# OPERATING INSTRUCTION MANUAL

## FAST® Marine Sewage Treatment System

## Marine FAST Manual

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**FAST MODEL _____ SERIAL NO. _____**

**CUSTOMER_____**

**VESSEL / PLATFORM_____**

**DATE _____**

**MAJOR ITEMS OF EQUIPMENT**

_____

_____

_____

**IMPORTANT NOTE**

DV-Series tables apply to all D-Series Models including D, DM, DV, DVM and DVMS. Similarly, the M, MX-Series and LX-Series tables apply to all FAST models within those series. For example, data for the D-5VM apply to D-5VM and D-5VMS.

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# 5.0 1.0 GENERAL

This manual covers all standard FAST marine sewage treatment systems. That includes units not only of different capacities, but configured to meet different regulations, fitted with different machinery, different controls and employing different means of disinfection depending upon the applicable regulations.

For example, the unit might be set up to meet minimum USCG 33CFR159 requirements, EPA VGP 2013, MEPC.159(55), MEPC.227(64), EPA secondary treatment standards, Transport Canada or the requirements of a specific State discharge permit. So, much of the text below will simply not apply to your unit.

# 6.0 2,0 DANGER

DO NOT UNDER ANY CIRCUMSTANCES ENTER ANY TANK WHICH HAS CONTAINED SEWAGE UNLESS IT HAS BEEN POSITIVELY DETERMINED THAT THE TANK IS SAFE FOR ENTRY.

THE TANK MUST BE THOROUGHLY CLEANED, DISINFECTED AND PROPERLY FORCE VENTILATED WITH A GOOD SUPPLY OF FRESH AIR.

HYDROGEN SULFIDE GAS CAN BE LETHAL. IT CAN FORM IN SEWAGE TANKS THAT ARE NOT PROPERLY AERATED OR VENTILATED.

# 7.0 3.0 WARNINGS

## 3.1 UNITS FITTED WITH PAA DISINFECTION

1. PAA (peroxyacetic acid) is an environmentally friendly disinfectant that can be used in USCG certified FAST marine sewage treatment systems. It is at least as effective if not more effective than chlorine but does not result in discharge of mutagenic or carcinogenic compounds as chlorine does.
2. However, PAA is a powerful oxidizing agent and can be hazardous if not employed and handled in a safe manner.
3. PAA begins to break down at temperatures above 50°C. and must not be stored at very high temperatures. Also, PAA containers must have vented caps or otherwise be vented to prevent pressure buildup due to off-gassing of oxygen from hydrogen peroxide.
4. Refer to the enclosed PAA Best Practices Safe Handling Storage and Spill Response to ensure proper facilities, protection and procedures before handling or working with PAA.

## 3.2 UNITS FITTED WITH CHLORINE DISINFECTION

1. Chlorine and caustic can be hazardous. Do not inhale vapors. Protect eyes and skin from contact. Wear a facemask and rubber gloves. Wash thoroughly with water after contact. If eyes are affected, flush eyes with water and call doctor immediately.
2. Keep chlorine containers tightly capped. Keep away from oil, rags, paper and other combustible materials. Store in a cool dry area. In case of fire use water.
3. Similarly, sodium metabisulfite and sodium sulfite used for dechlorination can be hazardous. Mix the liquid solution in a well ventilated space.

   Do not inhale or expose eyes to vapor. Consult the MSDS for instructions.

## 3.3 AMBIENT AIR TEMPERATURE

1. The basic FAST unit fitted with tablet chlorinator and tablet dechlorinator (if applicable) is suitable for continuous duty with ambient air temperatures up to 50° C. (122° F.).

2. Liquid chemicals used for disinfection (sodium hypochlorite bleach, sodium bisulfite and metabisulfite and peracetic acid) deteriorate with time and higher temperatures accelerate the rate of deterioration.
3. A good rule of thumb for all of these chemicals, pumps and feed tanks is to store the chemicals at lower temperatures.

## 3.4 ALL UNITS

1. The Blower and its discharge piping may be hot. Keep body, hands, clothing and foreign objects away from the blower inlet.
2. After coming into contact with sewage, treated or untreated, wash thoroughly with soap and water.
3. Unless the unit is specially equipped with the proper explosion-proof electrical equipment, do not install it in or expose it to an explosive atmosphere.

# 8.0 RESTRICTIONS

## 4.1 ENZYMES

Do not use or dispose of any supplement or cleaning agent or any other compound containing enzymes in any drain or toilet leading to the sewage treatment systems. Enzymes are used to remove bacterial slimes and they will prevent the culture from adhering to the media and processing the sewage.

## 4.2 DISINFECTANTS

Do not use or dispose of Pine Sol, Lysol or any other disinfectants in any toilet or other drain leading to the sewage treatment system. Any commercially available soap or detergent can be used for cleaning so long as it does not claim disinfecting properties.

Small amounts of acid or chlorine in sprays can be used to clean and bleach toilet bowls, urinals and other fixtures and surfaces. But do not use disinfectants.

Similarly, detergents, rinses and other additives used in dishwashing and laundry must not employ disinfectants. If the dishwasher temperature is less than 160° F. then the dishwasher detergent may incorporate some chlorine to enhance disinfection.

A good rule of thumb is to read the Material Safety Data Sheet (MSDS) for each chemical being considered. If the compound incorporates any quaternary ammonium compounds or if the MSDS states that it is toxic to aquatic life, do not use it.

Remember that on land, disinfectants are mixed with extremely large amounts of water before reaching a sewage treatment system. But, on a ship or offshore platform there is no such dilution.

## 4.3 GREASE

Do not dispose of grease through drains leading to the sewage system. Galley drains should be equipped with efficient grease traps that are properly sized and maintained. Sciencofast sells grease high quality grease traps to meet this guideline.

## 4.4 FOREIGN OBJECTS

Sanitary napkins, tampon applicators, condoms and other foreign objects should not be flushed down the toilets. Although it is unlikely that they would clog the unit, such practices should be discouraged to prevent long-term accumulation.

## 4.5 WASTEWATER TEMPERATURE

The biological process employs mesophilic microorganisms. These originate in the human intestine at the human body temperature of 37ºC. (98.6ºF.)

The process will certainly meet or exceed regulatory requirements with the nominal water temperature of 20ºC. (68ºF.). But, the optimum water temperature range is a bit higher, between 25ºC. and 40ºC (77ºF. and 104ºF.).

This provides for best removal of organic contaminants from the wastewater and operation above or below this temperature range will result in reduced ability to remove contaminants from the wastewater.

## 4.6 UNITS FITTED WITH PAA DISINFECTION

1. PAA is a powerful oxidizing agent. Do not spill or expose to any material that is not listed as recommended or approved in the enclosed PROXITANE Peroxyacetic Acid Safety and Handling Technical Data Sheet or specifically approved in writing by Scienco/FAST or Solvay Chemicals.
2. The 5 mg/l residual employed for disinfection in the wet well has been tested and should not affect the epoxy coating in the tank or the discharge pump and associated piping.
3. However, when it comes to spillage, even a dilute solution of PAA will attack iron and mild steel if not provided with a suitable protective coating.
4. Test and be absolutely certain of the integrity of the epoxy coating in FAST unit wet wells fabricated of steel.

## 4.7 ALUMINUM TANKS

Do not under any circumstances use lye, trisodium phosphate, sodium hydroxide, potassium hydroxide or any other caustic or high pH cleaner on or in aluminum tanks or components. The caustic will attack the aluminum and cause serious structural damage.

## 4.8 SEWAGE LIFT STATIONS

The FAST unit will process the sewage as it is produced. It is neither desirable nor is it necessary to store the sewage in holding tanks or lift station sumps.

If a new or existing lift station transfers the sewage to the FAST unit, then special care must be taken in the setup of the lift station.

The volume of sewage pumped in each cycle must be limited so that it does not exceed the maximum which the FAST unit can handle. The volume of sewage pumped in each cycle must also be large enough so that the lift station pump does not start too frequently and overheat the pump motor.

The maximum lift station cycle volumes are specified below for each standard FAST model and for conventional sewage. For operation with vacuum sewage, limit cycle volume to 25% of the corresponding figure for conventional sewage:

| LX-Series Sewage Lift Station Requirements - standard sewage | | | | | | |
|---|---|---|---|---|---|---|
| **model** | **L-1X** | **L-2X** | **L-3X** | **L-4X** | **L-5X** | **L-6X** |
| **min pump gpm** | **10** | **10** | **10** | **10** | **10** | **10** |
| **max cycle volume (gal)** | **4** | **5** | **4** | **5** | **6** | **6** |
| **min time between starts (min)** | **3** | **3** | **3** | **3** | **3** | **3** |

| M-Series Sewage Lift Station Requirements - standard sewage | | | | | |
|---|---|---|---|---|---|
| **model** | **M-1** | **M-2** | **M-3** | **M-4** | **M-5** |
| **min pump gpm** | **10** | **10** | **10** | **10** | **10** |
| **max cycle volume (gal)** | **10** | **15** | **22** | **15** | **23** |
| **min time between starts (min)** | **3** | **3** | **3** | **3** | **3** |

| MX-Series Sewage Lift Station Requirements - standard sewage | | | | | |
|---|---|---|---|---|---|
| **model** | **MX-1** | **MX-2** | **MX-3** | **MX-4** | **MX-5** |
| **min pump gpm** | **10** | **10** | **10** | **10** | **10** |
| **max cycle volume (gal)** | **10** | **15** | **15** | **22** | **34** |
| **min time between starts (min)** | **3** | **3** | **3** | **3** | **3** |

| DV-Series Sewage Lift Station Requirements - standard sewage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **model** | **D-1V** | **D-2V** | **D-3V** | **D-4V** | **D-5V** | **D-6V** | **D-7V** | **D-8V** | **D-9V** |
| **min pump gpm** | **10** | **10** | **13** | **15** | **18** | **28** | **42** | **55** | **82** |
| **max cycle volume (gal)** | **17** | **30** | **45** | **56** | **67** | **112** | **135** | **180** | **135** |
| **min time between starts (min)** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** |

There are two methods for controlling this volume:

1. Adjust the volume swept between PUMP-ON and PUMP-OFF level sensors.
2. Add the FAST Pump Station Interlock to the lift station pump controller.

