Wisconsin Department of Safety and Professional Services
Division of Policy Development
4822 Madison Yards Way
PO Box 8366
Madison, WI 53705

Phone: 608-266-2112
Web: http://dsps.wi.gov
Email: dsps@wisconsin.gov

Tony Evers, Governor
Dawn B. Crim, Secretary

VIRTUAL/TELECONFERENCE
PRIVATE ONSITE WASTEWATER TREATMENT SYSTEMS (POWTS)
TECHNICAL CODE ADVISORY COMMITTEE
4822 Madison Yards Way, Virtual, Madison, WI
Contact: Bradley Johnson (608) 266-2112
October 7, 2020

The following agenda describes the issues that the Committee plans to consider at the meeting. At the time of the meeting, items may be removed from the agenda. Please consult the meeting minutes for a record of the actions of the Committee.

AGENDA

9:00 A.M.

OPEN SESSION – CALL TO ORDER – ROLL CALL

A. **Adoption of Agenda (1-2)**

B. **Approval of Minutes for April 26, 2019 (3)**

C. **Administrative Matters – Discussion and Consideration**
   1. Committee, Department, and Staff Updates
   2. Committee Member Introductions
      a. Jeffrey Hammes
      b. Frederick Hegeman
      c. Daniel Keymer
      d. Robert Schmidt
      e. Todd Stair
      f. Daniel Vander Leest
      g. Eric Wellauer

D. **Technical Advisory Matters - Discussion and Consideration**
   1. Proposal for Permitting of Experimental Use of a Septic Tank Retrofit Unit **(4-34)**

E. **Public Comments**

ADJOURNMENT

****

MEETINGS AND HEARINGS ARE OPEN TO THE PUBLIC, AND MAY BE CANCELLED WITHOUT NOTICE.

Times listed for meeting items are approximate and depend on the length of discussion and voting. All meetings are held at 4822 Madison Yards Way, Madison, Wisconsin, unless otherwise noted. In order to confirm a meeting or to request a complete copy of the board's agenda, please call the listed contact person. The board may also consider materials or items filed after the transmission of this notice. Times listed for the commencement of disciplinary hearings may be changed by the examiner for the convenience of the parties. Requests for interpreters for the deaf or hard of hearing, or other accommodations, are considered upon request by contacting the Affirmative Action Officer, 608-266-2112, or the Meeting Staff at 608-266-5439.

TELECONFERENCE/VIRTUAL
POWTS TECHNICAL ADVISORY COMMITTEE
MEETING MINUTES
APRIL 26, 2019

PRESENT: Frederick Hegeman, Daniel Keymer, Robert Schmidt, Daniel Vander Leest, Eric Wellauer

STAFF: Bradley Johnson, Section Chief; Tim Vander Leest, DIS Staff; Kate Stolarzyk, Bureau Assistant; and other Department staff

Bradley Johnson, Section Chief, called the meeting to order at 9:03 a.m. A quorum of five (5) members were present.

ADOPTION OF AGENDA

MOTION: Robert Schmidt moved, seconded by Daniel Vander Leest, to adopt the agenda as published. Motion carried unanimously.

APPROVAL OF MINUTES FEBRUARY 8, 2019

MOTION: Eric Wellauer moved, seconded by Robert Schmidt, to approve the minutes of February 8, 2019 as published. Motion carried unanimously.

TECHNICAL ADVISORY MATTERS

New Eljen Mound in a Box Component Manual

MOTION: Robert Schmidt moved, seconded by Daniel Vander Leest, to approve the New Eljen Component Manual for Mound in a Box. Roll Call Vote: Daniel Keymer-yes, Robert Schmidt-yes, Daniel Vander Leest-yes, and Eric Wellauer-yes. Motion carried unanimously.

ADJOURNMENT

MOTION: Robert Schmidt moved, seconded by Daniel Vander Leest, to adjourn the meeting. Motion carried unanimously.

The meeting was adjourned at 10:32 a.m.

Proposal for Permitting of Experimental use of a Septic Tank Retrofit Unit

Wisconsin Legislature: SPS 383.27

(1) The provisions of this chapter or Ch. SPS 384 are not intended to prevent the design and use of an innovative method or concept for the treatment or dispersal of domestic wastewater which is not specifically addressed by this chapter, provided the experiment has been first approved by the department in accordance with s. SPS 384.50 (3).

(2) The department shall review a submittal of an experiment under this section with input from the technical advisory committee assembled under s. SPS 384.10 (3) (d).

(3) The protocol for a proposed experiment submitted to the department for consideration shall include all of the following:

(a) The experiment shall be supervised by a professional who has experience in small-scale wastewater treatment.

- **The professional to supervise this experiment has been identified as Charles Otis. His CV is an attachment to provide his experience in the field of small-scale wastewater treatment.**

(b) The professional shall submit a vita of training and experience relative to small-scale wastewater treatment along with the application for the experiment.

- **The CV is an attachment to provide his experience in the field of small-scale wastewater treatment. Charles is a graduate of UW Madison in Civil Environmental Engineering and a Master's graduate from the University of Stavanger in Environmental Technology. Charles worked with small scale systems for over 8 years, pilot testing various technologies related to wastewater treatment, building and running various pilot plants such as simple activated sludge plants, SBRs, MBBRs, MBRs, and chemical and physical separation techniques. He worked as a environmental R&D consultant for Aquateam/COWI in Oslo Norway and as an environmental research engineer for Microbial Discovery Group in Franklin, WI before beginning with Pulsed Burst Systems. Ancillary, Charles has been working with Ken Neu who sells and installs onsite wastewater treatment systems in the state of Wisconsin under the trademark SMART-treat.**

SPS 383.27(3)(c)(c) A proposal shall be submitted for the experiment that includes at least all the following:

1. The purpose of the experiment.

- **The purpose of this experiment will be to test the efficacy of a small MBBR unit that can be placed inside of a septic tank for the reduction of both BOD and nitrogen. Specifically, our interest is in the nitrification/denitrification of septic tank wastewater with the unit.**

2. The theory and science behind the proposed experiment including a description of the systems or processes to be used as part of the experiment.

