Norweco Singulair® DN and Singulair Green® DN Wastewater Treatment Systems

Operation and Maintenance Manual

norweco®

Engineering the future of water and wastewater treatment

220 Republic Street
Norwalk, OH 44857
(419) 668-4471

DESIGN, INSTALLATION AND
SERVICE INFORMATION FOR THE
SINGULAIR® DN AND SINGULAIR GREEN® DN
NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250 and 1,500 GPD
& Singulair Green® DN 600

INTRODUCTION

The concrete Singulair® DN is a modified version of the Singulair® system, consisting of the following components:

Reinforced precast three-compartmented concrete tank or HDPE

Reinforced precast concrete anaerobic tank (for 1,000 GPD, 1,250 GPD, and 1,500 GPD systems)

Aerator(s) – The Model 206C aerator is installed in a 12" riser and the Model 225L is installed in a 6" riser.

Bio-Kinetic® System(s)

Recirculation well

Controls and timer

The system is certified for Nitrogen reduction by the Rhode Island Department of Environmental Management for design flows up to 1,500 GPD.

The Singulair Green® DN is certified to 600 GPD capacity only. It has the addition of a recirculation well with timer.

The design and the installation of the Singulair® DN and Singulair Green® DN is very similar to that of the Singulair® and Singulair Green® Model 960. The differences are explained in this guidance document.

DESIGN, INSTALLATION AND SERVICE INFORMATION

FOR THE

SINGULAIR® DN AND SINGULAIR GREEN® DN NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250, and 1,500 GPD
& Singulair Green® DN 600

TABLE OF CONTENTS

DESIGN, INSTALLATION AND
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SINGULAIR® DN AND SINGULAIR GREEN® DN
NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250 and 1,500 GPD
& Singulair Green® DN 600

SPECIAL DESIGN REQUIREMENTS

In the design of the Singulair® DN system the following special requirements are to be followed:

1. Selection of the applicable system is based on the design flows. The following is recommended:
   (a) Up to 600 GPD ..... select Singulair® DN 600 GPD
   (b) 601 to 800 GPD ..... select Singulair® DN 750 GPD
   (c) 801 to 1,000 GPD ..... select Singulair® DN 1,000 GPD
   (d) 1,001 to 1,250 GPD ..... select Singulair® DN 1,250 GPD
   (e) 1,251 to 1,500 GPD ..... select Singulair® DN 1,500 GPD
   (f) Up to 600 GPD ..... select Singulair Green® DN 600 GPD
2. The drop in invert elevations between the inlet and the outlet of the Singulair® tank is always 4", irrespective of the system size.
3. Anaerobic tank is required for the 1,000 GPD, the 1,250 GPD and for the 1,500 GPD systems. See system diagrams.
4. A recirculation well is required immediately downstream from the Singulair® treatment system.
5. The electrical components include a running time clock, to be wired as indicated on the wiring diagrams.
6. A 40% leach field area reduction is allowed for the Singulair® DN system. See the Certifications for further information.

Note: Providing extra capacity in the system is not recommended. The Singulair® DN will operate better when slightly overloaded than significantly under loaded.

System diagrams and technical information are available from Norweco, Inc. or customerservice@norweco.com.

DESIGN, INSTALLATION AND
SERVICE INFORMATION FOR THE
SINGULAIR® DN AND SINGULAIR GREEN® DN
NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250 and 1,500 GPD
& Singulair Green® DN 600

INSTRUCTIONS TO INSTALLERS

(A) Responsibilities

Installer:

All excavation and backfill
Grading and leveling pad installation (if required)
Installation of all piping and risers as detailed below:

1. Install standard T baffle on the inlet wall of the first chamber of the Singulair® tank. (concrete only)
2. Install a modified T baffle (14" deep and 10" above flow line into the cast-in flange on the outlet wall of the first chamber. (concrete only)
3. Install the recirculation well and T baffle
4. Install the electronic control panel and time clock, wiring and conduits
5. Install 1" flexible conduit from the recirculation well to the inlet riser (or to the alternate location).
6. Provide approximately 10 feet of 3/8" clear, flexible recirculation line.

Precaster:

Tank and riser delivery
Setting of tank in the prepared excavation

Licensed Distributor:

Treatment system equipment:

1. Aerator(s)
2. Bio-Kinetic® filter(s)
3. Control panel and time clock
4. Recirculation well and pump
5. Installation of aerator(s) and filter(s)
6. Installation of recirculation pump
7. Green tank and components (if Green installation)

System start-up and certification of completion

(B) Instructions to Installer:

The precaster will deliver but not install the access risers and covers that are required for the Singulair® DN. The Installer is required to perform the following work for the proper installation of the system, in strict compliance with these instructions:

1. Install the small diameter riser(s) with tapered end down and seal it with Conseal CS-102B, or approved equal, to the top of the tank. Complete the electrical work.
2. Install the large diameter riser(s) over the holes of the third chamber and seal it with Conseal CS-102B, or approved equal, to the top of the tank.
3. Install immediately downstream from the tank the PVC or PolyLok recirculation well. The ground must be prepared to the correct elevation and the bottom of the excavation compacted. The well shall be set level in all directions. The interconnection between the recirculation well and the first chamber of the Singulair® tank shall be 1" conduit with a downward slope to the riser on top of the chamber.
4. Install the T baffles in the recirculation well.
5. Do not backfill the excavation above the top of the Singulair® tank unless approved by licensed distributor field technician.
6. Complete all piping from the building and to the D-box, fill the Singulair® tank with clean water. Check for leaks (if any found, notify the precaster for repair). Note that licensed distributor will not install the aerator(s) and filter(s) unless the tank is full.
7. Green tanks are delivered with components in the tank.

(C) Electrician:

The electrical work is to be completed in accordance with the applicable codes by a licensed electrician. The requirements are the following:

1. The electrician shall run two (2) 12 gauge power cords in conduit from the control panel supplied by licensed distributor, through the hour meter to the aerator and the recirculation well. A 20A breaker is to be used in the main panel in the building.
2. One cable terminates in the riser above the middle chamber with the watertight electrical plug supplied by licensed distributor. Leave approximately 12" to 18" of cable within the riser.
3. The second cable terminates in the recirculation well with an outdoor rated outlet with cover.
4. Ensure that both the aerator plug and the recirculation outlet are powered for the installation of the aerator and recirculation pump.
5. Wiring diagrams are included in the control panels.

(D) General Notes:

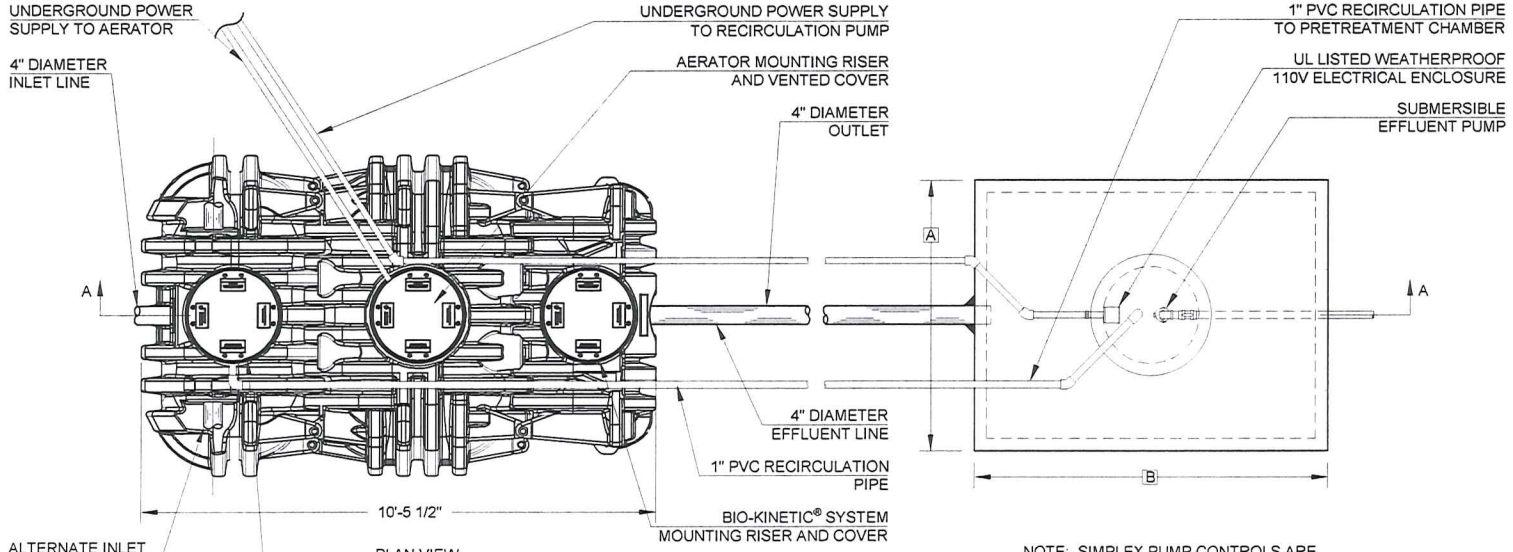
1. The difference in elevation between the inlet invert and the outlet invert of the Singulair® tank is always 4".
2. Maintenance considerations require easy access to the risers and covers. Locate the Singulair® so as not to make service unduly difficult. DO NOT locate a Singulair® under decks with inadequate space for service work. Provide an outside faucet in the near vicinity of the tank.
3. Locate the electronic controls outside the building in the near vicinity of the Singulair®. The location should always be accessible to maintenance personnel and visible/audible for the home owner.
4. For tank dimensions and for other components refer to the design drawings and to the diagrams included with the installation instructions.
5. Please call licensed distributor for system activation at least one (1) day in advance.

(E) Final check and startup:

The responsibility of licensed distributor for final check and start-up is limited to the components the company supplies. Specifically, the following is checked and certified by licensed distributor:

1. The installation of the aerator(s) and filter(s)
2. The installation of the recirculation well and equipment
3. Recirculation lines
4. Setting and testing recirculation rates
5. Setting and checking aerator run time
6. Completeness of the installation

After the final check, the system is activated and the required documentation is provided.



PLAN VIEW

NOTE: SIMPLEX PUMP CONTROLS ARE REMOTELY LOCATED AND REQUIRE A DEDICATED CIRCUIT BREAKER. PUMP SIZE AND TYPE DEPENDS ON TOTAL DYNAMIC HEAD REQUIREMENTS.

GENERAL NOTES:

① MUST BE SERVICED BY FACTORY TRAINED PERSONNEL.

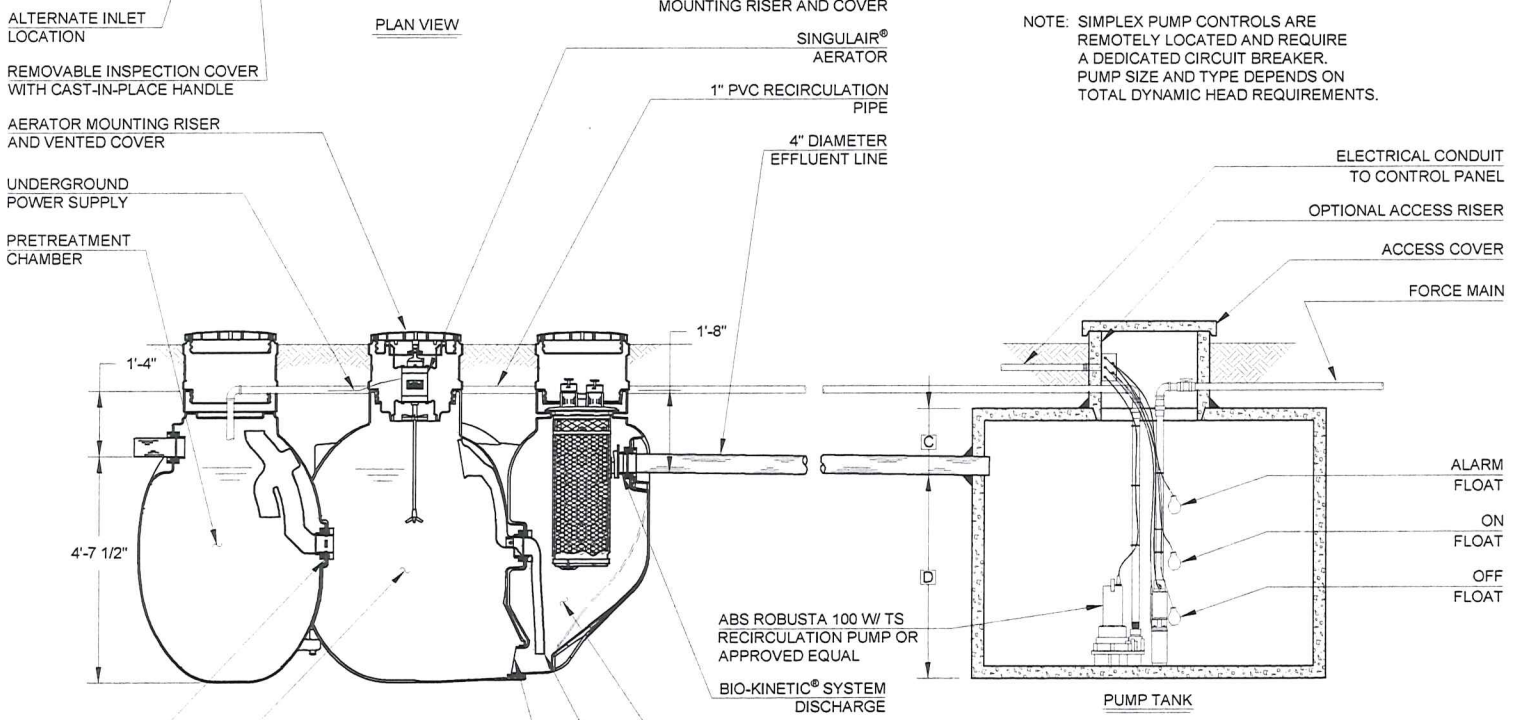
② SINGULAIR GREEN SYSTEMS CANNOT BE LOCATED IN PAVED AREAS SUBJECT TO HIGH LOADING.

③ ALL RISERS AND COVERS MUST BE AT GRADE AND ACCESSIBLE FOR SERVICE.

④ SINGULAIR GREEN HDPE TANKS MEET ALL RIDEM AND MADEP REQUIREMENTS.

⑤ FOR DEEPER THAN NORMAL INSTALLATIONS, CONTACT NORWECO FOR DETAILS.

⑥ FOR CONDITIONS WITH HIGH WATER TABLE, BOUYANCY COMPUTATIONS ARE AVAILABLE FROM NORWECO UPON REQUEST.



SECTION A-A

PUMP TANK

NOTE: SOME CRITICAL DIMENSIONS ARE INTENTIONALLY LEFT BLANK TO BE FILLED IN PER INDIVIDUAL JOB SITE SPECIFICATIONS. TYPICAL PUMP TANK SHOWN. ACTUAL CONFIGURATION MAY VARY.

NOTE: RATED CAPACITY: 500/600 GALLONS PER DAY.

PROJECT ENGINEER'S APPROVAL:
I (WE) HEREBY CERTIFY THAT THIS DRAWING HAS BEEN CHECKED AND IS APPROVED FOR USE IN CONFORMITY WITH THE CONTRACT DOCUMENTS.

DATE: _____

NAME: _____

CONTRACTOR'S CERTIFICATION:
I (WE) HEREBY CERTIFY THAT THIS DRAWING HAS BEEN CHECKED AND IS APPROVED FOR USE IN CONFORMITY WITH THE CONTRACT DOCUMENTS.

DATE: _____

NAME: _____

CRITICAL DIMENSIONS

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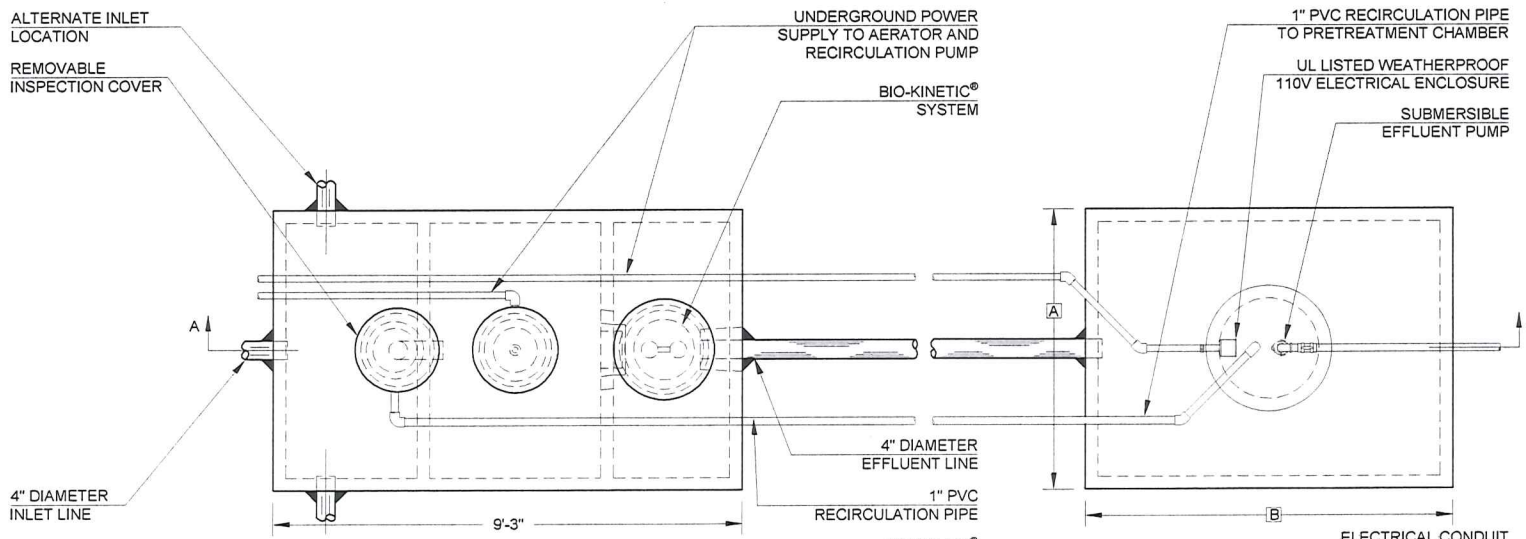
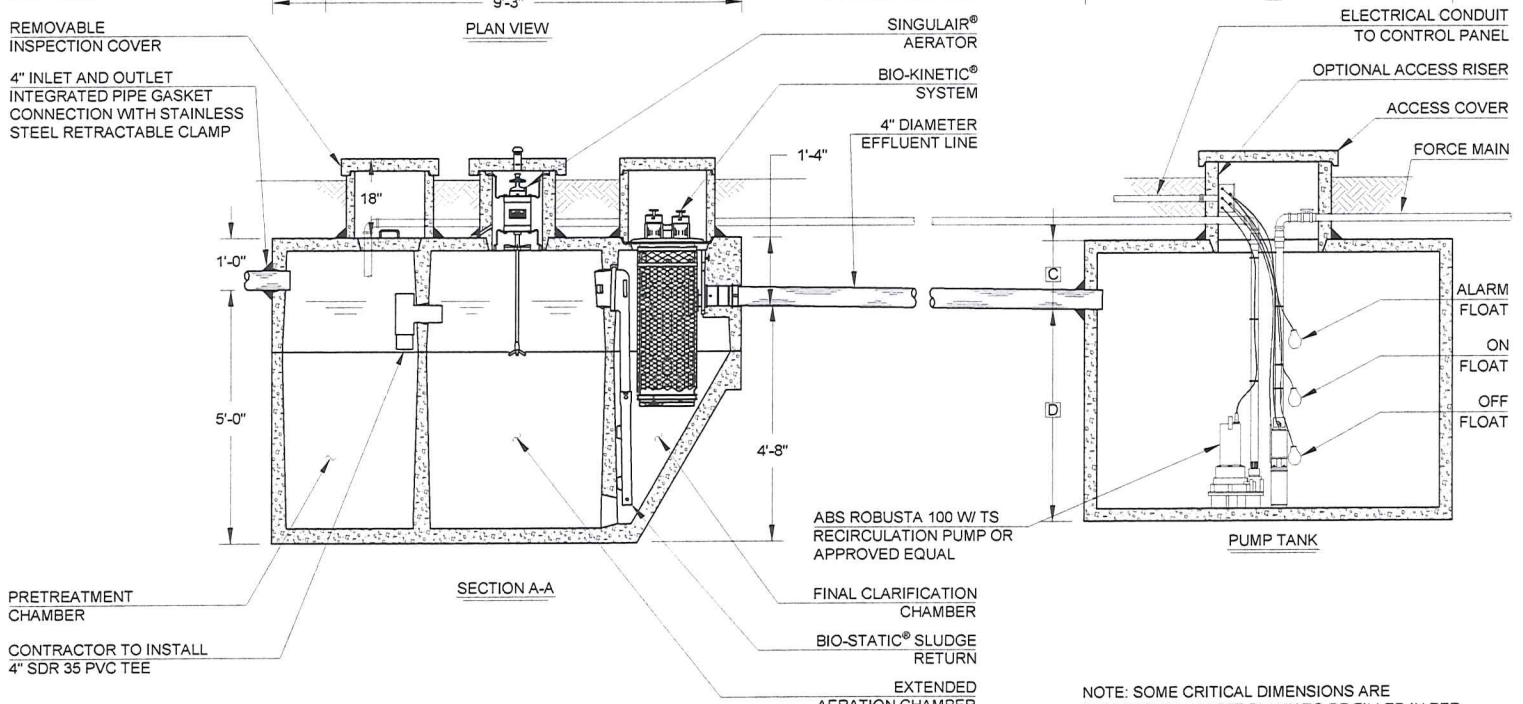
SINGULAIR GREEN® DN 600 GPD DENITRIFICATION WASTEWATER TREATMENT SYSTEM WITH PUMP TANK

REVISION DATE	04-11-2017
REVISION	A
DRAWN BY	NPD
APPROVED BY	JMM
DATE	03-22-2017
SCALE	NTS
DRAWING NO.	PC-5-7172





NOTE: SIMPLEX CONTROLS ARE REMOTELY LOCATED AND REQUIRE A DEDICATED CIRCUIT BREAKER. PUMP SIZE AND TYPE DEPENDS ON TOTAL DYNAMIC HEAD REQUIREMENTS.

NOTE: SOME CRITICAL DIMENSIONS ARE INTENTIONALLY LEFT BLANK TO BE FILLED IN PER INDIVIDUAL JOB SITE SPECIFICATIONS.

NOTE: TYPICAL PUMP TANK SHOWN. ACTUAL CONFIGURATION MAY VARY.

NOTE: RATED CAPACITY: 500/600 GALLONS PER DAY.

GENERAL NOTES:

1. MUST BE SERVICED BY FACTORY TRAINED PERSONNEL.
2. THE RECIRCULATION TANK IS SHOWN WITH A 24" x 48" BASIN. THIS CAN BE EXTENDED ON SITE CONDITIONS.
3. SINGULAIR SYSTEMS UTILIZING CONCRETE TANKAGE MAY BE LOCATED IN PAVED AREAS SUBJECT TO HIGH LOADING IF APPROPRIATELY DESIGNED.
4. ALL RISERS AND COVERS MUST BE AT GRADE AND ACCESSIBLE FOR SERVICE.
5. CONCRETE TANKS MEET ASTM STANDARD SPECIFICATIONS FOR PRECAST CONCRETE SEPTIC TANKS, C-1227-09.
6. FOR DEEPER THAN NORMAL INSTALLATIONS, CONTACT NORWECO FOR DETAILS.

PROJECT ENGINEER'S APPROVAL:
I (WE) HEREBY CERTIFY THAT THIS DRAWING HAS BEEN CHECKED AND IS APPROVED FOR USE IN CONFORMITY WITH THE CONTRACT DOCUMENTS.

