



507 N. Nanum Street, Suite 102  
 Ellensburg, WA 98926  
 T: 509.962.7515 F: 509.962.7581  
 www.co.kittitas.wa.us/health/

FOR OFFICIAL USE ONLY
Accepted By: _____
Permit #: _____
Date Processed: _____
Receipt #: _____

### ON SITE SEWAGE INSTALLATION PERMIT APPLICATION

A "Permit to Install a Sewage System" allows the Landowner to install or to contract a licensed OSS installer to install an on-site septic system according to the design approved by the Health Officer. Development other than that described on the permit application and approved design, may without advanced approval of the Health Officer invalidate the Permit.

**A sewage system installation permit expires one year from the month of issuance, and must be complete before final inspection. A one-year renewal permit may be applied for prior to expiration.**

*It is the responsibility of the requesting party to have established boundary lines prior to any work being conducted on the parcel.*

**PARCEL OWNER:** JILL JOHNSON  
 Site Address: 951 MCDONALD ROAD  
 Mailing Address: \_\_\_\_\_  
 Owner Phone: \_\_\_\_\_  
 Owner Email: JMJOHNSON60@MSN.COM

**SITE INFORMATION:**  
 Assessor's Parcel Number: 525135  
 Parcel Size: 1.58 ACRES  
 Directions to site: \_\_\_\_\_  
 \_\_\_\_\_  
 Subdivision: \_\_\_\_\_  
 Block: \_\_\_\_\_  
 Lot: \_\_\_\_\_

**REQUESTED BY:** MARK NELSON  
 Requester Phone: 509-304-9062  
 Requester Email: MCN.ELLENSBURG@GMAIL.COM

Designer's name: MARK NELSON Designer's email: MCN.ELLENSBURG@GMAIL.COM  
 Installer name: \_\_\_\_\_ Installer's email: \_\_\_\_\_

**STRUCTURE** (check all that apply):  
 Proposed OR  Existing  
 On-site construction OR  Manufactured  
 Single OR  Multiple family dwelling  
 Other: \_\_\_\_\_  
 Number of bedrooms (per dwelling unit): 4  
 Number of (intended) permanent occupants: 8

**DRINKING WATER SUPPLY:**  
 Public Group A  
 Name of system: \_\_\_\_\_  
 Public Group B  
 Name of system: \_\_\_\_\_  
 Private well  
 Shared well (Max 2 Connections)  
 Cistern

**Fee Information (fees are non-refundable)**

PERMIT APPLIED FOR:	TYPE OF SYSTEM:	PREFERRED NOTIFICATION METHOD:
<input checked="" type="checkbox"/> New	<input checked="" type="checkbox"/> Conventional/Gravity (\$590.00)	<input type="checkbox"/> Pick up (Public Health front desk)
<input type="checkbox"/> Repair	<input type="checkbox"/> Homeowner Gravity Design (\$2,500.00)	<input type="checkbox"/> Mail
<input type="checkbox"/> Alteration	<input type="checkbox"/> Pressure (\$725.00)	<input checked="" type="checkbox"/> E-Mail
<input type="checkbox"/> Redesign	<input type="checkbox"/> Alternative (\$855.00)	<input type="checkbox"/> No copy requested at this time
<input type="checkbox"/> Tank Placement (\$350.00)	<input type="checkbox"/> Commercial (\$1,250.00)	

**SEPTIC TANK:** (Must be from state approved list)  
 New  
 Existing  
 Gallons: 1000

**PUMP CHAMBER:**  
 New  
 Existing  
 Gallons: 1000

**DRAIN FIELD CALCULATIONS**  
 Gallons per day: 480 GPD  
 Application Rate: .6 Gals/Sq.Ft./Day  
 Reduction Factor: 40 %  
 Drain Field Area: 480 Sq.Ft.  
 Reserve DF Area: 800 Sq.Ft.

**DESIGNER STAMP HERE:**



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 www.co.kittitas.wa.us/health/

**RECEIVED**  
 JUL 08 2022  
 BY: KS

FOR OFFICIAL USE ONLY	
Accepted By:	<u>KS</u>
Permit #:	<u>OE-22-00165</u>
Date Processed:	<u>7-6-22</u>
Receipt #:	<u>PH22-01357</u>

**APPLICATION FOR SITE EVALUATION**

Property Owners Name: Jill M. Johnson  
 Site Address: 951 McDonald Road  
 City: Cl Elum Zip: 98922  
 Phone Number: 425-418-7448  
 Property Owner Email: jmjohnson60@msn.com  
 Requested By: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Requester Mailing Address: 663 Morrison Canyon Lane  
 City: Cl Elum Zip: 98922  
 Requester Email: jmjohnson60@msn.com  
 Designers Name: NA Phone: \_\_\_\_\_  
 Designer Email: \_\_\_\_\_  
 Signature of owner or agent: [Signature]

**EMAIL RESULTS TO:**

Owner  Requester  Designer

**SITE (PARCEL MAP MUST BE ATTACHED)**

Map Parcel Number 525135 Lot #: \_\_\_\_\_  
 Subdivision: \_\_\_\_\_ Gate Code: \_\_\_\_\_ Acreage Size: 2  
 Directions to site: \_\_\_\_\_

Go Online to <https://www.co.kittitas.wa.us/health/> to Schedule your Inspection

**STRUCTURE (CHECK ALL THAT APPLY):**

Proposed OR  Existing  Repair OR  Alteration  
 Single Family Residence OR  Commercial Application  
 Number of bedrooms: 3 Number of permanent occupants: 2  
 Other (Specify) \_\_\_\_\_ Expected Daily Design Flow \_\_\_\_\_

**WATER SUPPLY:**

Public Water System (3+ connections) - Name of system: \_\_\_\_\_  
 Private well  Shared well (2 connections) ✓  
 Cistern  Well is drilled and located on attached Map  Well not drilled

**\$695.00 Site Evaluation fee is non-refundable after service has been provided.**

**Site Evaluation is valid for five years.**

**Please Note: The Owner/Requester is responsible for the digging of the test holes.**

**It is the responsibility of the requesting party to have established boundary lines prior to any work being conducted on the parcel.**

**OSS SITE EVALUATION - TEST HOLE DATA & PARCEL INFORMATION**

File Last Name: Johnson

Parcel Number: 525135

SOIL LOG #	PRIMARY		
Depth Feet	Texture	Structure	Color
1-	LS	- Granular or Structureless - weak to mod. CO	Dark Brown
2-			
3-			
4-		Bottom H <sub>2</sub> O	
5-			
6-			

SOIL LOG #	RESERVE		
Depth Feet	Texture	Structure	Color
1-	SL	- Granular or Structureless - weak to moderate CO	Dark Brown
2-			
3-			
4-		MOT	
5-	S	CO	Brown to grey
6-			

Bottom H<sub>2</sub>O

Soil Profile		Field Observations:
C = Clay	CO = Cobbles	<ul style="list-style-type: none"> <li>• Heavy roots due to woods in TH1 + TH2</li> <li>• Ground was damp in TH1 &amp; TH2</li> <li>• Ground was uphill and dry for TH3</li> </ul>
S = Sand	BKR = Broken Rock	
Si = Silt	HP = Hard Pan	
L = Loam	H2O = Water	
GR = Gravel	MOT = Mottling	
RL = Root Line		

Minimum Setbacks:	APP Rate:
<input checked="" type="checkbox"/> Surface Water (100') <input checked="" type="checkbox"/> Wells (100') <input checked="" type="checkbox"/> Water Lines (10') <input checked="" type="checkbox"/> Cut banks (25' + 5' or 50' + 5') <input checked="" type="checkbox"/> Interceptor Ditches (10' up or 30') <input checked="" type="checkbox"/> Property Lines (5') <input checked="" type="checkbox"/> Buildings (10') <input checked="" type="checkbox"/> Cuts or fills? Slope: _____ (Percent & Direction)	<input type="checkbox"/> .2 <input type="checkbox"/> .4 <input checked="" type="checkbox"/> .6 <input type="checkbox"/> .8 <input type="checkbox"/> 1.0 <input type="checkbox"/> Unsuitable  Restrictive Layer Depth: <u>TH2 = MOT at 4'</u>  Additional Soil Comments: _____ _____

Comments or Waivers: \_\_\_\_\_

Staff Signature: [Signature]

Date: 7/11/22

**OSS SITE EVALUATION - TEST HOLE DATA & PARCEL INFORMATION**

File Last Name: Johnson

Parcel Number: 525135

SOIL LOG # <u>3</u> PRIMARY			
Depth	Texture	Structure	Color
Feet			
1 -	<u>LS</u>	<u>NO Structure</u>	<u>Dark Brown</u>
<u>1'8"</u>		<u>granular</u>	
2 -		<u>Weak to med</u>	
3 -	<u>S</u>	<u>Weak Structure</u>	<u>CO</u>
4 -			<u>Brown to grey</u>
5 -			
6 -		<u>Bottom</u>	

SOIL LOG # RESERVE			
Depth	Texture	Structure	Color
Feet			
1 -			
2 -			
3 -			
4 -			
5 -			
6 -			

Soil Profile		Field Observations:
C = Clay	CO = Cobbles	
S = Sand	BKR = Broken Rock	
Si = Silt	HP = Hard Pan	
L = Loam	H2O = Water	
GR = Gravel	MOT = Mottling	
RL = Root Line		

