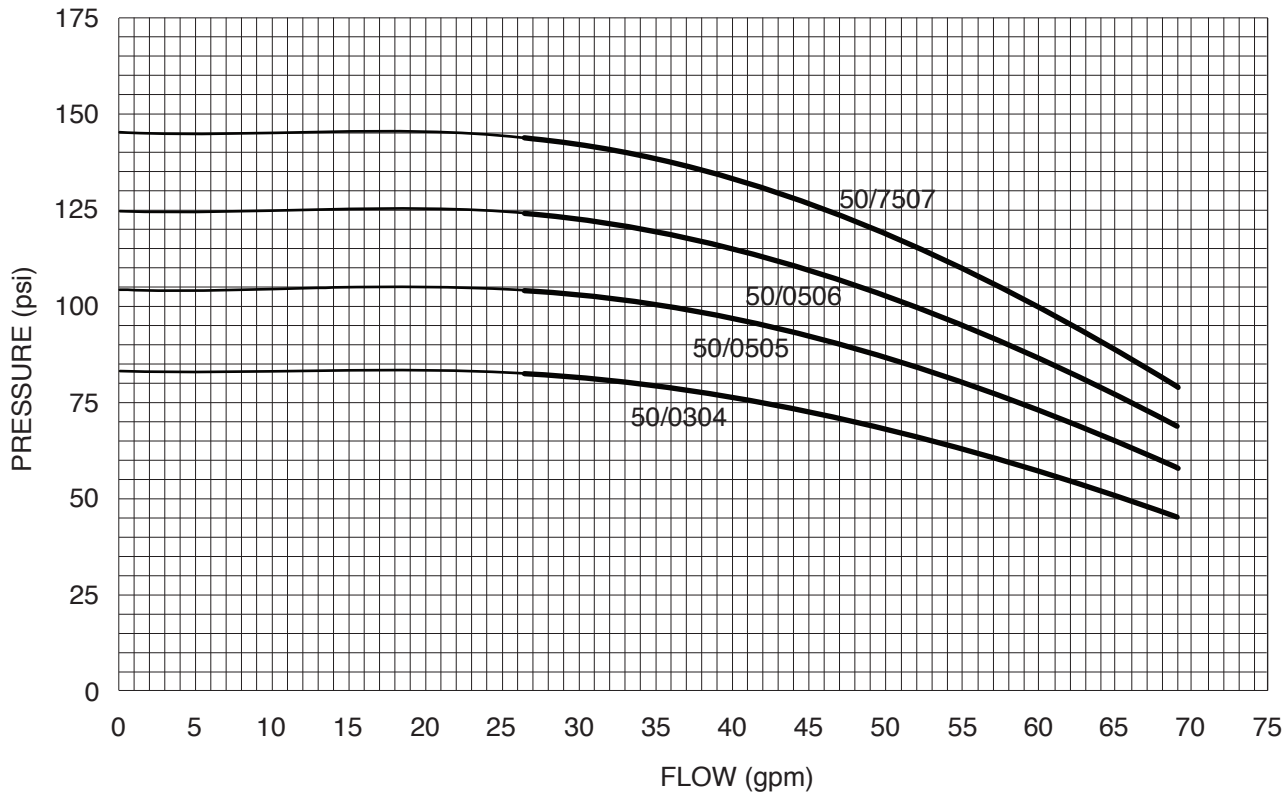
Each pump is independently operated with an *Aquadrive+* NEMA 4X variable frequency drive pump controller. Dual pumps automatically alternate for optimal durability and automatically cascade for optimal performance over a wide range of flow rates.

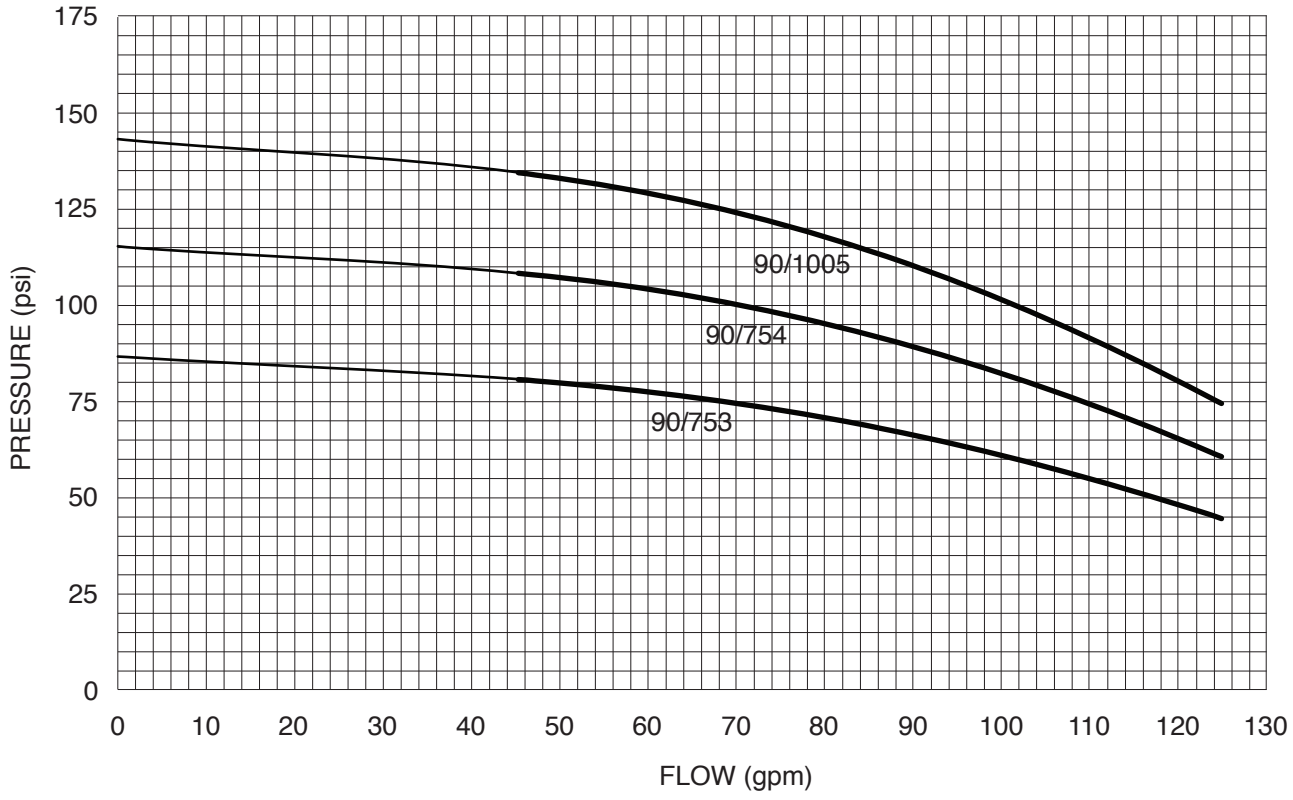
All components are selected for long-life and easy maintenance: bolted ball valves have replaceable seals, check valves have replaceable gaskets, tanks have replaceable bladders, and even the skid framing parts are easily replaceable. Dual pump system remains functional when either a pump or control panel requires maintenance.

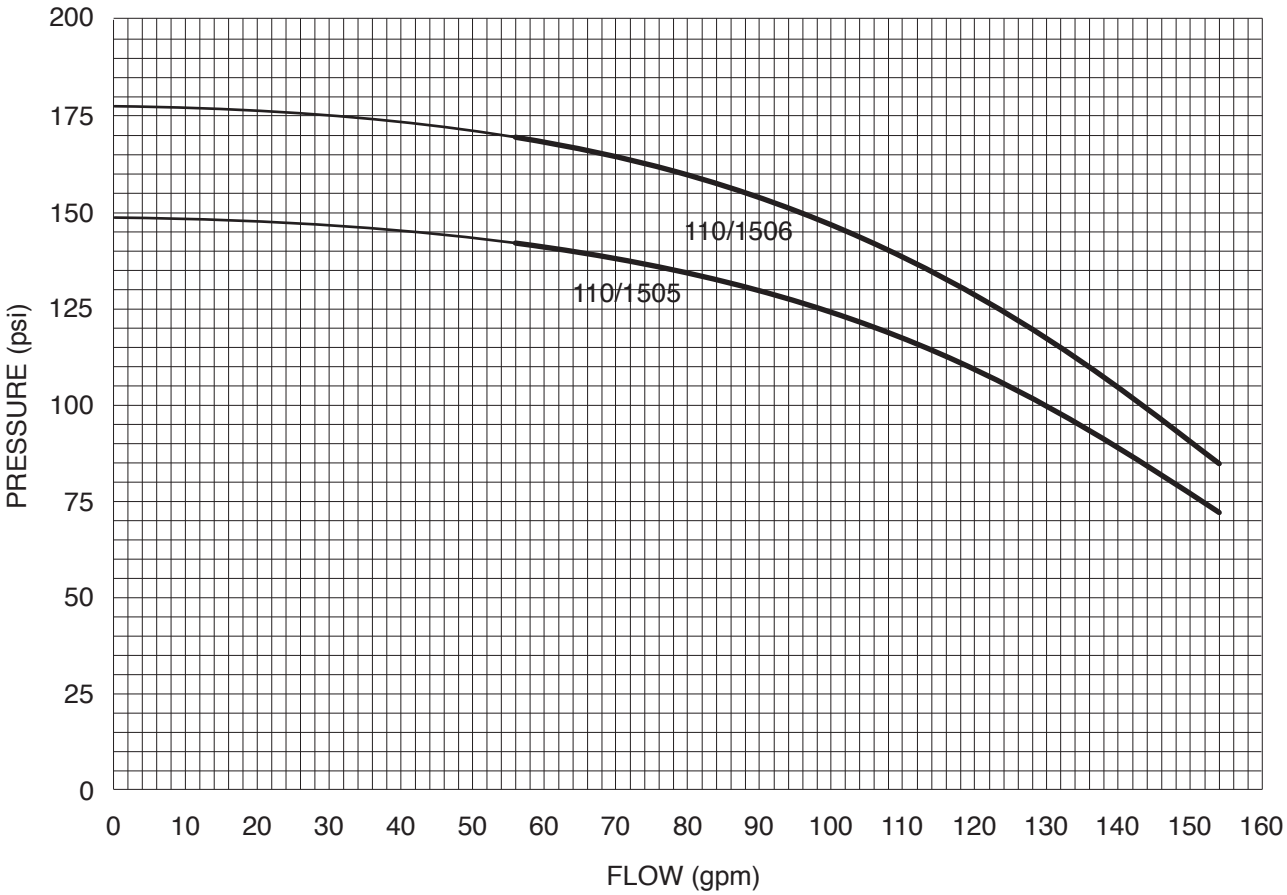
PERFORMANCE

In the following charts, the thick curves represent the recommended range of peak design flow rates for each pump on the skid. The first two digits of the pump designation identifies the peak design flow rate for optimal energy efficiency, the second two digits identifiy the motor horsepower, and the last two digits denote the number of impellers. Pumps with other performance curves are available.




