NOTICE TO INSTALLER: Instructions must remain with installation.

CL0301J
0210
Supersedes
New

CLARUS ENVIRONMENTAL
Zoeller Family of Water Solutions™

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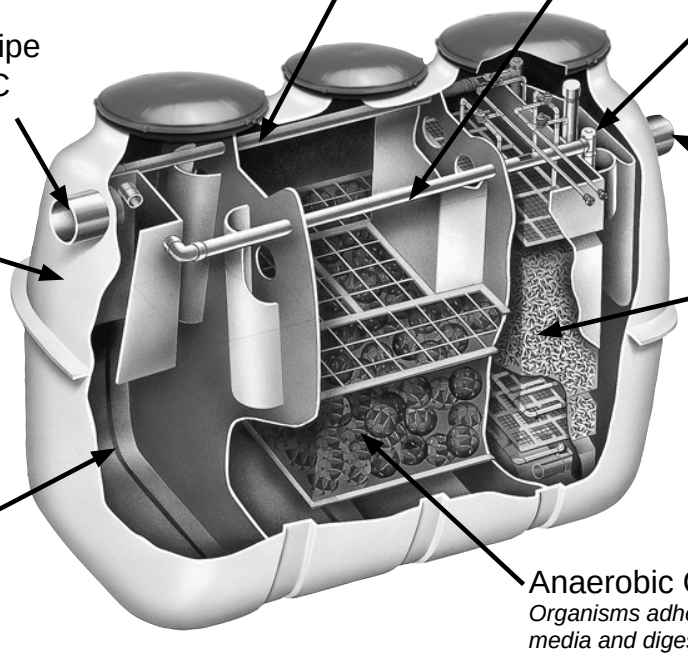
Fusion® Series Treatment Systems

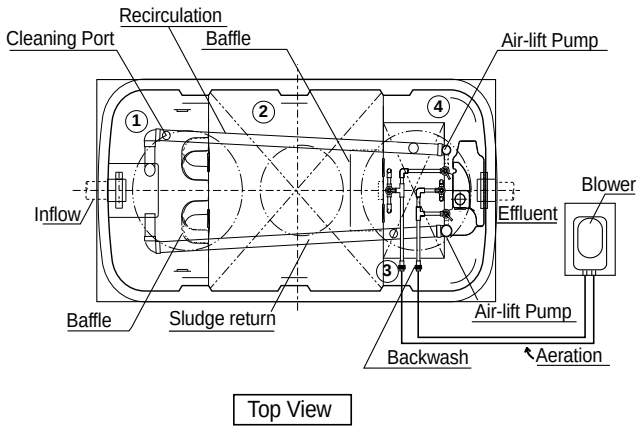
OPERATION and MAINTENANCE

NSF®
Certified to ANSI-NSF40 Class I performance designation



Risers must be purchased separately.

The Fusion® Series Treatment Systems represent a collaboration with Fuji Clean Co., Ltd.



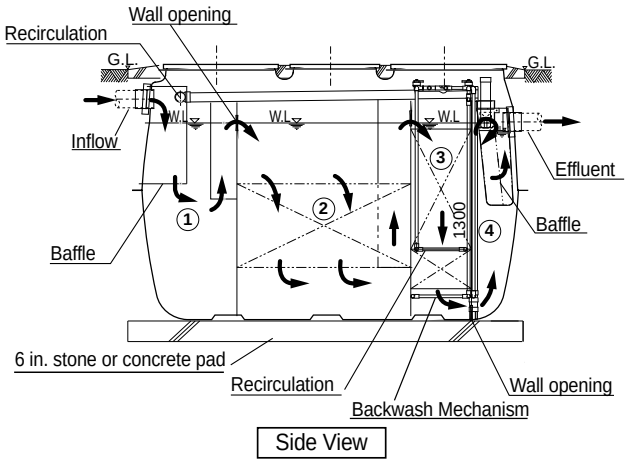
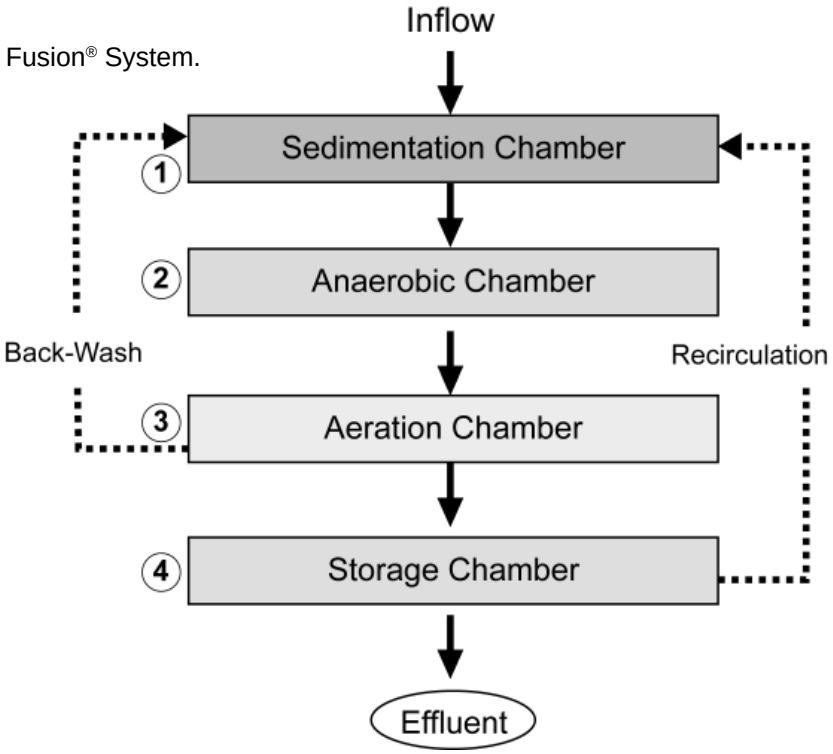


Figure 1. Schematic diagram of the Fusion® System.