Minimum Setbacks:	APP Rate:
<input checked="" type="checkbox"/> Surface Water (100') <input checked="" type="checkbox"/> Wells (100') <input type="checkbox"/> Water Lines (10') <input type="checkbox"/> Cut banks (25' + 5' or 50' + 5') <input type="checkbox"/> Interceptor Ditches (10' up or 30') <input checked="" type="checkbox"/> Property Lines (5') <input checked="" type="checkbox"/> Buildings (10') <input checked="" type="checkbox"/> Cuts or fills? Slope: _____ (Percent & Direction)	<input type="checkbox"/> .2 <input type="checkbox"/> .4 <input checked="" type="checkbox"/> .6 <input type="checkbox"/> .8 <input type="checkbox"/> 1.0 <input type="checkbox"/> Unsuitable  Restrictive Layer Depth: <u>N/A</u>  Additional Soil Comments: _____ _____

Comments or Waivers: \_\_\_\_\_

Staff Signature: [Handwritten Signature]

Date: 7/11/22



KITTITAS COUNTY  
PUBLIC HEALTH

Receipt Number: PH22-01352

507 N Nanum St., Suite 102  
Ellensburg, WA 98926  
509-962-7515 / <https://www.co.kittitas.wa.us/health/>

**Payer/Payee:** JOHNSON, JILL M  
841 MCDONALD RD  
CLE ELUM WA 98922-8487

**Cashier:** KIM SHILLEY  
**Payment Type:** CHECK (11658)

**Date:** 07/06/2022

**OE-22-00165    On Site Sewage Evaluation    951 MCDONALD RD CLE ELUM**

<u>Fee Description</u>	<u>Fee Amount</u>	<u>Amount Paid</u>	<u>Fee Balance</u>
OSS Site Eval Permit	\$695.00	\$695.00	\$0.00
<b>OE-22-00165 TOTALS:</b>	<b>\$695.00</b>	<b>\$695.00</b>	<b>\$0.00</b>
<b>TOTAL PAID:</b>		<b>\$695.00</b>	

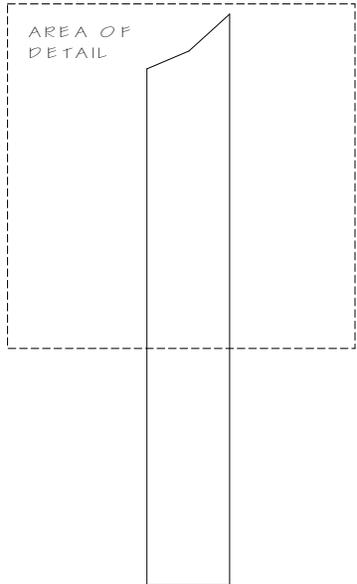
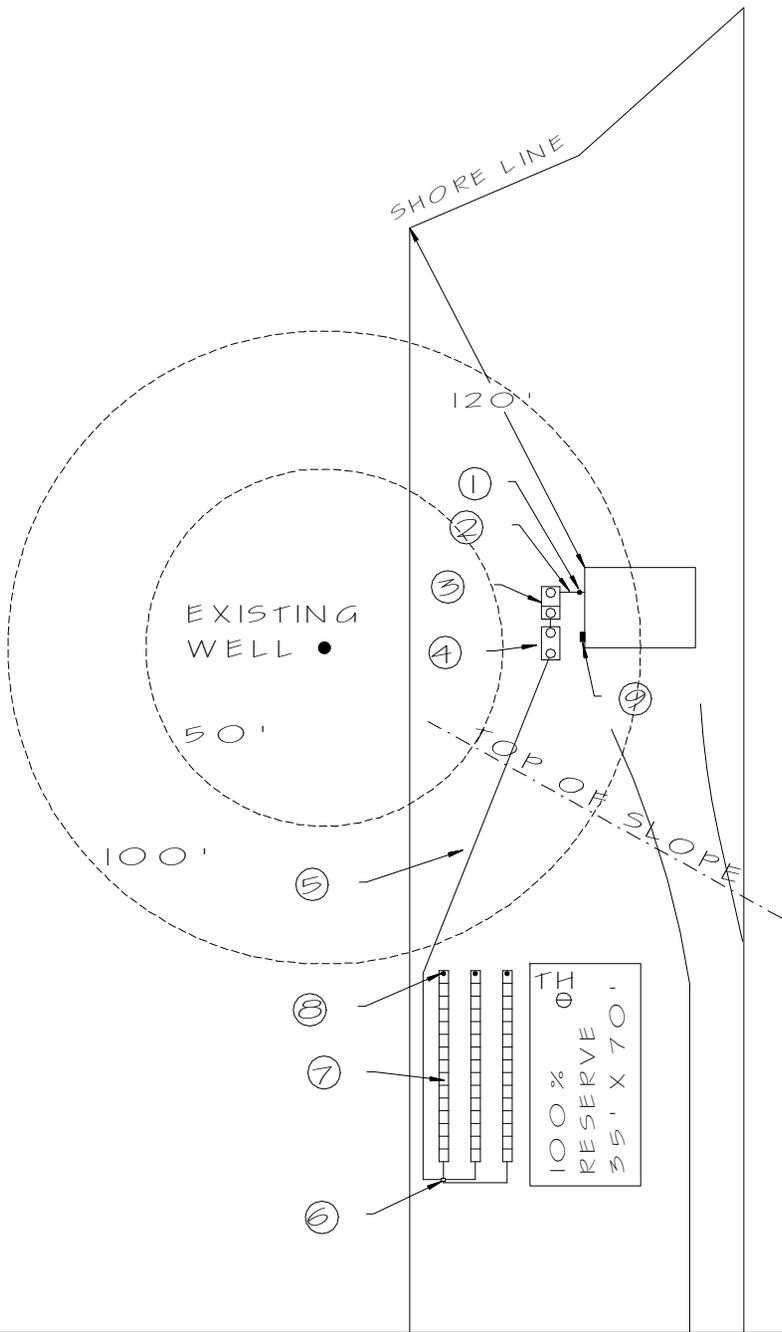
# DRAINFIELD CALCS

PROPERTY OWNER: JOHNSON  
PARCEL#: 525135

NUMBER OF BEDROOMS: 4  
GALLONS/BEDROOM/DAY: 120  
ESTIMATED PEAK FLOW: 480  
SOIL APPLICATION RATE: 0.6

SQUARE FEET OF DRAINFIELD REQUIRED: 800  
GRAVELESS CHAMBER REDUCTION FACTOR: 0.6  
SQUARE FEET AFTER REDUCTION: 480  
REQUIRED L.F. OF CHAMBERS: 169.6113074  
REQUIRED VERTICAL SEPARATION: 36"  
MAX. DEPTH OF TRENCHES: 36"  
TEST HOLE DEPTH TO RESTRICTIVE LAYER: 72"

SCALE 1" = 60'



- ① 4" CLEANOUT
- ② 4" 3034 SEWER PIPE
- ③ 1000 GALLON SEPTIC TANK  
5' MINIMUM TO HOUSE.  
EFFLUENT FILTER REQUIRED  
ACCESS RISERS TO FINISH GRADE REQUIRED.
- ④ 1000 GALLON PUMP CHAMBER  
5' MINIMUM FROM HOUSE  
ACCESS RISERS TO FINISH GRADE REQUIRED
- ⑤ 2" SCHEDULE 40 TRANSPORT LINE
- ⑥ 5-HOLE CONCRETE GRAVITY DISTRIBUTION BOX
- ⑦ 3 - 60' LATERALS ON 10' CENTERS.  
MAXIMUM DEPTH IS 36"  
INFILTRATOR Q4 LP CHAMBERS TO BE USED  
5' MIN. TO PROPERTY LINES AND EASEMENTS  
100' MINIMUM TO WELLS.  
10' MINIMUM TO BUILDINGS
- ⑧ 4" INSPECTION PORTS TO FINISH GRADE AT EACH LATERAL END.
- ⑨ SJE RHOMBUS 112 PANEL (DEMAND)  
PANEL MOUNTED WITHIN LINE OF SIGHT OF THE PUMP CHAMBER.  
ELAPSED TIME METER AND DOSE COUNTER ARE REQUIRED.

