

TECHNICAL MANUAL
OPERATOR'S MANUAL
FOR
WATER PURIFICATION UNIT,
REVERSE OSMOSIS,
600 GPH TRAILER MOUNTED,
FLATBED CARGO,
5 TON 4 WHEEL TANDEM ROWPU,
MODEL WPES-10 (4610-01-341-6289)
MODEL H-9518-1 (4610-01-420-7547)
AND
600 GPH SKID MOUNTED ROWPU,
MODEL WPES-20 (4610-01-341-6288)
MODEL H-9518-2 (4610-01-420-7546)
MODEL WPES-30 (4610-01-341-6287)
MODEL H-9518-3 (4610-01-420-7548)

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HEADQUARTERS, DEPARTMENTS OF THE ARMY
AND AIR FORCE
SEPTEMBER 1992

ELECTRICAL HIGH VOLTAGE CAN KILL YOU

Electrical high voltage cannot be seen but it can kill you. Electricity is unlike most other dangerous things you can come in contact with because it gives no warning and no symptoms to be wary of. Its effect is immediate. It can kill you, render you unconscious, or severely burn you. To ensure your safety and that of other maintenance personnel, always observe the following precautions:

DO NOT perform any maintenance on electrical equipment unless all power is removed.

BE CERTAIN that there is someone assisting you who can remove power immediately.

ALWAYS place **POWER OFF** warning tags on power supply switches so that no one will apply power while you are performing maintenance.

WARNING

FOR ARTIFICIAL RESPIRATION, REFER TO FM 21-11.

WARNING

DANGEROUS CHEMICALS CAN KILL YOU

The chemicals used for operation in the ROWPU can kill you. Breathing some of the chemicals used in the ROWPU system can cause severe headaches, dizziness, loss of muscular control, a sleepy feeling and coma. Brain damage, eye injury, severe skin damage, or death can result from heavy exposure. The chemicals alone or in a mixture can be very dangerous without good air movement. These precautions must be followed to ensure safety when handling or mixing chemicals.

ALWAYS wear protective clothing (rubber gloves, goggles and apron) while handling dangerous chemicals.

NEVER get too close to or breathe dangerous chemicals.

ALWAYS make certain that a good clean water supply is available to flush away any chemicals that might come in contact with the body.

BE alert at all times during operation for chemical odors and exposure symptoms. If either is present, **IMMEDIATELY VENTILATE** personnel compartments. If symptoms persist, remove personnel to fresh air.

To prevent contamination of product water system, do not use discharge hoses intended for potable product water in the raw water system. Product water hoses are identified by a blue stripe running the full length of the hose. **VENT VESSELS** and **WASTE** hoses must be placed at least 25 yards down stream of raw water intake.

DO NOT dispense product water to product water tanks until TDS percent rejection is at least above 96.5% according to Table 2-3.2, less than 1000 ppm TDS, and chlorine residual is 2 ppm.

WARNING

NOISE CAN DAMAGE YOUR HEARING

Operating level of the generator set powering the ROWPU can cause hearing damage. Ear protectors, as recommended by the medical or safety officer and supplied in the component boxes, must be worn when working within 12 feet of this set.

WARNING

EXHAUST GASES CAN BE FATAL

Generator sets must not be operated in enclosed areas unless exhaust discharge is properly vented to the outside. Be alert at all times during operation for odors and exposure symptoms.

WARNING

HEAVY EQUIPMENT

Some accessory components used to make the ROWPU operational are very heavy and difficult to handle. Don't try to move heavy equipment by yourself. Get other personnel to assist you when moving, positioning, loading or unloading heavy equipment.

**CHANGE
NO. 3**

**TM 10-4610-241-10
TO 40W4-13-41**

**HEADQUARTERS
DEPARTMENTS OF THE ARMY AND AIR FORCE
WASHINGTON, D.C., 30 NOVEMBER 2004**

**OPERATOR'S MANUAL
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WATER PURIFICATION UNIT, REVERSE OSMOSIS
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MODEL WPES-30 (4610-01-341-6287)
MODEL H-9518-3 (4610-01-420-7548)**

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Operator's Manual
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5 TON 4 WHEEL TANDEM ROWPU,
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NO. 1

**Operator's Manual
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WATER PURIFICATION UNIT, REVERSE OSMOSIS,
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5 TON 4 WHEEL TANDEM
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(4610-01-341-6289)
and
600 GPH SKID MOUNTED ROWPU MODEL WPES-20
(4610-01-341-6288)
MODEL WPES-30
(4610-01-341-6287)**

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Date of issue for the original manual and changed pages are:

Original 15 Sept 92
Change 1 1 Feb 94
Change 2 15 Sept 97
Change 3 30 November 04

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TECHNICAL MANUAL
NO. 10-4610-241-10

HEADQUARTER&DEPARTMENTS OF
THE ARMY AND AIR FORCE
WASHINGTON, D.C., 15 SEPTEMBER 1992

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MODEL H-9518-3 (4610-01-420-7548)**

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this bulletin. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028(Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual directly to Commander, U. S. Tank-Automotive and Armaments Command, Attn:AMSTA-AC-NML, Rock Island, IL 61299-7630. You may also submit your recommended changes by E-mail directly to amsta-ac-nml@ria-emh2.army.mil, or fax number 309/782-0726/DSN 793-0726. A reply will be furnished directly to you. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028.

For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, Section VI, T.O. 00-5-1. Forward to Commander, WR-ALC/LZD, Robbins AFB, GA 31098-5609.

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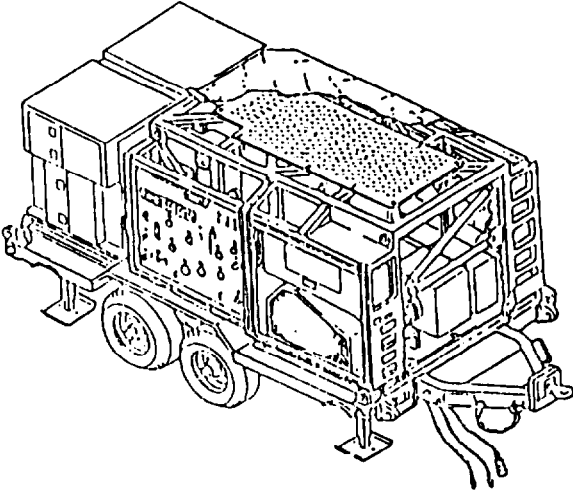
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HOW TO USE THIS MANUAL

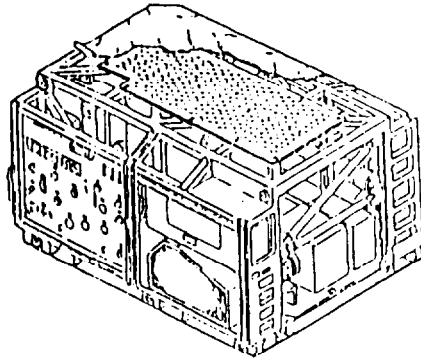
Be sure to read all Warnings before using your equipment.

This manual contains operating and maintenance Instructions for the operator of the 600 GPH ROWPU.

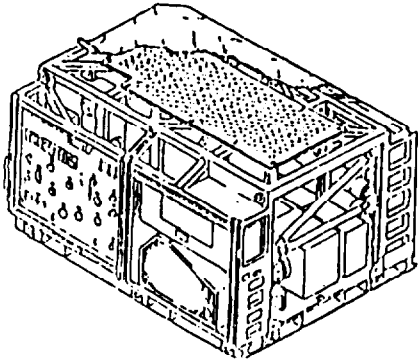
- Chapter 1 - Introduces you to the equipment and gives you information such as weight, height,, length, generally used abbreviations and information on how the unit works The chapter is preceded by a full page illustration of the equipment.
- Chapter 2 - Provides information necessary to identify and use the equipment's operating controls. Operating instructions in this chapter tell you how to use the equipment in both usual and unusual weather conditions. In addition, preventive maintenance instructions provide information needed to inspect and service the ROWPU.
- Chapter 3 - Provides operator troubleshooting procedures for identifying equipment malfunctions and maintenance instructions for performing operator maintenance tasks.
- Chapter 4 - Provides operator maintenance instructions for equipment supplied and used with the ROWPU.
- Appendix A gives you a list of frequently used forms and publications referenced or used in this manual.
- Appendix B lists components that are not mounted on the equipment, but are required to make the unit functional. All components in the Components of End Item and Basic Issue Items Listed are illustrated for easy identification.
- Appendix C lists additional equipment authorized for your unit for use with the ROWPU, but are not supplied as part of system. This equipment list may include fire extinguishers, buckets, protective clothing etc.
- Appendix D provides you with information about expendable supplies such as sealants, lubricants, chemicals etc. that are used when operating or maintaining the equipment.



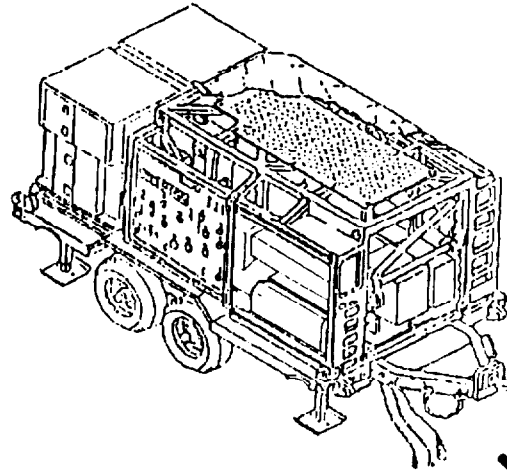
MODEL WPES-10



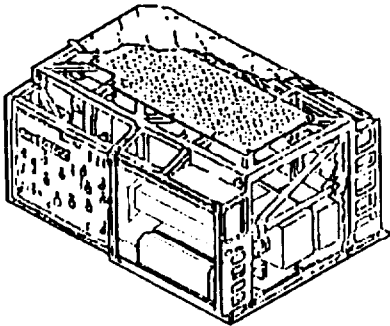
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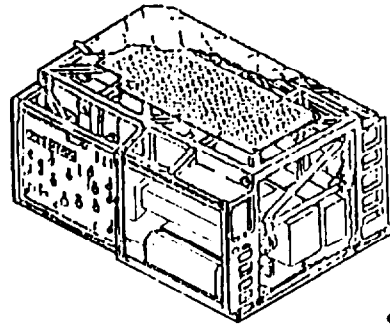
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MODEL H-9518-2



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CHAPTER 1

INTRODUCTION

Section I.	General Information
Section II.	Equipment Description
Section III.	Technical Principles of Operation

Section I. GENERAL INFORMATION

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1-1. SCOPE.

This operator's manual describes the Operating and Operator's Maintenance Procedures for the 600 Gallon Per Hour (GPH) Reverse Osmosis Water Purification Unit (ROWPU), Models WPES-10, H-9518-1, WPES-20, H-9518-2, WPES-30 and H-9518-3. Model WPES-10, NSN 4610-01-341-6289 and Model H-9518-1, NSN 4610-01-420-7547 are the Army ROWPU designations. Model WPES-30, NSN 4610-01-341-6287 and Model H-9518-3, NSN 4610-01-420-7548 are the Navy ROWPU designations. Air Force units are designated by Model WPES-20, NSN 4610-01-341-6288 and Model H-9518-2, 4610-01-420-7546.

1-2. MAINTENANCE FORMS AND RECORDS

Good maintenance records must be kept. Department of Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Air Force personnel refer to MAJCOM and local directives.

1-3. HAND RECEIPT (ARMY).

A companion hand receipt technical manual has been issued with the ROWPU to aid in accounting for all of the end-item related equipment. The hand receipt manual is numbered with TM number of this manual (TM 10-4610-241- 10) followed by "-HR". Hand Receipt Manual TM 10-4610-241-10-HR contains reprinted hand receipts for Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) items. Additional HR manuals may be obtained from the U.S. Army Adjutant General Publications Center, ATTN: AGDL-OD, 2800 Eastern Blvd., Baltimore, MD 21220, in accordance with the procedures in Chapter 3, AR 310-2.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's).

- a. Army. If your ROWPU needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at:

Commander
US Army Aviation and Troop Command
ATTN: AMSAT-I-MDO
4300 Goodfellow Blvd.
St. Louis, MO 63120-1798

- b. Air Force. Air Force personnel submit AFTO Form 22 in accordance with T.O.00-5-1.

1-5. WARRANTY INFORMATION.

The ROWPU is warranted by Engineered Air Systems, Inc. and Highland Engineering, Inc. in accordance with the terms of contract DAAK01-91-C-0178 and DAAK01-95-D-0024. Refer to TB 10-4610-24 1-24 for details of the warranty program. Report all defects in material or workmanship to your supervisor who will take appropriate action.

1-6. SAFETY, CARE AND HANDLING.

Observe all **WARNINGS**, **CAUTIONS** and **NOTES** in this manual. This equipment can be dangerous or may be damaged if these instructions are not followed.

Section II. EQUIPMENT DESCRIPTION AND DATA

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Equipment Data	1-15
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1-7. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

- a. Characteristics. The ROWPU is a mobile water purifying unit that supplies drinking water for troops in the field and water for support equipment.
- b. Capabilities and Features.
 - (1) Capable of providing potable water at a rate of 600 gallons per hour.
 - (2) Purifies raw water that is highly polluted, turbid, colored, salty or contaminated. Raw water source includes lakes, streams, underground wells, ocean, and tanker truck.
 - (3) Deionization cartridges remove Nuclear, Biological and Chemical (NBC) contaminants.
 - (4) Powered by commercial electric power or 30kw generator set.
 - (5) Highly flexible installation to meet varied operating requirements.
 - (6) Easily accessible control panel.
 - (7) Air, rail, and truck transportable.
 - (8) Models WPES-10 and H-9518-1 are supplied with a flatbed cargo trailer designed to provide a mobile platform for operation and transportation of the ROWPU.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

- a. Over Pack. To provide room for all operating components, material is stored in layers inside the ROWPU during transportation and storage. The following paragraphs describe major components which can be identified after unpacking the unit.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

- b. Unit Components. Refer to figure 1-1.

CANVAS COVER (1). Protects unit from weather. Rolled and strapped up during normal operation.

R.O. PRESSURE TUBES (2). Four tubes with eight internal reverse osmosis elements reduce total dissolved solids from filtered water to produce drinking water.

JUNCTION BOX (3). Contains circuit breakers, overload heaters, motor starters, relays, etc. Provides connection of external power for operation of the unit.

CONTROL PANEL (4). Contains meters, gages, valves and hose couplings. Connects accessory items and hoses to ROWPU. Controls system operation.

GROUND ROD (5). Driven into ground and attached to ROWPU to keep operators from getting electric shocks from power source or static electricity. Stored on control panel when not in use.

CONTROL BOX (6). Contains switches to control all pumps and panel lighting.

WATER METER (7). Measures total number of gallons of product water produced by the unit.

TRAILER (8) (Models WPES-10 and H-9518-1 only). Serves as operating and transportation platform for the ROWPU.

COVER PLATE (9). Provides support for canvas cover.

CARTRIDGE FILTER (10). Provides additional filtering (second stage) of water coming out of the multimedia filter.

PULSE DAMPENER (11) (Models WPES-10, WPES-20, and WPES-30 only). Removes pulses from high pressure water to protect R.O. elements.

R.O. PUMP ASSEMBLY (12). Consists of electric motor and high pressure pump. Applies high pressure to system water for operation of reverse osmosis process.

MULTIMEDIA FILTER (13). Provides first stage filtering of raw water.

CHEMICAL FEED PUMP (14). Pumps chemicals from chemical cans into water being processed.

BOOSTER PUMP (15). Forces water from multimedia filter through the cartridge filter and provides a positive head pressure to R.O. pump.

I-8 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

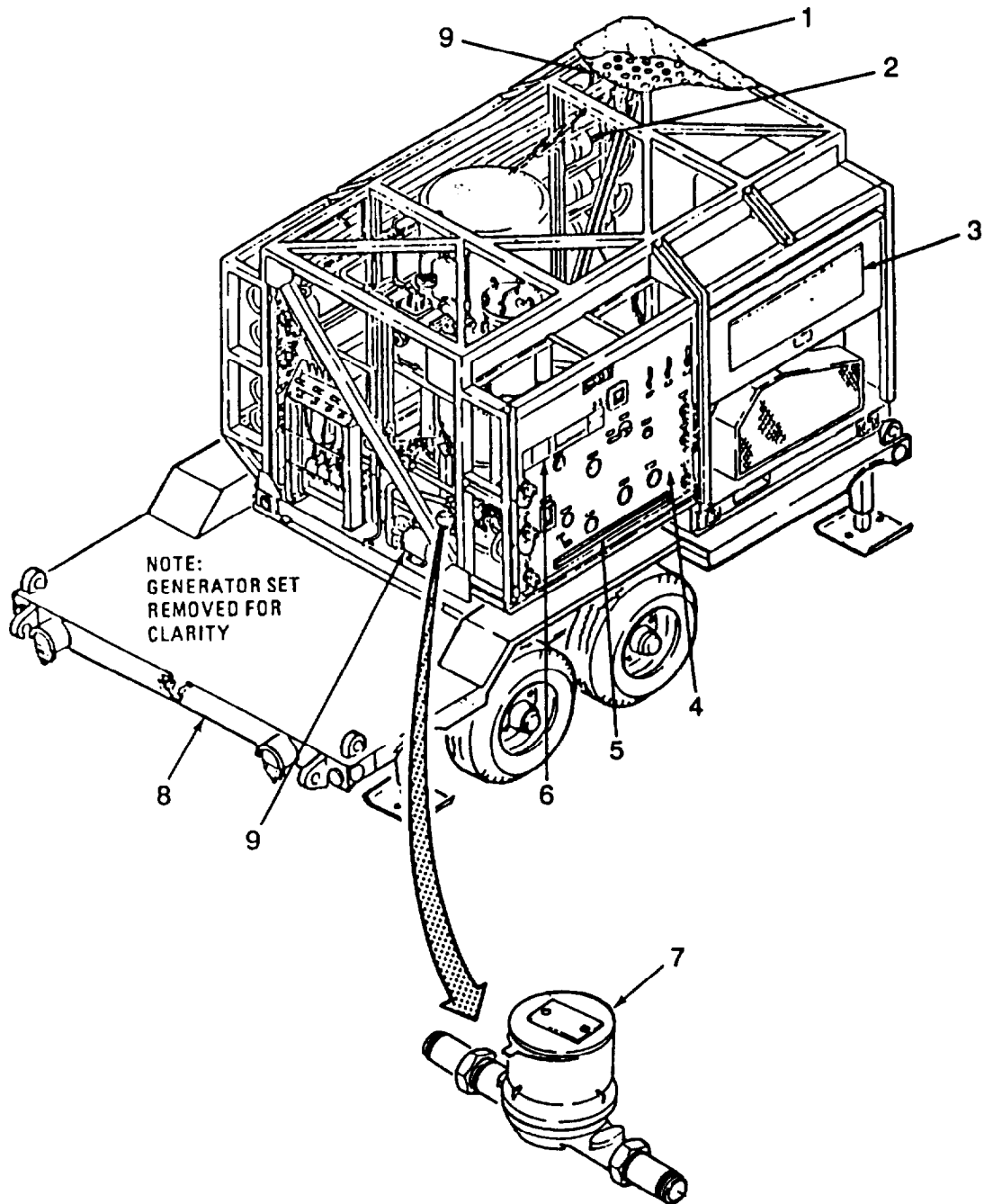


Figure I-1. Unit Components (Sheet 1 of 4).

I-8 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

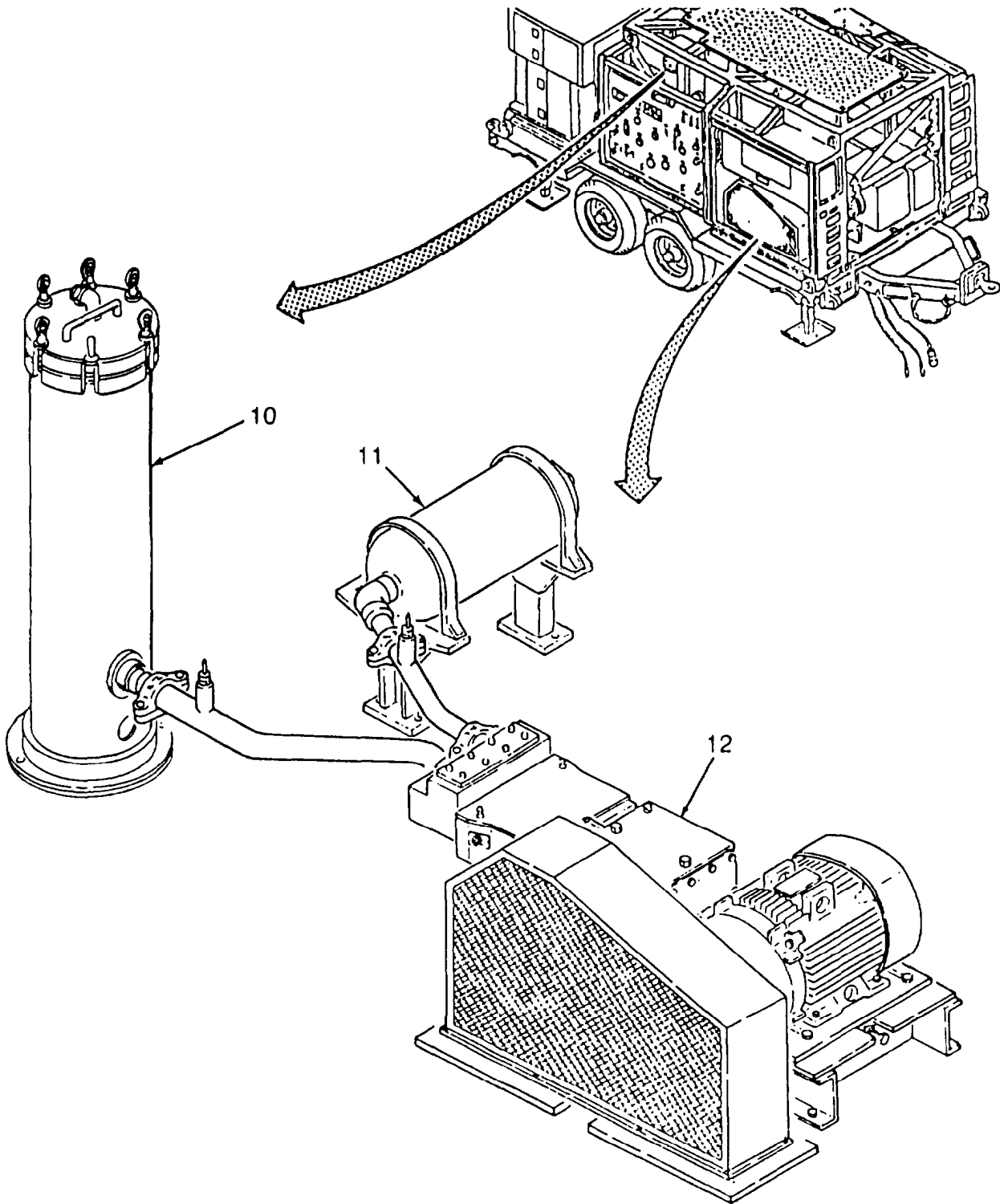


Figure I-1. Unit Components (sheet 2 of 4).
Models WPES-10, WPES-20 and WPES-30 only.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

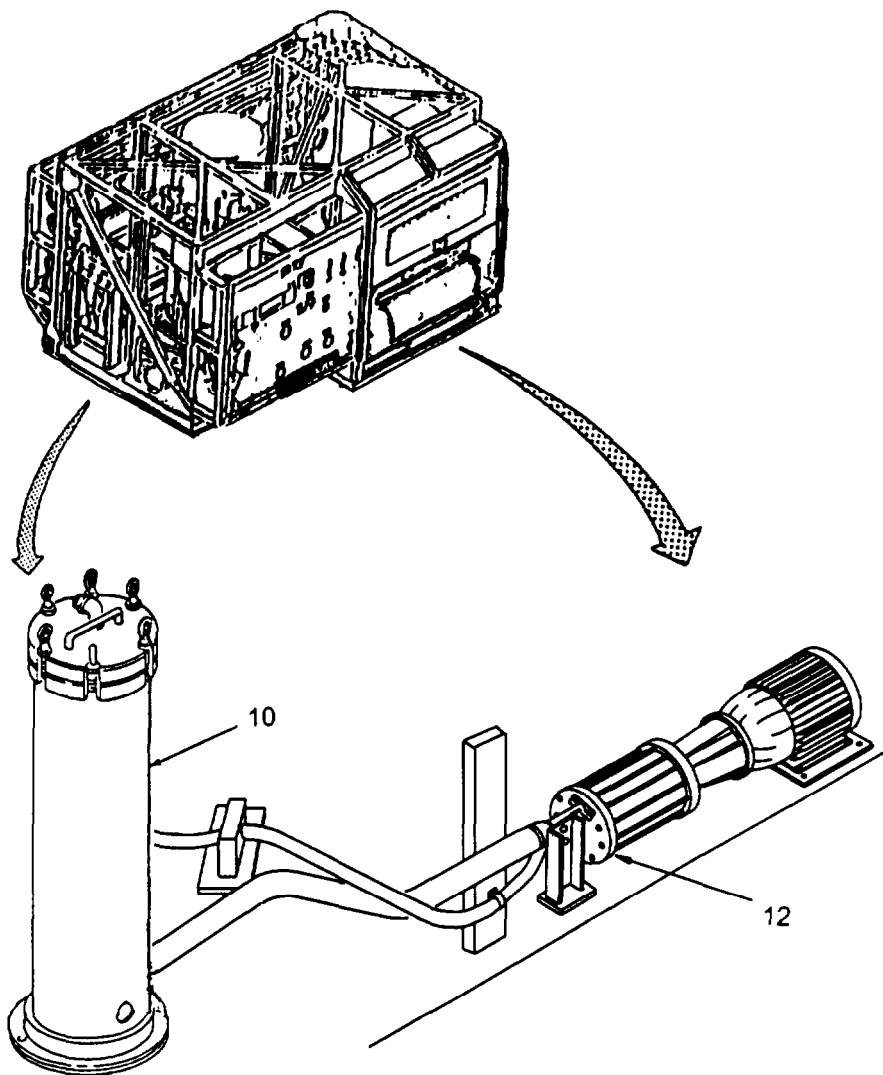


Figure 1-1. Unit Components (sheet 3 of 4).
Models H-9518-1, H-9518-2, and H-9518-3 only.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

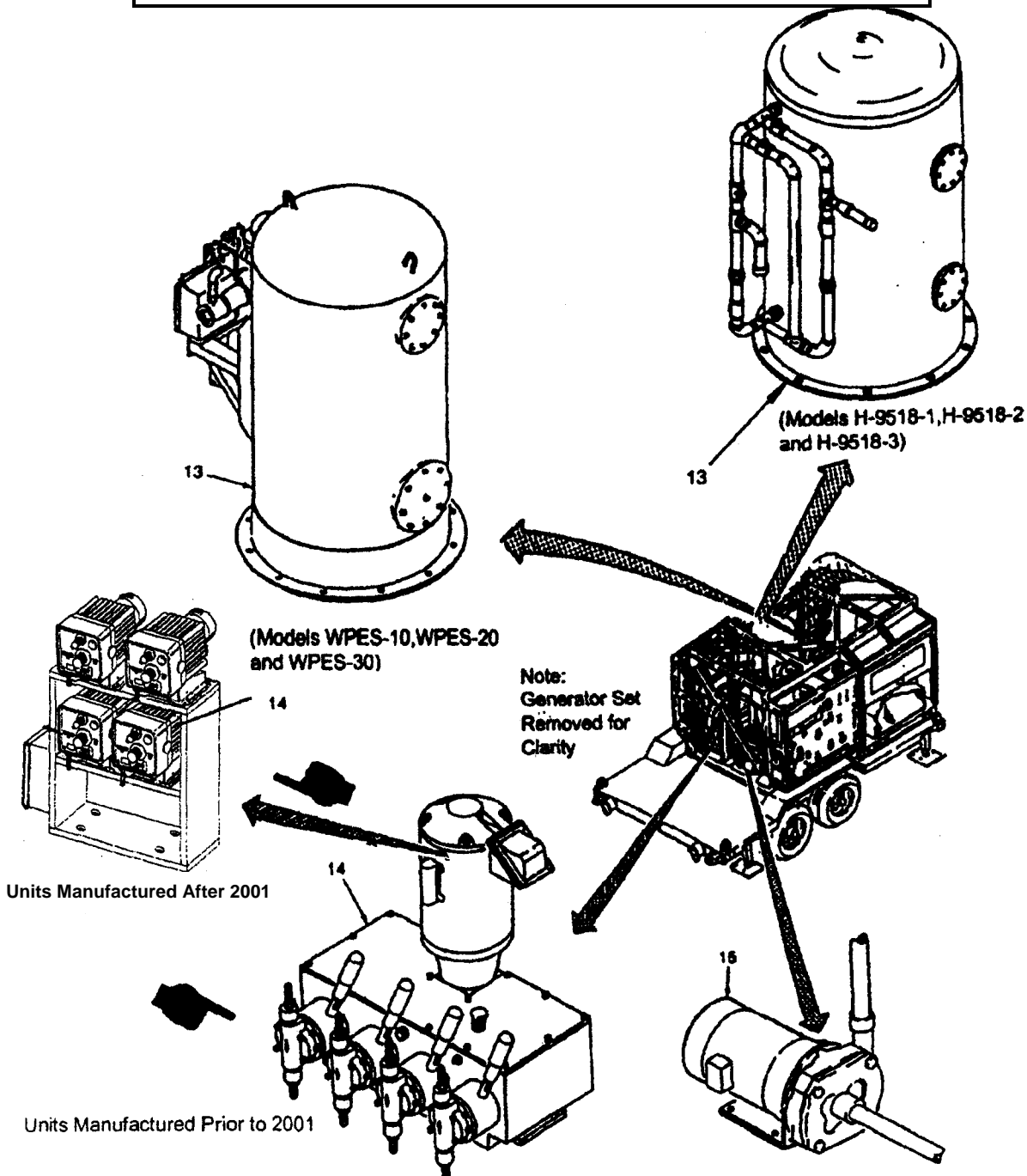


Figure 1-1. Unit Component: (sheet 4 of 4).