PRESSURE (psi)
175
150
125
100
75
50
25
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
FLOW (gpm)
50/7507
50/0506
50/0505
50/0304

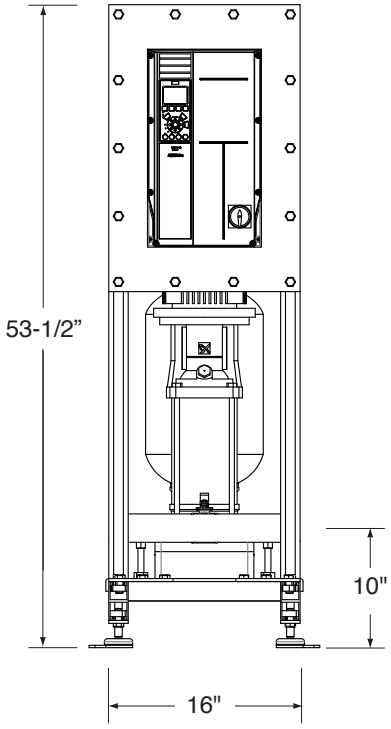

PRESSURE (psi)
175
150
125
100
75
50
25
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130
FLOW (gpm)
90/1005
90/754
90/753

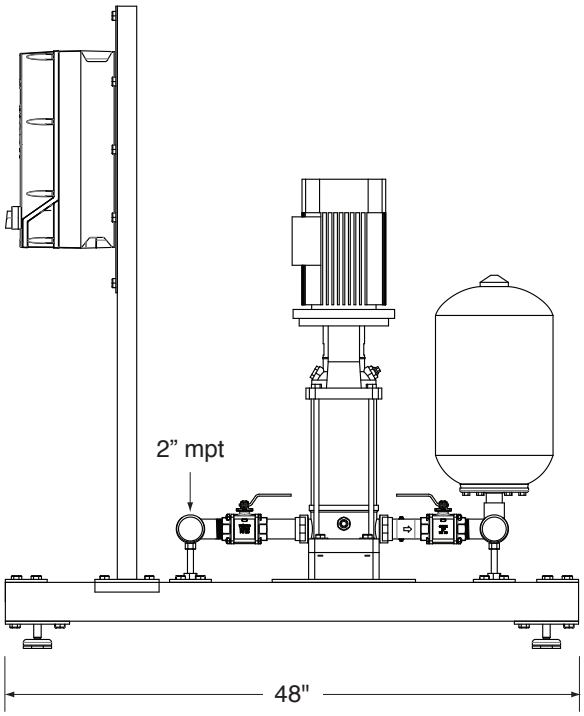

200
175
150
125
100
75
50
25
0
PRESSURE (psi)
110/1506
110/1505
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
FLOW (gpm)

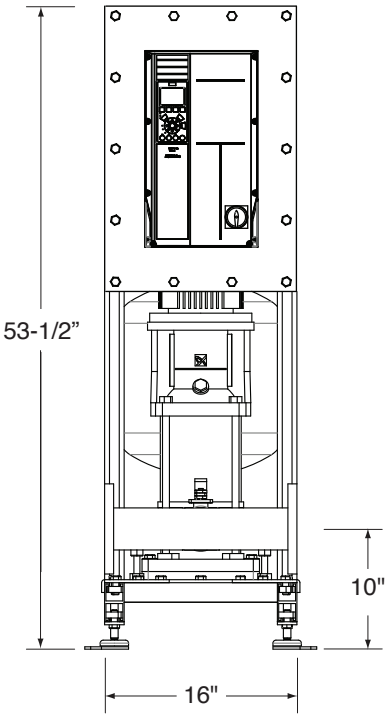
Conservation Technology

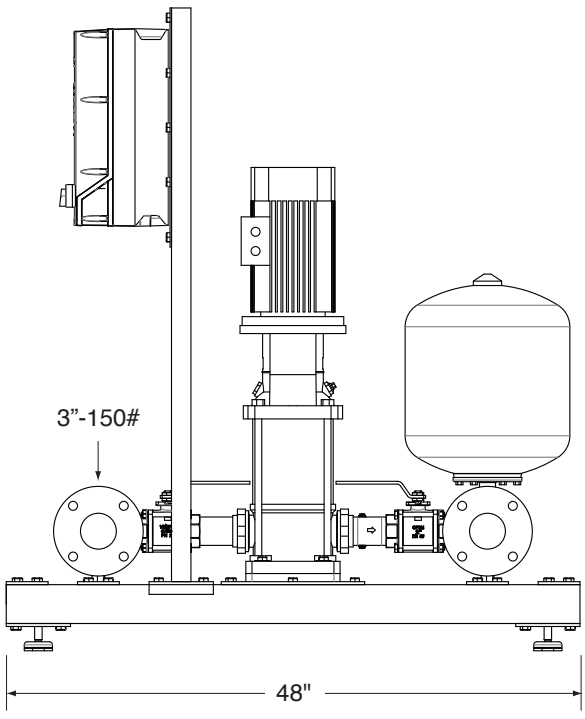
SIMPLEX SKIDS

Simplex (single-pump) skids are available with peak flow rates up to 124 gpm. Each includes a pump, a VFD controller, two ball valves, an outlet check valve, two manifolds, a hydropneumatic tank, and fully-adjustable vibration-absorbing mounting feet. The control panel and manifolds can be re-positioned to perfectly match treatment and storage skids or to fit site conditions





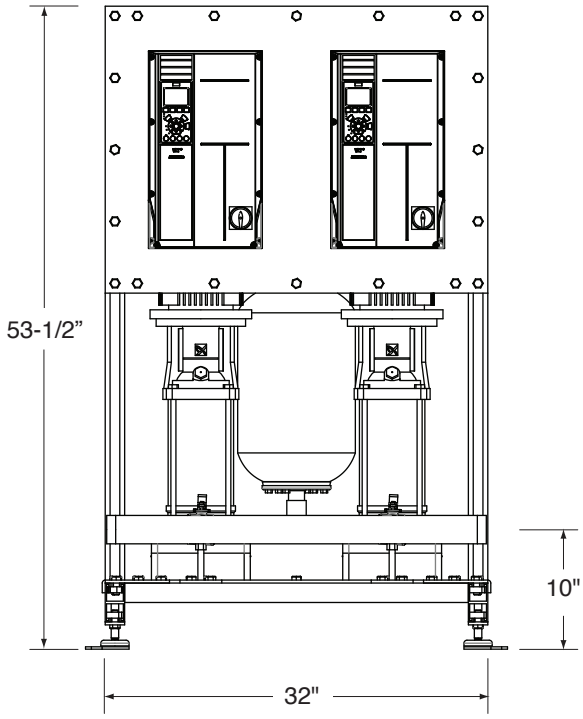


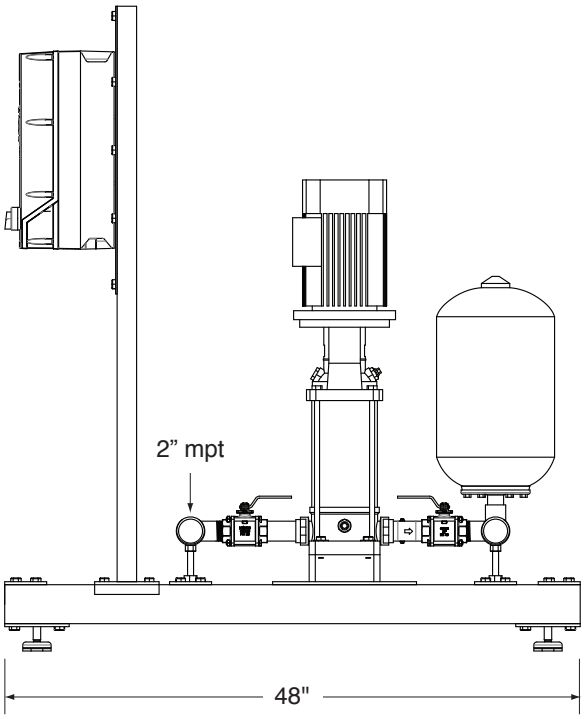


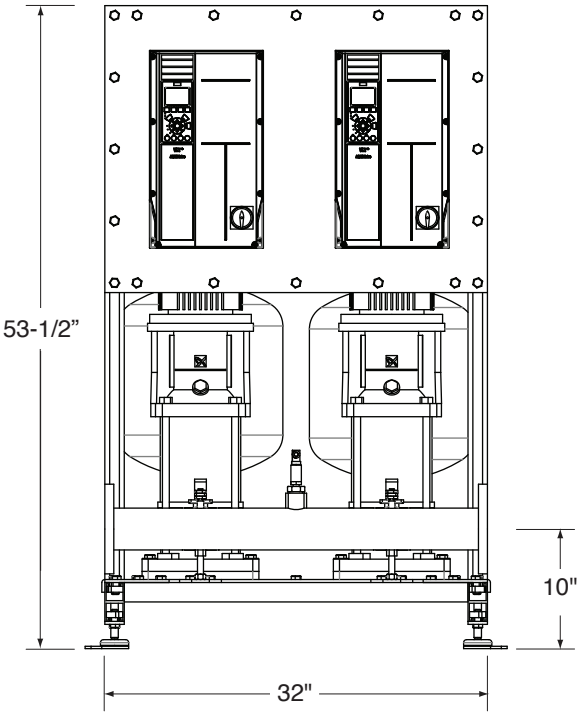
Conservation Technology

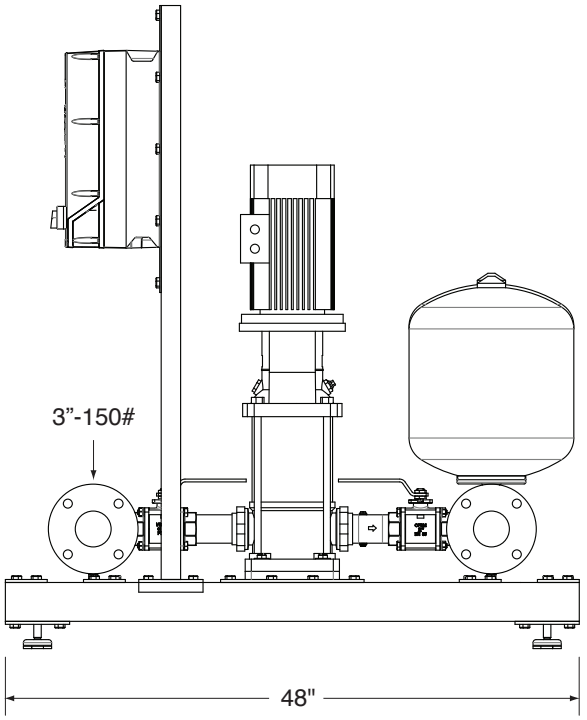
DUPLEX SKIDS

Duplex (two-pump) skids are available with peak flow rates up to 248 gpm. Each includes two pumps, two VFD controller, four ball valves, two outlet check valves, two manifolds, one or two hydropneumatic tanks, and fully-adjustable vibration-absorbing mounting feet. The control panel and manifolds can be re-positioned to perfectly match treatment and storage skids or to fit site conditions