THIS IS NOT A SURVEY AND IS ONLY INTENDED FOR THE APPROVAL AND CONSTRUCTION OF THE SEPTIC SYSTEM DESIGN. MCN CONSULTING RECOMMENDS THAT A LICENSED SURVEYOR (PLS) ALWAYS BE USED TO SET CORNERS, ESTABLISH LOT LINES AND DETERMINE ELEVATIONS

OSS SITE PLAN

DATE: 8/28/25

PROPERTY OWNER: JOHNSON

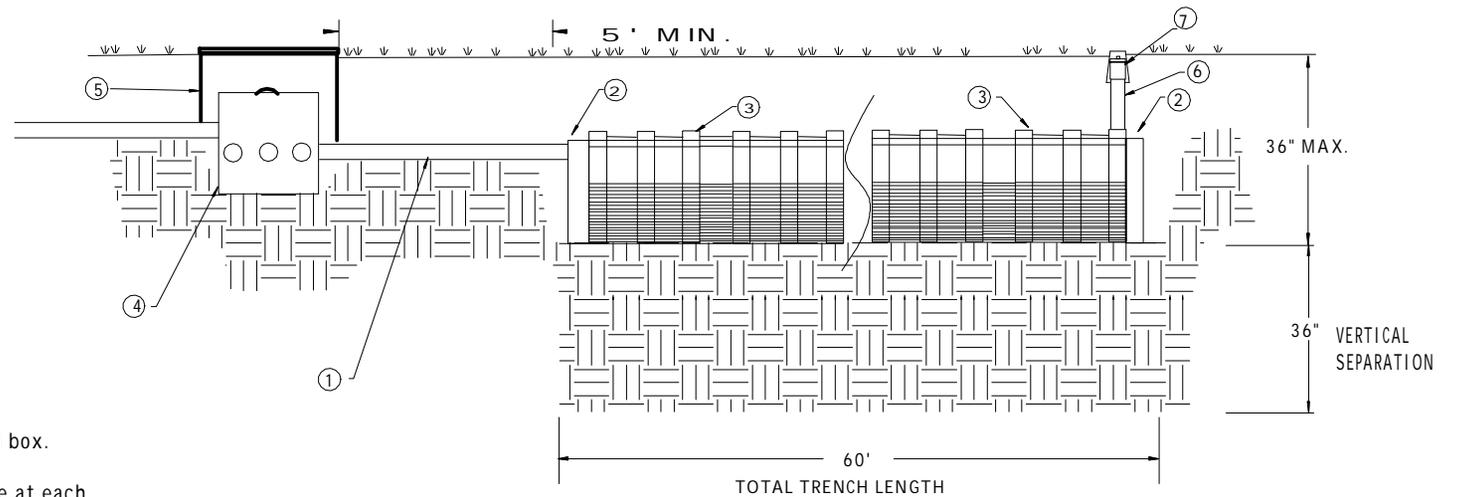
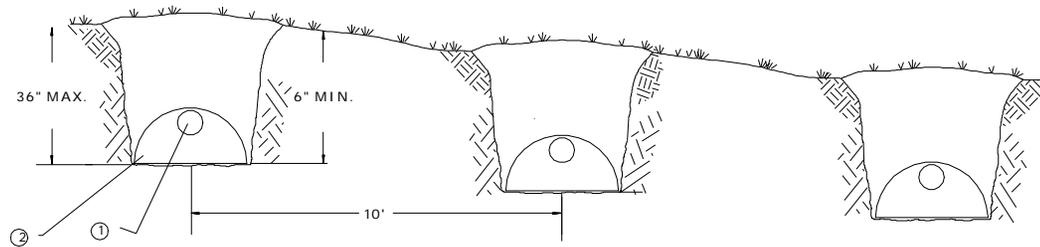
PARCEL #: 525135

MCN CONSULTING

MARK NELSON  
509-304-9062



# CHAMBER CROSS SECTION



- ① 4" SDR 35
- ② Infiltrator low profile end plate
- ③ Infiltrator Low Profile chamber (4' length)
- ④ Distribution box.  
\*5' min. from tank and drainfield.
- ⑤ Access riser  
\*Use septic tank riser or irrigation control box.
- ⑥ 4" inspection port extended to finish grade at each lateral end.
- ⑦ 4" female adapter and threaded plug.

TRENCH DETAIL

NAME: JOHNSON

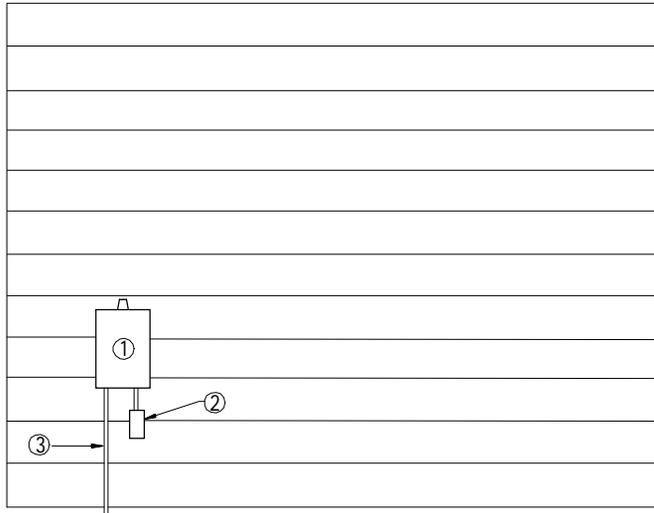
MCN CONSULTING

PARCEL: 525135

MARK NELSON  
509-304-9062

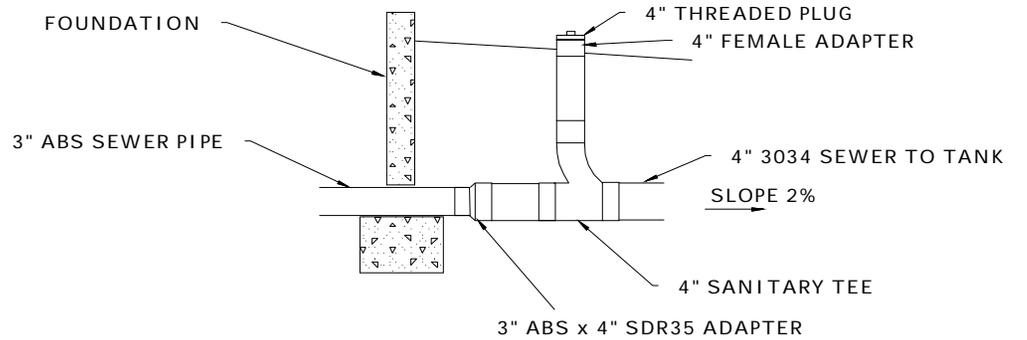
# GENERAL DETAILS

## ELECTRICAL COMPONENT DETAILS



- ① SJE RHOMBUS TYPE 112 CONTROL PANEL - ELAPSED TIME METER AND CYCLE COUNTERS REQUIRED.
- ② DISCONNECT SWITCH MUST SHUT OFF ALL POWER TO PANEL.
- ③ 3/4" SCHEDULE 40 CONDUIT TO SPLICE BOX

## FOUNDATION DETAIL (TYP)



**NOTE:**

CLEANOUTS REQUIRED WITHIN 2' OF THE BUILDING AND THEN AGAIN AT EVERY 50' INTERVAL.

OWNER: JOHNSON

PARCEL #: 525135

MCN CONSULTING  
509-304-9062

DESIGNER:  
MARK NELSON

# General Notes:

## Tight line from house to septic tank:

- 1 Grade shall be 1/8" per foot minimum with the last 10 foot section having no more than 1/4" per foot.
- 2 At least one cleanout is required in this line outside the structure and within 2 feet of the structure. If the cleanout must be installed greater than 2 feet from the structure, use a 2 way cleanout. If the the line extends for more than 50 feet, additional cleanouts at 50 foot intervals are required.
- 3 If there are elbows, they shall be no greater than 45 degrees.
- 4 Any pipe crossing a driving area shall be cased inside 6" SCH 40 or equal grade pipe to avoid crushing by vehicular traffic.
- 5 If the pipe must cross a water line, the sewer line shall be sleeved for 10 feet in each direction. If possible, the sewer line shall cross below the water line. There shall be no joints in the pipe used for the sleeve.
- 6 This line must be 50' minimum to any well or surface water.

## Septic Tank and Pump Tank:

- 1 All tanks must be from a supplier whose tanks are on the Washington State list of approved septic tank providers.
- 2 The tank shall be a min. of 5' from any building, 50' from any well or surface water, 5' min. from any property line or easement, and 10' min. from any water line. Community well requires a 100' setback.
- 3 Soil beneath the inlet and outlet pipes shall be compacted to avoid settling.
- 4 All pipe connections to the tank must be water tight.
- 5 The tank shall be set on undisturbed soil or a compacted bed of aggregate.
- 6 The quick disconnect union located in the pump chamber, must be within 24" of lid/final grade.
- 7 The tank shall have risers with secured lids at finished grade on both compartments.
- 8 An outlet filter is required.

## Tight line from the pump chamber to the manifold:

- 1 Line shall be schedule 40 PVC
- 2 If this line crosses any water lines, it shall be sleeved for 10' in each direction. If possible, the transport line shall cross under the water line. There shall be no unglued joints in the pipe used for the sleeve.

## Manifold and flow control valves:

- 1 Manifold and low control valves shall be a min. of 5' to the first drainfield trench.
- 2 Valves shall be PVC ball valves.
- 3 Valves shall be in an accessible valve box at finished grade. Use a septic tank riser or an irrigation valve box with a securable lid.

## Drainfield:

- 1 The drainfield shall be installed in the location as designed. If site conditions have changed or the system can not be installed as designed, call your designer.
- 2 The drainfield shall be installed no deeper than as specified in the design. The maximum depth is measured from the up hill side.
- 3 The drainfield must be installed in undisturbed soil.
- 4 The bottom of the trench must be level.
- 5 The drainfield shall be a min. of 100' to any well, 10' min. to any building and 5' min. to any property line or easement.
- 6 3/4"-1 1/2" washed gravel or approved gravelles chambers and Sch 40 PVC pipe shall be used .
- 7 Do not attempt to install the drainfield if the conditions are too wet. Smearing of the soil could occur, reducing its ability to absorb water. Call your designer if you are not sure if the conditions are suitable for construction.
- 8 If pressure system and drainfield is located below pump chamber, a anti-siphon hole shall be drilled before transport pipe leaves tank.