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

- c. Accessory Components. Refer to figure 1-2, The following paragraphs describe major accessories supplied with the ROWPU that are used to operate or service the unit. Couplings, tools, and chemicals are stowed in the storage chests.

DISPENSING NOZZLE (1). Hand operated nozzle controls water flow to user containers.

DISTRIBUTION PUMP (2). An electrically driven pump that draws water from the product water tanks and distributes it through the potable water system.

PRODUCT WATER TANKS (3). Two self-erecting 3,000 gallon fabric tanks are used to store product water produced by the ROWPU. The tanks have an inflatable collar and are supplied with a repair kit and cover. Refer to TM 10-5430-237-12&P/TO 35E31-3-4-1 for additional information on the water tanks.

BACKWASH (BRINE) WATER TANK (4). A self-erecting 3,000 gallon fabric tank is used to store brine water for use during the backwash cycle. The tank has an inflatable collar and is supplied with a repair kit and cover. The tank must be identified and marked as the brine tank to prevent use in the product water system.

BACKWASH PUMP (5). Electrically driven pump with an external strainer is used during backwash of the multimedia filter and cleaning R.O. elements. A screen inside the strainer removes large particles from the brine water to prevent contamination of the ROWPU.

RAW WATER PUMPS (6). Two electrically driven water pumps draw water from the raw water source and pump it to the unit for processing. During NBC operation, one raw water pump is used to assist water flow through the deionization cartridges.

SUCTION STRAINER (7). Connects to the end of the raw water suction hose to prevent rocks, sand and debris from entering the raw water pumps and the ROWPU.

FLOAT (8). Used to suspend raw water strainer off bottom of water source.

SUCTION HOSES (9). Suction hoses are installed on the inlet (suction) side of most accessory pumps and are used to carry water to the pumps. The suction hoses are constructed of a black, wire wound, rigid material that prevents collapse of the hose when under suction pressure. Quick disconnect coupling ends aid rapid assembly and disassembly of hose connections. Each hose is supplied with a cap and plug. If required, the 1-1/2 inch black suction hoses may be used as discharge hoses when additional hose lengths are needed. Hoses reserved for potable water use have a blue stripe down their full length. Do not use blue striped hoses in the raw water or backwash water systems.

DISCHARGE HOSES (10). Discharge hoses are installed on the outlet (discharge) side of the accessory pumps and carry water, under pressure, away from the pumps. The discharge hoses are constructed of rubber hose material covered in a white canvas. When not under pressure, the discharge hoses lay flat. Quick disconnect coupling ends aid rapid assembly and disassembly of hose connections. Each hose is supplied with a cap and plug. Discharge hoses reserved for potable water use have a blue stripe down their full length. Do not use blue striped hoses in the raw water or backwash water systems or vent vessels.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

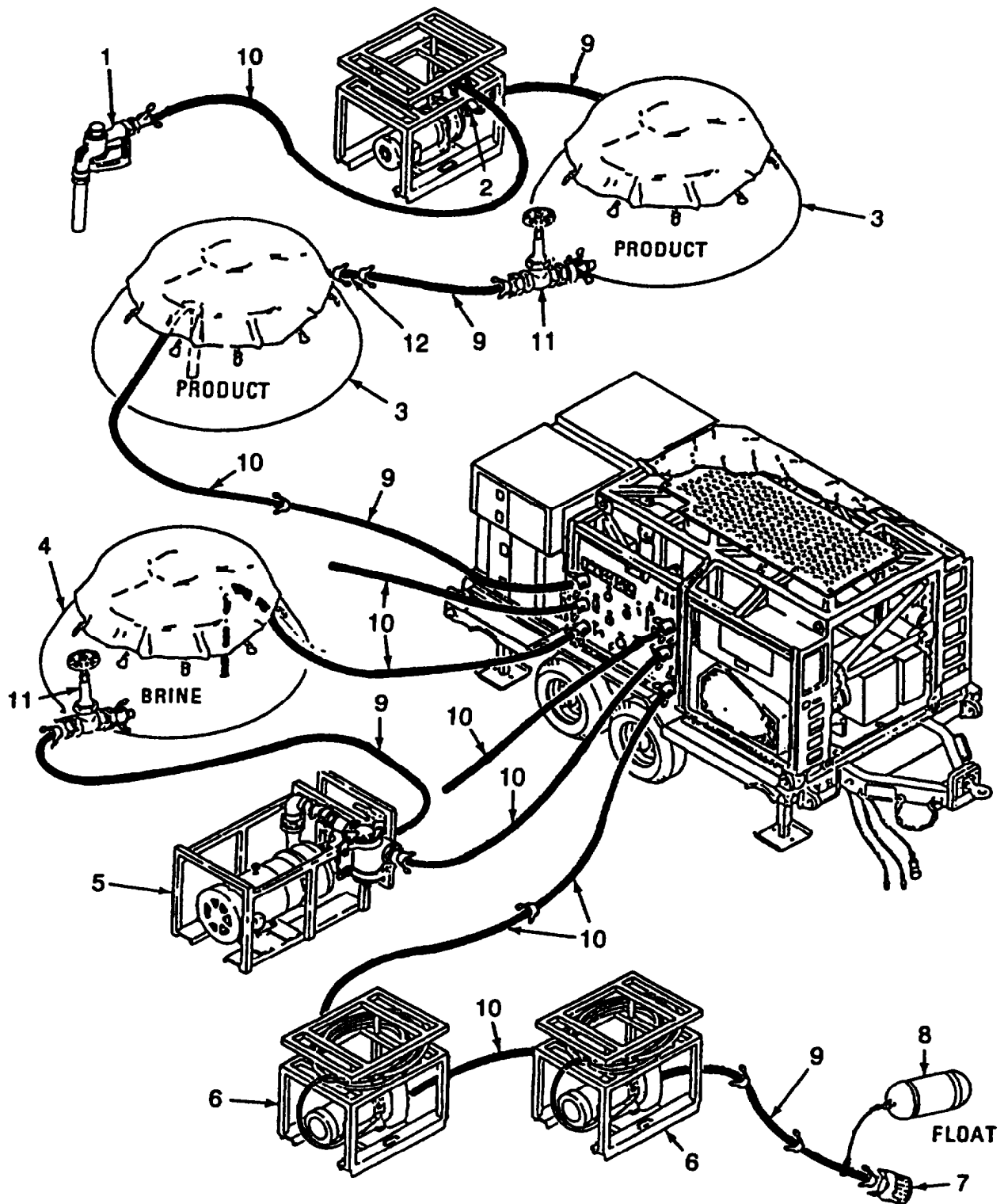


Figure 1-2. Accessory Items.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

GATE VALVES (11). Gate valves are installed in the backwash and product water lines to control water flow through the system.

COUPLINGS (12). Various types and sizes of couplings, adapters, reducers and nipples are supplied with the unit to meet operational requirements.

Refer to figure 1-3.

DEIONIZATION CARTRIDGES (1). Used to remove nuclear, biological and chemical contaminants from product water. Two cartridges are supplied; one for nuclear and one for biological and chemical contaminants. Both cartridges are required during operation in contaminated areas.

R.O. ELEMENTS (2). Remove dissolved solids from water. Two elements are installed in each R.O. pressure tube during operation,

STORAGE CHESTS (3). Two storage chests are used to stow the chemicals, tools, and small system components to prevent loss or damage.

CARTRIDGE FILTER TUBES (4). Eight spare filter tubes are supplied with the ROWPU. The filters are stored in the overhead storage box mounted in the ROWPU.

TDS MONITOR (5). Mounted on control panel during operation. Used to indicate level of dissolved solids in product water.

CHEMICAL CANS (6). Four chemical cans store chemical solutions for use by the chemical feed pump and are supported by a metal frame. The cans are connected to the feed pump by flexible hoses.

GENERATOR SET (7) (WPES-10 and H-9518-1). Supplies electrical power to operate the ROWPU. Generator set is mounted behind the ROWPU on back of the trailer.

OCEAN INTAKE STRUCTURE (1) Refer to figure 1-3a. (Models H-9518-1, H-9518-2, and H-9518-3). Utilizes self-jetting wellpoints to extract water from a variety of water sources, but especially from an ocean-type environment.

I-8 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

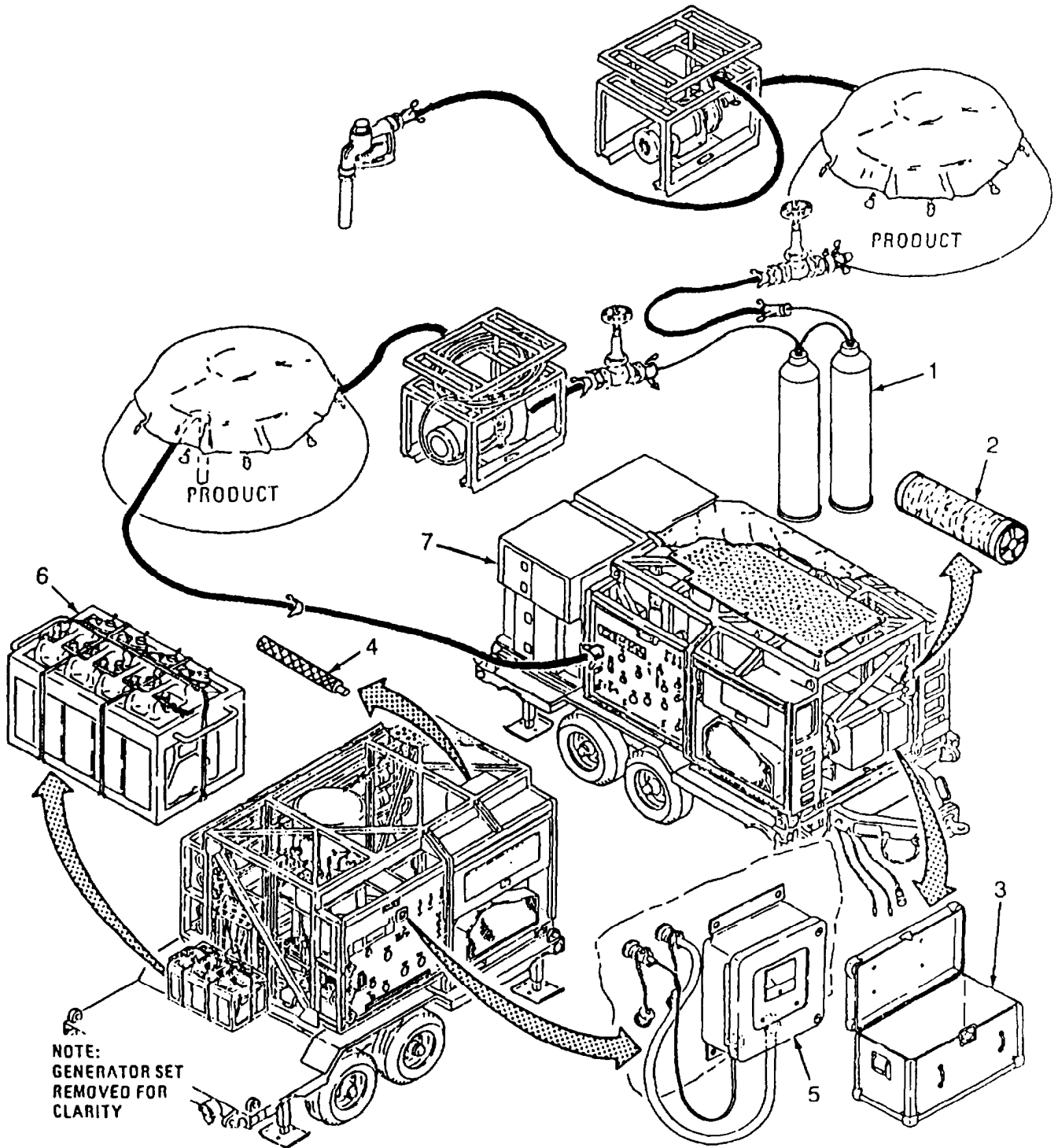


Figure 1-3. Accessory Items.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

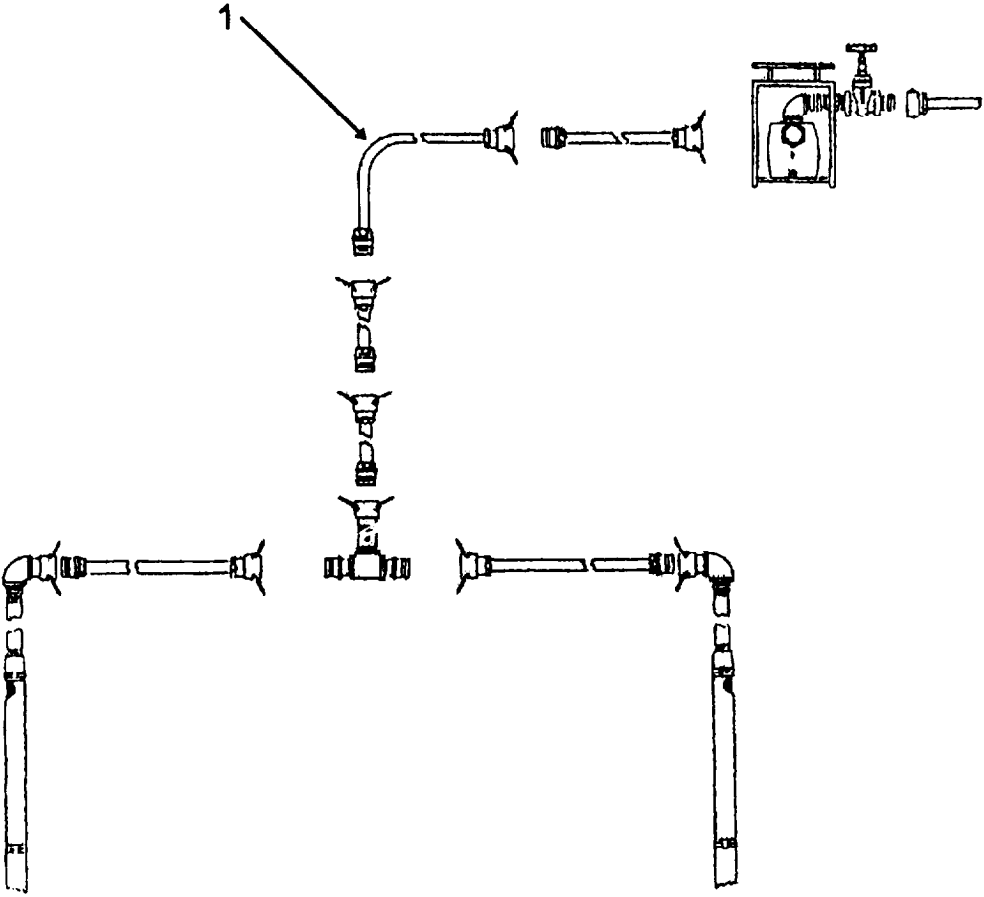


Figure 1-3a Accessory Items (Ocean Intake Structure)
Models H-9518-1, H-9518-2 and H-9518-3.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

- f. Flatbed Cargo Trailer (Models WPES-10 and H-9518-1). Refer to figure 1-4. The trailer provides a mobile platform for the ROWPU. The trailer includes an emergency and automatic parking brake function that is activated when the air hoses are disconnected from the towing vehicle.

LIFT EYES (1). Four lift eyes permit hoisting of trailer and attached ROWPU. Two towing eyes are located on the front of the trailer frame.

SPARE TIRE AND CARRIER (2). Spare tire is used to replace flat or defective tire. Carrier raises, lowers and supports spare tire on the trailer frame.

TAIL LIGHTS (3). Composite blackout-stoplight and tail light assemblies provide stop, turn, and driving lights during night towing operations.

WHEELS AND SUSPENSION (4). Provides shock and vibration dampening during towing.

MANUAL STORAGE BOX (5). Provides storage for technical manuals and related documents.

LEVELING JACKS (6). Four leveling jacks support and level the trailer when disconnected from the towing vehicle. Handles to operate the jack are stowed under the trailer frame.

SAFETY CHAINS (7). Two safety chains connect to the towing vehicle to prevent loss of trailer in the event of lunette or pintle failure.

LUNETTE (8). Connects trailer to pintle hook of towing vehicle.

ELECTRICAL CABLE (9). Connects electrical system of trailer to the towing vehicle. Distributes electrical power to the tail lights.

AIR BRAKE HOSES (IO). Two brake hoses connect trailer airbrake system to towing vehicle. Two hangers on the frame provide storage and prevent damage to the hoses when not in use.

AIR TANK (11). Stores air when the trailer is disconnected from the towing vehicle.

PORTABLE STEP (12). Aids personnel in climbing onboard ROWPU trailer.

I-8 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - cont.

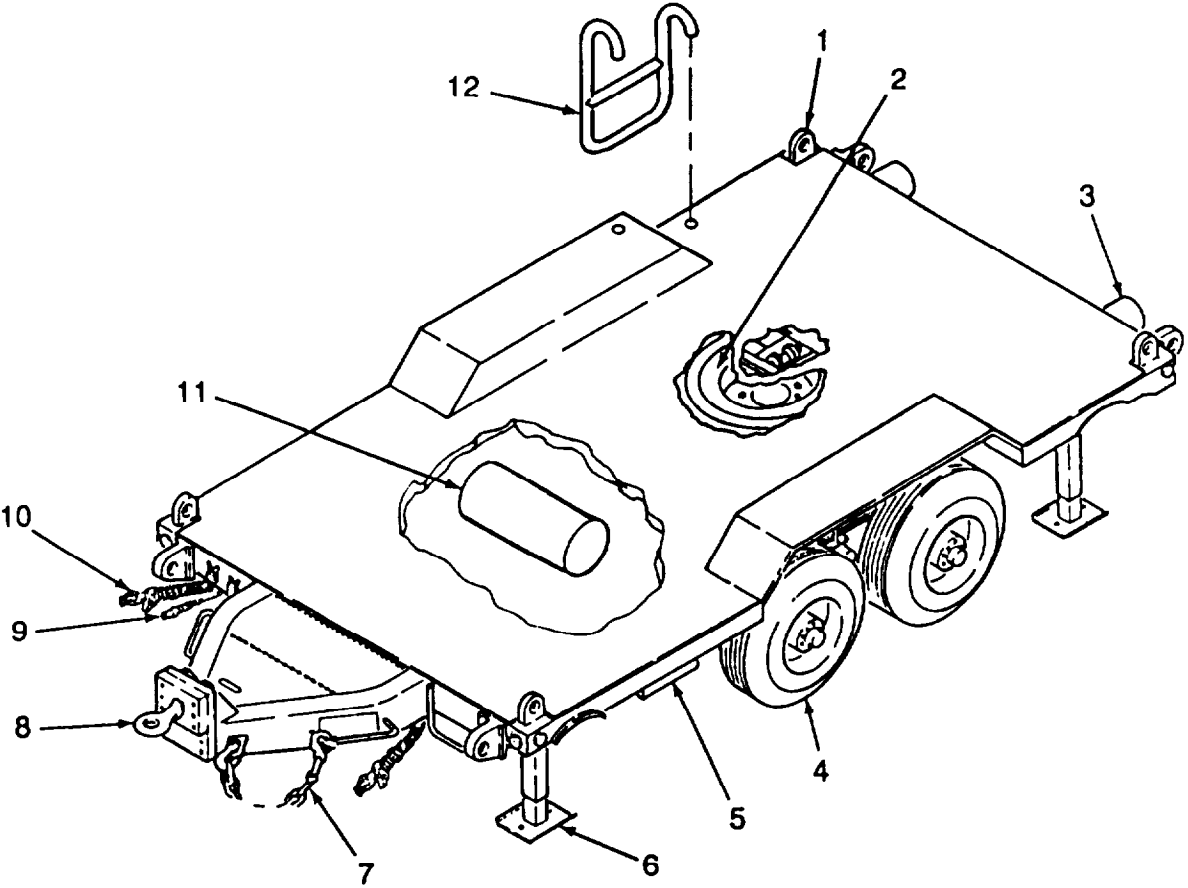


Figure 1-4. Flatbed Cargo Trailer (Models WPES-10 and H-9518-1).

1-9. DIFFERENCES BETWEEN MODELS.

There are six models of the ROWPU covered in this manual. These model are designated as follows:

Army.....	Model WPES-10 and Model H-9518-1
Air Force	Model WPES-20 and Model H-9518-2
Navy.....	Model WPES-30 and Model H-9518-3

Operating procedures in this manual that are applicable to only specific models of the ROWPU are identified with the model designation (Model WPES-10, Model H-9518-1, Model WPES-20, Model H-9518-2, Model WPES-30, or Model H-9518-3) in the paragraph heading or procedural step. Procedures applicable to all six models do not contain a model designation. Major differences between the six models are described below:

- a. Only Models WPES-10 and H-9518-1 are mounted on a flatbed cargo trailer. A self contained 30KW generator set installed on the trailer supplies electrical power for operation of the unit. Models WPES-20, H-9518-2, WPES-30, and H-9518-3 are skid mounted (no trailer).
- b. Models WPES-20, H-9518-2, WPES-30 and H-9518-3 get electrical power from an external source that is not supplied with the unit.
- c. Differences in the electrical systems are:
 - (1) Models WPES-10, H-9518-1, WPES-30, and H-9518-3, have only one external power connector on the junction box. Internal wiring between these four models is identical.
 - (2) Models WPES-20 and H-9518-2 have two external power connectors on the junction boxes. One connector supplies power to the high pressure pump (R.O. pump) motor, the other supplies power to remaining system components. Both power cords must be connected to operate the unit. Internal wiring is different between these units and models WPES-10, H-9518-1, WPES-30, and H-9518-3.
- d. Differences in the piping systems are:
 - (1) Piping on models WPES-20, H-9518-2, WPES-30 and H-9518-3 is identical. On these models, the R.O. elements must be removed from both the front and back ends of the R.O. pressure tubes.
 - (2) The 30KW generator set installed on the flatbed cargo trailer of Models WPES-10 and H-9518-1 prevents removal of the R.O. elements from the back of the R.O. vessels. Piping is different on these models to allow removal of all R.O. elements from the front ends of the R.O. pressure tubes.

1-9. DIFFERENCES BETWEEN MODELS- cont.

DIFFERENCES BETWEEN MODELS			
	WPES-10 and H-9518-1	WPES-20 and H-9518-2	WPES-30 and H-9518-3
USER	ARMY	AIR FORCE	NAVY
EQUIPMENT			
Flatbed cargo trailer	x		
30KW Generator set	x		
Two forklift pockets in frame		X	
Four forklift pockets in frame			X
Single power input	x		X
Dual power input		X	
Front removal of R.O. elements	X		
Front/rear removal of R.O. elements		x	x
Power cable supplied	X		

1-10. EQUIPMENT DATA.

Dimensions and Weights (Trailer without ROWPU - Models WPES-10 and H-9518-1 Only)

Length	19.01 ft. (5.79m)
Width.....	8.00 A. (2.44m)
Height (to top of the wheel cover).....	3.18 ft. (0.97m)
Weight	5,893 lbs. (2652 kg)
Height to lunette	2.42 ft. to 2.92 ft. (0.74m to 0.89m)
Maximum towing speed	50 mph (80 kph)
Tire pressure (WPES-10)	75 psi (5.27 kg/sqcm)
Tire pressure (H-9518-1).....	50 psi (3.52 kg/sqcm)
Voltage	24 VDC

1-10. EQUIPMENT DATA-cont.

Power Requirements (Overall)

Power	22KW
Voltage	120 VAC, 1-phase; 208VAC, 3-phase, 5 wire
Frequency	60 Hertz
Current	104 amp (max)

ROWPU Dimensions-Trailer Mounted with Generator Set
(Models WPES- 10 and H-9518-1)

Length	19.01 ft. (5.79 m)
Width	8.00 ft. (2.44 m)
Height	8.08 ft. (2.46 m)
Weight (dry) (WPES-10)	16,567 lbs. (7456 kg)
Weight (dry) (H-9518-1)	14,800 lbs. (6719 kg)

ROWPU Dimensions - Skid Mounted (Models WPES-20, H-9518-2, WPES-30 and H-9518-3)

Length	9.45 ft. (2.88 m)
Width	6.91 ft. (2.11 m)
Height	5.68 ft. (1.73 m)
Weight (dry)(WPES-20 and WPES-30)	7825 lbs (3521.3 kg)
Weight (dry)(H-9518-2 and H-9518-3)	6057 lbs (2750 kg)

R.O. Pump Motor

Voltage	208 VAC, 3-phase
Current (WPES-10,WPES-20 and WPES-30)	52 amp
Current (H-9518-1 ,H-9518-2 and H-9518-3)	50 amp
Horsepower	20
Frequency	60 Hertz
Revolutions Per Minute (WPES-10,WPES-20 and WPES-30)	1175
Revolutions Per Minute (H-9518-1, H-9518-2 and H-9518-3)	1750
Duty Cycle	Continuous
Weight (WPES-10,WPES-20 and WPES-30)	120 lbs (54 kg)
Weight (H-9518-1 ,H-9518-2 and H-9518-3)	202 lbs (91.7 kg)

R.O. Pump (Models WPES-10, WPES-20, and WPES-30)

Type	Positive displacement
Pumping Capacity	32 gpm (121 lpm) 980 psi (689,038 kg/sqm)head
Oil Capacity	3.5 quarts (3.3 liters)
Drive	Five V-belts
Revolutions Per Minute	500 (maximum)
Weight	330 lbs (148.5 kg)

R.O. Pump (Models H-9518-1, H-9518-2, and H-9518-3)

Type	Multiplex piston
Pumping Capacity	30 gpm (113.5 lpm) 1000 psi (70.38 kg/sqcm) head
Oil Capacity	Not Applicable
Drive	Electric Motor
Revolutions Per Minute	1750 (maximum)
Weight	65 lbs (29.48 kg)

1-10. EQUIPMENT DATA-cont.

