SHS TECH, LLC
A Sea Horse Systems Company

INSTALLATION, OPERATION & MAINTENANCE MANUAL

USCG CERTIFIED TYPE II MSD and LANDBASE UNITS

Certified for Use on Inspected and Uninspected Vessels

2020 Edition

120 ROW 1
Lafayette, LA 70508
Phone: (337) 984-6130 Fax: (337) 456-3099

Table of Contents

TABLE OF CONTENTS.....2

WELCOME! 4

PREFACE

PROFILE

INTRODUCTION.....6

ALTERNATIVE USES/APPLICATIONS

GENERAL TERMINOLOGY & CRITERIA

USEPA EFFLUENT PARAMETERS

GLOSSARY OF TERMS.....8

BACKGROUND.....9

Design/Sizing Parameters.....10

Fact.....10

OPERATING WARNINGS/MAINTENANCE INSTRUCTIONS/SAFETY PRECAUTIONS.....11

OPERATING WARNINGS

MAINTENANCE INSTRUCTIONS

SAFETY PRECAUTIONS/WARNINGS

ELECTRICAL PRECAUTIONS/WARNINGS

ACCEPTABLE LEANERS.....12

MULTI-PURPOSE CLEANERS

ACCEPTABLE COMMERCIAL CLEANERS.....13

CLEANERS TO AVOID

RULE OF THUMB

SUMMARY OF OPERATING INSTRUCTIONS.....14

DO'S & DON'TS

SECTION 2..... 15

DESCRIPTION & OPERATION INSTRUCTIONS..... 16

CONSTRUCTION OPERATION

OPERATION OF AERATION CHAMBER

OPERATION OF CLARIFING CHAMBER

OPERATION OF CHLORINE CONTACT CHAMBER

TECHNICAL SPECIFICATIONS…… 18

1.0 GENERAL DESCRIPTION

2.0 PERFORMANCE CRITERIA FOR SECONDARY STAGE OF EFFLUENT

3.0 AIR SUPPLY BLOWER MOTOR UNITS

4.0 ELECTRICAL CONTROL PANEL

5.0 PAINT SYSTEM - COATING SYSTEM

MSD TECHNICAL INFO SHEET

PRE-INSTALLATION CHECK LIST.....20
ELECTRICAL REQUIREMENTS
TEMPERATURE
WATER REQUIREMENTS
TOILET REQUIREMENTS
MAXIMUM ALLOWABLE TIT ANGLE
TANK CAPACITY
EXPLOSIVE ENVIRONMENT
TREATMENT CAPACITIES

INSTALLATION.....22

FIGURE 1…….....24
TIE-IN CONNECTIONS

ELECTRICAL SCHEMATICS……..24

START-UP PROCEDURE.....28

ROUTINE MAINTENANCE.....29

ROUTINE INSPECTION.....30

INTERNAL FLOW DIAGRAM.....…..33

TOUBLE SHOOTING 34

BASIC SIZING GUIDELINES……..……..……35

SHUT-DOWN PROCCEDURES……..36

SERVICE DEPARTMENT……..……37

LIMITED WARRANTY.....38

SUMMARY OF REGULATORY REQUIRMENTS……39

DISCHARGE REGULATIONS……39

USE OF CHLORINE TABLETS……..……....40

PARTS LIST ………….41

NOTES…….....42

Welcome!

Dear Fellow Environmentalist:

I am pleased to introduce the SHS TECH Marine Sanitation Device. We have been providing the finest in packaged wastewater treatment systems to a base of satisfied customers that spans the United States. The stars behind the operation are the USCG and IMO certified models.

Did you know, every day in the United States alone, over 385 billion gallons of water is consumed? When you combine that with the fact our Earth has less than 1% of fresh water available, this equals a catastrophic problem for the future of our planet. SHS TECH, LLC believes the future of our Earth's water supply should become every individuals concern. The SHS TECH marine sanitation device was designed to be a powerful tool to aid humanity in their mission to begin taking better care of our Earth. Your interest in our products is just another piece of the puzzle needed to improve our Earth's supply of fresh water. We believe a difference can be made with the combination of both teamwork and commitment. We are excited and pleased to introduce to you the SHS TECH marine sanitation device! We believe you will agree – it is the wastewater treatment system you can depend on for reliability and optimum efficiency.

The SHS TECH can be engineered to fit most small, hard to fit areas and handle many different capacities. SHS TECH is committed to the continued performance and technological innovation of our units. Outperforming the competition, the Seahorse Research and Development Team never rests in its dedication to technological advancement and system enhancement. Providing a quality product at a competitive cost, Seahorse strives to maintain our reputation in the industry as the Leader in environmental quality.

Thank you for giving SHS TECH the opportunity to provide you with this powerful tool. We hope you will find the information within this manual informative and useful and look forward to the opportunity to assist you in your future environmental and wastewater needs.

Sincerely,

SHS TECH

Preface

We are all faced with a most serious problem — our Earth's water supply. The problem is not the amount of water available — The problem is mankind. Mankind is polluting our precious water supply day by day. Statistics now show, worldwide, the percentage of "fresh" water has been dangerously reduced to less than 1%.

Concern over the Earth's water supply, the increasing worldwide pollution problems, as well as the necessity of engineering 'pollution prevention products', must become the norm, not the exception. At the present rate of pollution, however, and the ever increasing rate of water usage, mankind will soon find "fresh water" to be more precious than gold. The steps we take now, and in the future, will mean the difference between our children's inheritance of an environmentally safe world with a plentiful supply of fresh water — or not.

SHS TECH believes these issues to be of such importance, we have made it our Mission to contribute to worldwide pollution prevention by introducing a powerful tool into the market: The SHS TECH Marine Sanitation devices addresses wastewater treatment for Marine, Offshore, and Commercial Land Based applications.

Company Profile

SHS TECH has been a pioneer in the manufacturing of quality packaged wastewater treatment systems. SHS TECH is a well-proven wastewater treatment system; constantly monitored for efficiency and optimum performance.

With clients who use our products all over the united States, SHS TECH is confident in its standing in the market place. Our company continues to grow, always searching for and obtaining the latest in technological advancement, determined to pave the way towards environmental awareness. Growth is evident with the addition of a Service Department, Chemical Product Line, Environmentally Safe Cleaning Chemical Product Line, Alternative Designs — the list continues to grow.

With team commitment to quality assurance, to environmental protection, to innovative and environmentally friendly products – SHS TECH looks forward to the future.

Introduction

SHS TECH has been providing units primarily to the marine industry, however we also applications such as dock facilities, bridges, and other onshore commercial applications.

With the advent of the U.S.C.G., OCS Order #8, the need of similar systems modified for offshore and maritime applications became more critical. SHS TECH designs and manufactures such systems.

This background of research, development, fabrication and service has resulted in the present and complete line of packaged, ready-to-use, U.S. Coast Guard approved and certified MSD — Type II Plants, approved for use on Inspected and Un-inspected Vessels under 33 CFR 159.000. The SHS TECH also complies with International Maritime Organization (IMO) Resolution MEPC.2 (VI). These features give our customers the confidence to use SHS TECH units for large vessels, as well as offshore rigs and platforms. SHS TECH offshore units are readily adaptable for other applications where their efficiency, simplicity and economical operation make them very attractive alternatives to large expensive and complex sewage systems. Examples of such applications are:

Alternative Uses/Applications

Large Boat
Barge
Over-Water Rigs & Platforms
Recreational Use

The primary purpose of this manual is to describe the SHS TECH line of Marine Sanitation Devices (MSD) and to provide sufficient information — both technical and general — to enable to Operator to enjoy many years of trouble-free, efficient operation. Within this manual you will find information designed to guide you through the installation, set-up, operation, maintenance and storage of your new system. Before beginning the installation or operation of your SHS TECH Marine Sanitation Device please read this manual thoroughly. **YOU CAN DAMAGE YOUR SEAHORSE UNIT DURING INSTALLATION**, so follow all instructions carefully. In order for your system to operate at peak conditions, you must first understand how it operates and the function of each part of the system.

General Terminology & Criteria

The packaged wastewater treatment plants fabricated by SHS TECH are generally referred to as “Extended Aeration” systems. This means SHS TECH systems incorporate the biological concepts of “Activated Sludge”, in the form of “Mixed Liquor Suspended Solids” (MLSS).