## General:

- 1 System shall only be installed by a licensed contractor certified by the local health jurisdiction to install septic systems.
- 2 System must be inspected by the local health department prior to backfill and final approval.
- 3 All conduit and electrical components must be installed by a state licensed electrical contractor and approved by the Washington State Department of Labor and Industries prior to final Health Department approval.
- 4 Bedding of pipes: 4" minimum of bedding material is to be placed under pipe and 6" of bedding material is to be placed over pipe. Native material may be used if free from rocks.
- 5 Any specified component in this design may be substituted with equal products.
- 6 If any portion of this design conflict with another, the more stringent of the two specifications shall apply.
- 7 Call your designer if you have questions or concerns.



Orencia Systems  
Incorporated

1-800-348-9843

Submittal  
Data Sheet

# 4" Biotube<sup>®</sup> Effluent Filters

## Applications

4" Biotube Effluent filters are designed to remove solids from effluent leaving residential septic tanks.

## General

Orencia 4" Biotube Effluent Filters (U.S. Patents No. 4439323 and 5492635) are used to improve the quality of effluent exiting a septic tank in a residential septic system. The Biotube cartridge fits tightly in the vault and is removable for maintenance; the tee handle can be extended for easy removal of the cartridge.

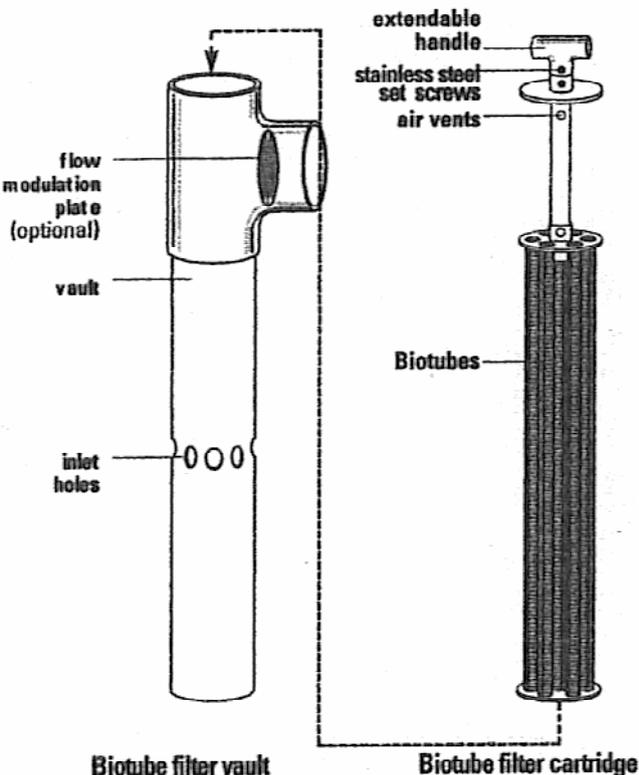
## Standard Series

FTS0444-36, FTS0444-36M, FTW0436-28, FTW0436-28M  
FTW0444-36, FTW0444-36M

## Nomenclature:

FTPW04□□-□□MA-□

For customized options (e.g., NC indicates meets North Carolina regs.)  
Indicates float bracket attached  
Indicates flow modulation plate installed  
Cartridge height. 28" and 36" are standard  
Housing height. 36" and 44" are standard  
Indicates filter diameter (in)  
W-Indicates fits 3034 outlet pipe  
S-Indicates Schedule 40 outlet pipe  
P-Indicates 1/16" filtration No P indicates 1/8" filtration  
Biotube effluent filter series



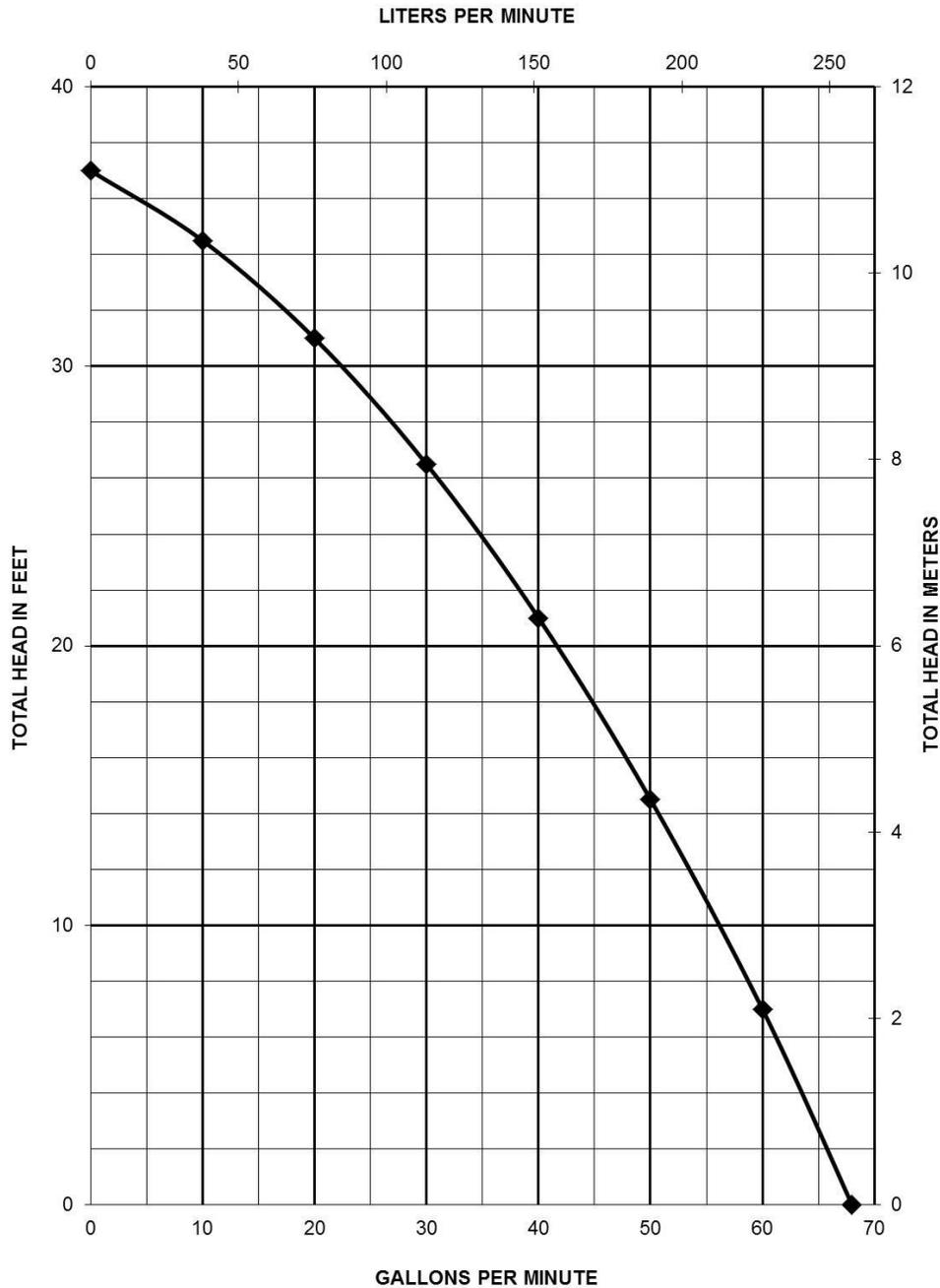
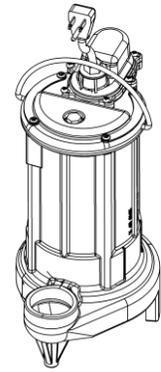
## Specifications

Component	Material(s) of Construction
Vault	4" PVC
Biotube Cartridge:	Polypropylene and polyethylene
Handle Components:	Sch. 40 PVC, polyethylene, stainless steel
Mesh Openings:	Nominal 1/8" or 1/16"; nominal open area of 30%