Figure 2.
Treatment Flow of the Fusion® System.



PROCESS DESCRIPTION

1. **Sedimentation Chamber**
   This chamber is designed to physically separate solids and scum from the incoming water.

2. **Anaerobic Chamber**
   This chamber contains a spherical-skeleton type of filter media (4.3 inch diameter). Through bacterial growth processes on the surface of the filter media, biological anaerobic treatment thrives while suspended solids are captured. Furthermore, the microorganisms/ bacteria in this chamber convert nitrates in the recirculated water returning from the aerobic chamber to gaseous nitrogen. The nitrogen then escapes to the atmosphere.

3. **Aeration Chamber**
   The aeration chamber consists of an aeration upper section and a filter media lower section. The chamber is filled with hollow, cylindrical filter media (0.6 inch diameter and 0.55 inches long). Biological treatment takes place on the filter media surface. Aeration is continuous. Residual suspended solids are captured by the filter media circulating in this section. During normal operation, a recirculation line transfers water back to the sedimentation chamber by way of an air lift pump.

   The filter media in the aeration chamber are backwashed regularly (twice a day, 5 or 10 minute cycle) by the backwash system located at the bottom of the chamber. The accumulated sludge is transferred by an air lift pump back into the sedimentation chamber for further digestion.

4. **Storage Chamber**
   This chamber is designed to temporarily store treated water exiting the aeration chamber. This treated water is ready for discharge.

EFFLUENT QUALITY

Fusion® Series systems are compact, efficient, and designed to be installed in a typical residential/light commercial environment. The final effluent leaving the system will be treated to the secondary quality strength of 10 mg/L CBOD5 and 15 mg/L TSS.

INSPECTION AND MAINTENANCE FREQUENCY

Fusion® Series systems are to be inspected and maintained every six months under normal usage. The inspection and maintenance is only to be performed by personnel trained and authorized by Clarus Environmental. A maintenance check sheet (CL0301F) is to be completed for each inspection and maintenance visit.

INSPECTION AND MAINTENANCE - 6 MONTH INSPECTION

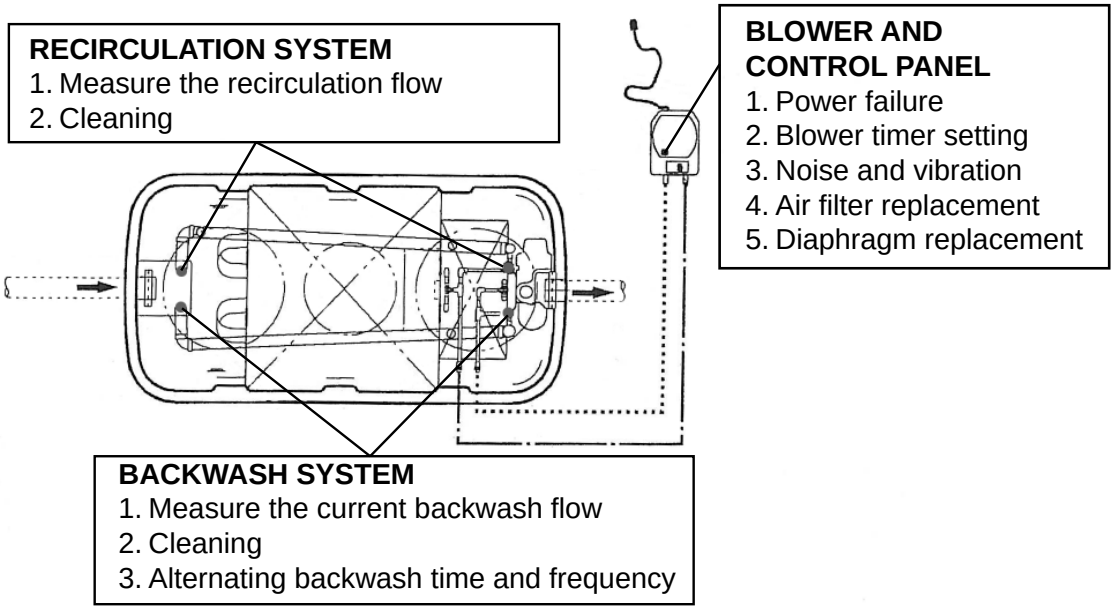
General Procedure

1. Verify that the unit is accessible and that nothing inhibits maintenance.
2. Verify that the unit is installed correctly, is level, and that each component functions properly.
3. Verify that the blower is on and operating properly.
4. Verify that there is no damage to the tank, piping, or other components.
5. Verify that there are no air leaks in the air piping and that the air piping is connected correctly.
6. Verify that any surface water is draining away from unit.
7. Verify that the unit is not leaking and that no liquid is surfacing from around the risers or lids.
8. Verify that operating water levels are correct in each chamber.
9. Measure the sludge accumulation (inches) of the first and second chamber only. Insert a ½ inch clear pipe or other appropriate device to the bottom of each chamber, then close the top end and remove the pipe slowly. Record the accumulated sludge depth. Typically an accumulation of 20 inches (ZF450 and ZF600), or 24 inches (ZF800) for the first chamber and 15 inches for the second chamber requires desludging.