The efficiency of such plants is typically defined in terms of the treated effluent discharged from the system. The U.S.E.P.A. describes the minimum level of effluent quality in four (4) major parameters:

USEPA Effluent Parameters

- Biochemical Oxygen Demand — 5 Days (BOD_5)
- Suspended Solids (SS or TSS)
- Fecal Coliform Bacteria
- PH

The least stringent effluent criteria are applicable to offshore Federal Waters and Open Ocean. The most stringent criteria are applied to inland waterways, lakes, bays, dockside use, etc. in the vicinity of heavily populated areas and sensitive recreation and protected nature areas.

The original U.S. Coast Guard Certified Type II MSD plants were designed to produce effluent in the range of 50 milligrams per liter (mg/l) BOD_5 and 150 mg/l TSS. Most extended aeration plants manufactured today will do much better than this. The latest models of SHS TECH can produce sterile effluent with less than 20 mg/l of BOD_5 and TSS.

<u>Note</u>: Determine the regulatory requirements for effluent quality, sampling and testing, for your installation and location.

Offshore units are identified by model numbers corresponding to the number of gallons of wastewater that will be treated in a 24-hour period. SHS TECH standard model sizes range from a 160 GPD treatment capacity to 10,000 GPD. Custom fabricated units, with non-standard dimensions and configurations are available, however, to accommodate space restrictions and other legitimate considerations. The system design and operation remains constant for both standard as well as non-standard model designs.

Glossary of Terms

Aeration: To combine or charge a liquid with air to raise the level of oxygen in the liquid. Raising this level supports the necessary life forms (bacteria, needed to decompose the organic materials in the wastewater being treated.

Aeration Chamber: A unit chamber where the wastewater being treated is subjected to an infusion of air.

Aerobic Bacteria: Bacteria that can only live in the presence of oxygen.

Anaerobic Bacteria: Bacteria that can only live when no oxygen is present.

Bio-Mass: A composition of primarily living microorganisms introduced into the unit for optimum decomposition of waste.

Black Water: Water that comes from the toilet systems of a facility and contains human waste**.**

BOD: Biochemical Oxygen Demand — The measurement of the dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter.

BOD_5: The amount of dissolved oxygen measured for a period of five (5) days.

Chlorinator: A chlorine contact chamber for the treated effluent that retains the liquid for a set amount of time to kill virtually all of the living microorganisms in the clarified effluent.

Clarifier: A quiescent environment where the treated effluent is retained for approximately four (4) hours allowing solids to settle to the bottom where they are continually removed via the sludge return back to the aeration chamber until dissolved.

Diffuser Valves: Valves located at the top of the aeration chamber that control the airflow through the diffusers. One valve controls airflow to the internal up-flow filter and floating skimmer, and the other controls the airflow to the aeration chamber.

Dissolved Oxygen: The amount of available oxygen in solution that is needed to sustain life. This amount is dependent on pH, temperature, salinity and barometric pressure.

Extended Aeration System: A treatment system that forces air/oxygen into the material being treated. This is done using a blower that forces air into the water.

Fecal Coliform Bacteria: Indicator organism used to determine the presence of harmful pathogens in wastewater.

Filter: Non-Clog up-flow mechanical device used to prevent the organic materials/solids from passing up into the clarifier section.

Gray Water: Water that comes from areas other than facility toilets. Such examples are: kitchen sinks, washers, wash down areas and showers.

SHS TECH **Skimmer:** A patented device located in the clarifier used to break the surface tension of the water, draw floating solids from the waters surface and return this material to the aeration chamber.

Sludge: Organic particles that accumulate in the treatment system that are suspended or settled in the aeration chamber.

Sludge Return: Located in the bottom of the clarifier to draw off sludge and return it to the aeration chamber.

Total Suspended Solids (TSS): A physical characteristic of wastewater that measures the total solid content taking into consideration all floating matter, settle-able matter, colloidal matter and matter in solution.

Bar Screen: The SHS TECH"S catch basket for preventing the in-flow of non-dissolving solids.

Background

"Domestic Sewage", sometimes referred to as "Sanitary Wastewater" refers to the liquid discharge from facilities occupied by human beings in the course of their normal living, working and recreational habits. For the purpose of this discussion, we do not include industrial wastes or storm drains and runoffs.

The volume of domestic wastewater generated by the average person may vary from less than 11 gallons per day (GPD), from 'low flush' toilets only, to as much as 100 GPD, for normal human activities in a 24-hour day. This volume of water emanates from toilets, sinks, showers, bathtubs, laundry equipment, kitchen appliances (such as garbage disposals), etc.

This wastewater is over 99% water! It is the remaining less than 1% of solids, which may be present in soluble, insoluble, colloidal or suspended forms, and a very small amount, which may be in the form of insoluble grit particles that are the cause for concern. It is this 1% for which the degree of environmental awareness and the need for concern over the protection of our Earths' water has been generated.

Two (2) fundamental parameters are essential to the design and sizing of a packaged wastewater treatment system. Those parameters are:

Design/Sizing Parameters

- Hydraulic Loading — simply the volume of water to be treated in a day; and
- Solids — often referred to as the "Biological or Organic Loading". This is simply the amount and nature of the small amount of solids in typical domestic sewage.

Years of investigation and research have established very reliable, typical values used in the sizing of these units to determine both the hydraulic as well as the organic loading. For example, the average person — nationwide — generates about 100 GPD of wastewater containing about 0.17 lbs of BOD_5. The typical offshore employee, however, eats a little more and a little 'richer', and uses a little less water, than the average person at home or work. The design for this application would be for about 75 to 100 GPD and about 0.20 lbs of BOD_5, per person, per day (if both "Black" and "Gray" water is to be treated).

USCG MSD units were originally designed to handle "Black" water only, preferably from low volume toilets and urinals. As an example, a MSD Type II Certified unit could service the wastewater generated by a four (4) man crew, from 'low flush' toilets, at a rate of approximately two (2) gallons per flush and five (5) flushes per day, per crew person.

Fact

Old standard toilets use approximately five (5) gallons per flush and the typical person will flush from five (5) to seven (7) times per day. New standard toilets use 1.6 gallons per flush.

Note: If your unit is not producing the desired quality effluent after carefully reading and following the Manual, check to make sure the rated capacity of your unit is not being exceeded!

Operating Warnings/Maintenance Instructions/Safety

Precautions

Operating Warnings

1. This unit **MUST** be filled with water **PRIOR** to operation. Refer to your manual for easy start-up procedures.

2. DO NOT flush any of the following items into the unit:
    - Cigarettes
    - Paper Towels
    - Grease/Oil
    - Disinfectant (Bleach/Chlorine/Acidic) Cleaners

Refer to your manual for a list of recommended cleaners.

Maintenance Instructions

1. Every 2 weeks — Flush 2 oz. of **Man-O-War** SDE340 and 2 oz. of **Man-O-War** SDE340 Enhancer down the toilet.

2. Every 2 weeks — Check the chlorinator and add chlorine tablets or liquid chlorine if needed. *Liquid drip option--Liquid chlorine drip should be set to 20 to 30 drips/minute

11. Once a week — Perform routine inspection by opening all Inspection Ports and observing operation. Refer to the *Routine Inspection Sect/on* within this manual.

Safety Precautions/Warnings

CAUTION!! This unit makes use of both **hazardous** and **non-hazardous** chemicals!! **Please refer to the enclosed Material Safety Data Sheets BEFORE HANDLING!**

Electrical Precautions/Warnings

ELECTRICAL HAZARD!! Disconnect or isolate, “Tag Out of Service”, all electrical *C* supplies prior to attempting any service on electrical equipment!

Acceptable Cleaners:

BioMax MULTI-PURPOSE CLEANER

For use in kitchen or bath, on any type of dirty job. This product contains a balanced blend of special surfactants, and bacteria and is safe for most surfaces, including wood, plastic, metal and painted surfaces.

This product provides the cleaning power you demand, while proving harmless to the environment as well as to the operation of your unit.

All SHS TECH systems work in conjunction with SHS TECH SDE 340 Enzymes and SHS TECH Enhancer SDE. These products were designed to assist your system in maintaining its level of efficiency. Care MUST be exercised in the selection of the cleaning products you will use with this system. To insure optimal performance of your SHS TECH system, it is imperative that all cleaning chemicals used during routine and general maintenance of your system be Biodegradable Only. Use of non-biodegradable products will kill off the necessary bacterial supply required in the treatment of your wastewater. Failure, therefore, to follow these precautions will require immediate corrective action to restore your system to full operational service.

