

Summary Report for Individual Task
551-88L-2066
Maintain a Sanitation System
Status: Approved

Distribution Restriction: Approved for public release; distribution is unlimited.

Destruction Notice: None

Foreign Disclosure: FD5 - This product/publication has been reviewed by the product developers in coordination with the [installation/activity name] foreign disclosure authority. This product is releasable to students from all requesting foreign countries without restrictions.

Condition: Given an operational sanitation system aboard a vessel, at sea, at anchor or moored alongside a pier, day or night, under all sea and weather conditions, while wearing appropriate PPE, (i.e. hearing protection, Nitrile gloves, eye protection, etc.), lock out tag outfit and a marine rail tool box.

Standard: The Soldier correctly maintains a sanitation system aboard an Army vessel, IAW the appropriate Technical Manual and local SOPs, without injury to self or others and without damage to equipment. The sanitation system was fully mission capable at task completion.

Special Condition: None

Safety Risk: High

MOPP 4:

Task Statements

Cue: None

DANGER
None

WARNING
None

CAUTION
None

Remarks: None

Notes: None

Performance Steps

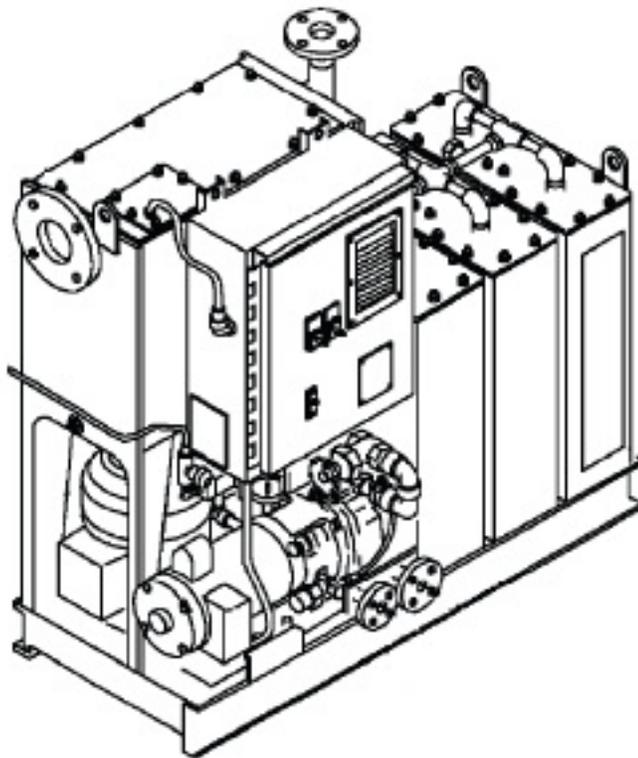
1. Demonstrate basic knowledge of a Orca II A Marine Sanitation Device (MSD).

a. System Description

(1) The Marine Sanitation Device is a self contained unit. All of the major components are located within the enclosure panels of the unit, with the exception of the bleach tank, commode warning light, and remote status indicator panel.

(2) The system is equipped with an electronic monitoring system which automatically controls the treatment of sewage, warns of any motor shutdown, and pinpoints the problem motor. It also warns of any treatment tank overload condition, thus avoiding damage to other system components or to the vessel's electrical supply.

(3) The control system comprises one modular unit. The control panel assembly houses the electronic monitoring circuit and an in-line circuit breaker.