SYSTEM DIAGRAM

Figure 3.
Inspection details.

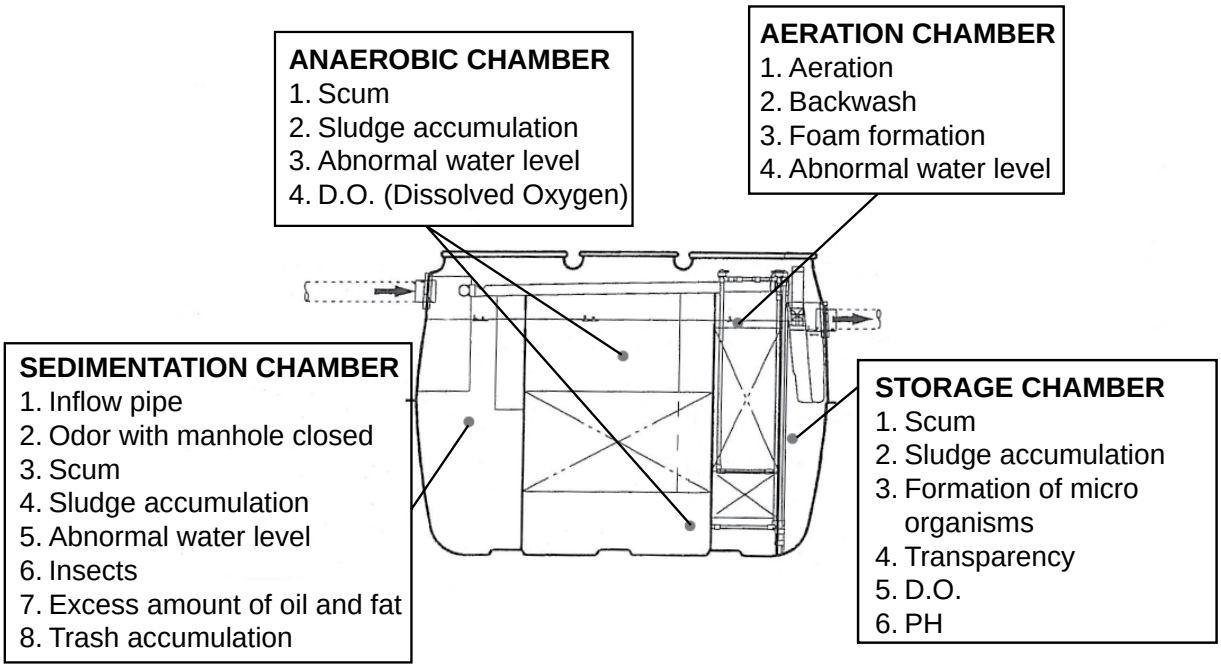
Refer to sections on following pages for detailed maintenance item descriptions.



SYSTEM DIAGRAM, *continued*

Figure 3. *continued*
Inspection details*, continued*

Refer to sections on following pages for detailed maintenance item descriptions.



MAINTENANCE PROCEDURES

Refer to System Diagram for procedure locations.

RECIRCULATION SYSTEM

1. Measure the recirculation flow.

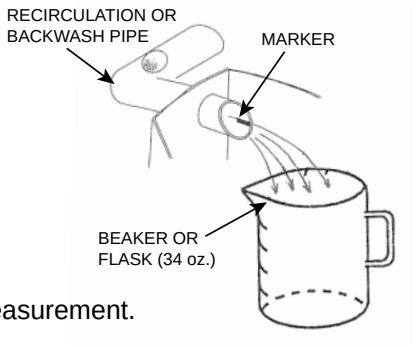


Figure 4. Flow measurement.

Measuring the current recirculation flow rate is very important for evaluating the operational status. Make sure to measure the recirculation flow rate before making adjustments. Recirculation flow rate must be measured in seconds/liters at the discharge end of pipe in the first chamber (Sedimentation Chamber). Compare the value with Table 1. A lower value may indicate clogging of the recirculation pipe and a higher value may indicate clogging of the filter media or obstruction of the air input line. Measure the recirculation flow rate again at the end of the maintenance visit and adjust it according to Table 1, if necessary.

2. Cleaning.

If the recirculation flow rate is lower than the usual value, clean the airlift pump and recirculation pipe with a brush and hose. To access the airlift pump and pipe, remove the cap (Fig.5) and clean as needed (Fig. 6).

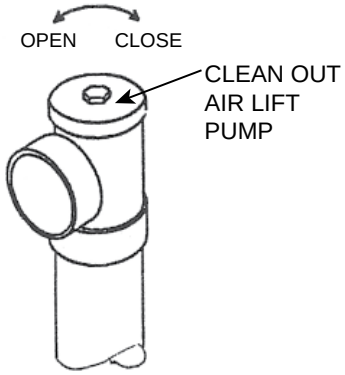


Figure 5.
Cleaning airlift pump.