Conservation Technology

HYDRAULIC AND ELECTRICAL SPECIFICATIONS

The following table summarizes the hydrauic and electrical characteristics of standard simplex and duplex vertical pump skids. If a pump skid is selected so that the required peak design flow rate is between the minimum and maximum values listed, the variable frequency drive pump controllers on each skid will assure efficient operation at all lower flow rates. The duplex skid maximum flow rates below are based on cascading operation, a standard feature which allows full simultaneous flow from both pumps. If 100% reserve capacity is desired, use the simplex flow rates for sizing duplex skids. Pumps with other hydraulic characteristics are available on special order.

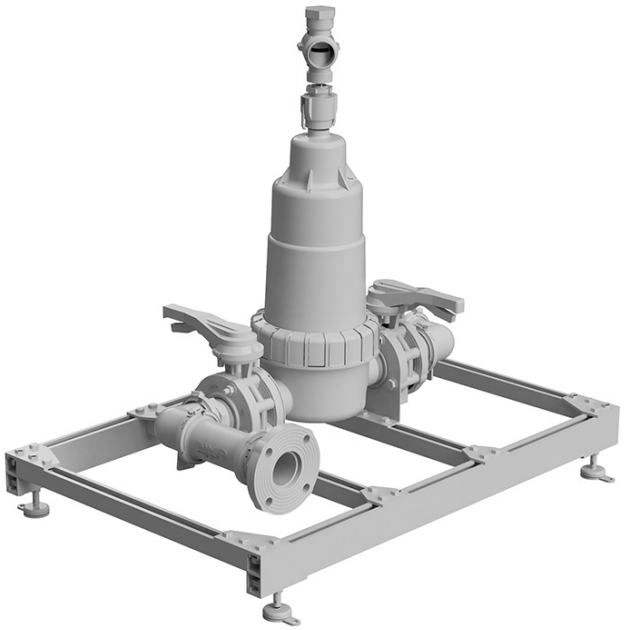
All motors are totally enclosed and fan cooled (TEFC) with efficiencies ranging from 87% to 91%. The amperage values listed represent full-load current and the service factor is 1.15. Typical operating current and power consumption values will be substantially lower, and the system will automatically enter a sleep mode when no pumping is required.

Model	Minimum	Maximum	Manifold	Power	208v	460v
AquaSimplex-30/0307	13 gpm	44 gpm	2” mpt	3 hp	8.4 a	3.8 a
AquaSimplex-30/0309	13 gpm	44 gpm	2” mpt	3 hp	8.4 a	3.8 a
AquaSimplex-30/0511	13 gpm	44 gpm	2” mpt	5 hp	14.1 a	7.3 a
AquaSimplex-50/0304	27 gpm	68 gpm	3” flange	3 hp	8.4 a	3.8 a
AquaSimplex-50/0505	27 gpm	68 gpm	3” flange	5 hp	14.1 a	7.3 a
AquaSimplex-50/0506	27 gpm	68 gpm	3” flange	5 hp	14.1 a	7.3 a
AquaSimplex-50/7507	27 gpm	68 gpm	3” flange	15 hp	19.5 a	9.1 a
AquaSimplex-90/7503	46 gpm	124 gpm	3” flange	7.5 hp	19.5 a	9.1 a
AquaSimplex-90/7504	46 gpm	124 gpm	3” flange	7.5 hp	19.5 a	9.1 a
AquaSimplex-90/1005	46 gpm	124 gpm	3” flange	10 hp	26.5 a	12.4 a
AquaSimplex-110/1505	56 gpm	154 gpm	3” flange	15 hp	37.5 a	17.0 a
AquaSimplex-110/1506	56 gpm	154 gpm	3” flange	15 hp	37.5 a	17.0 a
AquaDuplex-30/0307	13 gpm	88 gpm	2” mpt	2 x 3 hp	2 x 8.4 a	2 x 3.8 a
AquaDuplex-30/0309	13 gpm	88 gpm	2” mpt	2 x 3 hp	2 x 8.4 a	2 x 3.8 a
AquaDuplex-30/0511	13 gpm	88 gpm	2” mpt	2 x 5 hp	2 x 14.1 a	2 x 7.3 a
AquaDuplex-50/0304	27 gpm	136 gpm	3” flange	2 x 3 hp	2 x 8.4 a	2 x 3.8 a
AquaDuplex-50/0505	27 gpm	136 gpm	3” flange	2 x 5 hp	2 x 14.1 a	2 x 7.3 a
AquaDuplex-50/0506	27 gpm	136 gpm	3” flange	2 x 5 hp	2 x 14.1 a	2 x 7.3 a
AquaDuplex-50/7507	46 gpm	248 gpm	3” flange	2 x 7.5 hp	2 x 19.5 a	2 x 9.1 a
AquaDuplex-90/7503	46 gpm	248 gpm	3” flange	2 x 7.5 hp	2 x 19.5 a	2 x 9.1 a
AquaDuplex-90/7504	46 gpm	248 gpm	3” flange	2 x 7.5 hp	2 x 19.5 a	2 x 9.1 a
AquaDuplex-90/1005	46 gpm	248 gpm	3” flange	2 x 10 hp	2 x 26.5 a	2 x 12.4 a
AquaDuplex-110/1505	56 gpm	308 gpm	3” flange	2 x 15 hp	2 x 37.5 a	2 x 17.0 a
AquaDuplex-110/1506	56 gpm	308 gpm	3” flange	2 x 15 hp	2 x 37.5 a	2 x 17.0 a

Conservation Technology

Automatic Screen Filter Skid

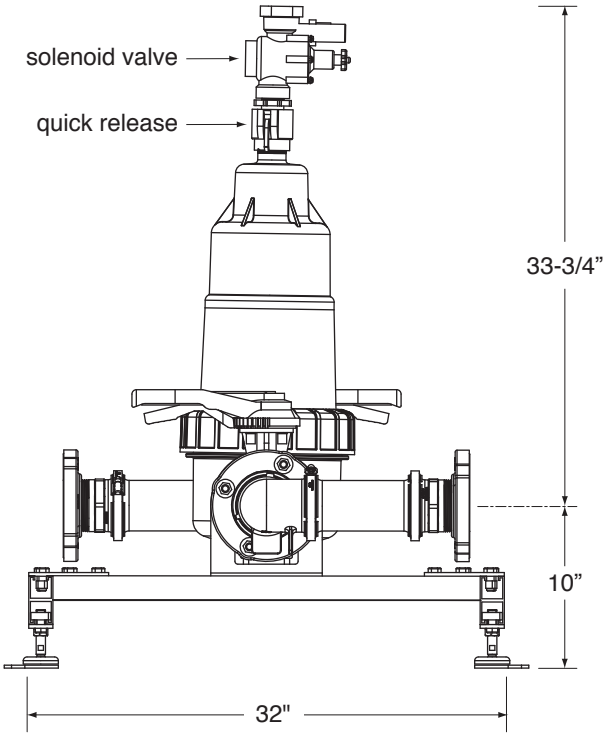
The *CT Automatic Screen Filter* is typically used as the first stage of a water treatment process to remove fine particles suspended in the water. A 175 in^2 stainless screen within a reinforced nylon housing traps the particles, and an internal cleaning mechanism periodically sucks accumulated debris off of the screen surface without interrupting the filtration process. Since the cleaning mechanism is located completely within the housing and is powered solely by water pressure, it does not require electric motors, gear boxes, pistons, cables, switches, or other external accessories commonly used with automatic filters. Both the filter screen and cleaning mechanism are easily accessible by simply separating a quick-release fitting and unscrewing a clamping ring.

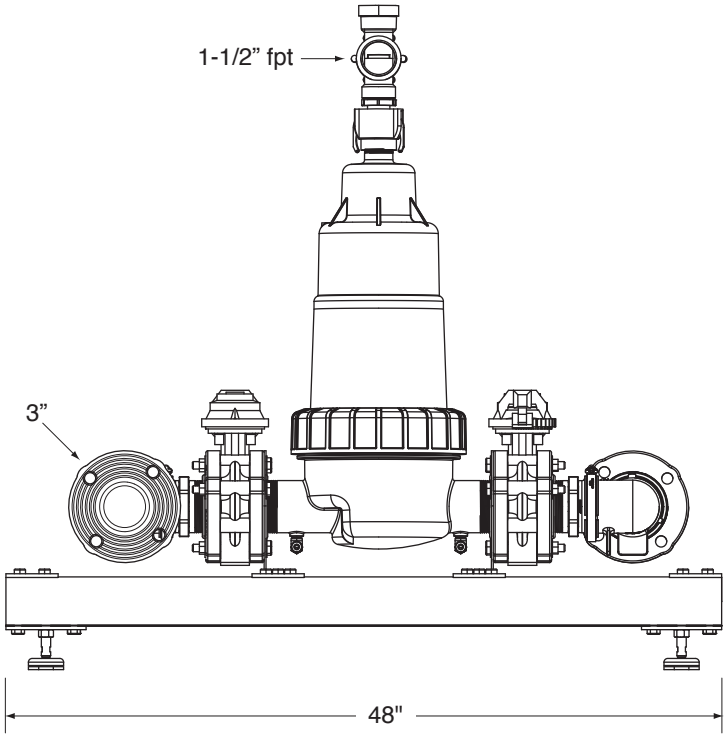


Cleaning can be triggered by any control device that opens and closes a solenoid valve in the waste line based on differential pressure, elapsed time, clock time, or other factors. A typical cleaning cycle flushes only five gallons of debris-laden water.