Marine Sanitation System
Figure 551-88L-2066_01

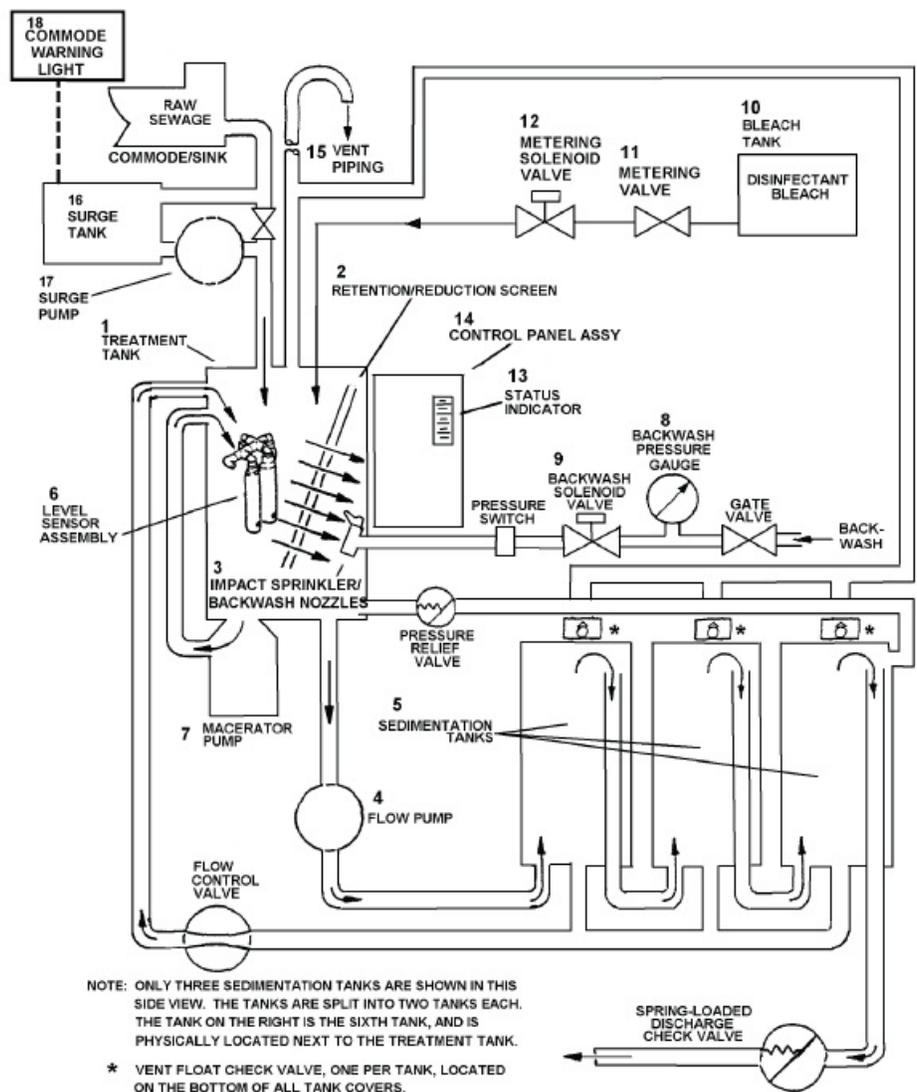
b. Treatment Process

(1) Blackwater and graywater from the surge tank enters the treatment tank of the MSD. The sewage is macerated and chlorinated. The macerated sewage is continuously recirculated into the treatment tank until the solids are small enough to pass through the retention/reduction screen. The retention/reduction screen is continuously backwashed to prevent solid build up and clogging/plugging. Sewage particles that passed through the screen enter the inlet of the flow pump, which pumps the sewage into the sedimentation tanks. Any agglomerated solids fall to the bottom of the sedimentation tanks and are returned via the sludge flow control valve to the treatment tank for further processing. If pressure in the discharge line builds up above 35 psig (241.5 kPa), the pressure relief valve opens to allow the return of processed sewage into the treatment tank.

(2) The processed effluent is discharged from the MSD through a spring loaded check valve. The check valve creates a back pressure to allow flow through the sludge return lines. The minimum pressure required to start opening is 5 psi (34.5 kPa). This pressure will increase as the discharge flow increases. The effluent is disinfected with a bleach solution (sodium hypochlorite and water) and chemical oxidation within the treatment tank. Disinfection is accomplished by a metering system (solenoid and needle valve) that meters an appropriate amount of bleach into the treatment tank. The bleach solution is stored in a 10 gallon tank mounted above the treatment tank.

(3) The level sensor assembly is located on the inlet side of the retention/reduction screen and consists of four electrodes (ground, low level, demand level, and high level). The level of the sewage in the treatment tank in relation to the electrodes is sensed by the microprocessor in the circuit control board assembly.