The FAST Pump Station Interlock is a dual recycle timer designed to limit the volume of sewage pumped to the FAST unit. It also protects the lift station pump from overheating due to too-frequent starts:

1. It can be used with any lift station and with any FAST unit.
2. If the sewage pump is controlled by a separate control panel and set of float switches, install the Interlock in the pilot circuit between the float switches and the starter coil as shown on the drawing. Using the lower pump-off float switch to start the pump will keep the lift station wet well essentially empty.
3. If the sewage pump is a self-contained automatic unit with its own on-off float switch, the Pump Station Interlock will be equipped with a current sensing relay. The current sensing relay will then determine when the pump has started and the Interlock will control power to the pump.
4. Determine the pump gpm from the pump curve and the actual total dynamic head (TDH) – this is the total discharge head less the total suction head, including friction and velocity effects. If not sure, use a stopwatch and a bucket to determine the actual pump gpm.
5. Determine the maximum allowable cycle volume in gallons as specified in the tables above for standard FAST units.
6. Divide the cycle volume by the gpm and multiply by 60 to get the on-timer setting in seconds.

7. Example: FAST Model MX-5, sewage pump rated 300 gpm. From the table above, max cycle volume is 34 gallons. The on-timer setting should be 34 ÷ 300 X 60 = 7 seconds.
8. Set the off-timer to 3 minutes and refer to the installation drawings for details. If you have any questions, contact Scienco/FAST.

## 4.9 VACUUM TOILETS – MAKEUP WATER

When vacuum toilets are employed with no gray water to supplement that flow, it is possible for the evaporation of water through the vent to exceed the inflow of water from vacuum toilets. The FAST Automatic Water Makeup System is required.

Seawater, lake water or river water can be used for makeup. If potable water is to be used, then the system must be equipped with a backflow preventer.

### 4.9.1 Flowmeter Type

A pressurized source of water is required from the sea chest and flowmeter settings are shown below for standard FAST Models:

| LX-Series Makeup Flow (gph) | | | | | | |
|---|---|---|---|---|---|---|
| FAST model | L-1X | L-2X | L-3X | L-4X | L-5X | L-6X |
| required gph | 0.6 | 0.7 | 1.1 | 1.3 | 0.8 | 1.6 |

| M-Series Makeup Flow (gph) | | | | | |
|---|---|---|---|---|---|
| FAST model | M-1 | M-2 | M-3 | M-4 | M-5 |
| required gph | 0.9 | 1.3 | 1.9 | 2.6 | 3.7 |

| MX-Series Makeup Flow (gph) | | | | | |
|---|---|---|---|---|---|
| FAST model | MX-1 | MX-2 | MX-3 | MX-4 | MX-5 |
| required gph | 1.0 | 1.4 | 1.3 | 1.9 | 2.7 |

| D/DV/DX-Series Makeup Flow (gph) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FAST model | D-1V | D-2V | D-3V | D-4V | D-5V | D-6V | D-7V | D-8V | D-9V |
| required gph | 2.7 | 3.5 | 3.9 | 4.3 | 4.9 | 8.4 | 13 | 14 | 43 |

#### 4.9.2 Pump Type

If a non-potable pressurized source of water such a source is not available, the water makeup system will incorporate a makeup pump, controller and flow regulating orifice.

1. The controller will be interlocked with the PUMP-ON and HI LEVEL dry contacts in the standard FAST discharge pump controller so that the makeup pump will only start when the discharge pump has not started in the time specified in the tables below.
2. The flow regulating orifice will throttle the discharge flow from the makeup pump so that this flow does not exceed the limits of the FAST unit spillover piping.
3. When the water level in the wet well rises to the PUMP-ON level and the discharge pump starts, the makeup pump will stop, the timer will reset and the process will begin again.
4. If the HI LEVEL float is actuated, the makeup pump will stop or not start as applicable.

The makeup pump and controller should be located close to the source of the non-potable water. Therefore, the makeup controller is not installed on the FAST unit but it should be located close to the makeup pump that it controls.

The DV-Series table applies to all DV-Series Models including DV, DVM and DVMS.

Similarly, the M, MX-Series and LX-Series tables apply to all FAST models within those series.

| FAST Water Makeup System With Pump | | | | | | |
|---|---|---|---|---|---|---|
| **FAST Model** | **L-1X** | **L-2X** | **L-3X** | **L-4X** | **L-5X** | **L-6X** |
| **timer setting - hours** | **7** | **7** | **7** | **7** | **7** | **7** |
| **expected on time at 30' tdh - minutes** | **2** | **2** | **3** | **3** | **2** | **4** |
| **FAST Model** | **M-1** | **M-2** | **M-3** | **M-4** | **M-5** | |
| **timer setting - hours** | **11** | **11** | **11** | **12** | **11** | |
| **expected on time at 30' tdh - minutes** | **2** | **2** | **2** | **2** | **3** | |
| **FAST Model** | **MX-1** | **MX-2** | **MX-3** | **MX-4** | **MX-5** | |
| **timer setting - hours** | **9** | **9** | **10** | **11** | **12** | |
| **expected on time at 30' tdh - minutes** | **3** | **4** | **4** | **6** | **6** | |
| **FAST Model** | **D-1V** | **D-2V** | **D-3V** | **D-4V** | **D-5V** | |
| **timer setting - hours** | **5** | **6** | **5** | **5** | **6** | |
| **expected on time at 30' tdh - minutes** | **7** | **5** | **8** | **8** | **15** | |
| **FAST Model** | **D-6V** | **D-7V** | **D-8V** | **D-9V** | | |
| **timer setting - hours** | **6** | **9** | **10** | **13** | | |
| **expected on time at 30' tdh - minutes** | **15** | **23** | **23** | **36** | | |

# 9.0 5.0 GENERAL DESCRIPTION

The FAST process (Fixed Activated Sludge Treatment) biologically oxidizes the organic matter in sewage. It produces a clear odorless effluent. This effluent is disinfected with chlorine and is automatically discharged overboard.

The system is designed for heavy marine and offshore applications. It withstands salt corrosion, roll, pitch, vibration, surge loads at change of watch and changes in the salinity of the flushing water.

There are no adjustments, and proper operation does not depend upon the skill of the operator. No chemicals or additives are required.

Because of its advantages, the FAST process has been used in a wide variety of systems. The smallest standard unit is rated for up to 7 persons, the largest 2,700 persons.

Equipment and control arrangements can vary widely. But, operation of all FAST systems is essentially the same, and the general principals in this manual apply regardless of system size and machinery options selected.

## 5.1 ARRANGEMENT

As a minimum, each FAST unit includes a Media Tank and a Wet Well. Biological treatment takes place in the Media Tank.

The Wet Well contains the Float Switch for control of the Discharge Pump. The volume of water in the Wet Well provides the contact time necessary for chlorine to efficiently disinfect the effluent.

Depending upon the Model, the Media Tank and Wet Well may be separate compartments of a single structural tank. In some cases, two smaller Media Tanks can be connected in series.

## 5.2 MACHINERY

As a minimum, each system requires a source of compressed air to provide oxygen for the process. A Blower Assembly is standard.

The system can be set up for gravity flow when no discharge pump is required. But, most marine installations require a discharge pump. Larger systems employ duplex discharge pumps, and very large installations also employ dual blowers.

Each FAST unit is built to order using the equipment specified by the customer or selected by FAST Systems for the application. Please check the enclosed data, drawings and manufacturers' instruction manual inserts for your unit.

## 5.3 DISINFECTION

Four methods for disinfection may be employed with the FAST process in certified devices:

1. Tablet chlorinators with calcium hypochlorite tablets in 33CFR159 units for domestic use. Where dechlorination is required a second tablet feeder charged with dechlor tablets may be employed prior to discharge.
2. Chemical pumps with 5% peracetic acid (PAA) for all applications.
3. Chemical pumps with 6% sodium hypochlorite laundry bleach. If effluent chlorine residual is limited as in MEPC.227(64), the unit is equipped with a dechlorination pump and contactor.
4. UV sterilizers in 33CFR159 units for domestic use and for systems meeting Canadian Great Lakes requirements. Details and operation of this system are contained in a separate instruction manual insert.

## 5.4 OPERATION

In the Media Tank, compressed air from the Blower powers the Airlift. The Airlift aerates and circulates the tank contents.

By maintaining aerobic conditions, corrosion and odor are minimized, and the growth of aerobic microbes is encouraged. Microbes occur naturally in human waste, and no external source is required for treating sewage.

The Media Tank provides a hospitable environment for these microbes. The microbial culture uses the organic matter in sewage as food.

If the amount of food exceeds the requirements of the existing culture, then the culture grows until equilibrium is attained. If the amount of food is decreased, then the culture shrinks until it reaches a new equilibrium with the food supply.

The byproducts are carbon dioxide and water. As the microbes pass through their life cycle, dead cellular material settles to the bottom of the Media Tank where it is stored as "sludge."

The water level in the Media Tank is constant. As sewage enters, an equal volume of clear effluent is discharged through the Spillover, then through the Tablet Chlorinator into the Wet Well.

In the Wet Well, the chlorine disinfects the water. It also bleaches and disperses any small organic particles carried over from the Media Tank.

When required, the Float Switch controls the Discharge Pump for automatic unattended operation. For gravity flow, the water level in the Wet Well is constant.

# 10.06.0 DETAILED DESCRIPTION

## 6.1 BASIC UNIT

The Basic Unit includes the Media Tank, Tablet Chlorinator and Wet Well.

## 6.2 MEDIA TANK

At the top of the Media Tank is a 12" air gap. Below this is a 3" layer of water covering the Media.

The Media Tank gets its name from the plastic Media, which is the site for microbial growth. The microbes naturally attach themselves to the large surface area provided by the Media.

### 6.2.1 Media

The Media is assembled into blocks from corrugated sheets of PVC. The corrugations provide flow channels and a large surface area for microbial growth.

The blocks are cut to fit the tank. The fit should be tight to prevent shifting and damage to the Media when the vessel is in a seaway.

### 6.2.2 Airlift

The Airlift is a vertical pipe that extends from below the Media to above the waterline. Compressed air from the Blower is injected near the bottom of the Airlift, and the Airlift acts as a high-volume pump.

The air bubbles transfer oxygen into the water, as does the splashing action above the waterline. The turbulent flow also throws paper, cellulose and other large solids to the sides and ends of the Media Tank where they will not interfere with the process while they decompose.

In some cases, multiple Airlifts will be used within the Media Tank.

### 6.2.3 Sludge Compartment

Standard units meet USCG requirements for Type II Marine Sanitation Devices as defined in 33 CFR Part 159. The required effluent quality can be achieved without the need to retain and store sludge within the unit.

As a result, standard marine units do not incorporate sludge compartments. They are designed for maximum rated capacity with minimum size, weight and cost. Small organic particles in the effluent are bleached and dispersed by the chlorine, and the chlorinated effluent is relatively clear.

Units designed to meet MEPC.159(55), provide secondary treatment and to meet higher standards of effluent quality do retain and provide long-term storage for sludge within the unit. The bottom of the Media Tank is modified to receive and store the excess microbes that slough off the Media.