All components are preassembled onto a 32” wide stainless-steel skid that fits through a standard commercial doorway. With 3” inlet/outlet ports and 3” full-port polypropylene butterfly valves, pressure loss is minimal even at high flow rates.

DIMENSIONS



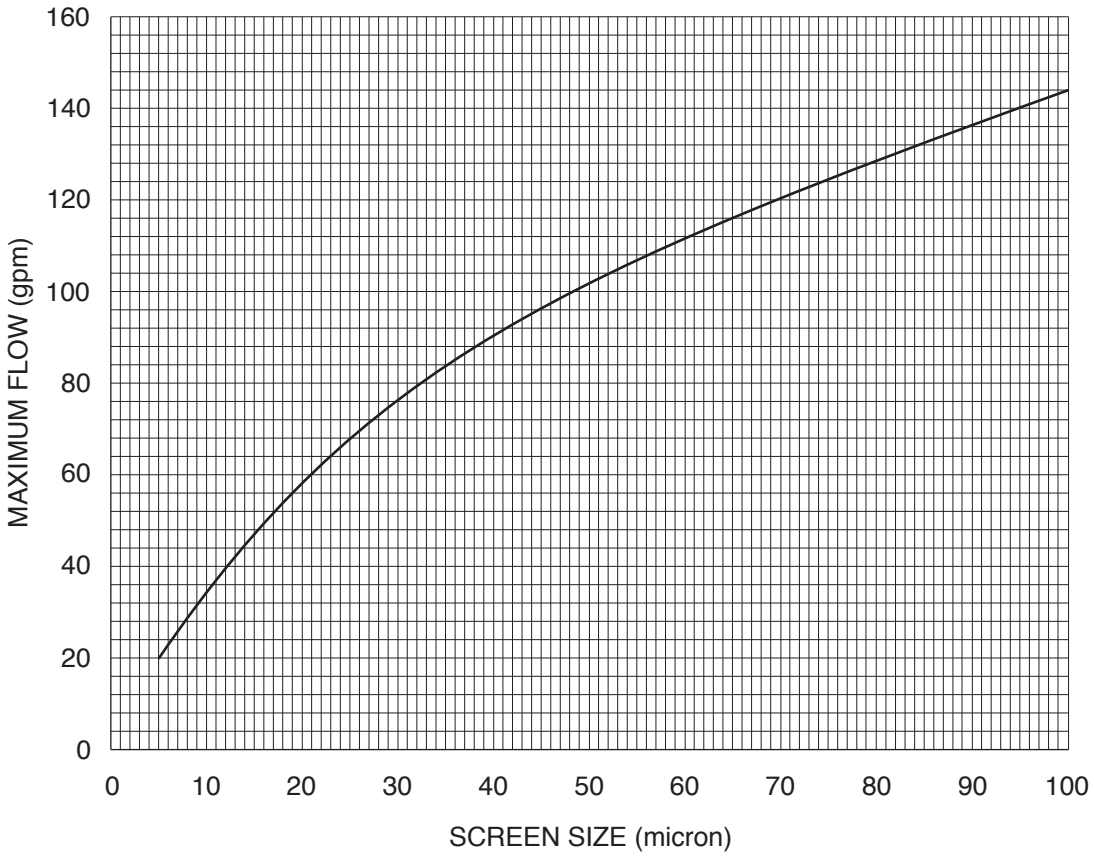


PERFORMANCE

Screen sizes from 5 micron to 100 micron are typically used for water reuse systems. The chart below shows the maximum recommended flow for average-quality water, for example rainwater collected from rooftops, in relation to the screen opening size measured in microns. Since screen filters should be backwashed when the pressure drop between the inlet and outlet reaches 7 psi (0.5 bar), designing for higher flow rates than shown may result in frequent backwashing and excessive water waste. When filtering water with high particulate levels, such as water collected from ground surfaces or ponds, maximum flow rates should be reduced in half.

Although an automatic screen filter may be the only treatment required for low-risk water re-use such as drip irrigation, screen filters are often used to as a pre-treatment stage for other filtration processes. For example, when water must be disinfected with ultraviolet sterilization, 5 micron filtration is normally required. While a 5 micron automatic screen filter might work when the incoming water quality is high and the required flow rate is low, screen filters might otherwise require frequent backwashing and excessive water loss. A better solution would be to use a 50 micron automatic screen filter followed by a 5 micron cartridge filter (see *CT High-Flow Cartridge Filters)* to provide optimal filtration efficiency with minimal maintenance. As another example, while granular activated carbon filter tank can effectively trap fine particulates, the backwashing required to maintain acceptable pressure loss would generate considerable waste water. Installing a screen filter before the carbon filter will remove a significant percentage of particulates and dramatically reduce backwash frequency.

Automatic screen filters will filter effectively at any flow rate, but a minimum of 30 gpm is required for effective cleaning. If the system normally operates at a flow of less than 30 gpm, the pump can be oversized and controlled with a variable frequency drive that will boost the flow during backwashing, or a hydro-pneumatic tank can be installed before the filter to supply the required flush volume.



Conservation Technology

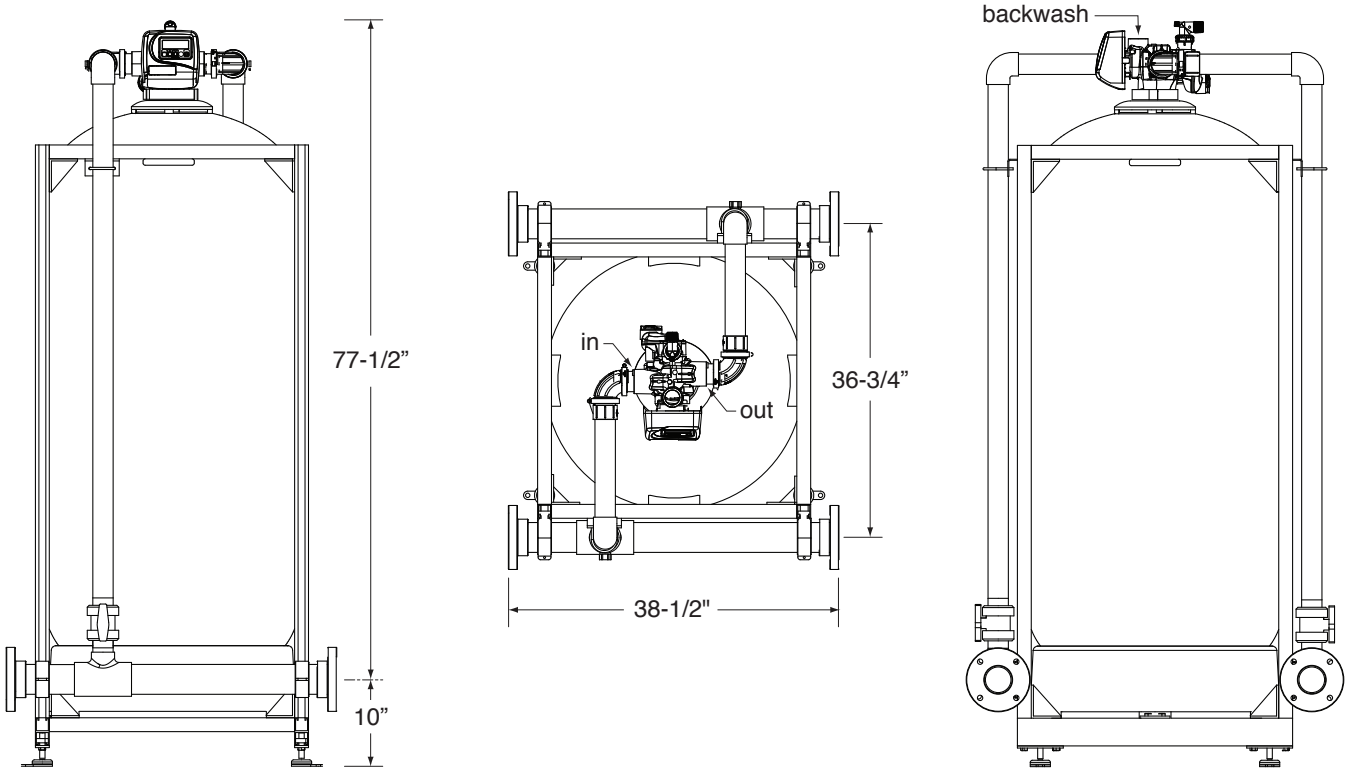
Multimedia Filter Skid

CT Multimedia Filter Skids consist of a 30” diameter, polyethylene-lined seamless fiberglass tank mounted on a stainless-steel skid and enclosed within a stainless-steel frame. Filtration and backwashing is automatically controlled with a 2” multi-port epoxy-coated brass control valve mounted to a 6” flanged access port at the top of the tank. Flanged 3” inlet and outlet manifolds allow multiple filters to be connected in serial or parallel or directly to other CT process skids.

The tanks can hold virtually any loose media used for mechanical or chemical water filtration, but most commonly, they are supplied with 15 cubic feet of granular activated carbon over a gravel base layer, several hundred times the amount of activated carbon contained in a 4” x 20” filter cartridge element.

The flow direction can be set for either downflow or upflow. Downflow provides optimal particulate removal but may require frequent backwashing which can be problematic for water reuse systems with limited water availability. Upflow provides optimal flow distribution with minimal backwashing but is only recommended when particulate removal is provided by a preceding step in the treatment process, for example a CT Automatic Screen Filter.