Backwash Pump Assembly	
Weight (with cover)	317 (142.6 kg)
Backwash Pump Motor	
Voltage	208 VAC, 3-phase, 5 wire
Current	26.5
Horsepower.....	10
Frequency	60 Hertz
Revolutions Per Minute.....	3450
Duty Cycle.....	Continuous
Backwash Pump	
Type	Centrifugal
Capacity	120 gpm (454 lpm) 70 psig (49,217 kg/sqm)
Drive.....	Electric motor
Revolutions Per Minute.....	3450
Raw Water Pump Assemblies, 2 each	
Weight (with cover)	123.5 lbs (55.6 kg)
Raw Water Pump Motor	
Voltage	208 VAC, 3-phase, 5 wire
Current	5.8 amp
Horsepower.....	2
Frequency	60 Hertz
Revolutions Per Minute.....	3450
Duty Cycle.....	Continuous
Raw Water Pump, 2 each	
Type	Centrifugal, self-priming
Capacity	30 gpm (114 lpm) 105 ft. (32m) head (45.5 psi/31,990kg/sqm)
Drive.....	Electric motor
Revolutions Per Minute.....	3450
Distribution Pump Assembly	
Weight (with cover)	90 lbs (40.5 kg)
Distribution and Booster Pump Motors	
Voltage	208 VAC, 3-phase
Current	3.4 amp
Horsepower.....	1
Frequency	60 Hertz
Revolutions Per Minute.....	3450
Duty Cycle.....	Continuous
Distribution and Booster Pumps	
Type	Centrifugal
Capacity	30 gpm (114 lpm) 50 ft.(15m) head (21.7 psi/15,239 kg/sqm)
Drive.....	Electric motor
Revolutions Per Minute.....	3450

1-10. EQUIPMENT DATA-cont.

Chemical Feed Pump Motor	Before 2001	After 2001
Voltage	115 VAC, 1-phase	115 VAC, 1-phase
Current	2.0 amps	1.0 amps
Horsepower	1/3	N/A
Frequency	60 Hertz	60 Hertz
Revolutions Per Minute	1725	Adjustable
Duty Cycle	Continuous	Continuous
Chemical Feed Pump	Before 2001	After 2001
Capacity	2.67 gallons/hr (10.10liters/hr)	2.5 gallons/hr (9.5liters/hr)
Drive	Electric motor	Electronic Diaphragm
Multimedia Filter		
Flow Rate	6.5 gpm/sq. ft.	
Backwash Flow Rate	70 to 120 gpm (265 to 454 lpm)	
Pressure Drop	5 psid (nominal) (3516 kg/sqm)	
Cartridge Filter		
Cartridge (8 cartridge tubes)		
Length	40 in. (101.6 cm)	
Flow Rate	35 gpm (132.5 lpm)	
Pressure Drop	2 to 35 psid (1406 to 24,609 kg/sqm)	

1-11. PIPING IDENTIFICATION

The ROWPU piping is identified according to function by the following colors:

Function:	Color:
Raw Water	Black band
Backwash waste	Red band
Filtered Water	Yellow band
Product water	Blue band
Brine discharge	Purple band
Brine Piping on R.O. pressure vessels	Purple band

Section III. TECHNICAL PRINCIPLES OF OPERATION

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System Technical Principles of Operation	1-19
Component Principles of Operation	1-20

1-12. SYSTEM TECHNICAL PRINCIPLES OF OPERATION.

- a. General. The ROWPU removes suspended solids (called turbidity), chemicals, and solids held in solution (called dissolved solids), found in most fresh water and seawater sources to a level fit for human consumption. This is done by filtering, reverse osmosis, and treating the water with selected chemicals.
- b. Reverse Osmosis. Reverse osmosis is the process by which purified water is separated from the available fresh, seawater, or brackish water sources. High pressure is applied to the raw water side of a semipermeable membrane and desalinated product water diffuses through the membrane to the freshwater side. The 600 GPH ROWPU is arranged so that prefiltered water is pumped under pressure across the semi-permeable membranes called R.O. elements. The R.O. elements separate this water stream into a product water stream and a brine concentrate stream, both of which continuously flow away from the membranes through the R.O. pressure tubes. About 10 gallon of product water is produced for every 30 gallon of raw water processed.
- c. Water Processing. Water flowing through the ROWPU is processed as follows:

CAUTION

Petroleum contaminated raw water will damage R.O. elements, multimedia filter and cartridge filter.

- (1) First Stage of Filtration - Multimedia Filter. The multimedia filter is the first stage of filtration. Large particles of suspended solids are removed by the various layers of filter material in the tank. Polymer, added to the raw water by the chemical feed pump, collects suspended solids into groups large enough to be removed by the multimedia filter in a process called coagulation.
- (2) Second Stage of Filtration - Cartridge Filter. The cartridge filter removes finer suspended solids that pass through the multimedia filter.
- (3) Reverse Osmosis (R.O.). The R.O. elements remove dissolved solids from the water and any suspended solids that may have passed through the multimedia and cartridge filters.
- (4) Chemical Injection - Chemical Feed Pump. The chemical feed pump is comprised of four liquid heads which inject chemicals into the water system. Polymer is injected into the raw water before entry into the multimedia filter. Polymer aids in the removal of suspended solids by the multimedia filter through a process called coagulation. Sodium hex is injected into the raw water to reduce scaling and corrosion of pipes, pumps and filters caused by hard water deposits. Chlorine is added to the product water to reduce bacteria and make the water safe for consumption. Citric acid is injected downstream of the multimedia filter to remove scale deposits that build up on the R.O. elements and maintain pH.

1-13. COMPONENT PRINCIPLES OF OPERATION.

The following paragraphs describe the principles of operation for components and assemblies of the ROWPU. Refer to figure 1-5.

CAUTION

Source water must be free of chlorine. Chlorine will instantly destroy the R.O. elements. Destruction of the R.O. elements will make the ROWPU unable to perform its mission.

RAW WATER SOURCE (1). The raw water source can be any reservoir of fresh, brackish or saltwater. Water source should contain enough water to perform your mission.

STRAINER (2). The strainer prevents small stones, twigs and debris from entering suction hose.

OCEAN INTAKE STRUCTURE (2a)(Models H-9518-1, H-9518-2, and H-9518-3). Utilizes self-jetting wellpoints to extract water from a variety of water sources, but especially from an ocean-type environment.

RAW WATER PUMPS (3 and 4). Two portable, electrically driven, centrifugal pumps draw raw water from the water source and supply it to the ROWPU under pressure. These pumps are normally connected in series. One pump is used in the product water system during NBC operations to pressurize the water flow through the deionization cartridges.

CHEMICAL FEED PUMP. The chemical feed pump consists of an electric motor, housing, four feed heads and four stroke adjustment assemblies. The electric motor turns a camshaft inside the housing. A shaft inside each stroke adjustment assembly converts the rotating action of the camshaft to a reciprocating stroke that operates a diaphragm inside each feed head. Each feed head performs the following function (Units made after 2001 have four separate pumps that work in much the same way):

POLYMER FEED HEAD (5). Adds the polymer solution to the raw water to coagulate solids in multimedia filter.

SODIUM HEX FEED HEAD (6). Adds diluted sodium hex to the raw water to prevent scaling and corrosion.

CHLORINE FEED HEAD (13). Adds chlorine to the product water after the R.O. process takes place. Chlorine reduces bacteria in the product water to a level safe for human consumption.

CITRIC ACID FEED HEAD (17). Adds diluted citric acid to filtered water to maintain the optimal pH (5.0-8.0) for the R.O. process; aids in preventing scale buildup inside the R.O. membranes.

MULTIMEDIA FILTER (7). Removes large suspended solids from the raw water. The multimedia filter contains six types of media: gravel, coarse garnet, fine garnet, silica sand, anthracite, and carbon. Water entering the filter flows through a baffle to prevent disruption of the filter media. The water then flows through the filter media leaving larger suspended solids behind. The media bed is backwashed when the loss of head pressure through the filter bed increases above a certain level; or the quality of the water flowing out fails to meet standards.

1-13. COMPONENT PRINCIPLES OF OPERATION-cont.

BOOSTER PUMP (8). Electrically driven, centrifugal pump increases water pressure to the cartridge filter.

CARTRIDGE FILTER (9). Removes small suspended solids that pass through the multimedia filter. Solids are trapped on eight replaceable cartridges filter tubes inside the filter body. Elements should be replaced when cartridge filter gage differential pressure rises above 20 psid.

R.O. PUMP (10). Electrically driven high pressure pump increases system water pressure to the R.O. pressure tubes for operation of the R.O. process.

PULSE DAMPENER (11) (Models WPES-10, WPES-20 and WPES-30 only). A cylindrical metal tank installed between the R.O. pump and the R.O. pressure tubes removes pulses in water flow caused by the reciprocating action of the R.O. pump pistons.

R.O. PRESSURE TUBES (12). The four fiberglass R.O. pressure tubes each contain two R.O. elements. Water entering the R.O. pressure tubes is under high pressure. The semi-permeable R.O. elements use the high pressure to separate (strain) dissolved solids from the filtered water. Product water is removed from the center of the elements. Dissolved solids are flushed out of the R.O. pressure tubes as brine.

PRODUCT WATER TANKS (14). Two 3,000 gallon collapsible water tanks store product (potable) water produced by the ROWPU.

DISTRIBUTION PUMP (15). Pumps and distributes potable water from the product water tanks to user containers.

DISTRIBUTION NOZZLE (16). Controls water flow from the distribution pump. Used for filling small hand held containers or portable water tanks.

BACKWASH WATER TANK (18). Collapsible 3,000 gallon water tank stores brine water produced by the R.O. process for use during the backwash cycle and cleaning R.O. elements.

BACKWASH PUMP (19). Pumps brine water from the backwash water tank to the multimedia filter for operation of the backwash cycle. A strainer connected to the outlet of the backwash pump removes large particles of debris that may have entered the brine water tank.

CHAPTER 2
OPERATING INSTRUCTIONS

section I	Description and Use of Operator's Controls and Indicators
section II	Preventive Maintenance Checks and Services
Section III	Operation Under Usual Conditions
Section IV.	Operation Under Unusual Conditions

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

	Page
ROWPU Controls and Indicators..	2-4
Trailer Controls and Indicators(Models WPES-10 and H-95 18- 1)	2-1

2-1. TRAILER CONTROLS AND INDICATORS (Models WPES-10 and H-9518-1).

- a. Electrical Connector. The only indicators on the flatbed cargo trailer are the stop lights, tail lights, and the blackout light assembly: 'These lights are powered and controlled from the towing vehicle. The plug on the trailer electrical cable (figure 2-1) makes the electrical system operational.
- b. Air Brake Connectors. Two air hoses connect the trailer brakes to the towing vehicle brake system with glad-hand connectors (figure 2-2). When the trailer is not connected to the towing vehicle, the connectors are stowed on dummy couplers on the trailer to prevent damage and contamination.

CAUTION

Do not attempt to move trailer without releasing air brakes, brakes are locked.

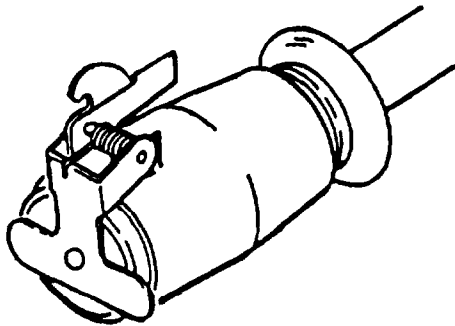


Figure 2-1. Trailer Electrical Plug.

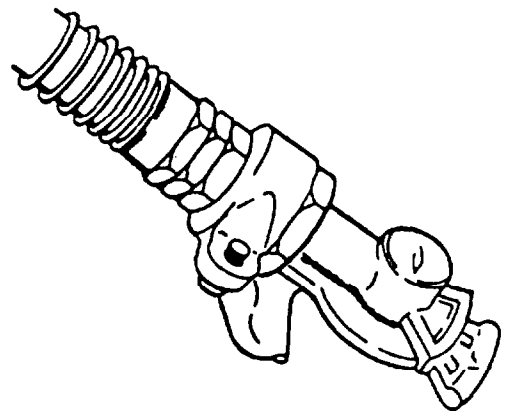


Figure 2-2. Trailer Air Hose Glad-Hand Connectors.

2-1. TRAILER CONTROLS AND INDICATORS (Models WPES-10 and H-9518-1) - cont.

- c. Brake System. Refer to figure 2-3. The service brakes are air actuated and controlled by the towing vehicle. When the two air hoses (5 and 6) from the trailer are connected to the towing vehicle, the service brake system and the brake pedal on the towing vehicle automatically operate the trailer brakes. Disconnecting the air hoses causes the service brakes to engage automatically, which serve as parking brakes for the trailer. If the air supply from both the towing vehicle and the trailer reservoir is lost, a compression spring immediately locks the trailer brakes. Notify unit maintenance if the trailer brakes are locked and trailer must be moved.

CAUTION

The leveling jacks must be in the stowed position (horizontal position) when towing or shipping the ROWPU by truck or rail.

- d. Leveling Jacks. Refer to figure 2-3. Leveling jacks (4) are installed at each corner of the trailer (7). The jacks are manually operated by hand cranks (2) stowed on the trailer. Turning the crank counterclockwise retracts the jack; turning the crank clockwise extends the jack. The mount (3) permits the jack to swivel up or down. A spring inside the mount locks the jack in the vertical or horizontal position. In the vertical and locked position, the jacks are used to level the trailer by raising or lowering the trailer corners. When rotated to the horizontal position, the jacks are stowed. The front jacks, when locked in the vertical position, can also be used to assist in uncoupling the trailer from the towing vehicle.
- e. Snare Wheel and Tire Carrier. Refer to figure 2-3. The spare wheel and tire carrier (9) is a manually operated, cable-driven winch mounted under the rear of the trailer (7). The carrier is operated by connecting the hand crank (2) to the carrier ratchet (1). Two (2) wheel lug nuts secure the spare tire (8) to the carrier. The vehicle's lug wrench is used for removing the lug nuts.

2-I. TRAILER CONTROLS AND INDICATORS (Models WPES-10 and H-9518-1) - cont.

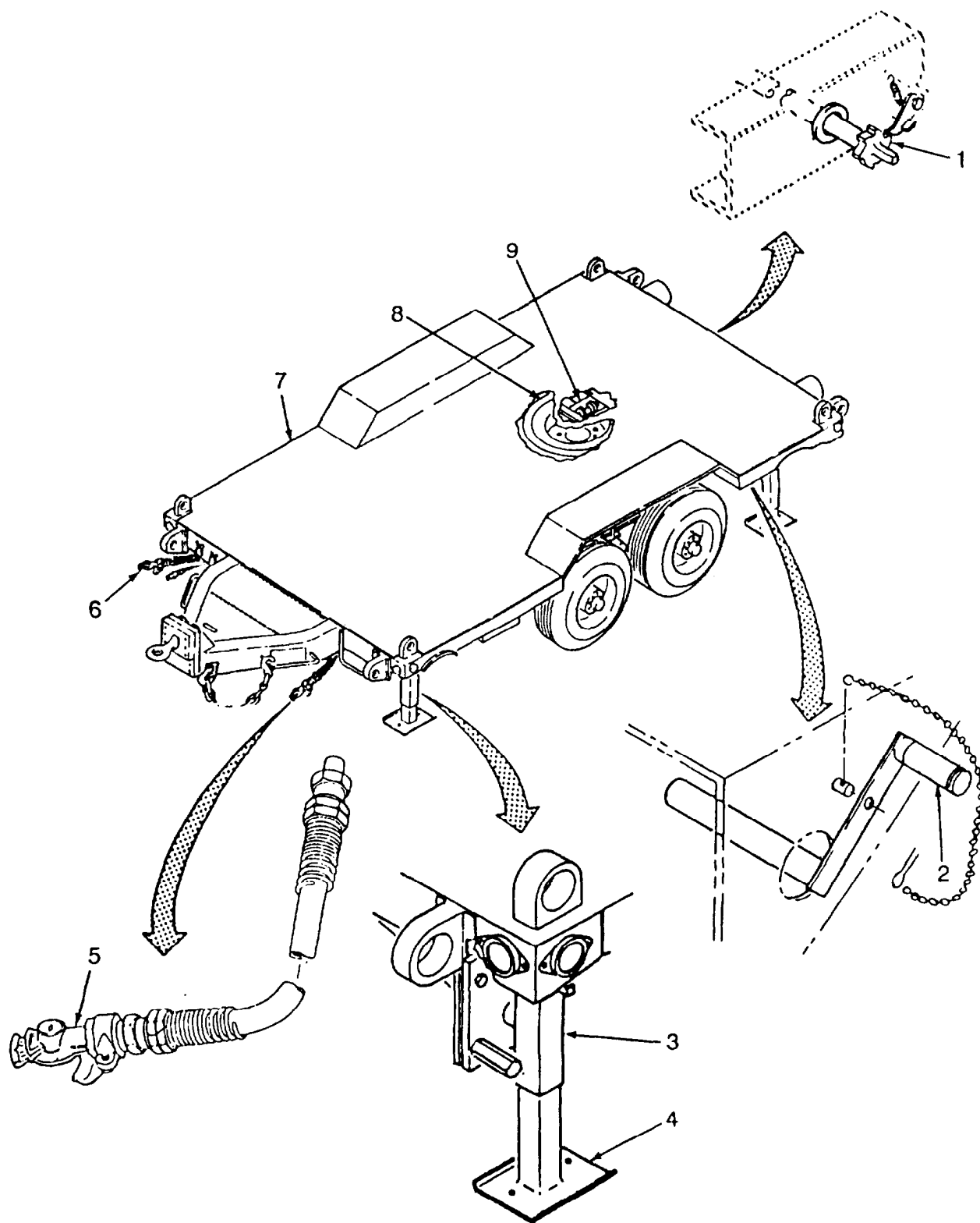


Figure 2-3. Trailer Controls and Indicators.

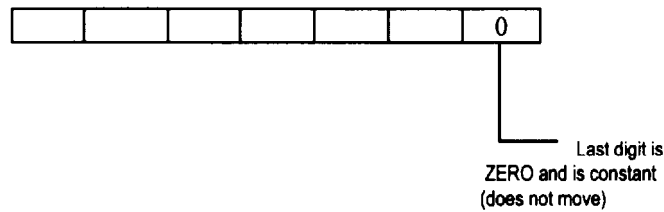
2-2. ROWPU CONTROLS AND INDICATORS

The following paragraphs describe controls and indicators used to operate the ROWPU.

- a. Product Water Meter. Refer to figure 2-4. The product water meter (2) is located on the floor of the ROWPU frame (4) directly behind the booster pump (3). A lid (1) protects the face of the meter from damage. This water meter is used to indicate the total number of gallons, in tenths of a gallon, of product water the unit has produced. The number of gallons is read directly from the numerals in the small window and the tenths of gallons from the position of the needle on the dial face.

(1) One revolution of dial equals 10 gallons of product water produced.

(2) The meter registers as follows:



(3) After one revolution, a total of 10 gallons are produced and the meter will register as follows:



(4) After two revolutions:



(5) After 10 revolutions:



- b. Control Panel. The control panel consists of various gages, valves, lights, switches, and hose connections as shown in figure 2-5, sheet 1. Their functions are described in table 2-1 (Items 1 thru 24).
- c. Control Box. The control box consists of the pump control switches and indicator lamps as shown in figure 2-5, sheet 2. Their functions are described in table 2-1 (Items 25 thru 44).
- d. Circuit Breaker Panel. The circuit breaker panel is located in the junction box and consists of circuit breakers for the pumps, utility outlets and backwash timer as shown in figure 2-5, sheet 3. Their functions are described in table 2-1 (Items 45 through 53).

2-2. ROWPU CONTROLS AND INDICATORS - cont.

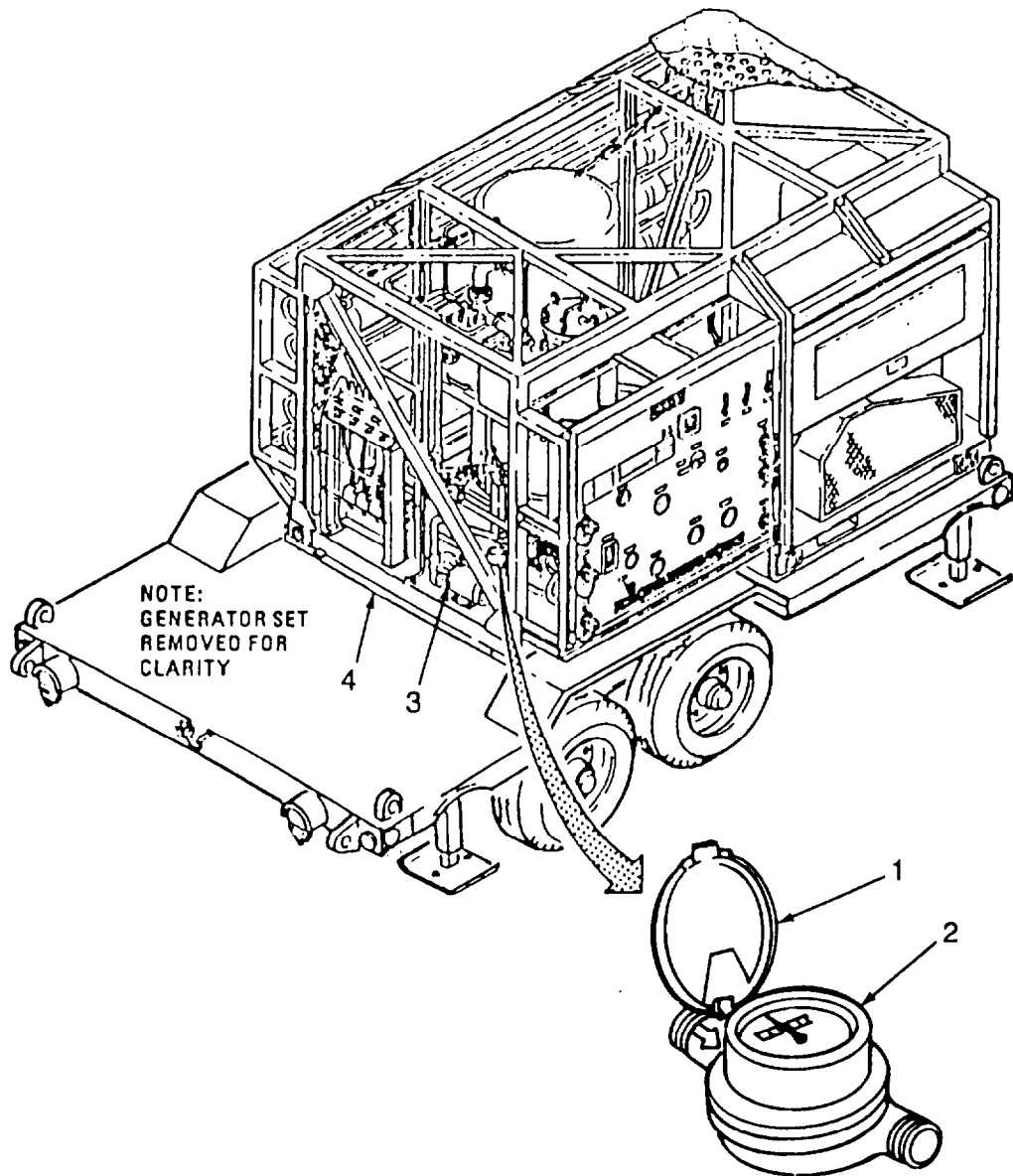


Figure 2-4. Water Meter.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

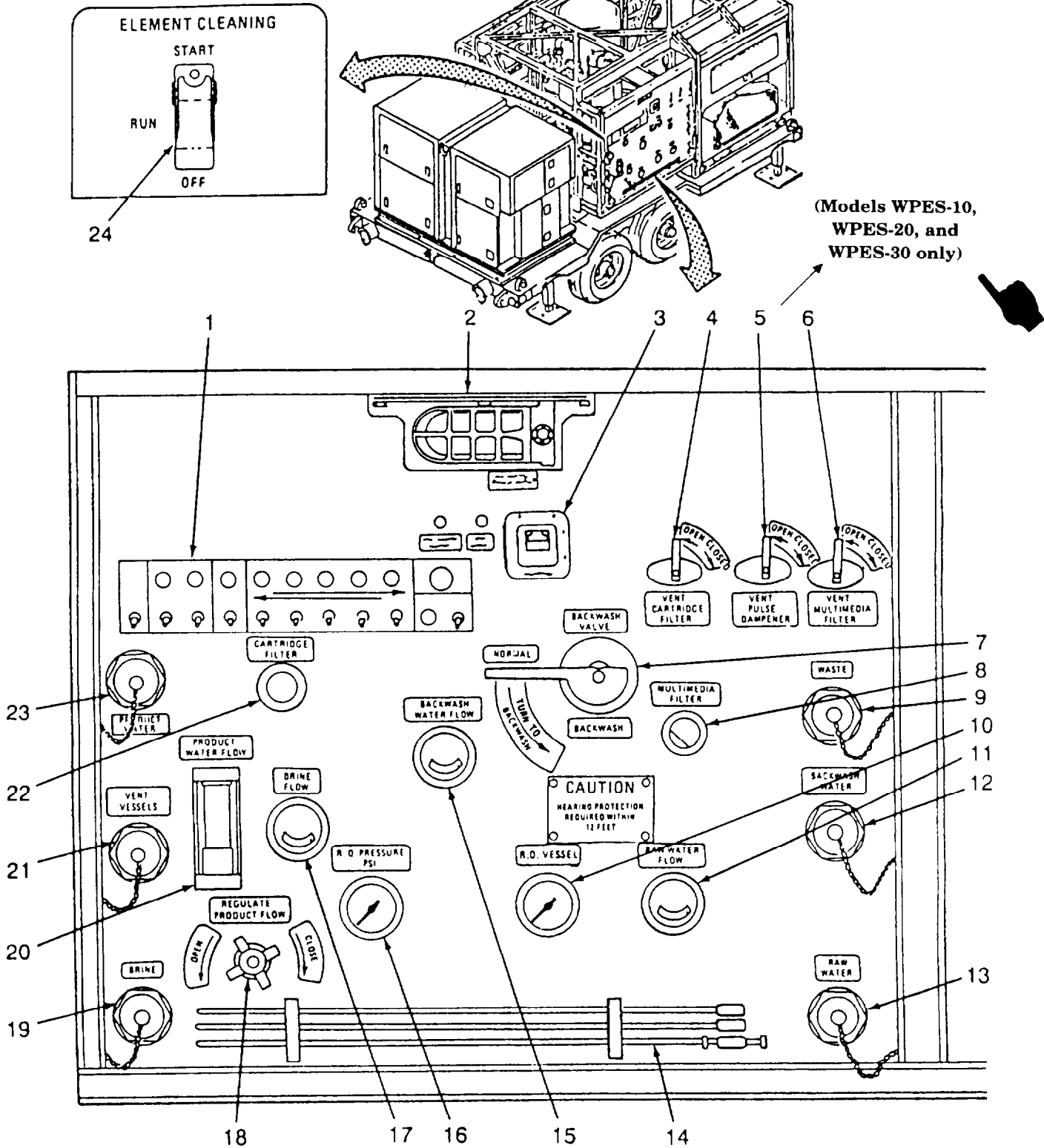


Figure 2-5. ROWPU Controls and Indicators (sheet 1 of 3).

2-2. ROWPU CONTROLS AND INDICATORS - cont.