#### 6.2.4 Air Scour

At the bottom of the Media Tank is an air sparger with holes drilled at regular intervals. This is used to air scour and clean the Media and to ensure complete draining of the Sludge Compartment.

There are two arrangements. If a separate air connection is provided on the unit for the Air Scour, then an external source of compressed air is required.

If a separate connection is not provided, then the Blower if so designed, will provide the pressure needed for Air Scour of the Media Tank, and no external source of compressed air is required.

## 6.3 SPILLOVER

A gravity Spillover establishes the water level in the Media Tank. In standard units, the Spillover is internal and located at tank centerline.

This maintains the correct water level in the Media Tank despite vessel motion in a seaway. As it exits the Media Tank, the water passes through a trap to prevent venting of the Media Tank through the Tablet Chlorinator or the Wet Well.

## 6.4 WET WELL

Efficient disinfection with chlorine requires contact time prior to discharge. The Wet Well provides that time during peak flows at change of watch.

This minimizes the amount of chlorine required for disinfection, and therefore the consumption of chlorine tablets. The Wet Well also provides the volume necessary to protect a discharge pump motor from too frequent starts.

The volume between the Pump On and Pump Off switches is designed to provide not less than three (3) minutes between pump starts during peak flows at change of watch.

## 6.5 TABLET CHLORINATOR

This simple and reliable unit has no moving parts. It provides chlorination proportional to flow.

As water passes through the unit, calcium hypochlorite tablets are dissolved. This releases chlorine into the water.

Higher flow rates cause the water level to rise in the Chlorinator, increase the tablet area exposed to the water and therefore increase the rate of chlorine injection.

Both the Tablet Chlorinator and the Wet Well are vented into the machinery space. They are isolated from the Media Tank by the water seal trap between the Media Tank and the Tablet Chlorinator.

Once the unit has fully started up and is running properly, use the chlorine residual test kit to check the chlorine residual in the effluent. The residual of total available chlorine should be not less than 1.0 mg/l or more than 2.0 mg/l.

The chlorination rate can normally be adjusted by changing the tilt of the tablet feeder, changing the number of feed tubes loaded with tablets and/or changing the arrangement of the feed tubes to be employed.

## 6.6 TABLET DECHLORINATOR

In some applications, it is necessary to reduce the chlorine residual in the effluent below the normal range required for disinfection. In such cases, a tablet feeder identical with that used for chlorination can be used and the tablet chlorinator would be loaded with sodium sulfite “dechlor” tablets.

Although removal of free available chlorine is almost instantaneous, removal of chloramines requires a few seconds. If the governing regulation specifies total available chlorine, the FAST system would provide a minimum contact time of 30 seconds following the tablet dechlorinator.

This can be a small tank or it may be a length of larger pipe installed in the effluent piping.

Please note that two effluent sample points are provided:

1. Sampling of the chlorinated effluent in the wet well is necessary to verify that the total available chlorine residual is between 1.0 and 2.0 mg/l.
2. Sampling of the dechlorinated effluent is required to verify that the total available chlorine residual has been reduced below the level specified in the governing regulations.

## 6.7 LIQUID CHLORINATION

The liquid chlorinator is used when the system is to be certified under MEPC.227(64), by Transport Canada or when suitable chlorine tablets are not readily available. The effluent can be disinfected using sodium hypochlorite laundry bleach.

Ordinary laundry bleach is a solution of sodium hypochlorite and water. Concentration typically ranges from 5-1/4% to 6%. Initial settings are shown in the tables below for standard FAST models and assuming laundry bleach at 5% concentration:

Note: Because of the low flow rates, it is important that the chlorine pump be installed in flooded suction to prevent loss of prime.

The system includes a feed pump with suitable tubing and injection fittings, a feed tank and a controller. When the effluent pump or discharge pump completes an automatic cycle, the controller starts the chlorine pump.

After a preset time, the controller stops the pump. Both the pumping rate and the timer setting are adjustable. Always operate the pump at or near full stroke speed to expel any off gasses from the solution. The speed is factory set at 350 strokes/min. This should not be changed.

The timer settings shown below are initial settings the chemical feed pump will run after the discharge pump stops. You may find the times may have to be changed due to solution degradation, effluent condition or other factors. To change the timer, open the control panel and find the timer relay (it has a series of white rocker switches, known as dip switches). The total time is determined by adding up the value of all the dip switches that are in the “on” position. The “on” position is when the top of the dip switch is depressed. To change to time, just turn on or off different dip switches to increase or decrease the time.

It is a good idea to check the chlorine residual periodically and adjust the timer if needed.

## STANDARD CHEMICAL FEED PUMP, PUMP SETTING, TIMER SETTING FOR 5 1/4% HOUSEHOLD BLEACH

| | 60 AND 50 CYCLE OPERATION | | | | | |
|---|---|---|---|---|---|---|
| FAST MODEL | CHEM PUMP MODEL | SCIENCO/FAST PUMP PART NUMBER | LIQUID VOLUME IN WETWELL | CHEM PUMP SPEED (STROKES PER MINUTE) | TIMER SETTING IN CONTROL CABINET (SEC.) | RECOMMENDED TANK SIZE (QUARTS) |
| L1X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 16 | 2 |
| L2X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 16 | 2 |
| L3X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 16 | 2 |
| L4X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 16 | 2 |
| L5X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 16 | 2 |
| L6X | WALCHEM EZB11D1-VCA | 513-0543 | 49.4 GALLONS 190 LITERS | 350-360 | 43 | 2 |
| | | | | | | |
| | | | | | | |
| M1 & MX1 | WALCHEM EZB11D1-VCA | 513-0543 | 33.8 GALLONS 130 LITERS | 350-360 | 29 | 2 |
| M2 & MX2 | WALCHEM EZB11D1-VCA | 513-0543 | 41.6 GALLONS 160 LITERS | 350-360 | 36 | 2 |
| M3 & MX3 | WALCHEM EZB11D1-VCA | 513-0543 | 62.4 GALLONS 240 LITERS | 350-360 | 54 | 2 |
| M4 & MX4 | WALCHEM EZB11D1-VCA | 513-0543 | 96.2 GALLONS 370 LITERS | 350-360 | 83 | 2 |
| M5 & MX5 | WALCHEM EZB11D1-VCA | 513-0543 | 96.2 GALLONS 370 LITERS | 350-360 | 83 | 2 |
| | | | | | | |
| | | | | | | |
| D1 | WALCHEM EZB11D1-VCA | 513-0543 | 88.4 GALLONS 340 LITERS | 350-360 | 76 | 2 |
| D2 | WALCHEM EZB11D1-VCA | 513-0543 | 88.4 GALLONS 340 LITERS | 350-360 | 76 | 2 |
| D3 | WALCHEM EZB11D1-VCA | 513-0543 | 140.4 GALLONS 540 LITERS | 350-360 | 121 | 4 |
| D4 | WALCHEM EZB11D1-VCA | 513-0543 | 140.4 GALLONS 540 LITERS | 350-360 | 121 | 4 |
| D5 | WALCHEM EZB16D1-VCA | 513-0774 | 260 GALLONS 1000 LITERS | 350-360 | 136 | 4 |
| D6 | WALCHEM EZB16D1-VCA | 513-0774 | 260 GALLONS 1000 LITERS | 350-360 | 136 | 6 |
| D7 | WALCHEM EZB21D1-VC | 513-0775 | 551.2 GALLONS 2120 LITERS | 350-360 | 202 | 6 |
| D8 | WALCHEM EZB21D1-VA | 513-0775 | 551.2 GALLONS 2120 LITERS | 350-360 | 202 | 12 |
| D9 | WALCHEM EZB31D1-VA | 513-0776 | 873.6 GALLONS 3360 LITERS | 350-360 | 150 | 12 |

Once the unit has fully started up and is running properly, use the chlorine residual test kit to check the chlorine residual in the effluent. The residual of total available chlorine should be not less than 1.0 mg/l or more than 2.0 mg/l.

Adjust the pump settings to adjust chlorination rate. Remember that it may take several hours for the chlorine residual to stabilize at the new setting.

## 6.8 LIQUID PERACETIC ACID (PAA)

If disinfecting with peracetic acid (PAA) to meet the requirements of MEPC.159(55), MEPC.227(64) or EPA VGP 2013 and avoid the use of chlorine, the following table shows the initial chemical pump timer settings.

Note: Because of the low flow rates, it is important that the PAA pump be installed in flooded suction to prevent loss of prime.

The system includes a feed pump with suitable tubing and injection fittings, a feed tank and a controller. When the effluent pump or discharge pump completes an automatic cycle, the controller starts the chlorine pump.

After a preset time, the controller stops the pump. Both the pumping rate and the timer setting are adjustable. Always operate the pump at or near full stroke speed to expel any off gasses from the solution. The speed is factory set at 350 strokes/min. This should not be changed.

The timer settings shown below are initial settings the chemical feed pump will run after the discharge pump stops. You may find the times may have to be changed due to solution degradation, effluent condition or other factors. To change the timer, open the control panel and find the timer relay (it has a series of white rocker switches, known as dip switches). The total time is determined by adding up the value of all the dip switches that are in the “on” position. The “on” position is when the top of the dip switch is depressed. To change to time, just turn on or off different dip switches to increase or decrease the time.