PHYSICAL CHARACTERISTICS

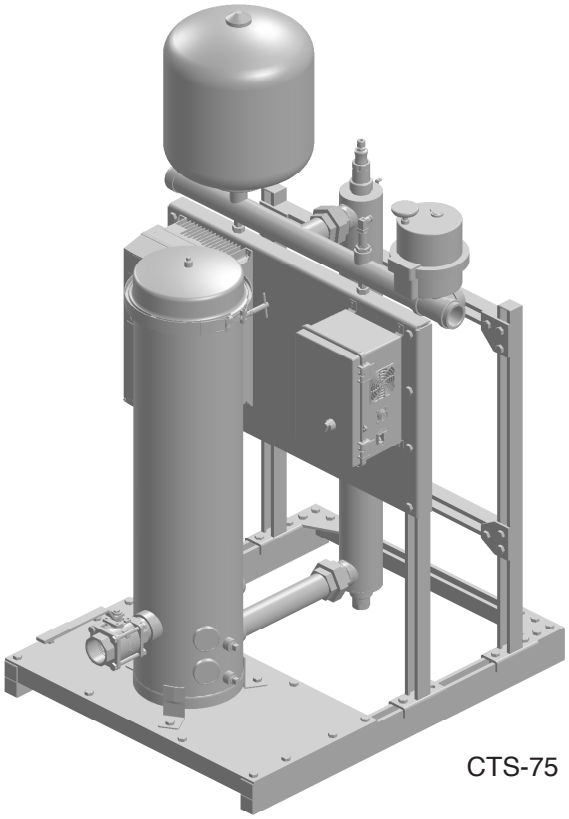


Combination Treatment Skids

CT Combination Treatment Skids combine mechanical components required for small commercial water reuse systems into a compact, economical, no-compromise package. The basic skid consists of a *CT High-Flow Canister Filter* and a *CT High-Flow UV Sterilizer*. The most advanced skids add a *CT AquaDrive+* control panel, a hydropneumatic tank, and a motorized three-port valve. Two sizes are available to treat flow rates up to 50gpm or 75 gpm for non-potable reuse.

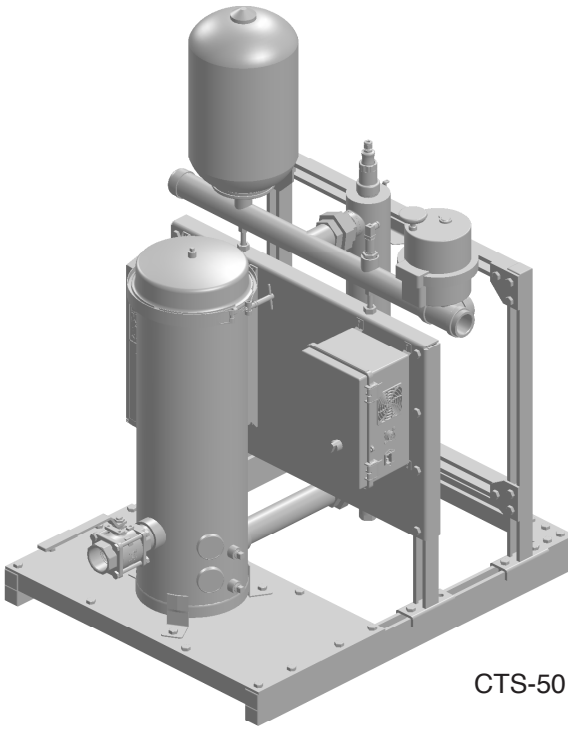
When used for rainwater harvesting, a basic skid can be used in break-tank systems to treat water in transit between a cistern and the break tank. For systems that do not require a break tank, an advanced skid can operate the cistern pump, treat the water and supply it directly to the end use at constant pressure, monitor the cistern water level and UV sterilizer output, and operate a motorized valve to switch to public water when required.

Components are preassembled onto a 32” wide stainless-steel skid designed to be moved with a pallet jack and fit through a standard commercial doorway. All components in contact with water are made of 316 stainless steel for durability and have 2” full-flow ports for minimal pressure loss. All componnts can be easily repaired or replaced for economical maintenance.



CTS-75

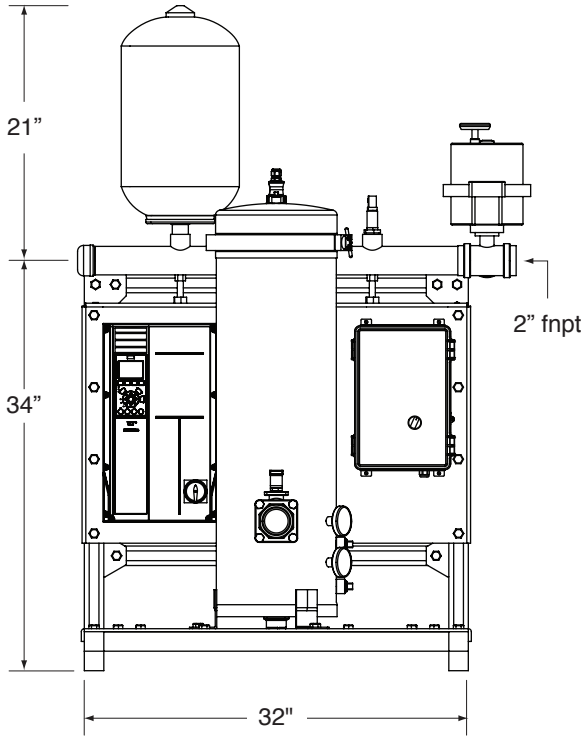
Model	CTS-50	CTS-75
Design Flow	50 gpm	75 gpm
Canister Filter	CF-90	CF-170
UV Sterilizer	UV-50	UV-75
Pressure Tank	5 gal	10 gal
VFD Controller	3 hp	5 hp
Backup Valve	2”	2”
UV Voltage	120	120
UV Power	170w	220w
Filter Size	8” x 20”	8” x 31”
Pore Size	5*μ*	5*μ*
Inlet	2”	2”
Outlets	2”	2”
Overall Height	55”	66”
Minimum Ceiling	74”	96”

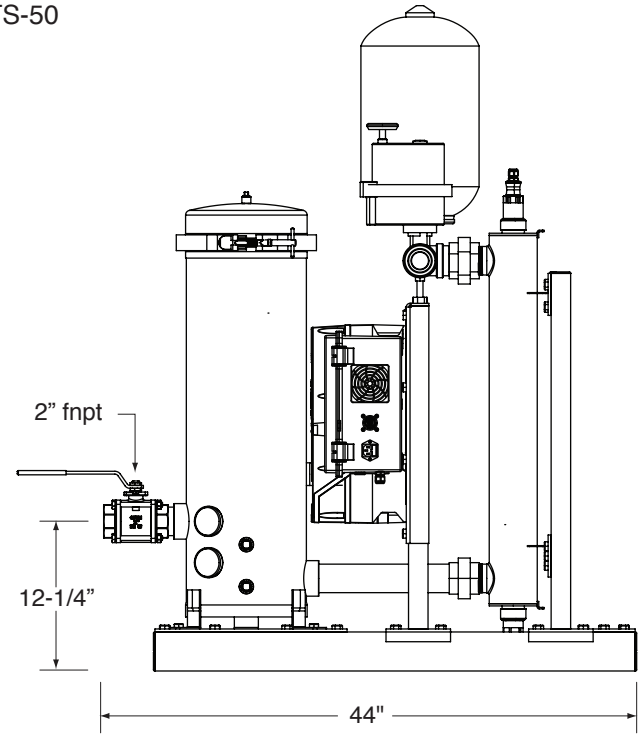


CTS-50

Conservation Technology

CTS-50





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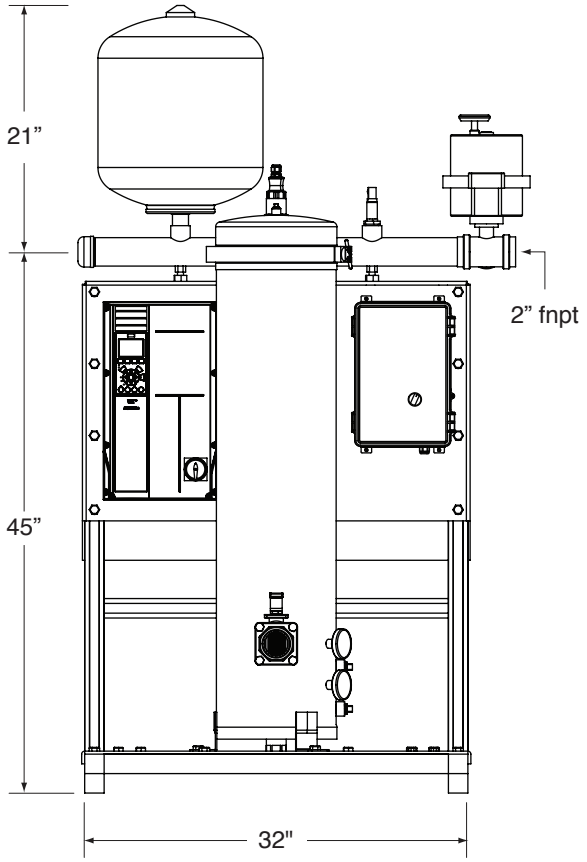
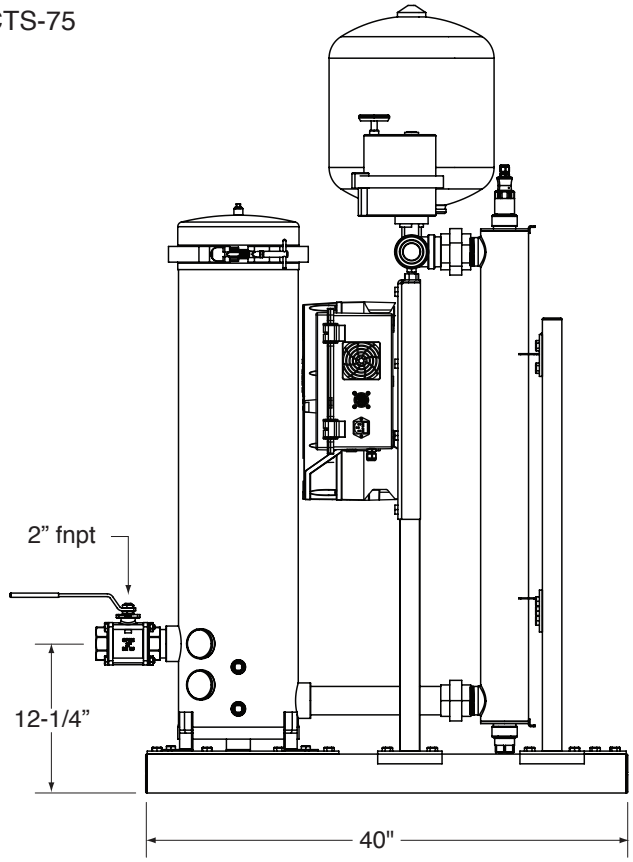
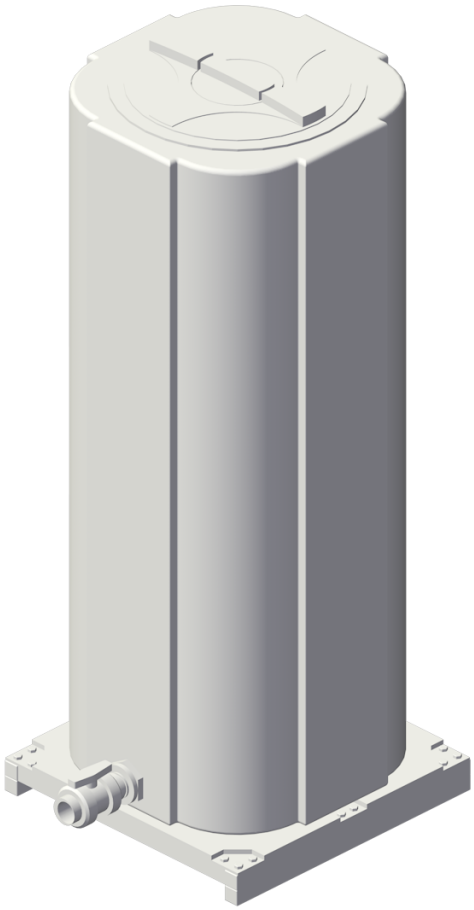