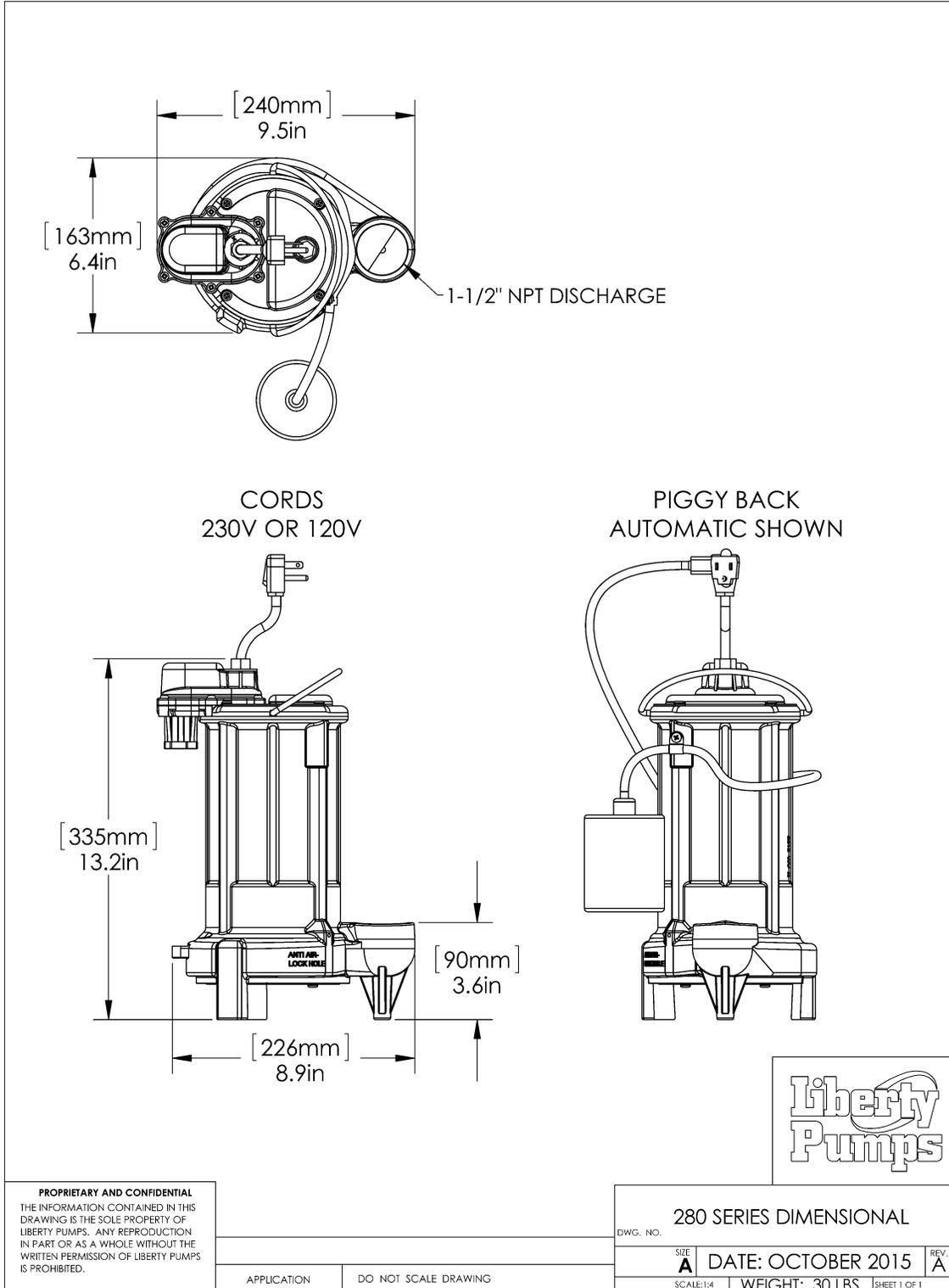


## Pump Specifications

### 280 Series 1/2 hp Submersible Effluent Pump



## 280-Series Dimensional Data



## 280-Series Electrical Data

MODEL	HP	VOLTAGE	PHASE	FULL LOAD AMPS	LOCKED ROTOR AMPS	THERMAL OVERLOAD TEMP	STATOR WINDING CLASS	CORD LENGTH FT	DISCHARGE	AUTOMATIC
280	1/2	115	1	8.0	23	105°C / 221°F	B	10	1 1/2	NO MANUAL
281	1/2	115	1	8.0	23	105°C / 221°F	B	10	1 1/2	YES INTEGRAL FLOAT
283	1/2	115	1	8.0	23	105°C / 221°F	B	10	1 1/2	YES PIGGY BACK FLOAT
287	1/2	115	1	8.0	23	105°C / 221°F	B	10	1 1/2	YES INTEGRAL VERTICLE FLOAT
280HV	1/2	208-230	1	4.0	12.5	105°C / 221°F	B	10	1 1/2	NO MANUAL
281HV	1/2	208-230	1	4.0	12.5	105°C / 221°F	B	10	1 1/2	YES INTEGRAL FLOAT
283HV	1/2	208-230	1	4.0	12.5	105°C / 221°F	B	10	1 1/2	YES PIGGY BACK FLOAT
287HV	1/2	208-230	1	4.0	12.5	105°C / 221°F	B	10	1 1/2	YES INTEGRAL VERTICLE FLOAT

## 280-Series Cord Length Options\*

Model	10'	25'(-2)	35'(-3)	50'(-5)
280	Standard	Optional	Optional	Optional
281	Standard	Optional	Optional	Optional
283	Standard	Optional	Optional	N/A
287	Standard	Optional	N/A	N/A

10' cord length standard on all models. For optional lengths, add "-2, -3 or -5" suffix to model number.  
Example: for model 280 with 35' cord. Order 280-3

**WARNING:** \*Always use a replacement power cord assembly of the same length and type as originally installed on the Liberty product. Using a cord of improper gauge or length may lead to exceeding the electrical rating of the cord and could result in death, injury, fire or other significant failure.

## 280-Series Technical Data

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IMPELLER	VORTEX ENGINEERED POLYMER
SOLIDS HANDLING SIZE	3/4"
PAINT	POWDER COAT
MAX LIQUID TEMP	60°C / 140°F
MAX STATOR TEMP	CLASS B 130°C / 266°F
THERMAL OVERLOAD	105°C / 221°F
POWER CORD TYPE	SJTW (10ft & 25ft models) SJTOOW (35ft & 50ft models)
MOTOR HOUSING/ VOLUTE	CLASS 25 CAST IRON
SHAFT	STAINLESS
HARDWARE	STAINLESS
ORINGS	BUNA N
MECHANICAL SEAL	UNITIZED CERAMIC CARBON
WEIGHT	30 LBS

## 280-Series Specifications

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### 1.01 GENERAL:

The contractor shall provide labor, material, equipment, and incidentals required to provide \_\_\_\_\_ (QTY) centrifugal pumps as specified herein. The pump models covered in this specification are Series 280 single phase pumps. The pump furnished for this application shall be model \_\_\_\_\_ as manufactured by Liberty pumps.

### 2.01 OPERATING CONDITIONS:

Each submersible pump shall be rated at 1/2 hp \_\_\_\_\_ volts, single phase, 60 Hz., 3450 RPM. The unit shall produce \_\_\_\_\_ G.P.M. at \_\_\_\_\_ feet of total dynamic head.

The submersible pump shall be capable of handling effluent with 3/4" solid handling capability. The submersible pump shall have a shut-off head of 37 feet and a maximum flow of 62 GPM @ 5 feet of total dynamic head.

The pump shall be controlled with:

\_\_\_\_\_ A piggy back style on/off float switch.

\_\_\_\_\_ An integrally wired on/off float switch.

\_\_\_\_\_ A Vertical Mechanical Float (VMF) type on/off switch.

\_\_\_\_\_ A NEMA 4X outdoor simplex control panel with three float switches and a high water alarm.

\_\_\_\_\_ A NEMA 1 indoor simplex control panel with three float switches and a high water alarm.

\_\_\_\_\_ A NEMA 4X outdoor simplex control panel with four float switches and a high water alarm.

\_\_\_\_\_ A NEMA 1 indoor simplex control panel with four float switches and a high water alarm.

\_\_\_\_\_ A NEMA 4X outdoor duplex control panel with three float switches and a high water alarm.

\_\_\_\_\_A NEMA 1 indoor duplex control panel with three float switches and a high water alarm.

\_\_\_\_\_A NEMA 4X outdoor duplex control panel with four float switches and a high water alarm.

\_\_\_\_\_A NEMA 1 indoor duplex control panel with four float switches and a high water alarm.

### **3.01 CONSTRUCTION:**



Each submersible pump shall be equal to the <sup>CSA</sup> certified Series 280 SERIES pumps as manufactured by Liberty Pumps, Bergen NY. The castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring. The pump shall be furnished with stainless steel handle.

### **4.01 ELECTRICAL POWER CORD**

The submersible pump shall be supplied with 10, 25, 35, or 50 feet of multiconductor power cord. It shall be cord type SJTW, or SJTOOW capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

### **5.01 MOTORS**

Single phase motors shall be oil filled, permanent split capacitor, class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 130 degrees C unsumerged. Since air filled motors are not capable of dissipating heat they shall not be considered equal. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump.

### **6.01 BEARINGS AND SHAFT**

An upper and lower ball bearing shall be required. The ball bearing shall be a single ball / race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 or 400 series stainless steel and have a minimum diameter of .311"

### **7.01 SEALS**

The pump shall have a unitized carbon / ceramic seal with stainless steel housings and spring equal to Crane Type 6A. The motor plate / housing interface shall be sealed with a Buna-N o-ring.

### **8.01 IMPELLER**

The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.

### **9.01 CONTROLS**

All pumps can be supplied with a CSA and UL approved VMF type switch, an integrally wired wide angle tilt float switch, or piggy back type wide angle tilt float switches. The piggy back style switches are equipped with a plug that allows the pump to be operated manually without the removal of the pump in the event that a switch becomes inoperable. Manual pumps are operable by means of a pump control panel.

### 10.01 PAINT

The exterior of the casting shall be protected with powder coat paint.

