

## AQUAROBIC INTERNATIONAL, INC. ®

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- The Aquarobic International, Inc. Proprietary Mini-Plant™ and Raised Filter Bed disposal system are sold and as a package system as long as the Filter Bed design is approved by Aquarobic.
- The system uses an application rate to the top of the filter bed of 4 gal / Sq. Ft. / day for residential systems with flows of up to 1,500 gpd. (Apply only to the actual effluent distribution area)
- For commercial, industrial and residential systems in excess of 1,500 gpd. Use a filter bed loading rate of 2.5 gal. /Sq. Ft. /day. (Apply only to the actual effluent distribution area)
- The Filter Bed must be installed during **DRY CONDITIONS**

### **The Filter Bed System is designed to take advantage of:**

- The very high degree of treatment of the effluent from the Mini-Plant™ (7-BOD<sub>5</sub>, 11 mg/L SS and 5 mg/L DO.)
- The rate of percolation on the top 12” of original ground, that is the soil immediately below the leveling fill material use prior to the placing of the 12" of sharp concrete sand mantel area.
- The capillary or wicking action of the 12” of concrete sand material on the contact and mantel area.
- The additional photosynthesis that the Kentucky 31 tall Fescue grass with its broad leaf and very long root system (18”+) takes up.

## The Aquarobic International, Inc. Mini-Plant™, & Filter Bed Total System Notes

- The water loving plants that are planted on the perimeter of the contact and mantel area, (7' to 8' **willow trees**, evergreens etc).
- Take up considerable water amount of water and helps to aerate the soil. The system improves with age as the vegetation becomes more established.
- The Aquarobic filter bed systems, dimensions, and construction must be as designed by Aquarobic to be fully warranted to work properly by Aquarobic International, Inc.
- The single batch “Sequential Batch Reactor” (SBR) Mini-Plant™ pumps daily the total highly treated effluent once a day to the top of the Filter Bed. It pumps from 5:00 am to 6:00 am to a distribution grid (4” perforated pipe).
- The Mini-Plant pumps the total daily load in 60 minutes flooding the 4” perforated pipe manifold to ensure even distribution.
- The distribution grid is to be placed level, on 15” centers in 12” of washed 1/2 to 3/4 inch stone on top of the 30” of filter material. (Clean Pea Gravel) (See drawing)
- The maximum size of the top surface of the **distribution area of the** Filter Bed mound is to be no larger than 900 Sq./Ft. If a larger area is needed, multiple beds must be used, separated by a minimum distance of 15’ using a common contact and mantle area.
- The side slopes of the filter bed must be a **minimum** of 3to1. (For every Foot up three feet out)

**The Aquarobic International, Inc. Mini-Plant™, & Filter Bed Total System Notes**

- The Aquarobic filter media must be material approved by Aquarobic International Inc. Which has an effective size of 1.0 to 10.0 millimeters, uniformity co-efficient less than 5.0, and dust content less than 0.5 %. (Clean Pea Gravel)
- The filter material under the distribution area must be a minimum of 30" depth under the 12" of 1/2" to 3/4" stone where the distribution grid is placed. (See drawings)
- The contact and mantle (sand area) is to be cut into the ground when possible (level + or -1"), and back-filled with a minimum of 12" of a sharp clean sand, 0.5 to 1.5 mm, i.e., Concrete Sand.
- On land that has a slope to it, and the separation distance requirements to the limiting zone will not allow to dig down to level the area, it will be necessary to import fill material to level the area prior to placing the sand mantel, from soil group III (60 min/inch) approved by Aquarobic in writing, to level the area. Since we level the area first there is no need to calculate lineal line loading.
- The footprint of the filter bed portion is to be placed on the leveling fill material, never remove the original earth under the footprint of the Bed to replace it with imported fill material.
- If the high ground water table, gray modeling or limiting zone to rock is only 12" inches from the surface of the original soil, the system can be place at grade but a mound (berm) of clay material (Type IV Soil) around the perimeter of the contact and mantle area must be constructed and have a **minimum** of 3 to 1 side slope. If type IV soil is not available, Bentonite clay may be mix with the existing soil to use on the perimeter of the concrete sand lair and then back-fill with available soil to a **minimum** of 4 to 1 side slopes.