The unit is designed to contain a media with a relatively high protected biological surface area, which will house bacteria and microorganisms. The aeration of the biomedia creates an internal circulation of media and eventually bacteria will proliferate and grow as biofilm on the media. Since the bacteria is protected internally from sloughing and does not require any solids recycle, slowly growing nitrifyers can flourish (this can take two weeks or more for a population to grow).

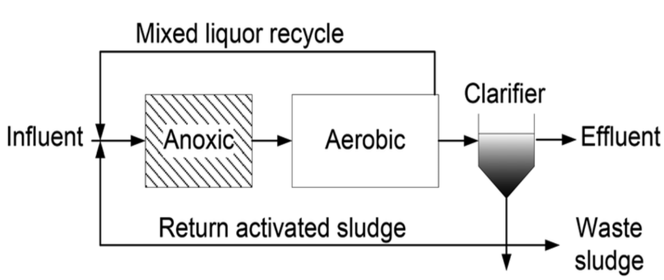
Aeration is contained within the unit and does not provide a significant amount of oxygen into the surrounding water, such that the septic tank itself (not inside the unit) is anaerobic/anoxic. Air is vented through the unit's unsubmerged top and into the headspace of the septic tank. Inside the unit, an air-driven intermittent airlift pump provides the fluid movement in and out of the unit. Each pump event evacuates roughly one gallon of water, which in turn draws in an equal amount of water into the unit to maintain equilibrium. The ability to control the duty cycle of the pump events therefore allows control of the hydraulic residence time inside of the unit. The hydraulic retention time is the key factor in the nitrification process, maintaining a longer residence time allows for the process to work.

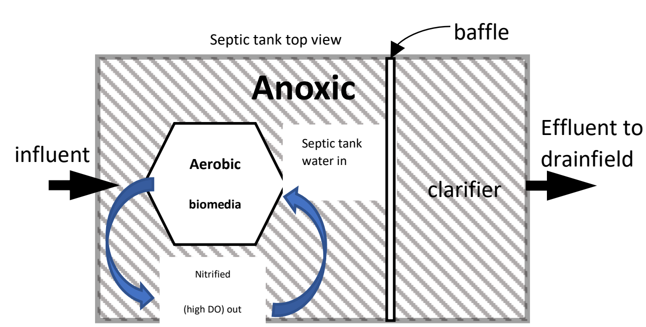
When high DO and nitrified water is evacuated into the septic tank during a pumping event, the dissolved oxygen contained in the eject water is consumed almost immediately. The septic tank itself has a high concentration of BOD/COD especially in the sludge layer – in an environment with low dissolved oxygen, the bacteria resort to using nitrate as the electron acceptor and thus reduce nitrate into N_2 gas (this process is more complicated, but simply stated).

The N_2 gas will then exit the septic tank through the headspace and venting system as it is not soluable in water. Thus, the nitrogen is removed from the liquid. Due to the nature of treating continuously and constant recycles through the unit, the nitrogen reduction is expected to happen slowly by design, and may take months to be measurably reduced. By keeping the septic tank itself low in oxygen, the high carbon environment provides an environment ideal for dentrification.

Essentially, this process takes an A/O nitrification denitrification process and folds it in on itself. The constant recycle should see an asymptotic decrease of the total nitrogen concentration over time, and necessarily BOD/TSS.

A/O nitrification/denitrification system left and proposed system on the right.





The main concern for the nitrification will be the consumption of a large amount of alkalinity. In areas with low alkalinity in the influent water, there may be a point where the nitrification decreases, thus

denitrification will then be limited. However, when denitrification occurs, it returns a portion of the alkalinity back into the water. If there is a case where alkalinity is an issue, it can be remedied by a monthly prescription to flush bicarbonate tablets or addition of oyster shells or another source into the septic tank.

3. The number of systems or components to be installed or modified as part of the experiment.

- **A minimum of 5 and maximum of 10 sites will be targeted for experimental use.**

4. The identification of the initial sites, if known, that will take part in the experiment.

- **The initial sites will be conducted in various locations in WI that have varying influent water types and ambient temperatures to provide a range of experiments. The reason for varying water types and temperatures will provide data on whether the bacterial growth will maintain levels of treatment to target a minimum value. One interest is to see how well the nitrification process will continue through the winter months.**

5. A letter of comment from the governmental unit or units where the experiment is to be conducted.

- **The governmental unit letters or approval will be held open until the individual locations have been specifically identified.**

6. The data to be collected and the method to be employed to collect the data.

- **The data to be collected will be: BOD (preferably COD for ease), TSS, TKN or TN, NO_3^-/NO_2^-, ammonia, alkalinity. Additonally, the amount of use that the septic tank gets which can be measured by access to water usage to the home. Furthermore, burst rate of the pump will be adjusted – this changes the HRT of the unit and required burst rate may vary depending on the site. With each sample taken, a spot check of DO, pH, ORP, temperature will be taken. Burst rate will be noted and adjusted.**

The samples will be collected by standard methods at various locations of the septic system to ensure that the unit is operating with no outside influence. Standard tests will be done for TSS, and reagent testing will be used for nutrient concentration analysis. DO/pH/ORP/temp will be collected with a calibrated multiparameter meter, in this case a WTW 3420.

Initial samples, prior to installation, will be taken from the tank and analyzed for the variables above as a baseline.

If there are further samples required for Wisconsin approval of the system (for setback credits), these will be taken. Please let us know which is required.

7. The duration of the proposed experiment.

- **After installation, data points will be taken roughly every 30 days for 6-8 months, samples will be taken and analyzed for the variables above. Data will be tracked, and reports will be generated quarterly. The experimental units are easily removable and can be removed once the experiment comes to a close in approximately 1 year. In the event the unit fails, the mode of failure is the septic system operates as normal with only very minor reduction in capacity (~10 gallons).**

(d) The experiment may not involve less than 5, and not more than 50 individual installations.

- **5 to 10 units shall be used for the experiment.**

(e) An experiment shall be designed to provide definitive results within 5 years from the start of the experiment.

- **The expected time to begin to see results shall be within 3-5 months and shall be concluded within 1 year from the time of installation.**

(f) An experiment on a site not previously developed shall include a contingency plan that provides for a code complying replacement POWTS, if the experiment fails to meet the required performance standards of this chapter.