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CRITICAL DIMENSIONS

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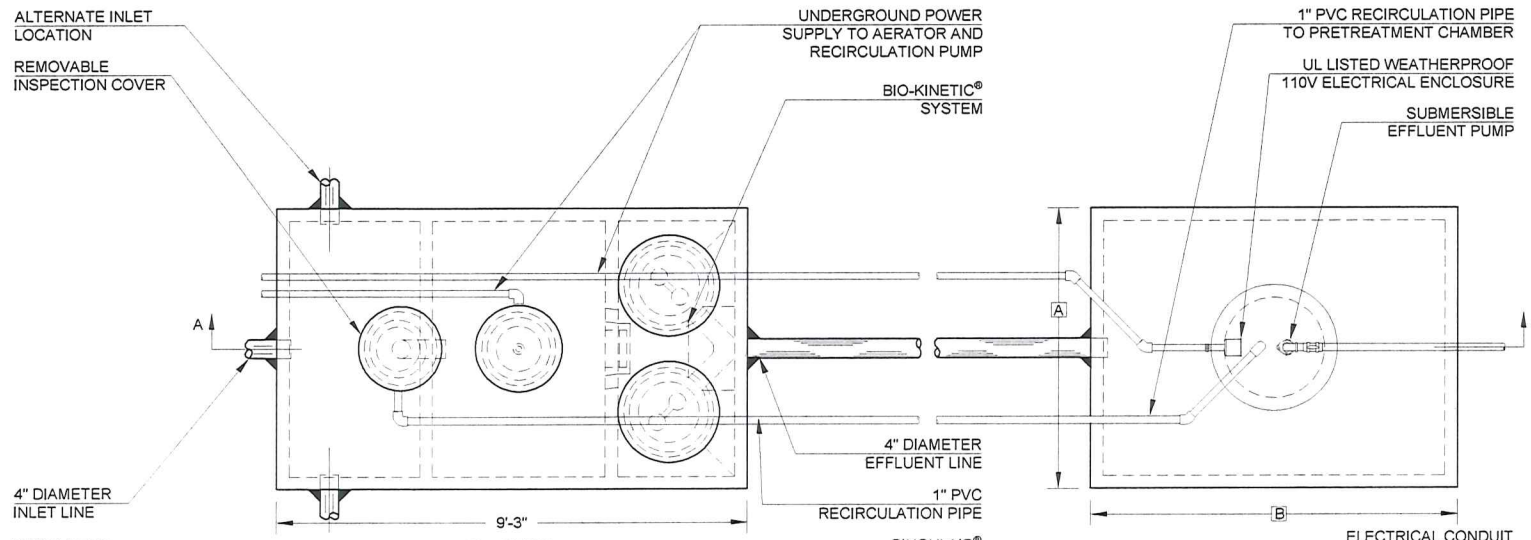
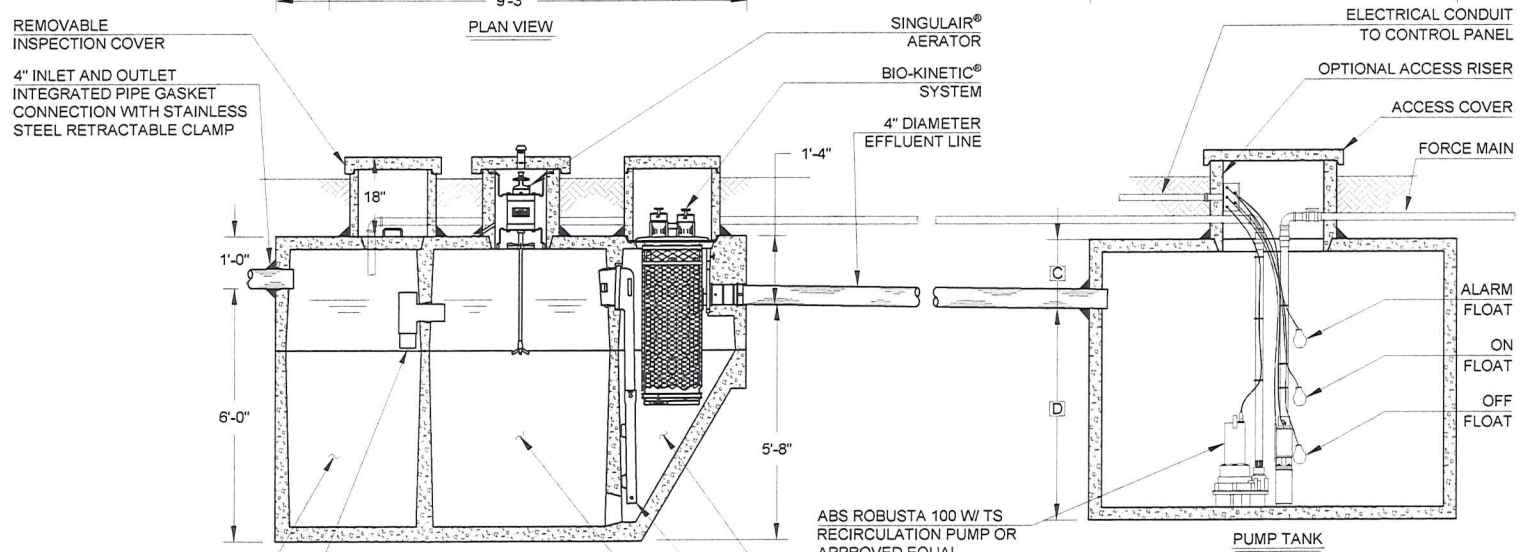
SINGULAIR® DN
600 GPD DENITRIFICATION WASTEWATER TREATMENT SYSTEM WITH PUMP TANK

REVISED TO	04-11-2017
VERSION	A
DRAWN BY	NPD
CHECKED BY	JMM
DATE	03-22-2017
SCALE	NTS
DRAWING NO.	PC-5-7173





NOTE: SIMPLEX CONTROLS ARE REMOTELY LOCATED AND REQUIRE A DEDICATED CIRCUIT BREAKER. PUMP SIZE AND TYPE DEPENDS ON TOTAL DYNAMIC HEAD REQUIREMENTS.

NOTE: SOME CRITICAL DIMENSIONS ARE INTENTIONALLY LEFT BLANK TO BE FILLED IN PER INDIVIDUAL JOB SITE SPECIFICATIONS.

NOTE: TYPICAL PUMP TANK SHOWN. ACTUAL CONFIGURATION MAY VARY.

NOTE: RATED CAPACITY: 750/800 GALLONS PER DAY.

GENERAL NOTES:

1. MUST BE SERVICED BY FACTORY TRAINED PERSONNEL.
2. THE RECIRCULATION TANK IS SHOWN WITH A 24" x 48" BASIN. THIS CAN BE EXTENDED ON SITE CONDITIONS.
3. SINGULAIR SYSTEMS UTILIZING CONCRETE TANKAGE MAY BE LOCATED IN PAVED AREAS SUBJECT TO HIGH LOADING IF APPROPRIATELY DESIGNED.
4. ALL RISERS AND COVERS MUST BE AT GRADE AND ACCESSIBLE FOR SERVICE.
5. CONCRETE TANKS MEET ASTM STANDARD SPECIFICATIONS FOR PRECAST CONCRETE SEPTIC TANKS, C-1227-09.
6. FOR DEEPER THAN NORMAL INSTALLATIONS, CONTACT NORWECO FOR DETAILS.

PROJECT ENGINEER'S APPROVAL:
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CRITICAL DIMENSIONS

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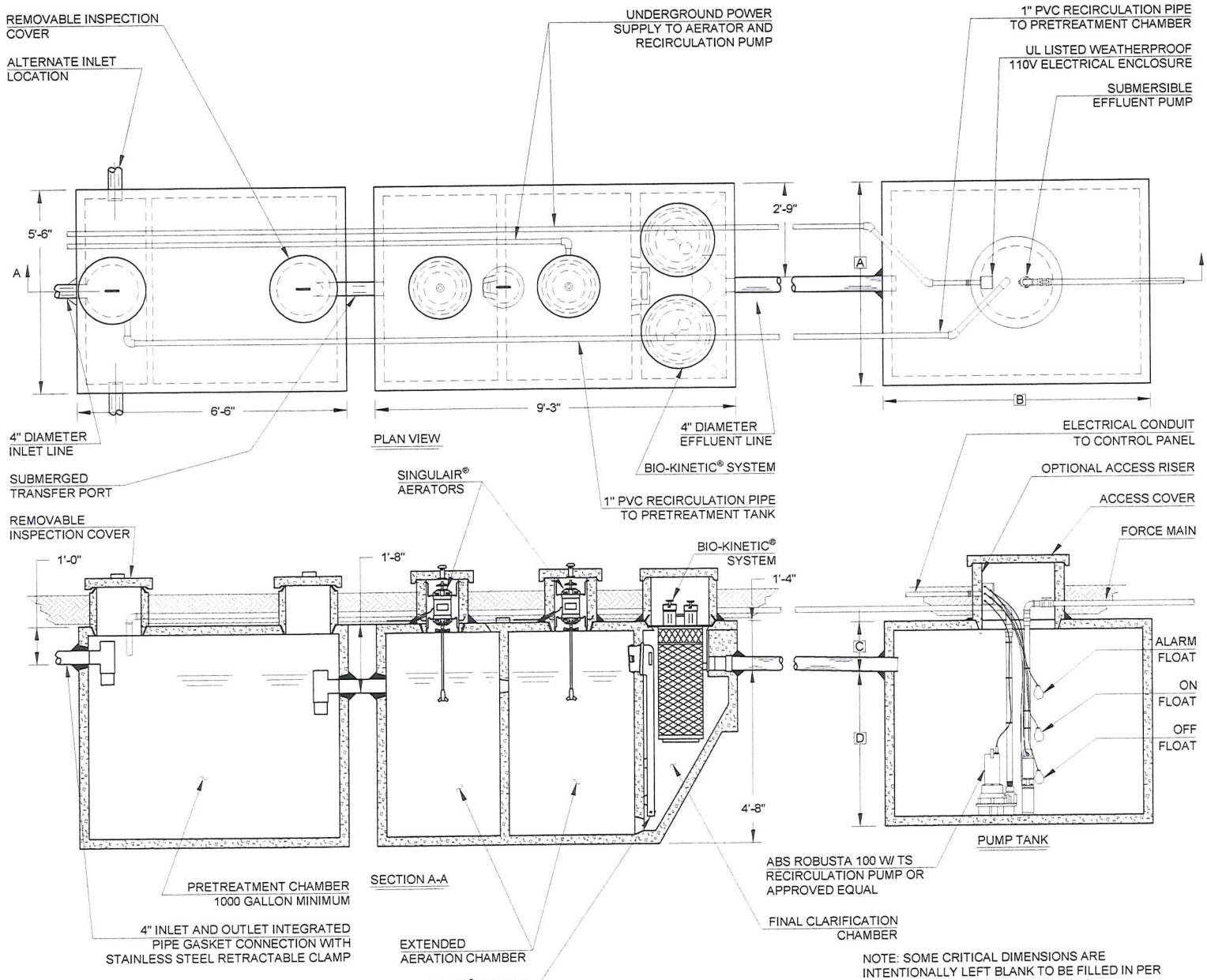
SINGULAIR® DN
750 GPD DENITRIFICATION
WASTEWATER
TREATMENT SYSTEM
WITH PUMP TANK

DRAWN BY:	NPD
APPROVED BY:	JMM
DATE:	04-11-2017
SCALE:	NTS
DRAWING NO.:	PC-5-7174



NOTE: PRETREATMENT CHAMBER MINIMUM REQUIREMENTS SHALL BE: 1000 GALLONS CAPACITY, 15 GALLONS PER INCH OF LIQUID LEVEL AND 12 INCHES OF FREEBOARD.

NOTE: SIMPLEX CONTROLS ARE REMOTELY LOCATED AND REQUIRE A DEDICATED CIRCUIT BREAKER. PUMP SIZE AND TYPE DEPENDS ON TOTAL DYNAMIC HEAD REQUIREMENTS.

NOTE: SOME CRITICAL DIMENSIONS ARE INTENTIONALLY LEFT BLANK TO BE FILLED IN PER INDIVIDUAL JOB SITE SPECIFICATIONS.

NOTE: TYPICAL PUMP TANK SHOWN. ACTUAL CONFIGURATION MAY VARY.

NOTE: RATED CAPACITY: 1000 GALLONS PER DAY.

GENERAL NOTES:

1. MUST BE SERVICED BY FACTORY TRAINED PERSONNEL.
2. SINGULAIR SYSTEMS UTILIZING CONCRETE TANKAGE MAY BE LOCATED IN PAVED AREAS SUBJECT TO HIGH LOADING IF APPROPRIATELY DESIGNED.
3. ALL RISERS AND COVERS MUST BE AT GRADE AND ACCESSIBLE FOR SERVICE.
4. CONCRETE TANKS MEET ASTM STANDARD SPECIFICATIONS FOR PRECAST CONCRETE SEPTIC TANKS, C-1227-09.
5. FOR DEEPER THAN NORMAL INSTALLATIONS, CONTACT NORWECO FOR DETAILS.
6. SUBJECT TO APPROVAL, THE PRETREATMENT TANK DIMENSIONS MAY BE DIFFERENT FROM WHAT IS SHOWN, BUT THE TANK CAPACTIY MUST BE MINIMUM 1000 GALLONS 4" BELOW THE INLET INVERT. THE INTERCONNECTION BETWEEN TANKS MUST BE BELOW THE FLOW LINE (SUBMERGED).

PROJECT ENGINEER'S APPROVAL:
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CRITICAL DIMENSIONS

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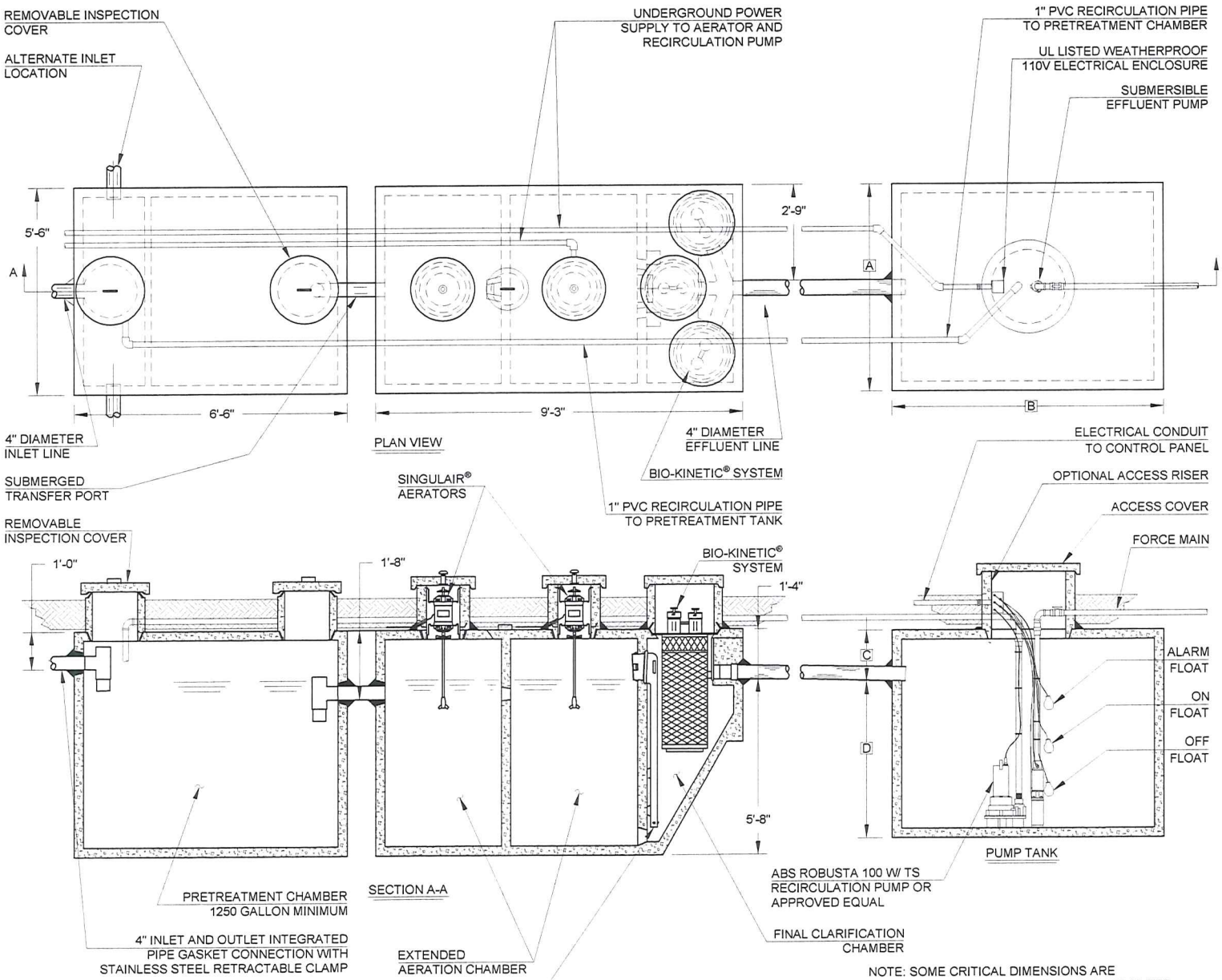
SINGULAIR® DN 1000 GPD DENITRIFICATION WASTEWATER TREATMENT SYSTEM WITH PUMP TANK

DRAWN BY	NPD
APPROVED BY	JMM
DATE	04-11-2017
SCALE	NTS
DRAWING NO.	PC-5-7175



NOTE: PRETREATMENT CHAMBER MINIMUM REQUIREMENTS SHALL BE: 1250 GALLONS CAPACITY, 16 GALLONS PER INCH OF LIQUID LEVEL AND 12 INCHES OF FREEBOARD.

NOTE: SIMPLEX CONTROLS ARE REMOTELY LOCATED AND REQUIRE A DEDICATED CIRCUIT BREAKER. PUMP SIZE AND TYPE DEPENDS ON TOTAL DYNAMIC HEAD REQUIREMENTS.

NOTE: SOME CRITICAL DIMENSIONS ARE INTENTIONALLY LEFT BLANK TO BE FILLED IN PER INDIVIDUAL JOB SITE SPECIFICATIONS.

NOTE: TYPICAL PUMP TANK SHOWN. ACTUAL CONFIGURATION MAY VARY.

NOTE: RATED CAPACITY: 1250 GALLONS PER DAY.

GENERAL NOTES:

1. MUST BE SERVICED BY FACTORY TRAINED PERSONNEL.
2. SINGULAIR SYSTEMS UTILIZING CONCRETE TANKAGE MAY BE LOCATED IN PAVED AREAS SUBJECT TO HIGH LOADING IF APPROPRIATELY DESIGNED.
3. ALL RISERS AND COVERS MUST BE AT GRADE AND ACCESSIBLE FOR SERVICE.
4. CONCRETE TANKS MEET ASTM STANDARD SPECIFICATIONS FOR PRECAST CONCRETE SEPTIC TANKS, C-1227-09.
5. FOR DEEPER THAN NORMAL INSTALLATIONS, CONTACT NORWECO FOR DETAILS.
6. SUBJECT TO APPROVAL, THE PRETREATMENT TANK DIMENSIONS MAY BE DIFFERENT FROM WHAT IS SHOWN, BUT THE TANK CAPACTIY MUST BE MINIMUM 1250 GALLONS 4" BELOW THE INLET INVERT. THE INTERCONNECTION BETWEEN TANKS MUST BE BELOW THE FLOW LINE (SUBMERGED).

PROJECT ENGINEER'S APPROVAL:
I (WE) HEREBY CERTIFY THAT THIS DRAWING HAS BEEN CHECKED AND IS APPROVED FOR USE IN CONFORMITY WITH THE CONTRACT DOCUMENTS.

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NAME: _____

CONTRACTOR'S CERTIFICATION:
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DATE: _____

NAME: _____

CRITICAL DIMENSIONS

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SINGULAIR® DN 1250 GPD DENITRIFICATION WASTEWATER TREATMENT SYSTEM WITH PUMP TANK

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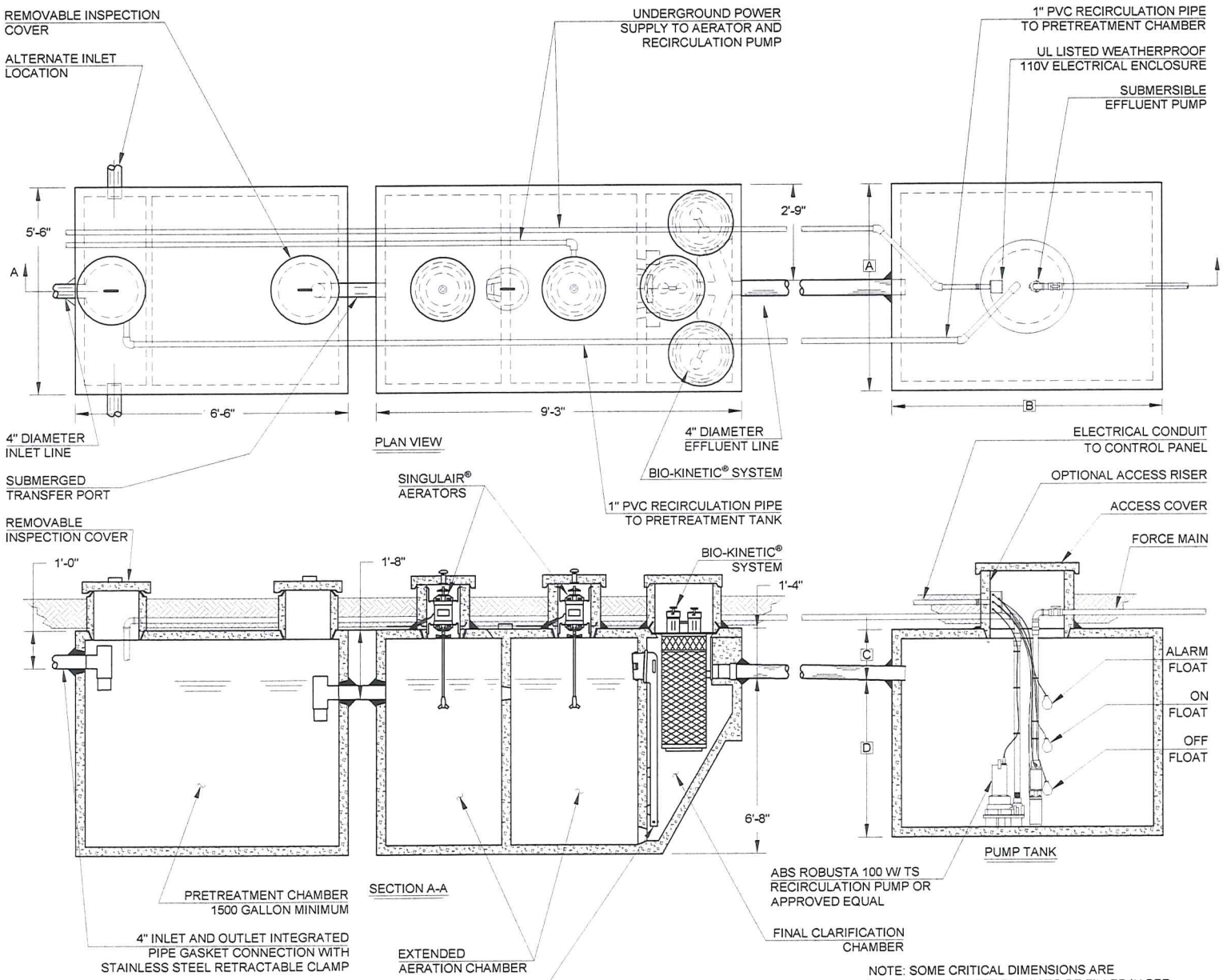
DRAWN BY:	NPD
APPROVED BY:	JMM
DATE:	04-11-2017
SCALE:	NTS
DRAWING NO.:	PC-5-7176



NOTE: PRETREATMENT CHAMBER MINIMUM REQUIREMENTS SHALL BE: 1500 GALLONS CAPACITY, 22 GALLONS PER INCH OF LIQUID LEVEL AND 12 INCHES OF FREEBOARD.

NOTE: SIMPLEX CONTROLS ARE REMOTELY LOCATED AND REQUIRE A DEDICATED CIRCUIT BREAKER. PUMP SIZE AND TYPE DEPENDS ON TOTAL DYNAMIC HEAD REQUIREMENTS.

NOTE: SOME CRITICAL DIMENSIONS ARE INTENTIONALLY LEFT BLANK TO BE FILLED IN PER INDIVIDUAL JOB SITE SPECIFICATIONS.

NOTE: TYPICAL PUMP TANK SHOWN. ACTUAL CONFIGURATION MAY VARY.

NOTE: RATED CAPACITY: 1500 GALLONS PER DAY.

GENERAL NOTES:

1. MUST BE SERVICED BY FACTORY TRAINED PERSONNEL.
2. SINGULAIR SYSTEMS UTILIZING CONCRETE TANKAGE MAY BE LOCATED IN PAVED AREAS SUBJECT TO HIGH LOADING IF APPROPRIATELY DESIGNED.
3. ALL RISERS AND COVERS MUST BE AT GRADE AND ACCESSIBLE FOR SERVICE.
4. CONCRETE TANKS MEET ASTM STANDARD SPECIFICATIONS FOR PRECAST CONCRETE SEPTIC TANKS, C-1227-09.
5. FOR DEEPER THAN NORMAL INSTALLATIONS, CONTACT NORWECO FOR DETAILS.
6. SUBJECT TO APPROVAL, THE PRETREATMENT TANK DIMENSIONS MAY BE DIFFERENT FROM WHAT IS SHOWN, BUT THE TANK CAPACTIY MUST BE MINIMUM 1500 GALLONS 4" BELOW THE INLET INVERT. THE INTERCONNECTION BETWEEN TANKS MUST BE BELOW THE FLOW LINE (SUBMERGED).

PROJECT ENGINEER'S APPROVAL:
I (WE) HEREBY CERTIFY THAT THIS DRAWING HAS BEEN CHECKED AND IS APPROVED FOR USE IN CONFORMITY WITH THE CONTRACT DOCUMENTS.

DATE: _____

NAME: _____

CONTRACTOR'S CERTIFICATION:
I (WE) HEREBY CERTIFY THAT THIS DRAWING HAS BEEN CHECKED AND IS APPROVED FOR USE IN CONFORMITY WITH THE CONTRACT DOCUMENTS.