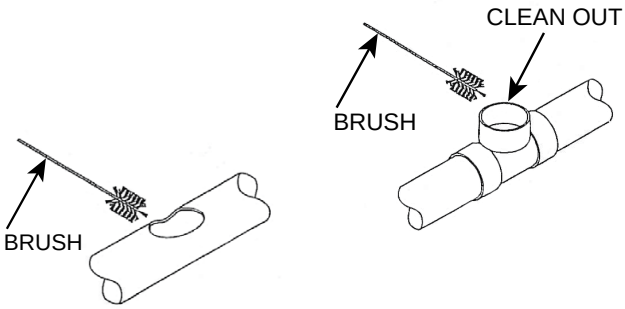


Figure 6. Cleaning recirculation and backwash pipe.

BACKWASH SYSTEM

1. **Measure the backwash flow.**
   Measure the backwash flow rate in a similar fashion as the recirculation flow rate. See Fig. 3 for piping orientation. Adjust the backwash flow rate according to Table 2.

2. **Cleaning.**
   If the backwash flow rate is lower than the usual value, clean the airlift pump and sludge return pipe with a brush. The airlift pump cap can be unscrewed (Fig.5) and there is a cleanout in the sludge return pipe. (See Fig. 6)

3. **Alternating backwash time and frequency.**
   In some cases, it may be desirable to set the backwash time and frequency to something other than the standard value. Consult with the manufacturer for details.

SEDIMENTATION CHAMBER

1. **Inflow pipe.**
   Clear blockages, if any.

2. **Odor with manhole closed.**
   Make sure there is no undesirable odor with the lids closed. See the troubleshooting section if odor is an issue.

3. **Scum.**
   Break the scum if the scum layer reaches to the top of the baffle.

4. **Sludge accumulation.**
   Measure the sludge accumulation depth, and pump out the sludge if accumulation exceeds 20” (ZF450 and ZF600) or 24” (ZF800).

5. **Abnormal water level.**
   If the water level exceeds the upper line marked on the partition wall, check for possible clogging in the other chambers.

6. **Insects.**
   Spray insecticides lightly around lids as needed to control mosquitoes, sewage flies, etc.

7. **Excess amount of Oil and Fat.**
   Remind homeowner to refrain from disposing too much oil and fat. Additional literature is available from Clarus Environmental for homeowner education. (See CL0002)

8. **Trash accumulation (diapers, paper towels, etc.).**
   Remind homeowner not to dispose of undigested materials.

ANAEROBIC CHAMBER

1. **Scum.**
   Break the scum if the scum layer reaches to the top of the baffle.

2. **Sludge accumulation.**
   Measure the sludge accumulation depth, and pump out the sludge if accumulation exceeds 15” (ZF450, ZF600 and ZF800).

3. **Abnormal water level.**
   If the water level exceeds the upper line marked on the partition wall, check for possible clogging in the filter media section. Clogging may be cleared by using the manual backwash tool (see Fig.8).

4. **Placement of the D.O. measurement.**
   To measure the D.O. in the anaerobic chamber, place the D.O. probe into the anaerobic chamber baffle on the downstream side of the anaerobic section.

AERATION CHAMBER

1. Aeration.
The aeration system must be flushed every maintenance visit.

There are two flushing methods; (A) Air flushing and (B) Water flushing. Air flushing must be done every maintenance visit. Water flushing must be done if there is a sign of clogging in the Aeration Chamber (e.g. abnormal increase in recirculation flow).

(A) Air flushing procedure: (See Fig. 10)
- Make sure that the blower is in the aeration mode.
- Close valve (2) all the way.
- Rotate valve (1) back and forth from the 0% to the 100% position several times to flush.
- Set valves (1) and (2) back to the appropriate positions. (See Recirculation System)

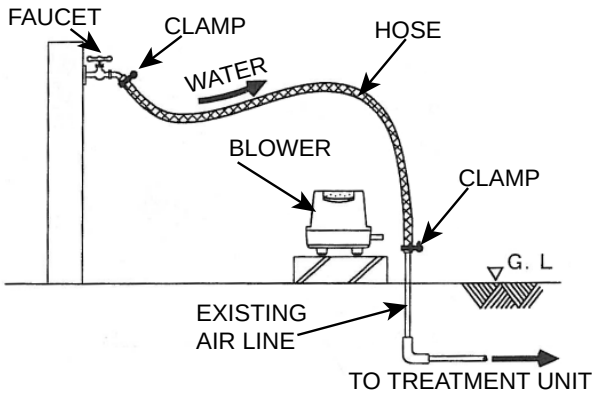
(B) Water flushing procedure: (See Fig. 10)
- Make sure that the blower is off.
- Close valve (2) all the way.
- Connect a water line to the aeration line as shown in Fig. 7.
- Gradually open the water faucet and introduce water into the system.
- Rotate valve (1) back and forth from the 0% to the 100% position several times to flush.
- Turn off the water, remove the water line, and reconnect the airline to the blower.
- Set valves (1) and (2) back to the appropriate positions. (See Recirculation System)

2. Backwash.
The backwash system must be flushed every maintenance visit.

There are two flushing methods; (A) Air flushing and (B) Water flushing. Air flushing must be done every maintenance visit. Water flushing must be done if there is a sign of clogging in the Aeration Chamber (e.g. abnormal increase in recirculation flow).

(A) Air flushing procedure: (See Fig. 10)
- Make sure that the blower is in the aeration mode.
- Close valve (4) all the way.
- Rotate valve (3) back and forth from the 0% to the 100% position several times to flush.
- Set valves (3) and (4) back to the appropriate positions. (See Backwash System)

Figure 7. Image of water flushing procedure.



