***LOWeFLOW™-UV* Treatment System O& M and Troubleshooting Manual**
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Manufactured by:

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System Description

The *LOWeFLOW™-UV* treatment system is comprised of the *LOWeFLOW™* recirculation filter, a septic tank, recirculation/mixing tank, headworks, clarifier tank, discharge tank, Salcor 3G UV light, and control equipment.

Wastewater is collected in a standard septic tank where gross solids are settled out and primary treatment occurs. Septic tank effluent flows from the septic tank into the recirculation tank. Liquid in the recirculation tank is mixed with treated filtrate from the *LOWeFLOW™* filter. The mixed liquid is dosed to a drip tubing network called a *Coil* in the top of the *LOWeFLOW ™* filter.

Treated filtrate from the *LOWeFLOW™* filter flows back to the recirculation tank through the split flow tee. The position of the splitter valve determines the flow path of the filtrate. When the liquid level in the recirculation tank is high enough to seat the splitter valve, all of the filtrate passes into the clarifier, through the UV light, and discharge tank, otherwise, all or a portion of the returning filtrate returns to the recirculation tank.

Liquid in the discharge/clarifier tank is timed dosed to final dispersal.

Performance expectations

The typical performance of the *LOWeFLOW™-UV* system produces final effluent quality that is clear, odorless, or a slight musty smell. The *LOWeFLOW™-UV* system meets Class I wastewater treatment standards set forth in NSF/ANSI standard 40 and *Washington State Department of Health's* treatment level B. Testing performance during NSF testing was:

BOD	TSS	Fecal coliform w/UV	Turbidity
<10	**<15**	**<1000 MPN/100ml**	**<5 NTU**

Parts list

Recirculation tank:

- *LOWeFLOW*™ splitter valve (*Lowridge Onsite Technologies, LLC)*
- *LOWeFLOW*™ recirculation pump (30 gpm turbine pump)
- Floats switches, normally open (SJ Rhombus)
- Control panel (***LF2P-RF-AUX-CW****), Lowridge Onsite Technologies, LLC*)

Headworks:

- Housing
- 3/4" *Netafim*™ disc filter, 120 mesh, 130 micron (part number 25A45-120)
- 5- 1" 24 volt solenoid valves, model number 61ET1PBI-BC (made by *DOROT*)
- 3-Pressure gauges: 0-100 psi oil filled

LOWeFLOW™ filter:

- Containment vessel: a polyethylene basin.
- *Coil: Netafim* Bioline™, 0.42 gph emitters (part number 08WRAM.4-06V500).
- Media
- Child proof mesh
- Salcor UV light (supplied by others)

LOWeFLOW™ Media:

Washed rock, 3/8" to 7/8"

Basic Tools and Equipment

Cordless drill motor & misc. bits
Philips and flat head screwdrivers
Multi test meter
DO test kit (recommend ampoule type)
Litmus paper
Shovel
Channel locks
Pipe cutter
Pipe saw
Glue
Water hose and nozzle
Extension cord
Wire cutters
Wire strippers
Turkey baster
Sump pump w/adapter to garden hose
Rubbing alcohol
Dielectric grease

Spare Parts

3/4” disc filter cartridge, 120 mesh, 130 micron
1” normally closed two- way solenoid valve, Netafim™
Normally open float switches
Splice box screws
Riser lid bolts
Wire nuts for 12 gauge and 16 gauge wire

Maintenance Schedule:

During the first two years after installation there are 4 inspections: two six month and two annual inspections. The items and intervals to be inspected are as follows:

Six month inspections: At six months and 18 months after installation the inspections are cursory in nature. Components to be checked and observations recorded are: Headworks pressure, recirculation flow, forward flow, UV light, and effluent clarity.

Annual inspections: All components listed for the six month inspection plus all other items listed on the O&M inspection check list.