It is a good idea to check the chlorine residual periodically and adjust the timer if needed

**STANDARD CHEMICAL FEED PUMP, PUMP SETTING, TIMER SETTING FOR 5% PERACETIC ACID (PAA)**

**60 AND 50 CYCLE OPERATION**

| FAST MODEL | CHEM PUMP MODEL | SCIENCO/FAST PUMP PART NUMBER | LIQUID VOLUME IN WETWELL | CHEM PUMP SPEED (STROKES PER MINUTE) | TIMER SETTING IN CONTROL CABINET (SEC.) | RECOMMENDED TANK SIZE (QUARTS) |
|---|---|---|---|---|---|---|
| L1X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 8 | 2 |
| L2X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 8 | 2 |
| L3X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 8 | 2 |
| L4X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 8 | 2 |
| L5X | WALCHEM EZB11D1-VCA | 513-0543 | 18.2 GALLONS 70 LITERS | 350-360 | 8 | 2 |
| L6X | WALCHEM EZB11D1-VCA | 513-0543 | 49.4 GALLONS 190 LITERS | 350-360 | 21 | 2 |
| | | | | | | |
| M1 & MX1 | WALCHEM EZB11D1-VCA | 513-0543 | 33.8 GALLONS 130 LITERS | 350-360 | 15 | 2 |
| M2 & MX2 | WALCHEM EZB11D1-VCA | 513-0543 | 41.6 GALLONS 160 LITERS | 350-360 | 18 | 2 |
| M3 & MX3 | WALCHEM EZB11D1-VCA | 513-0543 | 62.4 GALLONS 240 LITERS | 350-360 | 54 | 2 |
| M4 & MX4 | WALCHEM EZB11D1-VCA | 513-0543 | 96.2 GALLONS 370 LITERS | 350-360 | 41 | 2 |
| M5 & MX5 | WALCHEM EZB11D1-VCA | 513-0543 | 96.2 GALLONS 370 LITERS | 350-360 | 41 | 2 |
| | | | | | | |
| | | | | | | |
| D1 | WALCHEM EZB11D1-VCA | 513-0543 | 88.4 GALLONS 340 LITERS | 350-360 | 38 | 2 |
| D2 | WALCHEM EZB11D1-VCA | 513-0543 | 88.4 GALLONS 340 LITERS | 350-360 | 38 | 2 |
| D3 | WALCHEM EZB11D1-VCA | 513-0543 | 140.4 GALLONS 540 LITERS | 350-360 | 60 | 4 |
| D4 | WALCHEM EZB11D1-VCA | 513-0543 | 140.4 GALLONS 540 LITERS | 350-360 | 60 | 4 |
| D5 | WALCHEM EZB16D1-VCA | 513-0774 | 260 GALLONS 1000 LITERS | 350-360 | 68 | 4 |
| D6 | WALCHEM EZB16D1-VCA | 513-0774 | 260 GALLONS 1000 LITERS | 350-360 | 68 | 6 |
| D7 | WALCHEM EZB21D1-VC | 513-0775 | 551.2 GALLONS 2120 LITERS | 350-360 | 101 | 6 |
| D8 | WALCHEM EZB21D1-VA | 513-0775 | 551.2 GALLONS 2120 LITERS | 350-360 | 101 | 12 |
| D9 | WALCHEM EZB31D1-VA | 513-0776 | 873.6 GALLONS 3360 LITERS | 350-360 | 75 | 12 |

The chemical tank should be checked weekly. Do not let it go dry, as chemical pump damage could occur.

## 6.9 LIQUID DECHLORINATOR

When it is necessary to meet the requirements of MEPC.159(55), MEPC.227(64) or EPA VGP 2013 while using chlorine to disinfect, the effluent can be

dechlorinated using a 38% or 40% solution of sodium metabisulfite, sodium sulfite or a mixture of the two.

Although removal of free available chlorine is almost instantaneous, removal of chloramines requires a few seconds. The dechlor pump runs at the same time as the discharge pump and the required minimum contact time of 30 seconds is provided by a length of larger pipe installed in the effluent piping.

Special note - because of the low flow rates, it is important that the dechlor pump be installed in flooded suction to prevent occasional loss of prime.

As above, at startup or after replacing the chemical pump, turn the pump control up to maximum flow and purge air from the tubing. You should be able to see air bubbles though the tubing. Then, reduce the pump settings as specified below:

#### 6.9.1 Preparing The 40% Solution

Sodium metabisulfite and sodium sulfite are normally packaged in the form of coarse white granules. They must be mixed with water for use with the system.

Sodium metabisulfite and sodium sulfite used for dechlorination can be hazardous. Mix the liquid solution in a well-ventilated space. Do not inhale or expose eyes to vapor and consult the MSDS for safety instructions.

To obtain a 40% solution by weight, add one part of the granules to three parts water. That is, to make one quart of solution, add one cup of granules to 3 cups of water.

Always add the chemicals to the water. Do <u>not</u> add water to the chemicals.

#### 6.9.2 Pump Settings

To obtain proportional chemical feed for dechlorination, it is necessary to regulate the flow of the centrifugal discharge pump.

A globe valve is provided to throttle the pump discharge. When the correct setting is determined, tighten the bonnet to prevent the setting from changing due to vibration or human error.

The best and simplest method to determine pump gpm is to clock the time required for the pump to go through an automatic cycle. The volumes are known and the times required are shown in the tables above.

It is important that inflow be stopped when the pump starts. That is, if feeding the wet well with a water hose, shut off the flow as soon as the pump starts.

Data regarding the settings for each standard FAST Model are shown below:

| LX-Series Dechlor Pump Initial Settings | | | | | | |
|---|---|---|---|---|---|---|
| FAST Model | L-1XM | L-2XM | L-3XM | L-4XM | L-5XM | L-6XM |
| MEPC gpm | 10 | 10 | 10 | 10 | 10 | 10 |
| Walchem model | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA |
| initial setting | 23 | 14 | 9 | 4 | 11 | 7 |
| max pressure psi | 150 | 150 | 150 | 150 | 150 | 150 |
| connection size (tubing OD) | 3/8 | 3/8 | 3/8 | 1/2 | 1/2 | 3/8 |

| MX-Series / M-Series Dechlor Pumps Initial Settings | | | | | |
|---|---|---|---|---|---|
| FAST Model | MX-1M | MX-2M | MX-3M | MX-4M | MX-5M |
| MEPC gpm | 10 | 10 | 10 | 10 | 10 |
| Walchem model | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA |
| initial setting | 23 | 14 | 9 | 4 | 11 |
| max pressure psi | 150 | 150 | 150 | 150 | 150 |
| connection size (tubing OD) | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 |

| DV-Series Dechlor Pump Initial Settings | | | | | |
|---|---|---|---|---|---|
| FAST Model | D-1VM | D-2VM | D-3VM | D-4VM | D-5VM |
| MEPC gpm | 10 | 10 | 13 | 16 | 18 |
| Walchem model | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA | EZB11D1-VCA |
| initial setting | 23 | 23 | 30 | 35 | 42 |
| max pressure psi | 150 | 150 | 150 | 150 | 150 |
| connection size (tubing OD) | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 |

| DV-Series Dechlor Pump Initial Settings | | | | |
|---|---|---|---|---|
| **FAST Model** | **D-6VM** | **D-7VM** | **D-8VM** | **D-9VM** |
| **MEPC gpm** | **29** | **43** | **56** | **83** |
| **Walchem model** | **EZB11D1-VCA** | **EZB11D1-VCA** | **EZB11D1-VCA** | **EZB16D1-VCA** |
| **initial setting** | **67** | **97** | **128** | **114** |
| **max pressure psi** | **150** | **150** | **150** | **105** |
| **connection size (tubing OD)** | **3/8** | **3/8** | **3/8** | **3/8** |

Once the discharge pump gpm has been set, if it is necessary to increase or decrease the feed of sodium metabisulfite to obtain the effluent chlorine residual, adjust the dechlor pump settings as required. Unless otherwise specified, adjust for the residual of total available chlorine to be less than 0.5 mg/l for MEPC.159(55) or effectively zero for EPA 2013 VGP.

Once set, the dechlor chemical pump provides a constant feed rate.

Pump settings shall be the same as for chlorine pumps with timer, except that the on-time in seconds shall be forty percent (40%) that for chlorine.

Here as with chlorine and dechlor pumps, it is important that the chemical pump be installed in flooded suction to prevent occasional loss of prime.

As above, at startup or after replacing the chemical pump, turn the pump control up to maximum flow and purge air from the tubing. You should be able to see air bubbles. Then, reduce the pump setting as specified:

## 6.10 COMPRESSED AIR FOR AERATION

The normal source of aeration air is either a Roots positive displacement blower or a regenerative turbine blower. An external source of compressed air may also be employed but is not recommended.

If an external source of compressed air is provided in addition to the blower, then the blower will be the primary source and the rig/ship air will be the standby source. This is because the internals of the Roots blower will corrode if the blower is not operating.

Except as otherwise specified by FAST Systems, a continuous source of aeration air is required to provide the oxygen required by the microbial culture. For normal

operation, the discharge from the blower should be routed to the Airlift. The Air Scour is only used for maintenance purposes.

## 6.11 ROOTS BLOWER

This is a rotary lobe blower that is normally vee belt or direct driven. The Roots blower is equipped with an inlet silencer, discharge check valve, relief valve and pressure gage.

The blower, electric motor and drive are mounted on a steel bedplate to ensure good alignment. This bedplate is suspended on vibration isolators to minimize noise transmission through the structure.

In addition, hose or flex connections are provided to minimize transmission of noise and vibration through the piping. When noise levels are critical, the unit may also be fitted with a discharge silencer.

The Roots blower normally provides air for normal Airlift operation and also for Air Scouring.

## 6.12 REGENERATIVE TURBINE BLOWER

This blower is very quiet in operation and does not require the silencing and isolation measures required by the Roots blower. It is normally equipped with an inlet filter, discharge check valve and pressure gage.

Compared with the Roots blower, it is a relatively low-pressure machine. It does an excellent job in Airlift operation, but several models are not well suited for Air Scouring.

Unless otherwise specified, it will be assumed that external compressed air will be available for sir scouring.

## 6.13 INTERMITTENT BLOWER OPERATION

During long periods of reduced manning, it may be desired to reduce blower power consumption. This is not necessary, as the system will operate perfectly well with an excess of air.

The percentage of time the blower runs must never be less than the percentage of full load personnel aboard. If in doubt, run the blower full time.

If intermittent operation is selected, the blower must start not less than once per hour and operate continuously not less than ten (10) minutes after each start.

Therefore the minimum blower timer setting is equivalent to 10 minutes out of 60 minutes = 17%. Always give the system more air than you think it needs.

## 6.14 DISCHARGE PUMP

The system may be fitted with either an end suction centrifugal pump in a dry pit installation, or with a submersible effluent pump installed inside the Wet Well. In either case, operation is automatic.

## 6.15 END SUCTION CENTRIFUGAL PUMP

The standard discharge pump is installed either on the unit itself or is provided for separate installation. It is constructed of marine bronze with stainless steel trim.

The pump is close coupled to a marine duty motor. The specific model employed is matched to system rated capacity.

The pump is installed with isolation valves, discharge check valve and inlet basket strainer. The purpose of the basket strainer is to prevent nuisance plugging of the pump impeller.

Operation is controlled by the Float Switch in the Wet Well. This switch is equipped with three floats - High Level, Pump On and Pump Off.

Operation of a single pump is controlled by the Pump On and Pump Off floats. The High Level float can be used to provide an alarm signal.

In addition to normal automatic operation, the pump can be used for pumpout of the Media Tank.

## 6.16 SUBMERSIBLE EFFLUENT PUMP

This pump is installed inside the Wet Well. It is constructed of 304 stainless steel.

The standard pump is automatic, and is equipped with its own float switch and inlet strainer. A discharge check valve is provided.

This is an effluent pump only and is not used to drain the Media Tank. When draining the Media Tank, a separate portable pump should be employed.

## 6.17 DUPLEX DISCHARGE PUMPS

When duplex pumps are provided, two identical pumps are provided. Each pump is rated for 100% duty.

Either pump can be selected as the duty pump or as the standby. If the duty pump fails, the water level in the Wet Well will rise above the PUMP ON float.