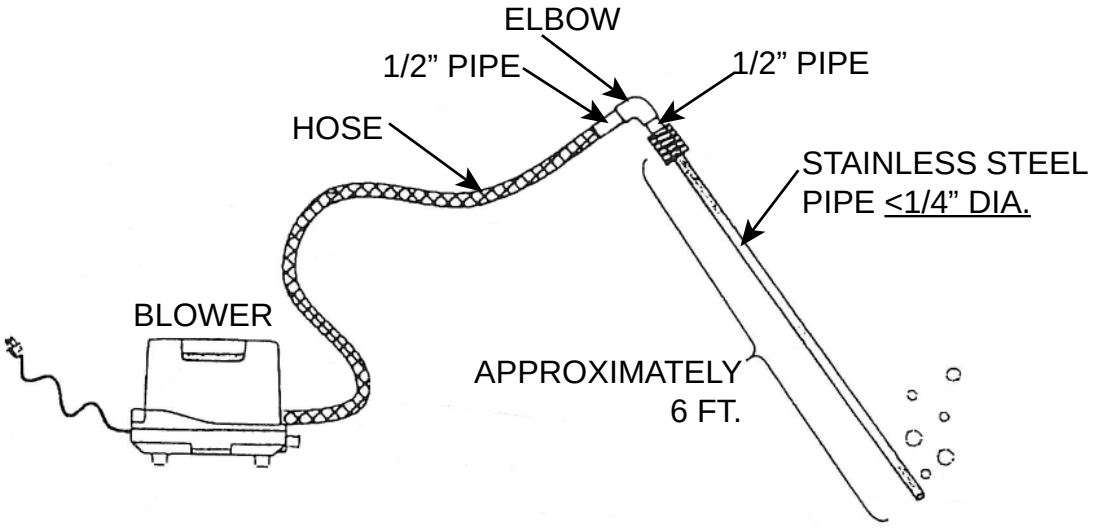
(B) Water flushing procedure: (See Fig. 10)
- Make sure that the blower is off.
- Close valve (4) all the way.
- Connect a water line to the backwash airline as shown in Fig. 7.
- Gradually open the water faucet and introduce water into the system.
- Rotate valve (3) back and forth from the 0% to the 100% position several times to flush.
- Turn off the water, remove the water line, and reconnect the airline to the blower.
- Set valves (3) and (4) back to the appropriate positions. (See Backwash System)

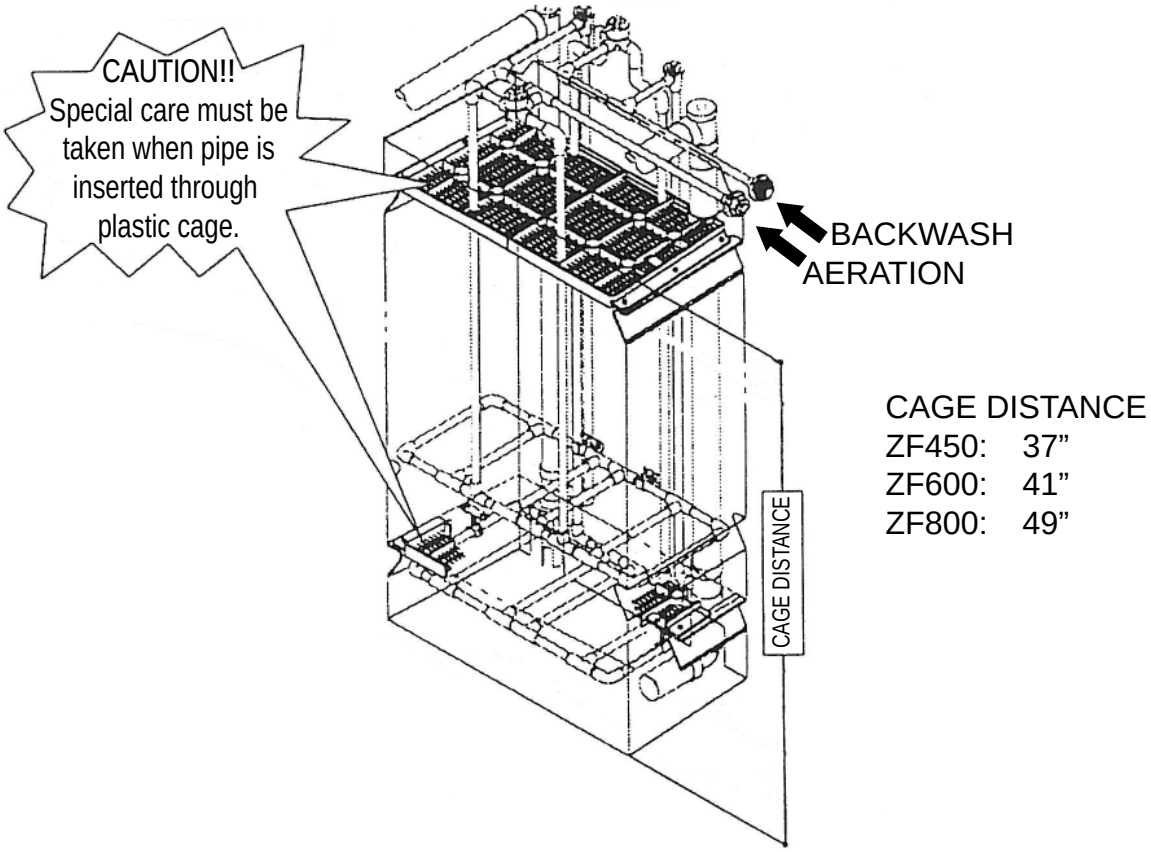
3. Foam formation.
Make sure there is not an excess amount of foam on the surface.