- Once the 12” of concrete sand, for the mantle and contact area is installed. Then the 30” of filter media, and its 3-1 sides slopes, creating the footprint of the filter bed is installed, **(the footprint of gravel may be smaller then the overall footprint of the sand layer depending on the percolation of the original soil)** then the distribution piping is placed in a 12” layer of 1/2” to 3/4” stone above the 30” of filter media (pea gravel) and covered by 6”to 8” of loam top soil over the mount and 4” loam top soil over the mantel sand area.
- The filter bed system may be installed on soils with percolation of less than 120 minutes per inch with this design minimum:
- The contact and mantle area shall be at least as wide to equal the footprint of the filter bed material. (Pea Gravel)
- All other separation distances (IE: Well, property line, buildings, etc) shall be measured from the toe of the filter bed.

### **Formula for the concrete sand area: $A = QT/25$**

- A = Area in sq./ft
- Q = Quantity of wastewater produce per day in US gallons.
- T = **The percolation time of the original ground, in min/inch (of the top 12” of the ground immediately under the mantel, contact mason sand).**
- The placement of sod or Hydro-seeding over the filter bed mound to hold the soil from eroding until the Kentucky 31 tall fescue becomes establish is a required part of the Aquarobic Innovative, proprietary, total Mini-Plant™ and filter bed System.
- During late fall or early spring, when sod may not be available, the filter bed may be seeded and a soil retention cloth material or Hydro-seeding may be used to keep the soil from eroding until sod becomes available or the Kentucky 31 tall fescue establishes itself.

- The mantle area must be seeded using Kentucky 31 tall fescue which is a grass with a broad leaf and 16” to 18” root system. A willow tree planted on every corner, and other water loving plants around the perimeter.
- The single batch SBR Mini-Plant™ tanks are sized to have three (3) times the daily wastewater flow for residential use (including the use of garbage disposal).
- Commercial or industrial systems shall have a Minimum tank size of four (4) times the daily wastewater use. (When using concrete tanks, multiple tanks may be used to achieve the required volume, if the tank were interconnected according to Aquarobic specifications).
- The discharge pump from the single batch Mini-Plant™ is sized to pump the total volume of the daily effluent to the filter bed in 60 minutes. Therefore, the pump size is determined by the treatment capacity, distance, and elevation to the Filter Bed of each Mini-Plant™ Filter Bed System.
- The total daily effluent volume is pumped to the manifold in the filter bed in 60 minutes as stated above; there by creating a pressure distribution discharge system, although the distribution pipe manifold is 4” in diameter.
- The Mini-Plant™ is an integral component of the total Aquarobic Filter Bed System. the Mini-Plant is a miniature advance wastewater treatment system which treats domestic wastewater (Influent from 100 to 400 mg./Liter BOD<sup>5</sup> “Biochemical Oxygen Demand” and SS. “Suspended Solids”) from homes, offices, businesses, and many other applications.
- The Mini-Plant™ provides a reduction in pollutants to a degree of treatment equal to or better than a modern municipal sewage treatment plant. It produces 7 mg/L BOD<sup>5</sup> & 11 mg/L SS.)

**The Aquarobic International, Inc. Mini-Plant™, & Filter Bed Total System Notes**

- The Mini-Plant™ has the capacity to treat up to 3,000 US. GPD the National Sanitation Foundation International, (N.S.F.I.) under standard # 40 only list units up to 1,500 gpd. And only for domestic waste from a single family home.
- The Aquarobic Mini-Plant™ is available in our custom manufactured Fiberglass tank, or as add on kit, to be installed onto locally manufactured one compartment concrete tank(s) of the write size.
- All Mini-Plant™ tanks are sized to hold (3) three times the daily wastewater flow for residential units and (4) four times the daily wastewater flow for commercial installations, thus, providing 100% or more overload capacity. This gives the Mini-Plant™ the ability to handle the occasional shock load.

**Filter bed upper surface distribution area size:**

Gal. /day	Residential system 2.5 gal./sq. Ft.	Commercial system Four gal./sq. Ft
500 gpd.	125 sq. Ft.	200 sq. Ft.
600 gpd.	150 sq. Ft.	240 sq. Ft.
750 gpd.	188 sq. Ft.	300 sq. Ft.
800 gpd.	200 sq. Ft.	320 sq. Ft.
900 gpd.	225 sq. Ft.	360 sq. Ft.
1,000 gpd.	250 sq. Ft.	400 sq. Ft.
1,100 gpd.	275 sq. Ft.	440 sq. Ft.
1,200 gpd.	300 sq. Ft.	480 sq. Ft.
1,300 gpd.	325 sq. Ft.	2 = 260 sq. Ft. Beds
1,400 gpd.	350 sq. Ft.	2 = 280 sq. Ft. Beds
1,500 gpd.	375 sq. Ft.	2 = 300 sq. Ft. Beds
2,000 gpd.	-----	2 = 400 sq. Ft. Beds
2,500 gpd.	-----	2 = 500 sq. Ft. Beds
3,000 gpd.	-----	3 = 400 sq. Ft. Beds