These are some of the commercially available ACCEPTABLE CLEANERS that can be used on fixtures that drain into the SEAHORSE system:

USE	**PRODUCT**	**MANUFACTURER**
General Purpose cleaner	-BIOMAX -Mr. clean -409	-Seahorse -Proctor & Gamble -Johnson Wax
Toilet cleaners and Drain Openers	-BIOMAX	- SHS TECH
Bathroom Tile, Shower Stall	- BIOMAX	- SHS TECH

And Toilet Bowl Cleaners	-Aerosol Bathroom Cleaner	-DOW
	-Mr. Clean	-Proctor & Gamble
	-409	-Johnson Wax

Dishwashing Detergents	-Palmolive DishWashing	-Palmolive-Peet
	-Dawn	-Proctor & Gamble
	-Cascade	-Proctor & Gamble

Cleaners to Avoid!!

- Para-dichlorobenzene Toilet Bowl Deodorant
- Pine Oil and/or its' derivatives
- Highly Acidic/Caustic Cleaners
- * **Bleach**
- ANY **ANTI-BACTERIAL CLEANER!**

Rule of Thumb:

If you choose to purchase cleaning chemicals, please keep this simple rule of thumb in mind. Any "anti-bacterial" cleaners will have adverse effects on your SHS TECH system. Avoid anything anti-bacterial, as well as anything containing bleach. **The** best type of toilet paper to use would be "Cottonelle®" brand, as this seems **to dissolve faster than other brands.**

Summary of Operating Instructions

Do's & Don'ts

READ the "Installation, Operation & Maintenance Manual" before operating your SHS TECH Marine Sanitation Device (SMSD) and OPERATE your SMSD according to the manufacturers instructions only.

DO NOT flush any of the following materials and/or products down the commodes, lavatories or basins or into the unit in any manner:

- Unauthorized toilet bowl and urinal cleaners
- "Saniflush", "Draino", "Pine Oil", "Bleach" or other similar products
- Large amounts of oil and/or grease
- Heavy paper towels, sanitary napkins, cigarette butts, candy wrappers or any other extraneous material
- ANY anti-bacterial cleaner or agent.

SHS TECH SYSTEMS provides biologically safe cleaning products for use with your SMSD.

These types of products, listed previously, should be used to protect the life and operation of your unit. Failure to follow the directions on acceptable cleaning chemicals will result in a breach of the manufacturer provided warranty.

Section 2

Description & Operation Instructions

The SHS TECH Marine Sanitation Device is a self contained, “extended aeration”, biological system that is delivered ready for use when site electrical and mechanical connections are in place.

Construction

The plant is constructed of Carbon Steel, Stainless Steel, or durable polyethylene,. Internal piping is schedule 40 PVC. ALL EXTERNAL PIPING IS STAINLESS STEEL OR CPVC APPROVED BY USCG

The plant is comprised of three (3) main compartments:

- Aeration Chamber
- Clarifier Chamber
- Chlorine Contact Chamber

Additionally, the following are major components of the plant:

- Inlet screening apparatus
- Blower/Motor for air supply
- Air distribution system including diffusers and airlift devices
- Surface skimmers
- System of weirs and baffles for velocity changes and sludge retention
- Chlorinator (chlorine dispenser)
- Electrical control panel and wiring
- Discharge pump
- Up-flow filter baffle

Operation

Operation of the Aeration Chamber

Raw waste enters the system through the inlet screen and is fed directly into the Aeration Chamber. In this compartment, the influent waste is intimately mixed under constant agitation with incoming air through the diffusers from the blower.

This is the source of the essential oxygen and the origin of the term “extended aeration”. The diffuser valve controls the volume of incoming air. The waste is in intimate contact with the metabolizing circulating “bio-mass” which rapidly metabolizes/oxidizes, and to some degree, flocculates the suspended, colloidal and soluble organic materials introduced in the influent waste. A portion of the incoming waste is utilized in the

synthesis of new microorganisms, thereby allowing the “absorption”/oxidation of additional organic material in an unending natural cycle. The degree of oxidation/metabolizing of the solids is primarily a function of the applied organic load and the availability of adequate dissolved oxygen over a period of time. After approximately 24 hours detention time in the Aeration Chamber, and/or a minimum of 80 cubic feet per pound of BOD_5 of applied loading, a sufficient time to effect the desired degree of treatment, the treated effluent is displaced by incoming raw waste and flows into the Clarifier Chamber through the up-flow weir.

Operation of the Clarifier Chamber

The Clarifier Chamber provides a quiescent environment where the treated effluent is retained for approximately four (4) hours. Most of the solids are kept in the Aeration Chamber by the up-flow weir, and virtually all of the residual entrained solids will be removed by simple sedimentation into the Clarifier Chamber. A small amount of floating material may be carried away from the Aeration Chamber to the Clarifier Chamber. This floating material is returned to the Aeration Chamber via the skimmer. The following specifications for this chamber shall be met:

- There shall be installed within the Clarifier Chamber a positive scum and skimming re-circulation system consisting of one (1) airlift skimming device, meeting the following specifications:

    - The skimming device shall be of the positive airlift pump type, located in a position to skim and return floating material to the Aeration Chamber.

    - The airline supplying air to the skimming device shall be equipped with a valve to regulate the rate of return.

    - The scum intake shall be equipped with a hose assembly, which will enable exact positioning of the skimmer at water level without placing the hand under the water.

The resulting clear effluent flows from the Clarifier over the effluent weir through the Chlorinator into the Chlorine Contact Chamber.

Operation of the Chlorine Contact Chamber

In the Chlorine Contact Chamber, the clarified effluent is detained for approximately one hour, killing virtually all of the live microorganisms still remaining in the clarified effluent. The chlorine picked up in the chlorinator is an amount sufficient to kill the live organisms and is dissipated in the Chlorine Contact Chamber so that the final discharged effluent contains very little residual chlorine that might endanger anything in the outside

environment.

Technical Specifications

1.0 General Description

1.1 SHS TECH systems operate on an extended aeration, biological treatment process, are self-contained, and delivered to site ready for immediate operation once electrical and mechanical connections are in place.

1.2 SHS TECH tank capacity's range from 50 GPD to several thousand GPD of sanitary wastewater loading.

1.3 Readily adaptable to extreme changes in volume treated due to seasonal usage changes.

2.0 Performance Criteria for Secondary Stage of Effluent

2.1 Less than 40 mg/100 ml of Bio-Chemical Oxygen Demand 5 day (BOD_5).

2.2 Less than 50 mg/l of Total Suspended Solids (TSS).

2.3 14 per 100 ml or less fecal Coliform to sterile effluent when properly disinfected.

2.4 Non-toxic to humans and animals.

11.0 *Air Supply Blower Motor Units*

3.1 A Regenerative or Positive displacement blower/motor unit shall be supplied, capable of providing a minimum of 2,100 cubic feet of air per pound of BOD.

3.2 The blower shall be mounted on a steel base. The base structure shall be adequately reinforced to support the blower and motor unit. The blower shall be equipped with a dry type filter-silencer at the air intake. Furthermore, the blower discharge shall be fitted with a check valve.

3.3 The air compressor shall meet the following specifications:

.3 to 5.0 hp; 115/208-230 volts, 10; 60 Hz; 66 CFM, 4 PSI, 3650 mm; 1 to 2" inlet and outlet.

4.0 Electrical Control Panel

4.1 An electrical control center with built in disconnect shall be installed within a weatherproof enclosure, and shall be provided for mounting as indicated on the plans. The enclosure shall be equal to NEMA 7 or greater. The electrical controls shall consist of either a manual starter or magnetic starters with program timers and switches necessary to automatically control all electrical devices and/or motors on the sewage treatment system.

5.0 Paint System — Coating System (Retro fit model Not applicable)

5.1 Exterior Finish — Sand blasted to near white metal, Prime coat- 893, Epoxy© 5-6 DFT. Top coat- Polyurethane 134-HG © 2.0 to 3.0 DFT.

11.0 **Interior Finish — Sand blasted to near white metal, 2 coats coal-tar epoxy© 5.0 to 10.0 mills DFT each. (Optional: Phenolic Liner can be applied)**

6.0 MSD's can be downloaded for Chlorine

Pre-Installation Check List

Prior to installing your SHS TECH Marine Sanitation Device, please make sure you've made provisions for the following requirements:

Electrical Requirements:

The SHS TECH Marine unit blower standard requirements, unless otherwise specified, are 115/208-230 Volt 10, 60 Hz, and TEFC. All wiring should be performed in accordance with applicable Codes and Standards, such as ABYC, USCG, NEC, etc.