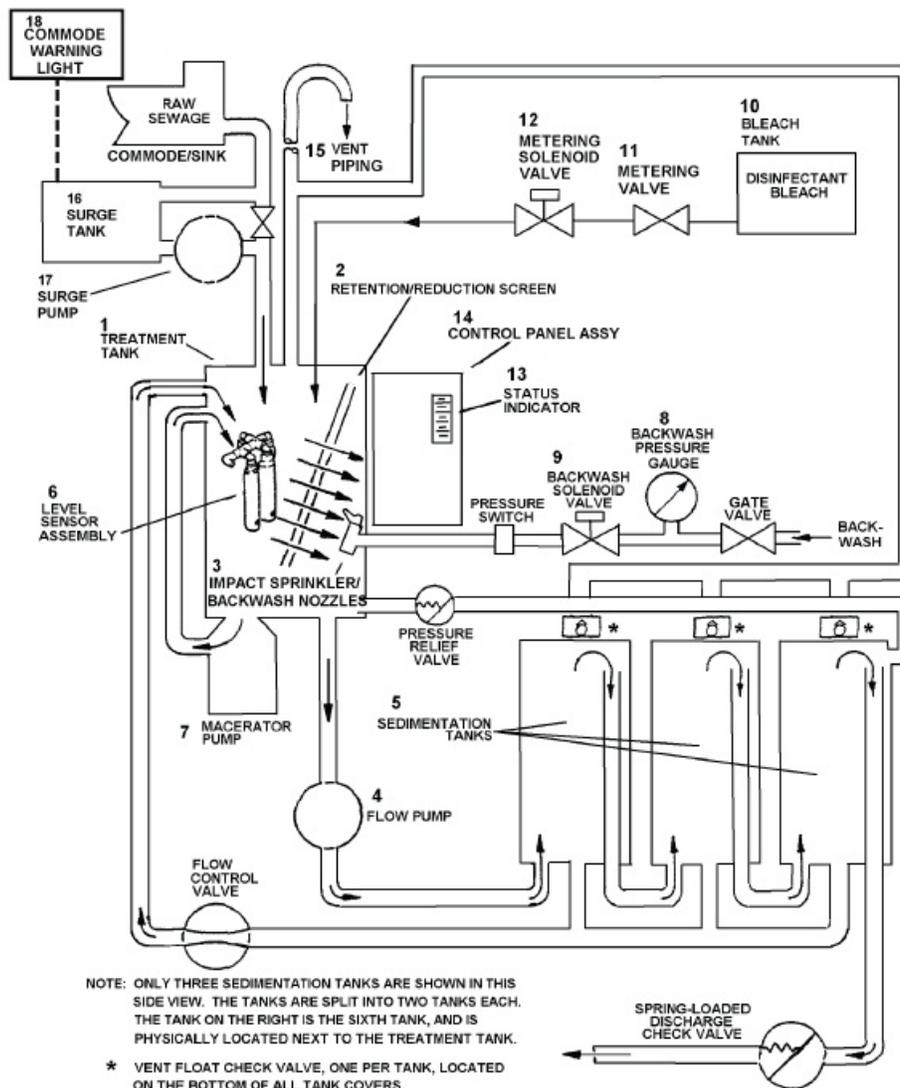
(4) When the sewage level reaches the tip of the demand electrode, an 18 minute cycle is started. If the low level electrode is uncovered after 18 minutes, the MSD stops processing sewage and goes into the standby mode. If the low level probe is covered after 18 minutes, another 18 minute cycle continues without interruption and the cycles are repeated, if necessary, until the low level probe is uncovered. If the sewage level covers the high level electrode, the HIGH LEVEL LED light on the status indicator (control panel) begins flashing. If the high level condition persists for 10 minutes, the MSD will shutdown automatically. During this automatic shutdown period, the LED light on the status indicator will remain illuminated. The MSD will not automatically restart after a power failure, the reset pushbutton must be depressed to restart the MSD system.



Functional Diagram
Figure 551-88L-2066_02

2. Demonstrate basic knowledge of a Orca II A Marine Sanitation Device (MSD) components.

- a. Treatment Tank (1). Provides space for sewage retention and treatment.
- b. Retention/Reduction Screen (2). Retains larger solids in the treatment tank until they are broken down by the macerator and able to pass through and into the sedimentation modules.
- c. Impact Sprinkler/Backwash Nozzles (3). Washes the retention/reduction screen to prevent clogging by solid.
- d. Flow Pump (4). Moves the effluent from the treatment tank into the sedimentation tanks.
- e. Sedimentation Tanks (5). Three sets of split tanks (6 total) in series for the filtration and settlement of suspended solids.
- f. Level Sensor Assembly (6). Monitors the treatment tank level by sending a signal to the electrical junction box which controls pump operation. It is located inside the treatment tank.
- g. Macerator Pump (7). A garbage disposal type unit for shredding treated sewage.
- h. Backwash Pressure Gauge (8). Indicates the pressure on the backwash water inlet line. The gauge line located in the front of the unit is installed in the backwash water line on the underside of the unit.
- i. Backwash Solenoid Valve (9). Controls the backwash water while the system is processing or is in the rest period. It is located on the underside of the unit beneath the treatment tank area.
- j. Bleach Tank (10). Provides storage for the bleach solution. It is located separate from the unit and has a gravity feed for delivering the bleach through a metering valve and to the optional metering solenoid valve on the unit.
- k. Metering Valve (11). Meters the required amount of bleach solution into the treatment tank for disinfection of the effluent.
- l. Metering Solenoid Valve (12). Electrically operated valve controls delivery of bleach from the bleach tank to the unit. It operates only when the metering valve is open.
- m. Status Indicator (13). Indicates any motor malfunction or high level of sewage.
- n. Control Panel Assembly. (14). Provides location for the mode selector switch, microprocessor, electrical connections, and is the control system that continually monitors motor operation and treatment tank conditions.
- o. Vent Piping (15). Vents the sanitation device to the outside air. Vent float check valves within each sedimentation tank cover prevent liquid from entering the vent piping system.
- p. Surge Tank (16). Provides short term storage prior to treatment tank to prevent overflow when system is shutdown and prevent treatment tank from running low on effluent.
- q. Surge Pump (17). Transfers unprocessed sewage from the surge tank to the treatment tank, controlled by level sensors.
- r. Commode Warning Light (18). Activated by the tank level indicator on the surge/holding tanks. Indicates treatment tank is filled to capacity.



Functional Diagram
Figure 551-88L-2066_03

3. Maintain a Orca II A Marine Sanitation Device (MSD).

a. Check for visible leaks.

b. Check all electrical connections for tightness: Control Panel Assembly, Cable Equipment Routing Assembly, Flow Pump and Solenoid, and Macerator.

c. With the system shutdown and drained remove and check the zinc anode plug in the treatment tank, if the zinc anode is less than 1 inch long, replace both the zinc anode in the treatment and sedimentation tanks.

d. Macerator

(1) With the unit operating, check for audible and/or visual malfunctions.

(2) Flush commode(s) if necessary, until unit is operating.

e. Flow Pump

(1) With the unit operating, check for audible and/or visual malfunctions.

(2) Flush commode(s) if necessary, until unit is operating.

(3) Adjust flow pump impeller as needed.

f. Impact Sprinkler/Back wash Nozzle

(1) Check for proper operation of impact sprinkler/backwash nozzle, by visual inspection if equipped with a clear tank top cover or if Backwash Status light or High level light on control panel is illuminated.

(2) Check gauge on backwash water inlet line for proper setting (40 +/- 5 psi) and adjust pressure accordingly with gate valve.

g. Treatment Tank and Sedimentation Modules

(1) Use vacuum cleaning equipment, dry cloth, or soft bristle brush to remove accumulations of dust and dirt on the exterior of the processing unit, including pumps, motors, and macerator.

(2) Visually check the PVC piping on the end and mid sedimentation covers for cracks and breaks.

(3) Replace the appropriate cover assembly if piping is damaged.

h. Bleach Tank

(1) Check level of sodium hypochlorite (bleach) to ensure continuous flow to metering valve.

(2) Fill as required.

4. Demonstrate basic knowledge of the Red Fox "Fox Pac" Marine Sanitation Device (MSD).

a. System Description

(1) The "Fox Pac" MSD consists of two treatment tanks. Sewage enters the first tank, the aeration tank, where the sewage mixes with the aerated liquid in the tank. The liquid in the aeration tank contains the bacterial sludge that will react with the sewage to start the first stage of the treatment process.

(2) Stainless steel non-clog diffusers inject the air into the liquid so that the bacteria will be able to obtain the oxygen they need to process the sewage. In addition, the turbulence created in the aeration tank liquid by the air flow from the diffusers helps mix the sewage in with the bacterial sludge and will also prevent sludge and sewage solids from settling on the bottom of the aeration tank. The air discharged from the surface of the liquid in the aeration chamber is vented to the atmosphere through a vent line connection.

(3) Flow of the liquid through the sewage treatment unit is by gravity displacement. When sewage flows into the aeration tank, an equal volume of liquid will flow through the system.

b. Treatment Process

(1) The Red Fox "Fox Pac" Type II MSD is a biological aerobic (bacteria and air) sewage treatment system. Liquid and solid waste are removed from the water being treated by bacteria naturally contained in the sewage. After entering the sewage treatment unit, the bacteria grow and multiply using the sewage as their food supply. This is the first stage of the treatment process.

(2) The second stage of the treatment process is to separate the bacteria produced from the water. After the second stage, the water will be clear. However, the liquid must be disinfected prior to discharge overboard to kill any disease-causing bacteria that could be left in the sewage flushing water.

(3) The third stage, disinfection process, uses ordinary laundry bleach to kill bacteria in the water prior to discharge.

5. Demonstrate basic knowledge of the Red Fox Marine Sanitation Device (MSD) components.

a. Aeration Tank (1) Sewage mixes with the aerated liquid in the tank. The liquid in the aeration tank contains the bacterial sludge that will react with the sewage to start the first stage of the treatment process.

b. Stainless steel non-clog diffusers (2) Injects air into the liquid so that the bacteria will be able to obtain the oxygen they need to process the sewage.

c. Vent line connection (3) The air discharged from the surface of the liquid in the aeration chamber is vented to the atmosphere.

d. Biological filter tanks (4) The liquid discharged from the aeration tank flows into the biological filter tanks. Some of the sludge in the liquid being discharged from the aeration tank will separate from the liquid by gravity settling in the chamber below the filter.

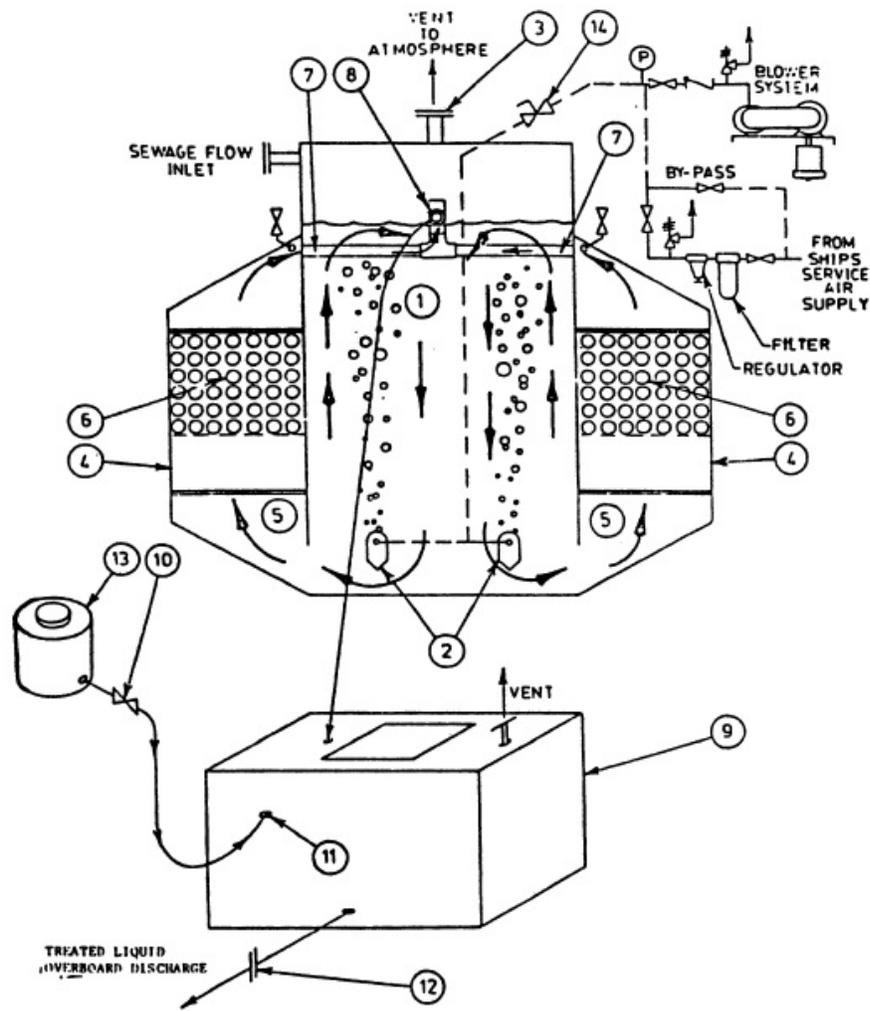
e. Biological filter elements (6) Solids and dissolved waste removal in the biological filter occurs because the waste is physically trapped in between and on the surface of the biological filter spheres

f. Discharge line (8) The accumulated water eventually is displaced by liquid flowing into the tank, and will flow out pipe.

g. Chlorine contact chamber (9) The water mixes with the disinfectant in the bottom.

h. PVC needle valve (10) The flow rate of the bleach from the chemical tank into the chlorine contact chamber is controlled.

i. Bleach Tank (13) Provides storage for the bleach solution. It is located separate from the unit and has a gravity feed for delivering the bleach through a metering valve and to the optional metering solenoid valve on the unit.



Functional Diagram
Figure 551-88L-2066_04

6. Maintain a Red Fox Marine Sanitation Device (MSD).

a. Daily Maintenance Inspection

- (1) Unit air supply adequate.
- (2) Chlorine chemical tank not empty.
- (3) Discharge pumps functioning as required.

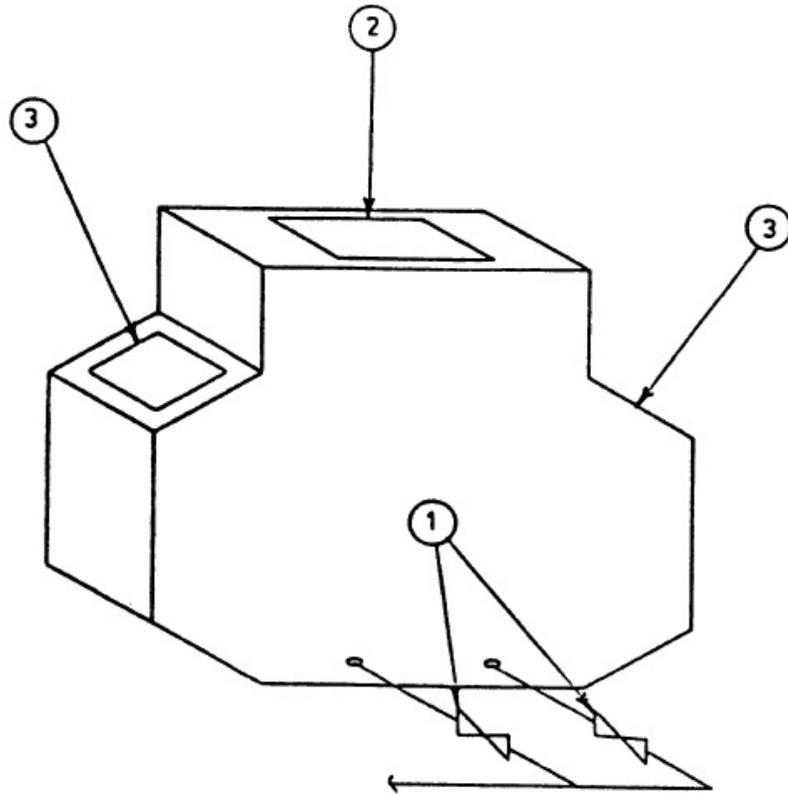
b. Biological Filter Flushing Requirements

- (1) The biological filter must be flushed out whenever a discharge sample no longer looks clean or has an unpleasant odor.
- (2) The frequency of filter flushing will depend on the size of the unit and the properties of the sewage being treated.
- (3) It is recommended that the unit be drained and flushed every 60 days in any case.

c. General Preventive Maintenance Requirement

(1) Never operate the sewage treatment unit without a continuous air supply.

(2) Do not use toxic cleaning products that will poison the bacteria in the sewage treatment unit (Pineoil, Draino, bleach, disinfectants, etc.).



- (1) Primary treatment tank drain valves
- (2) Aeration chamber access hatches
- (3) Biological filter access hatches

Primary Treatment Tand Draining and Flushing Arrangement
Figure 551-88L-2066_05

(Asterisks indicates a leader performance step.)

Evaluation Guidance: None

Evaluation Preparation: None

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Demonstrated basic knowledge of a Marine Sanitation Device (MSD).			
a. System Description			
b. Treatment Process			
2. Demonstrated basic knowledge of a Marine Sanitation Device (MSD) components.			
a. Treatment Tank			
b. Retention/Reduction Screen			
c. Impact Sprinkler/Backwash Nozzles			
d. Flow Pump			
e. Sedimentation Tanks			
f. Level Sensor Assembly			
g. Macerator Pump			
h. Backwash Pressure Gauge			
i. Backwash Solenoid Valve			
j. Bleach Tank			
k. Metering Valve			
l. Metering Solenoid Valve			
m. Status Indicator			
n. Control Panel Assembly			
o. Vent Piping			
p. Surge Tank			
q. Surge Pump			
r. Commode Warning Light			
3. Maintained a Marine Sanitation Device (MSD).			
4. Demonstrated basic knowledge of the Red Fox "Fox Pac" Marine Sanitation Device (MSD).			
a. System Description			
b. Treatment Process			
5. Demonstrated basic knowledge of the Red Fox Marine Sanitation Device (MSD) components.			
a. Aeration Tank			
b. Stainless steel non-clog diffusers			
c. Vent line connection			
d. Biological filter tanks			
e. Biological filter elements			
f. Discharge line			
g. Chlorine contact chamber			
h. PVC needle valve			
i. Bleach Tank			
6. Maintained a Red Fox Marine Sanitation Device (MSD).			
a. Daily Maintenance Inspection			
b. Biological Filter Flushing Requirements			
c. General Preventive Maintenance Requirement			

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary
	TM 55-1905-223-10	Operator's Manual for Landing Craft, Utility (LCU 2000 CLASS) (NSN 1905-01-154-1191) (Reprinted W/Basic Incl C1-9) (This item is included on EM 0273)	No	No
	TM 55-1905-223-24-11	UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS MARINE SANITATION DEVICE (MSD) FOR LANDING CRAFT UTILITY (LCU) (NSN 1905-01-154-1191)	No	No
	TM 55-1915-214-24&P	UNIT, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR MARINE SANITATION PLANT P/N RF-1500-FP-CBPN-D 0	No	No

Environment: Environmental protection is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions. In doing so, you will contribute to the sustainment of our training resources while protecting people and the environment from harmful effects. Refer to FM 3-34.5 Environmental Considerations and GTA 05-08-002 ENVIRONMENTAL-RELATED RISK ASSESSMENT.

Safety: In a training environment, leaders must perform a risk assessment in accordance with ATP 5-19, Risk Management. Leaders will complete the current Deliberate Risk Assessment Worksheet in accordance with the TRADOC Safety Officer during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available-time available and civil considerations, (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection, FM 3-11.5, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination.

Prerequisite Individual Tasks : None

Supporting Individual Tasks : None

Supported Individual Tasks : None

Supported Collective Tasks : None

ICTL Data :

ICTL Title	Personnel Type	MOS Data
88L20 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL2, Duty Pos: TFS, LIC: EN
88L30 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL3, Duty Pos: TFR, LIC: EN
88L40 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL4, Duty Pos: TGB, LIC: EN, SQI: O