4. Abnormal water level.
If the water level exceeds the partition wall, clean the plastic cage first with a brush, then check for possible clogging in the filter media section. Clogs may be cleared by using a manual backwash tool (see Fig. 8).

Backwash, *continued*

Figure 8. Manual backwash tool for cleaning the filter media.





CAGE DISTANCE
ZF450: 37”
ZF600: 41”
ZF800: 49”

STORAGE CHAMBER

1. **Scum.**
   Scoop the scum and transfer it into the Sedimentation Tank.

2. **Sludge accumulation.**
   Transfer the sludge to the Sedimentation Tank by the airlift pump.

3. **Insects.**
   Spray insecticides lightly around lids as needed to control mosquitoes, sewage flies, etc.

4. **Transparency.**
   Clarity of the water should allow visibility to more than 12 inches.

5. **D.O.**
   D.O. should be measured 25 inches below the water level and should be more than 1mg/L.

6. **pH.**
   pH should be in the range of 5.8-8.6. If it exceeds the range, check with the homeowner for excess amount of chemical usage and remind them not to use too much.

BLOWER AND CONTROL PANEL

1. **Power failure.**
   In case of power failure, air blowing stops but all times and settings are retained.

2. **Blower timer setting.**
   See attached sheet or Installation Instructions (CL0301D) for details.

3. **Noise and vibration.**
   If there is a void between bottom legs and the base, noise or vibration may occur. Make sure the blower legs firmly contact the base.

4. **Air filter.**
   Clean the filter every six months and replace with a new one annually.

5. **Diaphragm replacement.**
   It is recommended that the diaphragm be replaced every 2 years. See separate sheet attached for detailed instructions for replacement.

6. **Control panel.**
   Simulate alarm condition with the exterior test/ normal/silence switch. Inspect interior for unusual odors or visual damage.

RECOMMENDED METHODS FOR COLLECTING EFFLUENT SAMPLES*

Proper effluent sample collection technique is essential for obtaining an accurate assessment of treatment efficiency. To accurately interpret treatment efficiency, influent as well as effluent samples should be collected. In the event of reduced efficiency, influent composition can be useful in determining system owner practices. Depending upon configuration, effluent samples can be collected at;

1. Disposal pump tank downstream of the Fusion®
2. Fusion discharge chamber
3. Distribution Box downstream of the Fusion®

Samples should be obtained in clean, one liter bottles. Bottles should be labeled appropriately to denote the sample's original location and kept on ice during transport. Samples should be collected to approximate daily residential sewage flow. When opening the Fusion® lid during sampling, try not to disturb the unit. Also, do not collect the effluent sample from the wall of the tank.

For further information, reference Clarus Environmental procedure identification number SOP-F-103, Clarus Environmental, 1-877-244-9340.

* Consult local rules and regulations to determine jurisdictional effluent sampling requirements.

INSPECTION AND MAINTENANCE - 1 YEAR INSPECTION

Perform all inspection procedures listed in 6 month inspection. (See page 3.) Pump out sludge in the first and second chambers (if necessary).

If the maximum sludge accumulation has been reached, see description in 6 month inspection, item 9.

Make sure to remove the scum on top layer first, then pump out the sludge of each chamber (Fig. 9).

See CL0301F and Service Report.

(1) Cleaning of Sedimentation-Separation Tank

Remove all scum and sludge

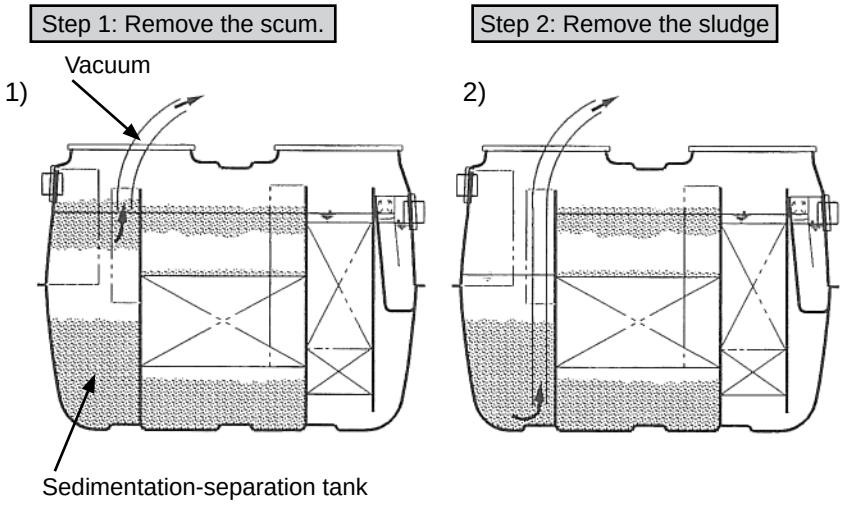
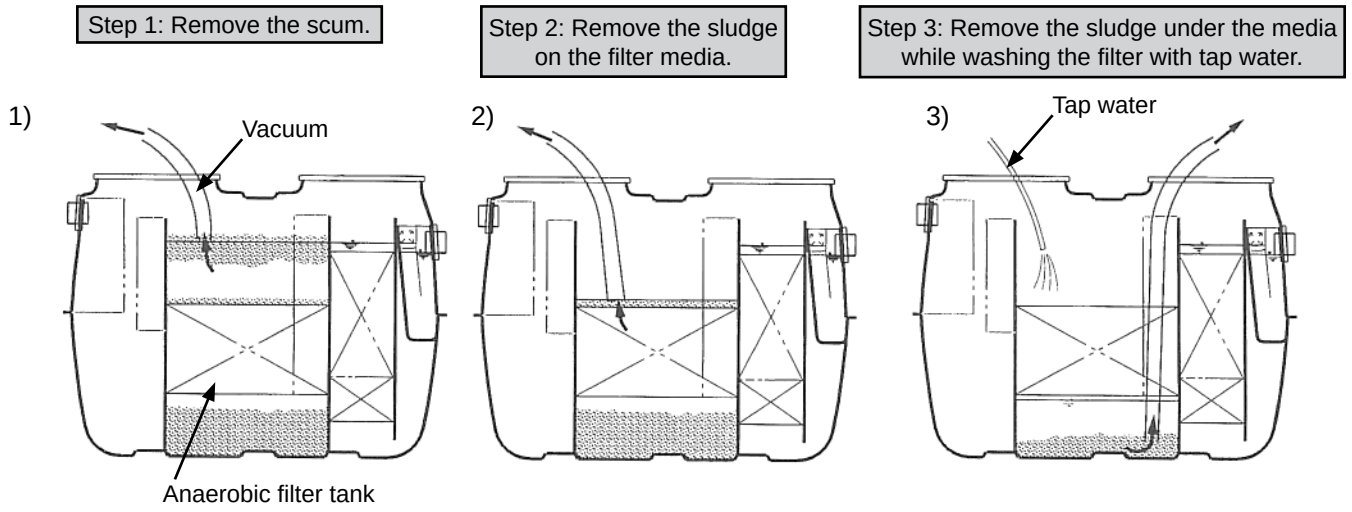