- **In the event that the unit fails to perform, the failure mode of the unit is that the system reverts to the normal mode of operation of a septic tank.**

(g) If the experiment is approved, the experimenter shall execute a signed agreement with the department setting forth the obligations of the parties.

- **This can and will be supplied upon approval.**

(h) Within 6 months of the completion of the experiment, the results or conclusions shall be forwarded to the department.

- **Because of the short duration of experiment, the data shall be supplied well in advance of the 5 year limit.**

SYNERGY

RESIDENTIAL SEPTIC TANK RETROFIT

OPERATION AND MAINTENANCE MANUAL

Table of Contents

Section I
Unit Description

HOW IT WORKS

The Synergy unit is designed to be placed in an existing septic tank. The unit is connected to an air source such as an air compressor, by a hose that goes into the septic tank, typically through the tank riser. The air source connects to the Synergy unit's air manifold. The manifold splits the air into two different streams - one stream enters a specialized pump, and the other provides air to a manifold for small bubbles to provide oxygen to the interior of the unit.

Raw sewage or wastewater enters the septic tank at the inlet (influent) of the existing septic tank. Once in the tank, the solids contained in the water begin to separate. Some tanks have a baffle wall that splits the tank into two compartments. The SYNERGY units are typically mounted at the inlet side of the tank.

- The SYNERGY unit has extendable legs for the unit to operate properly. The unit must have the legs adjusted to the proper level to allow the unit to sufficiently intake fluid from the clear phase of the septic tank, discharge the fluid at the upper level, and allow air to freely escape the unit into the head space above the liquid level.

Liquid contained within the unit is constantly aerated providing the bacteria with oxygen. This aeration causes the biomedia contained within the unit to be moved around continuously, providing the bacteria living on the media to reach food and oxygen for bacterial to growth and reduce contaminants.

Liquid is drawn into the SYNERGY through the sides of the unit in the clear phase of the septic tank – the area above the lower sludge layer, and below the top scum layer. Each time the bubble generator pumps water out of the unit, water is pulled into the unit necessarily to maintain equilibrium. Sloughed biosolids and treated wastewater are drawn into the draft tube in the bottom of the container, and are ejected to the exterior of the tank through the pumping action. This can be observed as the liquid splashes out the top side of the unit, like the effect of a coffee percolator. This light splashing effect also circulates the sewage around the primary compartment of the septic tank allowing for more complete treatment of the wastewater.

OPERATIONAL DESCRIPTION

SYNERGY is a device that is inserted into a septic tank, which is installed near the inlet of the tank and can perform two basic functions:

1) Provides wastewater treatment, reducing the waste strength being discharged to the drain field and consequently reducing the stress on the drain field.

2) Reduction of nitrogen compounds. The unit is designed to reduce the nutrient nitrogen in the form of nitrate, ammonia, and more complex forms from entering the drain field and subsequently into the ground water or surrounding surface water.

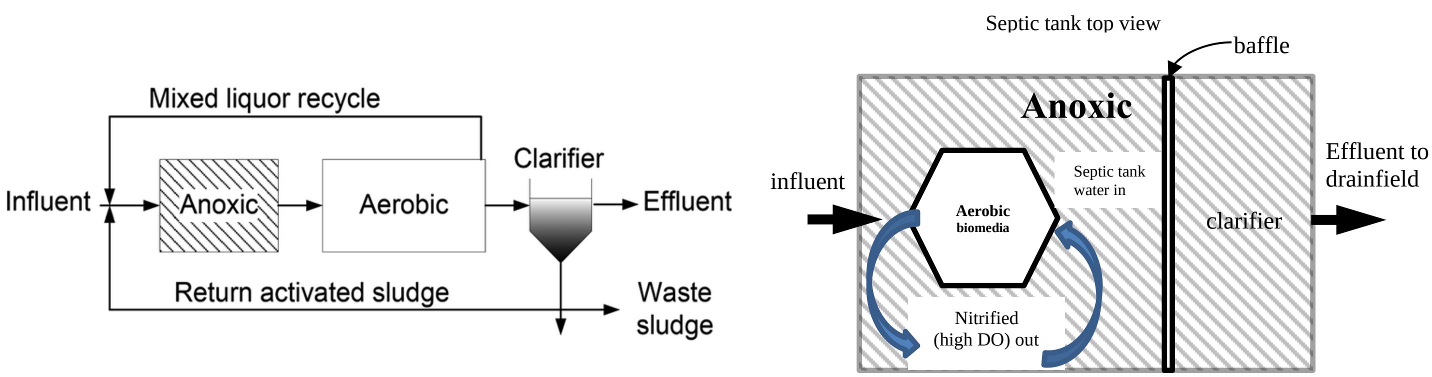
The Synergy insert is designed to contain an extremely high protected biological surface area, biomedia, which houses bacteria and microorganisms. The aeration of the biomedia creates an internal circulation of media and eventually bacteria will proliferate and grow on the media. This bacteria eats contaminants in wastewater and produces a cleaner water quality over time.

By design, slowly growing nitrifyers may grow – which can be up to two or more weeks to have a strong population. The aeration is contained within the container alone, and does not provide a significant amount of oxygen into the surrounding water since it is vented through the headspace of the unit.

A screened bubble generator provides the fluid movement in and out of the system, while containing biomedia. Each burst evacuates roughly one gallon of water through the draft tube to the upper portion of the unit, which necessarily draws in another gallon of water to retain equilibrium. This allows for a high hydraulic retention time which is required for nitrfication to occur, or the conversion of nitrogen compounds to nitrate.

When the nitrified water is evacuated into the septic tank, the dissolved oxygen is consumed almost immediately, leaving a low dissolved oxygen zone outside of the unit. The septic tank itself has a high concentration of waste, or bacterial food, espeicially in the sludge layer, and very low dissolved oxygen. In an environment with low dissolved oxygen, bacteria will resort to using nitrate as the oxygen source for respiration (in lieu of oxygen). The result is conversion of nitrate to N_2 gas. The nitrogen gas will then exit the septic tank through the headspace as it is not soluable in water. Thus, the nitrogen is removed from the liquid. Due to the nature of treating continuously and constantly recycling of wastewater through the system, nitrogen is reduced slowly by design, it may take several months to see drastic reductions.