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CRITICAL DIMENSIONS

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SINGULAIR® DN 1500 GPD DENITRIFICATION WASTEWATER TREATMENT SYSTEM WITH PUMP TANK

REVISION DATE	REVISION
DRAWN BY	NPD
APPROVED BY	JMM
DATE	04-11-2017
SCALE	NTS
DRAWING NO.	PC-5-7177

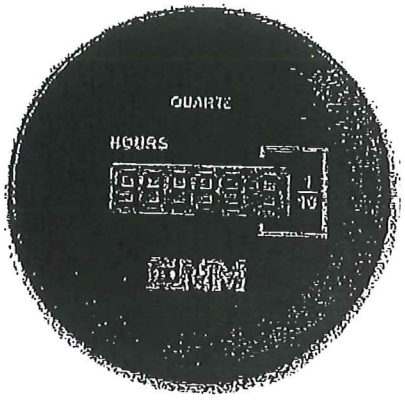
DESIGN, INSTALLATION AND SERVICE INFORMATION FOR THE SINGULAIR® DN AND SINGULAIR GREEN® DN NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250 and 1,500 GPD & Singulair Green® DN 600

HOUR METER AND RECIRCULATION PUMP

Hour Meter, LCD, Time Range 0 to 99,999 Hours, Bezel Face 2.23 In, Bezel Face Type Flush Round, Elapsed Time Voltage 115 VAC, Hz 60, Number of Digits 6, Display Units Hours and Tenths, Bezel to Back Length 1.42 In, Ambien to 149 F, Material of Construction ABS, Temp Range -22 to 149 F, Fits 2.0 in Diameter Opening; Mounting Method F Type Spade

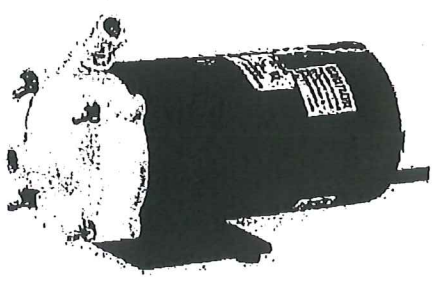
Tech Specs	Additional Information	Compliance & Restrictions
Item		Hour Meter
Type		LCD
Time Range (Hours)		0 to 99,999
Bezel Face (In.)		2.23
Bezel Face Type		Flush Round
Elapsed Time To		99999.9
Voltage		115 VAC
Hz		60
Number of Digits		6
Display Units		Hours and Tenths
Bezel to Back Length (In.)		1.42
Ambient Temp Range (F)		-22 to 149
Material of Construction		ABS
Temp Range (F)		-22 to 149
Fits		2.0" Diameter Opening
Mounting Method		Flange
Terminal Type		Spade



(Or approved equal)

Magnetic Drive Pump, Power Rating 1/25 HP, Voltage @ 60 Hz 115, Current Rating 1.65 Amps, Outlet 5/8 Inch OD, Maximum PSI 8.2, Maximum Head 19 Feet, Motor Enclosure OPFC, Maximum Temperature 150 F @ 10 PSI, 70 F @ Flow @ 1 Foot of Head 7.6 GPM, @ 3 Feet of Head 7.0 GPM, @ 6 Feet of Head 6.8 GPM, @ 9 Feet of Head 6.0 GPM, Inches, Length 8 ¼ Inches, Width 3 ¾ Inches

Tech Specs	Additional Information	Compliance & Restrictions
Item		Pump
Type		Magnetic Drive
HP		1/25
Voltage		115
Full Load Amps		1.65
Motor Type		SP
Motor Enclosure		OPFC
GPM @ 1 Ft. of Head		7.6
GPM of Water @ 3 Ft. of Head		7.0
GPM of Water @ 6 Ft. of Head		6.8
GPM of Water @ 9 Ft. of Head		6.0
Max. Head (Ft.)		19



(Or approved equal)

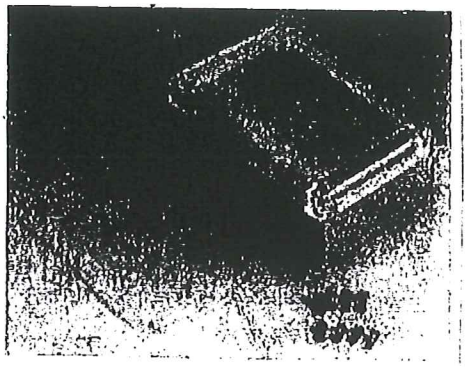
DESIGN, INSTALLATION AND
SERVICE INFORMATION FOR THE
SINGULAIR® DN AND SINGULAIR GREEN® DN
NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250 and 1,500 GPD
& Singulair Green® DN 600

ELECTRICAL ENCLOSURE

Enclosure, Nonmetallic, NEMA Rating 4X, Material of Construction Polycarbonate, Length 4.92 In, Width 3.35 In, Dep Cover Type, One Piece Molded Silicone Gasket, Color Clear Cover and Gray Bottom

Tech Specs	Additional Information	Compliance & Restrictions
Item		Enclosure
Type		Nonmetallic
NEMA Rating		4X
Material of Construction		Polycarbonate
Length (In.)		4.92
Width (In.)		3.35
Depth (In.)		2.16
Cover Type		Screw
Gasket		One Piece Molded Silicone
Color		Clear Cover and Gray Bottom



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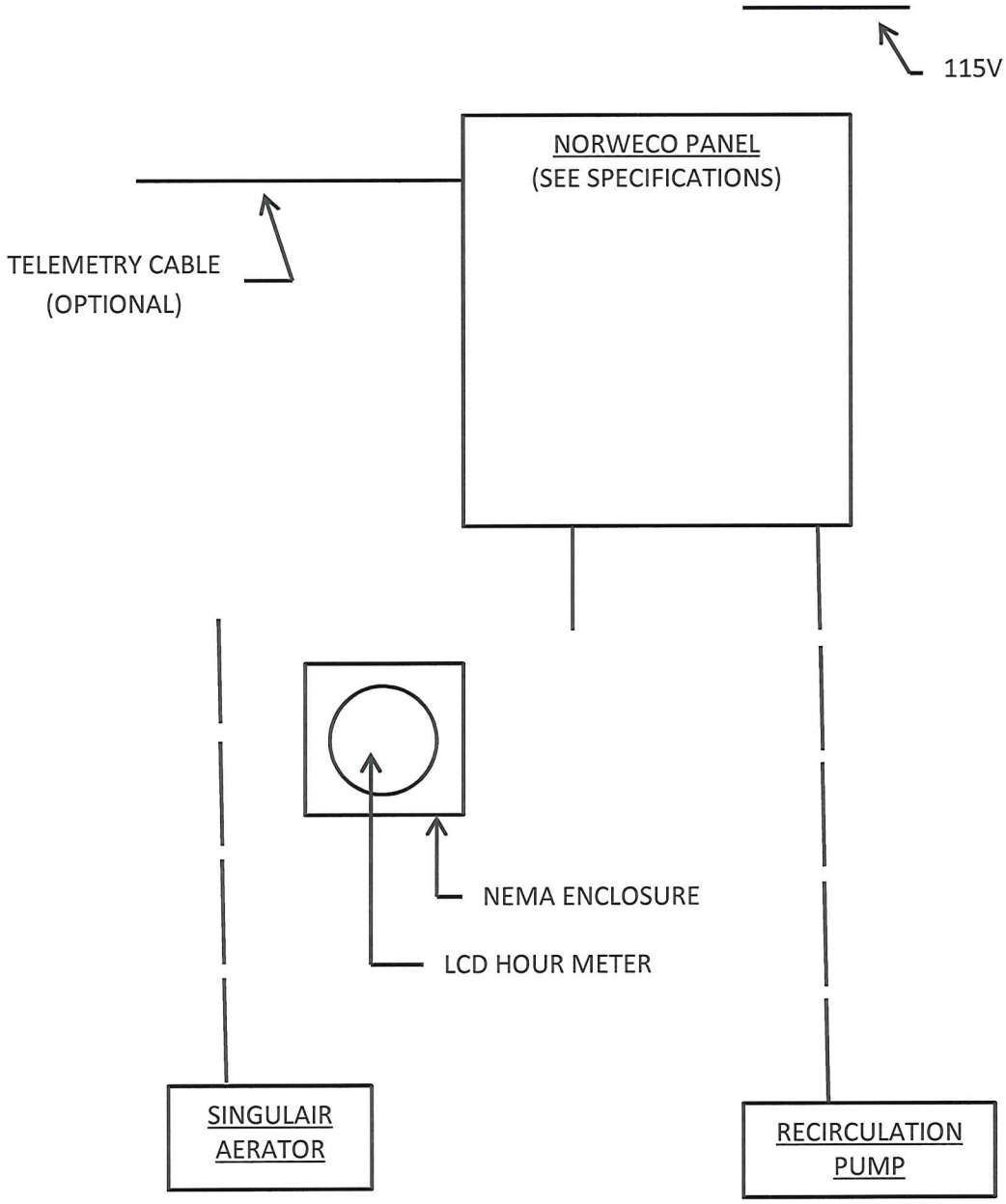


NOTE:
1. Enclosure shall be NEMA 1, 16 Ga. Model SC040404 Wiegmann (or equal)

2. LCD Hour meter shall be Flush Round model T1160EB ENM (or equal) time range 0-99,999 hours, Voltage 115 VAC

ELECTRICAL WIRING DIAGRAM

SINGULAIR® DN and SINGULAIR GREEN® DN

600 GPD NITROGEN REMOVAL
WASTEWATER TREATMENT SYSTEM

Norweco, Inc.
220 Republic Street, Norwalk, OH 44857
www.norweco.com
Tel: 419-668-4471
Date created: 3/28/17

norweco®

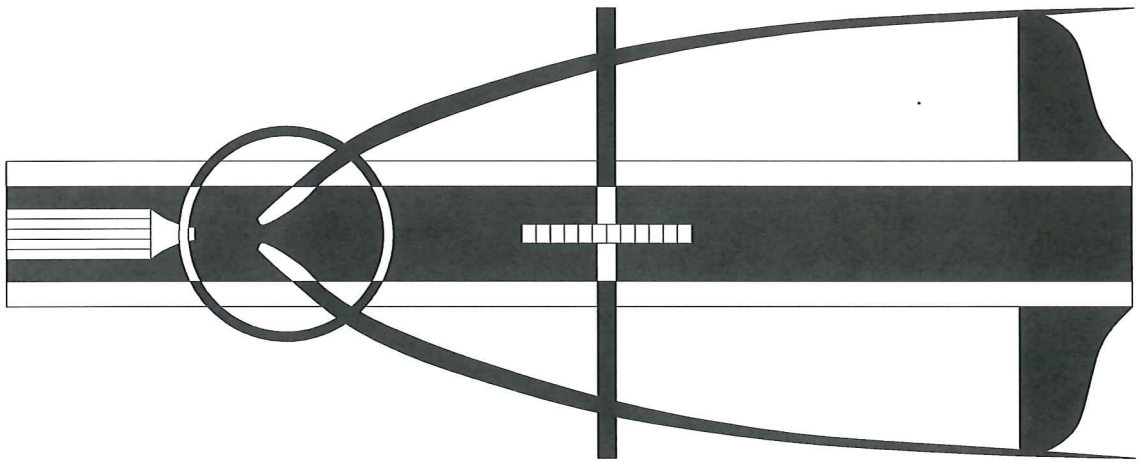
SINGULAIR® BIO-KINETIC®

WASTEWATER TREATMENT SYSTEM MODEL 960

SPECIFICATIONS

GENERAL SPECIFICATIONS

The contractor shall furnish and install one complete Singulair Bio-Kinetic wastewater treatment system with all necessary parts and equipment as described in the following specifications. Treatment of the domestic wastewater shall be accomplished by the extended aeration process with non-mechanical flow equalization, pretreatment of the influent and filtration of the final effluent. The treatment system shall provide primary, secondary and tertiary treatment of the wastewater flow, and if required, chlorination and dechlorination of the effluent prior to discharge. All treatment processes shall be contained within reinforced precast concrete tankage meeting the requirements of ACI Standard 318. The wastewater treatment system shall be a Singulair Model 960 as manufactured by Norweco, Inc., Norwalk, Ohio, USA.



The wastewater treatment system shall include precast concrete tankage providing separate pretreatment, aeration and final clarification chambers. The tankage shall be furnished with cast-in-place inlets, submerged transfer ports, aerator mounting casting with removable cover, cast-in-place molded plastic vent assembly, cast-in-place outlet coupling and Bio-Kinetic system mounting casting with removable cover. Principal items of electro-mechanical equipment supplied with the Singulair system shall be a 1725 RPM mechanical aerator, UL Listed Service Pro electrical control center with MCD technology, Bio-Static sludge return and Bio-Kinetic tertiary treatment device for flow equalization and final filtration of system effluent.

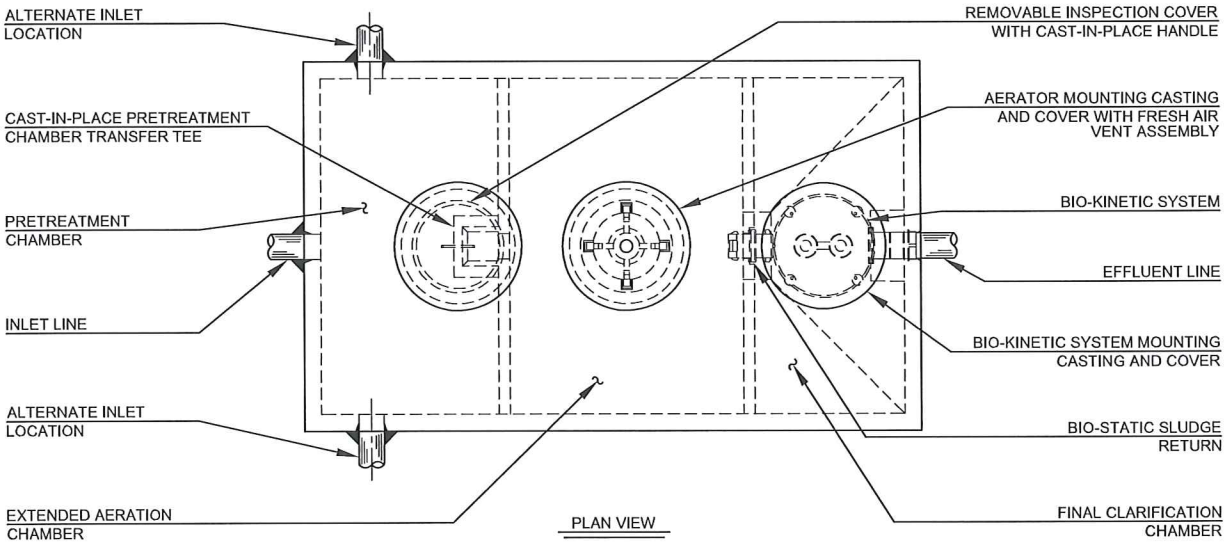
SINGULAIR®

OPERATING CONDITIONS

Total holding capacity of the system shall provide a minimum of 48 hour retention of the daily flow. The pretreatment chamber shall provide at least 18 hour retention, the extended aeration chamber shall provide at least 24 hour retention and the clarification chamber shall provide at least 6 hour retention. The non-mechanical flow equalization device shall increase each individual chamber and total system retention time in direct proportion to loading. Design of the system shall include a compartmented tank and non-mechanical flow equalization device to insure successful treatment performance without upset even when the significant runoff period is six hours. Hydraulic design considerations of the system and flow equalization device shall be such that intermittent peak flow factors as high as four shall not upset hydraulic reliability within the system. Capability of the system to perform as outlined, when built by an approved manufacturer, shall be certified by an independent testing laboratory and approved for use by the local governing regulatory agency.

PRETREATMENT CHAMBER

The pretreatment chamber shall be an integral part of the wastewater treatment system. All domestic wastewater shall be preconditioned and flow equalized while passing through the pretreatment chamber prior to being introduced to the extended aeration chamber. The outlet of the pretreatment chamber shall be equipped with a discharge tee that extends vertically into the liquid so that only the preconditioned equalized flow from the center area of the chamber is displaced to the extended aeration chamber. The discharge tee and transfer port shall be of adequate size to handle a peak flow factor of four without restricting the outlet and disturbing hydraulic displacement to the extended aeration chamber. A removable inspection cover shall be cast into the top of the pretreatment chamber to allow tank and transfer tee inspection. As a safety measure, the uncovered opening shall be small enough to insure that the tank cannot be entered for inspection or service.

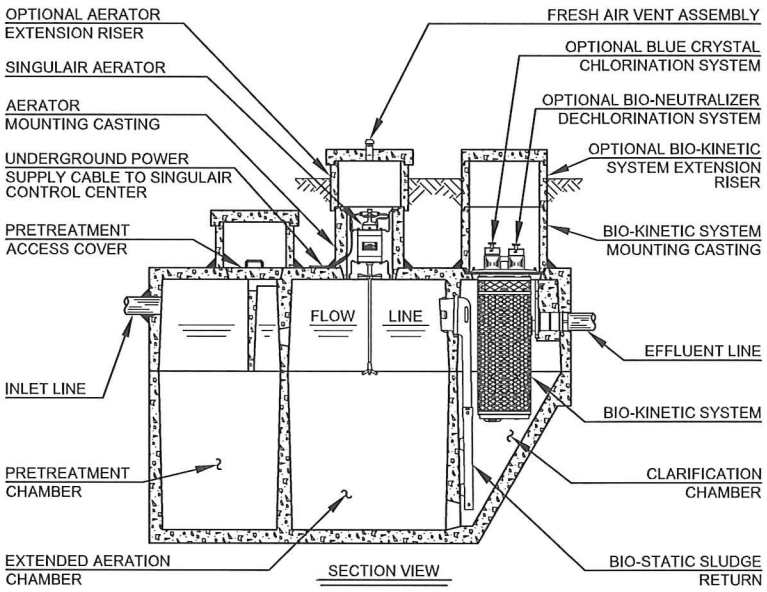


AERATION CHAMBER

The extended aeration chamber shall provide in excess of 24 hour retention of the equalized daily flow. The chamber shall be of sufficient size to provide a minimum of 80 cubic feet of tank capacity per pound of applied BOD. The aeration chamber length-width-depth ratio shall be designed to insure uniform tank mixing and provide optimum treatment. The aeration chamber(s) shall be an integral part of the system flow path and constructed of properly reinforced 5,000 PSI, 28 day compression strength precast concrete. All castings used to construct the precast concrete tankage shall be monolithic units with external and internal walls incorporated into each section.

FINAL CLARIFICATION CHAMBER

The final clarification chamber shall consist of 5 functionally independent zones operating together to provide satisfactory settling and clarification of the equalized flow. An inlet zone shall be provided and shall dissipate transfer turbulence at the flow inlet of the clarification chamber. Its performance shall also eliminate turbulence in other zones of the clarifier. Liquid shall be hydraulically displaced from the inlet zone to the sludge return zone. Hydraulic currents shall sweep settled sludge from the hoppered walls and return these solids via the inlet zone to the aeration chamber. As solids are removed, liquid is displaced to the hopper zone of the clarifier. In this zone, settling by gravity takes place. Three of the four sidewalls are slanted to form a hopper which directs all settled material back to the sludge return zone. Clarified liquid from the hopper zone shall be displaced into the final settling zone to provide additional clarification of the liquid. The liquid is finally displaced to the outlet zone for final filtration and discharge from the system. Non-mechanical equalization of the flow, through all 5 independent zones, shall provide optimal settling and clarification.

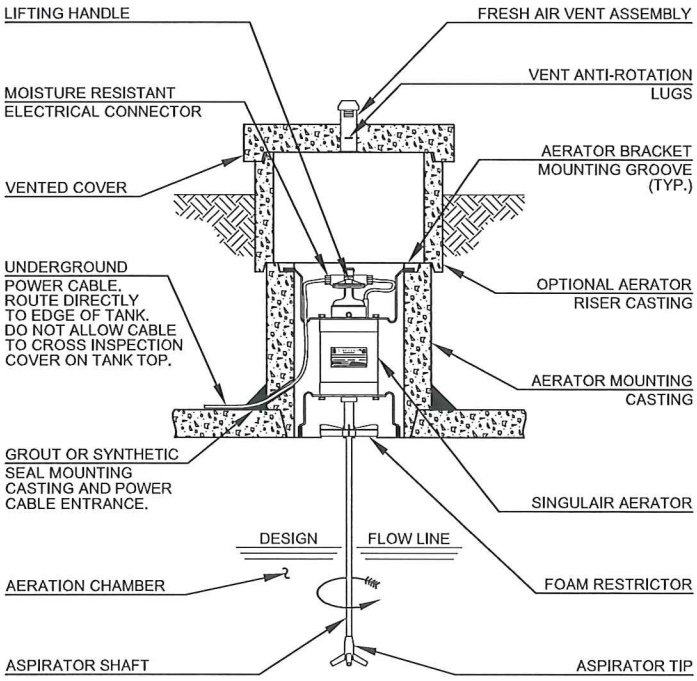


BIO-STATIC® SLUDGE RETURN

A Bio-Static sludge return shall be installed into the cast-in-place opening(s) in the aeration/clarification chamber wall to provide positive return of settled solids. Aeration chamber hydraulic currents shall enter the sludge return(s) and be directed into the sludge return zone of the clarification chamber. The Bio-Static sludge return shall accomplish resuspension and return of settled solids without disturbing the clarified liquid in the final settling zone and outlet zone.

MECHANICAL AERATOR

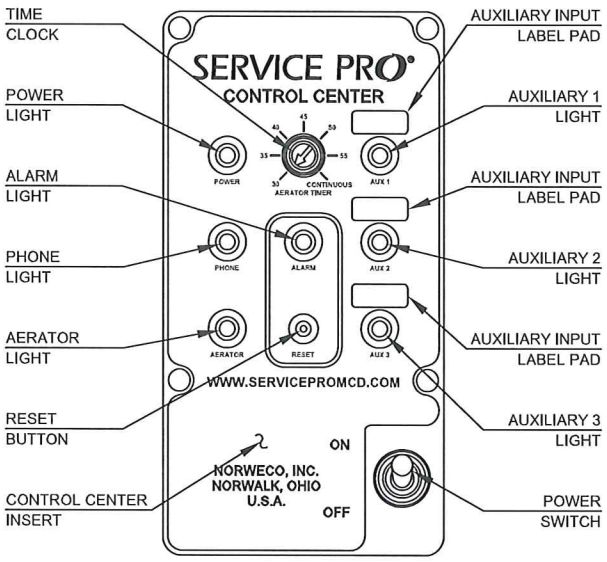
Each Singulair aerator shall be installed in a concrete aerator mounting casting above the aeration chamber. Fresh air shall be supplied through a molded plastic vent assembly cast into the concrete access cover above the aerator. The Singulair aerator shall include plated mounting brackets, NEMA 6 rated electrical connector, UL recognized fractional horsepower motor, molded plastic lifting handle, molded plastic air intake screens, molded plastic foam restrictor, stainless steel aspirator shaft and molded glass-filled nylon aspirator tip. The motor shall contain precision manufactured o-ring type seals installed between the motor shell and the machined aluminum endbells to insure watertight integrity is maintained. Molded Viton elastomer shaft seals shall be utilized to protect the bearings from contamination. Only the stainless steel aspirator shaft and glass-filled nylon aspirator tip shall be installed in contact with the liquid. There shall be no submerged electrical motors, bearings or fixed air piping in the aeration system. Singulair aerator motors shall be designed not to exceed the motor nameplate rating when installed and operated as recommended for the system. The fractional horsepower aerator motor shall be equipped with a foam restrictor to protect the motor against high water and foam. The motor shall be 4 pole, 1725 RPM, 115 volt, 60 Hertz, single phase, ball bearing constructed with a 1.0 service factor. It shall draw less than 4.0 amps when operating at the rated nameplate voltage. Aerator motors without UL recognition have not demonstrated compliance with international electrical standards for safety and reliability and shall not be considered for this application.



BIO-KINETIC®

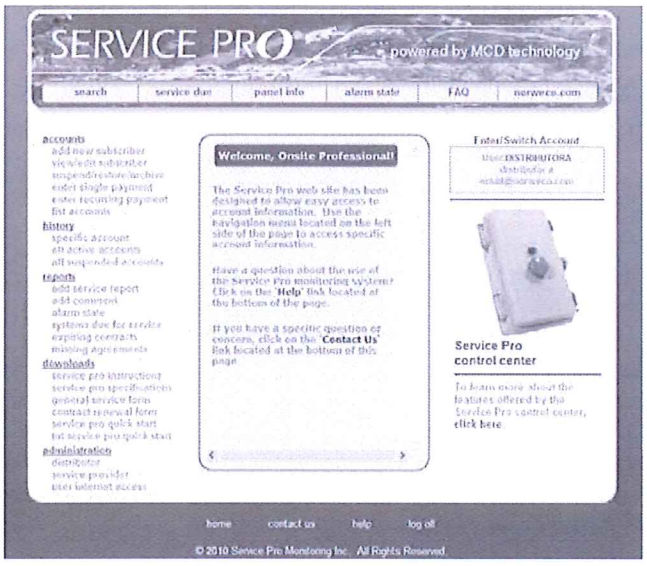
SERVICE PRO® ELECTRICAL CONTROL CENTER

The Service Pro electrical control center with MCD technology shall provide Monitoring, Compliance and Diagnostic functions for the Singulair treatment plant using a microprocessor based platform. The Service Pro control center shall contain nonvolatile memory to prevent loss of programming in the event of a power failure. The pre-wired controls shall be mounted in a lockable NEMA rated enclosure designed specifically for outdoor use. Each Service Pro control center shall be a UL Listed assembly and shall include a time clock, alarm light, reset button, power switch, power light, phone light, aerator alarm light and three auxiliary alarm lights. The control center shall monitor all treatment system operating conditions including aerator over current, aerator under current and open motor circuit. In the event the control center detects one of these conditions, power to the aerator shall be interrupted, a diagnostic sequence shall begin and the visual alarm shall activate. After a programmed recovery interval, an automatic restart attempt shall be initiated. If normal aerator operation does not resume during 24 programmed recovery and restart cycles, the audible alarm shall activate and the telemetry system shall report the specific condition to the Service Pro monitoring center. In the event that any of the auxiliary inputs detect abnormal operation of the treatment system auxiliary equipment, the audible and visual alarms shall immediately activate and the telemetry system shall report the alarm condition to the monitoring center. The service provider shall automatically be notified by the Service Pro monitoring center of the specific alarm condition using phone, fax or email.