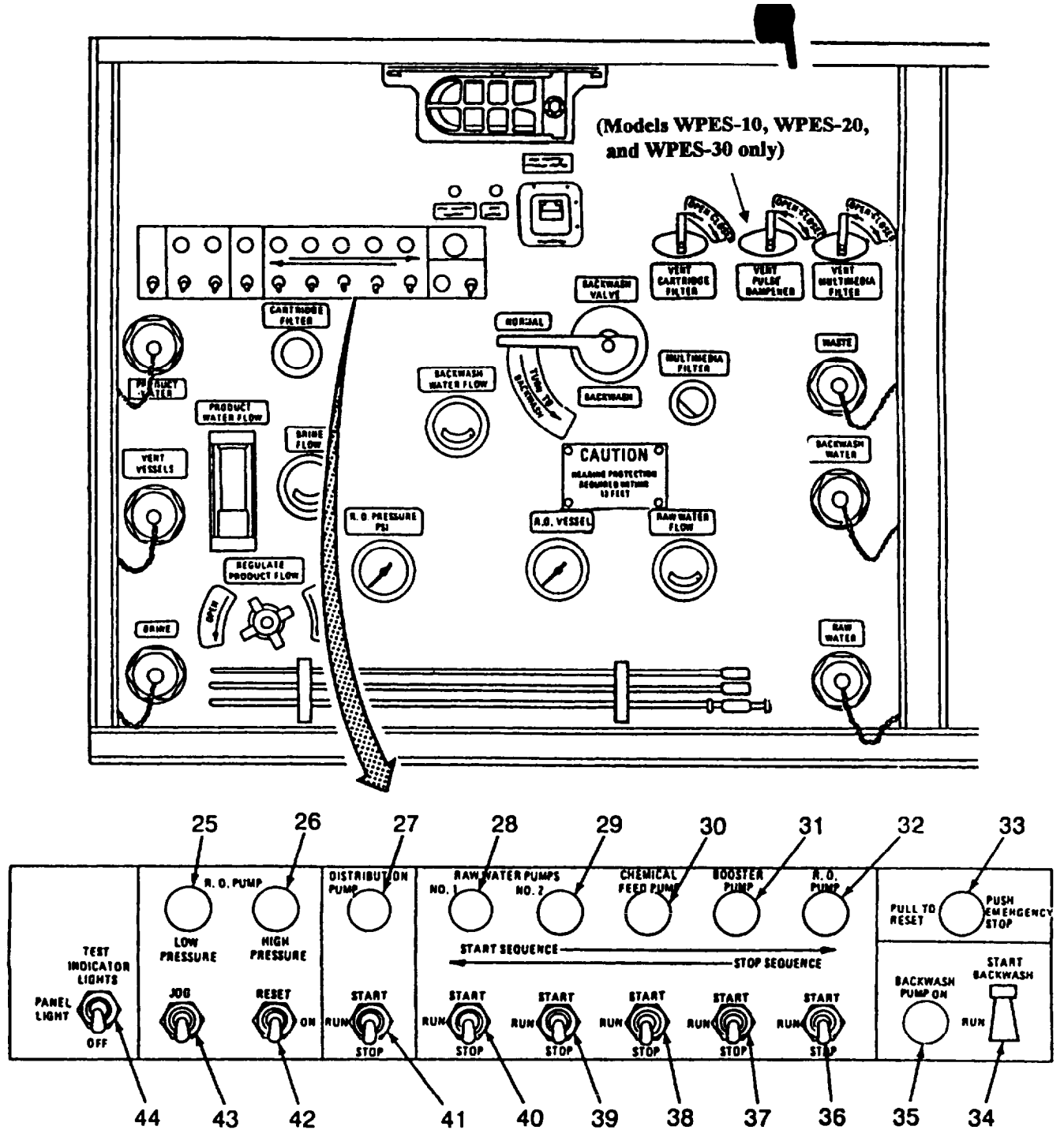


Figure 2-5. ROWPU Controls and Indicators (sheet 2 of 3)

2-2. ROWPU CONTROLS AND INDICATORS - cont.

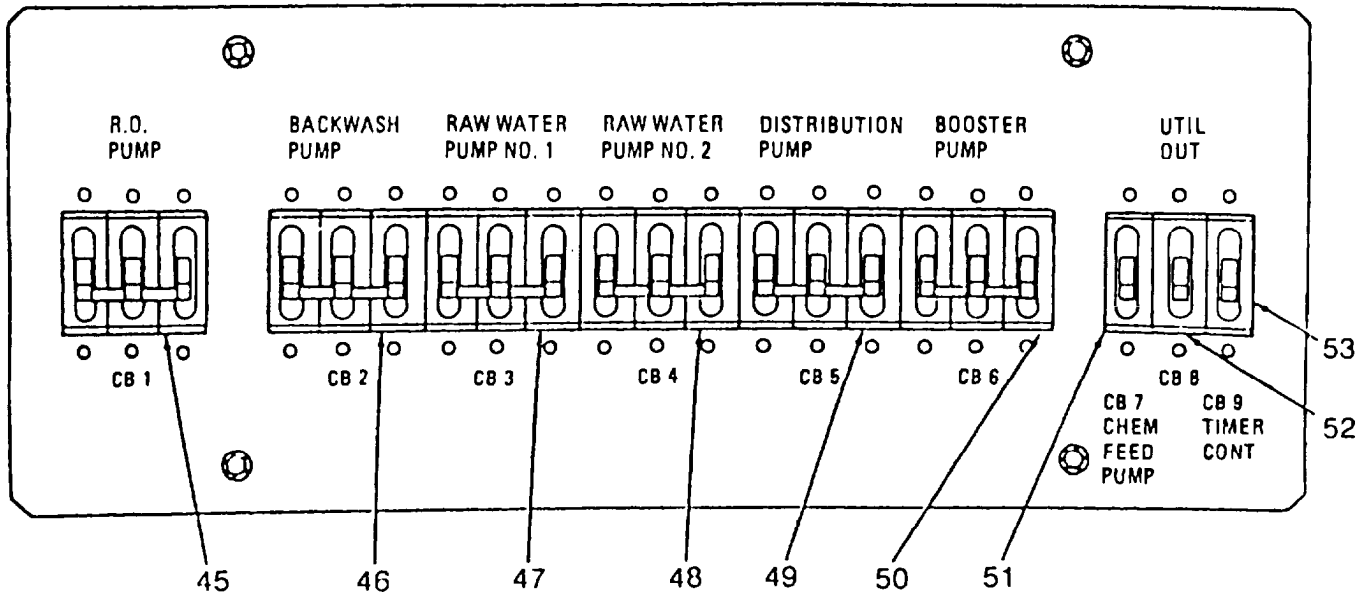
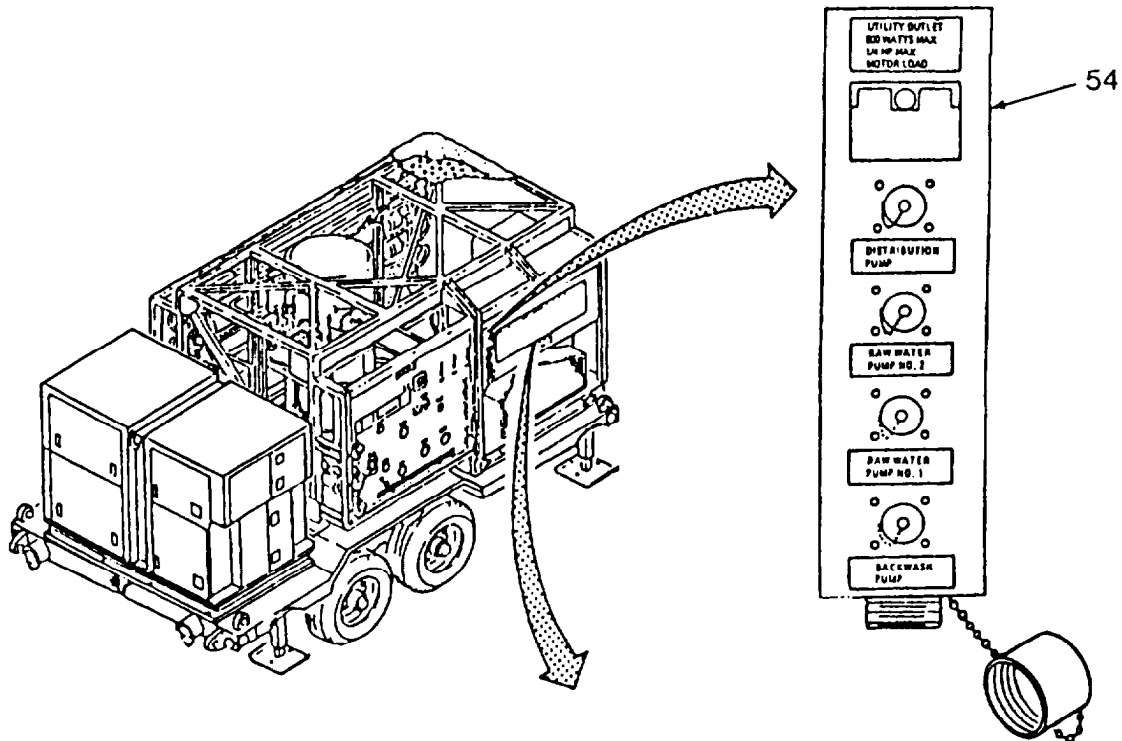


Figure 2-5. ROWPU Controls and Indicators (sheet 3 of 3).

2-2. ROWPU CONTROLS AND INDICATORS- cont.

Table 2-1. ROWPU Controls and Indicators

Key	Control or Indicator	Function
1	Control Box Assembly	Indicator lamps; switches to start, operate and stop (including EMERGENCY STOP) all pumps. (See figure 2-5 sheet 2, keys 25 through 44).
2	Panel Light	Provides light for inside of the ROWPU and for the control panel. It is mounted on a movable bracket that can be pulled forward to provide more light on the control panel.
3	In-Line TDS Monitor	Used to continually monitor quality of product water (see figure 2-5, sheet 1).
4	Vent Cartridge Filter Valve	Vents air during filling and draining cartridge filter.
5	Vent Pulse Dampener Valve (Models WPES-10, WPES-20 and WPES-30 only)	Vents air during filling and draining pulse dampener.
6	Vent Multimedia Filter Valve	Vents air during filling and draining multimedia filter.
7	Backwash Valve	Backwash valve has two positions: NORMAL and BACKWASH. In NORMAL, the valve closes the backwash inlet and allows raw water to flow through the ROWPU. In BACKWASH, the raw water inlet is closed and water is allowed to flow through the backwash inlet. After backwashing, the valve should be returned to the NORMAL position.
8	Multimedia Filter Gage	Indicates differential pressure across the multimedia filter.
9	Waste Outlet	Connection for waste water produced when backwashing.
10	R.O. Vessels Gage	Indicates differential pressure across the R.O. vessels.
11	Raw Water Flow	Measures in gallons per minute the amount of water drawn in by raw water pump(s) and fed into ROWPU.
12	Backwash Water Inlet	Connection for backwash hose from backwash pump.
13	Raw Water Inlet	Connection for hose from raw water pumps.
14	Ground Rod	Used to ground ROWPU. Protects personnel from electrical shock.
15	Backwash Water Flow Gage	Measures amount of water flowing through multimedia filter during backwash cycle.
16	R.O. Pressure P.S.I. Gage	Shows discharge pressure of the R.O. pump in pounds per square inch (psi). Gauge reading depends on setting of REGULATE PRODUCT FLOW valve.
17	Brine Flow Meter	Measures amount of brine flow from the ROWPU in gallons per minute (gpm).

2-2. ROWPU CONTROLS AND INDICATORS- cont.

Table 2-1. ROWPU Controls and Indicators - Cont.

Key	Control or Indicator	Function
18	Regulate Product Flow Valve	Closes the brine outlet of the R.O. vessels. Controls product water flow rate. Regulates output pressure of the R.O. pump.
19	Brine Outlet	Connection for brine water hose from ROWPU brine tank.
20	Product Water Flow Meter	Shows the number of gallons per minute of potable water put out by the ROWPU.
21	Vent Vessel Outlet	Diverts water from R.O. vessels. Also inputs R.O. element cleaning solution.
22	Cartridge Filter Gauge	Measures pressure drop across cartridge filter.
23	Product Water Outlet	Connection for drinking water from ROWPU to product water tank.
24	R.O. Element Cleaning Switch	CAUTION
		Element Cleaning switch must be OFF during normal operation to prevent damage to backwash pump.
25	R.O. Pump Low Pressure Indicator Lamp	NOTE
		See figure 2-5, sheet 2 for illustration of items 25 through 44.
26	R.O. Pump High Pressure Indicator Lamp	Lamp comes on when R.O. Pump discharge pressure is higher than 1250 psi. This lamp also indicates that R.O. pump should have shut off.
27	Distribution Pump Indicator Lamp	Lamp comes on when power has been applied to distribution pump.
28	Raw Water Pump No. 1 Indicator Lamp	Lamp comes on when power has been applied to raw water pump No.1,
29	Raw Water Pump No. 2 Indicator Lamp	Lamp comes on when power has been applied to raw water pump No.2.
30	Chemical Feed Pump Indicator Lamp	Lamp comes on when power has been applied to chemical feed pump.
31	Booster Pump Indicator Lamp	Lamp comes on when power has been applied to booster pump.
32	R.O. Pump Indicator Lamp	Lamp comes on when power has been applied to R.O. pump.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

Table 2-1. ROWPU Controls and Indicators (continued)

Key	Control or Indicator	Function
CAUTION		
The EMERGENCY STOP switch should not be used to shut off the ROWPU except in emergency condition. To do so can cause damage to the equipment.		
33	Push EMERGENCY STOP Switch	When pushed in, this switch shuts off power to ROWPU.
34	Start Backwash Switch	Toggle switch used to start the backwash pump motor.
35	Backwash Pump On Indicator Lamp	Lamp comes on when power has been applied to backwash pump.
36	R.O. Pump Start Switch	Toggle switch used to start, run and stop the R.O. pump motor.
37	Booster Pump Start Switch	Toggle switch used to start, run, and stop the booster pump motor.
38	Chemical Feed Pump Start Switch	Toggle switch used to start, run, and stop the chemical feed pump motor.
39	Raw Water Pump No. 2 Start Switch	Toggle switch used to start, run, and stop the raw water pump No. 2 motor.
40	Raw Water Pump No. 1 Start Switch	Toggle switch used to start, run and stop the raw water pump No. 1 motor.
41	Distribution Pump Start Switch	Toggle switch used to start, run, and stop the distribution pump motor.
42	R.O. Pump High Pressure, Low Pressure Reset Switch	Toggle switch that resets the high-or-low-pressure switch after it shuts off the R.O. pump. If the malfunction has been corrected, this switch will turn off the LOW PRESSURE or HIGH PRESSURE indicator lamp.
43	R.O. Pump Jog Switch	Toggle switch that can be used to run the R.O. pump 3 to 5 seconds to drain R.O. pump.
44	Panel Light Switch	Toggle switch used to turn the panel light on and off, and also used to test panel indicator lights.
NOTE		
Items 45 through 53 are circuit breakers located in the junction box which provides electrical power for all electrical components. See figure 2-5, sheet 3.		
45	R.O. Pump CB 1	Automatically shuts off power to R.O. pump motor if there is an electrical malfunction in the circuit.
46	Backwash Pump CB 2	Automatically shuts off power to the backwash pump motor if there is an electrical malfunction in the circuit.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

Table 2-1. ROWPU Controls and Indicators - cont.

Key	Control or Indicator	Function
47	Raw Water Pump No. 1 CB 3	Automatically shuts off power to raw water pump No. 1 motor if there is an electrical malfunction in the circuit.
48	Raw Water Pump No. 2 CB 4	Automatically shuts off power to raw water pump No. 2 motor if there is an electrical malfunction in the circuit.
49	Distribution Pump CB 5	Automatically shuts off power to distribution pump motor if there is an electrical malfunction in the circuit.
50	Booster Pump CB 6	Automatically shuts off power to booster pump motor if there is an electrical malfunction in the circuit.
51	CB 7 Chem Feed Pump	Automatically shuts off power to the chemical feed pump motor if there is an electrical malfunction in the circuit.
52	UTIL Out CB 8	Automatically shuts off power to the utility outlets if there is an electrical malfunction in the circuit.
53	CB 9 Timer Cont	Automatically shuts off power to the backwash timer and backwash pump motor if there is an electrical malfunction in the timer circuit.
54	Utility Outlet	Provides 110 Vac for operation of utility light. Outlet is equipped with a ground fault reset switch.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- e. Vent Vessels Gate Valve. Refer to figure 2-6. The vent vessel gate valve is located to the left and behind the control panel. Closing the vent vessels valve forces water to R.O. vessels. Turning handwheel fully clockwise closes the valve, turning fully counterclockwise opens the valve. Vent vessel valve diverts water from R.O. elements until polymer is adjusted and multimedia filter bed settles.

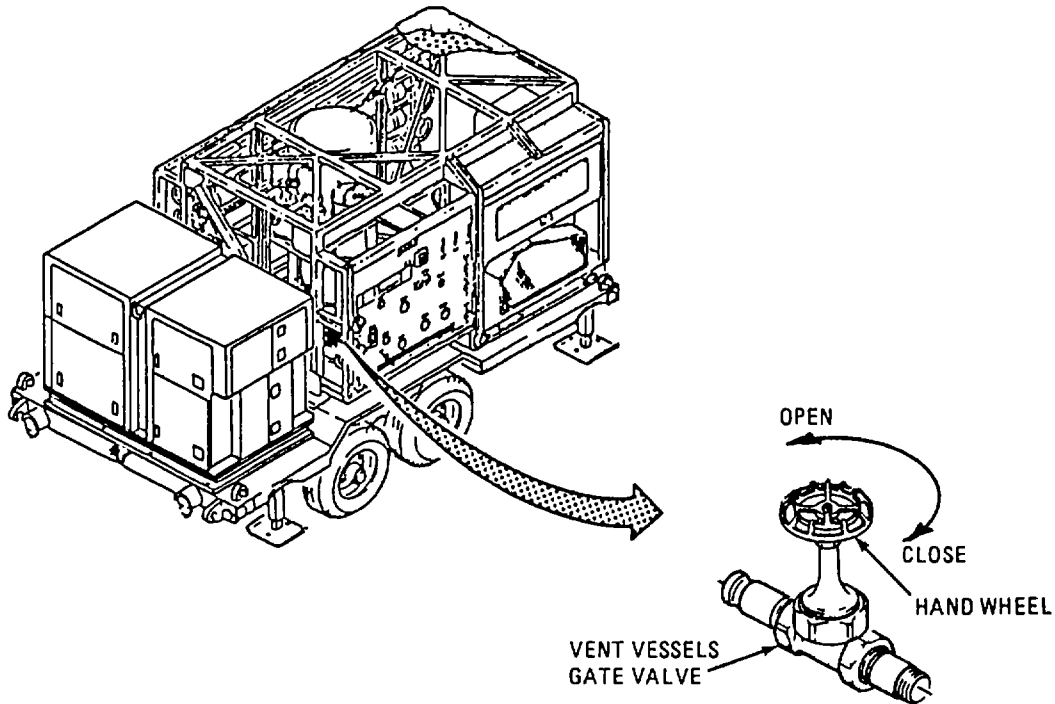


Figure 2-6. Vent Vessels Gate Valve.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- f. Vent Product Water Valve. Refer to figure 2-7. The vent product water valve is located above and to the rear of the of the top R.O. tube, on the product water manifold. It allows air to escape from the product water line.

NOTE

All lever operated ball valves are in the open position when control handle is in line with the inlet and outlet lines.

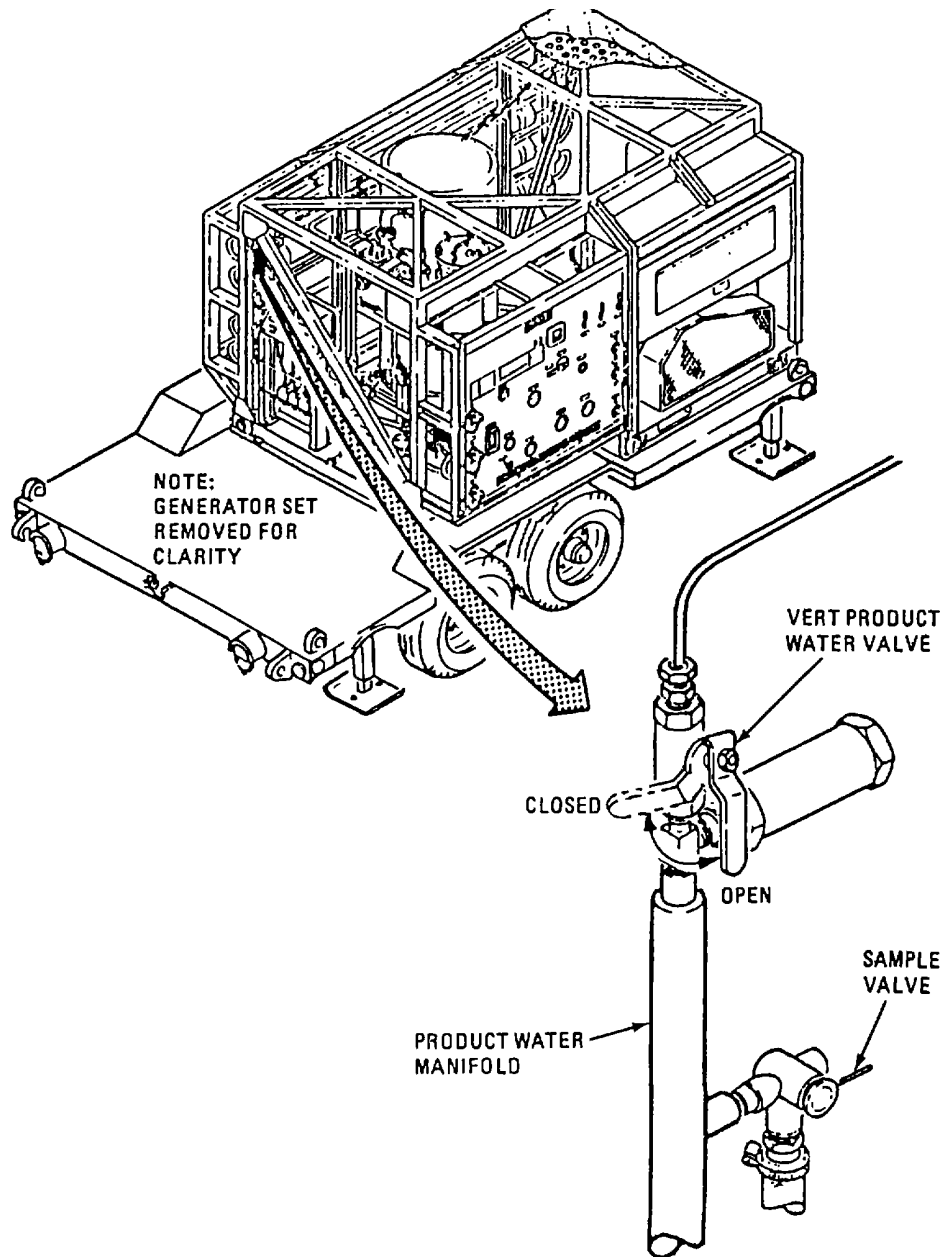


Figure 2-7. Vent Product Water Valve.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- g. Chemical Feed Pump Controls. Four control knobs are located as shown and are used to control the flow of each chemical. A sight gage, mounted on the front of the housing indicates oil level in the unit (Units made before 2001 only).

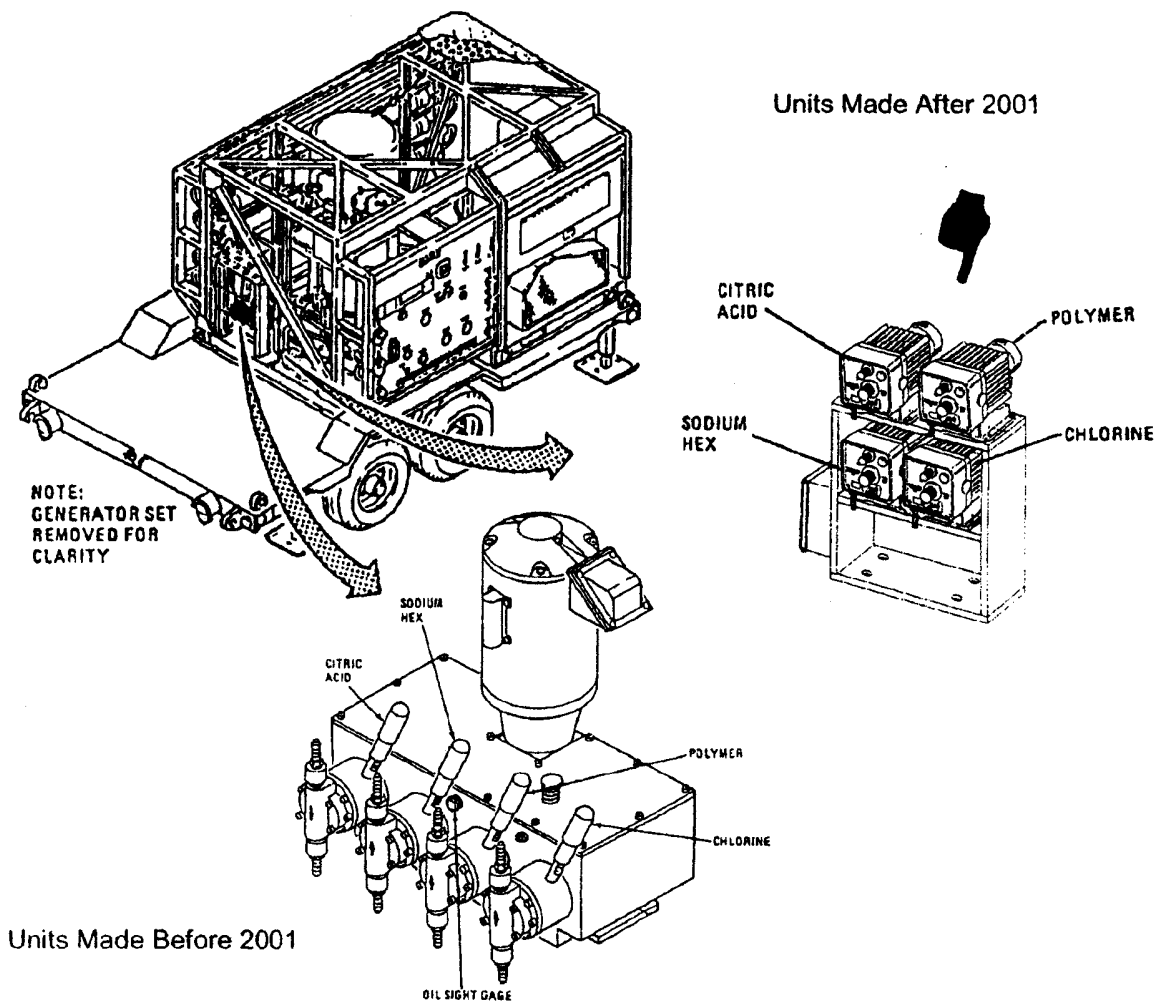


Figure 2-8. Chemical Feed Pump Controls and Indicator.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- h. Gate Valves. Two gate valves are used. One is installed between the brine tank and backwash pump, the other between the product water tanks; both regulate water flow. Turn handwheel counterclockwise to open valves; turn clockwise to close.