Essentially, this process takes a well known and widely used wastewater treatment process known as A/O (Anoxic/Oxic) nitrification-denitrification process and folds it in on itself. The constant recycle and long treatment time inside of a septic tank will see an asymptotic decrease of the total nitrogen concentration over time, as well as BOD (Oxygen demand) and suspended solids.



A/O nitrification/denitrification system left and Synergy Septic insert configuration right

COMPONENTS LIST

Blower	A low power air blower for each unit installed. The blower is designed to run continuously supplying air to the SYNERGY system.
Air Supply Line	The airline delivers air to the SYNERGY unit.
Air manifold	The flexible airline and union are the final adjustable connection to the air supply line and the internal air line that delivers to the draft tube.
Synergy	The ABS container that holds the draft tube and the media.
Draft Tube	Air discharged in the draft tube, displaces liquid in the tube and forces it out the top.
Intermittent Bubble Generator	The bubble generator is the motor for pumping treated liquid and waste solids from the unit. The flowrate of air to the bubble generator determines the frequency of pumping.
Pump Riser	The bubble from the bubble generator travels through the pump riser, where the liquid above the bubble generator in the riser is evacuated on each bubble event.
MBBR	MBBR stands for moving bed bioreactor. An MBBR consists of biomedia which is aerated and agitated by small to coarse air bubbles.
Biomedia	This media provides surface area for microorganisms to attach. Submerged media are .25” square plastic high surface area plastic pieces that are approximately neutrally buoyant when cultivated by bacteria. Biomedia pellets are held in the container below the liquid level.
Container	The unit is contained within a 22 inch diameter ABS hexagon container.
Ballast	Concrete ballast is used to keep the unit secure to the location it is placed.

Section II
Operations & Maintenance

INSPECTION & MAINTENANCE

The SYNERGY unit contains a living environment that must be kept healthy to efficiently do its job. In order to do this and also meet the terms of the SYNERGY warranty, there is a minimal amount of inspection and service that needs to be regularly performed. We recommend inspecting SYNERGY system at least once every six months.

1. *Noninvasive observation*

   A. Before opening the septic tank lid, look around for any wet areas or patches of lush green grass near the tank and drain field. This may mean there is a broken pipe or a loose or damaged riser lid. Listen for a low splashing noise (prior to opening the unit)

   B. A properly operating septic system should not have an odor. If you smell an obvious odor before the lid is opened, check to make sure that the lid is tight and not damaged. If this is not the cause of the odor, the system may be biologically overloaded or the vent line may be blocked. To mitigate any such odor, proper venting is recommended.

   C. Also, listen closely for a gurgling sound - an indication that the SYNERGY unit is properly percolating effluent out the topside. If a faint gurgling sound cannot be heard through the lid, check to be sure the blower is running.

2. *Full Inspection*

   A. Open septic tank lid, you should see treated effluent splashing up and out of the top s ide of the SYNERGY unit. If the treated wastewater is not splashing, the blower may not be working properly.

   B. After lifting lid take notice immediately to see if the media are mixing within the container and liquid percolating out the draft tube.

   C. If the blower is not running, check the breakers to make sure power is being delivered to the blower.

   D. Check to be sure that the intake filter is clean and that the source of fresh air is not blocked.

3. *Check Liquid Level & Measure Dissolved Oxygen*

   A. If the blower is working properly you will next want to check the flood level in the tank. The liquid level in the tank should be at the invert of the outlet pipe.

   B. If the liquid level is more than 2” below the invert of the outlet the venting may be blocked, Investigate the venting to be sure its not blocked.

   C. If instruments are available, measure and record the Dissolved Oxygen (DO) level from effluent splashing out the draft tube. Lower DO levels (e.g., under 2.0 mg/L) is an indication that the SYNERGY unit is not performing as well as should be expected and may need cleaning. Measure the pH and Temperature; A pH below 6.0 indicates system toxicity from medication or chemicals.

4. *Measure Sludge and Scum Levels*

   A. Using a Sludge Judge or other device, measure the sludge and scum levels in the first compartment of the septic tank. The combined sludge and scum level should not occupy more than 30 % of the tank capacity.

   B. The sludge or scum levels in the first compartment should not comprise more than 30% of the working volume.

   C. If sludge or scum levels should exceed those recommended, the tank should be pumped.

5. *Inspect Media*

   A. A properly operating unit will have a small to no amount of growth clinging to the media in the container and should not be so thick that the media does not move freely. If the growth is black or hinders flow through the media, the media should be cleaned and proper air flow through the diffuser checked.

6. *Cleaning the Media*

   a. Turn off the air supply and remove SYNERGY from the septic tank.

   b. Lay SYNERGY on its side with the removable panel on the top side, then remove the side panel which holds the lift pump.

c. Mechanically agitate the media and inspect the diffusers and draft tube for blockage.

d. Wash down the media and all surfaces with a hose and jet nozzle.

e. Replace the cover and clean up the surrounding area.

f. Check the air pump for proper operation and air line for kinks and cracks. Replace if needed.

g. Return SYNERGY to its original location and restore power to the air pump.

h. Ensure SYNERGY is working properly before returning the lib on the septic tank.

TROUBLESHOOTING

Odors

- Risers or lids may be leaking.
- System may be vented through plumbing
- Venting pipe may be clogged.
- Media has excessive biological growth.
- System may be biologically overloaded or may have encountered a toxic shock.

Insufficient pumping Out the Draft Tube

- Check the liquid level in the tank. If the liquid level in the tank is between 2" or more below the bottom of the discharge/outlet hole, this may be a normal operating condition (low flow condition).
- Check to make sure the blower is running. If the blower is not running, check the breakers to make sure power is being delivered to the unit.
- Check the inlet screen to the blower. Clean if necessary.
- Check to be sure the fresh air source is not obstructed.
- If the blower is running but not pumping air into the unit, the diffusers may be plugged and need replacing or likely just a cleaning.
- Media may be clogged. Check the media is moving and if necessary, clean it.
- Check the line between the blower and the unit for leaks or breaks.
- Check the air supply valves are in the correct position.
- Check to be sure the vent line is not plugged.