### 11.01 SUPPORT

The pump shall have cast iron support legs, enabling it to be a free standing unit. The legs will be high enough to allow 3/4" solids to enter the volute.

### 12.01 SERVICEABILITY

Components required for the repair of the pump shall be shipped within a period of 24 hours.

### 13.01 FACTORY ASSEMBLED TANK SYSTEMS WITH GUIDE RAIL AND QUICK DISCONNECT DISCHARGE

\_\_\_\_\_ Guide factory mounted rail system with pump suspended by means of bolt on quick disconnect which is sealed by means of nitrile grommets or o-rings. The Discharge piping shall be schedule 80 PVC and furnished with a PVC check valve and shut-off ball valve. The Tank shall be wound fiberglass or roto-molded plastic. An inlet hub shall be provided with the fiberglass systems.

- \_\_\_\_\_ Stainless steel Guide Rail
- \_\_\_\_\_ Zinc plated steel Guide Rail
- \_\_\_\_\_ "diameter of basin size
- \_\_\_\_\_ "height of basin size
- \_\_\_\_\_ "distance from top of tank to discharge pipe outlet
- \_\_\_\_\_ Fiberglass cover
- \_\_\_\_\_ Structural foam polymer cover
- \_\_\_\_\_ Steel cover
- \_\_\_\_\_ Simplex System with Outdoor panel and alarm
- \_\_\_\_\_ Duplex System with Outdoor panel and alarm
- \_\_\_\_\_ Separate Outdoor Alarm
- \_\_\_\_\_ Remote Outdoor Alarm

### 14.01 TESTING

The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage and current monitored, and the tester checks for noise or other malfunction.

### 15.01 QUALITY CONTROL

The pump shall be manufactured in an ISO 9001 certified Facility.

### 16.01 WARRANTY

Standard limited warranty shall be 3 years.

# SJE PUMPMASTER® Pump Switch

Mechanically-activated, wide-angle switch designed for direct control of pumps up to 1/2 HP at 120 VAC and 1 HP at 230 VAC.

This mechanically-activated, wide-angle pump switch provides automatic control of pumps in:

- potable water
- water
- sewage applications

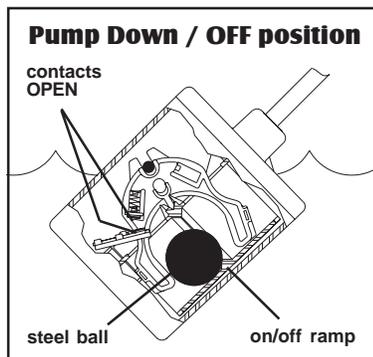
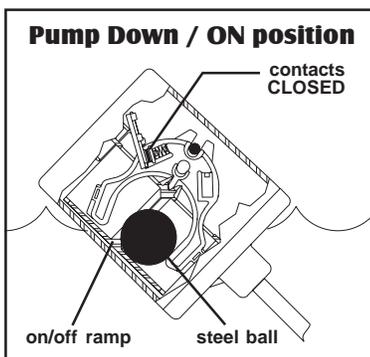
The SJE PumpMaster® pump switch is not sensitive to rotation or turbulence allowing it to be used in both calm and turbulent applications.



U.S. Patent Nos. 5,087,801 & 5,142,108

## FEATURES

- Passed NSF Standard 61 protocol by an approved Water Quality Association laboratory.
- Heavy-duty contacts.
- Controls pumps up to 1/2 HP at 120 VAC and 1 HP at 230 VAC.
- Adjustable pumping range of 7 to 36 inches (18 to 91 cm).
- Includes standard mounting clamp and boxed packaging.
- UL Recognized for use in water and sewage.
- CSA Certified.
- Three-year limited warranty.



## OPTIONS

This switch is available:

- for pump down or pump up applications as specified by part number.
- with a 120 VAC or 230 VAC piggy-back plug.
- without a plug for direct wiring in 120 VAC or 230 VAC applications.
- in standard cable lengths of 10, 15, 20, or 30 feet and 3, 5, 6, or 10 meters (longer lengths available).

## SPECIFICATIONS

**CABLE:** flexible 16 gauge, 2 conductor (UL, CSA) SJOW, water-resistant (CPE)

**FLOAT:** 3.05 inch diameter x 3.56 inch long (7.75 x 9.04 cm) high impact, corrosion resistant, PVC housing for use in sewage and water up to 140°F (60°C)

### ELECTRICAL:

#### 120 VAC 50/60Hz Single Phase:

**Maximum Pump Running Current:**

13 amps

**Maximum Pump Starting Current:**

85 amps

**Recommended Pump HP:**

1/2 HP or less

#### 230 VAC 50/60Hz Single Phase:

**Maximum Pump Running Current:**

13 amps

**Maximum Pump Starting Current:**

85 amps

**Recommended Pump HP:**

1 HP or less

**Note:** This switch must be used with pumps that provide integral thermal overload protection.

PUMP SWITCHES  
(MECHANICAL)

**SJE**  
**Rhombus**  
CONTROLS

PO Box 1708, Detroit Lakes, MN 56502

1-888-DIAL-SJE • 1-218-847-1317

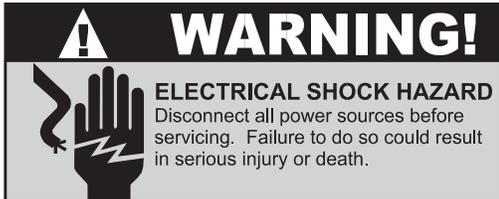
1-218-847-4617 Fax

email: sje@sjerhombus.com

[www.sjerhombus.com](http://www.sjerhombus.com)

# Single Phase Simplex SJE-Rhombus® Type 112

## Installation Instructions and Operation/Troubleshooting Manual



Warranty void if panel is modified.

Call factory with servicing questions:  
**1-800-RHOMBUS**  
(1-800-746-6287)

Manufactured by:

**SJE**  
**Rhombus**®

22650 County Highway 6 ■ P.O. Box 1708  
Detroit Lakes, Minnesota 56502 USA  
1-888-DIAL-SJE (1-888-342-5753)  
Phone: 218-847-1317 ■ Fax: 218-847-4617  
E-mail: sje@sjerhombus.com  
Website: www.sjerhombus.com

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PN1008704D • Rev 10/09

**This control panel must be installed and serviced by a licensed electrician in accordance with the National Electric Code NFPA-70, state and local electrical codes.**

All conduit running from the sump or tank to the control panel must be sealed with conduit sealant to prevent moisture or gases from entering the panel. **NEMA 1 enclosures are for indoor use only**, primarily to provide a degree of protection against contact with enclosed equipment. Cable connectors are not required to be liquid-tight in NEMA 1 enclosures. **Do not use NEMA 1 enclosures if subjected to rain, splashing water or hose-directed water. NEMA 4X enclosures are for indoor or outdoor use**, primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water and hose-directed water. **Cable connectors must be liquid-tight in NEMA 4X enclosures.**

### Installation

A standard Type 112 panel is designed to operate with three floats. These floats operate pump stop, pump start, and high level alarm functions.

**NOTE: Options ordered may affect the number of floats and their functions. Please reference the schematic provided with the control panel for proper installation.**

#### Installation of Floats

**CAUTION:** If control switch cables are not wired and mounted in the correct order, the pump system will not function properly.

**WARNING:** Turn off all power before installing floats in pump chamber. Failure to do so could result in serious or fatal electrical shock.

1. Use float label kit to label floats for specific operation (stop, start, alarm, etc.). See schematic for float options.
2. Determine your normal operating level, as illustrated in **Figure 1**.
3. Mount float switches at appropriate levels as illustrated in **Figures 2-4**. Be sure that floats have free range of motion without touching each other or other equipment in the basin.

**If using the mounting clamp; follow steps 4-6.**

4. Place the cord into the clamp as shown in **Figure 2**.
5. Locate the clamp at the desired activation level and secure the clamp to the discharge pipe as shown in **Figure 2**.

**NOTE:** Do not install cord under hose clamp.

6. Tighten the hose clamp using a screwdriver. Over tightening may result in damage to the plastic clamp. Make sure the float cable is not allowed to touch the excess hose clamp band during operation.

**NOTE:** All hose clamp components are made of 18-8 stainless steel material. See your SJE-Rhombus® supplier for replacements.

# Installation Instructions

## Mounting the Control Panel

1. Determine mounting location for panel. If distance exceeds the length of either the float switch cables or the pump power cables, splicing will be required. For outdoor or wet installation, we recommend the use of an SJE-Rhombus® liquid-tight junction box with liquid-tight connectors to make required connections. **You must use conduit sealant to prevent moisture or gases from entering the panel.**
2. Mount control panel (mounting flanges are furnished with control panel).
3. Determine conduit entrance locations on control panel. Check local codes and schematic for the number of power circuits required.

**NOTE:** Be sure the proper power supply voltage, and phase are the same as the pump motor being installed. If in doubt, see the pump identification plate for electrical requirements.