TIME CLOCK

The aerator run cycle shall be controlled by an adjustable, pre-wired time clock. The minimum setting shall not permit the aerator to be "off" for more than 30 minutes per hour. It shall be adjustable in 5 minute increments and designed such that any adjustment results in additional run time up to "continuous" operation (60 minutes per hour). Use of a time clock can seriously affect system performance and operating cost. Systems that have not been performance certified at the minimum time clock setting by an independent testing laboratory shall not be considered for this application.



www.servicepromcd.com

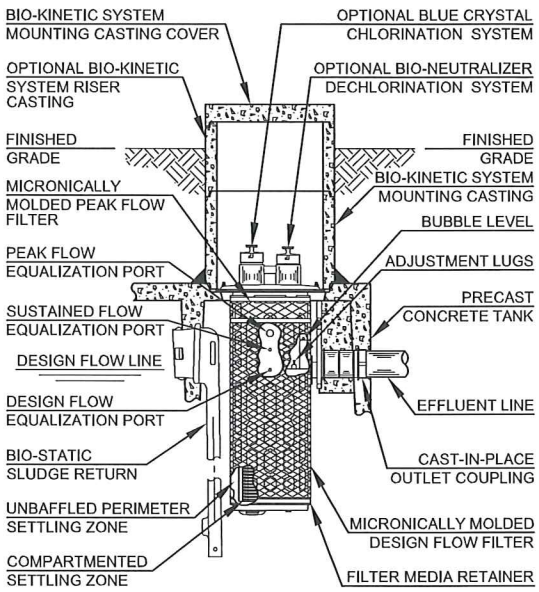
SERVICE PRO® MONITORING CENTER

The Service Pro monitoring center shall include a 128 bit encrypted password protected website for interface with the monitoring center database. Access to the secure website shall be obtained through a unique user name and password that provides tiered access to data from monitored treatment systems. Access level tiers shall include distributors, service providers, regulatory agencies and individual system owners. Distributors and service providers shall be able to create accounts, maintain service records and grant regulatory agencies access to the information. Individual system owners shall be able to view information regarding their own systems, as well as download instructional information. Integrity of stored data shall be maintained through the use of multiple servers operating in geographically isolated locations.

SPECIFICATIONS

BIO-KINETIC® SYSTEM

A Bio-Kinetic system shall be installed in the mounting casting(s) above the clarification chamber. Each Bio-Kinetic system shall provide non-mechanical flow equalization through all plant processes including pretreatment, aeration, clarification, tertiary filtration, chlorination and dechlorination. The assembly shall be supplied with locking lugs and removable moisture/vapor shield and shall consist of a design flow and peak flow micronically molded filter, baffled perimeter settling zone, flow distribution deck, lifting handles, level indicator, adjustment lugs, optional chlorination feed tube, unbaffled perimeter settling zone, solids contact zone, vertical inlet zone, compartmented settling zone consisting of 42 baffled chamber plates, effluent stilling well, final discharge zone, adjustable outlet weir, optional dechlorination feed tube, outlet zone and gasketed discharge flange. All components shall be manufactured from inert synthetic materials or rubber, assembled in circular fashion and connected to a plastic outlet coupling. The outlet coupling shall accept a 4" diameter, Schedule 40, PVC pipe. Each Bio-Kinetic system shall be installed with the inverts of the design flow equalization ports located at the normal liquid level of the clarifier. If intermittent flow rates exceed the capacity of the design flow ports, flow shall be held upstream until the intermittent flow dissipates. If the intermittent flow continues to increase, the liquid level may reach a pair of sustained flow equalization ports. With four ports in use, flow through the system increases while continuing to provide flow equalization to all upstream and downstream processes. Peak flow equalization ports are supplied but should not be required in a properly sized system. Optional Blue Crystal and Bio-Neutralizer tablet feed tubes shall be positioned such that the flow-activated chemical cannot make contact with the liquid upstream of the feed tubes.



FLOW EQUALIZATION

The wastewater treatment system shall include a non-mechanical, demand use, flow equalization device. The device shall control normal residential flow rates and reduce typical residential flow surges. The flow equalization rate shall be dependent upon the specific loading pattern and the duration of flow surges. At the 600 gallon per day NSF Standard 40 design loading schedule, minimum performance of the device shall equalize daily flow an average of 50%.

BLUE CRYSTAL® CHLORINATION SYSTEM (Optional)

The Singulair system shall be furnished complete with a tablet feeder and a six month supply of Blue Crystal disinfecting tablets. Blue Crystal tablets shall be specifically formulated for consistent chlorine dosage and effluent disinfection to the sustained, variable and intermittent flows that are typical of domestic wastewater treatment systems. The tablets shall be manufactured from pure calcium hypochlorite and contain a minimum of 70% available chlorine. Each tablet shall be $2\frac{5}{8}$" diameter, compressed to a 1" thickness, weigh approximately 5 ounces and be white in color with blue crystals for easy identification. The tablets shall dissolve in direct proportion to the flow rate, releasing controlled amounts of chlorine.

BIO-NEUTRALIZER® DECHLORINATION SYSTEM (Optional)

The Singulair system shall be furnished complete with a tablet feeder and a six month supply of Bio-Neutralizer dechlorination tablets. The dechlorination tablets shall contain active ingredients specially formulated to chemically neutralize both free and combined chlorine. Each tablet shall be $2\frac{5}{8}$" diameter, compressed to a $\frac{13}{16}$" thickness, weigh approximately 5 ounces and be green in color for easy identification. The tablets shall dissolve slowly, releasing controlled amounts of chemical for the instantaneous removal of residual chlorine from the system effluent.

WARRANTY AND EXCHANGE PROGRAM

The manufacturer shall provide a three year limited warranty for each Singulair aerator, Service Pro control center and Bio-Kinetic system purchased from the manufacturer. A comprehensive exchange program offers Singulair owners a lifetime of equipment protection. The distributor shall provide warranty and exchange program details to the regulatory agency, contractor and customer as required.

EQUIPMENT MANUFACTURER

The equipment specified herein shall be the product of a manufacturer having a minimum of seven years experience in the construction of prefabricated wastewater treatment equipment and systems. Bids shall be prepared on the basis of the equipment and material specified herein for purposes of determining the low bid. This is not done, however, to eliminate other products or equipment of equal quality and efficiency. If equipment is to be substituted, approval of such substitution must be made prior to execution of any order. It is assumed that substitution will result in a reduction of cost to the contractor and that if accepted, these savings will be passed along by a reduction in the base bid.

SINGULAIR® MODEL 960 DATA CHART

Designation: Model 960-	500 GPD	750 GPD	1000 GPD	1250 GPD	1500 GPD
Daily Treatment Capacity (Gallons Per Day)	500/600	750/800	1000	1250	1500
Total System Capacity (Gallons)	1300	1600	2300	2850	3400
Number of Singulair Aerators	1	1	2	2	2
Number of Bio-Kinetic Systems	1	2	2	3	3
Number of Bio-Static Sludge Returns	1	1	1	2	2
Drawing Number (PC-5-)	7006	7007	7008	7009	7010

PROGRESS THROUGH SERVICE SINCE 1906

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SINGULAIR GREEN® BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

MODELS 960 AND TNT WITH SERVICE PRO® CONTROL CENTER

SPECIFICATIONS

SPECIFICATIONS

GENERAL SPECIFICATIONS

The contractor shall furnish and install one complete Singulair Green Bio-Kinetic wastewater treatment system with all necessary parts and equipment as described in the following specifications. Treatment of the domestic wastewater shall be accomplished by the extended aeration process with non-mechanical flow equalization, pretreatment of the influent and filtration of the final effluent. The treatment system shall provide primary, secondary and tertiary treatment of the wastewater flow, and if required, chlorination and dechlorination of the effluent prior to discharge. All treatment processes shall be contained within a single tank which shall be manufactured using high density polyethylene resin. The wastewater treatment system shall be a Singulair Green as manufactured by Norweco, Inc., Norwalk, Ohio, USA. Systems not including integral pretreatment or non-mechanical flow equalization shall not be considered for this application.

The wastewater treatment system shall include high density polyethylene tankage providing separate pretreatment, aeration and final clarification chambers. The tankage shall be furnished with a Schedule 40 PVC inlet hub, removable sealed pretreatment cover, submerged transfer ports, aerator mounting riser with removable vented cover, molded outlet coupling, Bio-Kinetic system mounting riser with removable sealed cover and Schedule 40 PVC outlet hub. Principal items of electro-mechanical equipment supplied with the Singulair Green wastewater treatment system shall be a UL Listed 1725 RPM mechanical aerator, UL Listed Service Pro electrical control center, Bio-Static sludge return and a Bio-Kinetic tertiary treatment device for flow equalization and final filtration of system effluent.

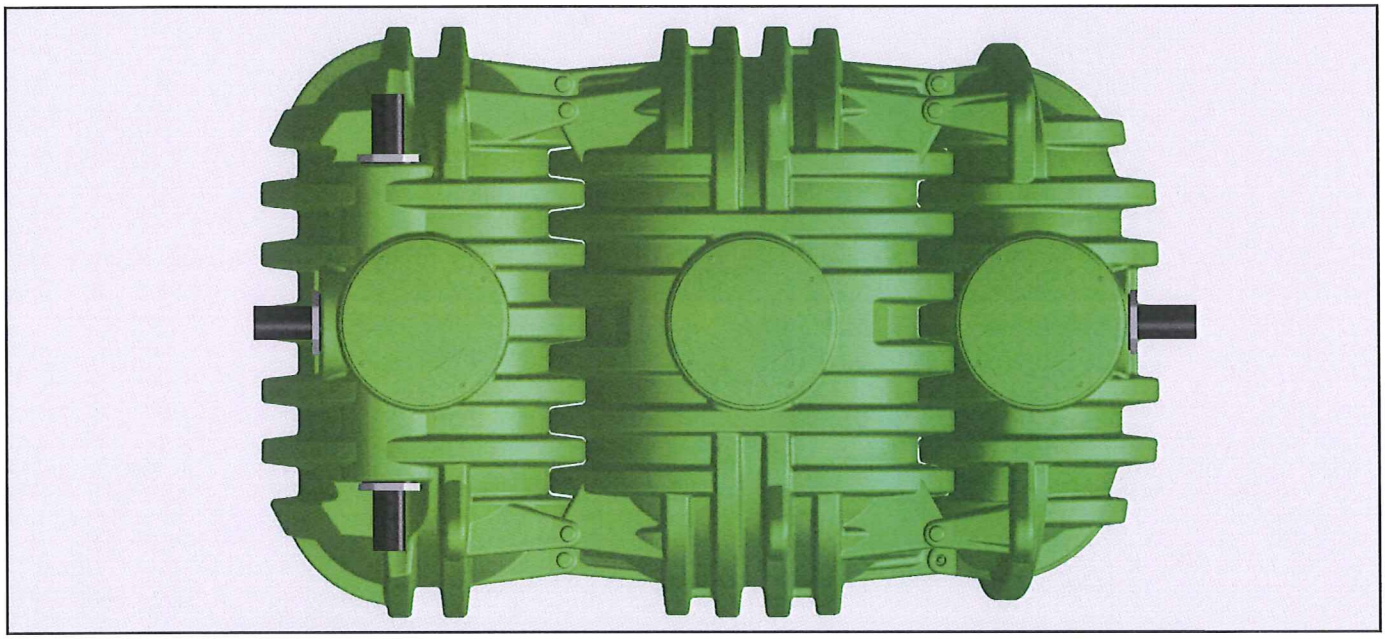
SINGULAIR GREEN®

OPERATING CONDITIONS

The Singulair Green system shall be certified to treat up to 600 GPD (gallons per day) of domestic wastewater. Total holding capacity of the system shall provide a minimum of 48 hour retention of the daily flow. The pretreatment chamber shall provide at least 18 hour retention, the extended aeration chamber shall provide at least 24 hour retention and the clarification chamber shall provide at least 6 hour retention. The non-mechanical flow equalization device shall increase each individual chamber and total system retention time in direct proportion to loading. Design of the system shall include a compartmented tank and a non-mechanical flow equalization device to insure successful treatment performance without upset even when the significant runoff period is six hours. Hydraulic design considerations of the system and flow equalization device shall be such that intermittent peak flow factors as high as four shall not upset hydraulic reliability within the system. Capability of the system to perform as outlined shall be certified by an independent testing laboratory and approved for use by the local governing regulatory agency.

PRETREATMENT CHAMBER

The pretreatment chamber shall be an integral part of the wastewater treatment system. All domestic wastewater shall be preconditioned and flow equalized while passing through the pretreatment chamber prior to being introduced to the extended aeration chamber. The outlet of the pretreatment chamber shall be equipped with a discharge tee that extends vertically into the liquid so that only the preconditioned equalized flow from the center area of the chamber is displaced to the extended aeration chamber. The discharge tee and transfer port shall be of adequate size to handle a peak flow factor of four without restricting the outlet and disturbing hydraulic displacement to the extended aeration chamber. A removable inspection cover shall be incorporated into the top of the pretreatment chamber to allow tank and transfer tee inspection.

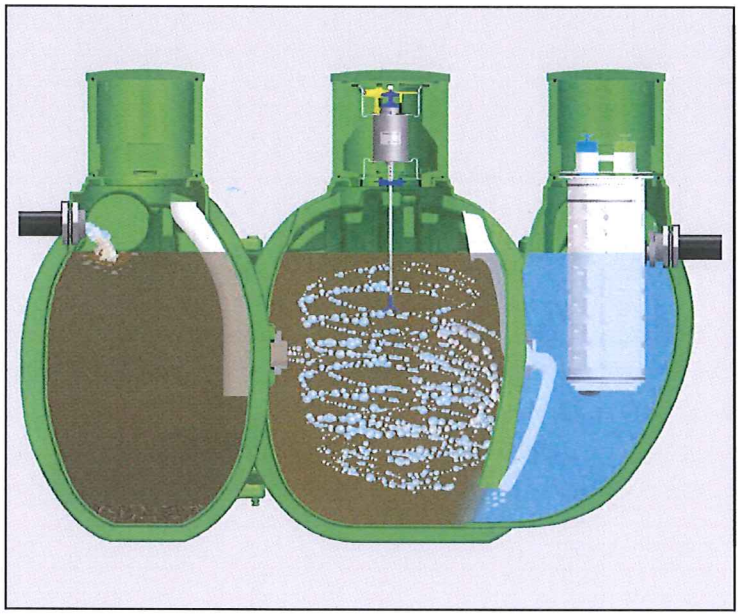


AERATION CHAMBER

The extended aeration chamber shall provide in excess of 24 hour retention of the equalized daily flow. The chamber shall be of sufficient size to provide a minimum of 80 cubic feet of tank capacity per pound of applied BOD. The aeration chamber shall be an integral part of the system flow path and configured to insure effective mixing of microorganisms, wastewater and fresh air. No area of the chamber shall be isolated from process mixing, thereby eliminating dead or quiescent areas of the treatment chamber which are detrimental to the treatment process. Influent into the aeration chamber shall be preconditioned, equalized flow from the pretreatment chamber and settled solids via the Bio-Static sludge return.

FINAL CLARIFICATION CHAMBER

The final clarification chamber shall consist of 5 functionally independent zones operating together to provide satisfactory settling and clarification of the equalized flow. An inlet zone shall be provided and shall dissipate transfer turbulence at the flow inlet of the clarification chamber. Its performance shall also eliminate turbulence in other zones of the clarifier. Liquid shall be hydraulically displaced from the inlet zone to the sludge return zone. Hydraulic currents shall sweep settled sludge from the hoppered walls and return these solids via the inlet zone to the aeration chamber. As solids are removed, liquid is displaced to the hopper zone of the clarifier. In this zone, settling by gravity takes place. Three of the four sidewalls are slanted to form a hopper which directs all settled material back to the sludge return zone. Clarified liquid from the hopper zone shall be displaced into the final settling zone to provide additional clarification of the liquid. The liquid is displaced to the outlet zone for final filtration and discharge from the system. Non-mechanical equalization of the flow, through all 5 zones, shall provide optimal settling and clarification.

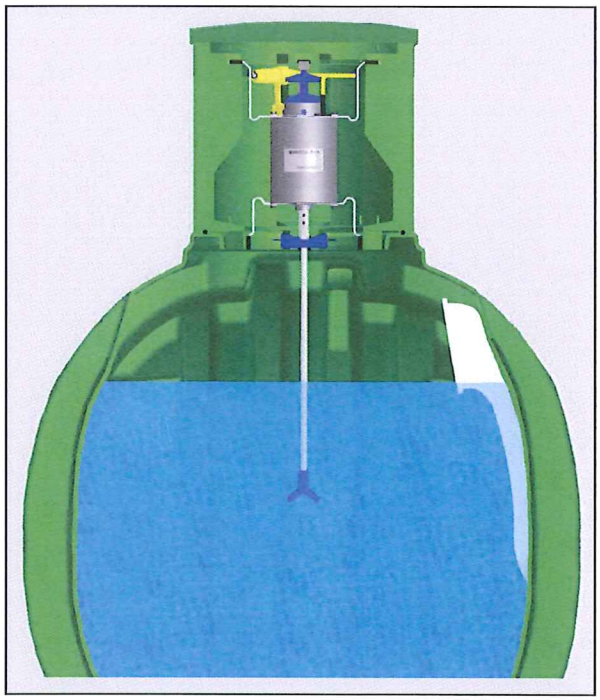


BIO-STATIC® SLUDGE RETURN

A Bio-Static sludge return shall be mounted into the opening in the aeration/clarification chamber wall to provide positive return of settled solids. Aeration chamber hydraulic currents shall enter the sludge return and be directed through the Bio-Static device into the second zone of the clarification chamber. The Bio-Static sludge return shall accomplish resuspension and return of settled solids without disturbing the clarified liquid in the final settling zone and outlet zone.

MECHANICAL AERATOR

The Singulair aerator shall be installed in a rotationally molded, heavy duty, high density polyethylene aerator mounting riser above the aeration chamber. Fresh air shall be supplied through an injection molded, heavy duty, glass-filled polypropylene access cover above the aerator. The vented access cover shall be secured to the mounting riser with four fasteners. The aerator shall be UL Listed and include plated mounting brackets, NEMA 6 rated electrical connector, fractional horsepower motor, molded plastic lifting handle, molded plastic air intake screens, molded plastic foam restrictor, stainless steel aspirator shaft and molded glass-filled nylon aspirator tip. The motor shall contain precision manufactured o-ring type seals installed between the motor shell and the machined aluminum endbells to insure watertight integrity. Molded Viton elastomer shaft seals shall protect the bearings from contamination. Only the stainless steel aspirator shaft and glass-filled nylon aspirator tip shall be in contact with the liquid. There shall be no submerged electrical motors, bearings or fixed air piping in the aeration system. The Singulair aerator motor shall not exceed the motor nameplate rating when installed and operated as recommended. The fractional horsepower aerator motor shall be equipped with a foam restrictor to protect the motor against high water and foam. The motor shall be 4 pole, 1725 RPM, 115 volt, 60 hertz, single phase, ball bearing constructed with a 1.0 service factor. It shall draw 4.0 amps when operating at the rated nameplate voltage. Aerators without UL listing have not demonstrated compliance with international electrical standards for safety and reliability and shall not be considered for this application.



BIO-KINETIC®

SERVICE PRO® CONTROL CENTER

The Service Pro electrical control center shall control all aspects of treatment plant operation using a microprocessor based platform. The prewired control center shall contain nonvolatile memory to prevent the loss of programming in the event of a power failure. For protection of wiring and components, the electrical controls shall be mounted in an injection molded, lockable, corrosion proof, NEMA rated enclosure designed specifically for outdoor use. The enclosure shall be equipped with a tamper evident seal to discourage unauthorized access. The Service Pro control center shall be a UL Listed assembly and shall include a time clock, alarm light, audible alarm, reset button and power switch. The control center shall monitor all treatment system operating conditions including aerator over current, aerator under current and open motor circuit. In the event the control center detects one of these conditions, power to the aerator shall be interrupted, a diagnostic sequence shall begin and the visual alarm shall activate. After a programmed recovery interval, an automatic restart attempt shall be initiated. If normal aerator operation does not resume during 24 programmed recovery and restart cycles, the audible alarm shall activate.

TIME CLOCK

The aerator run cycle shall be controlled by an adjustable, prewired time clock. The minimum setting shall not permit the aerator to be "off" for more than 30 minutes per hour. It shall be adjustable in 5 minute increments and designed such that any adjustment results in additional run time up to "continuous" operation (60 minutes per hour). The Service Pro TNT controls shall include a non-adjustable time clock. Use of a time clock can seriously affect system performance and operating cost. Systems that have not been performance certified at the minimum time clock setting by an independent testing laboratory shall not be considered for this application.

SERVICE PRO® ADVANCED CONTROLS (Optional)

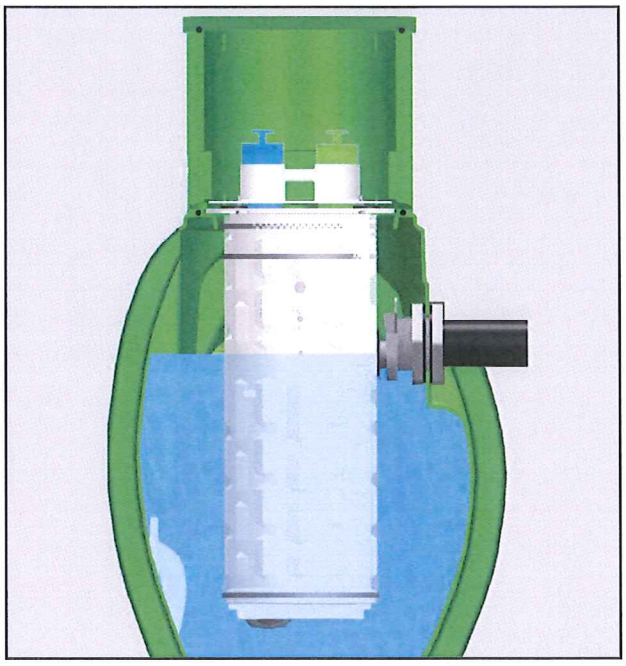
Advanced system control options shall be available for all Singulair Green Bio-Kinetic wastewater treatment systems. Service Pro control center options include the Service Pro control center with Monitoring, Compliance and Diagnostic (MCD) technology and the Service Pro control center with Total Nitrogen Treatment (TNT) technology.

The Service Pro control center with MCD technology shall be a UL Listed assembly and shall include a time clock, integral telemetry system, main alarm light, power light, phone light, aerator alarm light, three auxiliary alarm lights, reset button and power switch. The control center shall monitor all treatment system operating conditions including aerator over current, aerator under current and open motor circuit. In the event the control center detects one of these conditions, power to the aerator shall be interrupted, a diagnostic sequence shall begin and the visual alarm shall activate. After a programmed recovery interval, an automatic restart attempt shall be initiated. If normal aerator operation does not resume during 24 programmed recovery and restart cycles, the audible alarm shall activate and the telemetry system shall report the specific condition to the Service Pro monitoring center. In the event that any of the auxiliary inputs detect abnormal operation of the treatment system auxiliary equipment, the audible and visual alarms shall immediately activate and the telemetry system shall report the alarm condition to the monitoring center.

The Service Pro TNT control center shall provide the same Monitoring, Compliance and Diagnostic functions as the Service Pro control center with MCD technology. However, the Service Pro TNT control center shall include a non-adjustable time clock. The non-adjustable time clock shall create a 60 minute aeration cycle followed by a 60 minute anoxic cycle during which the aerator shall be off. This aeration cycle shall insure Total Nitrogen Treatment of the wastewater.