## Water Loving Trees / Shrubs / Ground Cover For the Aquarobic Filter Bed System

### Trees for wet Soil

#### \*\*\*Willow (Best)

Alder, European

Ash, White

Birch, River

Buckeye, Ohio

Hackberry

Linden, American

Magnolia, sweet bay

Oak, swamp white

Sycamore

\*\*\*Holly

### Shrubs that Thrives

#### In Wet Soils

Alder

Arrow-wood

Billiard Spirea

Buttonbush

Chokeberry

Dogwoods (various)

Elderberry

Golden elder

Hydrangeas (various)

Winterberry Holly

Juniper Festers

Swamp rose

### Ground Cover for Moist Soils

Forget-me-not

Lily-of-the-valley

Phlox

Sandwort, moss

Start violet

Wild Sweet William

Galax

Partridgeberry

Plantain-lily

Siberian tea

Swamp dewberry

Wintergreen

## System operation:

- The Mini-Plant™ is a Sequential Batch Reactor; (SBR) controlled by a factory set digital programmer which times the aeration and settling functions. It discharges a batch of treated effluent to the filter bed area once daily.
- The normal program aerates for 20 hours a day, supplying the wastewater with a minimum of 2,100 cf. of fine diffused air per pound of BOD.
- It aerates from 6:00 am. Until 2 a.m. the following morning, at 2:00 am. The digital programmer turns off the compressor and a 3-hour of perfectly quiescent settling period follows. (During this period, the aeration tank becomes the settling tank; the Batch Process uses this time to separate the solids from the clear supernatant. This differs from a flow-through system where a separate compartments or tanks are used to accomplish the separation, these compartments maintain a flow passing through them, so a perfectly quiescent settling is never achieves)
- After the 3 hours of a perfectly quiescent settling period, the stainless steel pump, which is suspended 1/3 off the bottom of the tank, pumps the clear supernatant (effluent) to the filter bed during the remaining hour, (5:00 am to 6:00 am.)
- The system then returns to the aeration process at 6 a.m., for the next 20 hours to further digest the retained organic solids and the new day wastewater load.
- The program settings can be adjusted to accommodate the family daily lifestyle. (I.e., people whom work night shifts, etc.) The Mini-Plant™ has three main sections; the control panel, the manway and the tank, with its' in tank components.

## **The Mini-Plant™ control panel:**

- The panel is mounted in an outdoors-weatherproof enclosure.
- An electronic brain monitors and controls all plant functions.
- The panel has visual and audible signals to show normal operations or possible malfunctions.
- There are circuit breakers, thermo-electric protected motor starting switches, relays, and level sensors to monitor the plant.
- The control panel enclosure is approximately 18”H X 14”W X 6”D. The power supply is 230 volt, single phase, and 60 hertz 35 amps, a 125 amp sub-panel is provided.
- The compressor and the pump can not operate at the same time.
- The Mini-Plant™ manway is manufactured from heavy fiberglass reinforced polyester. It protects and provides access to the air compressor, pump, electrical junction box, and all the piping and mechanical connections.

**Major components inside the manway:**

- One energy efficient ring type air compressor.
- The 3 level sensors
- One stainless steel submersible pump
- The waterproof electrical junction box.
- The installing dealer/contractor inter-connects the electrical wires from the junction box to the control panel.
- When using a concrete tank the manway is to be sealed to the tank using silicon sealant and checked for leaks. Diffuser manifolds are then installed.
- The manway is available in green or white color.
- The air compressor is a regenerative energy efficient ring type that can supply up to 52 cubic feet of air per minute to the diffusers. (52 CU.FT/min = 3,120 CU.FT. per Hr. X 20 Hr. Running time per day =62,400 CF/day 2,100 CF per pound of BOD<sub>5</sub> = 29.71 pounds per day.)
- The compressor operates on 230 volts, 60 Hz. In addition, varies in hp. and amps depending on size and BOD<sub>5</sub> loading. The compressor in the Mini-Plant is wired to the electrical junction box and piped to the air manifold and diffusers.

## **The tank & its' in tank components:**

- Aquarobic manufacture Mini-Plant™ treatment units that are completely assembled in our own Fiberglass tanks or are available as a conversion kit for installation onto locally manufactured concrete tanks having a hydraulic capacity of 3 times the daily treatment design flow, for residential systems and 4 times the daily treatment design flow for commercial installations.
- The fiberglass tank Mini-Plant™ comes completely assembled, ready to be installed.
- Sizes of Mini-Plant™ range from 500 gpd to a maximum daily treatment capacity of 3,000 gal. (11,356 liters) per day.
- We require that all tanks be sized to hold at a minimum three times the maximum daily design wastewater flow for domestic use and four time the maximum daily design wastewater flow for commercial use.