Conservation Technology

Modular Break Tank

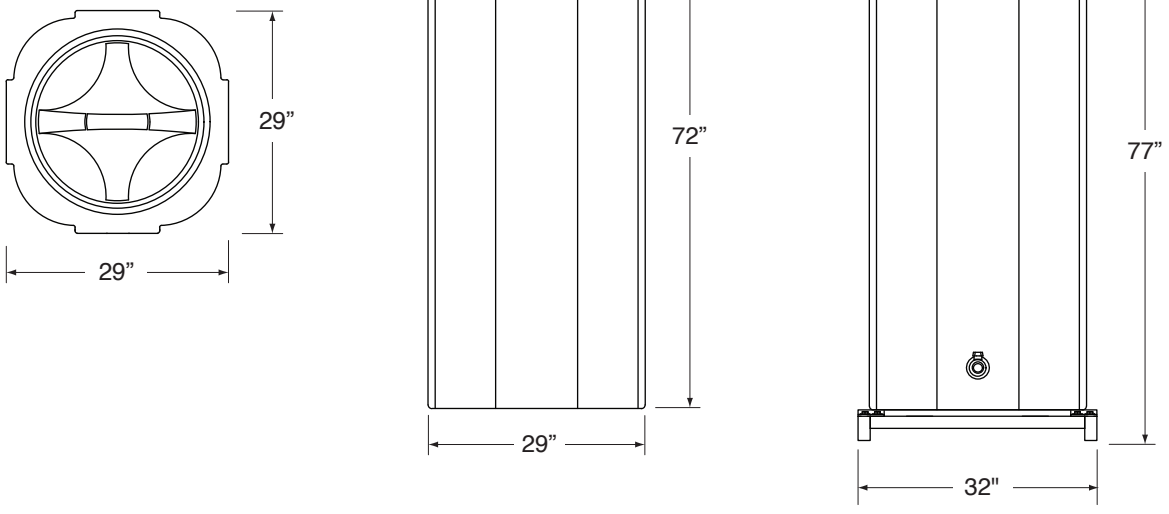
The *CT Modular Break Tank* is designd to provide 215 gallons of temporary storage to feed booster pumps in water reuse systems. Its unique shape maximizes usable volume while minimizing turbulence and residence time. Four wide flat surfaces extending the full height of the tank facilitate unlimited water or electrical connections. When more storage capacity is required, multiple tanks can be linked with bulkhead fittings installed in the flats. A 24” lid, nearly as large as the tank, unscrews to provide easy access to install or maintain internal equipment.



Measuring only 29” x 29” x 72”, the Modular Break Tank is small enough to fit almost any mechanical space. Optionally, it can be supplied on a 32” wide stainless-steel skid designed to be moved with a pallet jack through standard commercial doorways.

In a typical installation, rainwater, foundation water, or condensate stored in a large holding tank is pumped through a treatment system in order to maintain a constant water level in the break tank. When the holding tank is empty, public water is added directly to the break tank through an optional air gap system. Both the treatment system and the public water supply can be sized based on the average water consumption rate rather than the peak flow rate since the break tank serves as a buffer. Modular Break Tanks can also be used to strip volatile organic compounds from recycled water without using activated carbon by installing an optional air diffuser over a centering pedestal molded into the tank bottom.

DIMENSIONS



Conservation Technology

Aqua System Controller

The *Aqua System Controller* is a versatile and powerful microprocessor control system designed to operate rainwater harvesting, wastewater recycling, and stormwater management systems. Standard features include:

- 10” color touch-screen PLC
- 8 analog inputs (4-20ma) for pressure, level, or chemical sensors
- 8 digital inputs for flow sensors, rainfall sensors, float switches, or alarm contacts
- 8 long-life transistor outputs to operate control relays
- 8 isolated control relays with both normally-open and normally-closed functionality
- built-in Modbus and ethernet
- web interface for remote access to all functions
- optional BacNet and GSM
- 120vac input power with cord and plug
- 90 watt 24 vdc current limited Class 2 power supply
- 100 va 24vac current limited super-efficient Class 2 power transformer
- 15 amp 120vac circuit-breaker controlled power output
- 32 GB removable data storage card
- Gasketed plastic hinge-cover enclosure with lockable latches
- compact - only 16” tall x 14” wide x 7” deep
- UL-listed NEMA 4X control system

Each of the control relays can either serve as a dry contact or can be flexibly configured to deliver 24vdc, 24vac, or 120vac. The allows the controller to directly operate solenoid valves, three-port valves, small air compressors or water pumps, and other low-power devices without the need for external power supplies or control relays. For more complex systems additional inputs and outputs can be added within the same compact enclosure.

AquaDrive+

The *CT AquaDrive+* is a sophisticated pump control panel with the added capability to operate a complete water-recycling system. It combines a advanced variable-frequency drive (VFD), a fused disconnect, and a programmable logic controller (PLC) within a weatherproof enclosure. The drive runs a three-phase pump at constant pressure with optimal efficiency while protecting the pump from common problems such as dry-running, over current, low voltage, phase imbalance, ground faults, and overheating. The fused disconnect simplifies wiring and improves safety. An LCD indicates the supply pressure and storage tank level. Control relays can operate external valves or water treatment devices.

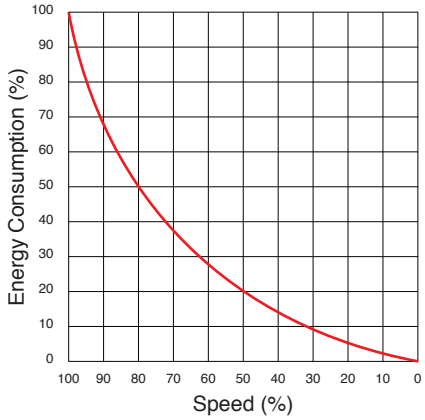
Standard panels are available for three-phase pumps up to 10hp operating at either 208v-240v or 460v-480v. For multi-pump systems, each pump is operated by a separate control panel for optimal reliability and efficiency, but the panels communicate to intelligently alternate pumps for optimal reliability and can operate the pumps simultaneously when higher flow is required.

FEATURES

durable weatherproof enclosure: The cast-aluminum AquaDrive+ is NEMA 4X (IP66) rated to resist water spray, so the panel can be located near the pump it controls. It can be used outdoors with a simple rain and sun shield, underground in a well-drained vault, or in damp mechanical rooms without the need for expensive enclosures.

integral fused disconnect: The built-in fused disconnect eliminates the need for pump disconnects and secondary circuit protection, allowing a less-expensive, more compact installation.

optimal energy efficiency: The variable frequency drive dramatically reduces energy consumption by reducing the motor speed to the minimum required to maintain the required pressure at the current flow rate. Reducing the speed by only 20% can reduce the energy consumption by 50%, and the internal power loss of the control electronics is less than 2%.



precise pressure regulation: Motor speed is accurately controlled by automatically tuned PID loops optimized for water pumping applications.

redundant control of multi-pump systems: In multi-pump systems, each pump has it's own AquaDrive+, so the system can remain fully functional when it is necessary to repair both a pump and a panel at the same time.

automatic pump alternation: In multi-pump systems, the AquaDrive+ panels commmunicate to alternate pumps with internal timers assuring equal run time. This prevents shafts from locking and keeps seals lubricated.

automatic pump cascading: In multi-pump systems, the AquaDrive+ panels optionally communicate so that if a single pump is not sufficient to meet the total required flow and pressure, multiple pumps will operate simultanously to equally share the demand. This "master-follower" functionality minimizes motor wear and sound levels compared with conventional cascading systems that only vary the speed of one pump and operate the others at full speed.

automatic sleep and restart: When the flow of water through the pump stops because there is no water being used, the AquaDrive+ automatically shuts the pump off. When the pressure drops below the set pressure, the pump automatically restarts. This minimizes pump wear and significantly reduces power consumption.

dry-run protection: When the flow of water through the pump becomes very low or stops because insufficient water reaches the pump, the AquaDrive+ automatically shuts the pump off. The shutoff is triggered by changes in the pump electrical behavior and does not require flow sensors.

voltage protection: Two standard AquaDrive+ voltages are available: 208v-240v and 460v-480v. The AquaDrive+ automatically adjusts the output voltage to match the motor specs provided the input voltage is within 10% of the required voltage, assuring full motor torque. When the voltage falls outside the allowable range, the pump shuts off.

current protection: The AquaDrive+ provides traditional short-circuit and overload protection, but also measures current flowing in each of the three motor phases and shuts off the pump if there are any irregularities.

ground fault protection: The AquaDrive+ monitors ground currents in both the power supply input and the motor power output and shuts off the pump if a fault is detected.

thermal protection: An electronic thermal relay in the AquaDrive+ detects motor overheating and shuts off the pump without need for a wired thermistor to directly measure pump motor surface temperatures.

phase protection: The AquaDrive+ monitors each of the three motor phases and shuts off the pump if there is a phase loss or imbalance.

transient protection: The AquaDrive+ dissipates voltage and current spikes from external sources such as lighting, as well as from internal sources such as inductive equipment, preventing damage to both the panel electronics and controlled pumps.

plumbing failure detection: When the pump runs at full speed without developing the set pressure, the AquaDrive+ automatically shuts off the pump and can also operate a safety throttle valve or trigger an alarm. This prevents catastrophic water loss due to broken pipes or faulty valves.