SPECIFICATIONS

BIO-KINETIC® SYSTEM

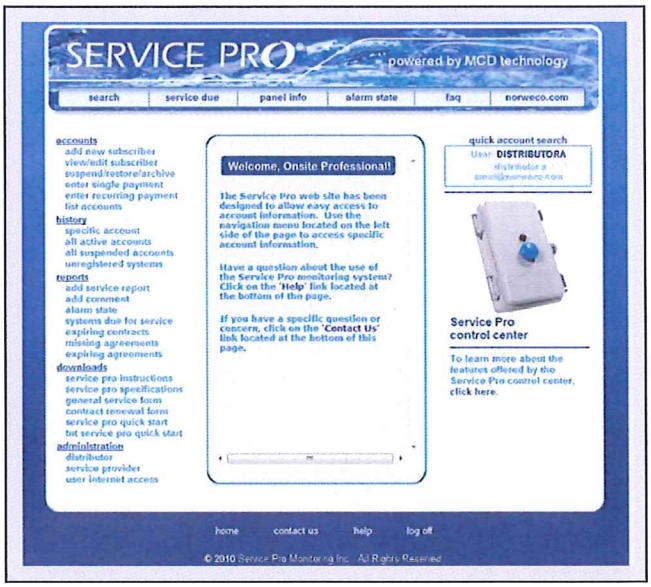


A Bio-Kinetic system shall be installed in the mounting riser above the clarification chamber. The Bio-Kinetic system shall provide non-mechanical flow equalization through all plant processes including pretreatment, aeration, clarification, tertiary filtration, chlorination and dechlorination. The assembly shall be supplied with locking lugs and removable moisture/vapor shield and shall consist of a design flow and peak flow micronically molded filter, baffled perimeter settling zone, flow distribution deck, lifting handles, level indicator, adjustment lugs, optional chlorination feed tube, unbaffled perimeter settling zone, solids contact zone, vertical inlet zone, compartmented settling zone consisting of 42 baffled chamber plates, effluent stilling well, final discharge zone, adjustable outlet weir, optional dechlorination feed tube, outlet zone and gasketed discharge flange. All components shall be manufactured from inert synthetic materials or rubber, assembled in circular fashion and connected to a plastic outlet coupling. The outlet coupling shall accept a 4" diameter, Schedule 40 PVC pipe. The Bio-Kinetic system shall be installed with the inverts of the design flow equalization ports located at the normal liquid level of the clarifier. If intermittent flow rates exceed the capacity of the design flow ports, flow shall be held upstream until the intermittent flow dissipates. If the intermittent flow continues to increase, the liquid level may reach a pair of sustained flow equalization ports. With four ports in use, flow through the system increases while continuing to provide flow equalization to all upstream and downstream processes. Peak flow equalization ports are supplied but should not be required. Optional Blue Crystal and Bio-Max tablet feed tubes shall be positioned such that the flow-activated chemical cannot contact the liquid upstream of the feed tubes.

FLOW EQUALIZATION

The wastewater treatment system shall include a demand use, non-mechanical, flow equalization device. The device shall control normal residential flow rates and reduce typical residential flow surges. The flow equalization rate shall be dependent upon the specific loading pattern and the duration of flow surges. At the 600 GPD (gallons per day) NSF Standard 40 design loading schedule, minimum performance of the device shall equalize daily flow an average of 50%.

SERVICE PRO® MONITORING CENTER



The Service Pro monitoring center shall include a 128 bit encrypted password protected website for interface with the monitoring center database. Access to the secure website shall be obtained through a unique user name and password that provides tiered access to data from monitored treatment systems. Access level tiers shall include dealers, service providers, regulatory agencies and individual system owners. Dealers and service providers shall be able to create accounts, maintain service records and grant regulatory agencies access to the information. Individual system owners shall be able to view information regarding their own systems, as well as download instructional information. Integrity of stored data shall be maintained through the use of multiple servers operating in geographically isolated locations.

BLUE CRYSTAL® CHLORINATION SYSTEM (Optional)

The Singulair Green system shall be furnished complete with a tablet feed tube and a six month supply of Blue Crystal disinfecting tablets. Blue Crystal tablets shall be specifically formulated for consistent chlorine dosage and effluent disinfection to the sustained, variable and intermittent flows that are typical of domestic wastewater treatment systems. The tablets shall be manufactured from pure calcium hypochlorite and contain a minimum of 70% available chlorine. Each tablet shall be $2^{5}/_{8}$" diameter, compressed to a 1" thickness, weigh approximately 5 ounces and be white in color with blue crystals for easy identification. The tablets shall dissolve in direct proportion to the flow rate, releasing controlled amounts of chlorine.

BIO-MAX® DECHLORINATION SYSTEM (Optional)

The Singulair Green system shall be furnished complete with a tablet feed tube and a six month supply of Bio-Max dechlorination tablets. The dechlorination tablets shall contain 92% sodium sulfite as the active ingredient and shall be specially formulated to chemically neutralize both free and combined chlorine. Each tablet shall be $2^{5}/_{8}$" diameter, compressed to a $^{13}/_{16}$" thickness, weigh approximately 5 ounces and be green in color for easy identification. The tablets shall dissolve slowly, releasing controlled amounts of chemical for the instantaneous removal of residual chlorine from the system effluent.

WARRANTY AND EXCHANGE PROGRAM

The manufacturer shall provide a three year limited warranty for each Singulair aerator, control center, Bio-Kinetic system and any other electro-mechanical components purchased from the manufacturer. The comprehensive aerator exchange program offers a lifetime of equipment protection. The dealer shall provide warranty and exchange information to the regulatory agency, contractor and customer as required.

EQUIPMENT MANUFACTURER

The equipment specified herein shall be the product of a manufacturer having a minimum of seven years experience in the construction of prefabricated wastewater treatment equipment and systems. Bids shall be prepared on the basis of the equipment and material specified herein for purposes of determining the low bid. This is not done, however, to eliminate other products or equipment of equal quality and efficiency. If equipment is to be substituted, approval of such substitution must be made prior to execution of any order. It is assumed that substitution will result in a reduction of cost to the contractor and that if accepted, these savings will be passed along by a reduction in the base bid.

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norweco® SINGULAIR®

BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

TANK DELIVERY AND SETTING

To insure that all work proceeds safely and efficiently, check these items prior to delivery of the Singulair tankage.

- ✓ Does the driver have complete and accurate directions to the installation?
- ✓ Does the driver have the Singulair installer's tool kit?
- ✓ Are the appropriate number of aerator mounting castings, Bio-Kinetic system mounting castings, extension riser castings and vented and non-vented access covers included?
- ✓ Is there an adequate supply of sealing material for the tank and all plumbing connections?
- ✓ Does the truck have the proper pick-up bar and cable (or chain)?
- ✓ Are the proper quantity and size of Bio-Static sludge returns installed?
- ✓ Are the proper quantity of Service Pro control centers available for delivery with the tanks?
- ✓ Is there sufficient underground electrical cable to reach from the control center location to the tank?

PLEASE NOTE: *The Singulair tank is constructed of monolithic castings and, if possible, the joints should be sealed at your plant before setting. This will minimize tank loading, unloading and setting time at the site. The castings may be set individually and sealed at the site if necessary. These instructions are written as if the castings will be installed separately and sealed at the site. However, the tank should be assembled and sealed in your plant if your tank handling and delivery equipment will allow it. Otherwise, proceed with tank setting as outlined herein.*

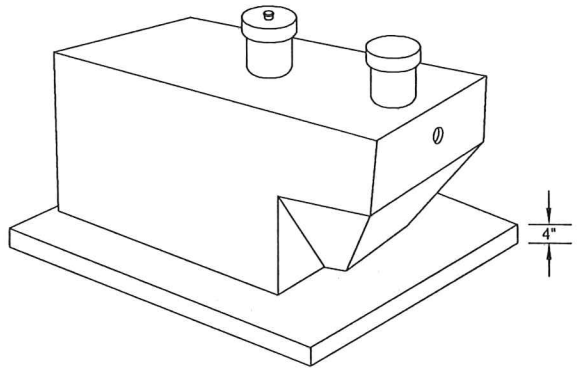
CHECKING THE EXCAVATION

Before tank setting begins, the length, width and depth of the excavation should be checked. The excavation should have sufficient overdig to allow for a minimum of 6" of clearance around the entire perimeter of the Singulair system. Additional overdig will be required on deep installations or where unstable soil conditions exist. Safe working conditions must be established and maintained during the entire installation procedure.

Check the influent and effluent sewer line trenches. The depth should correspond with the Singulair system inlet and outlet connections and the trenches should be smooth to prevent damage to the sewer lines.

A tank leveling pad should be installed in the bottom of the excavation. The pad should be a minimum of 4" thick and leveled to within 1/4" from side to side and end to end. The elevation of the top of the leveling pad should correspond to the outside bottom of the Singulair precast concrete tankage when installed.

Extreme care should be used any time personnel or equipment are in the vicinity of any excavation. A delivery truck can place excessive loading on excavation sidewalls and care must be taken in its positioning. Unstable soil conditions require constant monitoring of the site to insure safety. Construction and installation procedures, equipment, tools, materials and personnel should always comply with applicable safety regulations and federal, state and local codes.



LEVEL PAD END TO END AND SIDE TO SIDE WITHIN 1/4"

SAND OR GRAVEL PAD

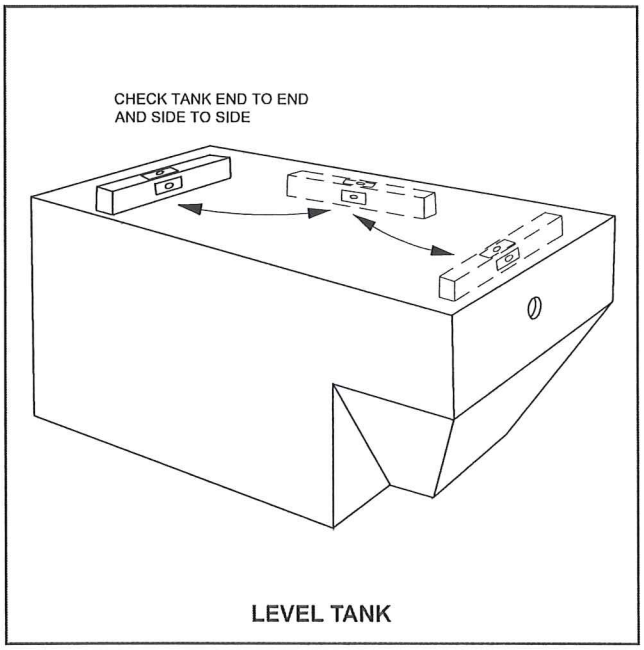
TANK DELIVERY AND SETTING (Cont.)

SINGULAIR TANK SEALING

While the tank bottom is still on the delivery truck, remove any concrete chips, stones, mud or debris from the groove in the casting and from the floor of the pretreatment and aeration chambers. Be sure the transfer port is clean and unrestricted. Apply a good quality mastic sealant into the groove of the bottom casting around the entire perimeter and fully across both internal baffles. Inspect the sealant after application to eliminate any gaps or uneven spots. A non-shrinking grout sealant may be used in place of mastic, but mastic will allow the tank to be filled with water immediately after its installation.

TANK SETTING AND SAFETY

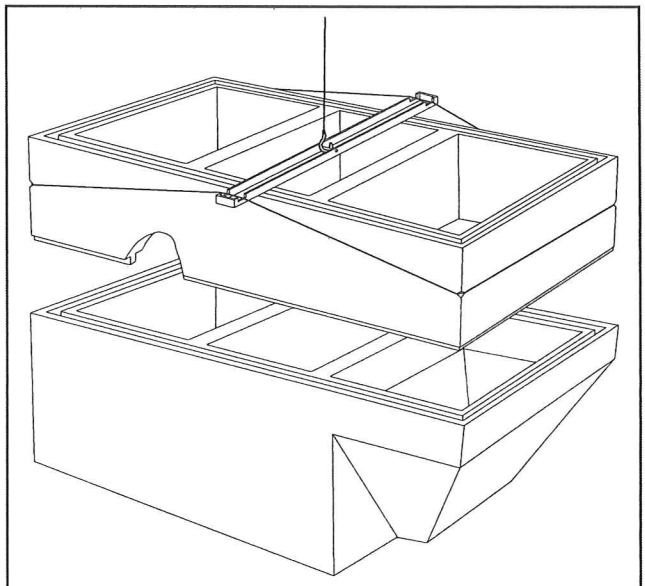
With the delivery truck in position at the excavation, make sure that its outriggers are firmly placed on stable soil. All personnel must be out of the excavation and a safe distance from the tank. Before lifting the tank, check all lifting chains to be sure they are properly seated in the casting pick-up grooves. Lift the tank bottom section and place it directly into the excavation. Do not set it down. Stop the casting several inches above the excavation floor and position it in the desired location. Now lower it carefully until all tension is off the lifting cable or chain.



LEVEL TANK

Place a level on the exposed joint and check the casting for level from end to end and side to side (if the tank is set as one piece, check for level on the top). It must be level within 1/4" from end to end and from side to side. The casting may need to be raised slightly so additional leveling pad material can be applied before level is achieved. If the casting needs to be raised more than six inches to apply leveling material, the contractor's personnel should move to a safe location so the casting can be fully returned to the bed of the delivery truck. The casting should then be reset after the excavation has been properly leveled.

For 750 GPD, 1250 GPD and 1500 GPD systems, the tank ring casting should now be prepared to be set in position. Care must be used to insure the ring casting is not damaged in shipment, handling or setting. While the tank ring is still on the delivery truck, clean the groove in the casting to remove concrete chips, stones, mud or debris. Apply mastic sealant into the groove of the casting around the entire perimeter and fully across both internal baffles. Inspect the sealant after application and smooth out any bubbles or gaps. Remove all debris from the bottom of the casting along the tongue sealing section. Do not reach under or get under any portion of the casting. Carefully position the ring and lower one corner into the groove of the bottom casting. Align the sides of the ring and bottom sections and lower the ring into position.



APPLY MASTIC SEALANT TO GROOVE

The top casting may now be set. Remove all debris from the bottom of the casting along the tongue sealing section. Do not reach or get under any portion of the casting. Carefully position the top and lower one corner into the groove. Align the sides of the casting and lower the top into position. Before proceeding with Bio-Static sludge return assembly and installation, recheck the tank for level from side to side and end to end.

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SINGULAIR® BIO-KINETIC®

WASTEWATER TREATMENT SYSTEM

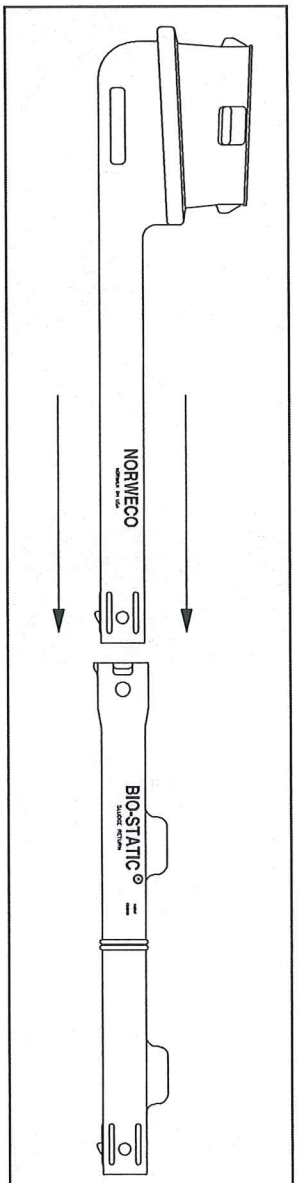
TANK DELIVERY AND SETTING (Cont.)

BIO-STATIC SLUDGE RETURN ASSEMBLY

Bio-Static sludge returns consist of inlet and extension sections and must be assembled prior to installation in the Singulair tank. Insert the small end of the inlet section into the socket end of the extension section until the retainer pins snap into position. A two piece assembly is used for 500 GPD and 1000 GPD systems.

A three piece assembly is used for 750 GPD, 1250 GPD and 1500 GPD systems. For 750 GPD and 1250 GPD systems the second extension section must be cut-off at the double line near the center of the extension. This cut can be made with a carpenter's saw or other suitable tool. After cutting the extension, de-burr the inside and outside perimeter of the extension with a router or sharp knife.

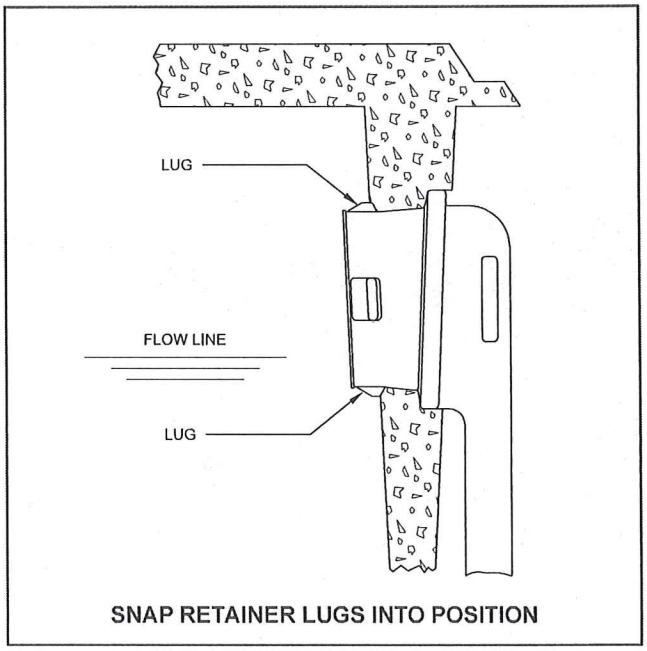
NOTE: Failure to de-burr may cause sludge return plugging. Install the cut-off extension on the bottom of the first extension section until the retainer pins of the first extension snap into place. The 1500 GPD system uses an assembly of one sludge return inlet with two full extensions and no cut-off is required.



SLUDGE RETURN

BIO-STATIC SLUDGE RETURN INSTALLATION

All Bio-Static sludge returns must be installed through the openings in the top of the clarification chamber, prior to installation of the Bio-Kinetic system mounting castings. A single Bio-Static sludge return assembly is installed in 500 GPD, 750 GPD and 1000 GPD systems. Two sludge return assemblies are installed in 1250 GPD and 1500 GPD systems. After the sludge return has been assembled to the correct length, it should be installed into the opening in the clarification chamber wall. Securely grasp the assembled sludge return by the inlet with the opening facing away from you. Lower the assembly through the clarification chamber access opening in the top of the tank. Firmly push the inlet of the sludge return through the opening in the clarification chamber wall until the four retainer lugs snap into position and the assembly is securely mounted. The standoff on the lower most extension piece should be touching the clarification chamber wall just above the transfer port. Repeat these steps when two Bio-Static sludge returns are required.



SNAP RETAINER LUGS INTO POSITION

MOUNTING CASTING AND OPTIONAL EXTENSION RISER INSTALLATION

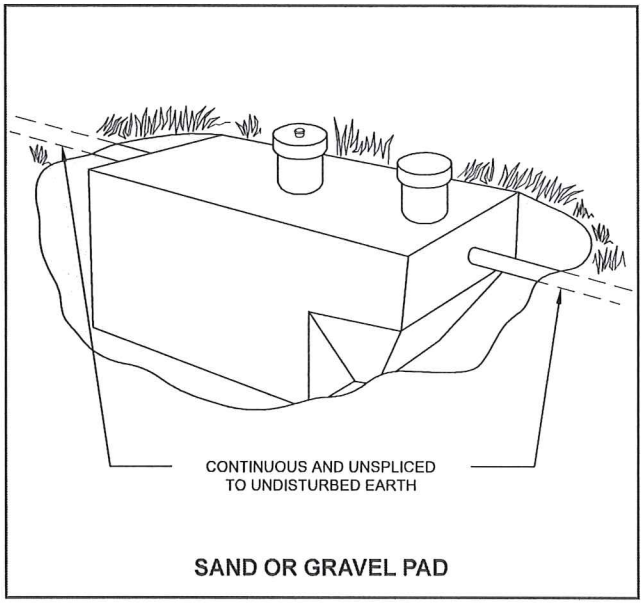
Locate the power cable entrance in each aerator mounting casting. It should be inspected for flash or sharp edges. Be sure it extends all the way through the casting side wall. Remove the cast-in access cover from the top of each aeration chamber. Apply a strip of mastic sealant around the perimeter of each access opening. Position and install each aerator mounting casting with the power cable entrance facing the tank side wall that is closest to the building. Be sure that each mounting casting is properly seated on the tank top and evenly sealed with mastic. If extension riser castings are required, install them as needed above each aerator mounting casting. Apply mastic sealant to all joints between castings. Do not apply sealant to the top of the mounting casting or riser that will receive the vented access cover.

TANK DELIVERY AND SETTING (Cont.)

The pretreatment chamber can be made accessible at grade or left below grade, as required by local regulation or owner preference. The inspection cover on the pretreatment chamber must at least be developed to within twelve inches of finished grade. Pretreatment chamber access covers should never be vented and should be sealed with mastic. Be sure all cast-in access opening covers that are not extended to grade are properly aligned, seated and securely in place. Tank covers which have been replaced by Bio-Kinetic or aerator mounting castings should be returned to your plant with the delivery truck. Install all covers for aerator mounting castings, Bio-Kinetic system mounting castings, risers and inspection ports before backfilling begins.

SEWER LINE INSTALLATION

Sewer lines may be installed as soon as the Singulair concrete tankage has been leveled and sealed. Sewer line trenches must be smoothly excavated and free of debris or sharp-pointed objects that could damage the installation. The trenches must allow sewer lines to be laid with 1/8" of fall per lineal foot of run along the entire length of the line. Influent and effluent sewer lines must be at least four inches in diameter. The influent line should be grouted into the Singulair system tank inlet. The effluent line should be PVC pipe, solvent welded into the Singulair outlet coupling. Inlet and outlet lines must be laid continuously and unspliced from the tank to undisturbed earth beyond the limits of the tank excavation. High quality PVC or other



SAND OR GRAVEL PAD

similar materials may be used for sewer lines, subject to the approval of local codes. Be sure the sewer lines are constructed with compatible fittings and joining materials throughout. Underground electrical cable for electrical service to each Singulair aerator should be installed in the sewer line trench before backfilling. Refer to Electrical Wiring and Control Center Installation instructions for complete details.

GROUND WATER RELIEF POINT

The effluent sewer line should be installed with a ground water relief point to prevent back-up into the system if the effluent discharge point is blocked or flooded. This device can be constructed by installing a pipe tee in the effluent sewer line and extending it to grade. The outlet must be at a lower elevation than the outlet invert of the Singulair system. The extension to grade should be installed with a suitable grate to prevent access to the sewer line.

BACKFILLING

The Singulair tankage should be backfilled immediately after sewer lines and underground electrical cable are installed. Fine, loose earth should be used to backfill the tank excavation and sewer line trenches. Be sure it is completely free of rocks, large clumps of earth and construction debris. Backfill evenly around the entire perimeter of the tank rather than all at once on each side. Take care to completely fill in the cavity beneath the slanted clarifier end wall. Final grading should be six inches below the top of each access cover and should slope away from the tank so surface runoff will drain away from the Singulair system. Use extreme care in backfilling. Do not allow dirt or mud to enter any part of the Singulair system or sewer lines. If dirt or mud enters any portion of the system, it must be removed to insure proper system operation. Removing the dirt or mud may require repeated flushing and tank pumping.

TANK HOLD DOWN WATER

Each compartment in the Singulair system must be filled with clean water. The water should be free of leaves, mud, grit, oils or other materials that might possibly interfere with system operation. The tankage should be filled with water as it is backfilled to reduce stress on the precast concrete tank. Do not fill the Singulair tank with water through the opening in the top of the clarification chamber. The clarification chamber will be filled by adding water to the aeration chamber. In systems with more than one aeration chamber, each aeration chamber should be filled separately. In all systems, pretreatment chambers should be filled through their access openings.

This completes the portion of the installation that requires a delivery truck for tank lifting and setting. Installation of the electrical control center and underground electrical cable are normally completed by the delivery truck driver before leaving the site. Refer to Electrical Wiring and Control Center Installation instructions for details.

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SINGULAIR GREEN® BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

TANK DELIVERY AND SETTING

To insure that all work proceeds safely and efficiently, check these items prior to delivery of the Singulair Green tank.

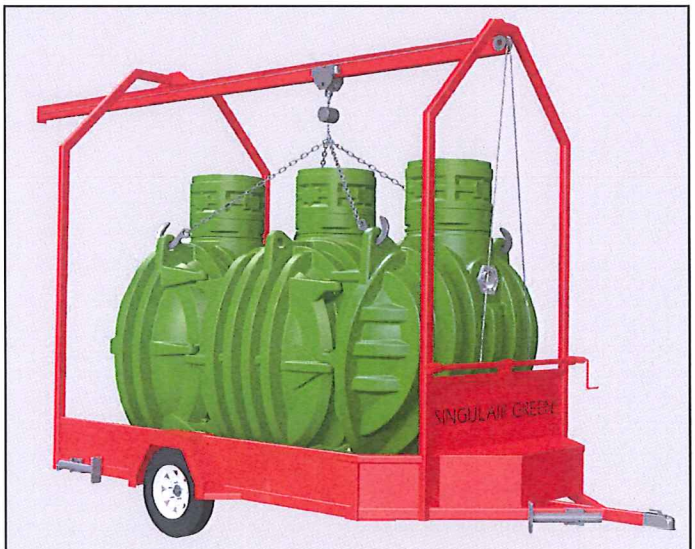
- ✓ Does the driver have complete and accurate directions to the installation?
- ✓ Does the driver have the Singulair installer's tool kit?
- ✓ Are the appropriate aerator mounting riser, vented access cover, Bio-Kinetic system mounting riser, pretreatment riser, sealed access covers and extension risers included?
- ✓ Are additional anti-flotation measures required for this installation?
- ✓ Is a sufficient amount of water and gravel available for the installation?
- ✓ Is an adequate supply of sealing material available for all plumbing connections?
- ✓ Does the delivery vehicle have the proper pick-up bar, cable, straps and/or chain?
- ✓ Is the proper Service Pro control center available for delivery with the tank?
- ✓ Is there sufficient underground electrical cable to reach from the control center to the tank?