When the High Level float is actuated, the standby pump will start automatically. It will remain on until the level drops below the PUMP OFF float.

## 6.18 ELECTRIC CONTROLS

Some systems may use separate starters for Blower and Discharge Pump, and may also employ single-phase power, particularly for the pump. Other systems operate from a single source of three-phase power, and are equipped with panels that control all equipment in the system.

# 11.07.0 STARTUP

## 7.1 NORMAL STARUP

This general procedure applies to start up of a new system, after an extensive lay-up or after a "kill" of the culture. Details will depend upon the type of machinery fitted.

1. Close all water and air valves and turn power to the blowers and pumps to OFF.
2. If the Roots blower is new, make sure the desiccant bag has been removed from the impeller chamber, that the oil level in the gear case is correct and that the grease fitting has been lubricated.
3. Check motor rotations (3-phase power).
4. Fill the Media Tank so that water spills over into the Wet Well and rises to one-half the height of the sight glass.
5. If one or more discharge pumps are fitted, then gradually add more water to the Wet Well (either directly or through the Media Tank) to check for proper cycling of the pump(s).
6. As applicable, fill the downstream feed tubes of the tablet chlorinator and dechlorinator with tablets or
7. If the unit is equipped with one or more chemical pumps to inject sodium hypochlorite solution (laundry bleach), peracetic acid (PAA) or sodium metabisulfite for dechlorination:

   (a) Make certain that the chemical pump is installed in flooded suction.

(b) Turn the pump control up to maximum and run the pump until all air is purged from the suction and discharge tubing. You should be able to see air bubbles in the tubing. Then return the pump settings to those specified in this Manual.

8. For units equipped with chlorination and dechlorination, run water into the wet well and check the pump cycle time per the tables in this Manual. Adjust the globe valve as required to increase or decrease gpm to the specified value and then tighten the valve bonnet.
9. Valve sewage into the Media Tank. Initially, the effluent will appear clear, since the tank was filled with clean water. System effluent will deteriorate as sewage is introduced before treatment has started. When the culture has started properly, the effluent will clear up.
10. Startup time for the process will depend upon water temperature. The microbes are more active in warmer water than in colder water. Colder water means longer startup times for the process. In general, the level of activity doubles with each 10°C. (18° F.) rise in temperature, and approximate startup times are:

| Water Temperature (C.) | 30 | 25 | 20 | 15 | 10 |
|---|---|---|---|---|---|
| Weeks | 2 | 3 | 4 | 6 | 8 |

11. These are the times estimated to develop a mature and stable culture for BOD5 removal. However, the process will provide some treatment much sooner, and effluent samples should be clear and odorless in approximately one-half these times. Startup can be accelerated by adding activated sludge from another system or by adding dried bacteria.
12. Please note however that the wastewater temperature should not exceed 98.6° F. (37° C.) as that is the maximum temperature that the mesophilic microorganisms that treat the sewage can tolerate.
13. Sample the water from the pump discharge (before dechlorination) or from the side of the wet well. The chlorine residual should be not more than 2.0 mg/l nor less than 1.0 mg/l. Adjust the chlorine pump or chlorine tablet

feeder as applicable. Recall that it may take several hours for the results of a change in settings to take place.

14. Once the chlorination rate is properly set, take a sample after dechlorination. The chlorine residual should be 0.5 mg/l or less depending upon the applicable regulation. Adjust the dechlor pump or dechlor tablet feeder as applicable. Here, it will probably take one full pump cycle for the residual to stabilize after a change in settings,

## 7.2 ACCELERATED STARTUP

Adding dried bacteria can accelerate startup. Dried bacteria can be used for an initial startup on installation, at the beginning of a season or after a partial or complete toxic kill of the culture in the media tank.

It is particularly useful when water temperature is low and good effluent quality is required from day one. It is also useful in maintaining effluent quality when large increases in loading are suddenly applied.

However, for most marine and offshore applications, this is either not required or is only rarely required:

1. Water temperatures are typically high resulting in rapid natural startup.
2. The FAST process typically starts up in half the time required by a suspended growth process such as extended aeration, activated sludge, etc.
3. The FAST process is more resistant to toxic kill than a suspended growth process such as extended aeration, activated sludge, etc. and it recovers in half the time.

Bacteria for startup are available in tablet form which is convenient to use. For Mighty Mike U&F (urine & feces) tablets, contact SCIENCO/FAST Division of Bio-Microbics, Inc., 12977 Maurer Industrial Drive, Sunset Hills, MO 63127-1515, tel: (314)645-6540, fax: (314)645-6131, email: solutions@sciencofast.com, URL: www.sciencofast.com.

Add the bacteria daily for 5 days. If a large increase in population is expected, start the day before the additional personnel are to arrive.

| Mighty Mike Tablets Required for Accelerated Startup | | |
|---|---|---|
| **FAST Model** | **gpd** | **Daily - 5 days** |
| **L-1X** | **126** | **1** |
| **L-2X** | **189** | **1** |
| **L-3X** | **273** | **1** |
| **L-4X** | **399** | **1** |
| **L-5X** | **420** | **1** |
| **L-6X** | **861** | **1** |
| **M-1** | **273** | **1** |
| **M-2** | **441** | **1** |
| **M-3** | **651** | **1** |
| **M-4** | **882** | **1** |
| **M-5** | **1,323** | **2** |
| **MX-1** | **294** | **1** |
| **MX-2** | **441** | **1** |
| **MX-3** | **672** | **1** |
| **MX-4** | **1,008** | **2** |
| **MX-5** | **1,512** | **2** |
| **D-1V** | **970** | **1** |
| **D-2V** | **1,700** | **2** |
| **D-3V** | **2,600** | **3** |
| **D-4V** | **3,200** | **4** |
| **D-5V** | **3,800** | **4** |
| **D-6V** | **6,400** | **7** |
| **D-7V** | **9,600** | **10** |
| **D-8V** | **12,800** | **13** |
| **D-9V** | **19,200** | **20** |

Note that if a toxic kill has occurred, the toxic chemical(s) must be flushed from the media tank before a new culture will start. Otherwise, the toxic chemical(s) will kill the new bacteria.

No other additives are required. The FAST process does not require dried bacteria, enzymes, dog food or any other supplement for everyday operation.

# 12.08.0 SET UP FOR OPERATION

All valves must be fully open or fully closed.

## 8.1 GRAVITY FLOW SETUP

| Gravity Flow Valve Table | | |
|---|---|---|
| **Valve** | **Function** | **Position** |
| **air scour** | **compressed air to air scour** | **closed** |
| **airlift** | **compressed air to airlift** | **open** |
| **media tank drain** | **drain media tank** | **closed** |
| **wet well discharge** | **set water level in wet well** | **open** |
| **wet well drain** | **drain wet well** | **closed** |

| Gravity Flow Control Table | |
|---|---|
| **Control** | **Position** |
| **blower** | **on** |

## 8.2 DRY PIT SIMPLEX SETUP

| Dry Pit Simplex Valve Table | | |
|---|---|---|
| **Valve** | **Function** | **Position** |
| **air scour** | **compressed air to air scour** | **closed** |
| **airlift** | **compressed air to airlift** | **open** |
| **media tank drain** | **drain media tank** | **closed** |
| **pump discharge** | **pump isolation** | **open** |
| **wet well drain** | **pump isolation** | **open** |

| Simplex Control Table | |
|---|---|
| **Control** | **Function** |
| **Blower** | **On** |
| **Pump** | **Auto** |

## 8.3 DRY PIT DUPLEX SETUP

| Dry Pit Duplex Units | | |
|---|---|---|
| **Valve** | **Function** | **Position** |
| **air scour** | **compressed air to air scour** | **closed** |
| **airlift** | **compressed air to airlift** | **open** |
| **media tank drain** | **drain media tank** | **closed** |
| **pump discharge** | **pump isolation** | **open** |
| **pump suction** | **pump isolation** | **open** |
| **wet well drain** | **drain wet well** | **open** |

| Duplex Control Table | |
|---|---|
| **Control** | **Function** |
| **blower** | **on** |
| **pump 1** | **auto** |
| **pump 2** | **auto** |
| **duty/standby** | **as desired** |

## 8.4 SUBMERSIBLE SIMPLEX SETUP

| Submersible Simplex Valve Table | | |
|---|---|---|
| **Valve** | **Function** | **Position** |
| **air scour** | **compressed air to air scour** | **closed** |
| **airlift ball valve** | **compressed air to airlift** | **open** |
| **media tank drain** | **drain media tank** | **closed** |
| **pump discharge** | **pump isolation** | **open** |
| **wet well drain** | **drain wet well** | **closed** |

| Submersible Simplex Control Table | |
|---|---|
| **Control** | **Function** |
| **Blower** | **On** |
| **Pump** | **Auto** |

# 13.09.0 ESTIMATED CHEMICAL CONSUMPTION

The system may employ one of three types of disinfection:

1. 70% calcium hypochlorite tablets.
2. 5% peracetic acid (PAA).
3. 6% sodium hypochlorite laundry bleach.

Units meeting MARPOL may not employ chlorine tablets. They will either employ PAA or sodium hypochlorite laundry bleach.

When laundry bleach is used for MARPOL applications, dechlorination prior to discharge is required and this is achieved using sodium bisulfite or sodium metabisulfite.

The figures below are for reference only as water usage can vary considerably:

## 9.1 CONSUMPTION OF CHLORINE TABLETS

The tablet chlorinator is the disinfection method of choice when the system is not required to meet MEPC.227(64) or any other regulation where it must provide effluent chlorine residual of less than 0.5 mg/l and provide efficient disinfection while inclined at 22.5° as specified in MEPC.227(64).

If the effluent residual must be below 0.5 mg/l but MEPC.227(64) does not apply, then the system can be fitted with a tablet dechlorinator. Use of tablet feeders is particularly efficient when the effluent can flow to the sea by gravity. Consult factory for details.

### 9.1.1 Tablet Consumption Treating Blackwater Only

Water usage and applications vary widely. For modern toilets at 1.75 gpf and with estimated leakage, tablet consumption should be about 0.83 lb/year per person.

On that basis, a 45 lb. pail of tablets should provide disinfection for 45 /0.83 = 54 persons for one year and for the same 54 persons, one fully charged feed tube should handle the flow for about 8 weeks.

Where vacuum toilets are employed, consumption will be greatly reduced due to the lower flow.

#### 9.1.2 Consumption Treating Blackwater Plus All Graywater

Treating blackwater and all graywater, consumption is much higher of course. Even though graywater consumption can vary considerably, a reasonable estimate including blackwater with 1.75 gpf toilets is about 3.0 lb/year per person.

A forty-five (45) lb. pail of tablets should provide disinfection for 45 / 3.0 = 15 persons for one year and for the same 15 persons, one fully charged feed tube should handle the flow for about 8 weeks.