Figure 9. Pump out procedures.

(2) Cleaning of Anaerobic Filter Tank

Remove all scum and sludge

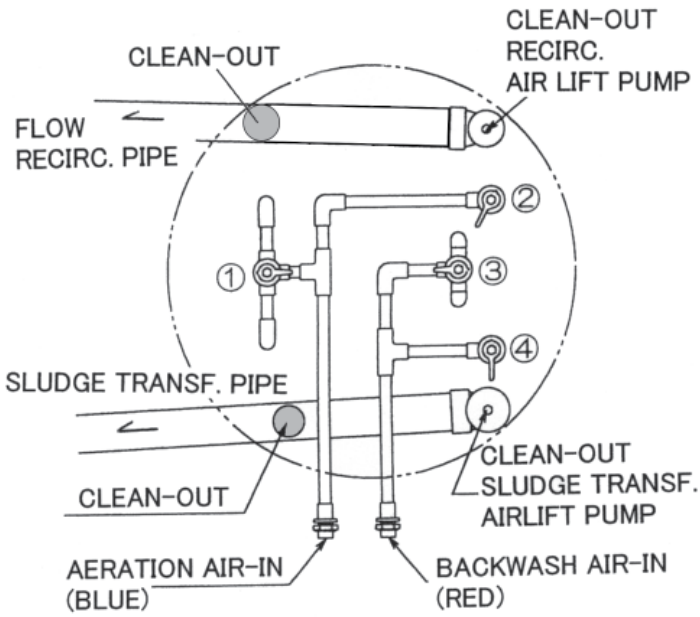


ATTENTION: Remove the scum first. If you remove the sludge first, the water level will decrease and the anaerobic filter will be blocked by the scum.

AERATION AIRFLOW ADJUSTMENT

There are two aeration systems within the aeration chamber. Normally, the valve dial is set at 50%. Visually observe the air flow rates on each side of the unit to verify equal flow. If there is an obvious discrepancy in air flow between the two sides (i.e., the media seems to “roll” from one side to the other), adjust the BLUE color coded air flow valve (1) so that the flow is equal.

Figure 10.
Valve legend.



Valve legend;

①	Aeration	Blue	Balance Aeration
②	Recirculation	Gray	See Table 1
③	Backwash	Red	Balance Backwash
④	Sludge transfer	Gray	See Table 2

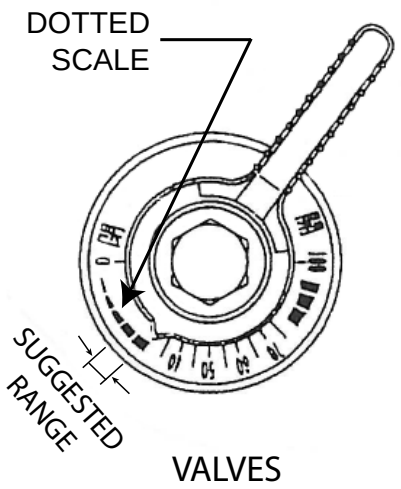
Table 1. Recirculation Flow Rates

Model	ZF450	ZF600	ZF800
Recirculating flow rate (sec/liter)	29-45	21-32	14-22
Suggested Valve Opening	35-40%	30-35%	30-35%

Table 2. Backwash Flow Rate Setting

Model	Frequency	ZF450	ZF600	ZF800
Backwash flow rate (sec/liter)	Twice/day	7-10	5-7	4-6
Valve open (%)	Twice/day	50-55	40-45	40-45

Figure 11. Flow controlling valve.



RECIRCULATION FLOW ADJUSTMENT

The recirculation flow is designed to be 1.2-1.8 times that of the inflow. Table 1 indicates approximate flow rates for each unit. However, fine adjustments may be necessary to ensure optimum performance.