Routine Procedures

The most important aspects of operation and maintenance of onsite systems are the accurate observation of system performance and the complete recording of the observations. Incomplete or inaccurate data will lead to false conclusions and the corresponding maintenance activities could be un-necessary and costly. In a majority of cases, monitoring visits will result in a confirmation that the system is functioning as intended. Other than routine, preventative maintenance, very little should be required to keep the system functioning properly. In the few instances where something is actually wrong with the system and significant corrective action is needed, proper diagnosis starts with correct observation. To insure no component of the system is skipped, follow the flow of wastewater: septic tank, recirculation tank, headworks, *LOWeFLOW*™ filter, clarifier, UV light, discharge tank, disposal field. For details of how to perform the specific operations mentioned below, see appendices.

Septic tank:

Observations:

- Measure sludge and scum layers
- Odor: the contents should have a strong, musty odor, but not putrid.
- Color: scum layer should be earth tones, i.e., dark brown.

Maintenance

- When 33% to 50% of the tank is filled with solids, have the tank pumped.

Field testing procedures (recommended, not required):

- DO
- Temperature
- pH

Recirculation tank:

Observations:

- Measure sludge level.
- Check clarity of liquid: should be fairly clear with a slight to no musty smell.
- Check float switches: properly attached and functional.
- Remove splitter, sample incoming filtrate: clear and odorless. Measure flow.
- Check voltage and amperage of recirculation pump

Maintenance:

- When 6” of sludge accumulates, pump the tank.
- Check inside splice box and remove any accumulated condensation.

Field testing procedures (recommended, not required):

- DO
- Temperature
- pH
- Turbidity

Headworks:

Observations:

- Check and record pressure gauge readings.
- Check proper operation of flushing sequence.

Maintenance:

- Clean disc filter.

***LOWeFLOW*™ filter:**

Observations:

- Check surface of media: dry, no odor or ponding. Media under tubing should be moist.

Maintenance:

- Remove any vegetation growing in media

UV light:

Observations:

- Check to see if light is illumined.

Maintenance:

- Refer for Salcor maintenance instructions at end of this manual.

Discharge tank:

Observations:

- Measure sludge level.
- Check clarity of liquid: should be clear with a slight to no musty smell.
- Check float switches: properly attached and function.
- Check voltage and amperage of discharge pump

Maintenance:

- When 6” of sludge accumulates, pump the tank.
- Check inside splice box and remove any accumulated condensation.

Field testing procedures (recommended, not required):

- DO
- Temperature
- pH
- Turbidity

Trouble Shooting

This section will outline the common problems that may arise. There will follow a detailed description of how to diagnose the critical internal components. For further information contact *Lowridge Onsite Technologies, LLC, 877-476-8823.*

Problem:	**Possible causes:**	**Solutions:**
High Level in recirc tank	Recirc pump failure	Repair or replace
	High level in discharge tank	Correct discharge issue
	Splitter valve failed or missing	Replace or repair splitter valve
	Float switch short	Replace float
	Ground water infiltration	Fix leak
	UV light failed	Replace bulb
No flow through the *Coil*.	Dosing pump doesn't run.	Repair or replace pump
	Valves 1 or 2 don't open	Repair or replace valve(s)
	Disc filter plugged	Clean or replace disc cartridge
	Emitters plugged	Chlorine wash or replace
Liquid surfacing on *LOWeFLOW*	Underdrain plugged	Unplug underdrain
	Incorrect media	Replace media
	Biological overload	Identify and correct overloading
Poor effluent quality	Low recirculation ratio	Change timer settings
	Biological overloading	Identify and correct loading
	Hydraulic overloading	Check water usage in house
	Disinfection and cleaning	Modify or discontinue practice
Disc filter clogging	Flush sequence failed	Restore flushing sequence
	Tanks need servicing	Pump tanks

High Level in Recirculation Tank:

There are a number of causes for a high level in the recirculation tank: recirculation pump failure, high level in discharge tank, splitter valve malfunction, float switch short, UV light failure, and leaky tanks.

Pump failure: Check all circuit breakers to insure power is available for pump. If the recirculation pump has failed the control panel will continue to cycle. The motor contactor (M1) for the recirculation pump will periodically engage and dis-engage: the motor contactor will make a banging noise and the center of the face will depress when engaged. While the motor contactor is engaged, check the pump voltage at the control panel and then in the splice box. If voltage is good in the splice box, check wire nut connections. If pump does not run, replace pump.

Override OFF: The ***LF2P-RF-AUX-CW*** control panel series is designed to over-ride OFF the recirculation pump whenever a high level alarm condition exists for any other pump in the system. If this condition exists, check for high level in the other pump chambers within the system. If high levels exist, pull the floats so the top float hangs down for 5 minutes. The recirculation pump should cycle. If the recirculation pump cycles, then correct problem in the secondary pump chamber.

Splitter valve: Check the splitter valve. If it was not replaced after the last service a high level condition may occur. If the pump cycles and splitter is in place, pull the splitter and inspect for possible damage. Repair or replace as needed.

Failed float switch: If all other indicators test negative (no high water conditions and pumps work) a float switch may be shorting out. Use a clamp type amp meter to measure possible amperage on float switch leads inside the control panel. The float that registers current is shorting out and needs to be replaced.

UV light failure: Check UV light for proper operation. If bulb is failed, replace with new bulb. Check alarm circuit by switching off the breaker for the AUX power. The alarm siren should sound and the "push to silence" light should illuminate.

Leaky tanks: If alarms are occurring during periods of rain fall, the tanks maybe leaking. Connections at the riser/tank connects, pipe connection to tanks, and protrusions through risers could be leaking. Inspect and seal as needed.

No Flow Through *Coil*:

Pump doesn't work: See section on "**High Level Alarms"**.

Valves #1 and #2 Don't Open: See **"Disc Filter Clogging"** section.

Disc Filter Clogged: "Disc Filter Clogging" section.

Emitter Clogged: Flush Coil into septic tank with chlorine solution or replace *Coil.*

Liquid Surfacing on *LOWeFLOW:*

Underdrain Plugged: The underdrain could be plugged for three reasons: the wrong media was installed during installation, the system has been biologically overloaded, and/or there is ground water

infiltration into the system. The correction is to: 1. Identify why the underdrain clogged and 2. Remove the media and clean the underdrain, 3. repair the infiltration.

Wrong Media: Refer to the media specifications in **"Parts List"**.

Biological Overloading: Examples of the causes of biological overloading can be one or a combination of the following: heavy use of medications by the residence of the house, heavy use of disinfectants and cleaners, certain cooking habits (heavy use of cooking oils and fats), heavy use of oil based soaps and lotions. This list is not inclusive!

Besides the liquid surfacing on top of the media, symptoms of biological overloading are heavy slimes covering the gravel media. These slimes can be black or a very light color depending on the cause of the overload.

Effluent samples must be sent to a certified laboratory for analysis: biological oxidation demand (BOD), total suspended solids (TSS), and fats, oils and grease (FOG).

A professional should be consulted to determine what the cause of the over load is before lasting corrective action can be taken.

Poor Effluent Quality:

Normal effluent quality will be clear and odorless. There may be a slight color tint and a very slight musty smell. There are two places within the system where sampling can occur: 1. Remove the splitter valve and sample from the falling stream of effluent, and 2. at the inlet of the discharge tank from the falling stream of effluent. Use a clean sampling bottle obtained for an analytical laboratory for this use. If the effluent has a cloudy appearance and/or a septic smell:

- Retention time in recirculation tank may be too low
- Recirculation ratio may be too low
- Disc filter may be clogging
- The septic tank may need to be serviced.
- Excessive organic concentrations in the septic tank effluent.

The retention time of the recirculation tank can be affected by a number of causes: excessive water use or the splitter valve could have been set too low. Review water use records to determine if the design parameters of the system are being exceeded.

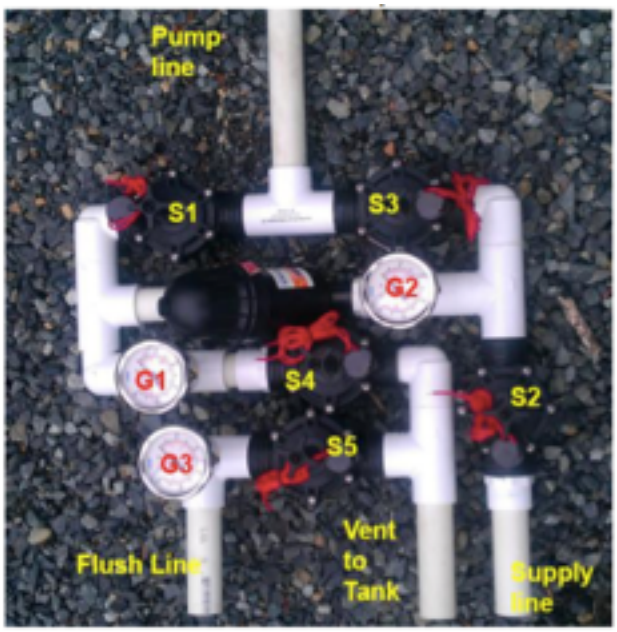
The recirculation ratio between the recirculation flow rate through the *LOWeFLOW*™ filter and the forward flow rates should be around 4:1. A plugged disc filter can significantly reduce the recirculation flow through the *LOWeFLOW*™ filter thereby reducing the recirculation ratio.

To determine if the disc filter is plugged, review the pressure gauge readings. The pressure gauges should read between 30-35 psi. There should be no more than 1-2 psi differential between gauges #1 and #2. A pressure drop between #1 and #2 indicates the disc filter is plugging and restricting flow to the *Coil*. If so, conduct a manual flush of the disc filter. If the pressures are not corrected then disassemble and replace disc cartridge with a clean unit. The disc filter could be plugging for a variety of reasons.

- If the septic tank has not been serviced adequately, excessive solids may carry-over from the septic to the recirculation tank.
- Inappropriate wastewater habits in the house may cause a biological upset in the septic tank resulting in higher organic concentrations in the septic tank effluent.
- The Headworks valves malfunction and do not properly flush the disc filter or *Coil.*

Headworks Diagnostics:

To trouble shoot the headworks, refer to the following illustration and Appendix B:



Diagnostic check of reverse flush headworks:

Position all toggle switches inside the control panel to "OFF" mode. Position pump 1 and valves 1 & 2 in "HAND" mode.

Pump runs but no pressure on any gauges. While pump is running manually open S1. If pressures on all three pressure gauges begin to rise, the solenoid for S1 needs replacing or solenoid is not being energized (possible bad wire connection). Check voltage at panel between V1 and VN, and in the headworks at the corresponding wire connections. If voltage is good (24-27 volts) the solenoid is bad.

Pump runs and gauges G1 and G2 register pressure and G3 is "0". Manually open S2. If the readings on G3 begin to rise, the solenoid for S2 needs replacing or solenoid is not being energized (or wire connection is bad). Check voltage at panel between V2 and VN, and in the headworks at the corresponding wire connections. If voltage is good (24-27 volts) solenoid is bad.

Pump runs and all gauges read the same pressure (more than 0 psi). Emitters are plugged.

Pump runs and G1 registers pressure and G2 and G3 read 0 psi (or significantly less than G1). The disc filter is plugged. Further diagnostic work is needed to determine why filter is not functioning (see below).

Disc Filter Flush Diagnostics: Open inlet of septic tank. Position pump #1 and valves 3 & 4 in "HAND" mode (all other toggles in OFF). G2 will have a higher reading than G1, and G3 will be zero and water will be entering into the inlet of the septic tank at a rapid rate. If not, follow the diagnostic steps:

Pump running with no pressure and no flow into septic tank inlet. Manually open S3. If pressure on G2 and G1 rise and water flows into septic tank inlet, S3 needs replacing or is not getting energized (possible bad wire connection). If pressures rise with no water flowing into septic tank inlet, manually open S4. If pressures drop and water flows into septic tank, both S3 and S4 are bad or both

are not getting energized. Check voltage at panel between V2 and VN, and in the headworks at the corresponding wire connections. If voltage is good (24-27 volts) one or more solenoids are bad.

***Coil* Flush Cycle Diagnosis:** Position pump #1, valves 1 & 2, and 5 in "HAND" position.

Pump runs, pressures on all gauges are close to identical and no flow into septic tank inlet. Manually open S5. If pressure on G2 and G3 drop and water flows into septic tank inlet, S5 solenoid is bad or valve is not being energized (or has a bad wiring connection). Check voltage at panel between V3 and VN, and in the headworks at the corresponding wire connections. If voltage is good (24-27 volts) solenoid is bad.

At completion of the diagnostic steps position all toggle switches in the "AUTO" position.

Appendices

Measuring *Coil* Dose Discharge Rate:

Position all Toggle switches in the "OFF" position. Switch pump 1, valves 1 & 2 to "HAND" and allow pump to run for a minute. While pump is running, measure flow for 1 minute on the flow meter. Flow for one 500 god coil should be between 5 and 5.5 gpm.

Reposition all toggle switches to the "AUTO" position.

Panel Operations

The ***LF2P-RF-AUX-CW*** control panels are 110 volt universal panels for single family *LOWeFLOW™-UV* systems. It has the capacity to operate four major outputs: recirculation pump, discharge pump, UV light, and the "*Reverse Flush"* headworks. All logic is controlled by an Siemens LOGO . The pump operation options are as follows:

- Recirc. Pump (Pump #1): is operated in a time-dose mode. Pump #1 pressurizes the *Coil* and back-flushes the disc filter and forward flushes the *Coils*. The LOGO allows the operator to determine the number of dose cycles before the disc filter flush and *Coil* flush cycles. This pump has a redundant off float switch that will shut off Pump #1 if the liquid level falls below the minimum liquid level.
- Discharge Pump (Pump #3): the discharge pump is time-dosed. The bottom float switch will operate as the "Timer On". The high level alarm float will override Pump#1 off.
- UV light: The UV power wires are connected to the AUX bus terminal positions. The dry contact wires are connected in parallel to the pump #3 high level alarm positions.

The timers have the following factory default settings:

- Recirculation-pump dosing: 3.5 minutes off, 30 seconds on. (V1_OFF, V1_ON)
- Disc filter flush: after pre-set number of dose cycles have completed, the disc filter flush "ON" cycle runs for 15 seconds. (V2_ON).
- *Coil* flush: after Disc filter flush is completed, the *Coil* flushes for 2 minutes (V1V3_ON).
- Discharge pump: field settings determined by designer.

Parameter Setting Instruction: See instruction inside panel.

Start Up Procedures:

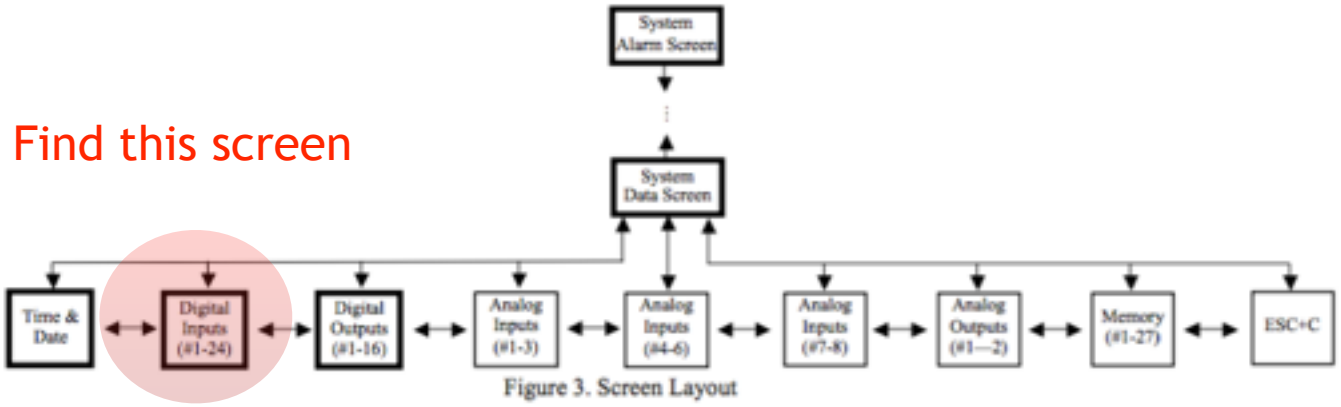
Start Up Procedures:

Prior to conducting any of the following procedures, inspect the wiring to insure the system is correctly wired. Pull all the float trees from the tanks and place across the tank openings so all the floats hang down. Now power up the system and turn all the breakers to the "ON" position and all of the toggle switches in the off position. Ensure there is enough water in tanks to conduct pump tests.

a. Test floats:

On the Siemens Logo scroll to the input screen as shown here:

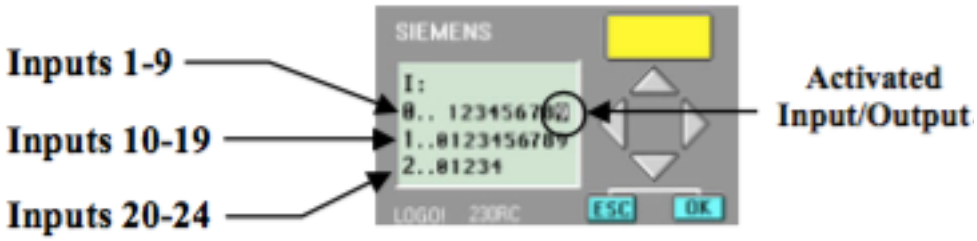
Screen Navigation:
The screens are arranged in the order shown in Figure 3 below. To move between screens, use the four arrow keys. The screens of interest are shown in bold. Additional built-in screens will be present, but do not contain useful information.



Find this screen

Figure 3. Screen Layout

The actual screen will look like this:



Input Screen

When lifting the floats check this screen to determine if the floats are wired into the correct position. When the floats are lifted a corresponding digit will be back lit. The input values are as follows:

1 = bottom recirc tank float
2 = top recirc tank float

3 = bottom discharge tank float
4 = top discharge tank float.

Test recirculation floats:

Lift top float. Input indicator “2” will back light and the alarm should sound and the beacon should illuminate.

Lift bottom float. Input indicator “1” will back light.

Test the discharge floats:

Lift top float. Input indicator “4” will back light and the alarm should sound and the beacon should illuminate.

Lift bottom float. Input indicator “3” will back light.

Place floats back into tanks.

b. Test pumps and valves:

Recirculation/Flush pump and valves:

Place valve 1 & 2 toggle switch and pump 1 toggle switch to HAND position. Pump should dose and all three pressure gauges should stabilize. No water should be flowing into septic tank.
Place valve 3 & 4 toggle switch to HAND and valves 1 & 2 toggle switch to OFF, pump #1 in HAND. Pump should run, pressures should change: gauge 2 highest pressure, gauge 1 less than 2, and gauge 3 should indicate 0 psi. Water should be flowing into septic tank very rapidly.

Place valves 1 & 2 and valve 5 in HAND position and valves 3 & 4 in OFF position, and pump 1 in HAND. Pressure on gauge 1 should indicate the highest pressure, gauge 2 less than 1, and gauge three should indicate between 1-3 psi and water should be flowing into septic tank at a moderate rate.

Position all toggle switches in the OFF position.

Discharge pump: Energize the discharge pump by switching the Pump #3 toggle switch to HAND.

Timer Settings for Recirculation Pump

The goal is to achieve a recirculation ratio of 4:1 of the average daily flow. The table below gives the timer settings for a variety of average daily flows. Note that the "ON" time is always **30 seconds**. The standard 500 gpd *Coil* has an estimated dose volume of approximately 2.5 gal/dose. Actual flow may vary.

Ave. Daily Flow	**Recirc. Flow rate**	**"ON" Time**	**"OFF" Time**
100 gpd	400 gpd	30 seconds	9.5 min
150	600	"	6.0
200	800	"	4.5
250	1000	"	3.5
300	1200	"	3.0
350	1400	"	2.5
400	1600	"	2.0
500	2000	30 seconds	1.5 min