4. Drill proper size holes for type of connectors being used.

**NOTE:** If using conduit, be sure that it is of adequate size to pull the pump and switch cables through. **You must use conduit sealant to prevent moisture or gases from entering the panel.**

5. Attach cable connectors and/or conduit connectors to control panel.

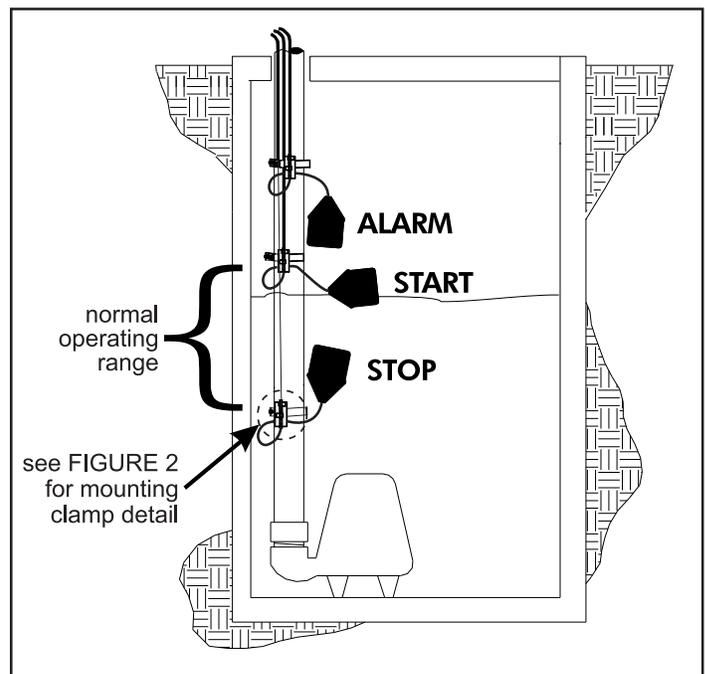
**FOR INSTALLATION WITHOUT A SPLICE,  
GO TO STEP 11;  
FOR INSTALLATION REQUIRING  
A SPLICE, FOLLOW STEPS 6-10.**

6. Determine location for mounting junction box according to local code requirements. **Do not** mount the junction box inside the sump or basin.
7. Mount junction box to proper support.
8. Run conduit to junction box. Drill proper size holes for the type of conduit used. Attach liquid-tight connectors to junction box.

9. Identify and label each wire before pulling through conduit into control panel and junction box. Pull pump power cables and control switch cables through connectors into junction box. Make wire splice connections at junction box.
10. Firmly tighten all fittings on junction box. Insure all cable connectors are liquid-tight and sealed.
11. If a junction box is not required, identify and label cables on both float and stripped ends.
12. Connect pump and float wires to proper position on terminals. See schematic inside control panel for terminal layouts.
13. Connect control, alarm and pump power conductors to proper position on terminals. See schematic inside control panel for terminal connections.

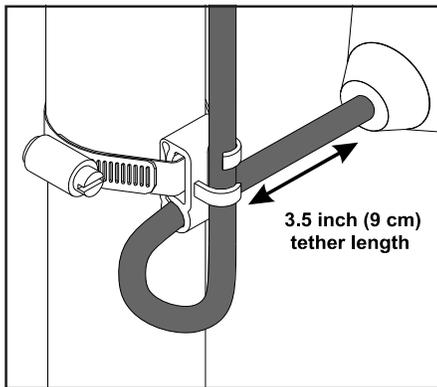
**NOTE:** It is the recommendation of the factory to use separate pump and control/alarm power sources.

**VERIFY CORRECT OPERATION OF CONTROL PANEL AFTER INSTALLATION IS COMPLETE.**

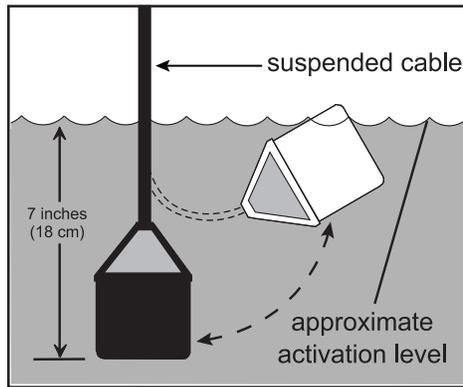


**FIGURE 1-  
Three float simplex - pump down installation**

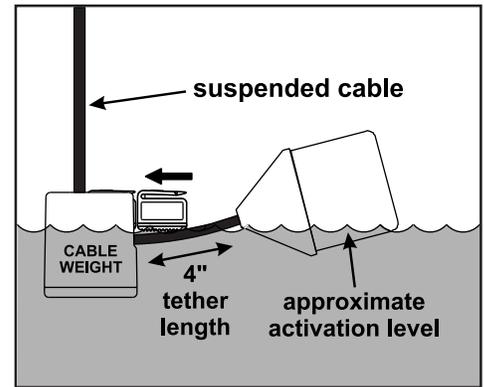
# Installation Instructions



**FIGURE 2**  
Mounting clamp detail



**FIGURE 3**  
Internally weighted float



**FIGURE 4**  
Float with cable weight

## Operations

SJE-Rhombus® Type 112 control panels are designed to operate in a three float system as standard. When all floats are in the open or OFF position, the panel is inactive. As the liquid level changes and closes the stop float, the panel remains inactive until the start float also closes. At this point the pump will start, providing the HOA switch is in the AUTOMATIC mode and the power is ON. The pump will remain ON until both the stop and start floats open (return to the OFF position). If the liquid level travels beyond both the stop and start floats and reaches the alarm float, the alarm will be activated. The alarm horn can be silenced by moving the test/normal/silence switch to the silence position.

### Alarm System (Horn and Indicator)

When an alarm condition occurs, a red light and horn will be activated. If the test/normal/silence switch is moved to the silence position, the horn will be silenced. When the alarm condition is cleared, the alarm system is reset. The alarm system can be tested by moving the test/normal/silence switch to the test position.

### HOA Switch

A hand-off-automatic switch is provided for the pump. In the hand mode, the pump will turn on unless other safety features are employed. In the automatic mode, the pump will turn on from commands by the float switches.

### Pump Run Light

The run light will be ON in either the hand or the automatic mode when the pump is called to run.

### Circuit Breaker (optional)

The pump circuit has a thermal-magnetic circuit breaker which provides pump disconnect and branch circuit protection.

### Dry Auxiliary Contacts (optional)

**Normally open** - Contacts are open under normal conditions and closed when alarm condition is present.

**Normally closed** - Contacts are closed under normal conditions and open when alarm condition is present. Both types automatically reset once alarm condition is cleared.

**NOTE:** Some options ordered may not be included in this manual.

For information regarding the operations of options not listed here or servicing questions,

please call a SJE-Rhombus® customer service technician at

1-800-RHOMBUS

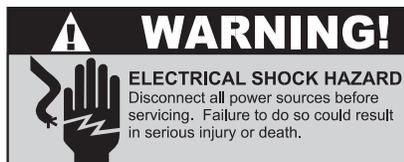
(1-800-746-6287)

Warranty void if panel is modified.

# Troubleshooting

## Alarm Horn

Moving the test/normal/silence switch to the test position or activating the alarm float should turn on the alarm horn. If the horn does not sound, replace horn with same type.



## Alarm Light

Moving the test/normal/silence switch to the test position or activating the alarm float should turn on the alarm light. If the light does not activate, replace with same type.

## Circuit Breaker (optional)

Check each pole of the circuit breaker for proper resistance reading using the following procedure.

**WARNING: Disconnect incoming power to panel.**

1. Isolate the circuit breaker by disconnecting either line side or load side wires.
2. Place the ohmmeter leads across the corresponding line and load terminals of each pole.
3. With the ohmmeter on the R X 1 scale and the breaker in the OFF position, the reading should be infinity (very high resistance). With the breaker in the ON position, the reading should be nearly zero ohms (very low resistance). If the readings are not as stated, replace the circuit breaker with one of the same ratings.

**NOTE: Readings may vary slightly depending on the accuracy of the measuring device.**

## Float Controls

Check the floats during their entire range of operation. Clean, adjust, or replace damaged floats.

**Checking the float resistance** - The float resistance can be measured to determine if the float is operating correctly or is defective. Use the following procedure to measure the float resistance. **WARNING: Disconnect incoming power to panel.**

1. Isolate the float by disconnecting one or both of the float leads from the float terminals.
2. Place one ohmmeter lead on one of the float wires, and the other ohmmeter lead on the other float wire.
3. Place the ohmmeter dial to read ohms and place on the R X 1 scale. With the float in the "off" position, the scale should read infinity (high resistance). Replace the float if you do not get this reading. With the float in the ON position, the scale should read nearly zero (very low resistance). Replace the float if you do not get this reading.

**NOTE: Readings may vary depending on the length of wire and accuracy of the measuring device.**

## Fuses

Check the continuity of the fuse. With power OFF, pull the fuse out of the fuse block. With the ohmmeter on the R X 1 scale, measure resistance. A reading of infinity indicates a blown fuse and must be replaced. Replace fuse with same type, voltage and amp rating.

## Magnetic Contactor Coil

**WARNING: Disconnect incoming power to panel.**

Check the coil by disconnecting one of the coil leads. Measure the coil resistance by setting the ohmmeter on the R X 1 scale. A defective coil will read zero or infinity, indicating a short or opened coil respectively. Replace defective contactor with same type.