Actual consumption will vary considerably depending upon actual flow per fixture, leaks, chlorinator adjustment, water conservation measures, etc.

Do not use swimming pool tablets! They dissolve too rapidly.

Note: If you can smell chlorine adjacent to the FAST unit you are using the wrong tablets or you are using too much!

Use only tablets specified for disinfection of sewage treatment plant effluent. For more information consult www.norweco.com.

## 9.2 CONSUMPTION OF 5% PAA

For systems meeting MEPC.227(64), the preferred method of disinfection is peracetic acid (PAA). This is environmentally friendly, does not produce a harmful residual and it is generally available worldwide.

We recommend using 5% PAA. It is also available in higher concentrations.

But:

1. Although environmentally friendly, PAA is corrosive and requires careful handling, probably somewhat more corrosive at higher concentrations.
2. PAA is not a true solution. It is a mixture that will deteriorate at higher ambient temperatures as may be experienced aboard ship.
3. The FAST process requires very little PAA so that more concentrated solutions will be exposed to high temperatures for longer periods of time and may deteriorate more rapidly than would a lower concentration.

#### 9.2.1 Consumption Treating Blackwater Only

For modern toilets at 1.75 gpf plus an allowance for leakage, estimated consumption is about 1.9 quarts per person per year.

#### 9.2.2 Consumption Treating Blackwater plus all Graywater

Also for 1.75 gpf toilets plus an allowance for leakage, estimated consumption is about 6.7 quarts per person per year.

## 9.3 CONSUMPTION OF LAUNDRY BLEACH

If laundry bleach is preferred over chlorine tablets with unit not subject to MEPC.227(64), the same pump used with PAA can be used with 6% sodium hypochlorite laundry bleach.

The only difference will be that the amount of bleach required will be 1.5 times the volume of PAA needed to do the same job.

# 14.010. MAINTENANCE

## 10.1 SCHEDULE

| FAST Scheduled Maintenance<br>As Applicable Based Upon Installed Equipment | |
|---|---|
| **Weekly** | **Lubricate Roots blower bearings**<br>**Check wet well sight glass for clear water**<br>**Check regenerative blower inlet filter & clean as required** |
| **Every three (3) months** | **Air scour, pump out & refill media tank**<br>**Check Roots blower vee drive belt tension & alignment**<br>**Check chlorine residual in wet well & adjust as required** |

## 10.2 TABLET CHLORINATOR

### 10.2.1 Adjusting the Chlorination Rate

The chlorination rate is adjustable. It should be adjusted to prevent under or over chlorination.

This will insure disinfection of the effluent without wasting tablets or requiring excessive maintenance. Use a DPD test kit.

This is the same type of kit used to measure chlorine residual in swimming pools. It is simple and inexpensive.

After the unit is fully started up and has stabilized, the residual of total available chlorine should be not less than 1.0 mg/l and not more than 2.0 mg/l. Once properly adjusted, the setting should be checked from time to time.

If you can smell chlorine in the water or in the space around the unit, you are adding too much chlorine.

Also, remember that adjusting the Tablet Chlorinator will not change the residual immediately. Allow several hours or a day for the adjustment to take effect before checking the residual.

For further information on adjustments, check the enclosed Instruction Manual Insert for the Tablet Chlorinator. Note that the test kit we recommend is the

Chemets K-2504 and further information can be obtained at the manufacturer's web site www.chemetrics.com.

#### 10.2.2 Chlorine Tablet Feeders

These units incorporate an internal downstream tilt to prevent water from standing in the chlorinator and dissolving tablets when there is no flow. No water should remain in the body of the tablet feeder when there is no flow.

The chlorination rate is adjustable:

1. When fully inserted into the feeder body, the feed tube locks into positioning ribs molded into the flow deck. This locked position provides the maximum chemical dose.
2. Rotating the feed tube ¼ turn raises the feed tube approximately 1/8" and reduces the chlorine dosage.
3. The body of the tablet feeder can be tilted to adjust the chlorination rate. Increasing the angle reduces the time during which the water is inside the chlorinator and is dissolving the tablets.
4. In certain cases, the tablet feeder may be fitted with adjustable weirs to regulate chlorination rate.

#### 10.2.3 Tablets

Do not use swimming pool tablets! They dissolve too rapidly.

Note: If you can smell chlorine you are using the wrong tablets or you are using too much!

Use only tablets specified for disinfection of sewage treatment plant effluent. For more information consult www.norweco.com.

## 10.3 ROOTS BLOWER

Grease the shaft weekly and change the oil at 1,000 hour (6 week) intervals in strict accordance with the Roots instruction manual. Check belt condition and tension at each oil change.

## 10.4 REGENERATIVE TURBINE AIR BLOWER

Replace the inlet air filter element as required.

## 10.5 MEDIA TANK

Unless otherwise specified, air scour, drain and refill the Media Tank at three (3) month intervals.

### 10.5.1 Pumpout Procedure

1. Close the sewage inlet valve to the FAST unit and bypass the sewage overboard or to a holding tank. There should be no flow into the unit.
2. Drain or pump out the Wet Well and close the Wet Well Drain Valve. This will keep sludge from contaminating the effluent.
3. Open the Air Scour Valve and Close the Airlift Valve. Let the air scour the Media and the tank bottom for about fifteen (15) minutes.
4. With the Air Scour still operating, open the Media Tank Drain Valve. Drain the tank using the Discharge Pump, a separate drain pump or by gravity as applicable.
5. Close the Media Tank Drain Valve, close the Air scour Valve and open the Airlift Valve. For systems equipped with discharge pumps, open the Wet Well Drain Valve.

### 10.5.2 Refilling The Media Tank

It is essential that the Media Tank be refilled with water immediately after pumpout. The procedure for doing this depends upon whether or not seawater is used to flush the toilets.

The salinity of the water used to refill the tank must be approximately the same as the salinity of the sewage being treated:

1. If only blackwater is being treated and seawater is used to flush the toilets, refill the tank with seawater.
2. If only freshwater is being used, refill the tank with freshwater.
3. If both freshwater and seawater are being used, then allow the tank to refill with the flow of sewage. The blower should be ON and the pump set for automatic operation.

## 10.6 COOKING GREASE

1. The microbial culture can digest normal amounts of grease in wastewater from dishwashing. But, large amounts of grease will solidify and

accumulate in the Media. Eventually the solid grease will plug the flow passages in the Media.

2. If wastewater from the galley is to be treated, then the galley sinks must be equipped with one or more properly sized and maintained grease traps. These should be inspected and cleaned weekly or as required to prevent grease from plugging the piping or the FAST unit.
3. Dispose of this grease separately as solid waste! Even if the grease trap contents are first treated with bacteria, allowing this to pass through to the FAST unit will substantially increase the organic loading and may overload the FAST unit.
4. Do not empty deep fryers or pots or pans containing cooking oil into the sinks leading to the FAST unit! Dispose of this grease separately as solid waste!
5. If some grease has accumulated on the media, you can remove it with the grease-eating bacteria. However, the amount of bacteria required must be determined by inspecting the media from time to time and adjusting the amount of bacteria used.
6. If the media is seriously plugged and a more immediate method is required, then refer to 11.5.1 CLEANING THE MEDIA WITH CAUSTIC.
7. In addition to the measures stated above, you can prevent grease accumulation by adding grease-eating bacteria on a regular basis. Here also, the amount of bacteria required must be determined by inspecting the media from time to time and adjusting the amount of bacteria used.

**10.6.1 Removing Accumulated Grease With Bacteria**

1. As stated above, the amount of bacteria required for removal and control of grease must be determined in practice. The amounts suggested below should only be considered as a starting point for the specified bacteria.
2. For other manufacturers, use the manufacturer's recommended amounts as a starting point.
3. The bacteria can be obtained in tablet form which is convenient to use. For Mighty Mike FOG (fats oil & greases) tablets, contact SCIENCO/FAST Division of Bio-Microbics, Inc., 12977 Maurer Industrial Drive, Sunset

Hills, MO 63127-1515, tel: (314)645-6540, fax: (314)645-6131, email: solutions@sciencofast.com, URL: www.sciencofast.com.

4. Add the bacteria weekly until observation indicates that the media is essentially free of accumulated grease.

| Mighty Mike Tablets Required for Grease Removal | | | |
|---|---|---|---|
| **FAST Model** | **gpd** | **Initial** | **Weekly** |
| **L-1X** | **126** | **1** | **1** |
| **L-2X** | **210** | **1** | **1** |
| **L-3X** | **273** | **1** | **1** |
| **L-4X** | **399** | **1** | **1** |
| **L-5X** | **420** | **1** | **1** |
| **L-6X** | **819** | **1** | **1** |
| **M-1** | **294** | **1** | **1** |
| **M-2** | **441** | **1** | **1** |
| **M-3** | **672** | **1** | **1** |
| **M-4** | **882** | **1** | **1** |
| **M-5** | **1,344** | **1** | **1** |
| **MX-1** | **294** | **1** | **1** |
| **MX-2** | **441** | **1** | **1** |
| **MX-3** | **672** | **1** | **1** |
| **MX-4** | **1,008** | **1** | **1** |
| **MX-5** | **1,512** | **1** | **1** |
| **D-1V** | **990** | **1** | **1** |
| **D-2V** | **1,800** | **1** | **1** |
| **D-3V** | **2,700** | **2** | **1** |
| **D-4V** | **3,300** | **2** | **1** |
| **D-5V** | **4,000** | **2** | **1** |
| **D-6V** | **6,700** | **3** | **2** |
| **D-7V** | **10,000** | **4** | **2** |
| **D-8V** | **13,300** | **5** | **3** |
| **D-9V** | **20,000** | **8** | **4** |

### 10.6.2 Preventing Grease Accumulation With Bacteria

The amount of bacteria required to prevent grease accumulation is less than that required to remove it. The manufacturer may have a specific recommendation and you should consider this as a starting point.

Using the Mighty Mike tablets with smaller FAST units, add a tablet once every week or once every two weeks rather than cutting tablets into smaller pieces. Adjust the dosage depending upon your results.

# 15.011.0 LAYUP

## 11.1 SHORT TERM LAY-UP

If the crew will be away for up to three weeks, no special procedure is required. Leave the system on-line with the blower running.

The microbial culture will begin to feed on itself and on the accumulated sludge in the absence of another food source.