## **The tank contains three liquid level sensors:**

- FLS # 1 - low level pump shut off
- FLS # 2 - high liquid level alarm and blower shut off
- FLS # 3 - emergency pump - on liquid level switch
- The high liquid level alarm (FLS # 2) turns on when the tank is 2/3 full, there is 1/3 capacity left in tank or a one day capacity, this switch turns on the alarm light, buzzer, and the remote alarm and also turns off the air compressor during an emergency. In an event that the liquid reaches the emergency pump on switch, (FLS # 3) the control panel will turn on the pump to prevent from flooding the compressor, and by the time this takes place the liquid in the Mini-Plant™ would have been perfectly quiescent for some time so only clear supernatant is pump to the filter bed. The pump would then run until the level is down to the high water alarm switch thus preventing the blower and other electrical components from flooding.
- Several high density air diffusers and one industrial type stainless steel submersible pump is inside the tank NSF I Listed Mini-Plants to be used with the Aquarobic International Inc. proprietary Mini-Plant™ and raised filter bed disposal systems.

**Models 54291-5 through 54291-15 are class 1 when used with or without filter kit model 3,000**

Model number	Rated capacity	NSFI Classification
54291-5-115V	500 gal. (Concrete tank)	class 1
F54291-5-115V	500 gal. (Fiberglass tank)	class 1
54291-6-230 V	600 gal. (Concrete tank)	class 1
F54291-6-230 V	600 gal. (Fiberglass tank)	class 1
54291-7-230 V	700 gal. (Concrete tank)	class 1
F54291-7-230 V	700 gal. (Fiberglass tank)	class 1
54291-7.5 –230V	750 gal. (Concrete tank)	class 1
F54291-7.5 230 V	750 gal. (Fiberglass tank)	class 1
54291-8-230 V	800 gal. (Concrete tank)	class 1
F54291-8-230 V	800 gal. (Fiberglass tank)	class 1
54291-9-230 V	900 gal. (Concrete tank)	class 1
F54291-9-230 V	900 gal. (Fiberglass tank)	class 1
54291-10-230V	1,000 gal. (Concrete tank)	class 1
F54291-10-230V	1,000 gal. (Fiberglass tank)	class 1
54291-11-230V	1,100 gal. (Concrete tank)	class 1
F54291-11-230V	1,100 gal. (Fiberglass tank)	class 1
54291-12-230V	1,200 gal. (Concrete tank)	class 1
F54291-12-230V	1,200 gal. (Fiberglass tank)	class 1
54291-13-230V	1,300 gal. (Concrete tank)	class 1
F54291-13-230V	1,300 gal. (Fiberglass tank)	class 1
54291-14-230V	1,400 gal. (Concrete tank)	class 1
F54291-14-230V	1,400 gal. (Fiberglass tank)	class 1
54291-15-230V	1,500 gal. (Concrete tank)	class 1
F54291-15-230V	1,500 gal. (fiberglass tank)	class 1
<b>Not NSFI Listed Models</b>		
54291-20-230V	2,000 gal. (Concrete tank)	AQI 1A
F54291-20-230V	2,000 gal. (Fiberglass tank)	AQI 1A
54291-25-230V	2,500 gal. (Concrete tank)	AQI 1A
F54291-25-230V	2,500 gal. (Fiberglass tank)	AQI 1A
54291-30-230V	3,000 gal. (Concrete tank)	AQI 1A
F54291-30-230V	3,000 gal. (Fiberglass tank)	AQI 1A
54291-35-230V	3,500 gal. (Concrete tank)	AQI 1A
F54291-35-230V	3,500 gal. (Fiberglass tank)	AQI 1A
54291-40-230V	4,000 gal. (Concrete tank)	AQI 1A
F54291-40-230V	4,000 gal. (Fiberglass tank)	AQI 1A
54291-45-230V	4,500 gal. (Concrete tank)	AQI 1A
F54291-45-230V	4,500 gal. (Fiberglass tank)	AQI 1A
54291-50-230V	5,000 gal. (Concrete tank)	AQI 1A
F54291-50-230V	5,000 gal. (Fiberglass tank)	AQI 1A

- The filter bed design and concept herein disclosed is proprietary with Aquarobic International Inc. Moreover, may not be reproduced or used without prior written authorization.