PLEASE NOTE: The Singulair Green tank is constructed of high density polyethylene. All joints have been factory sealed for your convenience. This will minimize tank loading, unloading and setting time at the site. The Singulair Green tank has been designed for underground use only. Do not install the tank in a location that is subject to vehicular traffic.

CHECKING THE EXCAVATION

Before tank setting begins, verify that the excavation is level and free of sharp stones and construction debris. Clear out any objects that could come in contact with the tank.

The length, width and depth of the excavation should be checked. The excavation should have sufficient overdig to allow between 18" to 24" of clearance around the entire perimeter of the Singulair Green system. In addition, the excavation should allow for a minimum of 6" and a maximum of 18½" of cover over the top of the tank. For deeper installations, consult the Deeper Burial Requirements section of this guide. Failure to follow the excavation and backfilling guidelines may result in tank damage and will void the system warranty.



TANK WITH DELIVERY TRAILER

Check the influent and effluent sewer line trenches. The trench depth should correspond with the Singulair Green system inlet and outlet connections and the trenches should be smooth to prevent damage to the sewer lines.

A tank leveling pad should be installed in the bottom of the excavation. The leveling pad should be a minimum of 4" thick and leveled to within ¼" from side to side and end to end. The elevation of the top of the leveling pad should correspond to the outside bottom of the Singulair Green tank when installed. In areas with unstable soil conditions, a reinforced concrete pad may be required under the Singulair Green tank.

Safe working conditions must be established and maintained during the entire installation procedure. Unstable soil conditions require constant monitoring of the site to insure safety. Installation procedures, equipment and personnel should always comply with applicable safety regulations as well as all federal, state and local codes.

Do not install the Singulair Green tank in saturated clay, areas with a high water table, bogs, swampy areas, landfills where the soil is soft or wet, areas containing expansive soils or soils with an ultimate bearing capacity of less than 1,500 psf. Failure to follow these directions may result in damage to the tank and will void the system warranty.

TEMPORARY UNIT STORAGE

If a Singulair Green tank is delivered before installation can occur, store the tank on smooth ground with no rocks or sharp objects against the tank. Chock the tank with sandbags to prevent tank movement. If high winds are anticipated, tie the tank down to prevent any damage.

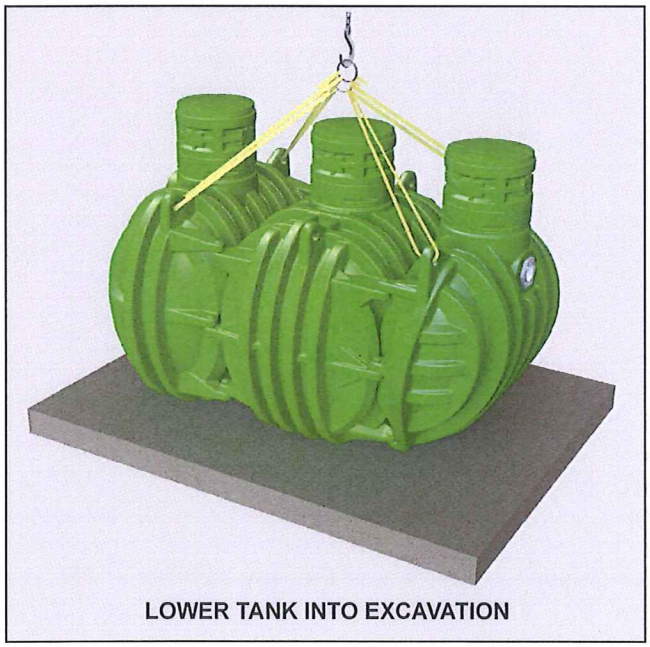
PREPARING THE SINGULAIR GREEN® TANK

Before installing the Singulair Green tank, inspect for signs of damage that may have occurred during transportation or handling. Damaged tanks could leak and should not be installed. Check the inlet and outlet couplings for any signs of damage that would prevent solvent welding to the plumbing. Inspect all risers and access covers to insure no damage has occurred. Verify that all riser and access cover fasteners are securely attached.

CAUTION: Extreme care should be used in the vicinity of any excavation. A delivery vehicle can place excessive loading on excavation sidewalls and care must be taken in its positioning. Once installed, no vehicle should operate over the tank or any other part of the treatment system.

TANK SETTING AND SAFETY

Make sure the delivery vehicle outriggers are firmly placed on stable soil at the excavation site. All personnel must be out of the excavation area and at a safe distance from the tank. Before lifting the tank, check all lifting chains, straps or cables to be sure they are properly secured. Lift the tank using at least four of the molded lifting lugs located on the Singulair Green tank. Carefully lower the tank into the excavation. Stop the tank several inches above the excavation floor and position it in the desired location. Lower the tank carefully until all tension is off the lifting device. Do not remove the lifting chains, straps or cables until tank leveling has been completed.



LOWER TANK INTO EXCAVATION

LEVELING THE TANK

Remove the access covers and place a level on the risers to verify that the tank is level within 1/4" from side to side and end to end. If the tank needs to be raised more than 6" to apply leveling material, all personnel should move to a safe location so the tank can be fully removed from the excavation. Fall through the system from inlet invert to outlet invert is 4". Therefore, the outlet invert of the system must be installed 4" lower than the inlet invert.

LEVEL BEFORE BACKFILLING TANK

MOUNTING RISER AND OPTIONAL EXTENSION RISER INSTALLATION

If extension risers are required, install them as needed above each mounting riser. To insure a watertight seal, install a gasket in all joints between the risers.

Access to the pretreatment chamber can be developed to grade or below grade as required by local regulation or owner preference. The access cover on the pretreatment chamber must be developed to within 12" of finished grade. Place a sealed access cover on the pretreatment chamber access opening. Place a vented access cover on the aerator mounting riser and a sealed access cover on the Bio-Kinetic system mounting riser before backfilling.

SEWER LINE INSTALLATION

Sewer lines may be installed as soon as the Singulair Green tank has been leveled. Sewer line trenches must be smoothly excavated and free of debris or sharp objects. The trenches must allow sewer lines to be laid with 1/8" of fall per lineal foot. Influent and effluent sewer lines must be at least 4" in diameter. The influent and effluent lines should be PVC pipe and solvent welded into the Singulair Green tank inlet and outlet couplings. Influent and effluent lines must be laid continuously and unspliced from the tank to the undisturbed earth beyond the tank excavation site.

Underground electrical cable for electrical service to the Singulair aerator should be installed in the influent sewer line trench before backfilling the Singulair Green tank. Refer to the "ELECTRICAL WIRING AND CONTROL CENTER INSTALLATION" instructions for complete details.

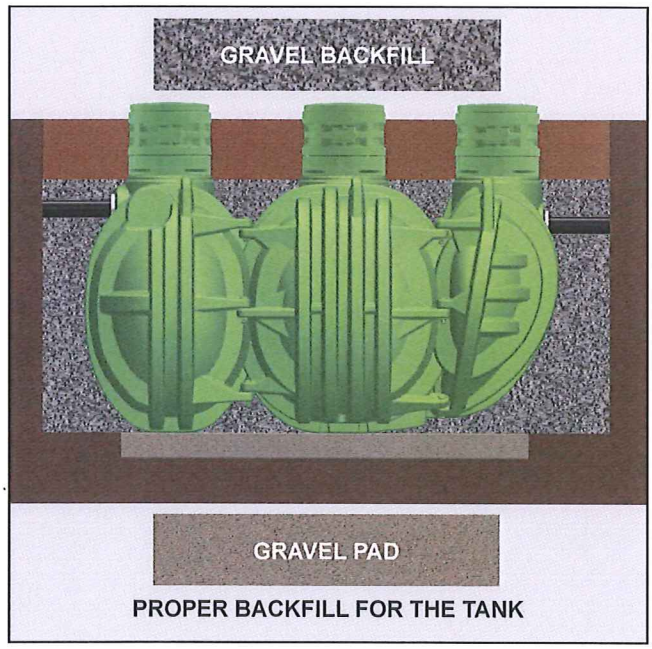
CAUTION: Do not attempt to adjust the position of the tank or sewer lines with the backhoe bucket. Excessive force may damage the inlet and/or outlet couplings.

GROUND WATER RELIEF POINT

The effluent sewer line should be installed with a ground water relief point to prevent back-up into the system if the effluent discharge point is blocked or flooded. This device can be constructed by installing a pipe tee in the effluent sewer line and extending it to grade. The relief point must be at a lower elevation than the outlet invert of the Singulair Green tank. The extension to grade should be installed with a suitable screen to prevent access to the sewer line.

BACKFILLING THE GREEN SYSTEM

Prior to backfilling, add a minimum of 12" (250 gallons) of ballast water to the Singulair Green tank to prevent shifting in the excavation. Fill each chamber to an equal level. Do not add water through the clarifier access opening. The clarification chamber will be filled through the transfer opening between the aeration and clarification chambers as the aeration chamber is filled. The Singulair Green tank must be backfilled immediately after the sewer lines, underground electrical cable and ballast water are in place.



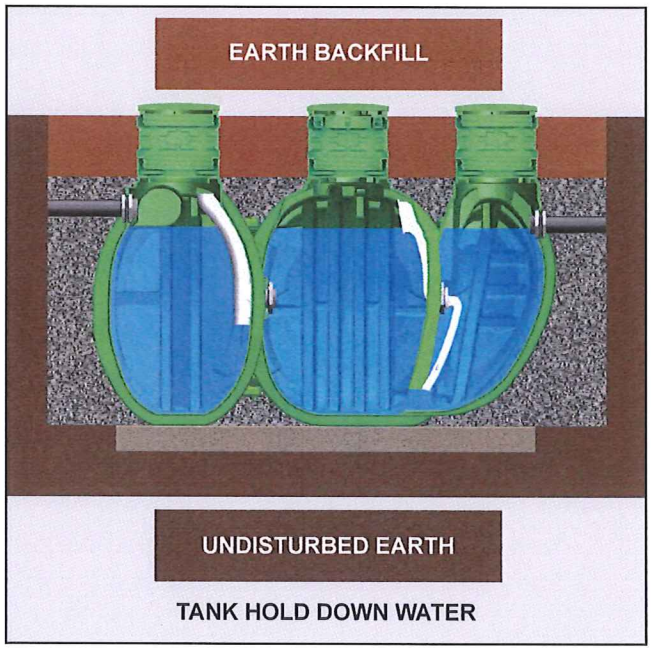
PROPER BACKFILL FOR THE TANK

Cover all openings, then begin backfilling with gravel under and around the sloped clarifier. Continue to add gravel until the discharge line from the Singulair Green tank is covered. Proceed to the inlet end of the pretreatment chamber and add gravel until the inlet line is covered. Fine, loose earth may be used to backfill the remainder of the excavation.

Be sure that the backfill is free of rocks, sharp objects, large clumps of earth and construction debris. Never use clay for backfill material. The backfill must flow freely and care should be taken to insure that all recesses formed between the ribs and beneath the area between the pretreatment and aeration chambers are completely filled. Add backfill evenly around the entire perimeter of the Singulair Green tank in 12" increments. Hand tamp each layer of fill to compact soil. When backfilling over the tank, add fill to the area between the risers first. Final grading should be 3" to 4" below the top of each access cover and should slope away from the tank so surface runoff will drain away from the Singulair Green system. Use extreme care when backfilling the excavation. Do not allow dirt or mud to enter any part of the Singulair Green system or sewer lines.

TANK HOLD DOWN WATER

The Singulair Green tank must be filled with clean water to the outlet invert immediately following backfilling. The water must be free of leaves, mud, grit or other materials that might interfere with system operation.



TANK HOLD DOWN WATER

When pumping or dewatering the Singulair Green tank, only pump the pretreatment chamber. Then, promptly refill the tank to capacity with clean water. Dewatering and leaving the Singulair Green tank empty will affect tank integrity and void the Singulair Green warranty.

DEEPER BURIAL REQUIREMENTS

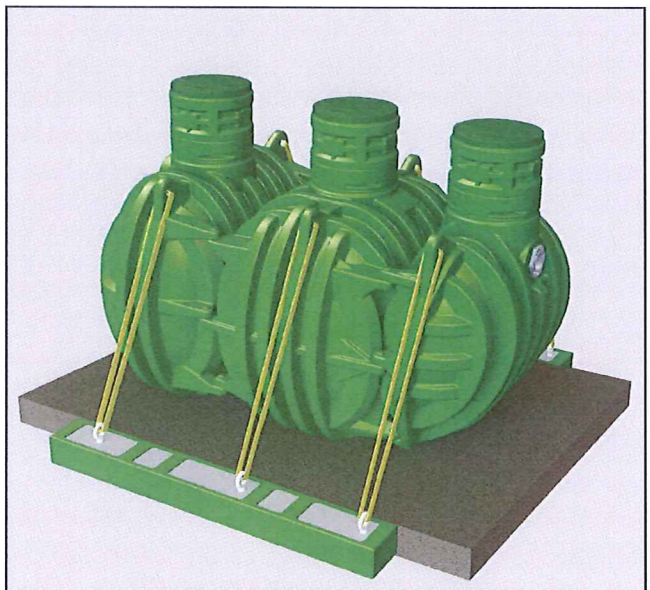
Special consideration should be taken if the Singulair Green tank is buried deeper than 18 ½" below grade. However, the tank should never be buried deeper than 36 ½" below grade. If deep burial is required, first fill the tank with 12" of clean ballast water. Next, backfill around the entire tank with gravel up to the base of the risers. Once gravel is in place, fill the tank with clean water to the design flow line. Finally, backfill to grade with native soil.

SPECIAL ANTI-FLOTATION SYSTEM

In areas where high water is a concern, it may be necessary to provide additional anti-flotation measures to secure the Singulair Green tank. Anti-flotation is not required when the tank is installed with at least 18" of fill over the tank and the soil density of the backfill is at least 100 pounds per cubic foot. Failure to follow the anti-flotation recommendations provided in this document may result in damage to the Singulair Green tank or shifting in the excavation and may void all or part of the limited warranty.

If anti-flotation is required, consult a soil scientist to measure soil density. Once soil density is defined, refer to the SHALLOW BURIAL AND REDUCED SOIL DENSITY HOLD DOWN REQUIREMENTS chart below. After the amount of additional hold down weight is determined, it is recommended that a pair of concrete beams of appropriate size be placed at the base of the excavation. Alternately, 0.60 CCA treated lumber beams may be used. Treated lumber beams and anti-flotation strap assemblies are available from Norweco. Beams must not be placed directly under the perimeter of the Singulair Green tank. The weight of the soil over the beams significantly contributes to the tank hold down forces. Placing beams under the tank will limit the amount of soil anchoring the beams into the excavation and should never be done.

Secure the anti-flotation beams to the Singulair Green tank with properly rated hold down straps that attach to the lifting lugs located at the top of each of the three chambers. The weight of the beams plus the weight of the soil over the beams must be greater than the required hold down weight shown in the table below.



ANTI-FLOTATION HOLD DOWN

COMPLETING THE INSTALLATION

Once backfilling has been completed and the tank has been filled with clean water, the access openings must be secured. Install a sealed access cover on the pretreatment and clarification chamber risers. Install a vented cover on the aeration chamber riser. Secure all access risers with the fasteners that have been provided. Installation of the control center and underground electrical cable are normally completed before leaving the site. Refer to "ELECTRICAL WIRING AND CONTROL CENTER INSTALLATION" instructions for details.

SHALLOW BURIAL AND REDUCED SOIL DENSITY HOLD DOWN REQUIREMENTS

Soil Density (lbs. per cu.ft.)	80	90	100	110	120	130
Fill Over Tank (inches)	Additional Weight Required (lbs.)	Additional Weight Required (lbs.)	Additional Weight Required (lbs.)	Additional Weight Required (lbs.)	Additional Weight Required (lbs.)	Additional Weight Required (lbs.)
6	6,915	5,935	4,956	3,976	2,996	2,017
8	6,091	5,008	3,926	2,843	1,761	678
10	5,267	4,081	2,896	1,710	525	*
12	4,443	3,155	1,866	578	*	*
14	3,619	2,228	836	*	*	*
16	2,796	1,301	STANDARD INSTALLATION	*	*	*
18	1,972	374	*	*	*	*
20	1,148	*	*	*	*	*
22	324	*	*	*	*	*
24	*	*	*	*	*	*

* HOLD DOWN WEIGHT NOT REQUIRED

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norweco® SINGULAIR®

BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

AERATOR INSTALLATION

Installation of the aerator and Bio-Kinetic system should take place when the Singulair system is ready for start-up. Refer to the Bio-Kinetic System Installation instructions for additional details. Your delivery truck driver should have instructed the contractor or owner to contact your office and make arrangements for equipment installation to coincide with occupancy and sanitary sewer use. Review your Singulair tank setting records weekly to insure that you do not have equipment installations that are overdue. If you suspect that adequate time has passed for system start-up and you have not yet heard from the owners, contact them to schedule equipment installation. For Singulair Bio-Kinetic wastewater treatment systems requiring more than one aerator installation, follow these instructions for each aerator to be installed.

PRE-INSTALLATION CHECKLIST

- ✓ The installer should have accurate directions to the facility and a list of service inspections due at other installations in the vicinity.
- ✓ The service vehicle should carry the Bio-Kinetic Tool Kaddy fully stocked with tools, spare parts and test equipment for use during installation.
- ✓ Someone should be present at the location to allow installer access to the control center and electrical service panel.
- ✓ The main electrical service panel wiring must be complete so each aerator may be started-up and tested.
- ✓ All chambers of the Singulair tankage should be full to the flow line.
- ✓ A Bio-Static sludge return should have been installed in each opening in the aeration/clarification chamber wall.
- ✓ The installer must have the proper model and quantity of aerators for the installation.
- ✓ The serial number on each aerator must match the service and warranty record card.

AERATOR START-UP PROCEDURE

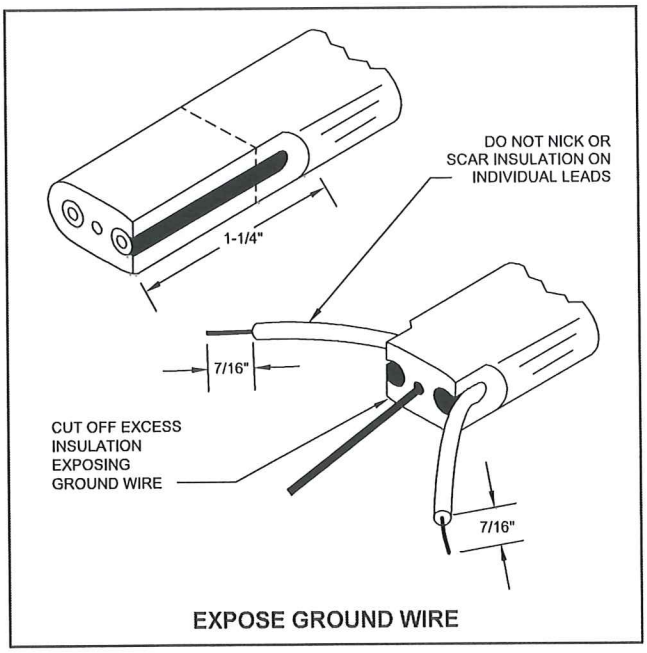
When you arrive on site, introduce yourself to the owner and ask to see the main electrical service panel and Singulair control center. Be certain each circuit for the Singulair system in the main electrical service panel is de-energized and that the selector switch in the Service Pro control center is placed in the "off" position. Explain to the owner that you will be installing the aerator in the tank and you will need access to the main electrical service panel for system start-up after the aerator has been installed. Carry the aerator in its shipping carton to the tank site. Place the Singulair Bio-Kinetic Tool Kaddy nearby for easy access to tools and test equipment. Remove the vented cover from the aerator mounting casting. Carefully remove the aspirator shaft from the shipping carton. Do not bump or bend the aspirator shaft. Lay the shaft on the vented cover. Grip the outside bottom of the shipping carton with your feet and lift the aerator to remove it. Lay the aerator on its side with the brackets resting on the vented cover near the aerator mounting casting. Uncoil the underground electrical service cable from inside the aerator mounting casting and extend it out of the casting. Test the exposed leads with the electrical multi-meter from the Tool Kaddy before proceeding. The circuit should not be energized and voltage should not be evident when the leads are tested with the multi-meter.

WIRING THE ELECTRICAL CONNECTOR

The moisture resistant electrical connector must be properly wired to insure system operation and protect components. Carefully follow these steps to completely wire the electrical connector:

1. Uncouple the two halves of the electrical connector on the Singulair aerator. Unscrew the three captive stainless steel screws from the face of the female half of the assembly. They will stay in the body of the receptacle. Lift out the rigid internal receptacle body.
2. Unscrew the compression nut on the strain relief connector assembly at the small end of the female half of the connector. Do not misplace the compression ring. Insert the electrical service cable through the compression nut, compression ring and neoprene grommet, which is contained in the molded plastic sleeve of the female connector.
3. Strip the outer insulation back 1 1/4" on the underground electrical service cable and expose the three individual leads. Use extreme care to be sure the insulation jackets on the individual black and white leads are not scarred or damaged while stripping the outer jacket. Check them carefully. If even slight damage is noticed, cut off the end of the cable just below your work and begin again.

AERATOR INSTALLATION (Cont.)



EXPOSE GROUND WIRE

4. Strip off the insulation jackets $^{7}/_{16}$" from the ends of the black and white leads.
5. Insert the black lead end into the hole adjacent to the brass-colored screw and tighten the screw securely.
6. Insert the white lead end into the hole adjacent to the silver-colored screw and tighten the screw securely.
7. Insert the bare copper ground lead into the hole that is adjacent to the green colored screw and tighten the screw securely.
8. Inspect your work to see that no two uninsulated leads are in contact with each other and that all screws are tight. Also be sure the wire insulation is not captured in the terminal. All power cable leads must be connected to the correct terminals in the female receptacle for proper aerator operation. The back of the insert body is clear, making it easy to verify that each wire is in place before tightening the terminal screws. Improper wiring or electrical hook-up will void the warranty.
9. Locate the insert key above the grounding pole on the side of the rigid receptacle body and align it with the keyway molded on the inside of the rubber receptacle sleeve. Grasp the connector and insert the receptacle body fully into the sleeve.
10. Engage the three captive stainless steel screws on the face of the receptacle body and tighten them.
11. Press the neoprene grommet onto the small end of the female half of the electrical connector. Tighten the compression nut and clear plastic compression ring against the grommet. The compression nut achieves maximum torque by hand-tightening. Do not over-tighten the compression nut.

NOTE: Any time the female connector is not in use, secure the closure cap in the end of the receptacle.

ASPIRATOR SHAFT INSTALLATION

Each Singulair aerator is manufactured and tested to a critical straightness tolerance from the aerator motor to the aspirator. Remember that the operating life of the aerator often depends on the straightness of the aspirator shaft. It must not be bumped or allowed to contact anything except the aeration tank liquid.

1. With the Singulair aerator lying on its side and the brackets propped up on the vented cover, rotate the foam restrictor until the stainless steel set screws in the intermediate shaft are facing up.
2. Loosen the two set screws that are located closest to the foam restrictor.
3. Examine the upper end of the aspirator shaft and locate the alignment mark permanently affixed during factory testing. Insert the aspirator shaft into the intermediate shaft so that the alignment mark on the aspirator shaft meets the corresponding mark on the intermediate shaft. Be sure both set screws have been loosened before inserting the aspirator shaft. The aspirator shaft must be fully inserted to the depth of the stop shoulder that has been machined in the outside of the aspirator shaft. Use a tee-handle allen wrench to tighten both set screws finger tight only. Overtightening may dish the side of the aspirator shaft and compromise the straightness tolerance.

INSTALLATION IN THE MOUNTING CASTING

1. Lower the aerator into the aerator mounting casting carefully to avoid any contact between the aspirator shaft, aspirator tip and concrete side walls.
2. Make sure that the weight of the aerator is evenly distributed on all four mounting brackets and that the brackets are seated in the four precast grooves on the top of the aerator mounting casting.
3. Arrange the underground power cable in the mounting casting so that it does not touch or come into contact with the side of the Singulair aerator.
4. Make sure the blades on the male half of the electrical connector are clean and dry. Plug the two halves of the watertight electrical connector together making sure the multiple lip seal is securely engaged. Arrange the aerator power cord, electrical connector and underground electrical cable around the aerator, and secure them into the mounting clips attached to the aerator upper brackets. Before replacing the aerator mounting casting lid, make sure these electrical connections are not resting against the top of the aerator.