## 11.2 LONG TERM LAY-UP OR SHUTDOWN

1. Close the sewage inlet valve to the FAST unit and bypass the sewage overboard or to a holding tank. There should be no flow into the unit.
2. Drain or pump out the Wet Well and close the Wet Well Drain Valve. This will keep sludge from contaminating the effluent.
3. Open the Air Scour Valve and Close the Airlift Valve. Let the air scour the Media and the tank bottom for two hours.
4. With the Air Scour still operating, open the Media Tank Drain Valve. Drain the tank using the Discharge Pump, a separate drain pump or by gravity as applicable.
5. Shut off the Blower, shut off all electric power to the unit and close all valves on the unit.
6. Drain all water piping, fittings and traps containing water.
7. Drain pumps casings or protect against freezing with ethylene glycol anti-freeze.
8. Disconnect the inlet and discharge piping from the Roots Blower and spray the impeller chamber with WD-40 or a similar protective coating. Turn the Blower by hand to distribute the coating and then plug the inlet and discharge ports.
9. Lubricate the grease fittings on the Roots Blower and on any motors or machinery equipped with grease fittings.

# 16.012.0 TROUBLE SHOOTING

The best way to tell how your unit is doing is to take a water sample. Look at it and smell it.

When the unit is operating properly:

1. The water in the Wet Well sight glass is clear.
2. An effluent sample will be odorless and essentially clear. It may contain a few fine particles.
3. There is no odor in the vicinity of the unit.
4. The chlorine residual in the wet well is 1.0 – 2.0 mg/l total available chlorine.
5. The toilets and all other fixtures which drain to the unit operate properly.

There are six major indicators of trouble; odor, poor drainage into the unit, foam coming out of the Media Tank vent, poor effluent quality, high water level in the Media Tank and high level alarm (or water spilling out of Wet Well vent).

## 12.1 ODOR

If there is a smell of hydrogen sulfide (rotten eggs) coming from the Media Tank vent or from a water sample, or if the water in the Wet Well sight glass is gray or black, this means that the culture is not getting enough air.

1. Make sure the Blower is running and has been running for the last several hours. If not, leave the Blower on and the odor should clear up in a few hours.
2. If the Blower is fitted with an inlet filter, make sure the filter is clean and properly installed.
3. Make sure that the Airlift Valve is fully open and that the Air Scour Valve is fully closed.
4. Check the Blower Silencer air inlet for blockage.
5. Make sure that the relief valve is not bleeding air. If it is, adjust, repair or replace.
6. If the Blower is belt driven, turn off the power and remove the belt guard. Check for belt slippage and adjust belt tension.

7. Make sure sheaves are as specified in the enclosed Shop Bills.
8. With power off, check Roots Blower shaft for end play. Check against normal clearances specified in the Roots manual insert. If clearance exceeds the maximum (typically 0.010 to 0.018 inches total), the head plates are worn and the Blower is not delivering enough air. Repair or replace the Roots Blower.
9. Open the inspection hatch on top of the unit and check operation of the Airlift. The Airlift should be pumping vigorously and the water surface should be turbulent, indicating flow to all parts of the Media Tank. If not, pull the drop hose and check for breaks, other damage and correct length. The drop hose should terminate 3 inches above the bottom of the Airlift draft tube. If it has fallen off, is too long or is too short, repair or replace.

## 12.2 POOR DRAINAGE INTO THE UNIT

Refer to the enclosed drawings. Make sure that the Media Tank Vent, inlet trap and trap vent are the correct size and are that horizontal offsets are installed and sloped correctly.

Horizontal offsets in the Media Tank vent must be sloped so that condensation drains back into the Media Tank and does not fill the vent pipe. If the installation is not correct, contact the factory.

## 12.3 FOAM COMING OUT OF THE MEDIA TANK VENT

1. Add a small amount of diesel fuel to the Media Tank by flushing it down the toilet. About 10 ppm should be enough, and the amounts of oil required for standard models are shown in the table below.
2. Flush a second or third time to carry the oil through the Inlet Trap and into the Media Tank. Allow a few minutes for the foam in the vent to be blown clear.
3. If more oil is required, add in small doses. Do not use more than is necessary.

4.

| Diesel Fuel Required For De-Foaming | | | | |
|---|---|---|---|---|
| model | persons | water in media tank (gallons) | diesel fuel | |
| | | | (fluid ounces) | (milli-liters) |
| L-1X | 6 | 46 | 0.06 | 2 |
| L-2X | 9 | 65 | 0.08 | 2 |
| L-3X | 13 | 91 | 0.12 | 3 |
| L-4X | 19 | 130 | 0.17 | 5 |
| L-5X | 20 | 135 | 0.17 | 5 |
| L-6X | 41 | 270 | 0.35 | 10 |
| M-1 | 13 | 120 | 0.15 | 5 |
| M-2 | 21 | 180 | 0.23 | 7 |
| M-3 | 31 | 269 | 0.34 | 10 |
| M-4 | 42 | 359 | 0.46 | 14 |
| M-5 | 63 | 539 | 0.69 | 20 |
| MX-1 | 14 | 120 | 0.15 | 5 |
| MX-2 | 21 | 180 | 0.23 | 7 |
| MX-3 | 32 | 239 | 0.31 | 9 |
| MX-4 | 48 | 359 | 0.46 | 14 |
| MX-5 | 72 | 539 | 0.69 | 20 |
| D-1V | 46 | 337 | 0.43 | 13 |
| D-2V | 81 | 598 | 0.77 | 23 |
| D-3V | 122 | 898 | 1.15 | 34 |
| D-4V | 152 | 1,122 | 1.44 | 42 |
| D-5V | 183 | 1,347 | 1.72 | 51 |
| D-6V | 304 | 2,244 | 2.87 | 85 |
| D-7V | 457 | 3,232 | 4.14 | 122 |
| D-8V | 609 | 4,309 | 5.52 | 163 |
| D-9V | 914 | 6,464 | 8.27 | 245 |

5.

If the foaming persists, use less detergent in cleaning, change to low-sudsing or non-sudsing detergents or use a non-biodegradable silicone defoamer which will not affect the process.

Do not add oil on a regular basis. The microbes will adapt to the oil and will digest it. The only result will be to overload the unit.

## 12.4 POOR EFFLUENT QUALITY

1. If the water in the Wet Well sight glass is gray or black and the water smells of hydrogen sulfide (rotten eggs), follow the procedure in section 11.1 above.
2. If disinfectants have been introduced into the Media Tank, air scour and pump out the tank per section 8.5.1 above. The culture will start up as described in section 6.0 above.
3. If the Air Scour Valve has inadvertently been opened, close it and make sure that the Airlift Valve is fully open. The effluent will clear up after a few hours of operation.
4. Remember that any upset in the Media Tank will cause sludge to carry over into the Wet Well. This sludge can prevent the chlorine from disinfecting the effluent.
5. So, after the Media Tank is drained, then drain the Wet Well. Do not do both at the same time, as the water level in the Media Tank is much higher than the water level in the Wet Well.

## 12.5 REMOVING SLUDGE FROM THE WET WELL

### 12.5.1 Shock Chlorinating The Wet Well

Sludge may accumulate in the Wet Well. It may result from an upset in the Media Tank or through operation of the system without chlorination of the water leaving the Media Tank.

When this occurs, the large amount of organic matter present in the Wet Well will use up the available chlorine and interfere with disinfection. Shock chlorination of the Wet Well is required.

This will clear the Wet Well of sludge. Pour laundry bleach into the Tablet Chlorinator or add directly into the Wet Well.

Recommended amounts are given in the Table below:

| Shock Chlorinate Wet Well with 6% Sodium Hypochlorite Bleach | | | | |
|---|---|---|---|---|
| **model** | **wet well volume (gallons)** | **bleach required (8 oz cups)** | **bleach required (quarts)** | **bleach required (gallons)** |
| **L-1X** | **20** | **3** | **1** | **1/4** |
| **L-2X** | **20** | **3** | **1** | **1/4** |
| **L-3X** | **20** | **3** | **1** | **1/4** |
| **L-4X** | **20** | **3** | **1** | **1/4** |
| **L-5X** | **20** | **3** | **1** | **1/4** |
| **L-6X** | **48** | **8** | **2** | **1/2** |
| **M-1** | **26** | **4** | **1 1/2** | **1/2** |
| **M-2** | **26** | **4** | **1 1/2** | **1/2** |
| **M-3** | **26** | **4** | **1 1/2** | **1/2** |
| **M-4** | **35** | **6** | **1 1/2** | **1/2** |
| **M-5** | **52** | **8** | **2 1/2** | **3/4** |
| **MX-1** | **37** | **6** | **1 1/2** | **1/2** |
| **MX-2** | **50** | **8** | **2 1/2** | **3/4** |
| **MX-3** | **61** | **10** | **2 1/2** | **3/4** |
| **MX-4** | **91** | **15** | **4** | **1** |
| **MX-5** | **91** | **15** | **4** | **1** |
| **D-1V** | **93** | **15** | **4** | **1** |
| **D-2V** | **93** | **15** | **4** | **1** |
| **D-3V** | **146** | **23** | **6** | **1 1/2** |
| **D-4V** | **146** | **23** | **6** | **1 1/2** |
| **D-5V** | **273** | **44** | **11** | **2 3/4** |
| **D-6V** | **273** | **44** | **11** | **2 3/4** |
| **D-7V** | **561** | **90** | **23** | **5 3/4** |
| **D-8V** | **561** | **90** | **23** | **5 3/4** |
| **D-9V** | **885** | **142** | **36** | **9** |
| **Notes:** | | | | |
| **1. Also applies to Models - L1XM, M-1M, MX-1M, D-1VM, etc.** | | | | |
| **2. Wet well must be at normal water level before adding bleach.** | | | | |
| **3. Allow 30 minutes contact time before pumping out wet well.** | | | | |

This shock chlorination will break up and disperse the sludge so that normal operation will cause it to flow out of the Wet Well with the water. However, the most positive way is to pump out the wet well about thirty (30) minutes after introduction of the bleach.

#### 12.5.2 Shock Treatment With PAA

If PAA is used for disinfection shock treatment with PAA may be employed.

Recommended amounts are shown in the table below:

| Shock Wet Well with 5% PAA | | | | |
|---|---|---|---|---|
| **Model** | **Wet Well Volume (gallons)** | **PAA Required (fluid oz)** | **PAA required (8 oz cups)** | **PAA required (quarts)** |
| **L-1X** | **20** | **12** | **1.5** | **0.4** |
| **L-2X** | **20** | **12** | **1.5** | **0.4** |
| **L-3X** | **20** | **12** | **1.5** | **0.4** |
| **L-4X** | **20** | **12** | **1.5** | **0.4** |
| **L-5X** | **20** | **12** | **1.5** | **0.4** |
| **L-6X** | **48** | **28** | **3.5** | **0.9** |
| **M-1** | **26** | **15** | **1.9** | **0.5** |
| **M-2** | **26** | **15** | **1.9** | **0.5** |
| **M-3** | **26** | **15** | **1.9** | **0.5** |
| **M-4** | **35** | **21** | **2.6** | **0.6** |
| **M-5** | **52** | **31** | **3.8** | **1.0** |
| **MX-1** | **37** | **22** | **2.7** | **0.7** |
| **MX-2** | **50** | **29** | **3.7** | **0.9** |
| **MX-3** | **61** | **36** | **4.5** | **1.1** |
| **MX-4** | **91** | **54** | **6.7** | **1.7** |
| **MX-5** | **91** | **54** | **6.7** | **1.7** |
| **D-1V** | **93** | **55** | **6.8** | **1.7** |
| **D-2V** | **93** | **55** | **6.8** | **1.7** |
| **D-3V** | **146** | **86** | **10.7** | **2.7** |
| **D-4V** | **146** | **86** | **10.7** | **2.7** |
| **D-5V** | **273** | **161** | **20.1** | **5.0** |
| **D-6V** | **273** | **161** | **20.1** | **5.0** |
| **D-7V** | **561** | **330** | **41.3** | **10.3** |
| **D-8V** | **561** | **330** | **41.3** | **10.3** |
| **D-9V** | **885** | **521** | **65.1** | **16.3** |
| **Notes:** | | | | |
| **1. Also applies to Models - L1XM, M-1M, MX-1M, D-1VM, etc.** | | | | |
| **2. Wet well must be at normal water level before adding PAA.** | | | | |
| **3. Allow 30 minutes contact time before pumping out wet well.** | | | | |

## 12.6 HIGH WATER LEVEL IN MEDIA TANK

1. If a lift station is feeding the FAST unit, be certain that the volume of sewage pumped in each cycle is in full accordance with the limits specified in Restrictions. If the lift station cycle volume is not restricted, a large sewage pump can press the tank, damage the Media and spill sewage into the bilge.
2. Shut off the Blower and open the inspection hatch on top of the Media Tank.
3. The water level should be about three (3) inches above the top of the Media and twelve (12) inches below the tanktop. If the heights are not correct, check that the Spillover arrangement has not slipped, fallen, broken or become clogged. Repair, reinforce, clean and replace as required.
4. If the water level is OK with the Blower off and only high when the Blower is running, the Media flow passages may be partly blocked. Air scour and drain the Media Tank per section 8.5.1 above.
5. If air scouring does not clear the Media, or if it causes the Media blocks to rise, then more aggressive methods are required to clear the Media. Grease, paper and other sewage solids can be removed using caustic.

## 12.7 CLEANING THE MEDIA WITH CAUSTIC

**WARNING - WEAR FACE MASK AND RUBBER GLOVES. SODIUM HYDROXIDE IS EXTREMELY DANGEROUS. AVOID SPLASHING OR SPILLING OF CRYSTALS OR LIQUID. AVOID CONTACT WITH EYES OR SKIN.**

**RESTRICTION - Do not under any circumstances use lye, trisodium phosphate, sodium hydroxide, potassium hydroxide or any other caustic or high pH cleaner on or in aluminum tanks or components. The caustic will attack the aluminum and cause serious structural damage.**

1. Bypass the Media Tank so that no fresh sewage enters it.
2. Open the top access hatch and add the amount of lye (sodium hydroxide) shown in the Table below:

| NaOH REQUIRED FOR pH = 12.0 | | | |
|---|---|---|---|
| model | water in media tank (gallons) | lye (NaOH) ounces | lye (NaOH) 12 ounce cans |
| L-1X | 50 | 3 | 1/4 |
| L-2X | 68 | 4 | 1/2 |
| L-3X* | 101 | 6 | 1/2 |
| L-4X* | 136 | 8 | 3/4 |
| L-5X | 126 | 7 | 3/4 |
| L-6X* | 253 | 14 | 2 |
| M-1 | 120 | 7 | 3/4 |
| M-2 | 180 | 10 | 1 |
| M-3 | 269 | 15 | 1 1/4 |
| M-4* | 359 | 20 | 1 3/4 |
| M-5* | 539 | 29 | 2 1/2 |
| MX-1 | 120 | 7 | 3/4 |
| MX-2 | 180 | 10 | 1 |
| MX-3 | 239 | 13 | 2 |
| MX-4 | 359 | 20 | 2 |
| MX-5 | 539 | 29 | 3 |
| D-1V | 337 | 18 | 2 |
| D-2V | 598 | 32 | 3 |
| D-3V | 898 | 48 | 4 |
| D-4V | 1,122 | 60 | 5 |
| D-5V | 1,347 | 72 | 6 |
| D-6V | 2,244 | 120 | 10 |
| D-7V | 3,232 | 173 | 15 |
| D-8V | 4,309 | 231 | 20 |
| D-9V* | 6,464 | 346 | 29 |
| * Units with 2 media tanks, use one-half total amount in each tank. | | | |

3. Close and seal the hatch.

4. Do not operate the blower or air scours during the caustic soak. If the media is plugged, air scouring may cause the media to rise and be damaged. Also, operating the airlift will cause the water level in the tank to rise temporarily and some of the caustic solution will spill over into the wet well and be lost.
5. Let the Media Tank soak for four (4) to eight (8) hours. Then operate the Air Scours for fifteen (15) minutes or so.
6. With the Air Scours still on, drain the Media Tank.
7. Fill the Media Tank with water to the normal water level.
8. Open the hatch and operate the Air Scours. The bubble pattern across the Media should be uniform indicating that the Media is not plugged.
9. If the Media is still plugged, repeat the procedure. Otherwise, place the unit back in normal operation.

## 12.8 HIGH WATER LEVEL IN WET WELL, HIGH LEVEL ALARM

1. Bypass the Media Tank so that no fresh sewage enters it.
2. Make sure all valves and controls are set up per section 7.0 above.
3. Make sure that the stop check valve at the hull is operating properly.
4. Check the Float Switch and pump control circuit. The pump on and pump off water levels are shown in the enclosed drawings and can be seen in the sight glass.

## 12.9 CHLORINE TABLETS STICK IN FEED TUBES

The ELTECH A200 Tablet Feeder used in much older FAST units is designed for flows of 1,500 gpd or more. It can be used for lower flows in many cases.

But, sticking of tablets in the feed tube can be a problem at low flows. If this is the case, consider changing to the correct model of the BIO-DYNAMICS Tablet Feeder (consult FAST Systems).

The changeover need not be difficult. Contact FAST Systems for details.

## 12.10 CHEMICAL PUMPS LOSE PRIME

The FAST process requires very little laundry bleach or PAA for disinfection and very little for dechlorination when applicable. Also, the Walchem chemical pumps employ FC wet ends.

The chemical pump must be installed in flooded suction to prevent occasional loss of prime.

# 17.013.0 EFFLUENT SAMPLING

## 13.1 SHIPBOARD OR ON-SITE EVALUATION

### 13.1.1 Chlorine Disinfection

1. Flush out the sample cock. Then, fill a clean glass jar with effluent. Let the sample stand for about 15 minutes.
2. The water should be odorless and essentially clear. A dusting of fine solids at the bottom of the jar is normal.
3. If the sample is not essentially clear and odorless, or if contains a lot of solids, refer to the Troubleshooting above. If it appears to be OK, then continue with a chlorine residual test.
4. Using a DPD test kit, check the chlorine residual in the sample. It should be not less than 1.0 mg/l and not more than 2.0 mg/l.
5. If the residual is too high or too low, adjust the chlorinator as specified above. If there is no residual even though tablets are being consumed, then there might be a lot of sludge in the Wet Well.
6. Clean the Wet Well with chlorine as specified above, let the system operate for a day or two to flush out the high chlorine concentration and then check the residual again.
7. For systems equipped with dechlorination, the above residuals refer to samples taken of chlorinated effluent before dechlorination. The effluent after dechlorination should be sampled separately to ensure that the remaining chlorine residual is in accordance with the applicable regulations, 0.5 mg/l total available chlorine for MEPC.159(55).

### 13.1.2 PAA Disinfection

Use the same procedures as for chlorine above except as follows:

Using a suitable test kit, check the PAA the residual in the sample. It should be not less than 0.5 mg/l and not more than 1.0 mg/l.

Note that the PAA residual drops more rapidly than that for chlorine residual. So, check PAA residual shortly after a discharge pump cycle.

If the residual is too high or too low, adjust the chemical pump settings. If there is no residual even though PAA is being consumed, then there might be a lot of sludge in the Wet Well.

Clean the Wet Well per section 12.5.1 for chlorine or section 12.5.2 for PAA above, let the system operate for a day or two to stabilize the concentration and then check the PAA residual again.

## 13.2 LABORATORY ANALYSIS

Four basic tests are used to evaluate process performance; 5 day biochemical oxygen demand (BOD5), suspended solids (TSS), chemical oxygen demand (COD) and fecal coliform MPN.

Unless specifically instructed by FAST Systems to do so, don't take samples for laboratory analysis unless the effluent passes the simple tests in section 12.0 above. Otherwise, the lab fees will be a waste of money.

Generally, the lab will provide the sample bottles required. The lab will also provide instructions for refrigeration of the samples and other measures to ensure accurate results.

Please forward a copy of all lab analysis reports to FAST Systems.

### 13.2.1 BOD5, COD and Total Suspended Solids (TSS)

1. Thoroughly flush out the sample cock. Hose or tubing may be used to direct the water to a drain or container.
2. The sample bottle must be clean and free of any contaminants before using it. If not sure, wash and rinse thoroughly with detergent and hot water.
3. Fill the sample bottle with water from the sample cock.
4. Cap the bottle tightly and refrigerate the sample or pack it in ice for delivery to the lab. Identify and date the sample.

### 13.2.2 Fecal Coliform MPN

1. Thoroughly flush out the sample cock. The cock must be fully open to provide the velocity required for flushing.
2. Open the sterile sample bottle and hold the cap in a down position. Be careful not to touch the lip or interior of either the cap or the bottle.
3. Reduce the flow to a reasonable sampling velocity and fill the sample bottle.

4. Cap the bottle tightly and wrap in a plastic bag for protection. Refrigerate or pack in ice, but do not freeze. Identify the sample and note the date and time it was taken.

## 13.3 LABORATORY PROCEDURES

All laboratory analysis should be accordance with the latest edition of “Standard Methods for the Examination of Water and Wastewater”. Fecal coliform MPN should be measured using the “Multiple Tube Fermentation” method.

# 18.014.0 SPECIAL NOTE

33CFR159.57(17) requires that the note quoted below be incorporated in each manual:

"Note: The EPA standards state 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 subject 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 operate to prevent the overboard discharge of sewage, treated or untreated, or of any waste derived from sewage. The EPA standards further state that this shall not be construed to prevent 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 (40CFR140.3)"

# 19.015.0 ADDITIONAL INFORMATION

For additional information or assistance, contact:

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