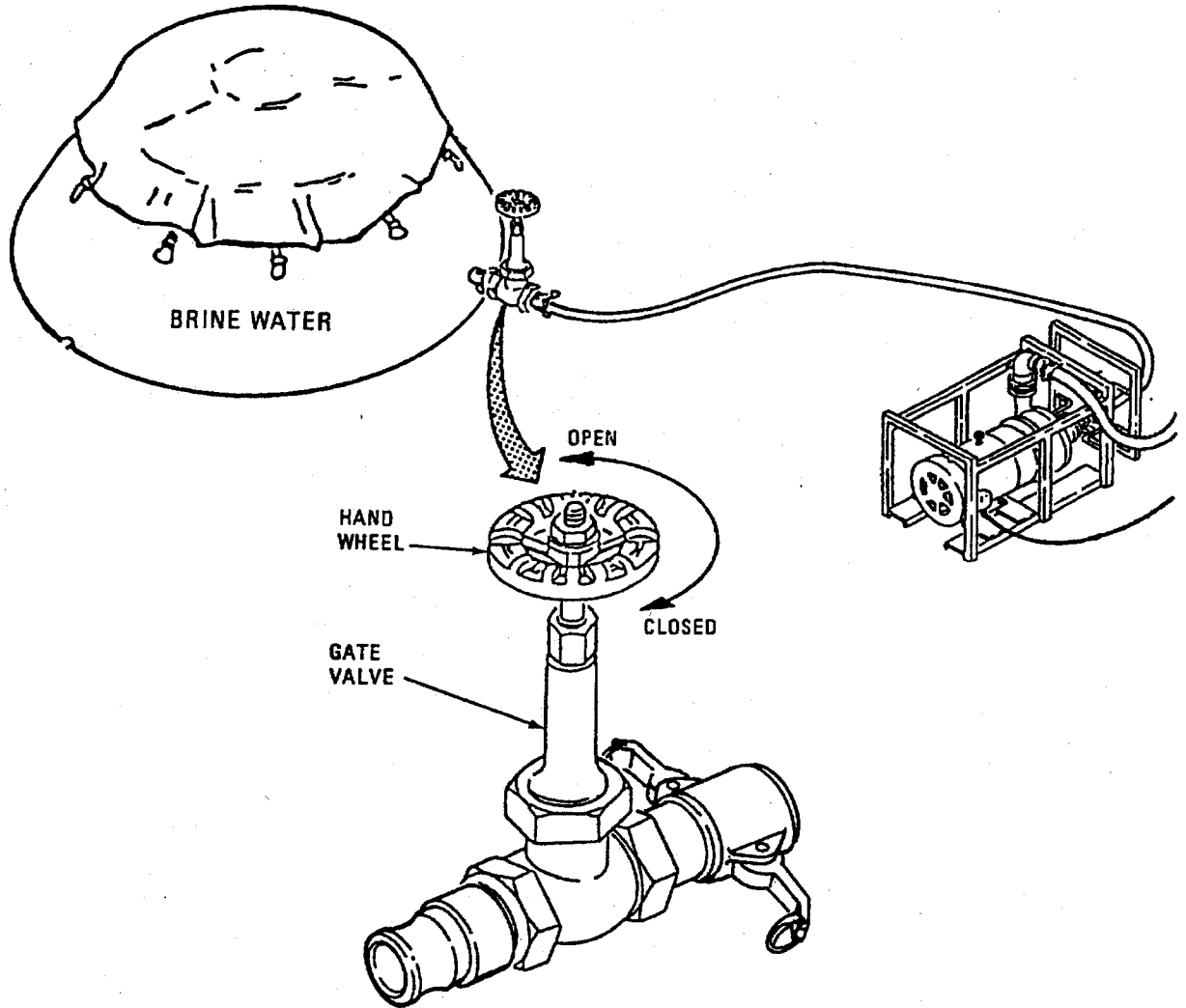


Figure 2.9. Gate Valves

2-2 ROWPU CONTROLS AND INDICATORS - cont.

- i. Drain Valves. Refer to figure 2-10. Seven drain valves are located at front of ROWPU below the R.O. tubes. These valves are used to draw samples at various stages of purification and to drain water from unit before moving. Turn valve handle to the right (towards back of unit) to close valve, turn valve handle to the left to open valve.

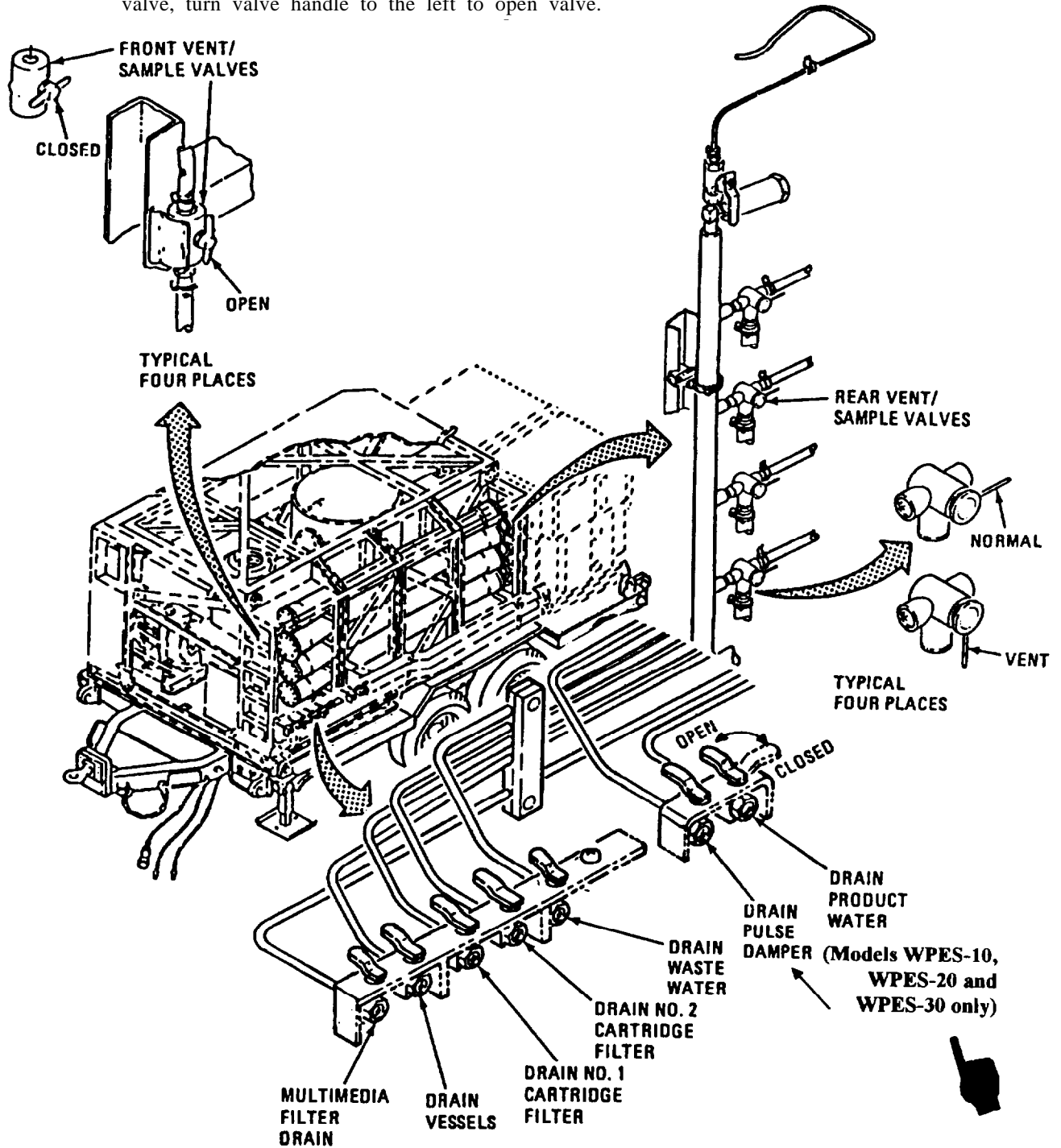


Figure 2-10. Drain Valves.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- j. Chemical Feed Run/Prime Valves. Refer to figure 2-11. The valves have two positions: PRIME and RUN. PRIME is used during startup for priming the chemical feed pump. The valves are set to RUN during normal operation.

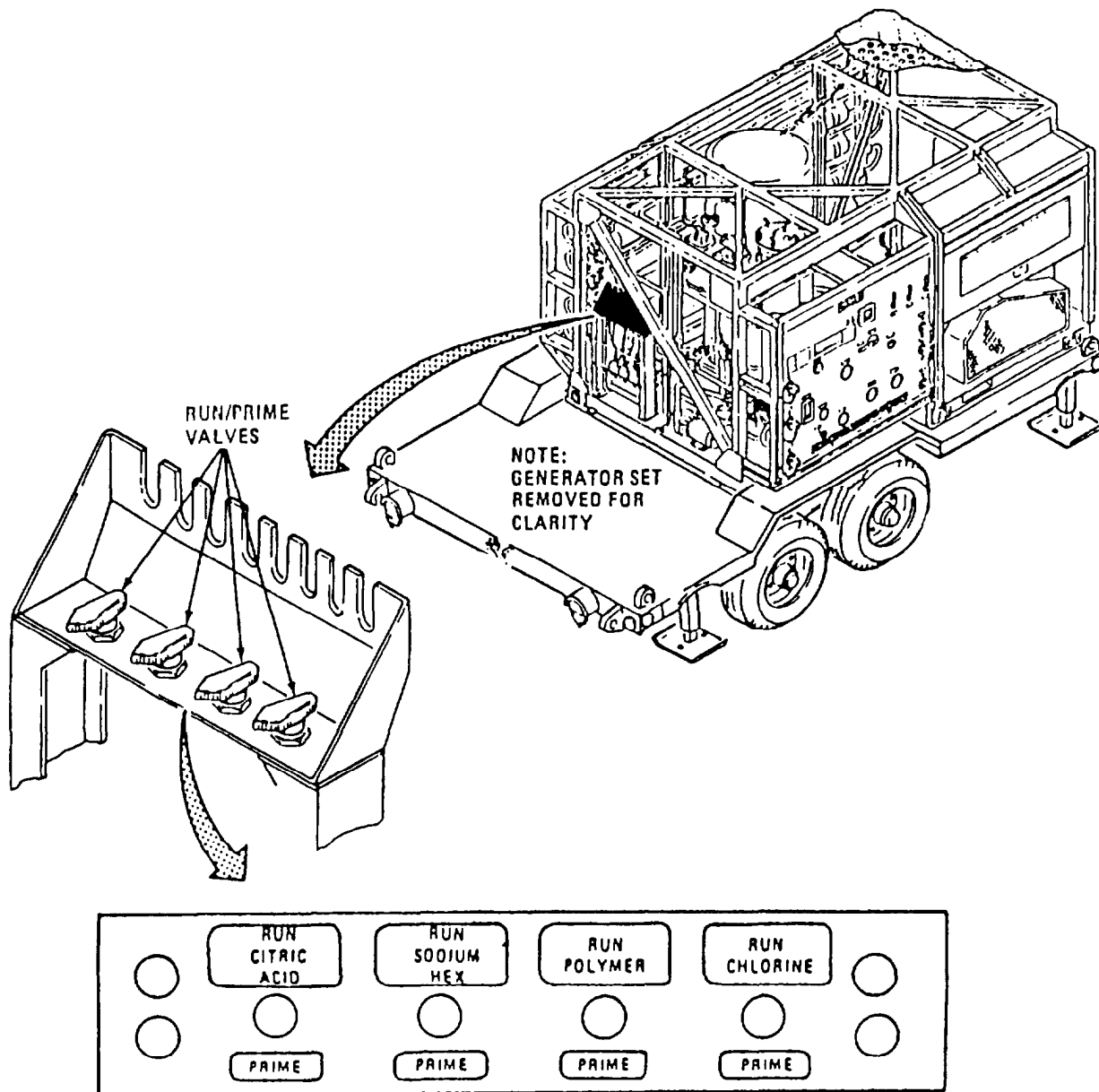


Figure 2-11. Chemical Feed Run/Prime Valves.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- k. Total Dissolved Solids (TDS) Meter. The portable TDS meter (figure 2-12) is used to measure total dissolved solids in raw, brine and product water.

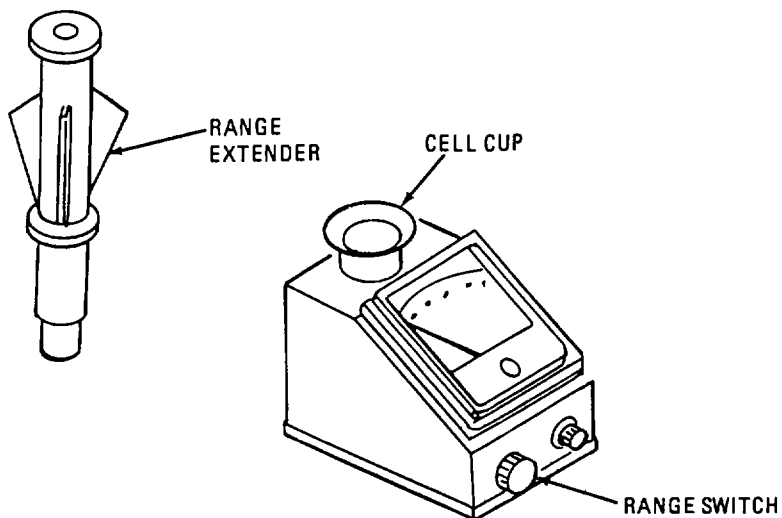


Figure 2-12. Total Dissolved Solids (TDS) Meter.

- l. Turbidity Tube. The turbidity tube (figure 2-13) is used to see how clear the filtered water is.

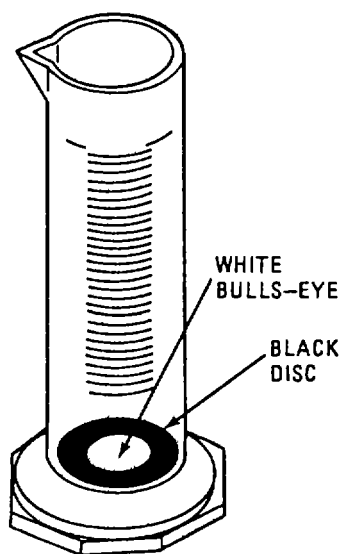


Figure 2-13. Turbidity Tube.

2-2. ROWPU CONTROLS AND INDICATORS- cont.

m. Color Comparator Kit. The color comparator kit is used to measure the amounts of chlorine in the product water and to determine pH of product water and brine water.

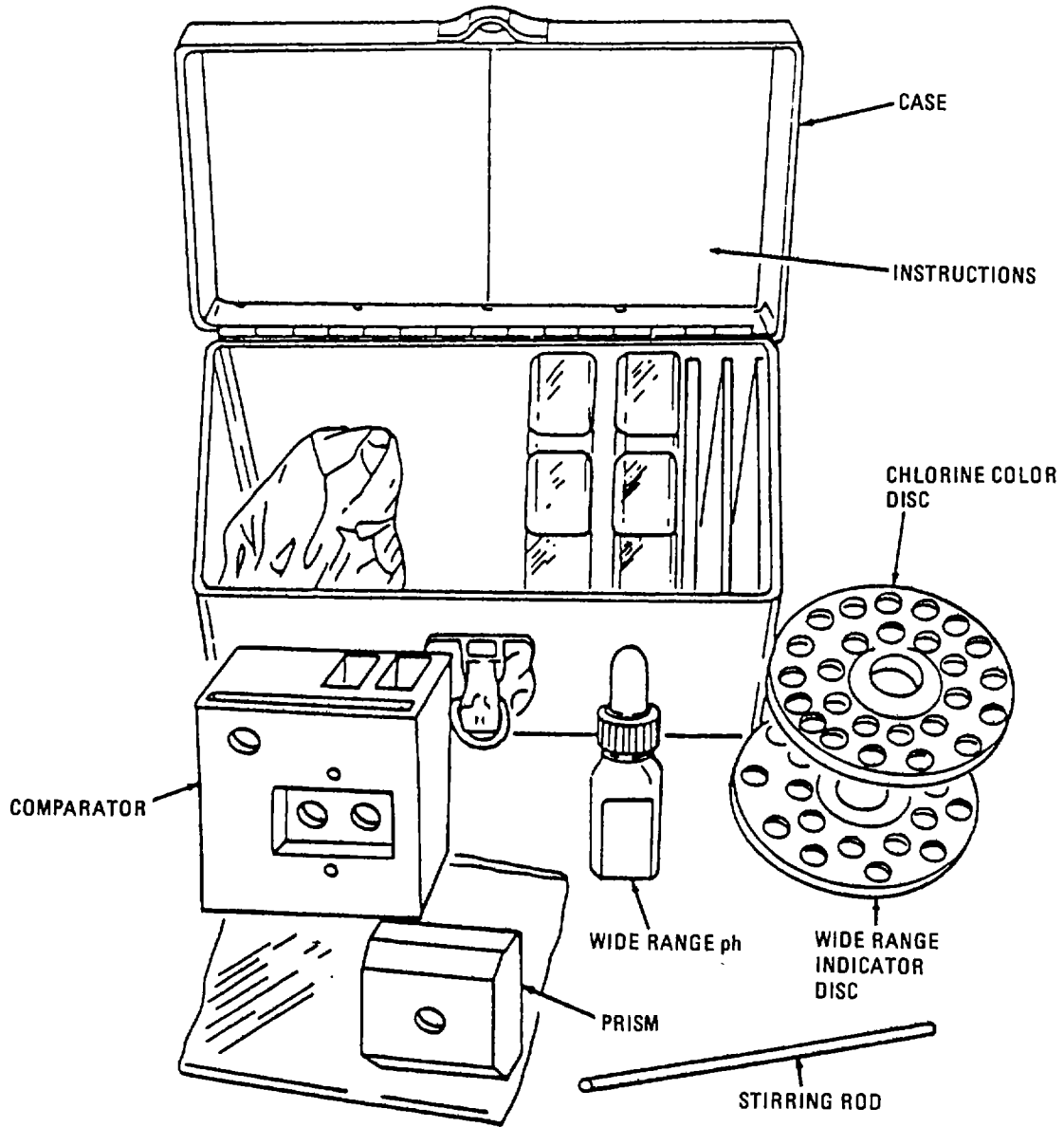


Figure 2-14. Color Comparator Kit.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- n. Backwash Timer. Refer to figure 2-15. The backwash timer is mounted on the rear of the multimedia filter. It automatically starts and stops the different stages of the backwash cycle. Indicator lights inside the timer cover (Models WPES-10, WPES-20, and WRES-30) or on the outside of the timer (Models H-9518-1, H-9518-2, and H-9518-3) show which stage of the backwash cycle the unit is in. An OVER CURRENT PROTECTION PUSH TO RESET button resets the backwash cycle on Models WPES-10, WES-20, and WPES-30. A circuit breaker resets the backwash cycle on Models H-9518-1, H-9518-2, and H-9518-3. No operator control is required.

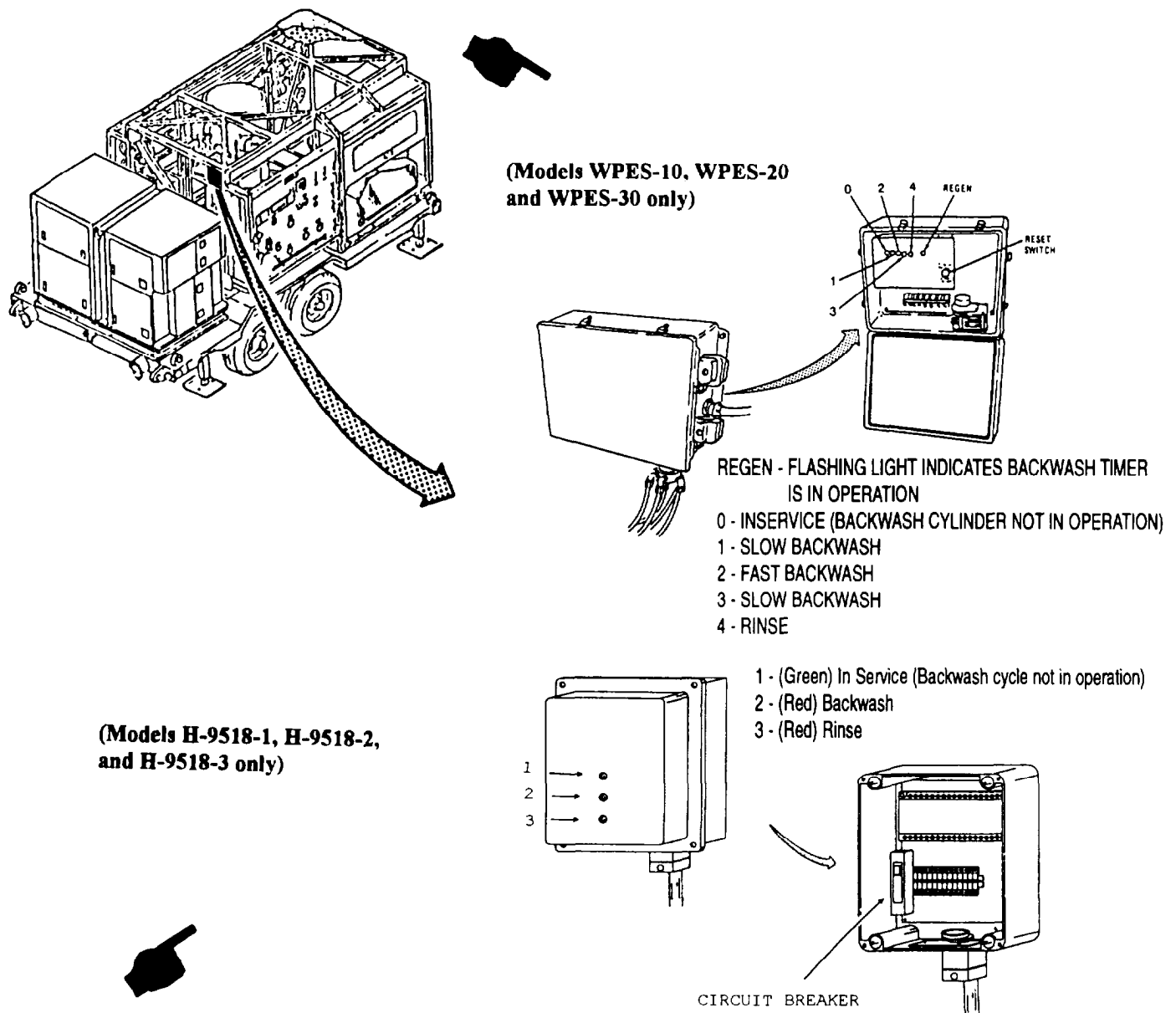


Figure 2-15. Backwash Timer.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

- o. R.O. Pump Sight Gage (Models WPES-10, WES-20, and WPES-30 only). Refer to figure 2-16. The R.O. pump sight gage provides a visual indication of the oil level in the pump. The pump is properly serviced when oil can be seen at least half way up the sight glass.

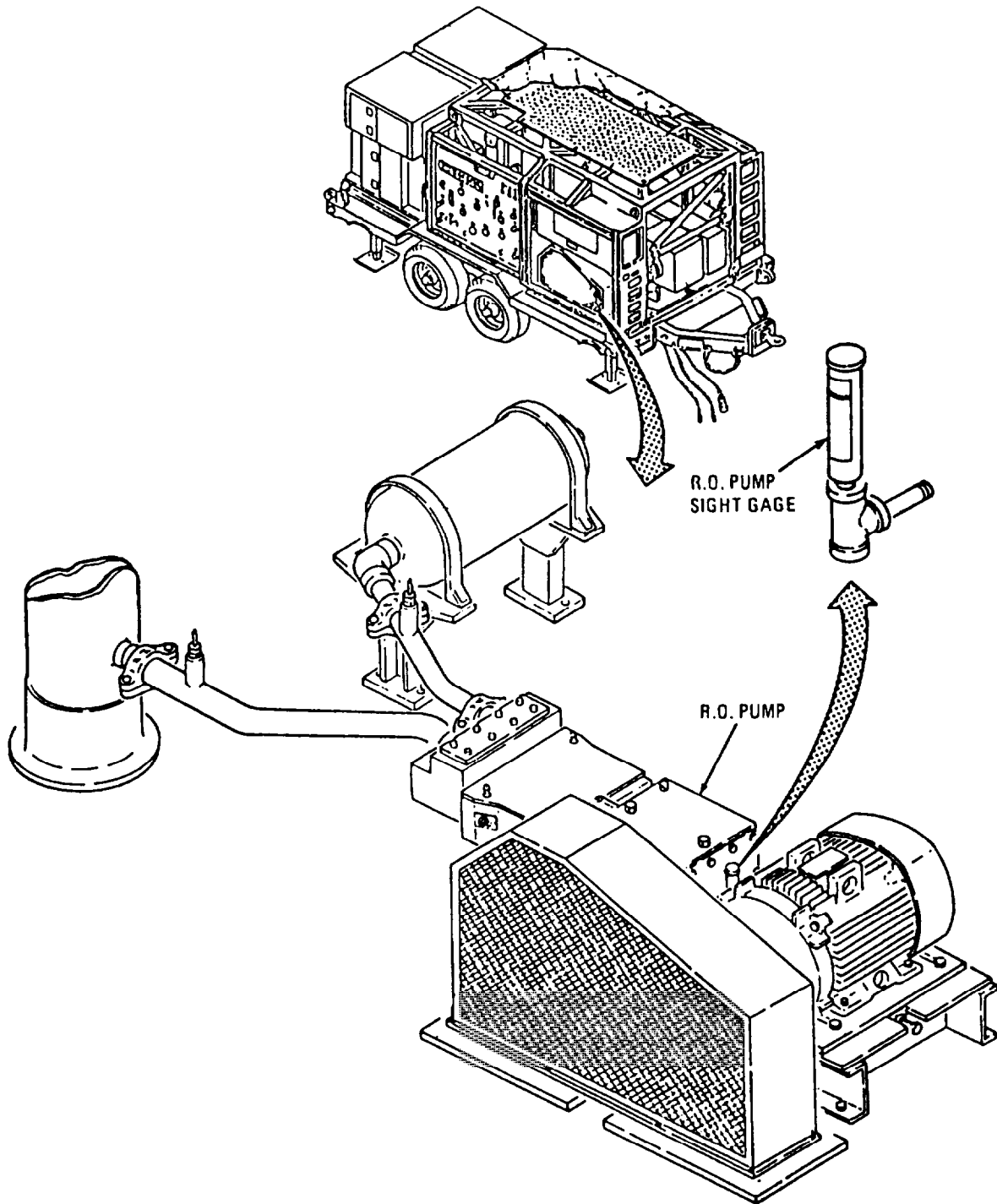


Figure 2-16. R.O. Pump Sight Gage
(Models WPES-10, WPES-20 and WPES-30).

2-2. ROWPU CONTROLS AND INDICATORS- cont.

- p. Safety Devices. Refer to figure 2-17. The ROWPU has four automatic safety devices: the high pressure relief valve, high pressure switch, low pressure switch and rupture disc assembly.
- (a) High Pressure Relief Valve. The high pressure relief valve is located just behind the VENT VESSEL gate valve. If R.O. pressure goes above 1100 psi, this valve opens automatically and discharges water through a pipe at the back of the ROWPU. If this valve activates (indicated by sudden pressure loss), immediately press the PUSH EMERGENCY STOP switch. Open REGULATE PRODUCT FLOW valve after unit is shutdown. When the pressure drops below 1100 psi, the valve will close automatically.

CAUTION

If the valve does not close automatically, notify unit maintenance and do not try to restart the ROWPU.

After the high pressure relief valve closes, clean the R.O. elements (para. 2-12) and restart the ROWPU (para. 2-9).

- (b) High Pressure Switch. The high pressure switch is mounted to the rear of the front panel adjacent to the PANEL LIGHT. The high pressure switch activates above 1250 psi. If the high pressure switch activates, the R.O. pump will automatically shut down and the HIGH PRESSURE LAMP will come on. Notify unit maintenance to troubleshoot the high pressure relief valve. When malfunction is corrected, use the RESET SWITCH to reset high pressure switch.
- (c) Low Pressure Switch. The low pressure switch is mounted on the back of the control panel adjacent to the PANEL LIGHT. The low pressure switch activates when water pressure to the R.O. pump drops to 10 psi (Models WPES-10, WPES-20, and WPES-30) or 40 psi (Models H-9518-1, H-9518-2, and H-9518-3). If the LOW PRESSURE SWITCH activates, the R.O. pump will automatically shut down and the LOW PRESSURE LAMP will come on. If required, notify unit maintenance to troubleshoot the malfunction. When malfunction is corrected, use the RESET SWITCH to reset low pressure switch.
- (d) Rupture Disc Assembly (Models WPES-10, WPES-20 and WPES-30 only). The rupture disc assembly is located on the pipe between the R.O. PUMP and the pulse dampener. The rupture disc is a thin sheet of metal that tears when the pressure goes above 1425 psi. Water is then discharged through the six holes in the top of the assembly. Because the water is under such high pressure, it will make a lot of noise, and water will be sprayed on the inside of the ROWPU. If the rupture disc assembly ever activates, press the PUSH EMERGENCY STOP switch and open the REGULATE PRODUCT FLOW valve. When the pressure has dropped, notify unit maintenance to replace the rupture disc and clean the R.O. elements (para. 2-12). Notify unit maintenance to troubleshoot the high pressure relief valve and the high pressure switch.