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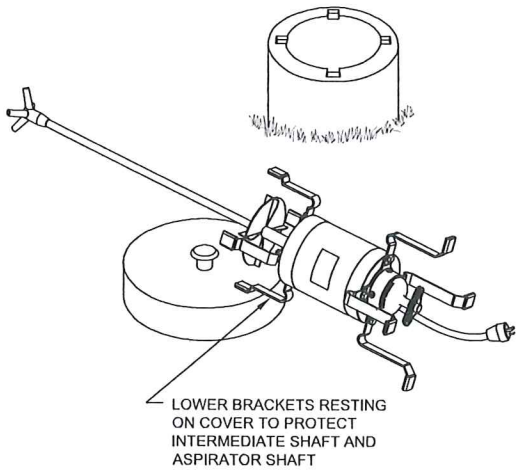
BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

SINGULAIR® AERATOR SERVICE

The Singulair aerator has been specifically designed for use in the Singulair system and is the only electro-mechanical component. It provides maximum air introduction, thorough mixing and assures reliable, economical wastewater treatment. For Singulair systems requiring more than one aerator, follow these instructions for each aerator and aeration chamber. The Singulair aerator is factory lubricated for the life of the unit. No service inside the aerator is required. Unauthorized disassembly will void the warranty.

CAUTION: Any time an aerator or test equipment is connected or disconnected, first shut "off" the selector switch in each control center. Failure to do so could result in personal injury or equipment damage.

1. Open the control center and push the reset button on the Service Pro panel.
2. As you approach the Singulair tank, listen for excessive noise before removing the vented cover.
3. Remove the vented access cover located above the aeration chamber and place it aside. The aerator should be operating normally.
4. Make sure the debris screens are in place in the air intake ports. Manually check the aerator brackets for excessive vibration.
5. Check the aeration chamber for odor. A musty odor indicates the presence of aerobic conditions essential for good treatment. A septic odor indicates inadequate aeration, suggesting that the passage of air into the tank contents has been restricted.
6. Carefully remove the debris screens from the air intake ports. Wipe the aerator air intake ports with a damp cloth being careful not to allow dirt or debris to enter the intake openings.
7. Using the Singulair flowmeter, check the air delivery. It should read approximately 3 CFM. Refer to the Singulair Aerator Flowmeter instruction sheet for complete details.
8. Inspect the outside of the electrical connector assembly for worn spots. Uncouple the connector and check for any evidence of moisture inside. Secure the closure cap over the female half of the connector to keep it clean and dry while you work.
9. Within 2-3 minutes after turning off the aerator, perform a settleable solids test of the aeration chamber contents. Refer to Singulair Tank Pumping instructions for details.
10. Remove the aerator from the mounting casting. BE CAREFUL when removing the aerator to see that the aspirator shaft does not come in contact with the mounting casting. The aspirator shaft is straightened to a critical tolerance before it is shipped from the factory. It must retain this straightness tolerance or vibration may result. Excessive vibration can greatly shorten aerator life and could also cause the unit to consume more electrical power than necessary.
11. Check the rubber shock absorbers on each bracket for wear. Replace any that are missing or worn.
12. Check the power cord from the moisture resistant electrical connector to the aerator. Be sure it is free of nicks or worn spots.
13. Lay the aerator on its side against the aerator mounting casting or vented cover. Check to see if there is a water mark on the outside of the aerator and notify the owner if one is found. The aerator is flood proof and mechanically designed so that it can return to normal operation unharmed after being subjected to intermittent high water. However, a high water mark on the outside of the aerator does indicate there is a problem in the effluent disposal line, disposal field or elsewhere in the installation. If the problem is left uncorrected, wastewater could back up into the tank, void the aerator warranty and eventually flood the facility.



PLACE AERATOR AGAINST COVER

SINGULAIR® AERATOR SERVICE (Cont.)

14. Carefully loosen the two stainless steel set screws on the bottom of the intermediate shaft and remove the aspirator shaft. Remove any internal deposits from the four aspirator orifices with the aspirator shaft cleaning tool. Connect the aspirator shaft to the shaft cleaning hose and outside water faucet to flush the inside of the aspirator shaft clean. Use full water pressure. Remove the shaft from the cleaning hose and inspect the bore to see that it is clean.
15. Push the stainless steel brush with extension handle through the stainless steel intermediate shaft and hollow motor shaft to dislodge any residue that may have accumulated. **NOTE:** Do not flush the motor shaft with water. Remove any debris from the air intake openings.
16. Thoroughly clean both the bottom and the top surfaces of the foam restrictor.
17. Reinstall the aspirator shaft into the intermediate shaft. Match the permanent alignment marks on the aspirator and intermediate shafts to maintain the original factory balance. Tighten the set screws with a tee-handle allen wrench, finger tight only. Too much pressure may dish the side of the aspirator shaft and compromise the straightness tolerance.
18. Visually check the aeration chamber surface for the presence of grease or oil. An accumulation of these materials indicates the pretreatment chamber should be evaluated. Refer to Singulair Tank Pumping instructions for details.
19. Check the aeration chamber for the presence of non-biodegradable materials, paper, mop fibers, hair, grease or oil. A significant accumulation of these materials in the aeration chamber indicates the pretreatment chamber should be evaluated. Refer to Singulair Tank Pumping instructions for details.
20. Inspect the underground power cable in the aerator mounting casting for breaks or scars in the insulation. Examine the inside of the mounting casting and riser for evidence of ground water entry.
21. Carefully reinstall the aerator in the mounting casting. Do not allow the aspirator shaft to touch the mounting casting side walls. Make sure the weight of the aerator is evenly distributed on the upper end of all four mounting brackets.
22. Using a multi-meter, check the voltage at the electrical connector. The meter should read 115 volts ± 5% for systems equipped with electro-mechanical control centers and zero volts for systems with Service Pro controls. Record the voltage on the Service Inspection Card.
23. Wipe the aerator electrical connector with a clean, dry cloth to remove moisture or dirt accumulated during service. Plug the electrical test pigtail in between the male and female electrical connectors and check the amperage of the newly serviced aerator. The aerator should not draw more than 3.8 amps. Record the amperage on the Service Inspection Card. **NOTE:** When the aerator is started for the first time, the break-in period may cause the amp draw to be as high as 4.2 amps for the first 48 hours of operation.
24. Clean or replace the four air intake debris screens. Make sure one screen is placed in each intake opening to prevent debris from entering the aerator.
25. Inspect the vent cap in the aerator access cover and clear the fresh air openings of any debris to insure unrestricted passage of air. Reinstall the access cover on the mounting casting.
26. Make the appropriate notations regarding the aerator, the results of the settleable solids test and related items on the Service Inspection Card.
27. Proceed with clarification chamber service as outlined in Clarification Chamber and Bio-Kinetic Service instructions. When the routine service is complete, return to the control center and restore the Singulair system to the proper operating time cycle for this installation. Close the control center cover and secure it with a new tamper evident seal.

IF AN AERATOR MUST BE REMOVED

The service technician should be able to restore most installations to full operation during the initial service call. If the aerator is no longer eligible for the three-year limited warranty, the aerator should be removed and replaced with a remanufactured and fully warranted exchange unit from your rotating stock. This will become the permanent aerator in service at the facility and your company's service records should be updated to reflect the new aerator serial number. If the serial number portion of the Warranty Registration Card is still attached to the control center, be sure to fill in the new serial number for the owner. When you have accumulated several aerators requiring factory service, return them to Norweco. This reduces administrative time and the cost of shipment per unit. When remanufactured aerators are returned to you, add them to your rotating stock. In this way, the installation is restored to full service with a fully warranted unit in only one service trip.

EXCHANGE AERATOR COSTS

You may compute exact costs for exchange aerators during your service inspection since the cost is determined by system age, regardless of condition. Exchange rates are given on the Singulair Warranty and Exchange Program data sheet. In cases where the aerator has failed under warranty, you should replace it with a loaner unit to insure continued operation of the system and protect effluent quality. Return the warranted unit to the factory immediately for replacement and schedule reinstallation with the owner at the earliest possible convenience when it is returned to you.

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BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

INSTALLATION OF THE BIO-KINETIC® SYSTEM

The Bio-Kinetic system is installed in the final clarification chamber of the Singulair tank. This unique device accomplishes tertiary treatment, flow equalization and, if required by local regulations, effluent disinfection and dechlorination in one compact assembly. The Bio-Kinetic system is recommended for use in direct off-lot discharge applications and any other application where extremely high quality effluent is desirable. Installation of the Bio-Kinetic system can take place as soon as the tank is ready for storage or immediately after the tank is installed in a prepared excavation.

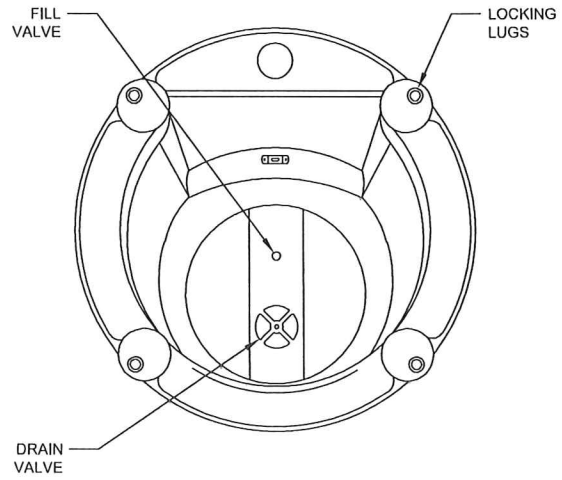
Drain and fill valves built into the Bio-Kinetic system allow it to be installed within the Singulair tank any time after the tank has been poured and stripped. This allows faster Singulair system installation and less time at the installation site. When installing the Bio-Kinetic system before tank delivery, make sure the tank is stored in a level position to avoid stress on the cast-in-place receiving flange, the Bio-Kinetic discharge flange or to prevent damage to the outer chamber filter media.

BIO-KINETIC® SYSTEM PRE-INSTALLATION CHECKLIST

- ✓ All chambers of the Singulair tank should be full to the flow line with clean hold down water as soon as the tank is placed in the excavation and backfilling begins. When the owner calls for start-up, ask him to check the liquid level in the Singulair system. If the liquid level has not reached the outlet invert, have the owner add clean water until full.
- ✓ These instructions consider the use of concrete as well as plastic risers and lids. The Bio-Kinetic system access opening pan, designed to accommodate the locking lugs into the tank top, must be used when installing plastic risers over the clarification chamber access opening.
- ✓ The service vehicle should be fully stocked, including the Norweco Tool Kaddy, Bio-Kinetic lubricant, Blue Crystal disinfecting tablets and Bio-Neutralizer dechlorination tablets.
- ✓ Make sure the proper quantity and model number of Bio-Kinetic systems for the installation are in the service vehicle. Bio-Kinetic systems may be supplied with or without Blue Crystal and Bio-Neutralizer chemical feed systems. Therefore, check your order and Distributor Service and Warranty Record Card carefully to be sure you have selected the proper quantity of Bio-Kinetic systems with the correct service cover, flow distribution deck and feed tube(s), and that they are properly labeled for the correct model Singulair system.
- ✓ For Singulair systems requiring multiple Bio-Kinetic tertiary treatment devices, follow these instructions for each Bio-Kinetic system to be installed.

PREPARING THE SINGULAIR TANK

1. Bio-Kinetic system mounting castings or plastic risers should be used for access to the clarification chamber. Additional riser castings or plastic risers may be added as necessary to reach finished grade.
2. When a mounting casting is used, it must be carefully sealed to allow the locking lugs of the Bio-Kinetic system to engage into the groove created when the mounting casting is installed on the tank top. Excess sealant in this groove may prevent the locking lugs from properly engaging. Other sealing procedures for the tank, mounting castings and risers are detailed in Singulair Tank Delivery and Setting instructions.
3. When plastic risers and lids are used to replace the concrete system mounting castings, make sure that the proper access opening pan has been used to create the grooves that are necessary for securing the locking lugs. Seal and secure the plastic risers to the manufacturer's specifications.
4. The Bio-Kinetic system should only be installed in a



BIO-KINETIC® SYSTEM
AUTOMATIC DRAIN AND FILL VALVES

INSTALLATION THE OF BIO-KINETIC® SYSTEM (Cont.)

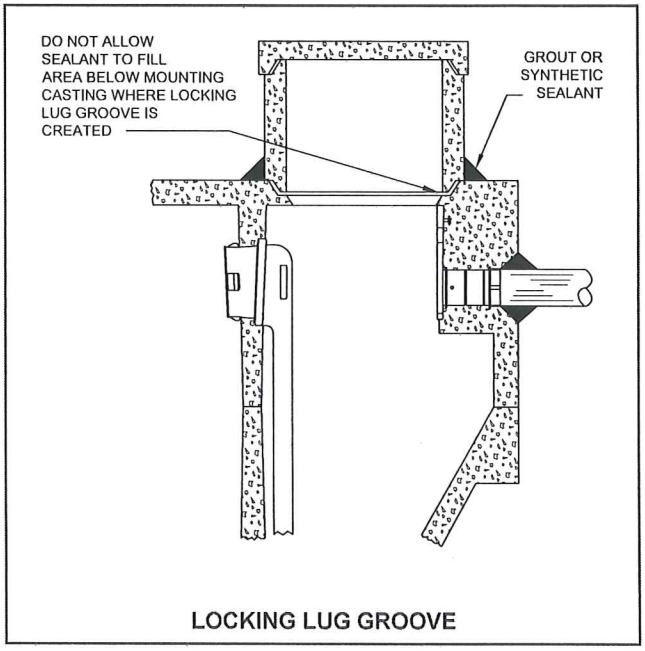
concrete mounting casting or plastic riser with a non-vented concrete or plastic cover above it. Do not seal the cover to the mounting casting or plastic riser. All mounting castings, risers and covers must be in place before backfilling the tank to prevent fill material from entering the Singulair tank.

5. The proper quantity of Bio-Static sludge returns should have been installed in the aeration/clarification chamber wall when tank delivery and setting was completed. Check to be sure that a Bio-Static sludge return is installed in each of the cast-in opening(s) in the aeration/clarification chamber wall.
6. If the Singulair tank is in an excavation, it should already be filled with clean water. The water should be free of dirt, mud, leaves, grit, oils or other materials that might possibly interfere with operation of the system. The tank should be filled with water inside, at the same time it is backfilled outside, to reduce stress on the precast tank. The aeration and clarification chambers will both be filled if the hose is installed in the aeration chamber access opening. The pretreatment chamber should be filled separately through its access opening.
7. Influent and effluent sewer lines must be installed and connected to the system as soon as it is set and before backfilling to prevent entry of mud or debris.
8. When a Singular system is being installed to replace a failed onsite wastewater treatment system, the old septic tank need not be abandoned. However, be sure the Singulair system is installed downstream of the old septic tank and that the entire obsolete system is completely pumped and cleaned before the Singulair tank is installed. If the owner prefers, the obsolete system may be totally removed or filled in and abandoned in the ground.
9. Check to see that roofing down spouts, footer drains, sump pump piping or garage and basement floor drains are not connected to the sanitary sewer. The Singulair system may not operate properly if hydraulic flows greatly exceed the rated treatment capacity. If the facility is equipped with a water softener, locate the backwash discharge line. The backwash line must not be connected to the Singulair system.

BIO-KINETIC SYSTEM INSTALLATION PROCEDURE

Remove the Bio-Kinetic system from the shipping carton. Lift off the Bio-Kinetic system service cover and set it aside. Use the disassembly tool to remove the internal components and discard the shipping sleeve. Reinstall the internal components. Rotate the round, black locking lugs inward to allow installation.

The Bio-Kinetic system discharge flange must engage the plastic receiving flange that has been cast into the outlet of the Singulair tank. Carefully examine the condition of the outlet coupling and receiving flange. Any concrete residue or aggregate that has accumulated in the grooves of the receiving flange or inside of the outlet coupling must be removed and the grooves and face of the receiving flange should be wiped clean. Use the swab tool to apply a liberal amount of Bio-Kinetic lubricant to the entire face of the receiving flange and the inside of the grooves. Apply the lubricant evenly until all interior surfaces of the receiving flange and the grooves are thoroughly coated. Locate the gasketed discharge flange assembly installed in the outlet of the Bio-Kinetic system. Check to make sure that the assembly is tight and fully engages the discharge opening of the Bio-Kinetic system. Using the swab tool, apply a liberal amount of lubricant to the exterior surfaces of the gasketed discharge flange. Apply the lubricant evenly over the entire face of both sides and along the edges of the discharge flange.



LOCKING LUG GROOVE

CAUTION: Bio-Kinetic lubricant has been specially formulated. Use of other lubricants, especially petroleum based lubricants, can cause degradation of the rubber components and will void the warranty.

SELF FILL VALVE

Use the lifting tool to lower the Bio-Kinetic system into the mounting casting. Be careful to align the discharge flange with the receiving flange that is cast into the tank. The Bio-Kinetic system is equipped with a pressure sensitive valve to aid in the filling process for new systems that are not yet filled and the draining process during service or removal. The fill valve is engineered to open when the pressure

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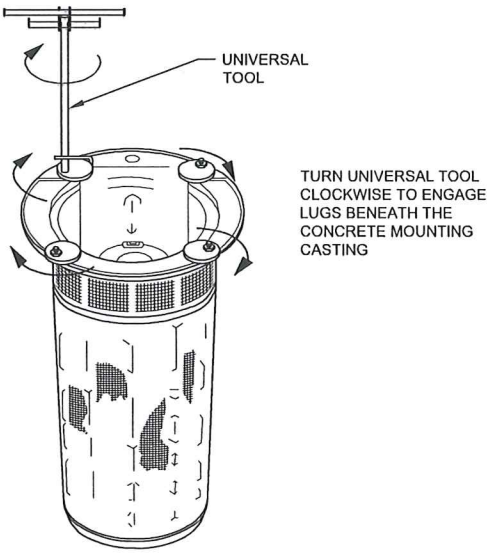
SINGULAIR® BIO-KINETIC®

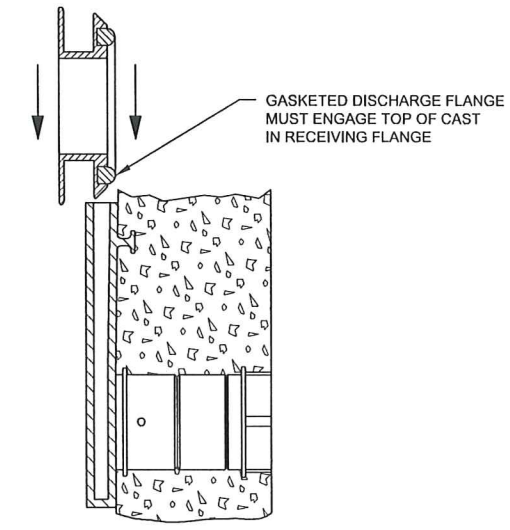
WASTEWATER TREATMENT SYSTEM

INSTALLATION OF THE BIO-KINETIC® SYSTEM (Cont.)



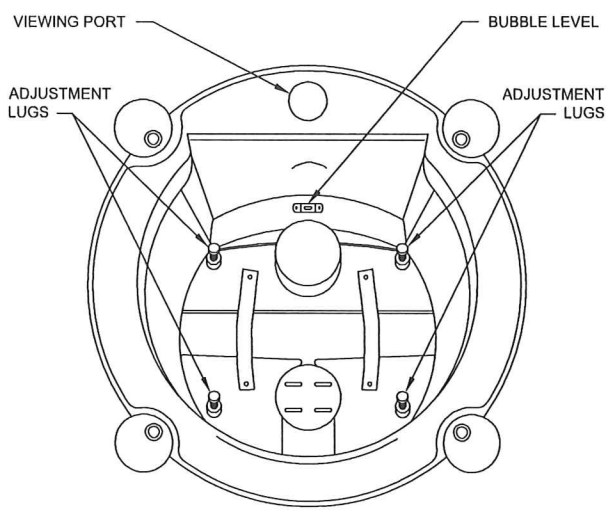
LOCKING DOWN THE BIO-KINETIC SYSTEM

outside the Bio-Kinetic system reaches 16 inches of head. When the tank water level reaches 16 inches on the outer chamber of an empty Bio-Kinetic system, the fill valve will open. The valve will remain open until the water level inside the filter reaches 4 inches below the water level outside the filter. At this point, the valve will close. For operation instructions on the drain valve system, refer to "Clarification Chamber and Bio-Kinetic Service." Carefully guide the system through the center of the opening using the lifting tool. Be sure to maintain the Bio-Kinetic system in a vertical position. If allowed to tilt, the system could rub the edge of the concrete opening and be damaged. **NOTE:** Use the viewing port to be sure proper alignment and engagement of the outlet connection takes place. The discharge flange must engage the top of the cast-in-place receiving flange.



CHECK FOR PROPER ALIGNMENT

Continue to lower the system until the discharge flange fully engages the receiving flange and the top collar of the Bio-Kinetic system rests on the concrete ledge of the clarification chamber access opening. To confirm that the discharge flange and receiving flange are fully engaged, look through the viewing port in the top collar. Use the locking lug tool to twist each of the round, black locking lugs clockwise, so that each locking lug is positioned directly beneath the concrete lip of the mounting casting.



BUBBLE MUST REST BETWEEN THE TWO LINES

PLACING THE BIO-KINETIC SYSTEM ON LINE

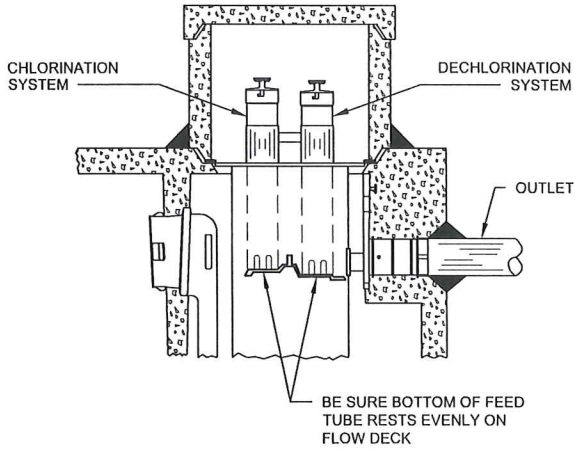
Locate the level indicator mounted above the outlet of the Bio-Kinetic system flow distribution deck. The bubble should be resting squarely between the two lines in the clear plastic case. If the location of the bubble indicates the system is not installed in a level position, the flow distribution deck should be leveled using the four adjustment lugs provided for this purpose. With the ratchet drive, extension and $^{7}/_{16}$" socket from the Tool Kaddy, turn each of the adjustment lugs the minimum amount necessary for the bubble to rest squarely between the two lines in the clear plastic case. Leveling of the flow distribution deck is essential for proper operation of the flow equalization ports, chemical feed tubes and effluent weir within the Bio-Kinetic system.

INSTALLATION OF THE BIO-KINETIC® SYSTEM (Cont.)

The system service cover can now be placed into position. Install the cover, handle side up, aligning the four holes in the cover with the four locking lug bolts. Be sure the optional chlorination and dechlorination feed tube access openings are in the proper position. The cover will come to rest on the collar of the Bio-Kinetic system. There is no need to add fasteners to the locking lug bolts.

If the installation requires a Blue Crystal disinfection system, the chlorine feed tube opening in the service cover must be positioned on the inlet side of the system nearest the aerator mounting casting. Before handling Blue Crystal disinfecting tablets, carefully read the container label and the "Warning" section of these instructions. To fill the chlorine feed tube, remove the cap, hold the tube (open end down) with one hand and insert Blue Crystal disinfecting tablets, one tablet at time, until the tube is filled. Each tablet must lie flat in the stack. When the tube has been completely filled, replace the cap. Install the feed tube, slotted end down, through the plastic collar molded into the top of the Bio-Kinetic system service cover. The feed tube will begin to engage the round recess in the flow distribution deck. Rotate the tube clockwise until it locks into position.

NOTE: The chlorine feed tube must always be installed through the mounting collar nearest the aerator mounting casting. If the installation requires disinfection and dechlorination, there will be two openings in the protective cover. The dechlorination feed tube must be installed nearest the system outlet.



BLUE CRYSTAL® AND BIO-NEUTRALIZER® FEED TUBE INSTALLATION

WARNING

Blue Crystal disinfecting tablets are a strong oxidizing agent and highly corrosive. Tablets should be stored in a cool, dry, well-ventilated area away from combustible materials such as paper, petroleum products, chemicals, rags or cardboard. Contact with other liquids or chemicals may cause fire. Wear proper protective equipment when handling Blue Crystal disinfecting tablets or working with the chlorine feed tube. Keep tablets out of the reach of children, as they can cause skin and eye damage, irritate the nose and throat, and may be fatal if swallowed. If on skin, wash with plenty of soap and water for fifteen minutes, call a doctor if irritation persists. If swallowed, immediately drink large quantities of water, do not induce vomiting, avoid alcohol and get medical attention immediately. If inhaled, immediately remove victim to fresh air. In the case of fire, apply liberal quantities of water. It is a violation of Federal Law to use Blue Crystal tablets in a manner inconsistent with the instructions printed on the storage container label.

If the installation requires a Bio-Neutralizer dechlorination system, the Bio-Kinetic system will be supplied with a dechlorination feed tube. Before handling Bio-Neutralizer dechlorination tablets, carefully read the container label and the "Warning" section of these instructions. To fill the dechlorination feed tube, remove the cap, hold the tube (open end down) with one hand and insert the Bio-Neutralizer dechlorination tablets, one tablet at a time, until the tube is filled. Each tablet must lie flat in the stack. When the tube has been completely filled, replace the cap. Insert the dechlorination feed tube, slotted end down, into the mounting collar closest to the system outlet. The bottom of the tube must come to rest evenly on the floor of the flow deck.