**NOTE: Readings may vary depending on the accuracy of the measuring device.**

# SJE-Rhombus® Three-Year Limited Warranty

**SJE-RHOMBUS®** warrants to the original consumer that this product shall be free of manufacturing defects for three years after the date of consumer purchase. During that time period and subject to the conditions set forth below, **SJE-RHOMBUS®** will repair or replace, for the original consumer, any component which proves to be defective due to defective materials or workmanship of **SJE-RHOMBUS®**.

**ELECTRICAL WIRING AND SERVICING OF THIS PRODUCT MUST BE PERFORMED BY A LICENSED ELECTRICIAN.**

**THIS WARRANTY DOES NOT APPLY:** (A) to damage due to lightning or conditions beyond the control of **SJE-RHOMBUS®**; (B) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions provided; (C) to failures resulting from abuse, misuse, accident, or negligence; (D) to units which are not installed in accordance with applicable local codes, ordinances, or accepted trade practices, and (E) to units repaired and/or modified without prior authorization from **SJE-RHOMBUS®**.

*Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.*

**TO OBTAIN WARRANTY SERVICE:** The consumer shall assume all responsibility and expense for removal, reinstallation, and freight. Any item to be repaired or replaced under this warranty must be returned to **SJE-RHOMBUS®**, or such place as designated by **SJE-RHOMBUS®**.

**ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS ARE LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. SJE-RHOMBUS® SHALL NOT, IN ANY MANNER, BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS A RESULT OF A BREACH OF THIS WRITTEN WARRANTY OR ANY IMPLIED WARRANTY.**

# THE QUICK4® PLUS STANDARD LP CHAMBER



Quick4 Plus Standard LP Chamber



Center Structural Column



Quick4 Plus All-in-One Periscope



Quick4 Plus Endcap



Quick4 Plus All-in-One Endcap

The Quick4 Plus Standard Low Profile (LP) Chamber offers maximum strength through its four center structural columns. This chamber can be installed in a 36-inch-wide trench. It is shorter in height than Infiltrator's other Standard model chambers, allowing for shallower installation. Like the original line of Quick4 chambers, it offers advanced contouring capability with its Contour Swivel Connection™, which permits 10-degree turns, right and left. It is also available in four-foot lengths to provide optimal installation flexibility. The Quick4 Plus All-in-One and Quick4 Plus Endcaps are available with this chamber and provide increased flexibility in system design and configurations.

## Quick4 Plus Standard LP Chamber

- Low profile design makes this chamber ideal for shallow applications
- Reduces imported fill needed for cap and fill systems
- Center structural columns offer superior strength
- Advanced contouring connections
- Latching mechanism allows for quick installation
- Four-foot chamber lengths are easy to handle and install

## Quick4 Plus All-in-One Endcap

- May be used at either end of a chamber row for an inlet/outlet or can be installed mid-trench
- Mid-trench connection feature allows center feed inletting of chamber rows
- Center feed connection allows for easy installation of serial distribution systems
- Variable pipe connection options allow for side, end or top inletting
- Piping drill points are set for gravity or pressure pipe

## Quick4 Plus Endcap

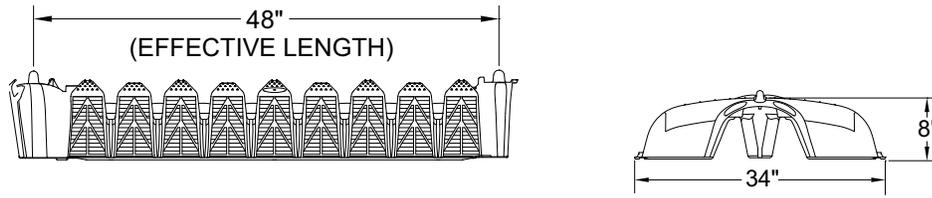
- Simple, flat design
- Allows installation of a pipe from the end only
- Piping drill points are set for gravity or pressure pipe



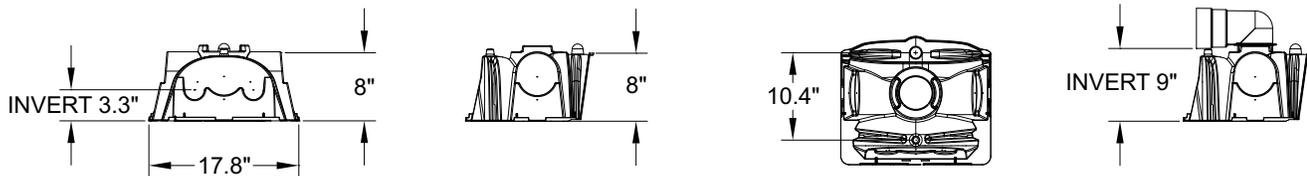
**Quick4** PLUS  
STD LOW PROFILE CHAMBER

# THE QUICK4 PLUS STANDARD LP CHAMBER

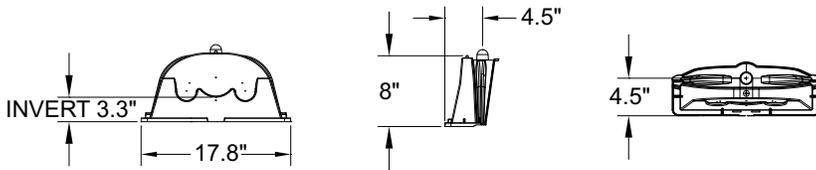
## Quick4 Plus Standard LP Chamber Side and End Views



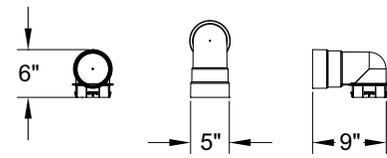
## Quick4 Plus All-in-One End Cap Front, Side and End Views



## Quick4 Plus End Cap Front, Side and End Views



## Quick4 Plus All-in-One Periscope



## Quick4 Plus Standard Chamber Specifications

Size (W x L x H) .....	34" x 53" x 8" (86 cm x 135 cm x 20 cm)
Effective Length .....	48" (122 cm)

Invert Height .....	3.3", 9" (8.4 cm, 22.8 cm)
---------------------	-------------------------------

### INFILTRATOR SYSTEMS, INC. STANDARD LIMITED WARRANTY

(a) The structural integrity of each chamber, end cap and other accessory manufactured by Infiltrator ("Units"), when installed and operated in a leachfield of an onsite septic system in accordance with Infiltrator's instructions, is warranted to the original purchaser ("Holder") against defective materials and workmanship for one year from the date that the septic permit is issued for the septic system containing the Units; provided, however, that if a septic permit is not required by applicable law, the warranty period will begin upon the date that installation of the septic system commences. To exercise its warranty rights, Holder must notify Infiltrator in writing at its Corporate Headquarters in Old Saybrook, Connecticut within fifteen (15) days of the alleged defect. Infiltrator will supply replacement Units for Units determined by Infiltrator to be covered by this Limited Warranty. Infiltrator's liability specifically excludes the cost of removal and/or installation of the Units.

(b) THE LIMITED WARRANTY AND REMEDIES IN SUBPARAGRAPH (a) ARE EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE UNITS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

(c) This Limited Warranty shall be void if any part of the chamber system is manufactured by anyone other than Infiltrator. The Limited Warranty does not extend to incidental, consequential, special or indirect damages. Infiltrator shall not be liable for penalties or liquidated damages, including loss of production and profits, labor and materials, overhead costs, or other losses or expenses incurred by the Holder or any third party. Specifically excluded from Limited Warranty coverage are damage to the Units due to ordinary wear and tear, alteration, accident, misuse, abuse or neglect of the Units; the Units being subjected to vehicle traffic or other conditions which are not permitted by the installation instructions; failure to maintain the minimum ground covers set forth in the installation instructions; the placement of improper materials into the system containing the Units; failure of the Units or the septic system due to improper siting or improper sizing, excessive water usage, improper grease disposal, or improper operation; or any other event not caused by Infiltrator. This Limited Warranty shall be void if the Holder fails to comply with all of the terms set forth in this Limited Warranty. Further, in no event shall Infiltrator be responsible for any loss or damage to the Holder, the Units, or any third party resulting from installation or shipment, or from any product liability claims of Holder or any third party. For this Limited Warranty to apply, the Units must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Infiltrator's installation instructions.

(d) No representative of Infiltrator has the authority to change or extend this Limited Warranty. No warranty applies to any party other than the original Holder.

The above represents the Standard Limited Warranty offered by Infiltrator. A limited number of states and counties have different warranty requirements. Any purchaser of Units should contact Infiltrator's Corporate Headquarters in Old Saybrook, Connecticut, prior to such purchase, to obtain a copy of the applicable warranty, and should carefully read that warranty prior to the purchase of Units.



**INFILTRATOR®**  
systems inc.

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Old Saybrook, CT 06475  
860.577.7000 • FAX 860.577.7001

**800.221.4436**  
**www.infiltratorsystems.com**

**For technical assistance, installation instructions or customer service, call Infiltrator Systems at 800.221.4436**

U.S. Patents: 4,759,661; 5,017,041; 5,156,488; 5,336,017; 5,401,116; 5,401,459; 5,511,903; 5,716,163; 5,588,778; 5,839,844  
Canadian Patents: 1,329,959; 2,004,564 Other patents pending.

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