Setting the flow rate:

- Adjust the flow according to Table 1.
- The flow rate is adjusted by rotating the air flow control valve (2) and observing the flow at the pipe end.
- Water flow should be approximately between the guide lines at the outlet of the pipe.

Measuring the flow rate:

- The actual flow rates must be measured to verify flow after adjustment of the air valve and observation at the pipe end.
- Record the amount of time to fill a one liter (34 oz.) breaker or flask at the recirculation pipe end. (See Fig. 4)
- Compare the time measured to the range in Table 1.
- If necessary, readjust the air valve and collect another sample to verify the correct flow rates.

NOTE: It is important not to set the flow rate too high because it can cause excessive agitation within the first chamber (Sedimentation Chamber), which could cause excessive suspended solids to flow into the second compartment (Anaerobic Chamber). This could cause poor performance and odor problems.

BACKWASH FLOW ADJUSTMENT

The backwash operation activates at a preset schedule to prevent plugging in the bottom section of the Aeration Chamber. If there is no backwash cycle or too short of a backwash cycle, the unit's performance will be adversely affected. Likewise, if the backwash cycle is excessive, the beneficial bacteria growing on the media will be washed away and performance will be adversely affected.

Typically, the backwash cycle begins at 2:00 AM and lasts for five minutes. One hour later, another five minute backwash cycle occurs. In certain circumstances, the backwash cycle must be adjusted to compensate for differences between design flow and actual flow.

Calculate backwash ratio using the following guide. Table 3 lists the appropriate blower timer settings.

a. Ratio of actual number of gallons to the design number of gallons per day.

b. Example:
   Actual number of gallons = 320 GPD
   Design number of gallons = 450 GPD
   Ratio = 320/450 = 0.71
   With a ratio of 0.71, set backwash cycle to two times per day at 5 minutes for each cycle.

Table 3. Backwash Ratios

Ratios - calculate actual	Up to 0.4	0.4 to 1.3	1.3 and up
Backwash Frequency	1	2	2
Backwash Time Period	5 min.	5 min.	10 min.

Normally, operation of the backwash cycle and sludge transfer takes place at the same time. There are two backwash sides provided within the Aeration Chamber. Verify that the air flow is equal between the two sides during a backwash cycle. If they are not even, adjust the backwash air control valve (3) accordingly.

Set the backwash flow rate by adjusting the air flow control valve (4). Use Table 2 to determine the typical setting for each Fusion® model.

Switch from the automatic backwash cycle to manual backwash by pressing and holding the pink button on the blower control until it clicks.

Measure the actual backwash flow rate at the outlet of the sludge return pipe in the first chamber using the same procedure described under "Measuring the Flow Rate" in the Recirculation Flow Adjustment section above.

Readjust the airflow control valve (4) if necessary to obtain the proper flows.

Return the blower to the standard recirculation position.

There is a clean-out provided at the top of each air lift pump. If the flow rates are low because of possible organic build up, remove the caps and clean the pipes with a bottle brush. Replace the caps when finished.

TROUBLESHOOTING

1. Odor.

Improper operation may generate odors. Add seeding material to both Anaerobic and Aeration chambers, and adjust operational conditions such as recirculation and backwash flow rates. Check all risers and lids to ensure an airtight seal.

2. Foam formation.

Foam formation is observed in the following situations:

a) In the early stage of operation when the aerobic bacteria colony is establishing itself,
b) when an excess amount of air is supplied for aeration,
c) when the difference between ambient temperature and water temperature is great, and
d) when an excessive amount of detergent is introduced.

In most cases, foam will disappear with proper operation. Seeding may also be effective. When excessive amounts of detergent have been introduced to the system, remind the homeowner to use appropriate amounts of detergent.

3. Cloudy treated water.

✓ Check the amount of scum and sludge:
If too much scum or sludge is observed, transfer them to the first chamber and adjust recirculation flow rate as well as backwash time, frequency and duration. (See backwash flow adjustment)

✓ Check the aeration situation:
If uneven bubble generation is observed, adjust valve (1). If aeration is weak, flush the aeration pipe with air or water.

✓ Check the recirculation flow rate:
If the recirculation flow rate has increased after the last inspection the aeration pipe may be clogged. Flush the aeration pipe with air or water. If the recirculation flow rate has de creased after the last inspection, the airlift pump or recirculation pipe may be clogged. Clean them with a brush and running water.

✓ Check the color of the returning sludge from the backwash pipe:
If the color is abnormally dark, decrease the recirculation flow rate accordingly. If the TSS of the water from Anaerobic to Aeration Chamber is high, check the sludge accumulation. If the sludge accumulation reaches the upper limit, pump out the sludge. If not, backwashing the Anaerobic Chamber by using a manual backwash tool (Fig.8) may work.

4. Blower.

No Aeration:
✓ Check the electric supply.
✓ Check the electric current with a voltmeter.
✓ Check the auto stopper. If the auto stopper has shifted, change the diaphragm.

No Backwash:
✓ Check the electric current with a voltmeter.
✓ Check the timer. If the timer does not go back to normal after depressing the reset switch, replace the timer.

Not enough dispersed air:
✓ Check the diaphragm and replace it if necessary.
✓ Check for a leak in the air piping.
✓ Check the air filter and clean or replace it.
✓ Check the air piping for leaks, clogging or dislocation and fix it accordingly.

NOTES: