

UNITED STATES MARINE CORPS

UTILITIES INSTRUCTION COMPANY
MARINE CORPS ENGINEER SCHOOL
TRAINING AND EDUCATION COMMAND
PSC BOX 20069
CAMP LEJEUNE, NORTH CAROLINA 28542-0069

OPERATE WATER PURIFICATION SYSTEM (3000 LMT) STUDENT OUTLINE

U-10E01
FEB 09

What Will I Learn From This Class?

1. Terminal Learning Objectives.

a. Provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), water source, 3000 gallon tanks, pumps, fuel, and references, OPERATE 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT). The 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) will be operated so that it will function normally, safely, and will not be damaged by the operation per the references. The operator shall produce product water with a nephelometric turbidity unit (NTU) of 1 or less. The product water shall have a chlorine residual of 5 parts per million (PPM) at the production site. (1171.02.06)

b. Provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), tools, personnel, preventive maintenance roster, ERO, EROSL, and the references, perform 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) preventive maintenance. The water purification unit preventive maintenance will be performed per schedule in the preventive maintenance roster, any deficiencies will be corrected/identified, and the ERO will reflect all required preventive maintenance action per the references. (1171.04.06)

2. Enabling Learning Objectives.

a. Provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), water

source, 3000 gallon tanks, pumps, fuel, and references, identify 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) safety concerns per the references. (1171.02.06a)

b. As part of a team, provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), water source, 3000 gallon tanks, pumps, fuel, and references, set up the 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) per the references. (1171.02.06b)

c. As part of a team, provided equipment, tools, preventive maintenance roster, ERO, EROSL, and references, conduct preventive maintenance checks on a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) per the references. (1171.04.06a)

d. As part of a team, provided equipment, tools, preventive maintenance roster, ERO, EROSL, and references, conduct preventive maintenance services on a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) per the references. (1171.04.06b)

e. Provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), water source, 3000 gallon tanks, pumps, fuel, and references, start the 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) per the references. (1171.02.06c)

f. Provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), water source, 3000 gallon tanks, pumps, fuel, and references, shut down the 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) per the references. (1171.02.06d)

g. Provided a 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT), water source, 3000 gallon tanks, pumps, fuel, and references, prepare the 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) for storage per the references. (1171.02.06e)

Let's Get Started!

1. **CHARACTERISTICS AND CAPABILITIES.**

a. **Capabilities.** The 3,000 Gallons Per Hour (GPH), Light, Medium, Tactical (LMT), Water Purification System (3000 LMT) is capable of purifying a fresh water source (less than 1,500 TDS) at a rate of 3000 gallons per hour. The unit was designed to be transported by tactical vehicle or air lifted by helicopter to remote sites. The unit can also perform numerous additional functions such as decontamination, fire fighting, and irrigation.

b. **Characteristics.** The 3000 LMT weighs 680 lbs, is a frame mounted, skid based, diesel operated, diatomite type unit, that requires 2 Marines to operate. The 3000 LMT uses three different chemicals for the filtration and storage process.

(1) **Chlorine.** The Chlorine is used to kill bacteria in the water and to prevent its growth during storage. The chlorine comes in a granular form and is mixed with water into a solution.

(2) **Polymer.** Polymer is a coagulant used to aid in the filtration process. Polymer creates a chemical reaction in which two or more small molecules bond together to form larger molecules. This makes the filtration more efficient.

(3) **Diatomaceous Earth.** Diatomaceous Earth (D.E.) is any class of minute planktonic unicellular or colonial algae with solidified skeletons that form a diatomite, which is a light friable siliceous material derived chiefly from diatom remains and used especially as a filter. D.E. is a white powdery substance similar in appearance to flour and baking soda. The D.E. is going to be forming a cake on your filter elements to perform the filtration process.

2. DESCRIPTION OF COMPONENTS.

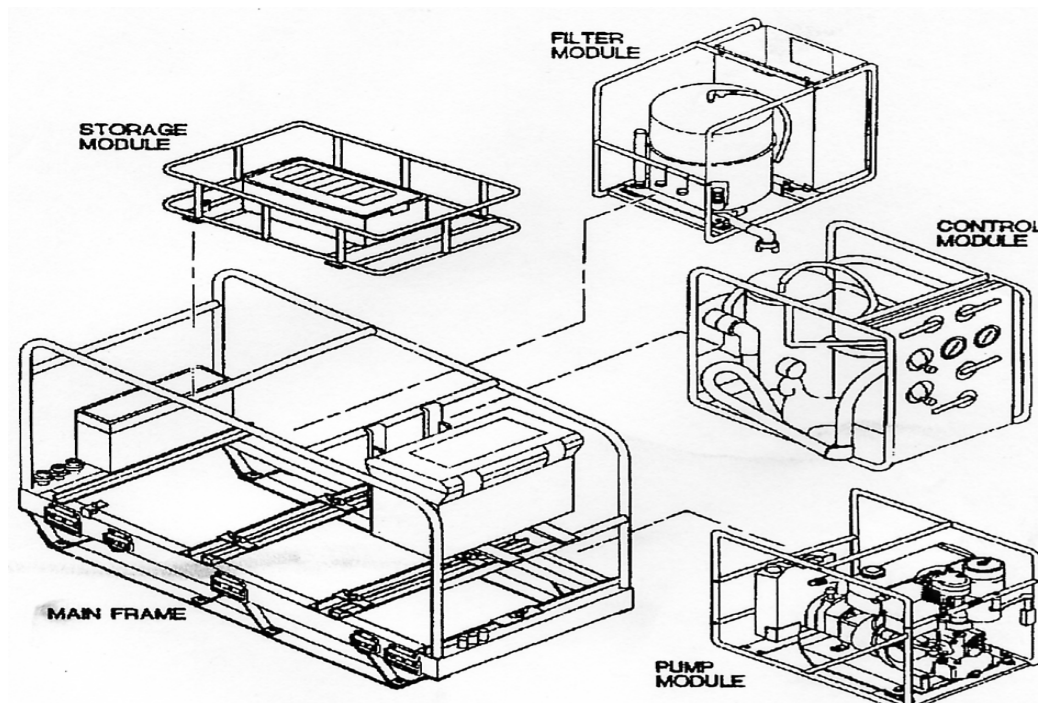


Fig 1-1

a. **Main Frame.** The main frame holds four modules, the pump module, control module, hose storage module, and the filter module (See fig 1-1). Additionally the main frame also consists of storage containers for the tools and equipment required to run the unit (SL-3). These containers are located in the Hose Storage module and on the main frame. This equipment is as follows:

(1) 1- Tool kit. This tool kit will contain all the tools you need to perform maintenance and conduct normal operation of the 3,000 LMT.

(2) Three 10'x 2" suction hoses, three 25'x 2" suction hoses, one 50'x 2" pump discharge hose, one 50'x 2" waste hose, and 50'x 1-1/2" fresh water hose, and a 50'x 1-1/2" fire hose with nozzle. This can be used in many of the applications mentioned before.

(3) One 2,000 ml D.E. measuring container.

(4) One chlorine measuring container.

(5) One chlorine test kit. This is a common pool type chlorine test kit.

(6) One suction strainer. There is also a stand off ring to keep the strainer off of the bottom of a shallow water source. A buoy is also provided to be used in conjunction with the suction hose. A collapsible priming bucket is provided for use with the 160 GPM. A lifting sling (for helicopter lift).

b. **Pump Module**. The pump module is suitable for a wide variety of fresh and saltwater applications. It is very corrosion resistant because it is made of bronze and stainless steel. The pump is a centrifugal, self-priming, lightweight, air cooled, single cylinder, 4 cycle overhead valve engine with direct fuel injection. It also is rated at 160 GPM, has 1 gallon capacity diesel fuel tank (0.4 Gallons Per Hour consumption at 3600 RPM and 0.3 Gallons Per Hour at 3250 RPM), and uses 1 quart of 30-weight oil.

c. **Control Module**. The control module houses the D.E. slurry tank, Chlorine reservoir, gauges, operating valves, ratio feeder adjusting knobs, and various piping systems.

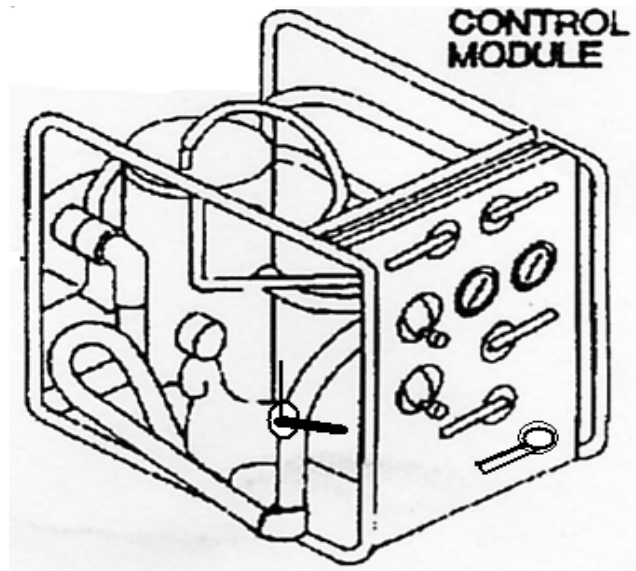


Fig 1-2
SO 5

(1) D.E. Slurry Tank. The D.E. slurry tank stores the D.E. slurry mixture. The D.E. is what actually filters the water. When the D.E. adheres itself to the filter, it is then called a pre coat or a filter cake.

(2) Chlorine Tank. The Chlorine Storage tank stores the chlorine slurry mixture. Chlorine is a disinfectant that kills bacteria in the water, which in turn helps keep the water safe for consumption.

(3) Gauges. These are used to monitor the operation of the 3000 LMT and indicate to the operator when the unit needs backwashing or any other maintenance.

(4) Chemical Feeders. Used to adjust the amount of chemicals introduced into the unit. The feeders measure on a scale of 0-10 with the optimum setting of 5.

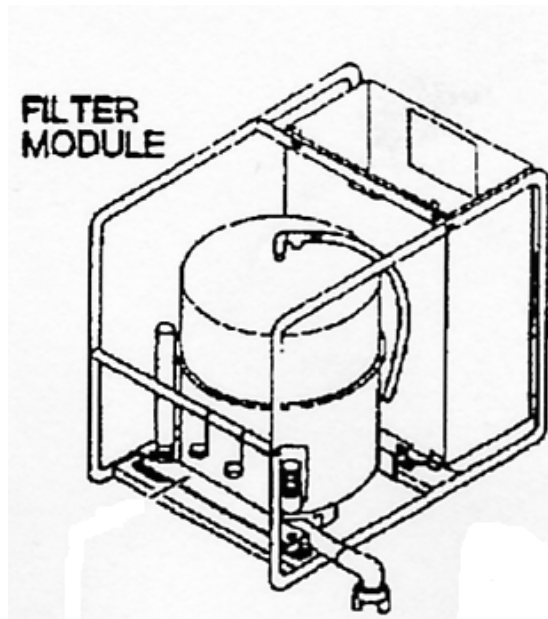


Fig 1-3

d. **Filter Module**. Contains the filter segments on which the D.E. is layered. The grade of the D.E. and the consistency of the filter cake is what will determine the filtering efficiency of the unit. The module also houses a compartment for D.E. storage.

(1) Storage Bin. Attaches to the main LMT frame and can be used to hold one bag of D.E. or to store equipment relevant to the LMT.

(2) Polymer Jug. Holds five gallons, contains the water/polymer mixture used in the filtration process. The jug itself has a quick disconnect adapter located near its handle. This allows the jug to be connected to the control module via a chemical feed hose.

3. SETUP PROCEDURES.

a. Site Selection.

- (1) Place the unit on firm flat level ground.
- (2) Upstream from camp.
- (3) Adequate cover and concealment.
- (4) Sufficient road networks (for distribution).
- (5) Good drainage area

b. Pump Placement. The unit can be used as a complete system without to remove the pump from the main frame. Place the LMT or just the pump module and hoses **within 25 feet of the water source, but no more than 20 feet above the water source.**

c. Installation.

(1) Set up 3,000 gallon storage tanks. Ensure there are enough tanks set up to store the appropriate amount of water needed to meet mission. Install one additional tank to use for backwash and wash down procedures.

(2) Connect a suction strainer and buoy to the end of suction hose. Connect a 2" suction hose to pump inlet.

(3) If the Pump is still in the unit, connect the control module inlet to the pump. If the pump has been placed by the source, attach a 50'x 2" discharge hose from pump outlet to control module inlet.

(4) Connect a 50'x 2" waste hose to the waste water discharge port located on the back of the control module, and set the other end of the hose at the drainage point

(5) Connect a 50'x 1-1/2" fresh water hose to the fresh water discharge port located on the back of the control module and set end of hose near storage tanks. **"DO NOT"** place fresh water discharge hose into storage tanks until required water tests have been performed.

(6) Connect the two 2" quick disconnect couplings from the control module to the filter module.

(7) Connect the quick disconnect chemical feed line to the connector on the polymer jug.

d. **Preposition Valves and Switches.** Preposition of valves and switches is where you the operator set all the valves and chemical feeders to startup position.

(1) Move the control valves to the "Start Up" position (W-O-F-F-C-C). Clean Water Valve # 1 is set to Waste. Waste Outlet Valve # 2 is On. Backwash Valve # 3 is set to Filter. Pre-coat Filter Valve # 4 is on Filter. D.E. Slurry Valve # 5 is set to Closed. Chlorine Reservoir Valve # 6 is set to Closed.

(2) Attempt to set the D.E., Chlorine, and the Polymer feeders to zero. If the feeders do not move do not force it. Try to adjust them again once the unit is running.

(3) Close petcocks on top, and bottom of the water motor. This is located right behind and at the bottom of the control panel on the control module.

(4) Close drain valve underneath the Chlorine reservoir. If you fail to do so, when you add the Chlorine it will pour back out the waste line.

(5) Close drain valve underneath the D.E. tank.

(6) Ensure drain plug is in filter.

(7) Check filter clamp for serviceability and tightness. The clamp should only be snug, not over tightened.

(8) Open the filter module top vent valve.

(9) Close the drain petcock on the pump housing. Open pump primer port to prime the pump with a bucket of water. The pump can also be primed by removing the suction strainer and pouring water through the suction hose into the pump housing. Pour the water into the end that had the strainer attached. Pour enough water to fill the pump housing at least halfway.

e. **Chemical Mixes.**

(1) Mix **16oz. of dry chlorine with 3 gallons of water** in a separate bucket. Mix until all Chlorine is dissolved. While pouring chlorine into the chlorine reservoir ensure that no granular chlorine is left. If there are any grains left, simply keep mixing the solution until all chlorine is dissolved. While handling chlorine, ensure the use of the proper protective equipment, which includes goggles, or face shield, dust mask, protective gloves and, a protective apron.

(2) **Mix (185 ml) or 6.3 fl oz. of polymer with 5 gallons of water** in the 5-gallon polymer can.

(3) **Load 10,000 ml of DE** (5 scoops of 2000 ml) into the DE slurry. Then secure the clamp and ensure that the vent is open. While handling D.E., be sure to use a dust mask.

4. **BEFORE OPERATION CHECKS AND SERVICES.**

a. **3,000 LMT.** Check for loose, missing, and broken bolts or nuts. Check the gauges for obvious damage or improper calibration. Inspect fittings and connections.

b. **The Pump Module.**

(1) Perform a 360-degree visual inspection on the pump. Look for loose or missing nuts and bolts, fuel and oil leaks and, any obvious signs of damage.

(2) Check the fuel level in tank. If low, refill with JP8 (diesel) only.

(3) Check the oil by observing the oil level on the dipstick. The dipstick is located on the lower left side of the motor while facing it. Refill with the appropriate oil according to Fig 3-1 and the ambient temperature.

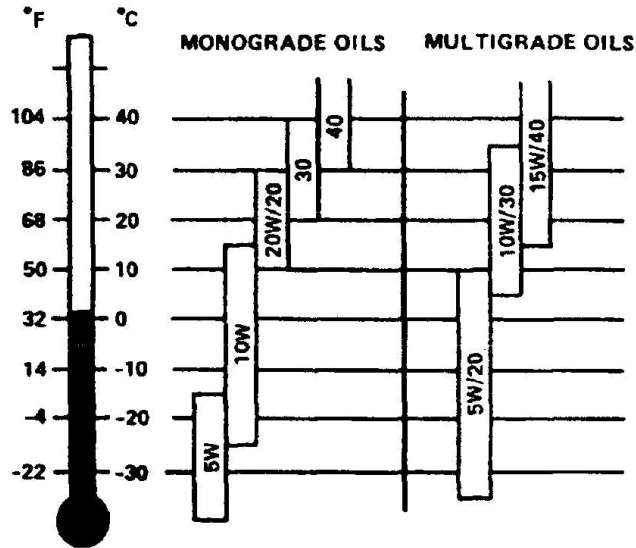


Fig 3-1

(1) Check the air cleaner cyclone by observing the clear plastic for any debris or other foreign matter.

(ON SLIDE #74)

5. STARTUP PROCEDURES.

a. Put the automatic decompression device in the starting position by turning it clockwise until you hear an audible click, and then add $\frac{1}{4}$ turn.

b. Set the speed-regulating lever to the full throttle position.

c. Pull out extra fuel button if needed for cold weather starting. This is located on the front of the motor underneath the crank handle port.

d. Insert the crank handle into the crank handle guide.

e. Using your left arm, to avoid injuries, crank the engine rapidly in a counterclockwise manner approximately eight times before compression is encountered and engine starts.

f. Remove crank handle from guide and properly clamp it to pump frame.

g. Run engine at half speed for two minutes or until suction has occurred.

h. After suction has occurred, bring engine to full speed. If you are running a pump that is not in the main frame, bring the pump to half speed (*this is for the units that are running a discharge hose between the pump and the control module in order to preserve the hoses due to the high rate of usage here at Utilities Instruction Company*).

i. At this point your filter module is filling with water. Close the filter vent valve once a steady stream of water flows from the vent hose.

j. Move valve #4 to pre coat the position and note the time. Once you have done this you are sending water through the DE slurry tank and starting to form a coating on your filter module. This takes about eight minutes.

k. Close the D.E. slurry vent valve once a steady stream of water flows from the vent.

l. Open the chlorine reservoir valve #6, until it fills up the tank to approximately 2" from the top, then close.

m. Adjust all three feeder heads to a setting of 5.

n. Open the injector valves (bleeders) for each feeder head to ensure there is a full-pulsed water flow. The chlorine, D.E., and polymer bleeders are gray plastic components located behind the control module panel within close proximity of each other.

o. After approximately 8 minutes the filter should be observed through sight-glass for a good D.E. cake on the filter elements.

p. If there is a good cake on the filter, set valve # 4 to filter. After this wait approximately one minute to allow the water to flow normally through the system.

q. Set clean water valve # 1 to clean water. Check the turbidity level of the water and the chlorine content. The chlorine level should be between 1.0 and 2.0 PPM. The turbidity level should not be higher than 1.0 NTU's. If the product water has met these standards, the clean water hose can be placed in the storage tanks.

6. **CONDUCT DURING OPERATION CHECKS AND SERVICES.**

a. **At 30-Minute Intervals, Monitor the Following.**

(1) Check the D.E. tank for slurry mixture. Remove the D.E. tank lid and observe the clarity of the mixture as well as the level. When liquid level reaches the low level mark, add one 2000 ml measure of D.E. and fill with water. Do not run with the mixer blade exposed to air, as the slurry mixture will be inhibited.

(2) Check the Polymer feed tank level. When the five-gallon jug becomes low, add another 153 ml of polymer and five gallons of water.

(3) Diesel fuel remaining.

(4) Take chlorine samples from product hose and make adjustments as necessary to the chlorine feeder control knob. Ensure the chlorine level of the water in the storage tanks remains between 1.0 and 2.0. If the level drops below the desired level follow batch-chlorinating procedures.

(5) Yield of raw water source. For example: a pond, tank or reservoir.

b. **Monitor the Following Gauge Readings.**

(1) The raw water pump suction gauge (located on the suction port of the pump) should read between 15 PSIVAC to 15 PSI.

(2) The raw water flow gauge (located on the side of the control module connected to the inlet hose) should read between 15-35 GPM.

(3) The raw water inlet gauge (located behind the raw water flow gauge) should read between 0-35 psi. This gauge will pulse between the max and minimum (0 to 35 psi) when operating correctly.

(4) Filter Differential Gauges. These are located on the front of the control module.

(a) The filter inlet gauge should read 0-40 psi.

(b) The filter outlet gauge should read 0-18 psi.

7. **SHUT DOWN PROCEDURES.**

a. **Short Shut Down.**

(1) Events Requiring Short Shutdown. The short shut down will be used for occasions when the equipment is being shut down for less than 8 hours. Some circumstances that may require this are as follows:

(a) The raw water level is low. The water level is monitored almost constantly. You as an operator should never allow the unit to run without sufficient water.

(b) The product water tanks are full. If you have fulfilled your mission requirements and anticipate restarting the unit within the next eight hours, you may then perform a short-term shutdown.

(c) There is an interruption in the normal operation cycle. If for any reason such as, but not limited to, a busted hose, a cracked filter module, a severe leak, or pump malfunction occurs perform a short shut down.

(d) When the unit will be shutdown for less than 8 hours. If there are any uncovered reasons that the unit will not be ran for eight hours, perform a short shutdown.

b. **Procedures for Short Shutdown.**

(1) Remove the product water hose from the tank. This is to prevent any contamination of the product water during shut down and start up procedures.

(2) Turn valve # 1 to waste. Water is no longer going out the product line and is now flowing through the waste hose into the drain.

(3) Turn valve # 3 to "Backwash".

(4) Bring the engine to the idle position for a short period to cool it down. Then hold the speed-regulating lever in stop position until the engine has come to a complete stop.

c. **After Operation Preventive Maintenance Checks.** These are a few basic checks that you the operator would perform after shutting the system down.

(1) Perform a 360-degree inspection of the pump and 3,000 LMT itself. You would be looking for any obvious signs of damage, loose or missing nuts and bolts and, any cracks or leaks.

(2) Check the oil level in the pump motor. Refer to Fig 3-1 for the type to refill with.

(3) Check the air cleaner cyclone for clarity and obvious debris buildup.

(4) Check the fuel level. If you are going back into operation or not, it is always good to ensure that you have sufficient fuel in the tank to restart with.

7. **RESTARTING PROCEDURES.**

a. To restart the unit, perform start up procedures (Main Idea 4. steps a-q).

b. Check for proper D.E. cake on the filter. If the cake is adequate, start the filtering process.

c. If the D.E. cake is inadequate, add 2,000 ml of D.E. and set valve #4 to pre-coat until a proper cake has formed.

8. **PREVENTIVE MAINTENANCE SERVICES.** The preventive maintenance services are broken up between operational preventive maintenance procedures and periodic preventive maintenance procedures. The operation preventive maintenance procedures (P.M.) are various courses of action that the operator would employ during and after operation to maintain operational status of the equipment. The periodic P.M. procedures are done hourly and or annually to prolong the life of the equipment.

a. **Operational Preventive Maintenance Procedures.** The operator performs the following procedures while the equipment is being utilized. These procedures include Backwashing the system, and an Open Filter Housing Wash down.

(1) **Backwashing.** Backwashing is a process in which all the debris and D.E. that have been collected on the filter

element are washed off by running water through the system in reverse (backwash). This is a normal and frequent occurrence depending on the quality of water being filtered. The dirtier the water, the more often the unit will require this.

(a) Events Requiring Backwash. If in normal operation any of the follow takes place, you will need to perform a backwash.

1. If the **filter inlet pressure gauge exceeds 25 PSI higher than that of the filter outlet gauge**. This means that there is excessive build up of debris on the filter element and the clean water is encountering too much resistance to get through the filter. This can eventually cause the next problem as well.

2. If the turbidity level rises over 1.0 NTU's. This would more often be a result of excessively high filter inlet pressure and the contaminants would be forced through the filter. Another cause of this would be that part of the filter cake may have become dislodged from the filter element. This would allow debris to flow through.

(b) Backwashing Procedures. These are the steps to follow to perform a backwash.

1. Remove the product water hose from the tank. This is to prevent any contamination of the water in storage.

2. You must then purge the system of D.E. to prevent any build up of D.E. on the clean water side of the filter element. To do this (*WHILE IN OPERATION*) you must first open the drain on the D.E. tank and allow all the D.E. to drain out. While the D.E. is draining, clean out the tank using the sampling hose.

3. Turn the D.E. feeder to 10 and open the bleed valve until the pulse of water is clear. (*Use caution when adjusting the feeder head. If the feeder dial is adjusted above 10 the internal part may malfunction. If this takes place the pump head will require re-calibration*). After all the D.E. has been purged from the system close the drain valve at the bottom of the D.E. tank, close the D.E. bleed, and set the D.E. feeder to 0.

4. Now set the valves to "Backwash-A" in this order. If valves are not adjusted in this order there is a

risk of busting the filter module as a result of having both valve #2 and valve #5 closed or off at the same time. You will remain in "Backwash-A" for one minute. The following are valve settings for "**Backwash-A**".

- a. Turn valve #1 to **waste**.
- b. Turn valve #2 to **off**.
- c. Turn valve #3 to **backwash**.
- d. Turn valve #3 to **open**.

5. After one minute of "Backwash-A" turn the valves to "Backwash-B". This would last for fifteen seconds. "**Backwash-B**" settings only require you to move one valve. Turn valve #3 to the filter position.

6. Steps 4 and 5 will be repeated 3 more times for a total of 4 cycles. While backwashing the unit, gently rock the filter module back and forth to assist the removal of debris from the filter element.

7. Upon completing the Backwash cycle, replenish 10,000 ml of D.E., repeat start up procedures and, put back into operation.

b. **160 GPM Pump Preventive Maintenance**. These are procedures that will be performed hourly and or annually. These services are to prolong the life of the equipment and identify any defects on the equipment.

(1) Pump Maintenance.

(a) The oil and filter must be changed after the first twenty hours of operation. Subsequent oil changes must be performed after each 100 hours of operation. If the unit is not ran for 100 hours, an oil change would be performed annually. To perform oil changes, follow the steps below:

1. Perform oil change on a warm engine.
2. Remove oil filler cap.
3. Place a container under the oil drain plug. Using the proper sized wrench, remove the drain plug and allow oil to drain completely.

4. Remove the oil filter with a strap wrench or by hand if possible. Dispose of the oil filter in accordance with local HAZMAT procedures.

5. Coat new oil filter O-ring with fresh oil and install hand tight. **DO NOT OVER TIGHTEN.**

6. Replace drain plug and fill crankcase with approximately one quart of new oil (see Fig 3-1 for oil selection).

7. Recheck engine oil level. **DO NOT OVERFILL.**

8. Replace the oil fill cap.

(b) The fuel filter must be replaced every 2000 hours. You will also need to replace the filter if you discover contaminated fuel in the tank and if water gets into the fuel.

1. To replace the fuel filter, use a fuel line clamp and clamp the fuel hose going into the filter to prevent the tank from draining.

2. Remove the hose clamps and then the fuel filter. Dispose of used fuel filter in accordance of local HAZMAT standards.

3. Install the new fuel filter ensuring the arrow on the filter is going in the appropriate direction.

4. Tighten hose clamps and remove the fuel line clamp.

(c) The air filter must be replaced every 500 hours or annually. You will also need to replace the filter if looks excessively dirty.

1. To replace the air filter, disconnect the three clips holding the air filter housing.

2. Remove & discard old filter and replace with a new filter. Reinstall housing and reattach retaining clips.

9. **LONG TERM STORAGE PROCEDURES**. These procedures are used when the unit will be shut down and prepared for storage.

a. **Long Term Shutdown.** A long term shutdown is used for when the unit will not be run for **more than eight hours**. When the unit is not in constant use, the chemicals may build up and cause problems in the unit itself. The cake on the filter may start to grow bacteria as well and alter the taste of the product water.

(1) Events Requiring Long Shutdown.

(a) If the unit will not be ran for more than eight hours you will have to perform a long term shutdown. An example of this is if you have met your mission requirements and do not expect to produce more water for a period of time that exceeds eight hours.

(b) You would perform a long term shutdown prior to the exercise ending. This would always be immediately followed by an open filter wash down. This is when you would purge the unit of all the chemicals and debris that have and are collecting inside.

(c) If you are packing up to move to another location or water point, you would perform a long term shutdown. While moving from one location to another, you do not want to have chemicals still inside the unit nor would you want a D.E. cake still on the filter.

(2) Procedures for Long Shutdown.

(a) If in operation, open drain on chlorine tank and D.E. tanks. Put control valves in start up position (*WOFFCC*), and allow the system to drain for approximately three to five minutes. If the system does not drain, perform a short shut down and drain and clean the chemical tanks. Close the drain valves and refill with clean fresh water.

(b) Once all **the chemicals are drained** (*WHILE IN OPERATION*), replace polymer with clean fresh water and close all drain valves.

(c) Open **all chemical injectors** and set all chemical feeders to 10. Allow unit to operate in start up position until all chemicals D.E., Polymer, and Chlorine are bleed from the lines and only a **clear stream pulses out the injectors**.

(d) At this point you would perform backwash procedures as in steps (b) 4 to (b) 8 from Preventive maintenance services operational maintenance.

(e) Following the backwash shut down the unit by performing a short shutdown. Then open all drains and drain the unit fully.

b. **Open Filter Wash Down.** This procedure is used for washing out the filter housing with the filter top half removed prior to storing the unit. A Filter Housing Wash down is also used when the filter has an excessive buildup of debris and sediments and a backwash can not solve the problem.

(1) Perform a backwash to the unit. This is to purge the unit of D.E. while operating during the filter wash down. Perform a short term shutdown on the unit.

(2) Following this you will need to remove the drain plug from the bottom of the filter module.

(3) Disconnect the two 2" quick disconnects from the control module to the filter module. Allow water to drain all the way.

(4) Install the 2" plug into the upper filter hose on the control module. This will prevent water from flowing freely through here and enable higher water pressure for the wash down.

(5) Using the ratchet and socket provided in the toolbox, remove the filter clamp. Remove the filter module upper half. Next, remove the o-ring around the filter module. Then, remove the filter element and set it carefully on the ground next to the unit.

(6) Set the control valves to the following settings:

(a) Valve #1 **Waste.**

(b) Valve #2 **On.**

(c) Valve #3 **Backwash.**

(d) Valve #4 **Filter.**

(e) Valve #5 **Close.**

(f) Valve #6 **Close**.

(7) At this point you are now ready to set up your pump. **You will be using water from the best available source such as your product water.** Have a separate tank set up to use for this. Set your pump up close to this tank and attach a suction hose to the tank. You may instead attach a strainer and buoy to the hose and set it into the tank. Ensure that there are no kinks in the hose going to the control module.

(8) Start the pump and run it at $\frac{3}{4}$ throttle (70%) and check for water flow from the waste hose.

(9) Squeeze the nozzle of the sampling hose to allow water to flow.

(10) Turn valve #2 to the OFF position. This stops water from flowing out of the waste line and increases the pressure in the sampling hose. Do not allow the system to operate at maximum power for more than two minutes at a time without water flowing from either the sampling hose or from the waste outlet valve #2, otherwise damage will occur from high pressure.

(11) While the valves are set in this position, begin to spray down the unit, the filter, the filter module, chlorine, and the D.E. tanks.

c. **Draining for Cold Weather & Storage**. Before performing the following steps, ensure that the long term shutdown and the open filter wash down have been completed. This procedure will be performed every time the unit is put into storage. This will also keep pipes and valves from freezing with water during cold temperatures.

(1) Prior to disassemble, a long term shutdown and an open filter wash down should always be performed. The chemical systems should be thoroughly flushed and cleaned with clean water.

(2) Disconnect and drain all hoses. Ensure that the hoses are still serviceable and have the proper o-rings installed in the female end.

(3) Open the drain cocks on the bottom of the 160 GPM pump, the top and bottom of the water motor and, open the drain valves on both the D.E. and the chlorine tank.

(4) Remove the filter plug located on the bottom of the filter module. Disconnect the two hoses connected to the filter module (remove the plug if necessary).

(5) Open both the D.E. and filter vents.

(6) Set all valves on the front panel to the left position. This will allow the water to drain straight out of the system.

(7) Remove, clean and, drain the clear plastic sediment bowl located near the raw water flow gauge and the pilot valve (also known as the skinner valve).

(8) Stretch out the sampling hose and squeeze the nozzle. This will allow the water in the hose to drain fully out.

(9) Tipping the unit slightly towards the rear may be helpful in draining the unit.

(10) Perform a Limited Technical Inspection (Preventive Maintenance Checks) of the equipment. This is done with an LTI sheet upon completion of this, turn it in to your section head or maintenance chief.

(11) Clean and repack all hoses and accessories. Replace and lock down all the modules and covers.

REFERENCE :**REFERENCE#**

Standards for Potable Water (Jul 99)	BUMEDINST 6240.10A
Safe Drinking Water (Apr 78)	DODD 6230.1
Water Purification, Supply and Related Equipment (CD-ROM) (Jul 00)	EM 0077
Federal, State and Local Environmental Regulations	ENVIRONMENTAL REGS
Camouflage, Concealment and Decoys (Aug 99)	FM 20-3
Preventive Medicine Services (Aug 00)	FM 4-02.17
Storage and Handling of Hazardous Materials (Jan 99)	MCO 4450.12A
Environmental Compliance and Protection Manual (Jul 98)	MCO P5090.2A
Engineer Forms and Reports (Oct 97)	MCRP 3-17B
Environmental Considerations in Military Operations (Jun 00)	MCRP 4-11B
Bulk Liquid Operations (Aug 96) w/Erratum (Jun98)	MCWP 4-11.6
Manual of Preventive Medicine, Chapter 5, Water Supply Ashore (Oct 98)	NAVMED P-5010-5
Manual of Preventive Medicine, Chapter 9, Preventive Medicine for Ground Forces (Jun 91)	NAVMED P-5010-9
Components List for Tank, Fabric,	SL-3-01034

Collapsible, Water Storage, 3,000
Gallon (Dec 96) w/Ch 2 (May 98)

Occupational and Environmental
Health: Sanitary Control and
Surveillance of Field Water
Supplies (Mar 86)

TB MED 577

The Soldier and the Environment
(May 01) w/Ch 1 (Oct 01)

TC 3-34.489

Operators and Maintenance
Instructions for the Water
Purification System, Model 3000
LMT (3,000 GPH Light, Medium,
Tactical) (Feb 94) w/Ch 1 (Mar 99)

TM 010334E-
12&P/1

Operation and Maintenance
Instructions for the Water
Purification System, Model 3000
LMT 3,000 GPH Light, Medium,
Tactical) (Feb 94) w/Ch 1 (Mar 99)

TM 09777A-
14/1

Operator and Unit Maintenance
Manual (Including Repair Parts
and Special Tools list) for Water
Quality Analysis Set:
Purification (WQAS-P) (Jun 01)
w/Ch 1 (Mar 02)

TM 10-6630-
222-12&P

Ground Equipment Record
Procedures (Jul 95) w/Ch 1 (Mar 02)

TM 4700-15/H

User's Logistics Support Summery
For Water Quality Analysis Set,
Purification WQAS-P) (Nov 03 Draft)

ULSS 009302-
15A