Temperatures:

The SHS TECH Marine Sanitation Device's operating temperatures are 40 to 120 F. The SMSD must be protected from freezing, if the unit has not been winterized in accordance with the Storage and Winterization Procedures found in this manual it could be damaged and need internal repairs.

Water Requirements:

The SHS TECH Marine Sanitation Device can operate using fresh, brackish, or salt water. The salinity of the water cannot exceed 4% NaCI.

Toilet Requirements:

SHS TECH recommends a low-flush (1.6 gal/flush) toilet be utilized with your unit, for proper operation. Use of any other type of toilet will alter the treatment capacity of your system.

Maximum Allowable Tilt Angle:

The SHS TECH Marine Sanitation Device will maintain treatment efficiency with vessel pitch and roll angles of up to **15°**. Angles greater than **15°** can stop the unit from working properly until it has been serviced, to start the digestive process again. No physical damage will occur at angles less than **30°**

Tank Capacity:

The SMSD is designed to operate completely full. The design of this system is one of positive displacement – the transfer of liquid through the treatment plant.

Caution!

Explosive Environment:
The SMSD is **NOT CERTIFIED FOR USE IN AN EXPLOSIVE ENVIRONMENT**. (Explosion proof equipment is an optional item and would incur additional expense. For more information, please contact your Authorized Distributor or Rep.). The blower **MUST** have fresh air available for use.

Note: The treatment capacity expressed in number of *person per 24 hours depends on* ***the type of toilet used with the system. The above capacities are based on the use of*** *an approved toilet. These capacities are not guaranteed when the* SHS TECH *unit* ***is used with an unapproved toilet(s).*** SHS TECH ***LLC recommends using a 1.6 Gallon per flush toilet.***

Installation

1. Select a suitable location to mount your SHS TECH **Marine Sanitation Device**. Keep the following in mind:

   - These units are essentially weather resistant. They may be installed under a shelter, such as a lower deck; or in the open, as on a top deck or on a cantilever over the side. An overhead shelter is always preferred for the convenience and protection of the Operator(s) conducting routine maintenance and inspection.
   - The unit should be mounted as near level in all four (4) directions as possible. On motor vessels it is recommended that the unit be installed with the long axis fore and aft.
   - It is generally preferred to locate the unit at the lowest available level to enable gravity feed into the unit and gravity discharge overboard of the treated effluent. This eliminates the need for lift stations and discharge pumps.

   - The lifting eyes installed on the unit are designed to lift the <u>empty weight</u> of the unit from a single point traveling block with four (4) hook slings. Spreader bars are not required.
   - The unit should be installed in a location that will be adequately ventilated and has space around and above the unit to allow for maintenance and inspection. For installation on an Inspected Vessel, the SMSD MUST HAVE ROOM for inspectors to check the unit label and operation.
   - The unit must be securely anchored to the vessel, by means of screws and anchor clips and into solid material. The unit(s) can be skid mounted, in the same manner, if so desired.
   - If installed in a location where freezing is a possibility, it should be equipped with an approved heater. It should not be located where the internal temperature will remain above 120 degrees F for prolonged periods. At **90 degrees F**, the microbial metabolism is about maximum. Even between 60 and 105 F, their activity is still very high.

2. Once the unit is mounted, connect the following four (4) tie in connections. **<u>(Refer to Figure 1).</u>**

   A. Connect raw wastewater line to inlet
   B. Connect treated effluent discharge
   C. Vent. **<u>DO NOT VENT SEWAGE UNIT IN ANY CONFINED SPACE!</u>**
   D. Connect electrical power

3. The inlet connection is a 3” EN PT. Conned to the inlet connection to the customer provided wastewater piping.

4. The outlet connection is a 1 ½” FNPT. Connect to the effluent discharge line to the discharge pump valve.

5 The vent connection is a 3” FNPT. Applicable codes and regulations, such as MMS, USCG, etc, should be consulted relative to vent piping. Avoid unnecessary valves, reducers, ells, etc, in the vent line. Keep the following in mind during vent installation:

- Vent lines should exit the system vertically, if possible. This configuration will eliminate the possibility of a slug of liquid getting trapped in a horizontal vent.
- Vent lines should be located no more than five (5) feet above the treatment system. Vents may not have sags or loops where water can accumulate and clog the vent lines.
- Position your vent lines with care. Although a properly operating, well maintained SMSD will not smell bad, it would be wise to locate your vent lines away from sleeping areas, kitchen areas, and high use areas.

    - Vent lines must remain free and clear for their entire length. Check valves or “filters” must not be used. Condensation will accumulate in vent line filters, causing blockage, and possible malfunction of your Seahorse Manufacturing Sanitation Device.
    - Proper venting of your SHS TECH Sanitation Device is extremely important. Restricted or inadequate venting can cause bubbling of the water in your toilets and may drain the water from the toilet bowl.

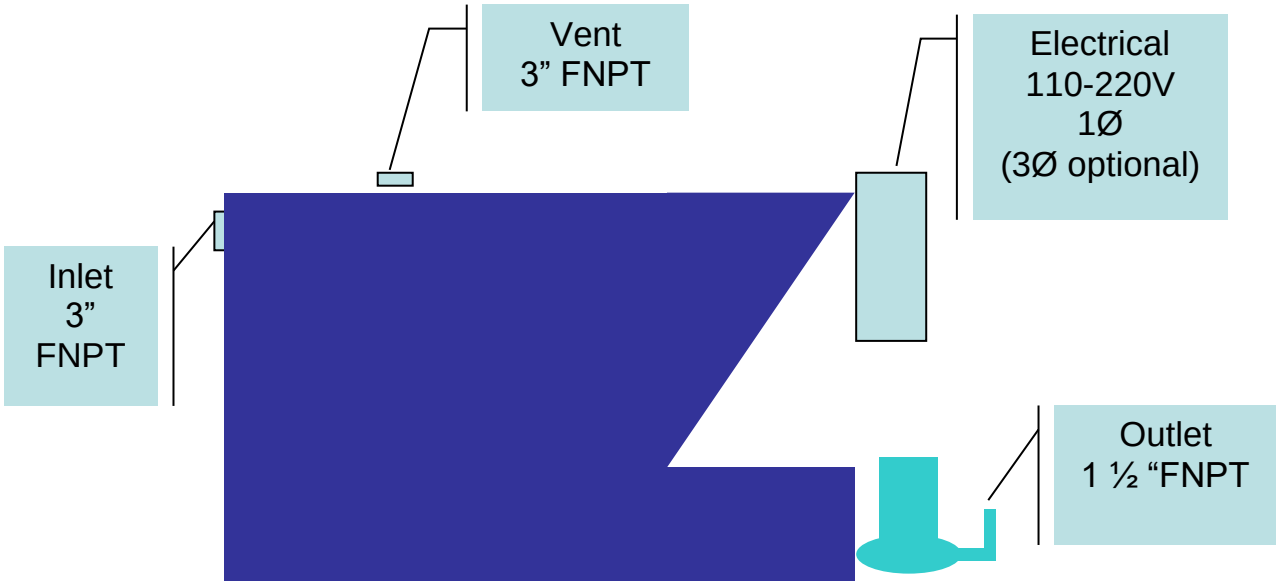
6. Connect power source — Standard electrical power is 115/208-230 volt, 10, 60 Hz. Verify switch positions on Control Panel.

7. The most important item of your system is the air supply. The sewage treatment system must have a continuous air supply to operate effectively. The blower must be free of obstructions and have an ample supply of free air. Make sure to use the supplied blower with your new MSD. <u>This system must have a continuous air supply to operate properly</u>.

8. Now that the unit is on its foundation, with inlet, vent and discharge connections being made, this unit must be filled with <u>FRESH WATER PRIOR TO INTRODUCING SEWAGE</u>! Place a fresh water hose in the opening on top, filling the tank until water begins to discharge from the 1 ***½ to 4”*** discharge connection on the Chlorine Contact Chamber.

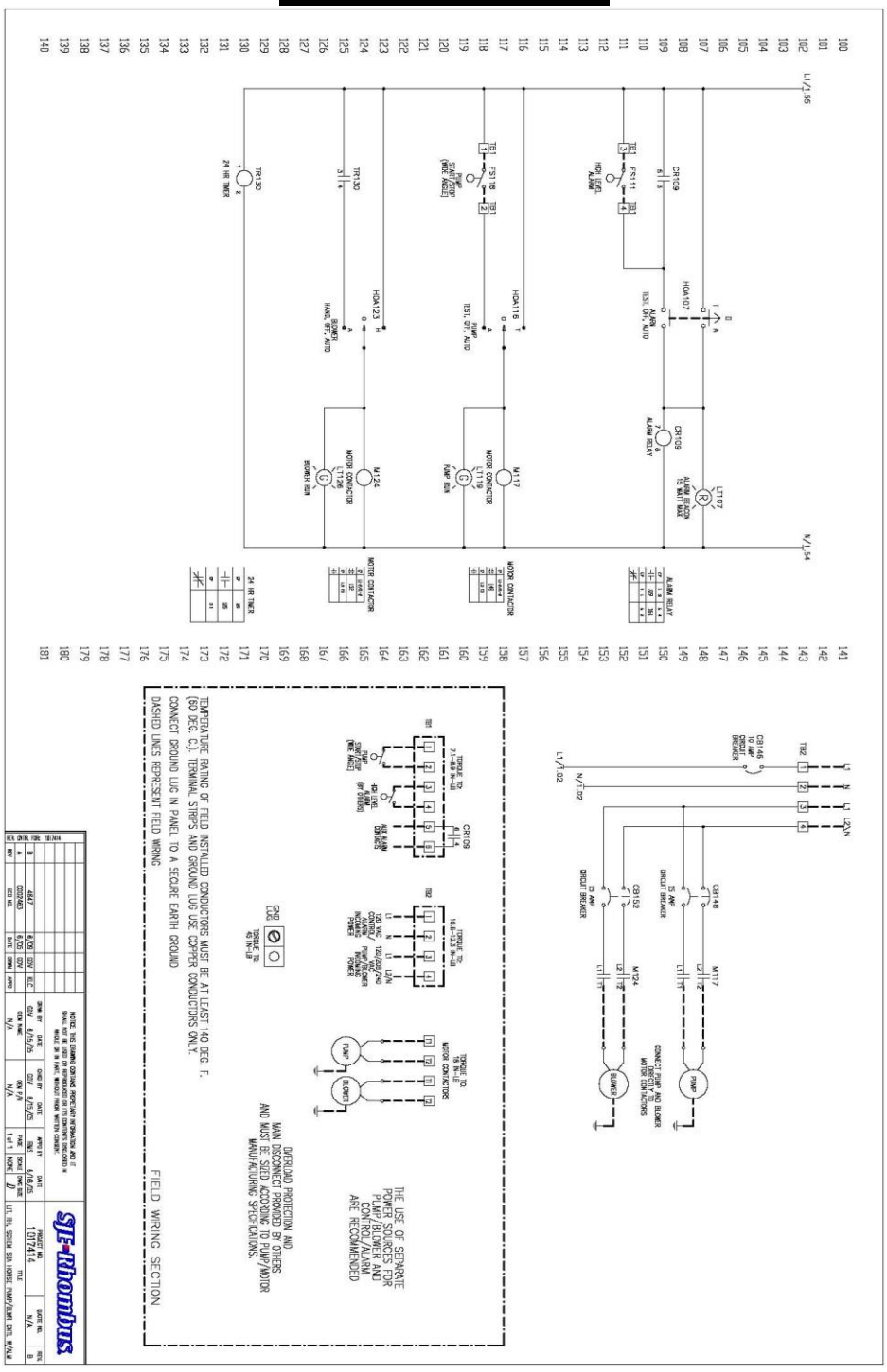
9 The unit is now installed. Proceed to the <u>Start-Up Procedure</u>.