2-2. ROWPU CONTROLS AND INDICATORS - cont.

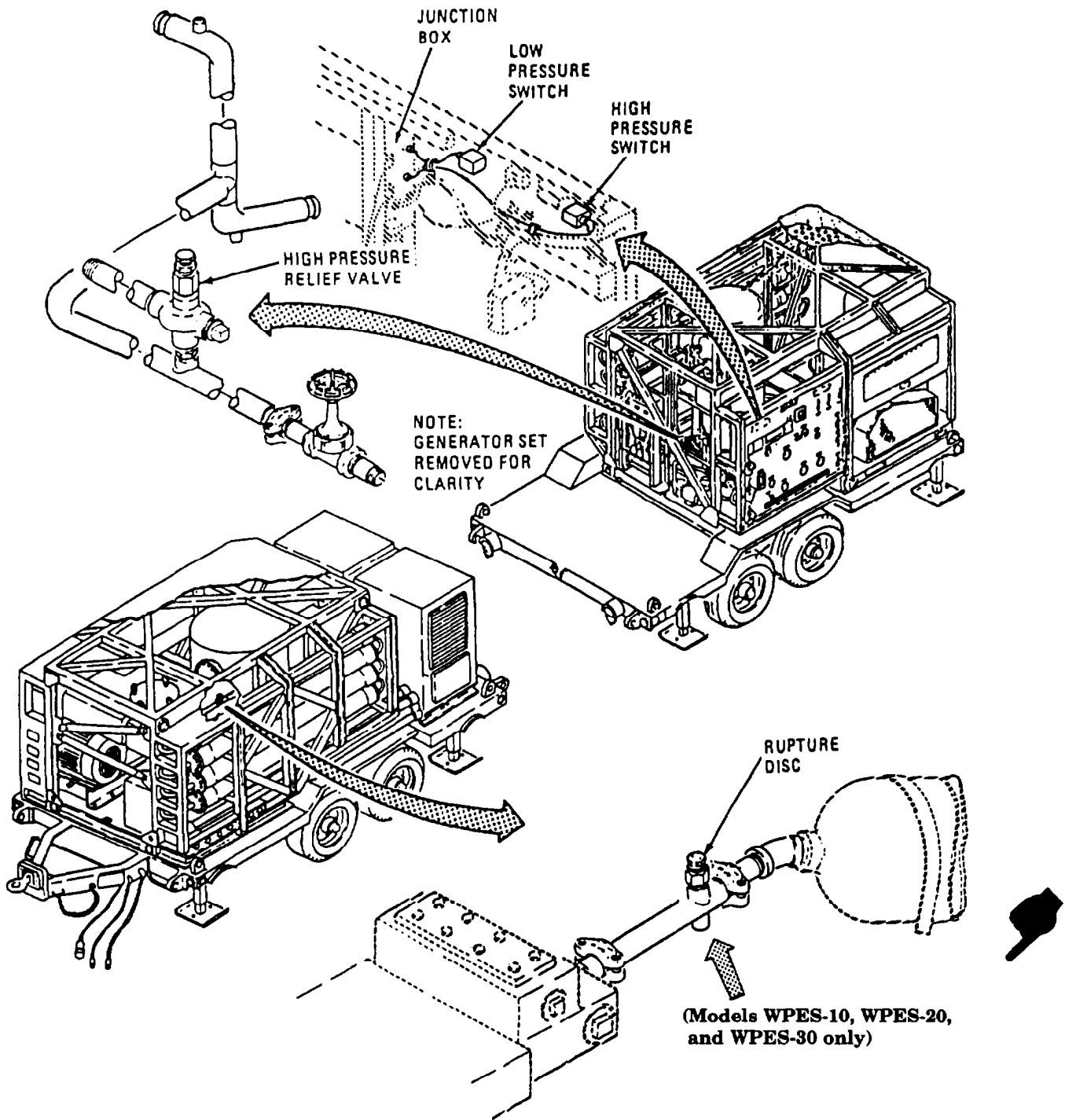


Figure 2-17. Safety Devices.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-4. GENERAL. Preventive Maintenance Checks and Services (PMCS) means systematic caring, inspecting, and servicing of equipment to keep it in good condition and to prevent breakdowns. As the ROWPU's operator, your mission is to:

a. Be sure to perform your PMCS each time you operate the ROWPU. Always do your PMCS in the same order, so it gets to be a habit. Once you've had some practice, you'll quickly spot anything wrong.

b. Do your BEFORE (B) PMCS just before you operate the ROWPU. Pay attention to WARNINGS, CAUTIONS, and NOTES.

c. Do your DURING (D) PMCS while you operate the ROWPU. During operation means to monitor the ROWPU and its related components while it is actually being operated. Pay attention to WARNINGS, CAUTIONS, and NOTES.

d. Do your AFTER (A) PMCS right after operating the ROWPU. Pay attention to WARNINGS, CAUTIONS, and NOTES.

e. Do your WEEKLY (W) PMCS once a week.

f. Do your MONTHLY (M) PMCS once a month.

g. Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any faults that you discover before, during, or after operation, unless you can fix them. You DO NOT need to record faults that you fix.

h. Be prepared to assist organizational maintenance when they lubricate the ROWPU. Perform any other services when required by organizational maintenance.

2-5. PMCS PROCEDURES

a. Your Preventive Maintenance Checks and Services, Table 2-2, lists inspections and care required to keep your ROWPU in good operating condition. It is set up so you can make your BEFORE (B) OPERATION checks as you walk around the ROWPU.

b. Checks and Services are numbered in chronological order regardless of interval. This column is used as a source of tire number for the "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

c. The "INTERVAL" column of Table 2-2 tells you when to do a certain check or service.

d. The "PROCEDURE" column of Table 2-2 tells you how to do required checks and services. Carefully follow these instructions. If you do not have tools, or if the procedure tells you to, notify your supervisor.

NOTE

Terms "ready/available" and "mission capable" refer to same status: Equipment is on hand and ready to perform its combat missions. (See DA Pam 738-750)

e. The "EQUIPMENT IS NOT READY/AVAILABLE IF:" column in Table 2-2 tells you when your ROWPU is nonmission capable and why the ROWPU cannot be used.

f. If the ROWPU does not perform as required, refer to Chapter 3, Section II, Troubleshooting.

g. If anything looks wrong and you can't fix it, write it on your DA Form 2404. IMMEDIATELY, report it to your supervisor.

h. When you do your PMCS, you will always need a rag or two. Following are checks that are common to the entire ROWPU:

(1) Keep It Clean. Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed.

(2) Rust and Corrosion. Check ROWPU body and frame for rust and corrosion. If any bare metal or corrosion exists, clean, and apply a thin coat of oil. Report it to your supervisor.

(3) Bolts, Nuts, and Screws. Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, but look for chipped paint, bare metal, or rust around bolt heads. If you find a bolt, nut, or screw you think is loose, tighten it or report it to your supervisor.

(4) Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.

(5) Electric Wires and Connectors. Look for cracked, frayed, or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors. Report any damaged wires to your supervisor.

(6) Hoses and Fluid Lines. Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to your supervisor.

i. When you check for "operating condition," you look at the component to see if it's serviceable.

2-6. CLEANING AGENTS

NOTE

- **DO NOT use diesel fuel, gasoline, or benzene (benzol) for cleaning.**
- **DO NOT SMOKE when using cleaning solvent. NEVER USE IT NEAR AN OPEN FLAME. Be sure there is a fire extinguisher nearby and use cleaning solvent only in well-ventilated places. Flash point of solvent is 138°F (600C).**
- **USE CAUTION when using cleaning solvents. Cleaning solvents evaporate quickly and can irritate exposed skin if solvents contact skin. In cold weather, contact of exposed skin with cleaning solvents can cause frostbite.**

a. Treating Mildewed Areas. Canvas that has mildewed can be cleaned by scrubbing with a dry brush. If it is necessary to use water to remove dirt, it should not be used until mildew has been removed. After removing mildew, examine fabric. Look for evidence of deterioration. If canvas has deteriorated it should be replaced.

NOTE

Use only those authorized cleaning solvents or agents listed in Appendix D.

b. Cleaning Rust or Grease. When cleaning grease buildup or rusty places, use a cleaning solvent. Then apply a thin coat of light oil to affected area.

2-7. LEAKAGE DEFINITIONS FOR OPERATOR PMCS. It is necessary for you to know how fluid leakage affects the status of the ROWPU. Following are types/classes of leakage an operator needs to know to be able to determine the status of the ROWPU. Learn these leakage definitions and remember - when in doubt, notify your supervisor.

NOTE

Use only those authorized cleaning solvents or agents listed in Appendix D.

- **Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.**
- **When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.**
- **Class III leaks should be reported immediately to your supervisor.**

- a. CLASS I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
- b. CLASS II - Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.
- c. CLASS III - Leakage of fluid great enough to form drops that fall from item being checked/inspected.

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location	Procedure	Not Fully Mission Capable If:
		Item To Check/Service		
1	Before	Flatbed Cargo Trailer	a. Inspect taillights for cracked lenses and verify all trailer lights for proper operation. b. Check tires for proper inflation (Model WPES-10: 75 psi; Model H-9518-1:50 psi).	Lights inoperable Tire is flat
2	Before	Generator Set	Check Generator (Refer to TM 5-6115-465-12)	In Accordance With TM 5-6115-465-12

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
3	During	Flatbed Cargo Trailer	<ul style="list-style-type: none"> a. Inspect hoses for leaks. b. Check leveling jacks for proper operation. 	<p>Any air leaks</p> <p>Leveling Jacks inoperable</p>
4	During	Ground Rods and Grounding Stud	Inspect Ground Rods and Grounding Stud for proper installation and loose connections.	Ground rods or grounding studs improperly installed or any loose connections
5	During	Raw Water System	<ul style="list-style-type: none"> a. Check Raw Water Pump and couplings for leaks b. Check pump Electric Motor for discoloration and excessive noise. c. Inspect Hoses for leaks d. Inspect Electric Power Cables for tears. burrs and cuts. 	<p>Class III leaks</p> <p>Steady stream of water</p> <p>Any tears, buffs or cuts</p>
6	During	Backwash System	<ul style="list-style-type: none"> a. Check Backwash Pump, Strainer and Couplings for leaks. b. Check Pump Electric Motor for discoloration and excessive noise. c. Inspect Hoses for leaks. d. Inspect Electric Power Cables for tears, burrs and cuts. e. Check Backwash Tank for leaks. 	<p>Class III leaks</p> <p>Steady stream of water</p> <p>Any tears, buffs or cuts</p> <p>In Accordance With TM 5-5430-227-12&P</p>
7	During	Product Water system	<ul style="list-style-type: none"> a. Check Distribution Pump and Couplings for leaks. b. Check Pump Electric Motor for discoloration and excessive noise. c. Inspect Hoses for leaks. d. Inspect Electric Power Cables for tears. buffs and cuts. e. Check Product Water Tanks for leaks. 	<p>Class III leaks</p> <p>Steady stream of water</p> <p>Any tears, burrs or cuts</p> <p>In Accordance With TM 5-5430-277-12&P</p>

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
8	During	Waste Water System	f. Check Nozzle for leaks and proper operation. a. Check Vent Vessels Line for leaks. b. Check Waste Line for leaks.	Steady stream of water Steady stream of water
9	During	Generator Set	See TM 5-6115-465-12	In accordance with TM 5-6115-465-12
10	During	Control Panel	a. Inspect Panel Light and Indicator Lights for proper operation. b. Inspect TDS Monitor for proper operation (Use TDS Meter). c. Inspect vents, valves and drains for smooth operation and leaks. d. Inspect gages for proper operation. e. Check for loose or disconnected Power Cable. Reconnect and tighten as required.	Vents, valves or drains inoperable. Gages inoperable.
11	During	Boost Pump	ROWPU INTERIOR a. Inspect Boost Pump Motor for discoloration and excessive noise. b. Inspect Pump and Connectors for leaks. c. Inspect Pump for cracks, corrosion and loose or missing mounting hardware.	Steady stream of water Missing mounting hardware or cracks in pump
12	During	RO Pump	a. Inspect Pump Motor for discoloration and excessive noise. b. Inspect Pump and Connectors for leaks.	Steady stream of water

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
13	During	Chemical Feed Pump (Units Made Before 2001)	<p style="text-align: center;">NOTE</p> <p>Procedures c-h only apply to Models WPES-10, WPES-20, and WPES-30.</p> <p>c. Check that sight gage is in RED area of sight glass. Add oil as required.</p> <p>d. Check gearbox and oil lines for leaks</p> <p style="text-align: center;">CAUTION</p> <p>Excessive leakage will contaminate the crankcase oil and score the plunger.</p> <p>e. Inspect Pump cavity for leakage at plunger sleeve. Water leakage(drops) into the cavity past the packings is normal and aids cooling. As packings wear from normal use, the leakage will increase. When this occurs, shut down the ROWPU and tighten packing nuts as follows:</p> <ol style="list-style-type: none"> 1. Get packing adjustment tool from storage box. Insert end of tool into packing sleeve. Slowly tighten packing sleeve 1/8 turn. Restart ROWPU and check for leakage. Repeat until leak has been reduced to an acceptable level. 2. Repeat step #1 for other leaking packings. <p>f. Inspect Pump Crankcase for oil leakage.</p> <p>g. Inspect Pump and Motor Stand for cracks, loose or missing hardware. Inspect Belt Guard for cracks, corrosion and leaks or missing mounting hardware and corrosion.</p> <p>h. Inspect Belt Guard for cracks, corrosion and leaks or missing mounting hardware.</p> <p>a. Inspect Electric Motor for discoloration and excessive noise.</p>	<p>Oil level too low</p> <p>Class III leaks</p> <p>Excessive leakage cannot be controlled</p> <p>Class III leaks</p> <p>Hardware missing</p> <p>Hardware missing</p>

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
14	During	(Units Made Before 2001) (Units Made Before 2001) RO Pressure Tubes PIPING	b. Check Chemical Feed Pump for correct oil level. Add oil as required. c. Inspect Chemical Feed Pump for chemical leaks and oil leaks. d. Check to see if each Chemical Feed Head operates correctly. Clean check valves as required. e. Inspect Chemical Feed Pump for cracked or broken hose couplings, disconnected flex hoses and loose or missing attaching hardware. a. Inspect RO Pressure Tubes for leaks. b. Inspect front and rear Sampling Valves for leaks.	Oil level too low Class III leaks Chemical Feed Heads inoperable Hose couplings cracked or broken Class III leaks
15	During	Low Pressure Lines	a. Inspect Pipes, Clamps and Fittings for leaks. b. Inspect for cracks, corrosion and loose or missing hardware.	Steady stream of water Hardware missing
16	During	High Pressure Lines	a. Inspect Pipes, Clamps and Fittings for leaks. b. Inspect for cracks, corrosion and loose or missing hardware.	Class III leaks Hardware missing
17	During	Filters (Multimedia and Cartridge)	a. Inspect Filter Tank for cracks and loose or missing mounting hardware. b. Inspect for leaks around filter and connecting pipes.	Class III leaks Mounting hardware missing Steady stream of water
18	During	Deionization Cartridges (If installed)	Check Flex Hoses, Fittings and Cartridges for leaks.	Steady stream of water

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
19	After	Flatbed Cargo Trailer (Model WPES-10 and H-9518-1)	<p>a. Inspect four Leveling Jacks for cracks, broken welds, and bent or broken components and proper operation.</p> <p>b. Inspect Taillights for cracked lenses and proper operation. Replace as required.</p> <p>c. Check Tires for proper inflation (75 psi on Model WPES- 10, 50 psi on Model H9518-1). Inspect for cuts, punctures and excessive tread wear. Inspect for loose or missing lug nuts. Tighten lug nuts if required.</p> <p>d. Inspect Axle, Springs and Trunnions for cracks, broken welds and corrosion.</p> <p>e. Inspect Air Hoses for kinks, cuts and cracks.</p> <p>f. Inspect Air Reservoir (under trailer) for dents, cracks and corrosion.</p> <p>g. Inspect Drain Cock on air reservoir for damage. Open Drain Cock slowly and allow condensation to drain, then close Drain Cock.</p> <p>h. Inspect Electrical Wiring under trailer for cuts, torn insulation and exposed wires.</p>	<p>Leveling jacks cracked, bent or broken or broken welds</p> <p>Tire(s) low or flat. Sidewalls cut</p> <p>Trunnions or springs cracked. Lug nuts missing</p> <p>Air Hose(s) cut or cracked</p> <p>Air reservoir cracked or corroded</p> <p>Drain cock damaged</p> <p>Electric wiring cut, insulation torn or wires exposed</p>
20	After	Storage Chests	<p>a. Check for missing tools, chemicals and components (see inventory list in storage chest). Inspect tools and components for damage.</p> <p>b. Inspect Chests for cracks, broken latches, hinges and hardware</p>	
21	After	Raw Water System	<p>a. Check Raw Water Pump frame and pump body for cracks, corrosion and loose or missing hardware.</p> <p>b. Inspect for cut, torn or burned Electrical Power Cable.</p> <p>c. Inspect Pump Electric Motor for debris blocking cooling slots and signs of discoloration.</p>	<p>Cracks, corrosion or loose or missing hardware</p> <p>Electric Power Cable cut, torn or burned</p> <p>Debris blocking cooling slots or signs of discoloration</p>

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
22	After	Backwash System	<p>d. Inspect Hoses for tears, cuts, signs of dry rot and missing gaskets.</p> <p>e. Inspect Strainer and Fittings for damaged gaskets, corrosion and cracks.</p> <p>f. Inspect Float for dents, cracks, punctures and corrosion.</p> <p>a. Check Backwash Pump frame, pump body and strainer for cracks, corrosion and loose or missing hardware.</p> <p>b. Inspect for cut, torn or burned Electrical Power Cable.</p> <p>c. Inspect Pump Electric Motor for debris blocking cooling slots.</p>	<p>Tears, cuts, signs of dry rot or missing gaskets</p> <p>Damaged gaskets, corrosion or cracks</p> <p>Float cracked or punctured</p> <p>Cracks, corrosion or loose or missing hardware</p> <p>Electric Power Cable cut, torn or burned</p> <p>Debris blocking cooling slots or signs of discoloration</p>
23	After	Product Water System	<p>d. Inspect Hoses for tears, cuts, signs of dry rot and missing gaskets.</p> <p>e. Inspect Fittings for damaged gaskets, corrosion and cracks.</p> <p>f. Inspect Tank in accordance with TM 5-5430-225-12&P.</p> <p>a. Check Distribution Pump frame, pump body and strainer for cracks, corrosion and loose or missing hardware.</p> <p>b. Inspect for cut, torn or burned Electrical Power Cable.</p> <p>c. Inspect Pump Electric Motor for debris blocking cooling slots.</p> <p>d. Inspect Hoses for tears, cuts, signs of dry rot and missing gaskets.</p>	<p>Tears, cuts, signs of dry rot or missing gaskets</p> <p>Damaged gaskets, corrosion or cracks</p> <p>In accordance with TM 5-5430-225-12&P</p> <p>Cracks, corrosion or loose or missing hardware</p> <p>Electric Power Cable cut, torn or burned</p> <p>Debris blocking cooling slots or signs of discoloration</p> <p>Tears, cuts, signs of dry rot or missing gaskets</p>

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
24	After	Waste Water System (Vent Vessels and Waste Lines)	<p>e. Inspect Fittings for damaged gaskets, corrosion and cracks.</p> <p>f. Inspect Tank in accordance with TM 5-5430-225-12&P.</p> <p>g. Inspect Nozzles for corrosion, cracks or missing hardware</p> <p>Inspect Hoses for tears, cuts, signs of dry rot and missing gaskets.</p>	<p>Damaged gaskets, corrosion or cracks</p> <p>In accordance with TM 5-5430-225-12&P</p> <p>Tears, cuts, signs of dry rot or missing gaskets</p>
25	After	Control Panel	<p>a. Inspect Panel Light and Indicator Lights for proper operation of iris and cracked or broken bulbs and lenses.</p> <p>b. Inspect TDS Monitor for cracked housing, damaged cover or electric cables.</p> <p>c. Inspect gages for cracked and broken glass.</p> <p>d. Inspect Vents, Valves and Drains for corrosion and missing or damaged hardware.</p>	<p>Valves damaged</p>
ROWPU INTERIOR				
26	After	Booster Pump	<p>Inspect Booster Pump Motor for discoloration and damaged or missing hardware.</p>	<p>Discoloration or damaged or missing hardware</p>
27	After	RO Pump (Models WPES-10, WPES-20 and WPES-30 only)	<p>a. Inspect RO Pump Motor for discoloration and damaged or missing hardware.</p> <p>b. Check that oil site gage is in red area of site glass. Add oil as required.</p> <p>c. Check Gearbox for signs of leakage.</p> <p>d. Insect Belt Guard for cracks, corrosion, loose or missing hardware.</p> <p>e. Inspect V-Belts for cuts, cracks, frayed or worn belts.</p>	<p>Discoloration or damaged or missing hardware</p> <p>Discoloration or damaged or missing hardware</p> <p>Oil level too low</p> <p>Class III leaks</p> <p>Hardware missing</p>

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Location Item To Check/ Service	Procedure	Not Fully Mission Capable If:
28	After	Chemical Feed Pump (Units Made Before 2001) (Units Made Before 2001) (Units Made Before 2001)	a. Inspect Chemical Feed Pump Electric Motor for discoloration and damaged or missing hardware. b. Inspect Chemical Feed Pump for proper oil level. Add oil as required. c. Inspect Chemical Feed Pump for oil leaks and damaged or missing hardware. d. Inspect Chemical Feed Hoses and connectors for cracked hoses and damaged or missing connectors. e. Inspect Chemical Feed Containers for cracks, punctures and damaged or missing hardware. f. Inspect Chemical Feed frame for cracked or broken welds and missing hardware.	Discoloration or damaged or missing hardware Oil level is too low Any leaks or damaged or missing hardware Cracked hoses or damaged or missing connectors Containers cracked, punctured or damaged or missing hardware Frame cracked, broken welds or missing hardware
29	After	RO Pressure Tubes	a. Inspect RO Pressure Tubes for cracks or separation of fiberglass layers and for missing hardware. b. Inspect Mounting Studs and End Caps for damage and missing hardware. c. Inspect RO Vessel Sampling Valves for damaged or missing hardware.	RO Pressure Tubes cracked or fiberglass layers are separated or hardware is missing Mounting Studs or End Caps damaged or hardware missing RO Vessel Sampling Valve damaged or hardware missing
30	After	Ground Rods and Ground Studs	Inspect Ground Rods and Ground Studs for damaged or missing components.	Ground Rods or Studs damaged or hardware missing
31	After	ROWPU Frame	Inspect ROWPU Frame for cracks, broken welds, bent frame components and corrosion.	Cracks, broken welds or severely bent frame components
32	After	Canvas Cover	Inspect Canvas Cover for punctures, rips, tears, damaged seams and missing hardware.	

Section III. OPERATION UNDER USUAL CONDITIONS

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2-5. CHOOSING THE SITE.

When choosing the site to set up and run the ROWPU, remember the following:

- a. If a stream is to be used as the raw water source, pick a site for ROWPU upstream from camp. Refer to Figure 2-18.

WARNING

Ensure that the site provides downstream waste water drainage away from the water source.

CAUTION

- Consider viable weather conditions when choosing site; avoid areas vulnerable to flash flooding and high tide.
- Raw water pump No. 1 must be as close to water source as possible (less than 10 foot lift).

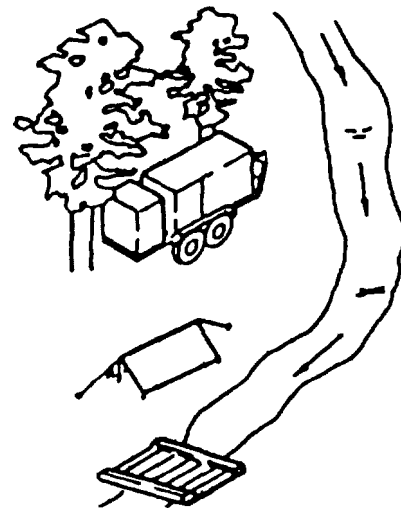


Figure 2-18. Site Diagram.

- b. The raw water hoses and electrical cable can reach about 75 feet. Ensure the ROWPU is placed close enough for the hoses to reach the water source, and check that the ground is solid and fairly level.
- c. Take advantage of available forest cover.
- d. Take advantage of finished roads. They can furnish a solid, level surface.

2-6. TRAILER ASSEMBLY AND PREPARATION FOR USE (Models WPES-10 and H-9518-1).

Upon reaching the operating area, prepare the flatbed cargo trailer for use as shown in figure 2-19.

2-6. TRAILER ASSEMBLY AND PREPARATION FOR USE (Models WPES-10 and H-9518-1) - cont.

1. CHOOSE SITE AS NEARLY LEVEL AS POSSIBLE. CLEAR SITE OF ROCKS AND VEGETATION. BE SURE SURFACE IS FIRM ENOUGH TO SUPPORT THE TRAILER MOUNTED ROWPU.

WARNING

DISCONNECT AIR BRAKE HOSES FROM TOWING VEHICLE AND COUPLE HOSES TO TRAILER. TRAILER WILL MOVE UNLESS HOSES ARE DISCONNECTED

3. OPEN AIR BRAKE COUPLING LEVERS. DISCONNECT AIR HOSES (16) FROM TOWING VEHICLE. PARKING BRAKES ARE NOW SET. STOW AIR HOSES (16) ON DUMMY COUPLINGS (17) PROVIDED ON TRAILER DRAWBAR (9).

2. MANEUVER TRAILER INTO POSITION WITH TOWING VEHICLE. BE SURE ALL SIDES OF TRAILER AND ALL FITTINGS AND CONTROLS FOR THE ROWPU ARE EASILY ACCESSIBLE. IF TOWING VEHICLE IS TO BE DISCONNECTED FROM TRAILER, USE FRONT LEVELING JACKS TO HELP IN UNCOUPLING.

4. REMOVE SAFETY PIN (1) AND CRANK HANDLE (2) FROM REAR OF JACK SUPPORT BRACKET (3).

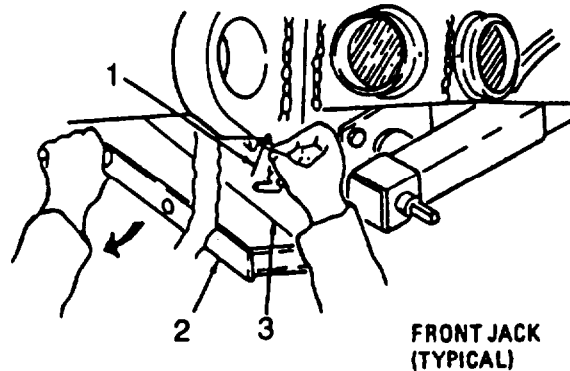
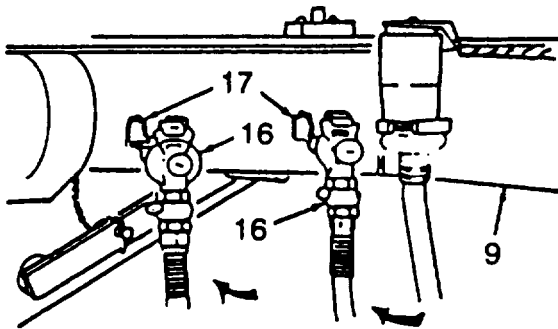
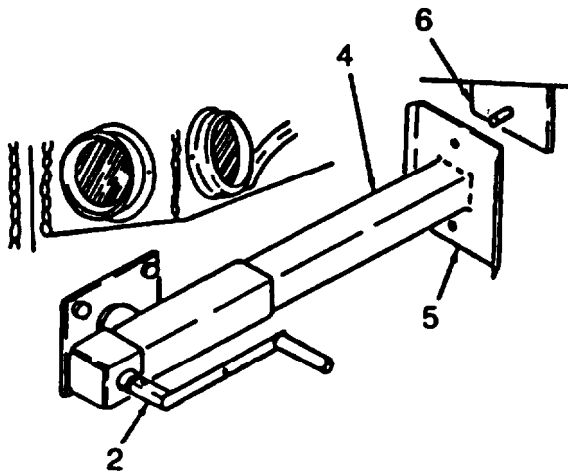


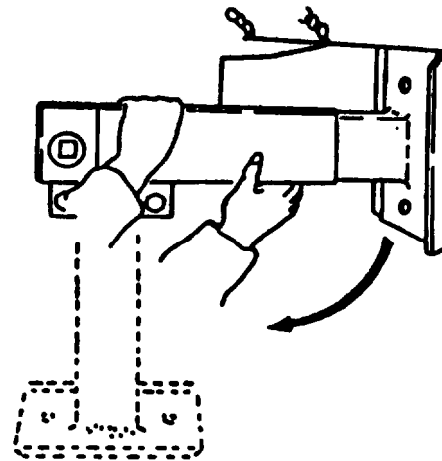
Figure 2-19. Trailer Preparation for Use (Sheet 1 of 5)
(Models WPES-10 and H-9618-1)

2-6. TRAILER ASSEMBLY AND PREPARATION FOR USE (Models WPES-10 and H-9618-1) - cont.

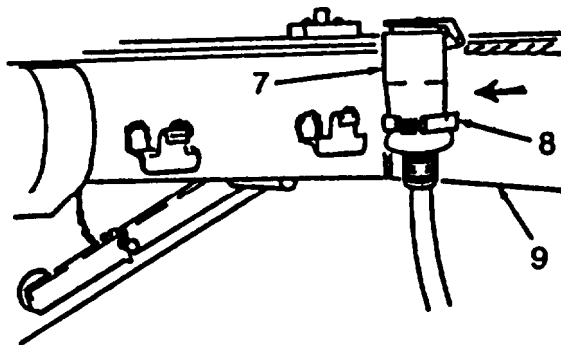
5. POSITION CRANK HANDLE (2) ON JACK (4) AND TURN HANDLE COUNTERCLOCKWISE TO RETRACT JACK UNTIL JACK PAD (5) IS CLEAR OF SECUREMENT PLATE (6) ROUND BAR.



6. TO ROTATE FROM LEVELING JACK TO LEVELING POSITION, REMOVE CRANK HANDLE. GRASP JACK AND PULL STRAIGHT OUT AGAINST SPRING TENSION. ROTATE JACK DOWN TO VERTICAL POSITION. ALLOW JACK TO SPRING BACK TO LOCKED POSITION.



7. DISCONNECT ELECTRICAL CONNECTOR (7) FROM TOWING VEHICLE. STOW CONNECTOR IN STOWAGE CLIP (8) ON TRAILER DRAWBAR (9).



8. RELEASE PINTLE (10) BY LIFTING PINTLE LEVER. RAISE PINTLE.

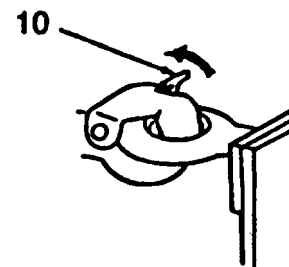


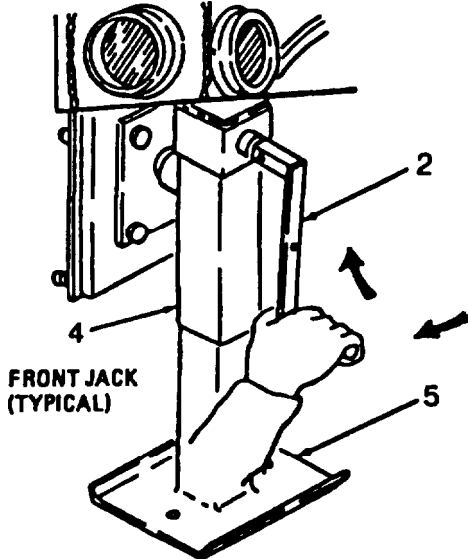
Figure 2-19. Trailer Preparation for Use (Sheet 2 of 5)
(Models WPES-10 and H-9518-1)

2-6. TRAILER ASSEMBLY AND PREPARATION FOR USE (Models WPES-10 and H-95181) - cont.

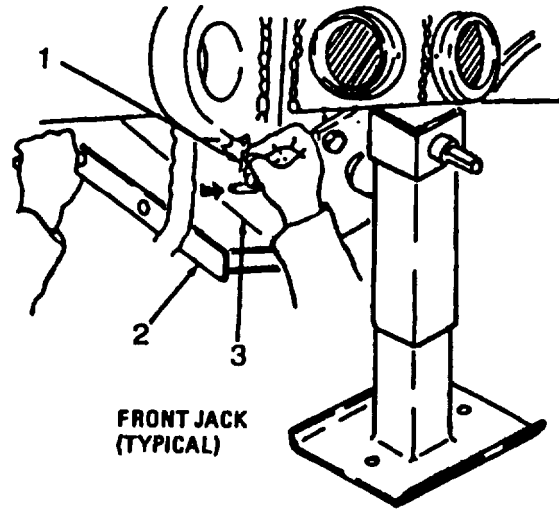
NOTE

TWO PERSONNEL OPERATING BOTH LEVELING JACKS ARE REQUIRED TO RAISE THE TRAILER.

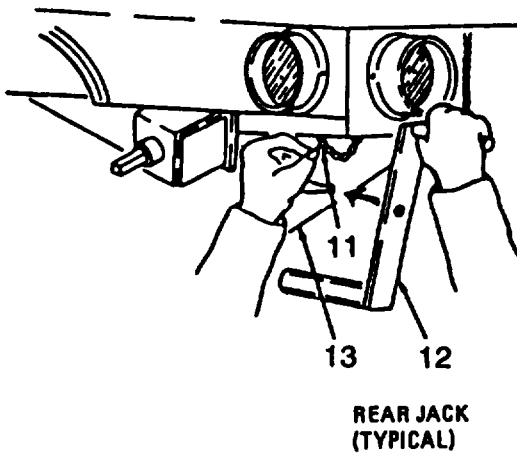
9. POSITION CRANK HANDLE (2) ON JACK (4) AND TURN HANDLE CLOCKWISE TO LOWER JACK PAD (5). CONTINUE TO LOWER BOTH FRONT JACKS UNTIL WEIGHT OF TRAILER RESTS ON JACKS INSTEAD OF TOWING VEHICLE AND LUNNETE IS CLEAR OF PINTLE.



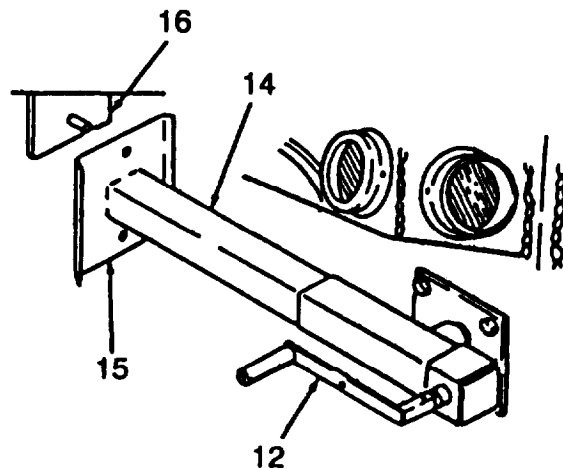
10. REPLACE CRANK HANDLE (2) ON REAR OF JACK SUPPORT BRACKET (3); INSTALL SAFETY PIN (1).



11. REMOVE SAFETY PIN (11) AND CRANK HANDLE (12) FROM REAR OF JACK SUPPORT BRACKET (13).



12. POSITION CRANK HANDLE (12) ON JACK (14) AND TURN HANDLE COUNTERCLOCKWISE TO RETRACT JACK UNTIL JACK PAD (15) IS CLEAR OF SECUREMENT PLATE (16) ROUND BAR.



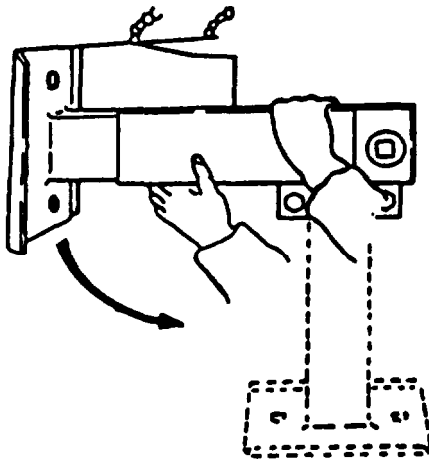
**Figure 2-19. Trailer Preparation for Use (Sheet 3 of 5)
(Models WPES-10 and H-9518-1)**

2-6. TRAILER ASSEMBLY AND PREPARATION FOR USE (Models WPES-10 and H-9618-1) - cont.

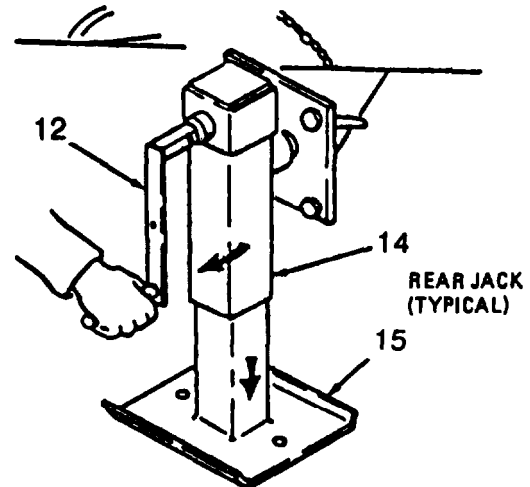
WARNING

JACK WILL ROTATE AND TRAILER WILL FALL IF LEVELING JACK IS NOT SECURELY LOCKED IN DOWN POSITION.

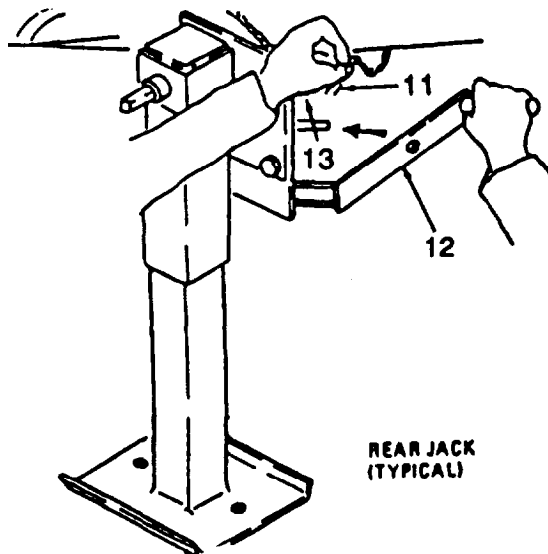
13. TO ROTATE REAR LEVELING JACK TO VERTICAL POSITION, REMOVE CRANK HANDLE, GRASP JACK AND PULL STRAIGHT OUT (AWAY FROM TRAILER) AGAINST SPRING TENSION. ROTATE JACK DOWN TO VERTICAL POSITION. ALLOW JACK TO SPRING BACK TO LOCKED POSITION. PUSH JACK IN TOWARD TRAILER TO ENSURE IT IS SECURELY LOCKED.



14. POSITION CRANK HANDLE (12) ON JACK (14) AND TURN HANDLE CLOCKWISE TO LOWER JACK PAD (15). CONTINUE TO LOWER BOTH REAR JACKS UNTIL JACK PADS REST FIRMLY ON THE GROUND.



15. REPLACE CRANK HANDLE (12) ON REAR OF JACK SUPPORT BRACKET (13); INSTALL SAFETY PIN (11).



16. DISCONNECT TRAILER SAFETY CHAIN (18) FROM TOWING VEHICLE. PLACE TRAILER SAFETY CHAIN (18) IN STOWED POSITION ON TRAILER DRAWBAR (9).

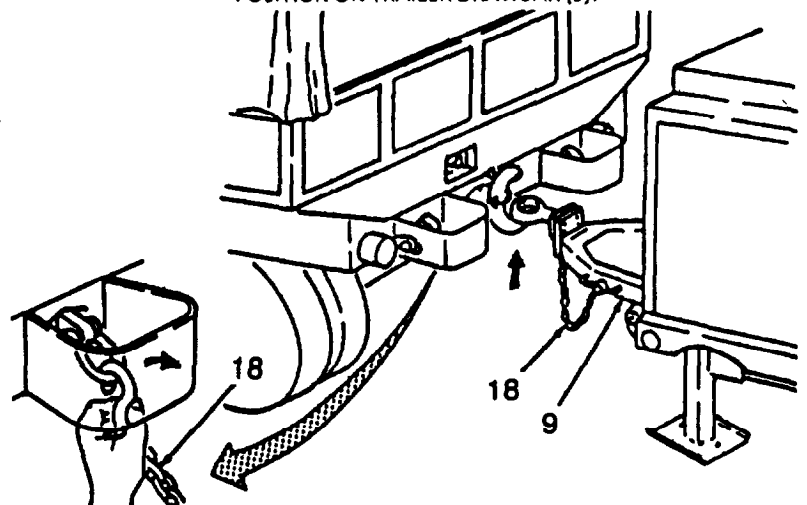
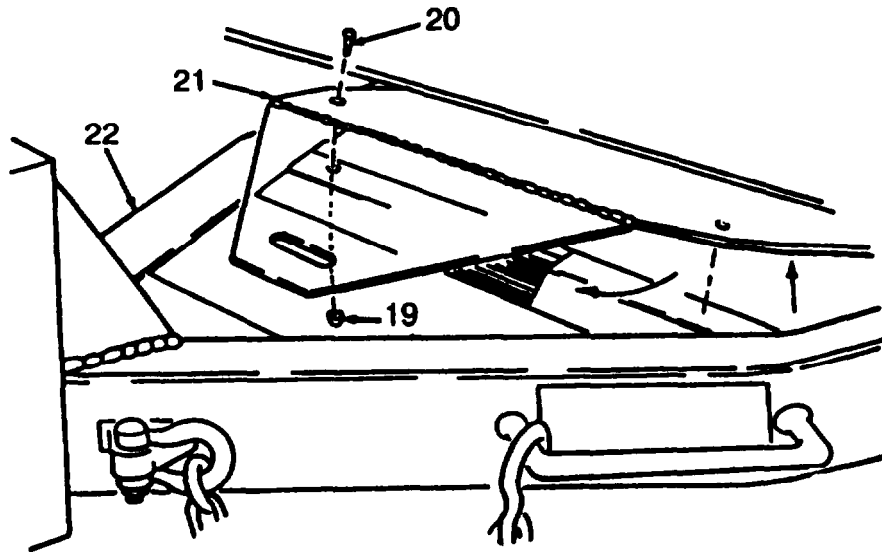


Figure 2-19. Trailer Preparation for Use (Sheet 4 of 5)
(Models WPES-10 and H-9518-1)

2-6. TRAILER ASSEMBLY AND PREPARATION FOR USE (Models WPES-10 and H-95181) - cont.



17. REMOVE NUTS (19) AND SCREWS (20) SECURING SAFETY STEP (21) IN PLACE. LAY SAFETY STEP DOWN ON DRAWBAR (22) AND INSTALL PREVIOUSLY REMOVED NUTS AND SCREWS.

Figure 2-19. Trailer Preparation for Use (Sheet 5 of 5)
(Models WPES-10 and H-9618-1)

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE.

Upon reaching the operating area, prepare the ROWPU for operation.

- a. Roll Up Canvas Cover. Refer to figure 2-20.
 - (1) Unfasten tie straps along bottom of canvas cover from ROWPU frame.
 - (2) Unfasten tie straps securing front, rear, left and right canvas panels.
 - (3) Roll up all four sides of canvas cover and secure in position with tie straps.

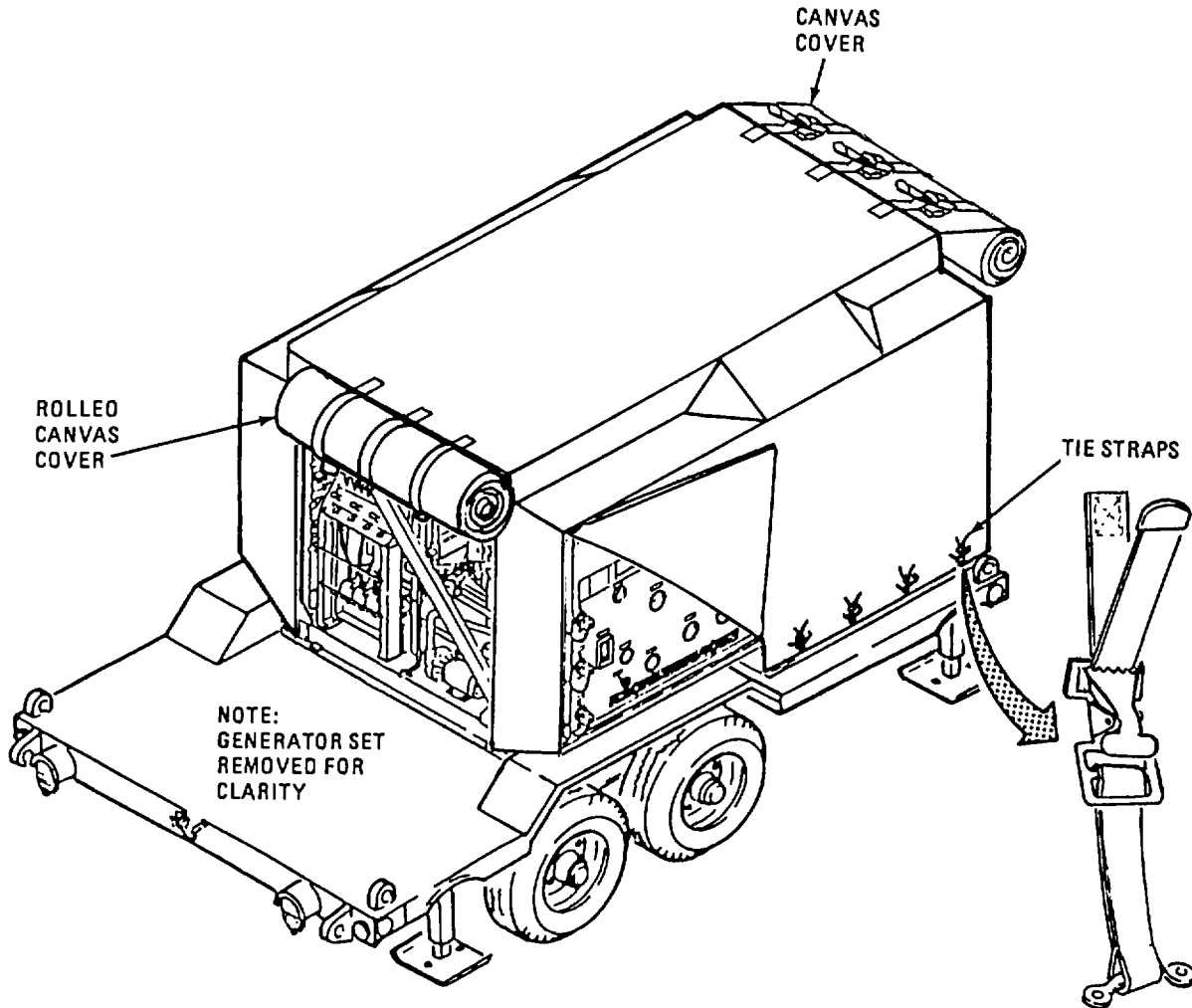


Figure 2-20. Canvas Cover.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE.

- b. Remove Cross Braces. Refer to figure 2-21.
- (1) While pushing in on detent pin with thumb, pull quick release pin from both ends of top cross brace. Remove top cross brace from frame.
 - (2) While pushing in on detent pin with thumb, pull quick release pins from both ends of bottom cross brace. Remove bottom cross brace from frame.
 - (3) Stow both cross braces on top of canvas cover.

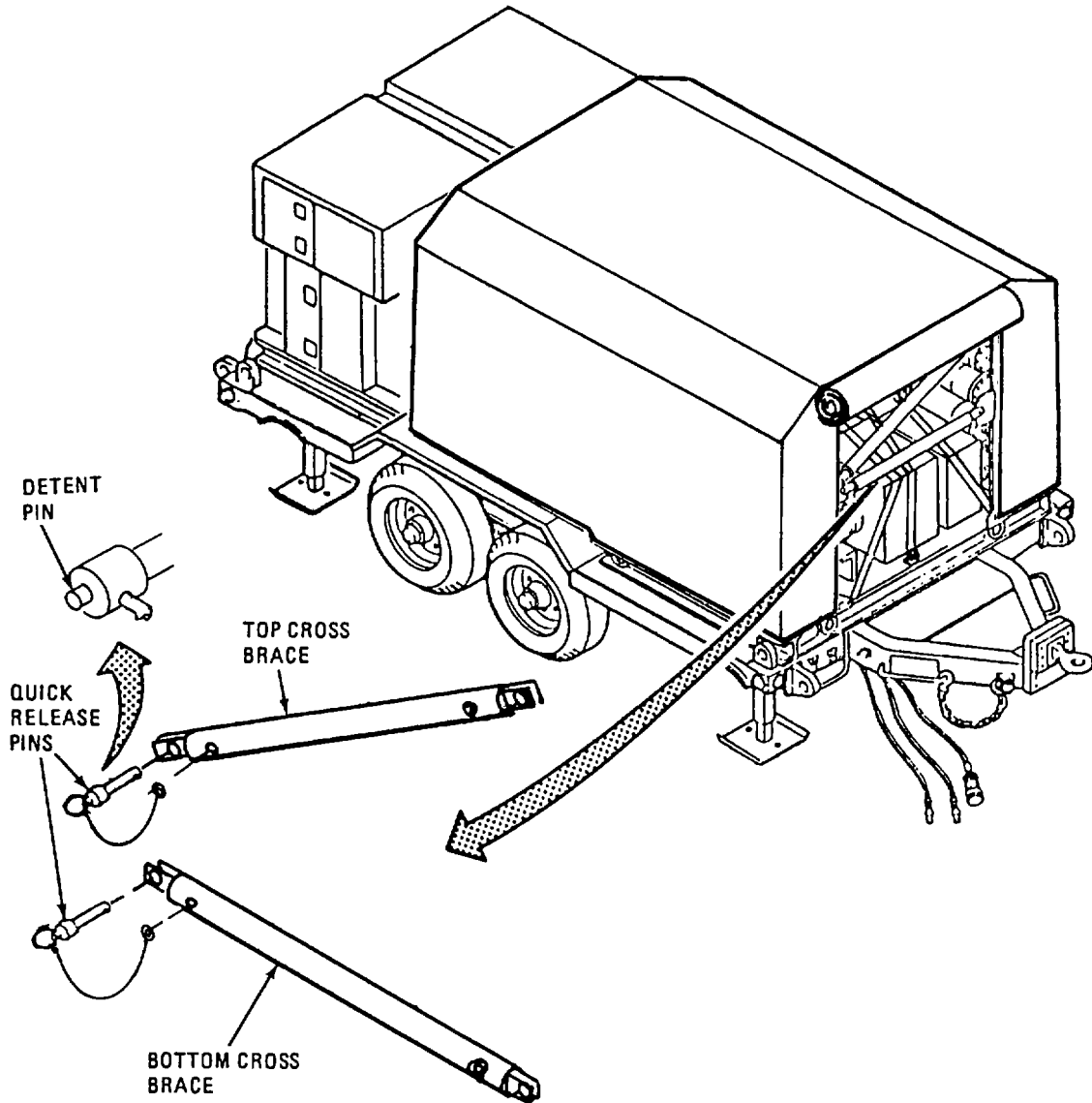


Figure 2-21. Cross Braces.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

c. Unpack Accessories.

- (1) Loosen three cargo straps. Refer to figure 2-22.
 - (a) While pulling down on ratchet release, pivot ratchet handle to full open position. Tension on strap will be released.
 - (b) Pull strap through ratchet until strap is loose.
 - (c) Lift keeper and disconnect hook from trailer frame.

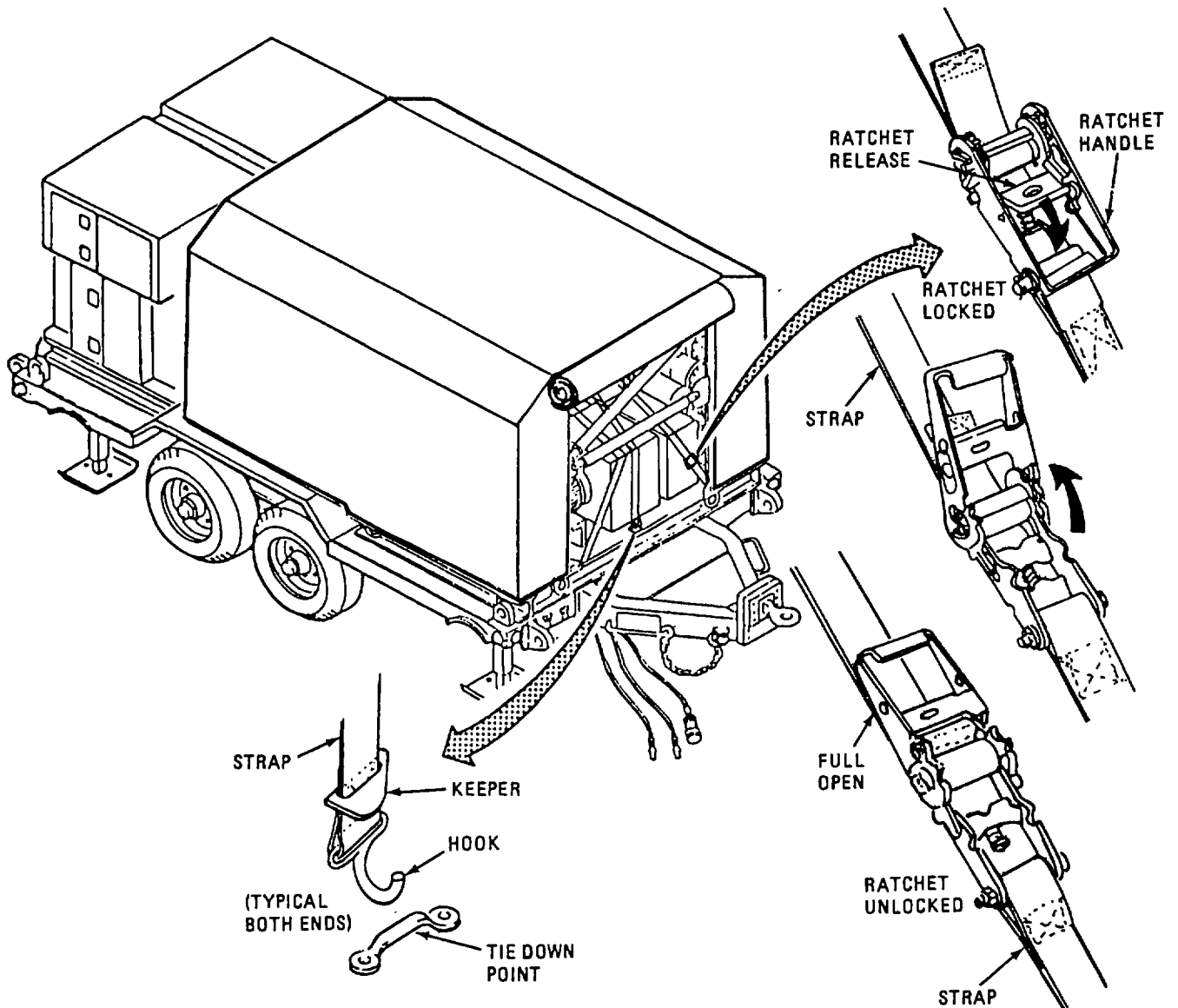


Figure 2-22. Cargo Straps.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

(2) Remove hold down straps. Refer to figure 2-23.