Liquid Level Too High

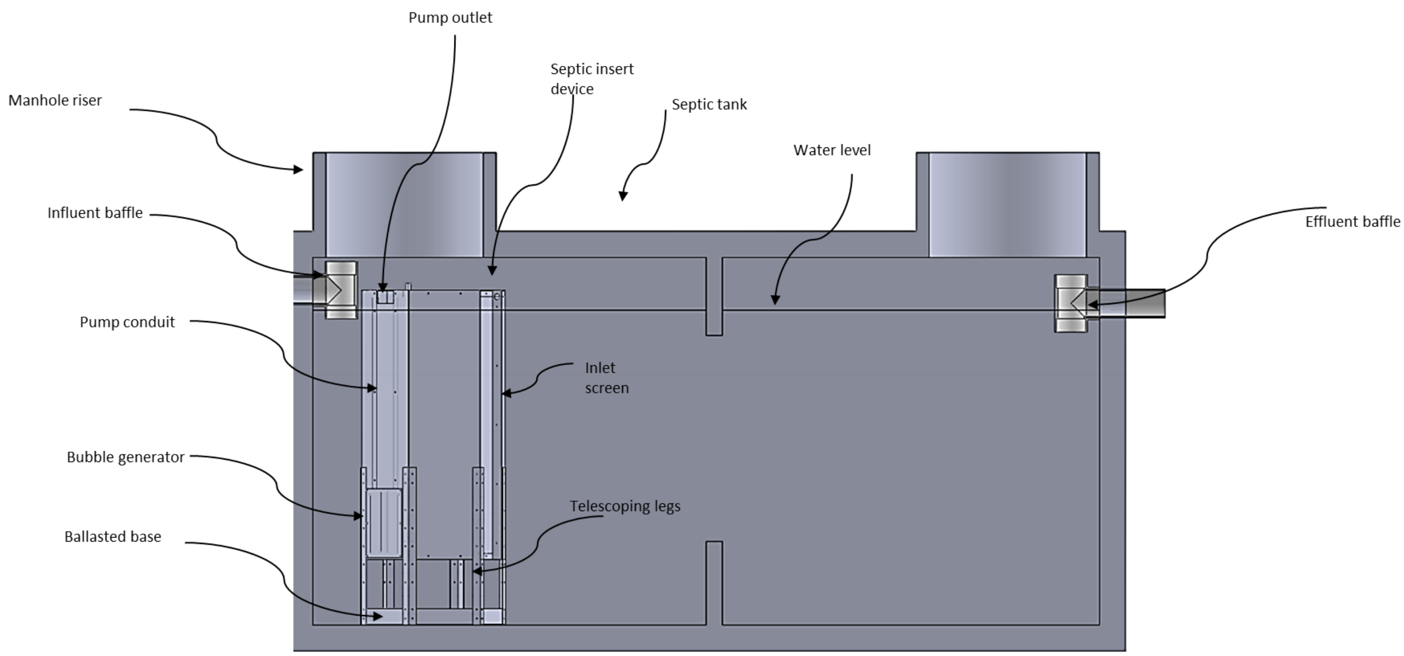
- Check for ponding in the drain field
- If the flood level is too high, check for obstructions downstream.
- Groundwater may be leaking into the tank.
- The home may be using excessive amounts of water. Check water use records or pump data if available.

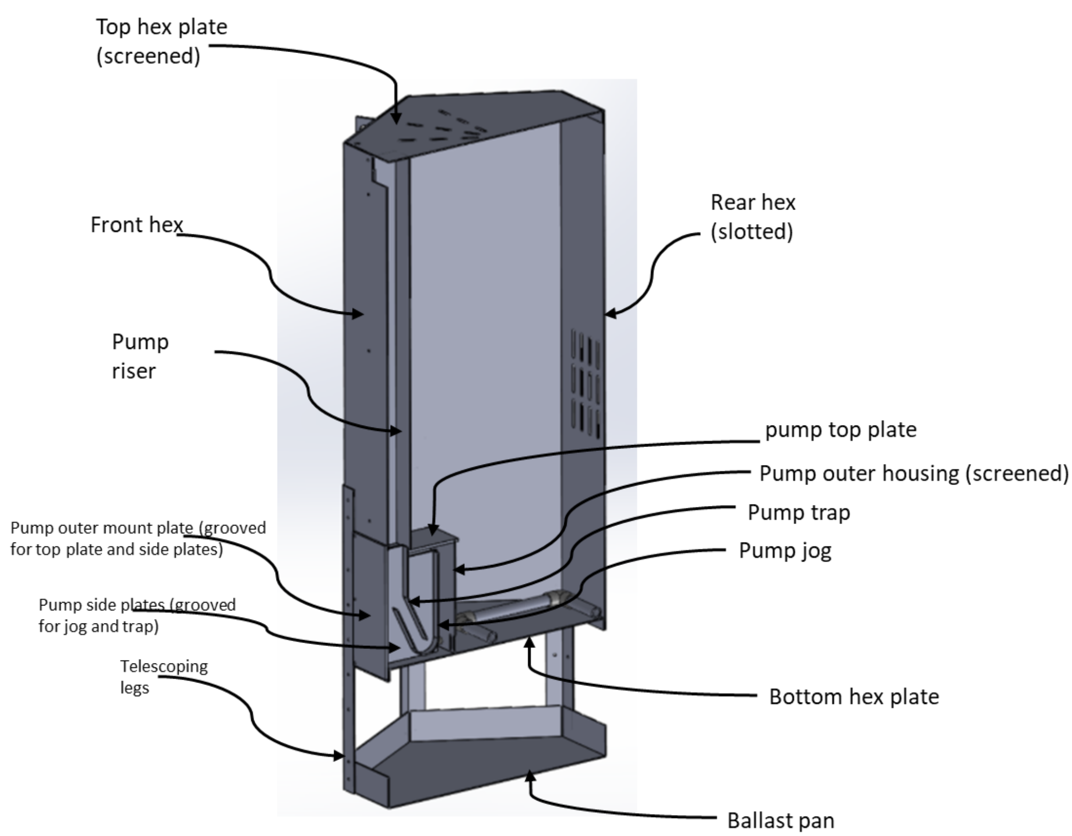
Liquid Level Too Low

- Check for venting blockage as the tank may be pressurized
- The tank may have a leak.

Appendix A Example Systems

Installation Recommendation





The Synergy unit assembled. The telescoping legs are to be riveted such that the top of the unit is 2-3" above the water level of the septic tank.

The ballast pan is to be filled with 40lb of concrete and allowed to set before installing the unit in the septic tank. The ballast keeps the unit secure inside of the tank where placed.

The unit comes preassembled with air manifolds and media. The airline from the linear diaphragm pump shall be connected to the tee union on the top of the tank. At the manifold the air is split to a smaller tube with a valve to control airflow to the bubble generator.

Installing the unit is simply a matter of lowering it into the septic tank with rope through the integrated eyelets. The unit should be placed such that the outlet of the airlift pump faces the influent baffle (where wastewater enters the tank). It may be required to temporarily remove the baffle in order to place the unit inside of the tank.

Once inside of the tank, the unit should sit with at least 2" of the unit exposed over the water level. This is to allow the biomedia room to roll around inside of the tank.

Once placed, the airflow may be turned on and the valve adjusted to control the airflow to the bubble generator. This valve shall be adjusted to provide a burst every 30 seconds to one minute.

Appendix B Blower Specifications

The Synergy septic insert uses either the XP-40 or the XP-60 linear diaphragm air pump. The pressure shall always be 1.5-2 psi underwater allowing 1.5-2 CFM of air to enter the unit.

LINEAR AIR PUMPS

HIBLOW®

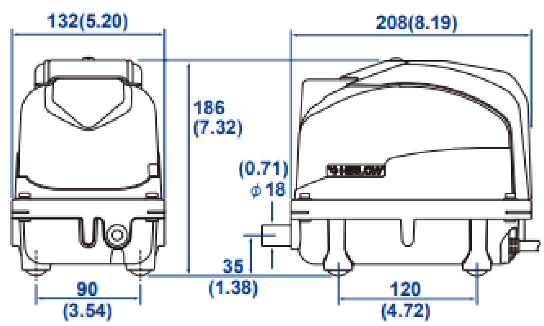
c UL US LISTED (115 volt only) CE (230 volt only)

XP-40,60,80

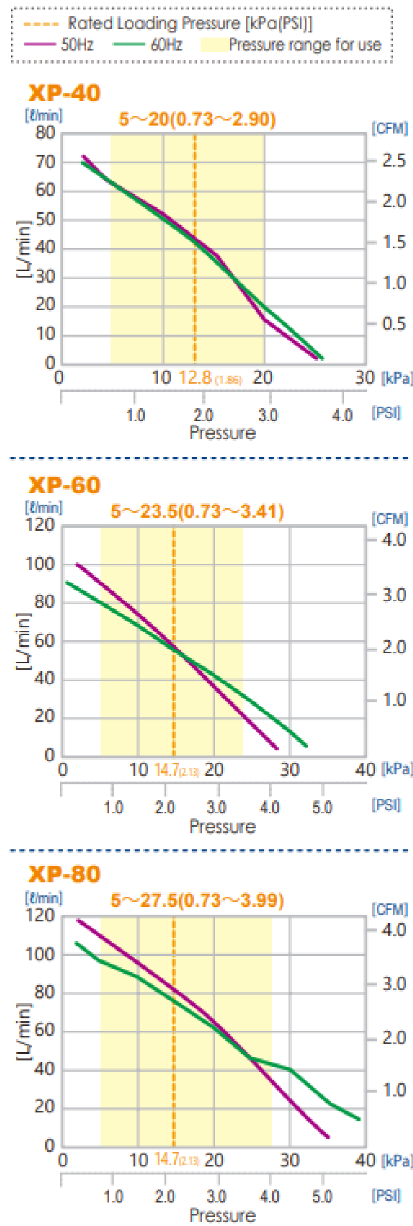
Small & medium capacity air pump

Dimensions

[Unit: mm(inch)]



Performance Curves



Specifications

		XP-40	XP-60	XP-80
Rated Voltage	V	AC100 / 120 / 230		
Power Supply Frequency	Hz	50 ⁝ 60	50 ⁝ 60	50 ⁝ 60
Rated Loading Pressure	kPa	12.8	14.7	
Airflow Volume	ℓ/min	40	60	80
Power Consumption	W	30	39	58
Noise Level	dBA	33	35	36
Weight	kg	4.1	4.3	
Pressure range for use	kPa	5~20	5~23.5	5~27.5

- Flow measured in Normal(NL/min)
- Performance data is representative of typical values.
  Specifications and performance data are subject to change without notice.
  Purchaser is responsible for determining suitability for product applications
- "HIBLOW" is a registered mark of Techno Takatsuki co., ltd.

HIBLOW USA
www.hiblow-usa.com
1300 Tefft Court, Suite 8 Saline, Michigan 48176
P: 734-429-5618 F: 734-944-5163

Appendix C Field Checklist Form

MONITORING CHECKLIST
Customer Name
Address

DATE ___________________ TIME _______________ INSPECTION ID____

DATE LAST CHECKED __________________ DAYS THIS PERIOD _____________ INSPECTED BY ________________________

ROUTINE A
PROBLEM A

CORRECTED A
NEEDS F/U A
NO F/U fi

NEEDS CORRECTION A
EMERGENCY A
NOT URGENT A

THIS FORM SHALL BE COMPLETED BY THE SYSTEM MANAGER AND SUBMITTED TO THE OWNER & MANUFACTURER UPON COMPLETION OF EACH INSPECTION.

BLOWER FAN:

FAN _______ ___________MALFUNCTION
_______OK

FAN AIR INTAKE FILTER ________________CLEAN _____________NEEDED CLEANING/WAS CLEANED

SYNERGY …

OPENING / DRAFT TUBE: _______ CORRECT: YES / NO
____”

IF NO, CHANGED TO: ________________” _______

SLUDGE LEVELS IN TANKS: ACCUM. SLUDGE FLOATING MAT COLOR

SEPTIC TANK:
1ST COMP. ________ ________ ___________________________
2ND COMP. ________" ________" ___________________________

Vent Cap Installed in the___________Outlet or_________Inlet

PH___________D.O__________Temp_________C°

EVIDENCE OF EFFLUENT SURFACING: YES / NO ____________________________

OBSERVATION OF LIQUID IN DRAINFIELD TEST PORTS: #1_________” #2 _________

OBSERVATIONS: ____

____

____

Appendix D Glossary

GLOSSARY OF TERMS

Advanced Treatment Unit-A Sand Filter, Recirculating Gravel Filter, or other device which is designed to reduce waste levels to less than 30 mg/L (BOD5› TSS & O&G) Many of these units will reduce waste strength levels to less than 10mg/L.

Aerobic - (1) A condition where free oxygen or dissolved oxygen is present. (2) Requiring or not destroyed by free oxygen. Generally referred to organisms, which use free oxygen for respiration.

Air Lilt Pump - A pump that lifts water using air. In SYNERGY systems an air lift pump is typically a pipe section with a smaller air tube in the center. The air tube delivers a large volume of air below the liquid level inside the larger pipe, which displaces the liquid in the large pipe and forces it out the top,

Anaerobic - (1) A condition where free oxygen or dissolved oxygen is not present. (2) Requiring or not destroyed by the absence of free oxygen. Generally referring to organisms, which do not require free oxygen for respiration.

ATU - Aerobic Treatment Unit - Typically a proprietary devise which uses air to treat wastewater.

Blackwater - Generally refers to flows from bathroom fixtures, i.e. toilets, sinks & urinals.

Baffle - Typically a plastic or concrete device mounted at the inlet or outlet of a tank wall intended to collect/discharge water from/to the clear zone in the tank.

BOD - Biochemical Oxygen Demand over a five-day test period. Generally refers to the amount of oxygen required by bacteria to stabilize organic matter under aerobic conditions It is determined entirely by the availability of the material in the wastewater be used as food and by the amount of oxygen utilized by the microorganisms during oxidation.

Bulking - As a sludge blanket matures it will produce gasses. As the gasses release they produce a zone of poorly settled flocculated material. This process is referred to as bulking.

Clear Zone or Phase - Typically the middle zone in the tank. Represents the clearest liquid in the tank.

Drainfield - Generally refers to a subsurface method or wastewater disposal.

Drawdown - Refers to the process of pumping a tank down a specific volume over a measured time. This information is then used to calculate a pump discharge rate (in GPM). A drawdown should be performed with the tank half full and the system components hooked up, as they would be for normal system operation.

Facultative - (1) Able to function both in the presence or absence of free oxygen. Generally refers to organisms, which can use free oxygen or bound oxygen for respiration.

Greywater - Greywater represents the flows from sources other than bathroom waste. Typically refers to waste flow from the kitchen and laundry.

GPD - Gallons per day.

GPM - Gallons per minute.

High Strength Waste - Generally refers to wastewater flows which have a BOD5 >150 mg/L, TSS> 80 mg/L and O&G >20 mg/L.

Media - Typically a plastic material used as a surface area for the growth of large microorganism population. May be trickle media (exposed to air), or submerged media (below the liquid level).

O&G - Oil and grease.

pH - An expression of the intensity of the alkaline or acidic strength of the water.

Septic Tank - Tank designed to retain solids (floatable and sinkable). Generally designed to have a 1.5 to 2 days detention time based on design flows.

TSS - Total Suspended Solids measured in mg/L or parts per million (PPM).

Dissolved Oxygen

The Dissolved Oxygen (DO) level in wastewater is an important aspect of aerobic treatment and a good tool for troubleshooting. However, DO is a very dynamic parameter and can vary considerably from system to system and from component to component. For each system you work on, you will develop a normal set of operating parameters (including DO). The following general statements are related to DO and the SYNERGY unit:

DO measurement is affected by; temperature, barometric pressure (altitude), and salinity. You must input the local altitude into the meter before you measure the DO in the wastewater.

The DO in the various SYNERGY components can be affected by; the waste strength of the influent, the aeration, the DO in the source water, and ground water infiltration.

The DO in a SYNERGY unit varies with depth, waste strength, and maturity of the organism population (food to micro-organism ratio). The DO in the SYNERGY unit generally ranges between 1 and 3 mg/L (not in the draft tube, and in mature system older than 2 months). In a properly operating SYNERGY system you will generally find that as you increase in depth the DO decreases. The DO in the sludge at the bottom of the tank may

High DO: It is possible for a SYNERGY unit to appear to have a very high DO (8-10 mg/1) and have very poor treatment occurring in the unit. If a vented lid is obstructed, the SYNERGY unit may receive poor aeration when the lids are closed. When the lid is opened, the unit appears to have excellent aeration. Since the unit has been operating without good aeration, there will be a small population of aerobic organisms. Therefore, the oxygen level will rise to near saturation levels without a hungry population of organism there to stabilize it. In addition, the effluent quality will not be as good and there is likely to be an odor present.

As previously noted the DO in different SYNERGY systems can vary. With each system you will develop a set of normal operating parameters including DO. Keeping a good record of the systems performance will help make the long term monitoring and maintenance easier.

CHARLES OTIS

Environmental Engineer

Water & wastewater, R&D, biogas, filtration, MBBR, mixing and aeration, DAF, coagulation/flocculation, field work, automation, programming, simulation, MacGyver.

DATE OF BIRTH	13 October 1982
EDUCATION	M.Sc. Environmental Technology, Universitetet i Stavanger, 2012-2013 Water/wastewater engineering, instrumental analysis, simulation, automation. B.S. Civil and Environmental Engineering, University of Wisconsin – Madison, 2007-2011 Civil engineering with major focus on environmental engineering and design, computer modelling, simulation, electrical circuits, R&D. B.A Child and Educational Psychology, University of Minnesota – Twin Cities, 2001-2005 Psychology, philosophy, writing, experimental procedure, critical analysis, statistics, metrics.
KEY QUALIFICATIONS	Fundamentals of Engineering (environmental), F.E., Simulation, automation/PLC, technical/practical skills, tool and material usage, big picture thinking.

LANGUAGE SKILLS	SPEAKING	READING	WRITING
ENGLISH	Mother tongue	Mother tongue	Mother tongue
NORSK/NORWEGIAN	Good	Very Good	Good
ESPAÑOL/SPANISH	Good	Very Good	Good

OTHER SKILLS	IT, computers, estimation, sales, purchasing, fixing nearly anything, psychology, technical writing, persuasive writing,
EMPLOYMENT RECORD	
7/2017-PRESENT	Pulsed Burst Systems Chief Technology Officer/Chief Operating Officer
1/2016-7/2017	Microbial Discovery Group Wastewater Research Engineer R&D
8/2013-12/2015	AquateamCOWI AS, Norway Consultant, R&D
6/2012-8/2012	Salsnes Filter, Norway Intern, Operations and R&D
3/2008-11/2011	Otis Painting, USA Owner, bidding/estimation, realization, billing, sales, marketing, customer service, logistics, management.

10/2010-7/2011	University of Wisconsin Water Chemistry and Technology Laboratory, USA Lab assistant, mostly working with Capacitive Deionization, building the rig, testing, etc.

WORK EXPERIENCE — United States of America, Norway, Spain, El Salvador, Poland, Portugal

VOLUNTEER EXPERIENCE — Engineers Without Borders – UW Madison.
Worked with planning, education, and installation of sewerage line from La Granja (village) to Nehapa wastewater treatment plant in El Salvador. Led teams of locals (in Spanish) to install 2.5 km of wastewater pipeline.
Documentary: https://www.youtube.com/watch?v=pfKUFZGHWWM

SELECTED PROJECTS

USA	Pulsed Burst Systems, CTO, COO Developed and patented MegaBubble Mixer (applied for non-provisional application 4-2019). Developed and patented Synergy Septic insert 8-2020, a self contained MBBR designed to nitrify and denitify a septic tank. Daily operation of business. Sales, marketing, bidding. Development and technical lead.
USA SEQUENCING BATCH REACTORS 2016-2017	MDG, Research Engineer Built and developed four 10 L sequencing batch reactors with automatic sampling, data collection, and operation. These were designed to be able to test various bacillus for the reduction of nutrients. Majority of equipment was purchased on Ebay.
USA AMPTS BIOGAS EXPERIMENTATION	MDG, Research engineer Experiments with waste sludge for the determination of increased activity with respect to bioaugmentation with bacillus.
NORWAY 2013-2015 SALSNES FILTER AS	BIA, Consultant S&B process: Sustainable treatment of wastewater by Salsnes Filter fine mesh sieves and biological processes Operations, innovation, consulting
SPAIN 2013-2014 SALSNES FILTER AS	OPERATION SWAT, Consultant Salsnes Water to Algae Treatment. Salsnes Filter Algae Harvesting Operations, innovation, consulting
NORWAY 2013-2015 SALSNES FILTER AS	FRA SLAM TIL ENERGI (SLUDGE TO ENERGY), Consultant Comparing biogas potential of primary sludge collected via Salsnes filter and conventional means Research
NORWAY 2013-2015 ENNOX OIL SOLUTIONS INC.	ENNOX OIL R&D, Consultant R&D support for the development of water treatment plants and documentation of the cleaning efficiency of technology R&D, consulting

NORWAY 2014-2015 SALSNES FILTER AS	SALSNES CEPT, Consultant Salsnes Filter Chemically Enhanced Primary Treatment R&D-project R&D, operations, consulting
POLAND 2013 POLITECHNIKA GDANSKA	BARITECH, Consultant Integrated technology for improved energy balance and reduced greenhouse gas emissions at municipal wwtp Equipment consulting
POLAND 2013-2014 INNOBALTICA SP. Z.O.O	POM-BIOGAS, Consultant Pomeranian Biogas Model Equipment consulting
2013-2015 SHELL, CONOCO PHILLIPS, STATOIL,	FASE III JIP, MILJØKONSEKVENSER AV EOR, Consultant Evaluation of the removability of EOR chemicals from water using coagulation and DAF Experimental build-out, equipment consulting
2013-2015 LIQTECH	O-WAR, Consultant Using membranes to separate various contaminants from process water Experimental build-out, equipment consulting
2013-2014 SALSNES FILTER AS	SUSTAINABLE TREATMENT OF WASTEWATER BY SALSNES FILTER, Consultant Using Salsnes Filter to treat raw wastewater and feeding two trains each of MBR and MBBR to investigate the effect of particle removal of the nitrification/denitrification process Experimental build-out, equipment expert

MEMBERSHIPS

Tekna, IWA, WEF, WERF

PUBLICATIONS

B. Rusten, V. A. Razafimanantsoa, M. A. Andriamiarinjaka, C. L. Otis and A. K. Sahu, 2015: Impact of fine mesh sieve primary treatment on nitrogen removal in moving bed biofilm reactors

B. Rusten, S. S. Rathnaweera, E. Rismyhr, A. K. Sahu, J. Ntiako, 2017: Rotating belt sieves for primary treatment, chemically enhanced primary treatment and secondary solids separation, Water Science and Technology Mar 2017

Otis, Charles Lee, 2013: From Sludge to Energy

PROFESSIONAL REFERENCES

Tor Olav Lyng, CTO, Salsnes Filter, torolav@salsnes-filter.no, +47 924 37 144

Ivar Solvi, Manager of Business Development, former CEO, Salsnes Filter, ivar@salsnes-filter.no, +47 916 65 210

Per Arne Jordbræk, CEO, Agronova AS, jordbrae@online.no, +47 900 28 300

Gang Xin PhD.CTO, WAI Environmental Solutions , **gang**@waies.no +47 994 69 080

Jan Terje Sørlie, Automation Engineer, TS Electro AS, jts@tse.no, +47 976 41 857

Anthony Dinning, PhD., Head of Section – Petroleum, AquateamCOWI AS, ajd@aquateam.no, +47 951 16 689

Line Diana Blytt, MSc., Head of Section – Environment, Aquateam COWI AS, ldb@aquateam.no, +47 918 13 179

Bjørn Rusten, Ph.D., Senior Consultant, AquateamCOWI AS, bru@aquateam.no, +1 (715) 695-3224

Ashish Sahu, Ph.D., Senior Consultant, AquateamCOWI AS, ashs@aquateam.no, +47 948 27 730

Torleiv Bilstad, Ph.D., Professor, Univerisitetet i Stavanger, torleiv.bilstad@uis.no, +47 913 27 915

Marc Anderson, Ph.D., Professor, University of Wisconsin – Madison, nanopor@wisc.edu, +1 (608) 262-2674
Mike King, PhD., CEO, Microbial Discovery Group – Franklin, WI mike.king@mdgbio.com
Ken Neu, MS, CEO Pulsed Burst Systems – Milwaukee, WI ken-ehs@juno.com +1 262-628-1300