SHS TECH System
Tie In Connections

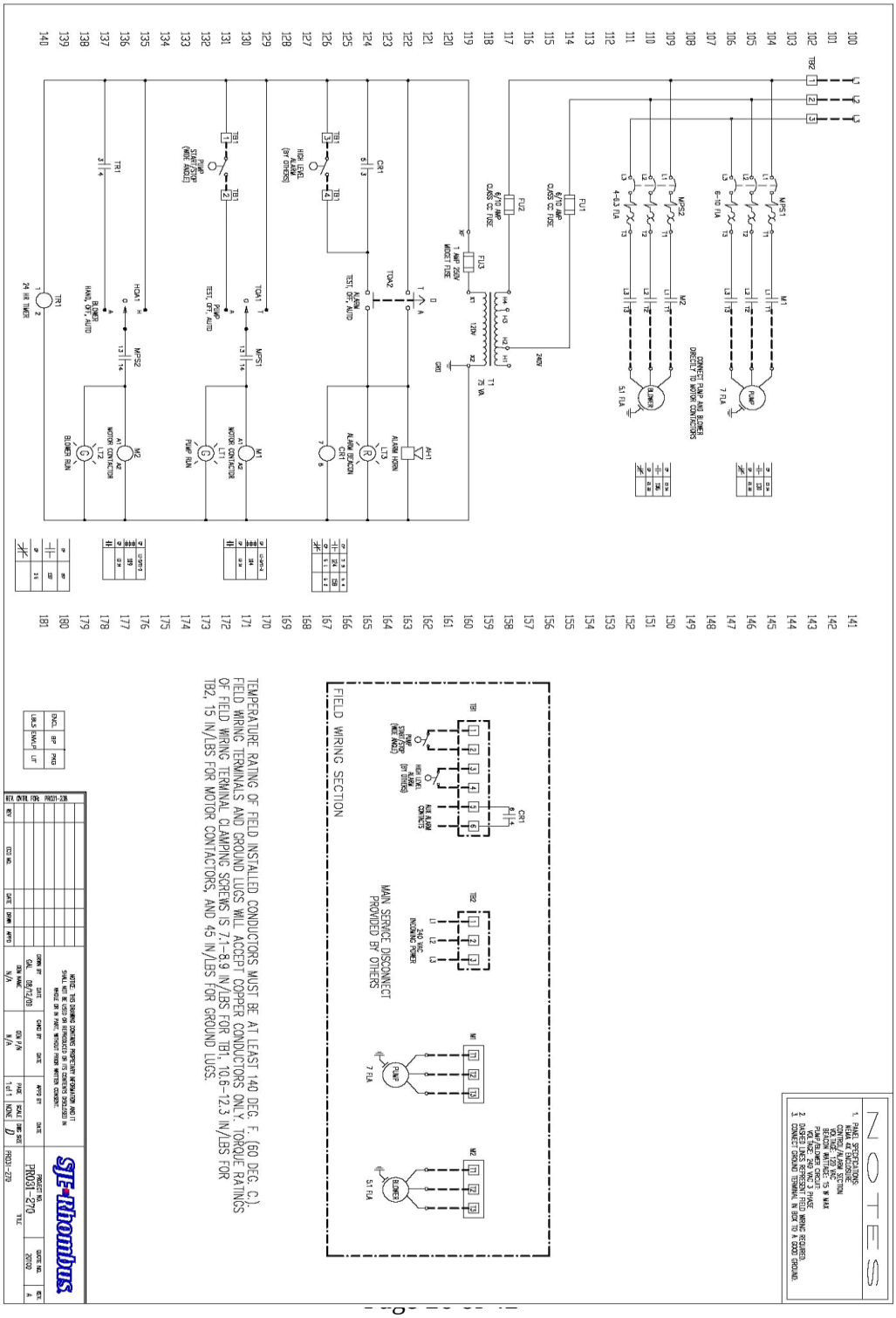


Electrical Schematics

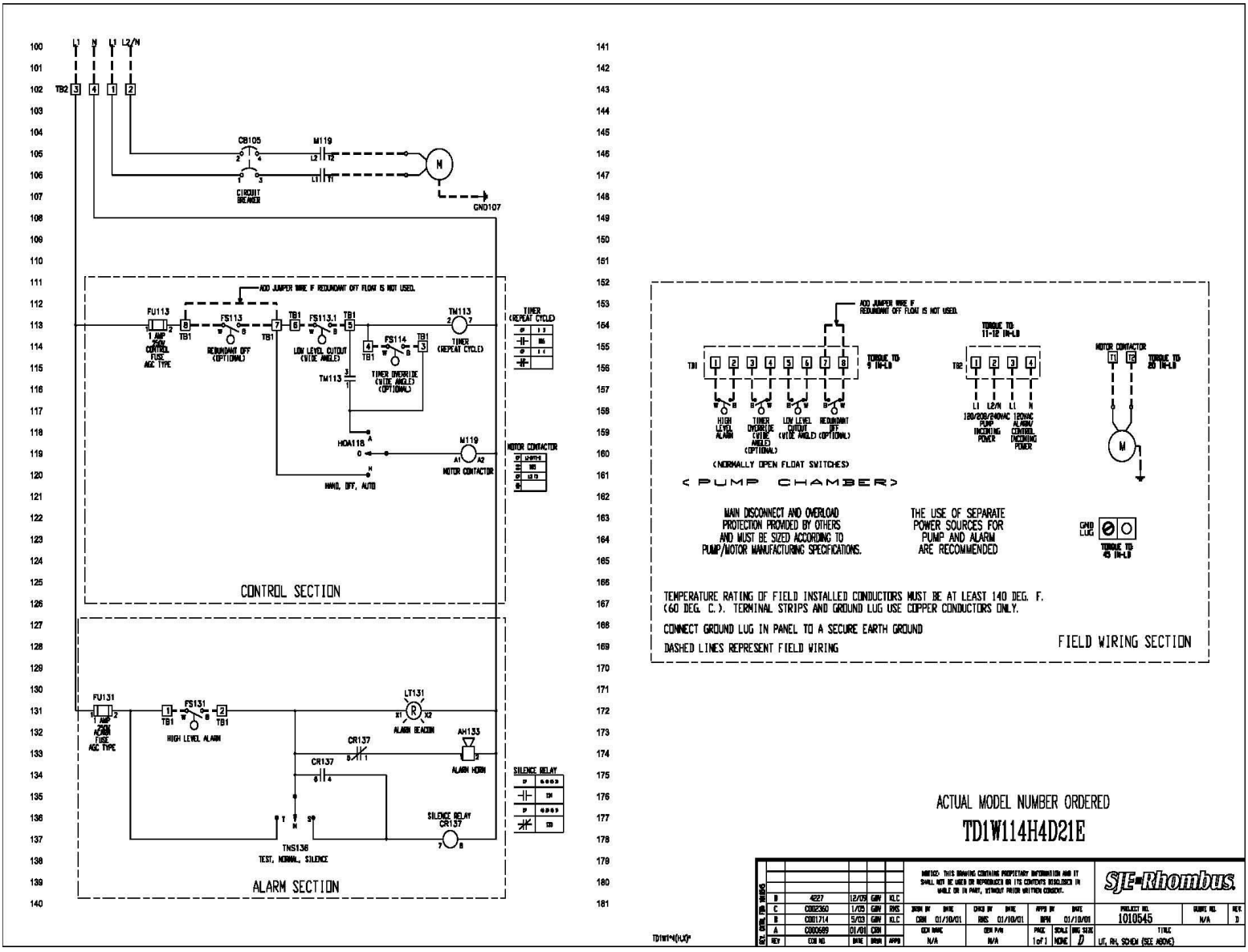
Marine Unit with Discharge Pump and Aerator Single Phase



Marine Unit with Discharge Pump and Aerator Three Phase



Marine Unit Aerator Only
Single Phase



Start-Up Procedure

1 After a proper installation has been accomplished and all piping connections have been made, (the inlet, outlet, and vent lines are properly connected, and system has been filled with water) you may now proceed to step **2** of this Start-Up Procedure. Refer to **Figure 2** for locations of all external connections.

2. Add Man-O-War SDE 340 Supplemental Bacteria — Add 2 oz product for every 500 gallons of waste treatment capacity. For example, if your system is a model 100, then it was designed to treat 160 gallons of wastewater per day. You would add 2 oz. of each product by flushing down the toilet.

3. Add Chlorine Tablets — Fill the chlorinator tube with 2 to 3 chlorine tablets until full and reinsert tube. These systems are designed to use 2 5/8" wastewater treatment chlorine tablets. Proper chlorine tablets must be used. **Pool grade chlorine is unacceptable.**

   CAUTION: Avoid breathing chlorine vapors. Avoid contact with skin and clothing. Keep chlorine tablets in a clean, dry container —preferably the original container in which they were received.

4. Electrical Connections — Connect the power supply to the starter panel only! For 3-phase equipment, verify proper rotation prior to continuing on to the next step.

5. Blower Operations — Start blower and observe internal operations of tank by removing access covers on top of tank.

   A. Aeration Chamber

   1. Diffusers should be causing bubbling and rolling of water in this chamber.

   2. The one to four return lines should have a slow flow of water coming from each line. Adjust associated valves, **ONLY** if necessary.

   B. Clarifier Chamber

   1. Water should be dropping into the throat of the aeration skimmer approximately 1" to 2". Skimmer depth is ¼" under surface of water to skim properly.

Routine Maintenance

Your SHS TECH is easily maintained by following this simple 4 point maintenance plan.

11. **SDE 340**

When: Every two (2) weeks

Action: Add 2 oz per 500 gals of each product to unit by flushing down toilet.

2. Chlorine

When: Every week

Action: Check chlorinator tube and insert more chlorine tablets as necessary. If using a liquid chlorination system check the level of the storage container

11. **Routine Inspection**

When: Once a month

Action: Inspection Ports to ensure all bio mass is being returned to the Aeration Chamber by means of the skimming devices. The Routine Inspection section describes proper operation.

11. **Inlet Filter**

When: Every three (3) months — six (6) months maximum

Action: Replace the inlet filter on the blower.

There are no consumable used in the operation of this Device other than the Chlorine Tablets and supplemental bacteria. No user action are needed other than normal cleaning and servicing as outlined in this manual.

Routine Inspection

1.0 Open all Inspection Ports and observe operation. Locate the Control Valves in the Aeration Chamber. These valves were preset at the factory and rarely require adjustment. Proper adjustment is determined by observing a gentle rolling of the water surface. ***The unit will not operate properly without sufficient air!*** Too much air, however, will not create any problems in the operation of your unit.

2.0 Locate the Strainer Basket at the inlet just inside the Aeration Chamber. If there appears to be an abnormal collection of paper or trash in the strainer, simply lift it off the retainer pegs, clean the basket and discard the trash, and replace the Strainer Basket back on the retainer pegs. This procedure is rarely necessary if users of your new SHS TECH follow all manufacturers recommendations.

3.0 Locate the Skimmers and the Skimmer Valves in the Clarifier Chamber. Locate the end of the 2,' discharge from the Skimmer back in the Aeration Chamber. There should be a small (one (1) or two (2) finger width) stream constantly discharging into the Aeration Chamber. Observe the Skimmer in the Clarifier Chamber. Push it down lightly to be sure the water is even with the top of the barrel just below the water surface. Observe that a small, but constant, flow from the surface is flowing into the barrel of the skimmer. The Skimmer Valve should be in a slightly open position to produce the desired constant small flow.

4.0 Locate the Sludge Return and the Sludge Return Valve in the Clarifier Chamber (only in unit models 500 to 8500). Locate the end of the 3" discharge from the Sludge Return into the Aeration Chamber. There should be a small constant flow from the Sludge Return, identical to the small steady flow from the Skimmer. Like the Skimmer, the Sludge Return Valve should be kept in a slightly open position to produce the desired constant small flow.

There should not be any surges of air out of either the Skimmer or the Sludge Return discharges.

5.0 inspect blower inlet filter. Remove wing nut on Filter/Silencer. Remove cover to expose filter element, replace filter if evidence of excessive build up of dirt/dust/oil. Carefully read the Operation Manual (Section 3) for all operational and maintenance instructions for the blower.

6.0 Locate the Chlorine Tube in the Chlorinator. Check the Chlorine Tube to ensure that partially dissolved tablets have not caked up in the cylinder (wash caked material out of Chlorine Tube if buildup has occurred). Add new tablets as necessary, insert Chlorine Tube into cylinder and replace cap. It should only be necessary to add chlorine tablets approximately every two (2) weeks of normal operation.

CAUTION: Avoid breathing chlorine vapors. Avoid contact with skin and clothing. Keep chlorine tablets in a clean, dry container. SHS TECH **strongly recommends all chemicals be stored in the original containers in which they were received. Exercise caution when opening the containers.**

WARNING: Chlorine, water and hydrocarbons (oil, grease, etc) form an Explosive mixture!

NOTES: When using sea- water or brackish water for flushing, it is virtually impossible to accurately determine free chlorine in the effluent using typical color-me tic indicator kits. A much more sophisticated laboratory type method must be used to determine the chlorine content called for in many required periodic regulatory reports Sea- water is frequently used for flushing and this is acceptable with all SHS TECH ***systems.***

Occasionally, systems are ordered with liquid chlorinators Carefully read and follow all instructions furnished with this unit. (Refer to Section 3)

7.0 Some units are supplied with Dual Motor/Blower systems. If allowed to sit idle for a long period of time, electric motors, air compressors, blower, etc, tend to "freeze up". This is especially true in high humidity and saltwater environments. Dual motor/blower systems should be run on, at least, an alternating weekly schedule. Some Operators alternate each 12-hour tour/shift.

8.0 Locate the 2" air check valve located in the blower discharge piping. Occasionally, relief valves and check valves tend to "click". To correct this minor problem turn the blower on and off, rapidly, two (2) or three (3) times until the "clicking" stops.

9.0 Occasional “wash-down” with fresh water and “touch-up” of external paint surfaces will enhance the appearance and prolong the life of the unit. This is especially true around the top inspection covers and in the vicinity of the chlorinator.

10.0 Efficient operation of these systems depends upon a healthy, stable population of microorganisms (primarily bacteria) and an adequate supply of available oxygen (air) in the Aeration Chamber.

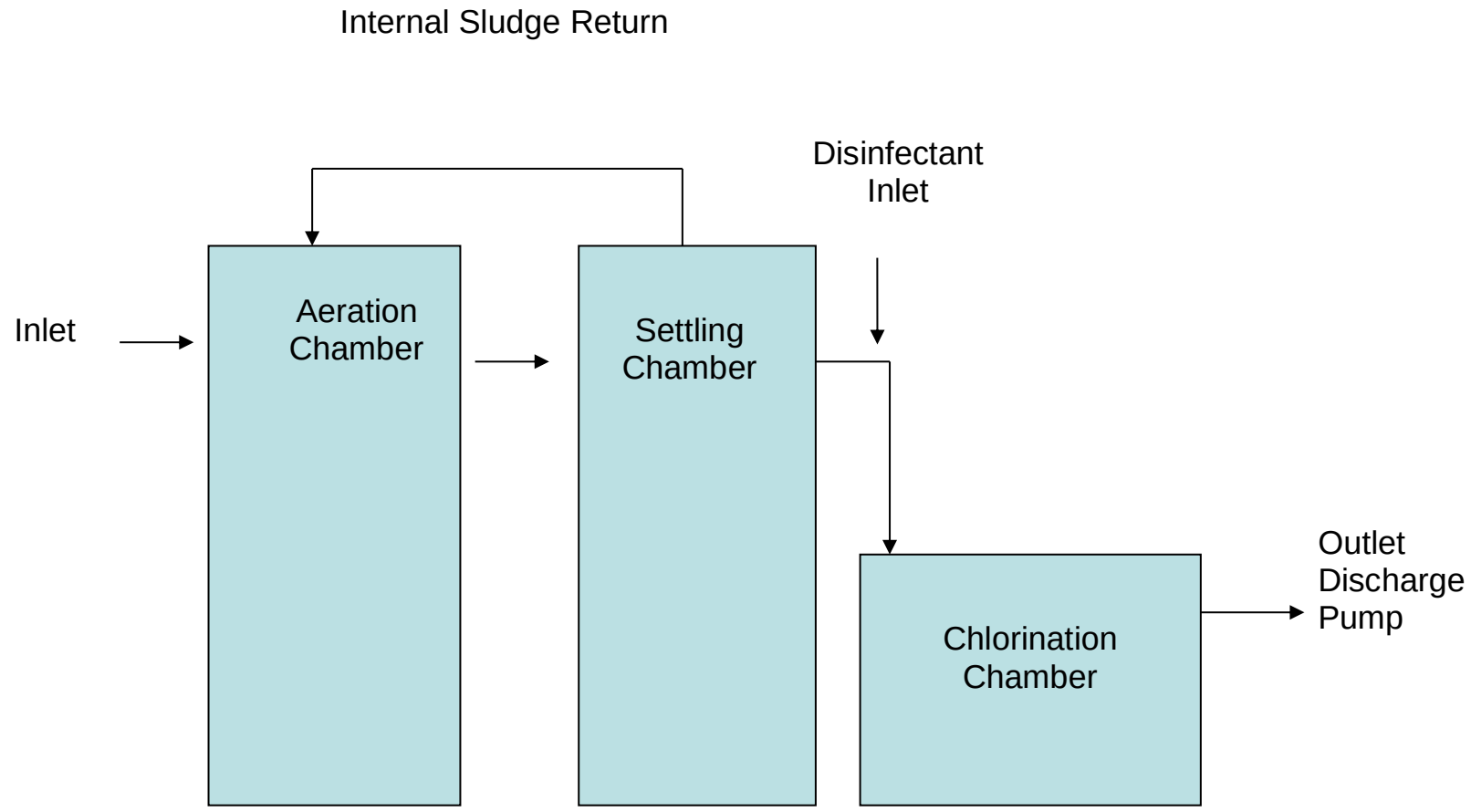
CAUTlON: Disinfectants, antiseptics, strong commercial floor cleaners, detergents, etc, are toxic to these microorganisms and must not be allowed to enter these units! Biologically safe cleaners are now supplied by Seahorse and should be used exclusively. Please refer to Recommended Cleaners section.

11.0 Most operational problems can be straightened out with a phone call to SHS TECH. Trained, experienced service personnel, however, are available at competitive rates. For more information, please contact Seahorse Manufacturing, or your local Authorized Seahorse Distributor.

Figure 2

SHS TECH Internal Diagram

Internal Flow Diagram



Trouble Shooting

Problem	Possible Causes	Corrective Action
Foul odor from the tank/improper blower operation	1. The blower is not turned on. 2. The unit is not plugged in. 3. Blower switch is not in automatic or On. 4. The timer switch, inside the control panel, is not in the center position. 5. Blower inlet filter has not been replaced.	1. Turn blower on. 2. Plug unit in. 3. Place blower switch to automatic or On. 4. Place timer switch in center position. 5. If filter is not white, it must be replaced.
Unit is backed up / does not discharge	1. Unit is not plugged in. 2. Pump switch is not in 'auto'. (If It Is Not Gravity Flow) 3. Pump isolation valve is shut. 4. Discharge check valve is stuck. 5. Pump switch or pump itself is bad.	1. Plug unit in. 2. Place pump switch in 'auto' position. 3. Open pump isolation valve. 4. Replace check valve. 5. Replace either/or switch or pump.
Effluent water does not meet purity standards	1. Blower switch is not in "On" or "automatic". 2. Chlorinator tube is not full of chlorine tablets. 3. Biological organisms in the tank have died due to introduction of unauthorized cleaning agents/chemicals into the unit. 4. Up-flow filter is clogged due to not cycling fluff& valve as stated in Four (4) Point Maintenance Plan. 5. Design capacity is being exceeded.	1. Place switch in "On" or "automatic". 2. Add chlorine tablets. 3. Discontinue use of unauthorized chemicals and add 2 oz. of Formula 101. 4. Clean up-flow filter as prescribed in maintenance plan. 5. Call your local SHS TECH distributor, or manufacturer, for sizing information.

Basic Sizing Guidelines

As mentioned previously in the Background Information section, there are only two (2) basic parameters that the prospective users need be concerned about:

Hydraulic Loading: The volume of water to be treated in a 24-hour day.
Organic Loading: The amount of organic solids (BOD) in that volume of water which needs to be removed.

There are obviously many other factors to be considered in the engineering and scientific design of such systems. These factors, however, are primarily the concern of researchers and manufacturers. The prospective user may be assured that reputable manufacturers, especially those who have had their systems approved and/or certified by monitoring and regulatory entities, have incorporated all of these factors into the delivered units.

Shut Down Procedures

When winterizing or leaving the vessel unattended for more than three (3) months, the sewage treatment system should be shut down. There are two (2) types of shut down procedures — Dry Dock storage — and — Minimum Use storage.

1. Dry Dock Storage: If the vessel is to be shut down, and no electricity or water will be available for your SMSD, do the following:

    - Shut off power to the blower.
    - Close any valves going from vessel toilet to the system.
    - Remove all sludge from the unit(s) by pumping the sludge into an authorized waste disposal tank located at the marina.
    - Rinse the unit(s) with clean, fresh water. DO NOT USE ANY CHEMICALS TO CLEAN THE UNIT(S). CHEMICAL RESIDUE WILL KILL ANY BACTERIA INTRODUCED WHEN THE TANK IS RESTARTED.
    - Close the discharge valve on the systems chlorinator section. The system is now ready for Dry Dock Storage.

2. Minimum Use Storage: If the vessel is to be shut down, and electricity and water will be available for the TANK, do the following:

    - Leave the power on to the blower.
    - Make sure that there is at least 2 — 5 gallons of water flowing into the system weekly.
    - It is important that the digestive process continues. By adding water and air into the system, your TANK will go into a dormant state, and not go septic. Without the water and air flow, Your unit will begin to go anaerobic and turn septic, making the system smell bad.

Service Department

SHS TECH LLC, takes great pride in its quality Service Department. Our Service Technicians are available to provide technical support and service for not only the SHS TECH MSD**, but** also nearly all other manufacturer's makes and models.

The SHS TECH Service Department carries a complete line of system enhancing products. Microbial formulas, disinfection chemicals, replacement parts and update kits are kept in stock and always available for immediate shipment.

Service is provided to all of our customers, regardless of location. Rates for Offshore work, however, will differ from our standard service call rates. Complete and expanded insurance coverage for any service location is a standard company policy.

Optimum system efficiency is easily attainable with the provision of the Seahorse Service Contract and/or regular inspections by an SHS TECH Service Technician. Quality Service, Reasonable Rates, Compliance Maintenance, Pollution Prevention SHS Tech lays it all within your grasp!

Limited Warranty

SHS TECH LLC, warrants the parts in this wastewater treatment unit to be free from defects in material and workmanship for a period of one year from date of purchase. Sole obligation under this warranty is as follows:

SHS TECH **shall** fulfill this warranty by repairing or exchanging any component part, F.O.B. factory, that in the judgment shows evidence of defects, provided said component part has been paid for and is returned through an authorized dealer, transportation prepaid. The warrantee must also specify the nature of the defect to the manufacturer, subjected to external damage due to altered or improper wiring or overload protection.

This warranty applies only to the treatment plant and does not include any of the house wiring, plumbing, drainage or disposal system. SHS TECH is not responsible for any delay or damages caused by defective components of material or for loss incurred because of interruption of service or for any other special or consequential damages or incidental expenses arising from the manufacture, sale or use of this plant.

SHS TECH **reserves** the right to revise, change or modify the construction and design of the treatment plant for offshore wastewater or any component part or parts thereof

without incurring any obligations to make such changes for modifications in previously sold equipment. SHS TECH also reserves the right, in making replacements of component parts under this warranty, to furnish a component part which, in its judgment, is equivalent to the Warrantee part replaced.

Under no circumstances will Seahorse be responsible to the warrantee for any other direct or consequential damages, including by not limited to, lost profits, lost income, labor charges, delays in production and/or idle production, which damages are caused by a defect in material and/or workmanship in its parts.

This warranty is expressly in lieu of any other express or implied warranty, excluding any warranty or merchantability or fitness, and of any other obligation on the part of SHS TECH.

WARNING:

When regenerative blowers and electrical motors are used in a salt water atmosphere they will cease when taken out of service. Care should be taken to spray lubricant in blowers prior to storage.

Summary of Regulatory Requirements

United States Environmental Protection Agency (USEPA) — The USEPA standards 40 CFR 140.3 states that in freshwater lakes, freshwater reservoirs or other freshwater impoundments whose inlets or outlets are such as to prevent the ingress or egress by vessel traffic subjected to this regulation, or in rivers not capable of navigation by interstate vessel traffic subject to this regulation, marine sanitation devices certified by the U.S. Coast Guard installed on all vessels shall be designed and operated to prevent the overboard discharge of sewage treated or untreated, or of any waste derived from sewage. The USEPA standards further state that this shall not be construed to prohibit the carriage of Coast Guard — certified flow-through treatment devices which have been secured so as to prevent such discharges. They also state that waters where a Coast Guard-certified marine sanitation device permitting discharge is allowed include coastal waters and estuaries, the Great Lakes and interconnected waterways, freshwater lakes and impoundments accessible through locks, and other flowing waters that are navigable interstate by vessels subject to this regulation.

Discharge Regulations

United States (USCG):

Total Suspended Solids (TSS)	<150 mg/L
Fecal Coliform Count	<200 per 100 mL
5 Day BOD	<50 mg/L

Some states and regulatory bodies may have even stricter requirements.

Use of Chlorine Tablets

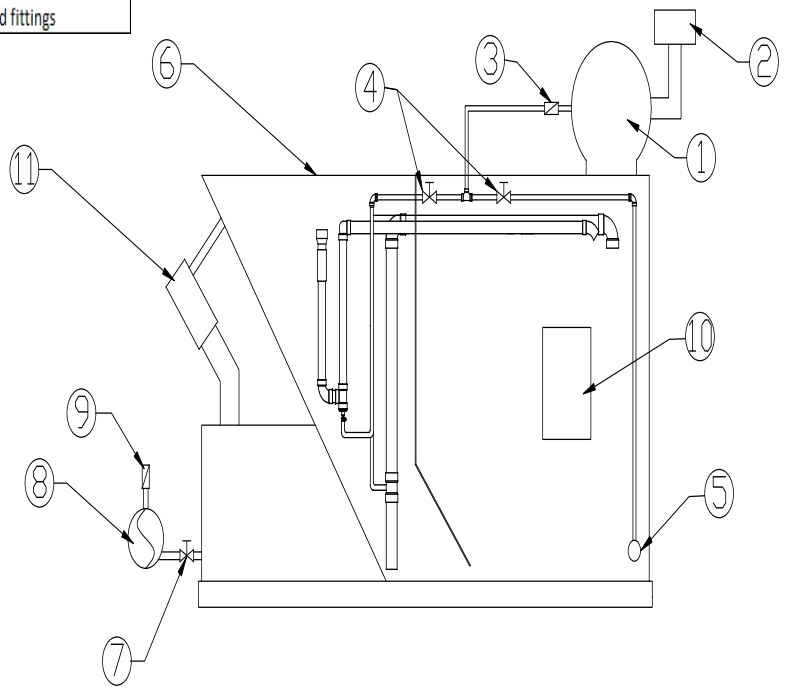
The only chemical needed for use in the SHS TECH Marine Sanitation Device is chlorine - in tablet form. The tablets are measured for use in the Chlorine Contact Chamber of your MSD and provide the correct amount of chlorine to disinfect the effluent discharge. Make sure to follow the MSDS sheet for use and handling of the tablets.
Chlorine can be caustic, so handle it with care. Use the procedures below for filling the chlorine contact tube.

1. Always use rubber gloves and splash-proof goggles when handling
2. Remove 3” tablet feeder tube cap
3. Fill the tablet feeder with enough tablets of chlorine to fill the tube
4. Replace the tablet feeder, followed by the cap.

If you have installed and set up the unit correctly, you should have years of trouble free operation. We hope you are pleased with your new SHS TECH **Marine Sanitation Device**.

If you have any questions, or require further information, give us a call, experienced field engineers are standing by to assist you. For more information about your SHS TECH Marine Sanitation Device, or other quality products, please contact your local SHS TECH Authorized Distributor.

Bill of Materials		
Item Number	Part Number	Description
1	Model Dependent	Aerating Blower
2	Model Dependent	Replacement Blower Filter
3	Model Dependent	Brass Check Valve
4	Model Dependent	Control Valves
5	Model Dependent	Diffuser
6	Model Dependent	Replacement Lid
7	Model Dependent	Gate Valve
8	Model Dependent	Discharge Pump
9	Model Dependent	Brass Check Valve
10	Model Dependent	Electrical Control Panel - Control Panel parts located on separate schematic
All external piping uses Spears Ocean Tuff Marine drainage systems or equal CPVC piping and fittings		



REV.	DATE	REVISION DESCRIPTION	BY
.	.	.	.

SHS TECH, LLC
LAFAYETTE, LA 70505

PARTS LIST - GENERIC

COMPANY CONFIDENTIAL: INFORMATION CONTAINED HEREIN IS CONFIDENTIAL, IT IS THE PROPERTY OF PENTAIR PUMP GROUP, IT IS TO BE USED SOLELY FOR THE PURPOSE PROVIDED, AND IT IS NOT TO BE DISCLOSED TO OTHERS WITHOUT THE PRIOR WRITTEN CONSENT OF PENTAIR PUMP GROUP.

PLOT SCALE	DRAWING NUMBER	DRAWN BY	DATE	SHEET OF	REV
NTS	–	R. DARBONNE	12/21/17	1 1	B

NOTES