intelligent pressure regulation: The basic idea behind variable frequency drive pump control is that the VFD increases the output power frequency and consequently the motor speed as required to maintain a preset pressure. A fundamental problem is that normally it is only practical to measure pressure at the pump outlet. Since the pressure loss in the plumbing systems is proportional to the flow rate, as the flow increases the pressure at the end of the line will drop unless the pressure at the pump is increased and not just kept constant. The typical solution is to increase the pressure setpoint at the pump outlet to deliver the required end of line pressure at maximum flow, but designing for the worst case wastes energy at more typical flow rates. The AquaDrive+ solves this problem by allowing the user to set a zero-flow pressure and automatically adjusting the pressure setpoint as the flow increases.

intelligent speed ramping: When the pump starts, the AquaDrive+ provides initial rapid acceleration until the pump reaches a pre-defined speed, then automatically reduces the acceleration rate to prevent bearing damage and motor overheating. When water flow slows, the process is reversed: the controller decelerates the pump at a moderate rate, then automatically reduces the deceleration rate until the pump reaches zero flow and stops. This behavior prevents water hammer, pipe damage, rapid check valve closure, and fixture blowouts, a particular problem in closed loop water supply and irrigation systems.

harmonic suppression: DC-link reactor technology minimizes harmonic currents, eliminating the need for AC line reactors that can cause a significant voltage drop. The reduced harmonics increase the lifetime of motor capacitors and result in smooth and quite motor operation. Motor cable sizes can be reduced while simultaneously cable lengths can be increased.

alarm history, counters, and reminders: The AquaDrive+ stores and displays the alarm history, maintenance reminders, trends in key parameters, motor running hours, kilowatt hours of energy consumed, and the number of motor starts.

water level monitoring: By connecting an optional stainless-steel submersible pressure transducer, the AquaDrive+ can display the water level in a tank, for example a cistern or break tank.

sterilizer monitoring and control: When used with a UV sterlizer with appropriate input and output capabilities, the AquaDrive+ can monitor the UV intensity and evaluate whether it is sufficient to provide sterilization. The AquaDrive+ can also turn the UV lamp on and off according to a clock schedule to save energy,

external valve control: Thee AquaDrive+ can contol a solenoid valve or motorized valve based on a pre-programmed sequence of events. For example, in a rainwater harvesting system, a motorized three-port valve can be set to automatically switch to municipal water to assure uninterrupted water availability in the event the rainwater tank is low, the UV sterilizer is not functioning, or there is a pump failure.

SPECIFICATIONS

Electrical:

Input Voltage: 208-240v or 460-480v, 60 hz, 3ø
Output Voltage: ±10% of input volts, 0-60 hz, 3ø
Pump Horsepower: up to 10 hp

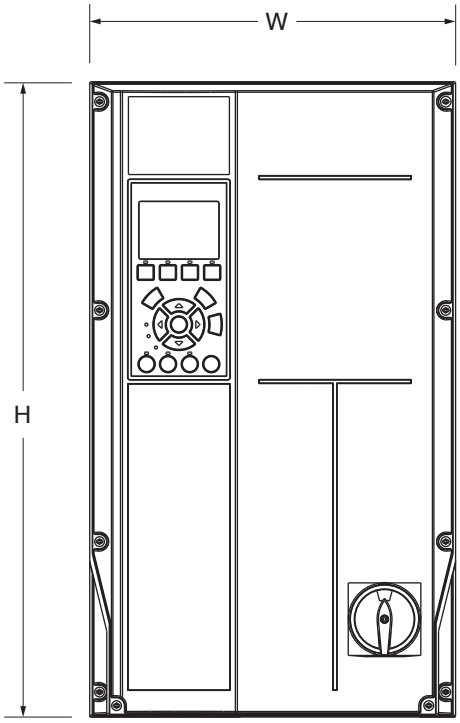
Ventilation:

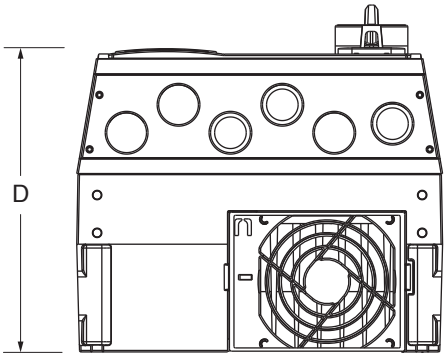
Minimum Top and Bottom Clearance: 4”
Mounting: must be mounted on solid surface

Control and Communication:

Pressure Sensor Input
Level Sensor Input
Backup Valve Relay Output
Low Water Float Switch Input
UV Sterlizer Input (optional)
UV Clock Output (optional)
Communication: Modbus RTU (optional EtherNet, BACnet, LonWorks, DeviceNet, CAN Open, and PROFIBUS)

Voltage	Amps	Height-H	Width-W	Depth-D
208-240	7.5	16-1/2”	9-1/2”	8”
208-240	10.6	16-1/2”	9-1/2”	8”
208-240	12.5	16-1/2”	9-1/2”	8”
208-240	16.7	16-1/2”	9-1/2”	8”
208-240	24.2	19”	9-1/2”	10-1/4”
208-240	30.8	19”	9-1/2”	10-1/4”
460-480	3.4	16-1/2”	9-1/2”	8”
460-480	4.8	16-1/2”	9-1/2”	8”
460-480	6.3	16-1/2”	9-1/2”	8”
460-480	8.2	16-1/2”	9-1/2”	8”
460-480	11	16-1/2”	9-1/2”	8”
460-480	14.5	16-1/2”	9-1/2”	8”





bottom with conduit knockouts

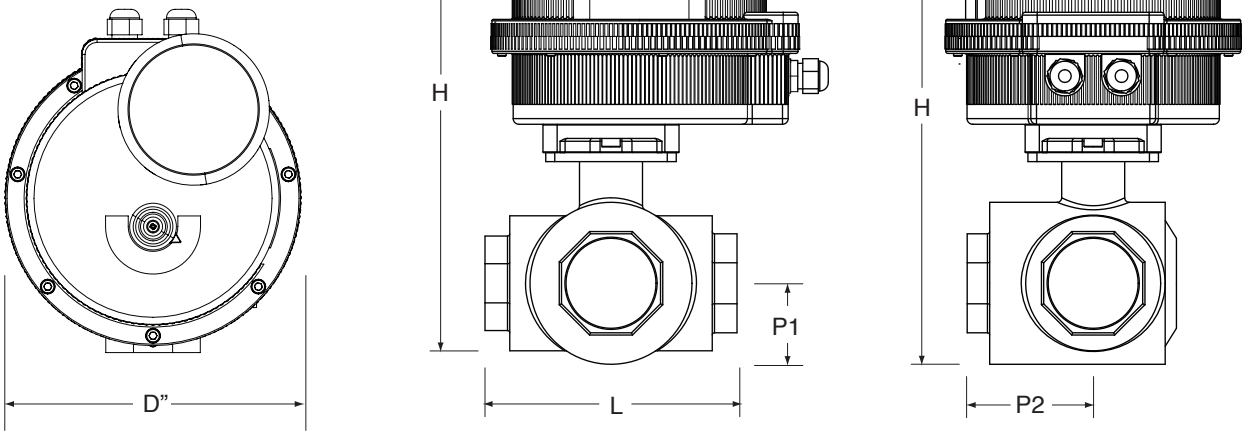
Motorized Diverter Valves

These industrial-quality motorized ball valves are ideal for switching between harvested rainwater and public water supplies when used with a backflow valve on the public water side. A gear-driven electric actuator rotates the valve 90° to connect the center port to either one of the end ports. Valve construction is 316 stainless steel for optimal corrosion resistance with PTFE seats for low operating torque. Standard sizes are 1", 1-1/4", 1-1/2", 2", and 3". All but the 3" have full ports for significantly lower pressure drop (higher CV) than standard 3-port valves.

The actuators housings are rated IP67 (NEMA 6) and are suitable for exterior use above ground or in well-drained underground vaults. Standard motors are 24v AC/DC, simplifying wiring and minimizing electrical hazards in wet environments. Other features include an electronic torque limiter, internal anti-condensation heater, internal limit switches, and a manual override knob. Where it is essential that water always be available, the actuator can b supplied with an internal rechargeable battery and trickle charger that will automatically switch the valve to the public water supply in the event of a power failure.

PHYSICAL CHARACTERISTICS

Size	Ports	CV	H	L	D	P1	P2	Power (AC-DC)
1"	1"	30	12"	4-1/2"	7-1/4"	1-1/4"	2-1/4"	43va - 29w
1-1/4"	1-1/4"	47	12-1/2"	5"	7-1/4"	1-1/2"	2-1/2"	43va - 29w
1-1/2"	1-1/2"	70	14"	6"	8-1/4"	2"	3"	43va - 17w
2"	2"	133	15-1/4"	7"	8-1/4"	2-1/2"	3-1/2"	43va - 29w
3"	2-1/2"	266	16-1/2"	7-3/4"	8-1/4"	2-3/4"	4"	43va - 29w



Tank Diffusers

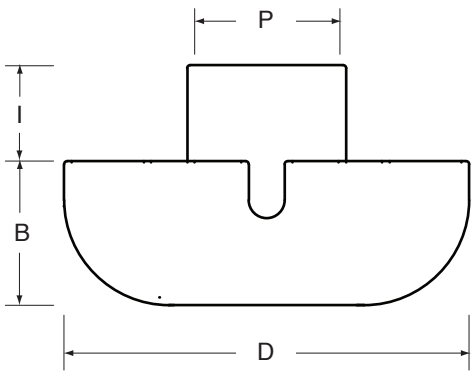
When rainwater is simply dumped into a storage tank, the resulting turbulence suspends accumulated sediment at the tank bottom and sinks floating debris at the tank surface. Until the water column has sufficient time to re-stratify, often a day or more, the quality of extracted rainwater is significantly diminished. This turbulence can be substantially reduced by installing a vertical inlet pipe connected to a *diffuser at* the bottom of the tank that reduces the flow velocity and reverses the flow direction upward and away from the sediment layer.

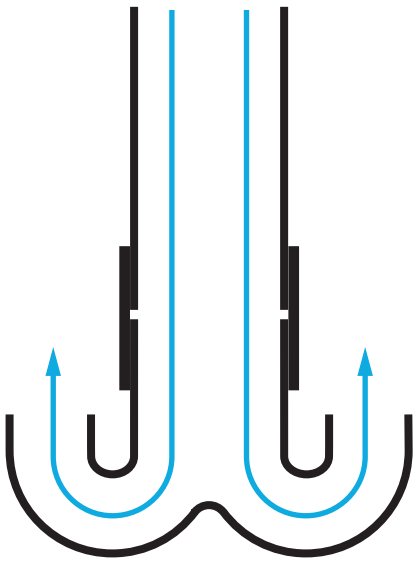
CT Tank Diffusers are hydrodynamically optimized to minimize turbulence. Gently curving interior flow channels preserve laminar flow, and four annular outlets disperse water uniformly in all directions. The total cross-section of the outlets is at least three times the cross-section of the inlet, reducing the flow velocity by more than two-thirds. Since all surfaces are curved and each outlet is almost as large at the inlet, the diffusers are inherently self-cleaning.