WARNING

Bio-Neutralizer dechlorination tablets must be stored in a cool, dry place away from acids and oxidizers. Do not allow Bio-Neutralizer tablets to come into contact with chlorine tablets. Although not rated a hazardous material by the USEPA, exercise caution when handling and wash skin thoroughly with soap and water if contact occurs.

Reinstall the Bio-Kinetic system access cover. If a plastic riser and lid are used, secure the plastic lid to the riser using the fasteners provided. Now proceed with the steps outlined in the Singulair System Final Check and System Start-Up instructions.

SERVICING THE BIO-KINETIC SYSTEM

Each Singulair installation equipped with the Bio-Kinetic system should be inspected and serviced during each six-month prescheduled service inspection. Refer to the Bio-Kinetic System Service instructions for service procedures and recordkeeping policies.

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BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

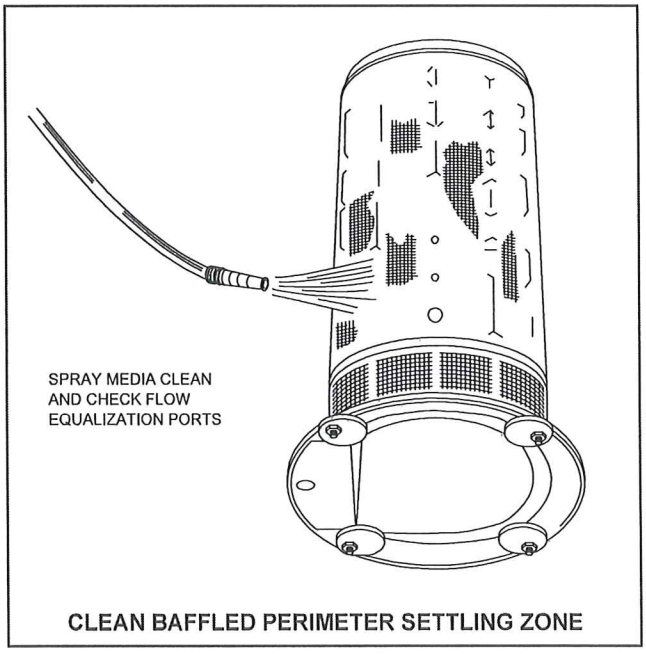
CLEANING AND DISASSEMBLY INSTRUCTIONS FOR THE BIO-KINETIC® SYSTEM

EQUIPMENT REQUIRED FROM THE BIO-KINETIC SYSTEM TOOL KADDY

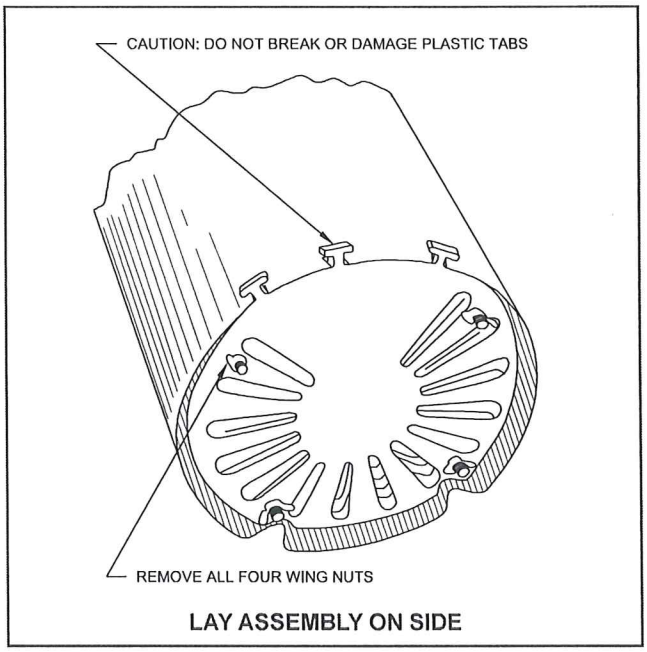
- ❑ water hose and spray nozzle
- ❑ Bio-Kinetic system universal tool
- ❑ rubber gloves
- ❑ safety face shield or goggles
- ❑ ratchet drive and $^{7}/_{16}$" socket

A fresh water supply and sewer drain are required for cleaning the Bio-Kinetic system.

1. Remove the Bio-Kinetic system from the service container. Rinse the container and lid. Rotate the four locking lugs to the outboard position on the Bio-Kinetic system. Remove the gasketed discharge flange assembly from the flow deck and rinse it with water.
2. Grasp the top flange of the system with one hand and insert the disassembly tool beneath each of the strap handles on the flow deck. Pull up on the disassembly tool to remove the flow deck and internal system components from the contact chamber and set aside. Use the water hose and spray nozzle to wash the inside of the contact chamber.
3. Use the water hose and spray nozzle to wash off the filter media. Continue spraying until all sludge and wastewater have been flushed from the media. Invert the filter assembly and flush accumulated material from the baffled perimeter settling zone. Inspect the perimeter settling zone to be certain that it is totally clean. Check the flow equalization ports to be sure they are clean and unobstructed.
4. Wash off any debris that has accumulated on the surface of the flow distribution deck and baffle wall shroud. Lay the assembly down on its side and remove the four wing nuts on the bottom. Remove and wash the bottom deck plate.



CLEAN BAFFLED PERIMETER SETTLING ZONE



LAY ASSEMBLY ON SIDE

CAUTION: Do not break or damage the molded plastic tabs on the edge of the bottom deck plate.

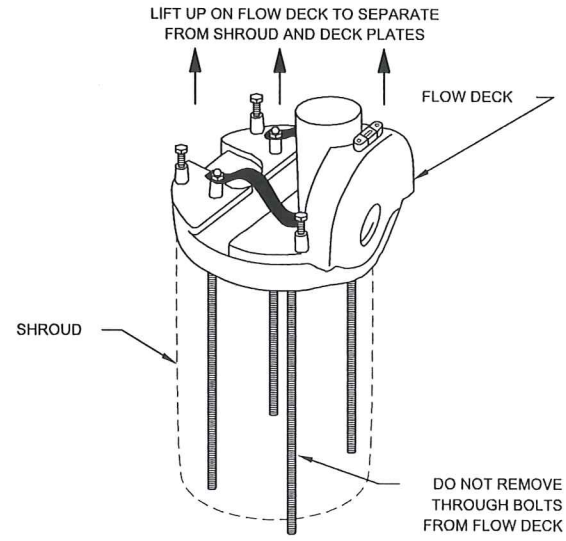
Do not remove the remaining deck plates at this time. Stand the assembly upright and lift up on the flow distribution deck to separate it from the baffle wall shroud and deck plates. You may find it helpful to hold the baffle shroud between your feet when lifting up on the flow deck.

NOTE: The through bolts will be removed from the shroud and deck plates when the flow deck is lifted off the baffle

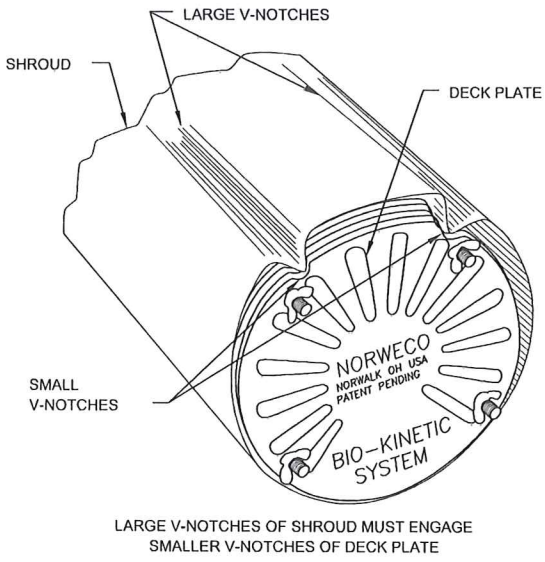
BIO-KINETIC® SYSTEM CLEANING AND DISASSEMBLY INSTRUCTIONS (Cont.)

wall shroud. Do not remove the through bolts from the flow distribution deck. Rinse the flow distribution deck thoroughly inside and out. Inspect the weir and final discharge zone to be sure they are completely clean.

5. Lift up the baffle wall shroud to remove it from the deck plates. Rinse the inside and outside of the shroud and set it aside. Take the cleaned, round bottom deck plate and set it on the floor with the engraved name facing down.
6. Remove the top deck plate from the remaining stack and wash off both sides. When cleaned, set it on top of the cleaned, round bottom deck plate. Repeat this procedure with each deck plate until all plates are cleaned and reassembled into a single stack. Each deck plate is molded with four circular depressions in the bottom side of the plate and four round stand-off posts in the top side of the plate. When restacking the clean deck plates, make sure the four depressions on the bottom engage the top of the four posts below. All deck plates must be placed onto the stack baffle side up (engraving down). When properly assembled, all edges of each plate should be vertically aligned.
7. Lower the baffle wall shroud over the assembled stack of deck plates. The two large V-notches in the shroud should engage the smaller notches on the edge of the deck plates. Check the four leveling lugs on the flow deck. They must be unscrewed until they are flush with the bottom of the flow deck. Now position the flow distribution deck above the baffle wall shroud so that the outlet of the flow distribution deck is directly opposite the two large V-notches in the shroud. Insert each of the four through bolts through the holes in the top of the baffle shroud and into the stack of deck plates. Lower the flow distribution deck until it fully engages the top of the baffle shroud. Push each through bolt down into the assembly as far as it will go.
8. Lay the assembly on its side and push the through bolts through the bottom deck plate. Fasten a wing nut to each of the four through bolts where they project through the bottom deck plate. While tightening each wing nut, make sure the molded plastic tabs on the bottom deck plate engage the slots on the edge of the shroud. Tighten enough to insure all three tabs are fully engaged into the three slots in the shroud.
9. Lubricate the grommet in the outlet opening of the contact chamber. Grasp the strap handles and lower the flow deck and internal components into the cleaned contact chamber making sure to align the flow deck outlet with the outlet of the contact chamber. Apply a moderate amount of downward force until the outlet of the flow distribution deck aligns with the outlet of the contact chamber.
10. Place the assembled Bio-Kinetic system back into the cleaned service container. Place the discharge flange assembly onto the flow distribution deck. Now place the service container cover into position by aligning the four holes in the cover with the locking lug bolts. Add a wing nut to each of the lug bolts to hold the cover in place. Return the container to your service stock.



REMOVE FLOW DECK FROM SHROUD



LARGE V-NOTCHES OF SHROUD MUST ENGAGE
SMALLER V-NOTCHES OF DECK PLATE

DECK PLATE AND SHROUD ASSEMBLY

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DESIGN, INSTALLATION AND
SERVICE INFORMATION FOR THE
SINGULAIR® DN AND SINGULAIR GREEN® DN
NITROGEN REDUCING WASTEWATER TREATMENT SYSTEM

Singulair® DN 600, 750, 1,000, 1,250 and 1,500 GPD
& Singulair Green® DN 600

RECIRCULATION PUMP SERVICE

The recirculation pump is located in the small recirculation chamber immediately after the Singulair® DN system.

The service requirements are the following:

1. Cleaning the screen of any deposits.
2. Checking the pump for normal operations with power on.

If the pump is not operating, it should be replaced.

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BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

TROUBLESHOOTING

During service inspections you may periodically encounter a situation which, if not identified and corrected, will result in interruption of service for the Singulair system. This troubleshooting guide is designed to enable you to isolate the cause of system problems that may be encountered from time to time. Whenever a potential problem is encountered, you should take immediate steps to eliminate the cause. Please note that all areas of installation, including those normally the responsibility of the contractor, excavator, electrician and owner, are covered. You will find that many problems can be traced to causes other than the system or its components. Your help and suggestions in solving these for the owner will save unnecessary expense and will insure maximum system performance.

PLEASE NOTE:

This troubleshooting guide provides efficient and correct solutions to most wastewater treatment problems when used in conjunction with established inspection procedures performed by a factory-trained service technician.

Before responding to a customer service call, check to see that:

- ✓ A member of your service staff, factory-trained and certified by Norweco, is dispatched to answer the call.
- ✓ Installation and service records for the particular system are up-to-date and have been reviewed.
- ✓ The service technician has a copy of the Singulair Service Manual.
- ✓ The service vehicle has loaner aerators, exchange aerators, Bio-Kinetic Service Cart, exchange Bio-Kinetic systems and a fully stocked Tool Kaddy with replacement parts.
- ✓ Clear and concise directions to the installation, including tank and control center location, are given to the service technician.

OPERATIONAL TROUBLESHOOTING

MUD OR SILT IN SINGULAIR SYSTEM OR BIO-KINETIC SYSTEM*

Influent sewer line separated at a joint or fitting	Have contractor excavate and repair
Sewer line crushed	Have contractor excavate and replace
Defective seal around tank inlet or outlet	Excavate and reseal
Singulair tank structurally damaged	Excavate and patch or replace tank
Singulair casting joint improperly sealed	Excavate and seal with non-shrink grout

*Have Singulair system pumped to remove mud after repairs have been completed. Multiple pumping may be required to remove all mud from the Singulair system. See: Singulair Tank Pumping instructions.

TROUBLESHOOTING (Cont.)

SEPTIC ODOR IN SINGULAIR SYSTEM

Aerator turned off	Place control center selector switch in "automatic" position
Insufficient air delivery by aerator	Service aerator
Aspirator shaft plugged with deposits	Remove from aerator and flush with shaft cleaning hose
Aspirator orifices plugged with deposits	Remove deposits
Water softener backwash discharging into system	Have owner remove backwash line from system
Circuit breaker tripped	See "Control Center Warning Light Glows/Audible Alarm Sounding"
Improperly sealed pretreatment chamber access cover	Seal pretreatment access cover
Vent cap openings restrict fresh air entry	Clean vent cap openings
Incomplete treatment due to hydraulic overloading	See "Hydraulic Overloading"
Periodic septic odor for no reason	Have sanitary sewer vent checked

HYDRAULIC OVERLOADING OF SINGULAIR SYSTEM

Ground water entering system through tank joint	Excavate and seal with non-shrink grout
Ground water entering system through crack in side wall	Excavate and patch with non-shrink grout
Ground water entering system through defective seal at inlet or outlet line	Excavate and reseal piping as needed
Roofing down spouts, footer drains, sump pump piping or garage and basement floor drains tied into Singulair system influent line	Have contractor relocate improper connection downstream of Singulair system

ORGANIC OVERLOADING OF SINGULAIR SYSTEM

Aeration chamber settled solids test reads in excess of 75%	Evaluate pretreatment chamber - See Singulair Tank Pumping instructions
Aeration chamber solids appear black	Evaluate pretreatment chamber - See Singulair Tank Pumping instructions

FLOATING SOLIDS IN CLARIFICATION CHAMBER OR PLANT EFFLUENT

Excessive sludge on clarifier sidewalls	Scrape hopper side walls
Restriction of Bio-Static or sludge return port	Remove obstruction
Pretreatment chamber discharging excessive solids	Evaluate pretreatment chamber - See Singulair Tank Pumping instructions
Hydraulic overloading of system	See "Hydraulic Overloading"

CONTROL CENTER WARNING LIGHT GLOWS/AUDIBLE ALARM SOUNDING

Liquid in tank at level of foam restrictor	See "Singulair System Flooded"
Aerator drawing excessive current	See "Aerator Drawing Excessive Current"
Dead short in power line to aerator	Have owner call his electrician

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BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

AERATOR TROUBLESHOOTING

AERATOR WILL NOT OPERATE

Electrical service to aerator interrupted	See "No Electrical Power from Control Center to Aerator"
Voltage supplied is insufficient to start aerator*	Report condition to power company
Defective bearing, windings or insulation in motor	Return entire aerator to factory
Debris wound on aspirator shaft	Remove debris with knife
Aspirator shaft bent	Return entire aerator to factory
Foam restrictor or entire aerator under water	See "Singulair System Flooded"

*If you suspect low voltage, check the voltage at the watertight electrical connector, not at the Service Pro control center. If voltage above 103 or more is measured, check the other possibilities listed in this section.

AERATOR DRAWING EXCESSIVE CURRENT

Foam restrictor partially under water	See "Singulair System Flooded"
Debris on aspirator shaft	Remove debris with knife
Motor failure	Return aerator to factory
Insufficient voltage (less than 103 volts)	Report condition to power company
Excessive voltage (greater than 126 volts)	Report condition to power company

AERATOR MAKING EXCESSIVE NOISE

Rubber shock absorbers on brackets worn	Replace shock absorbers
Bearing failure in aerator motor	Return aerator to factory
Noise is generated by excessive vibration	See "Aerator Operates With Excessive Vibration"

AERATOR OPERATES WITH EXCESSIVE VIBRATION

Debris on aspirator shaft	Remove debris with knife
Aspirator shaft bent	Return entire aerator to factory
Aerator mounting brackets bent	Straighten brackets
Top aerator brackets not seated evenly	Adjust mounting brackets
Aspirator shaft installed too tightly on intermediate shaft	Reinstall aspirator shaft with set screws finger tight only. If condition persists return entire aerator to factory.
Aspirator shaft installed with improper alignment to intermediate shaft	Reinstall aspirator shaft to factory alignment marks

AERATOR OPERATES BRIEFLY BEFORE CIRCUIT BREAKER TRIPS

Aerator is drawing excessive current	See "Aerator Drawing Excessive Current"
Aerator is partially under water	See "Singulair System Flooded"
Aspirator shaft bent	Return entire aerator to factory
Moisture has entered aerator motor	Return entire aerator to factory

AERATOR TROUBLESHOOTING (Cont.)

ELECTRICAL TROUBLESHOOTING

CAUTION: Before initiating any electrical component inspection or repair, turn off all power to the Singulair system by switching off the dedicated circuit breaker in the main electrical service panel and then testing with the electrical multi-meter. Repairs should always be made by a qualified electrician using proper procedures and safe tools. Make sure all circuits are properly grounded. Do not stand in damp locations when making electrical system tests. Always use tools with insulated handles for electrical repairs.

NO ELECTRICAL POWER FROM ELECTRICAL SERVICE PANEL TO CONTROL CENTER

Circuit breaker in electrical service panel has tripped	Turn breaker to "off" position, then turn "on"
Fuse in electrical service panel has blown	Have owner replace fuse
Circuit breaker in electrical service panel turned "off"	Turn breaker "on"
Loose connection in electrical service panel	Tighten all connections: First, shut off breaker in main electrical service panel
Defective circuit breaker in electrical service panel	Have owner replace circuit breaker
Corrosion on contacts prevents flow of current	Clean or replace contacts
Incomplete circuit - neutral not properly wired	Have owner wire directly to neutral bar
Power cable from service panel to Service Pro control center severed	Have owner locate break and repair

NO ELECTRICAL POWER FROM CONTROL CENTER TO AERATOR

Service Pro control center terminal A1 and neutral read zero voltage	Place selector switch in "on" position. If voltage is read, place selector switch in "automatic" position and rotate time clock knob until voltage is read. If no voltage can be read, replace control center insert.
Singulair circuit breaker has tripped	Push reset breaker
Singulair circuit breaker is defective	Replace breaker
Singulair selector switch turned "off"	Turn switch to "automatic" operation
Singulair selector switch defective	Replace control center insert
Corrosion on terminals prevents flow of current	Clean or replace contacts
Power cable from Service Pro control center to aerator damaged	Locate damage and repair
Loose wiring connection	Check all connections

AERATOR WILL NOT START

Reset breaker in Service Pro control center tripped	Push reset breaker
Loss of power to Service Pro control center	See both "No Electrical Power" sections
Insufficient voltage present at aerator	Report condition to power company
Watertight electrical connector not properly engaged	Remove watertight electrical connector and plug in tightly
Watertight electrical connector not properly wired	Rewire watertight electrical connector
Defective motor	Return entire aerator to factory

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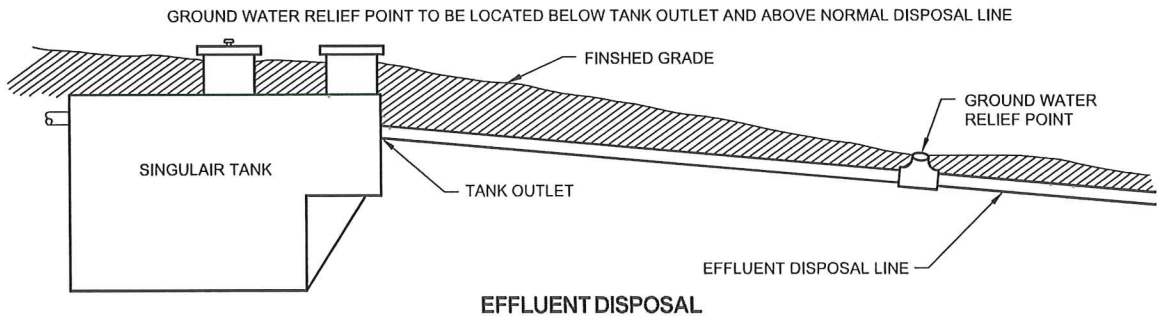
BIO-KINETIC® WASTEWATER TREATMENT SYSTEM

BIO-KINETIC® SYSTEM TROUBLESHOOTING

Although the system effluent may be discharged and/or disposed of in several acceptable fashions, there should be a ground water relief point installed in the effluent line. It should be at a point no higher than the outlet invert of the Singulair tank. It will prevent flooding in cases where the disposal line is submerged or saturated with ground water. Locate the ground water relief point and be sure that it is free from obstructions.



EFFLUENT DISPOSAL

SINGULAIR SYSTEM FLOODED

Bio-Kinetic system plugged	See "Bio-Kinetic System Plugged"
Tank outlet plugged	Clean debris from tank outlet
Groundwater relief point restricted	Remove obstruction
Disposal field plugged	Notify owner immediately
Effluent pump failure	Repair or replace effluent pump
Surface water drains toward Singulair tank	Have contractor regrade and/or install risers
Outlet line installed with insufficient fall	Have contractor correct
Outlet line crushed or filled with debris	Have contractor clean or replace
Effluent disposal lines installed with insufficient fall or have settled	Have contractor correct or replace

BIO-KINETIC SYSTEM PLUGGED

Mud has fouled filter media	See "Mud or Silt in Singulair System"
Organic overloading	See "Organic Overloading"
Hydraulic overloading	See "Hydraulic Overloading"
Water softener backwash discharging into system	Have owner remove backwash line from system
Solids flowing in from pretreatment chamber	Evaluate pretreatment chamber - See Singulair Tank Pumping instructions
Incomplete treatment due to aerator shut-off	Place control center selector switch in "automatic" position
Internal components flooded	Remove and service Bio-Kinetic system
Grease or inorganic matter on filter media or in clarification chamber	Evaluate pretreatment chamber - See Singulair Tank Pumping instructions

BIO-KINETIC® SYSTEM TROUBLESHOOTING (Cont.)

BIO-KINETIC SYSTEM PLUGGED (Cont.)

Compartmented contact chamber plates plugged	Clean chamber plates
Outlet weir obstructed	Inspect and clean outlet weir

CAUTION: Never allow chemical wastes, grease or mud to enter the Singulair system. These materials alter the desirable characteristics of activated sludge and will cause severe problems in the performance of the system.

NO RESIDUAL CHLORINE IN FINAL EFFLUENT

Chlorine feed tube not dispensing chlorine - empty	Refill feed tube with Blue Crystal disinfecting tablets
Chlorine feed tube not dispensing chlorine - tablets jammed	Gently tap tablets down in feed tube to be sure they make contact with the inside bottom of tube
Chlorine feed tube not dispensing chlorine - not fully engaged	Check feed tube to be sure bottom of tube is flush in flow deck
Chlorine feed tube not dispensing chlorine - feed tube plugged	Remove obstruction and reinstall feed tube

CAUTION: Extreme care must be used when handling chemicals. Refer to the Blue Crystal handling instructions before attempting any service. Proper procedures and personal protective equipment must be utilized to avoid serious injury.

FINAL EFFLUENT APPEARS CLOUDY OR TURBID

Aerator not operating	See Aerator Trouble-Shooting
Hydraulic overloading	See "Hydraulic Overloading"
Organic overloading	See "Organic Overloading"
Chlorinator not working	See "No Residual Chlorine in Final Effluent"
Bio-Kinetic system is damaged	Replace system. See Clarification Chamber and Bio-Kinetic Service instructions
Bio-Kinetic system is plugged	See Routine Clarification Chamber and Bio-Kinetic Service Instructions
Saturated disposal field	Report to owner immediately

DECHLORINATION INSTALLED WITH RESIDUAL CHLORINE STILL PRESENT IN FINAL EFFLUENT

Dechlorination feed tube not dispensing chemical-empty	Refill feed tube with Bio-Neutralizer dechlorination tablets
Dechlorination feed tube not dispensing chemical-tablets jammed	Gently tap tablets down in feed tube to be sure they make contact with the inside bottom of tube
Dechlorination feed tube not dispensing chemical-not fully engaged	Check feed tube to be sure bottom of tube is flush in flow deck
Dechlorination feed tube not dispensing chemical-feed tube plugged	Remove obstruction and reinstall feed tube

CAUTION: Extreme care must be used when handling any chemicals. Refer to the Bio-Neutralizer handling instructions before attempting any service. Proper procedures and personal protective equipment must be utilized to avoid serious injury.