The diffusers are made with thick-wall, potable-grade polyethylene in three sizes to fit 4”, 6”, or 8” pipe. Inlets are made to standard pipe dimensions so they can be joined to inlet pipes with flexible couplings or can fit directly into the belled end of gasketed pipes. Flexible mechanical connection eliminates the need to work with adhesives in confined spaces, allows easy adjustment, and prevents damage to underground tanks from compression during backfilling.

DIMENSIONS

Pipe Size (P)	4”	6”	8”
Base Height (B)	4”	6”	8”
Inlet Height (I)	4”	4”	4”
Diameter (D)	11-1/2”	17”	22”





water flow through diffuser

Floating Intakes

Even with effective rainwater pre-filtration, fine sediment accumulates at the bottom of rainwater storage tanks, and organic debris floats on the water's surface. *CT Floating Intakes* rise and fall with the water level, so the filter screen is always positioned in the cleanest water just below the water surface.

CT Floating Intakes consist of a stainless-steel screen welded to a stainless steel housing with an integral stainless-steel hose barb. This assembly hangs by a stainless-steel ring from a molded fitting in a sturdy polyethylene float. Water is drawn through a highly flexible, wire-reinforced hose made from food-grade PVC hose with sufficient density to prevent flotation. The hose is secured to the filter assembly and to a polypropylene threaded adapter with high-torque stainless-steel clamps. There are no parts to corrode or loosen over time.

Since rainwater prefilter screens typically openings less than 800 microns (1/32"), CT Floating Intake screens have 1000 micron openings so that any particle passing through a rainwater prefilter will pass through the floating intake. Larger particles formed by chemical or biological processes in the tank or entering though access openings are blocked before then can damage mechanical system components. The combined area of all of the openings is at least fifteen times the interior cross-section of the hose size to keep the water flow velocity and suction pressure loss very low. The low flow velocity also makes the floating intake screens virtually maintenance free.

Standard sizes are 1", 1-1/4", 1-1/2", and 2". Each size is available with integral stainless-steel check valves where there is potential for loss of prime, or without check valves for flooded suction. Standard kits have 8 foot or 16 foot hoses, but custom lengths are available.

floating intake assembly

1" 1-1/4" 1-1/2" 2"

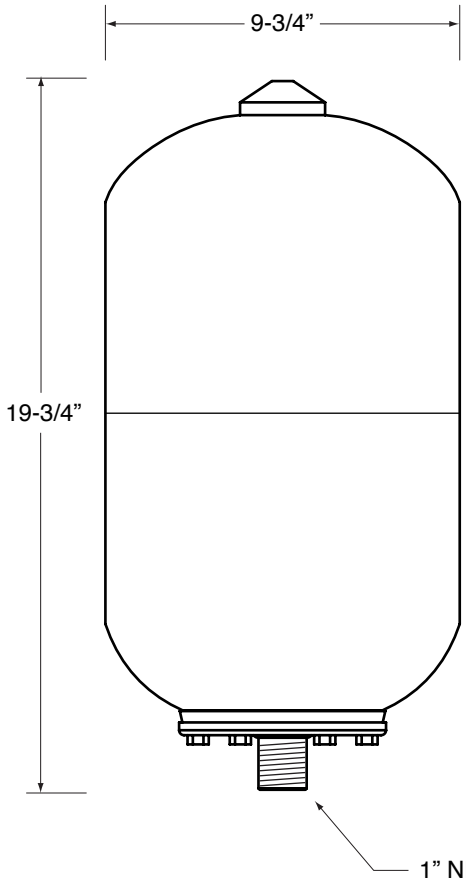
Hydropneumatic Tanks

CT Hydropneumatic Tanks are ideal for buffering water flow in variable-frequency-drive pump systems. All metal components are made of thick, electropolished 316 stainless steel to last a lifetime in water re-use systems where water quality can can corrode coated steel tanks. A heavy-duty butyl membrane is standard, and the membrane is easily replaced by unbolting the flanged bottom assembly. Although all components are drinking-water quality but the tanks is not certified for potable water use.

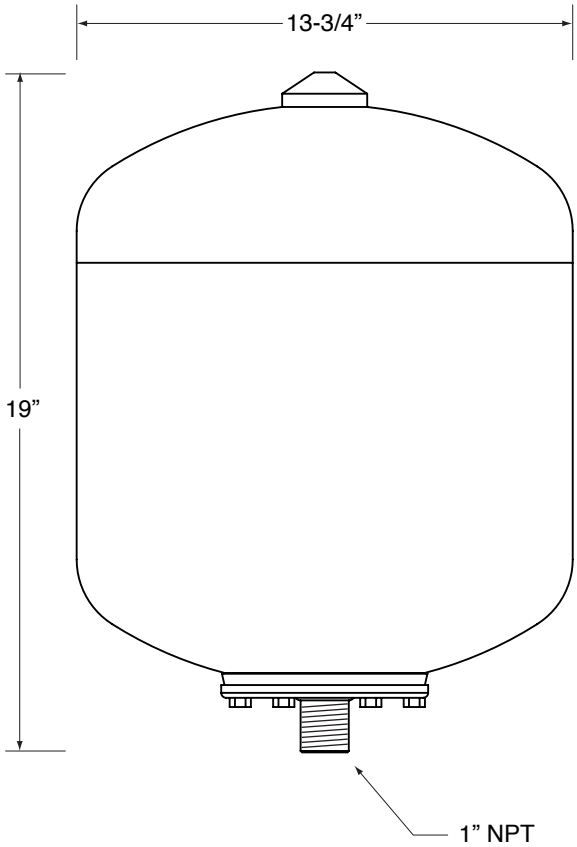
Two sizes are available: 5 gallons nominal (20 liter) and 10 gallons nominal (35 liter). For VFD systems, the nominal tank size at least 10% of the peak pump flow. The maximum recommended operating pressure is 180 psi. One-inch male npt pipe fittings are standard for minimal pressure drop.

DIMENSIONS

5 gallon

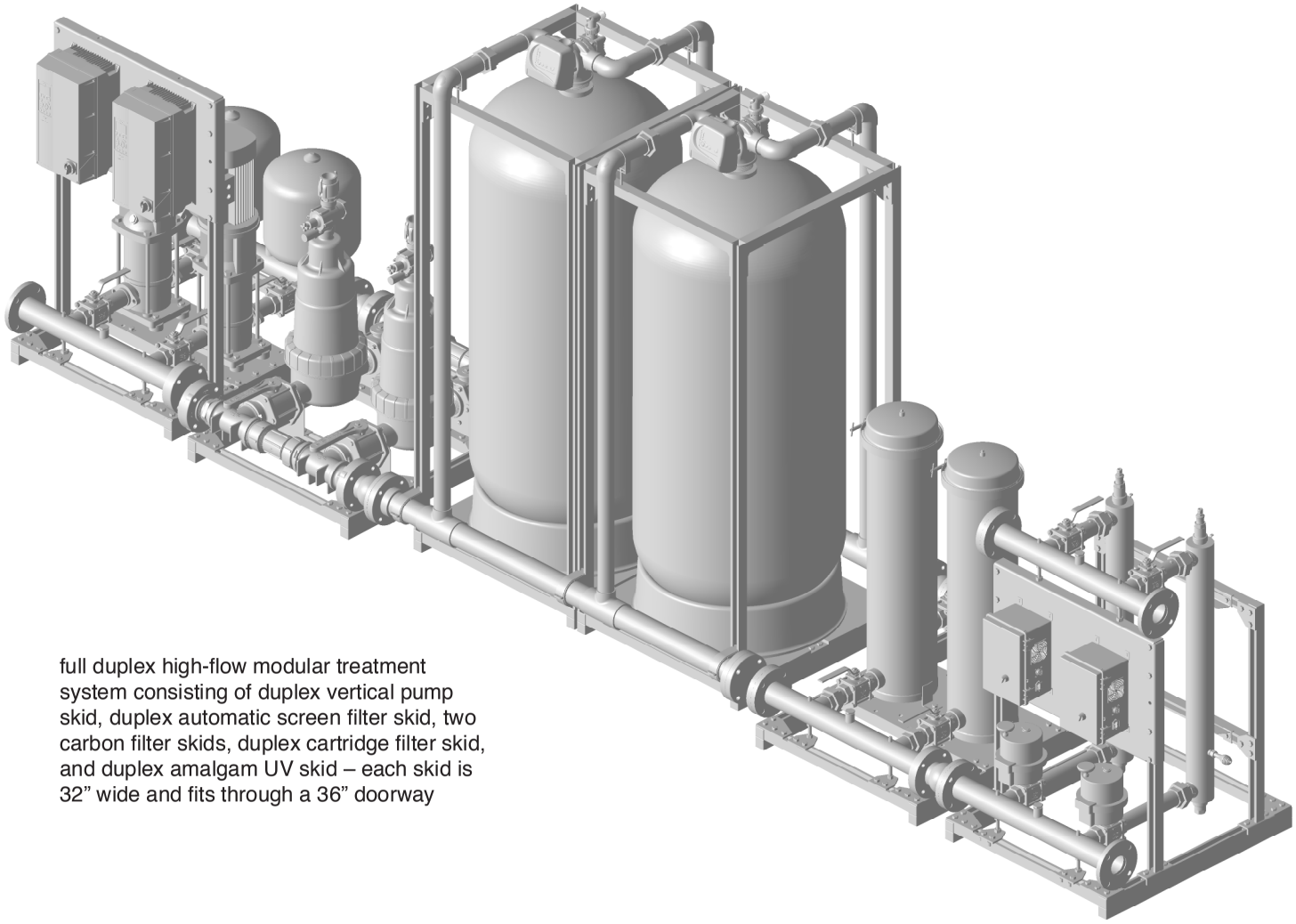


10 gallon



Conservation Technology

Duplex Modular Rainwater Mechanical System



full duplex high-flow modular treatment system consisting of duplex vertical pump skid, duplex automatic screen filter skid, two carbon filter skids, duplex cartridge filter skid, and duplex amalgam UV skid – each skid is 32” wide and fits through a 36” doorway