NOTE

Removal of one hold down strap is shown. Removal of remaining hold down straps is similar.

- (a) Press in on latch and pull end of hold down strap through buckle.
- (b) Pull hold down straps from anchors on ROWPU frame.
- (c) Roll up strap and stow for future use.

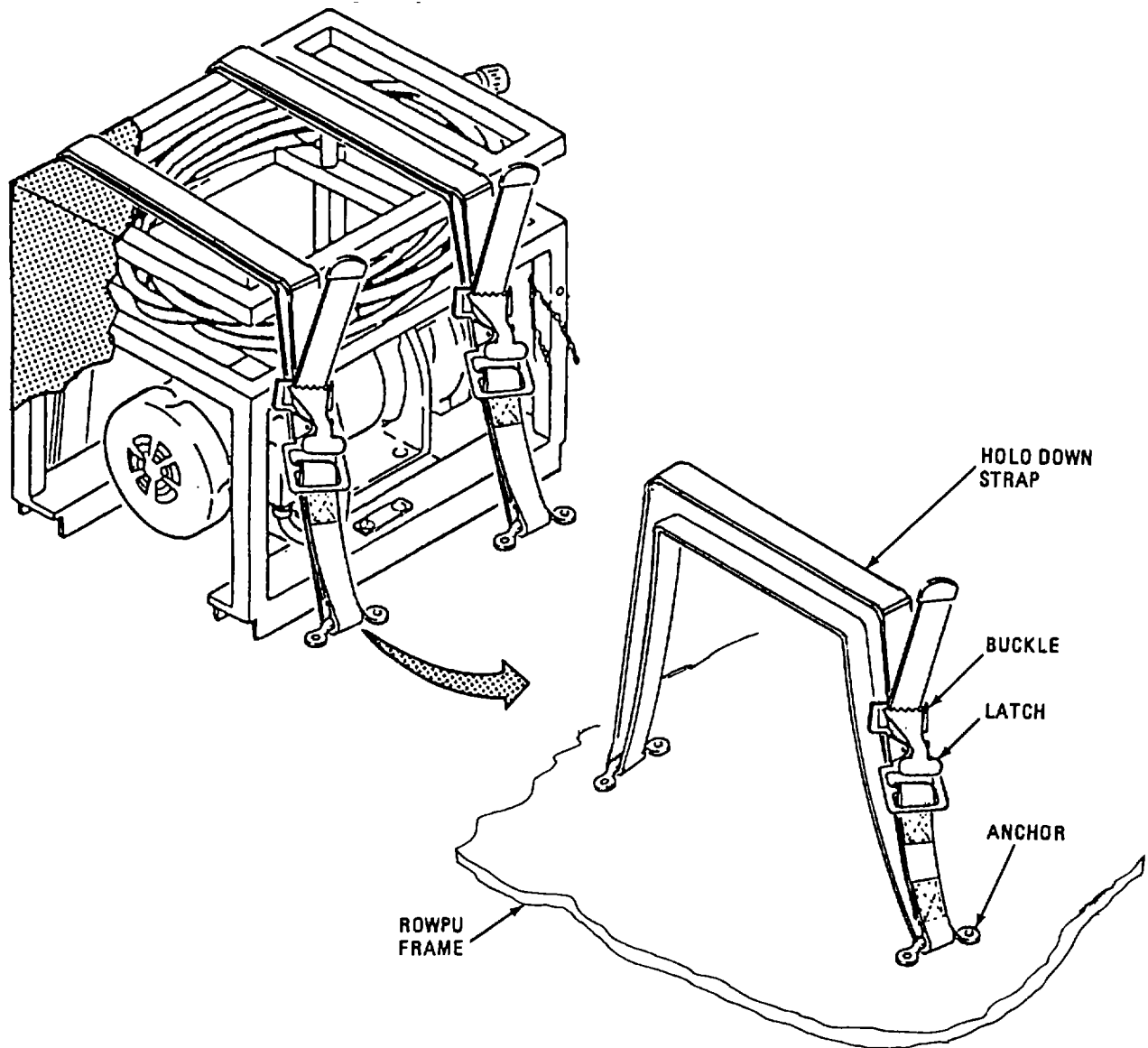


Figure 2-23. Hold Down Straps.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

NOTE

Step 3 applies to Models WPES- 10, WPES-20 and WPES-30 only.

- (3) Refer to figure 2-24 and unpack accessories from ROWPU as follows:

WARNING

Some accessories are heavy/difficult to handle. To prevent injury to personnel and damage to the equipment, four personnel are required to lift and remove the backwash pump, raw water pumps, water tanks and distribution pump from the ROWPU.

NOTE

Remove hold down straps as required to aid removal (fig. 2-23).

Third Layer (top)

- (a) Remove two deionization cartridges (2 1).
- (b) Remove three 2-inch hard rubber hoses (23).
- (c) Remove one 1-1/2 inch hard rubber hose (22).

Second Layer (middle)

- (d) Remove two storage chests (18 and 19).
- (e) Remove four canvas pump covers (20).
- (f) Remove three water tanks (15, 16, and 17).

First Layer (bottom)

- (g) Remove lug wrench (9), R.O. element tool (6), paddle (7) and sledge hammer (8).
- (h) Remove float (4).
- (i) Remove five utility pails (11).
- (j) Remove all canvas hoses (5).
- (k) Remove backwash pump (3).
- (l) Remove two raw water pumps (1 and 2).
- (m) Remove and stow three cargo straps (23).

ROWPU Frame

- (n) Remove eight 1-1/2 inch suction hoses (10) through front of ROWPU frame.

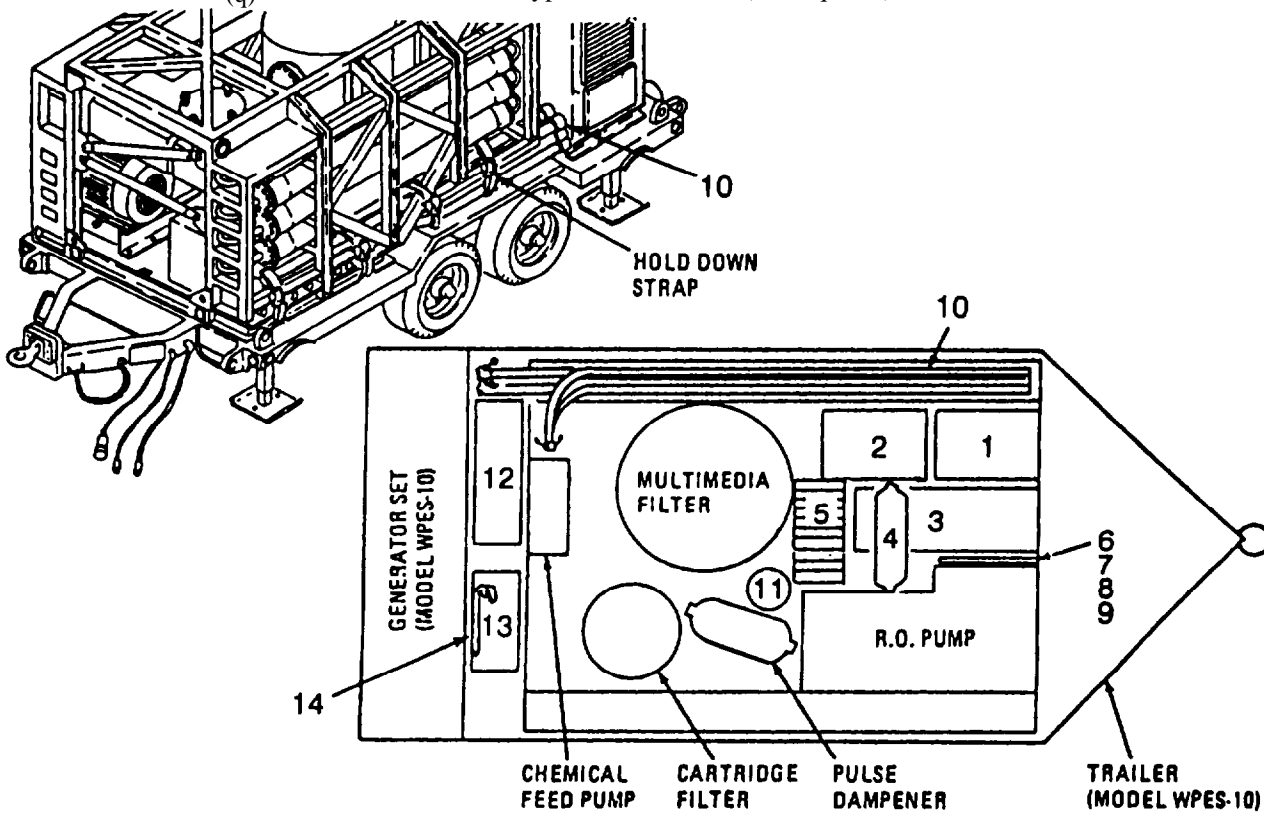
2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont

NOTE

On Models WPES-20 and WPES-30 the distribution pump, chemical cans and frame, and calcium hypochlorite are shipped separately.

Rear of Trailer (WPES-10 only)

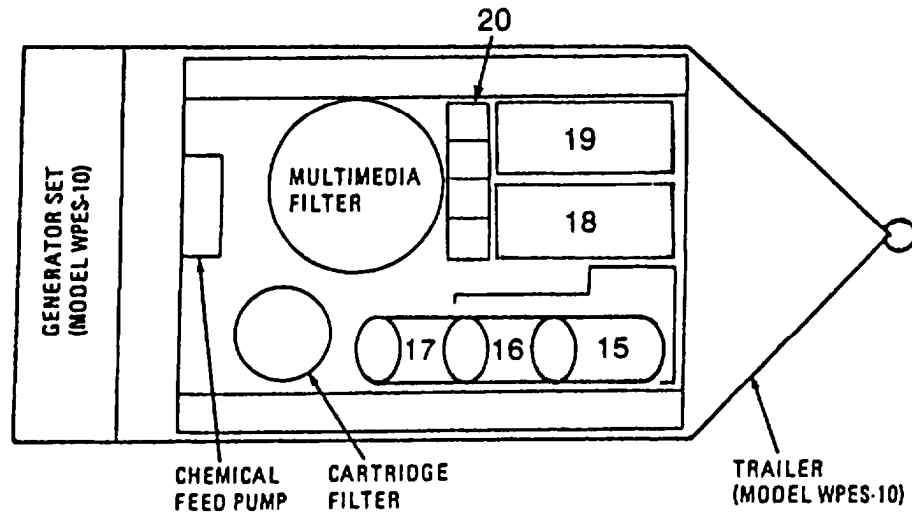
- (o) Remove distribution pump(13) and ladder (14).
- (p) Remove chemical feed cans and rack (12).
- (q) Remove calcium hypochlorite crate (as required).



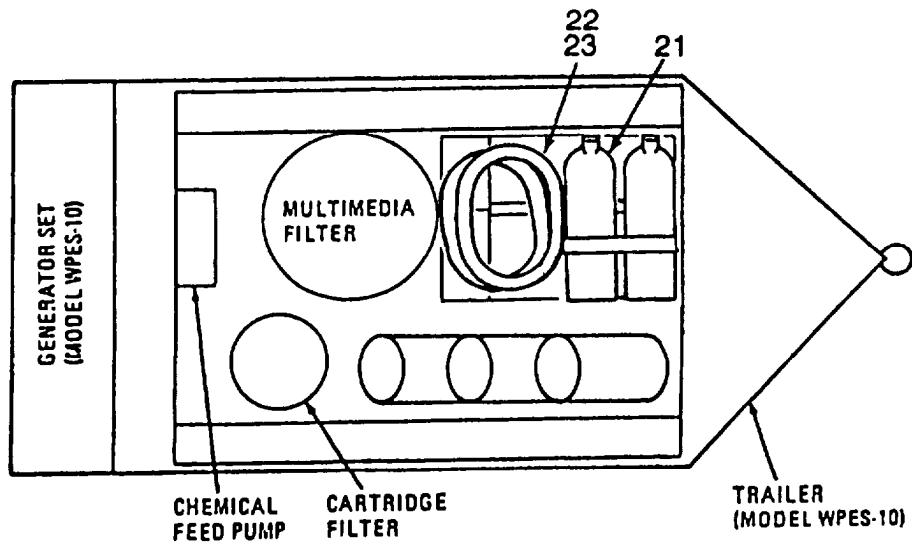
- | | |
|---------------------------------|------------------------------|
| 1. RAW WATER PUMP | 13. DISTRIBUTION PUMP |
| 2. RAW WATER PUMP | 14. LADDER (WPES-10 ONLY) |
| 3. BACKWASH PUMP | 15. WATER TANK |
| 4. FLOAT | 16. WATER TANK |
| 5. HOSES; CANVAS DISCHARGE | 17. WATER TANK |
| 6. R.O. ELEMENT TOOL | 18. STORAGE CHEST |
| 7. PADDLE | 19. STORAGE CHEST |
| 8. SLEDGE HAMMER | 20. CANVAS COVERS |
| 9. LUG WRENCH | 21. DEIONIZATION CARTRIDGES |
| 10. HOSES; 1-1/2 INCH SUCTION | 22. HOSE; 1-1/2 INCH SUCTION |
| 11. UTILITY PAILS | 23. HOSE; (3) 2-INCH SUCTION |
| 12. CHEMICAL FEED CANS AND RACK | |

Figure 2-24. ROWPU Accessory Overpack (sheet 1 of 2).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE cont.



SECOND LAYER
(MIDDLE)



THIRD LAYER
(TOP)

Figure 2-24. ROWPU Accessory Overpack (sheet 2 of 2).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

NOTE

Step 3.1 applies to Models H-9518-1, H-9518-2, and H-9518-3 only.

(3.1) Refer to figure 2-24a and unpack accessories as follows:

WARNING

Some accessories are heavy/difficult to handle. To prevent injury to personnel and damage to the equipment, four personnel are required to lift and remove the backwash pump, raw water pumps, water tanks and distribution pump from the ROWPU.

NOTE

Remove hold down straps as required to aid removal (fig. 2-23).

Third Layer (top)

- (a) Remove nine 2-inch hard rubber hoses (23).
- (b) Remove one 1 1/2-inch hard rubber hoses (4).

Second Layer (middle)

- (c) Remove one water tank (2 1).
- (d) Remove two deionization cartridges (22).
- (e) Remove float (20) and eight stakes (19).
- (f) Remove wellpoint assembly (18).
- (g) Remove two storage chests (16 and 17).

First Layer (bottom)

- (h) Remove two water tanks (14 and 15).
- (i) Remove RO. Element Tool (11), Paddle (12), and Sledge Hammer (13).
- (i) Remove four utility pails (10).
- (k) Remove three 2-inch canvas discharge hoses (5).
- (l) Remove backwash pump (9).
- (m) Remove six 1 1/2-inch canvas discharge hoses (8).
- (n) Remove two raw water pumps (6 and 7).
- (o) Remove eight 1 1/2-inch hard rubber hoses (4).

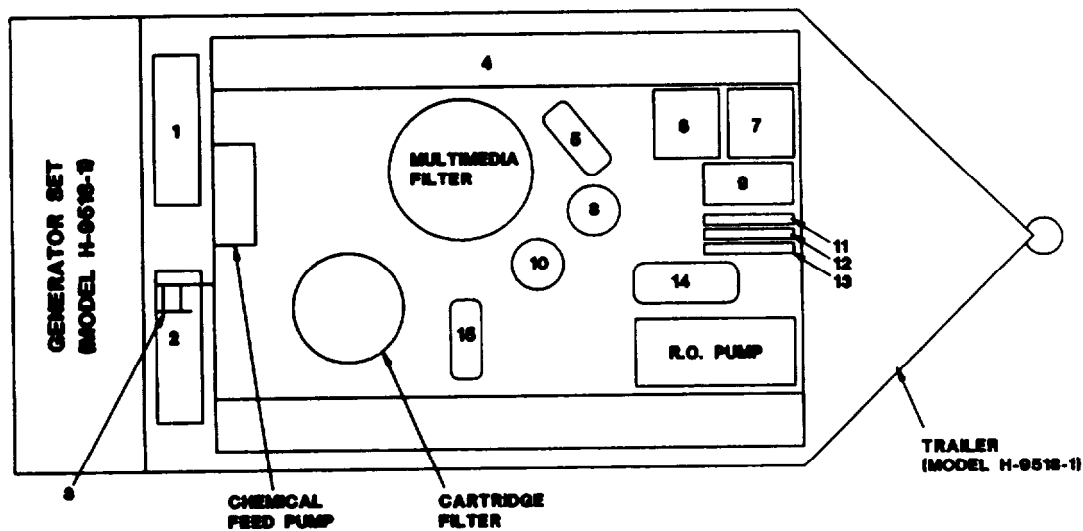
NOTE

On Models H-9518-2 and H-9518-3 the distribution pump, calcium hypochloride, and chemical cans and frame are shipped separately.

Rear of trailer (H-9518-1 only)

- (p) Remove distribution pump (2) and ladder (3).
- (q) Remove calcium hypochlorite box (2).
- (r) Remove chemical feed cans and rack (1).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

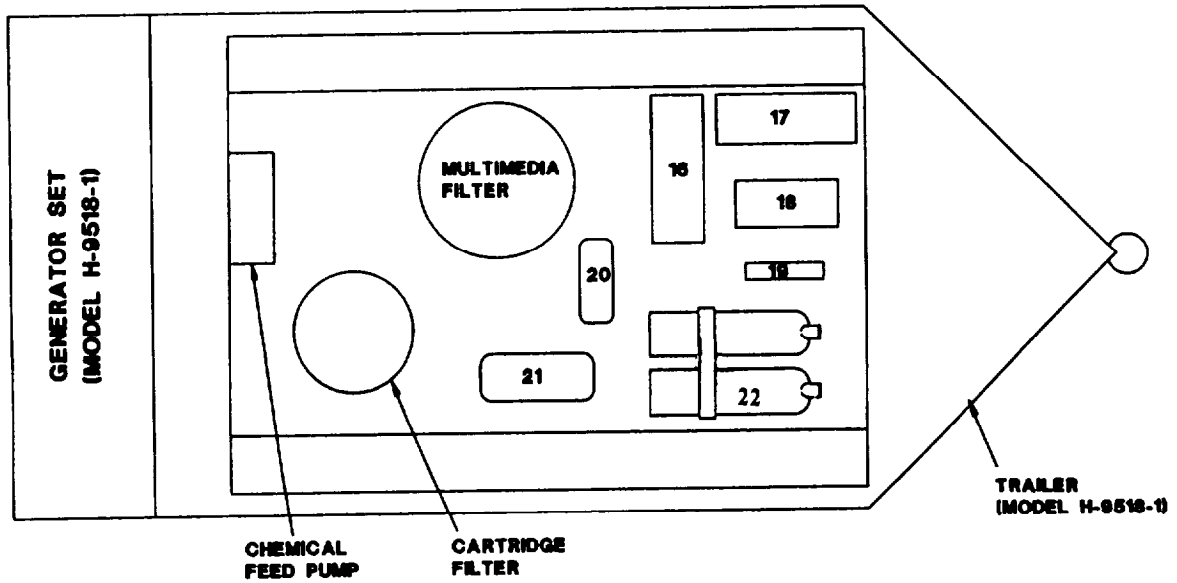


FIRST LAYER (BOTTOM)

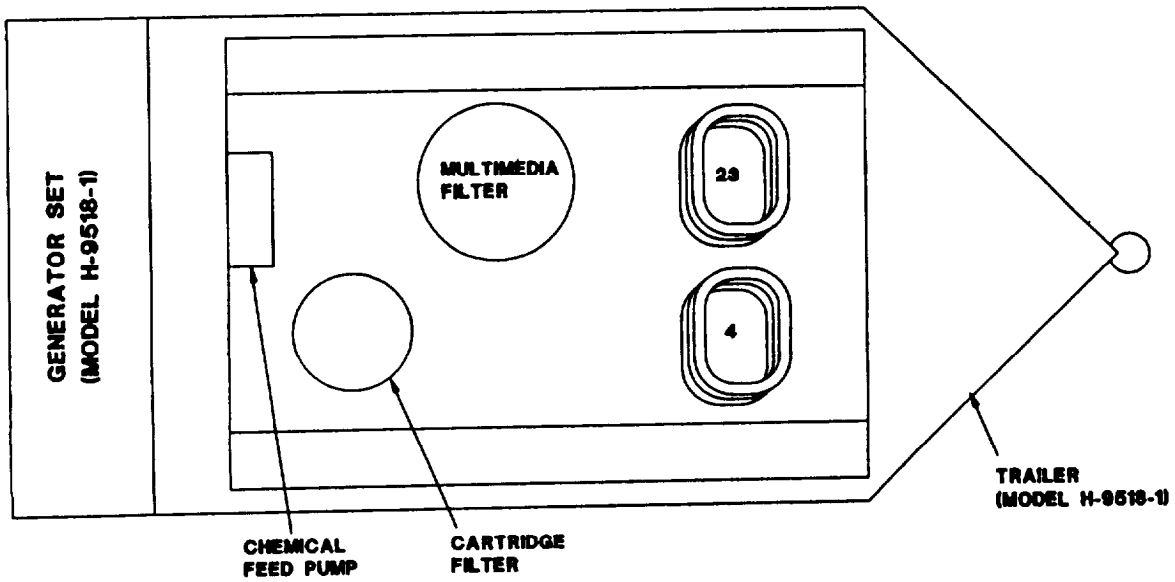
- | | | | |
|-----|------------------------------------|-----|-------------------------|
| 1. | Chemical Feed Cans and Rack | 13. | Paddle |
| 2. | Calcium Hypochlorite Box | 14. | Sledge Hammer |
| 3. | Distribution Pump | 15. | Water Tank |
| 4. | Ladder (H-9518-1) | 16. | Water Tank |
| 5. | Hoses; 1 1/2-inch Suction | 17. | Storage Chest |
| 6. | Hoses; 2-inch Canvas Discharge | 18. | Storage Chest |
| 7. | Raw Water Pump | 19. | Wellpoint Assembly |
| 8. | Raw water Pump | 20. | Stakes |
| 9. | Hoses; 1 1/2-inch Canvas Discharge | 21. | Float |
| 10. | Backwash Pump | 22. | Water Tank |
| 11. | Utility Pails | 23. | Deionization Cartridges |
| 12. | RO. Element Tool | 24. | Hoses; 2-inch Suction |

Figure 2-24a. ROWPU Accessory Overpack (Sheet 1 of 2)

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE -cont.



SECOND LAYER (MIDDLE)



THIRD LAYER (TOP)

Figure 2-24a. ROWPU Accessory Overpack (Sheet 2 of 2).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- d. Install Control Panel Quick Disconnect Fittings. Refer to figure 2-25. Using pipe wrench from storage chest, install quick disconnect fittings and components as follows:

NOTE

During installation, apply antiseize tape (from storage chest) to pipe threads of quick disconnect fittings.

- (1) Unscrew caps from WASTE, VENT VESSELS, and BACKWASH water hose couplings on control panel.
- (2) Install 2-inch male quick disconnect fittings on WASTE, VENT VESSELS, and BACKWASH water hose couplings on control panel.
- (3) Remove caps from PRODUCT WATER, BRINE, and RAW water hose couplings on control panel.
- (4) Install 1 1/2-inch male quick disconnect fittings on PRODUCT WATER, BRINE, and RAW water hose couplings on control panel.

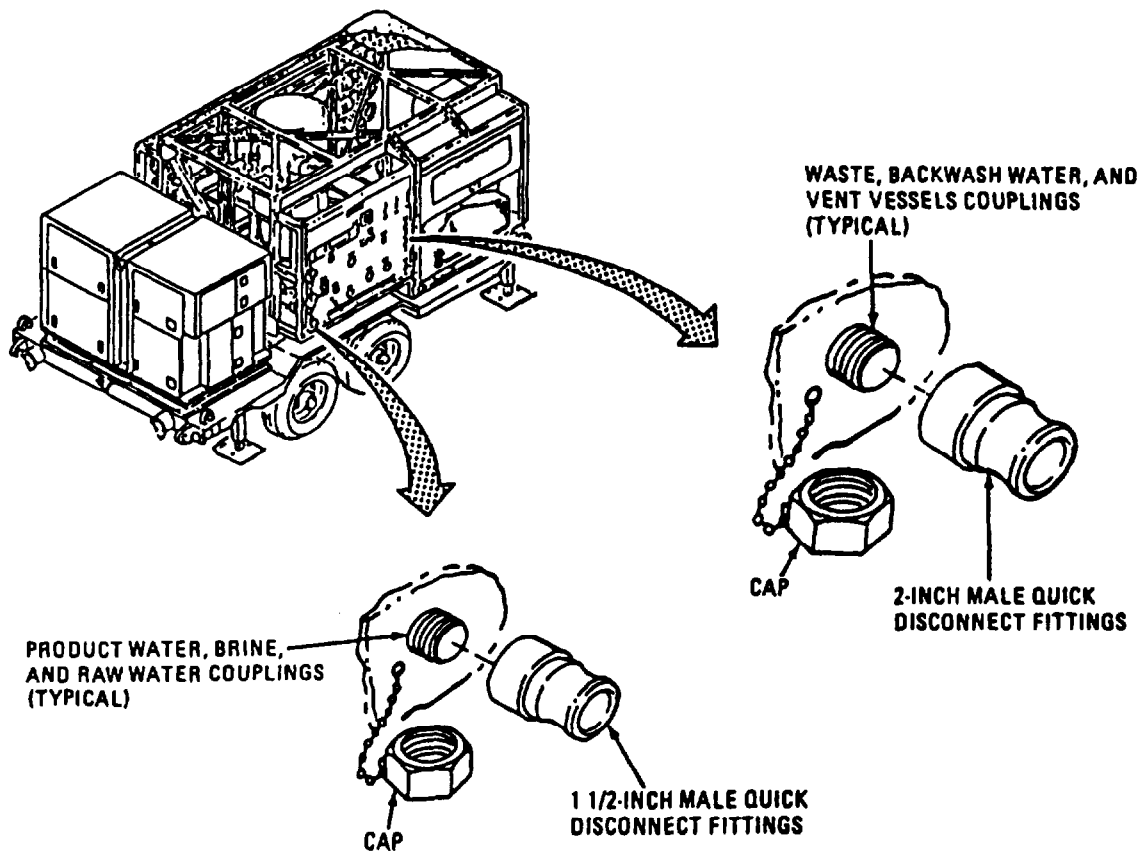


Figure 2-25. Control Panel Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- e. Install Raw Water Pump No. 1 Quick Disconnect and Strainer Fittings. Refer to figure 2-26.

NOTE

- During installation, apply antiseize tape (from storage chest) to pipe threads of quick disconnect fittings.
- Raw water pump No. 1 uses both a male and female quick disconnect fitting. Raw water pump No. 2 uses two female quick disconnect fittings.

- (1) If required, mark frame of one raw water pump as "No. 1".
- (2) Unscrew plugs from suction and discharge couplings.
- (3) Install 1 1/2-inch female quick disconnect fitting on suction coupling.
- (4) Install 1 1/2-inch male quick disconnect fitting on discharge coupling.
- (5) Close drain and vent valve on raw water pump No 1.
- (6) Install 1 1/2-inch male quick disconnect fitting on raw water strainer.

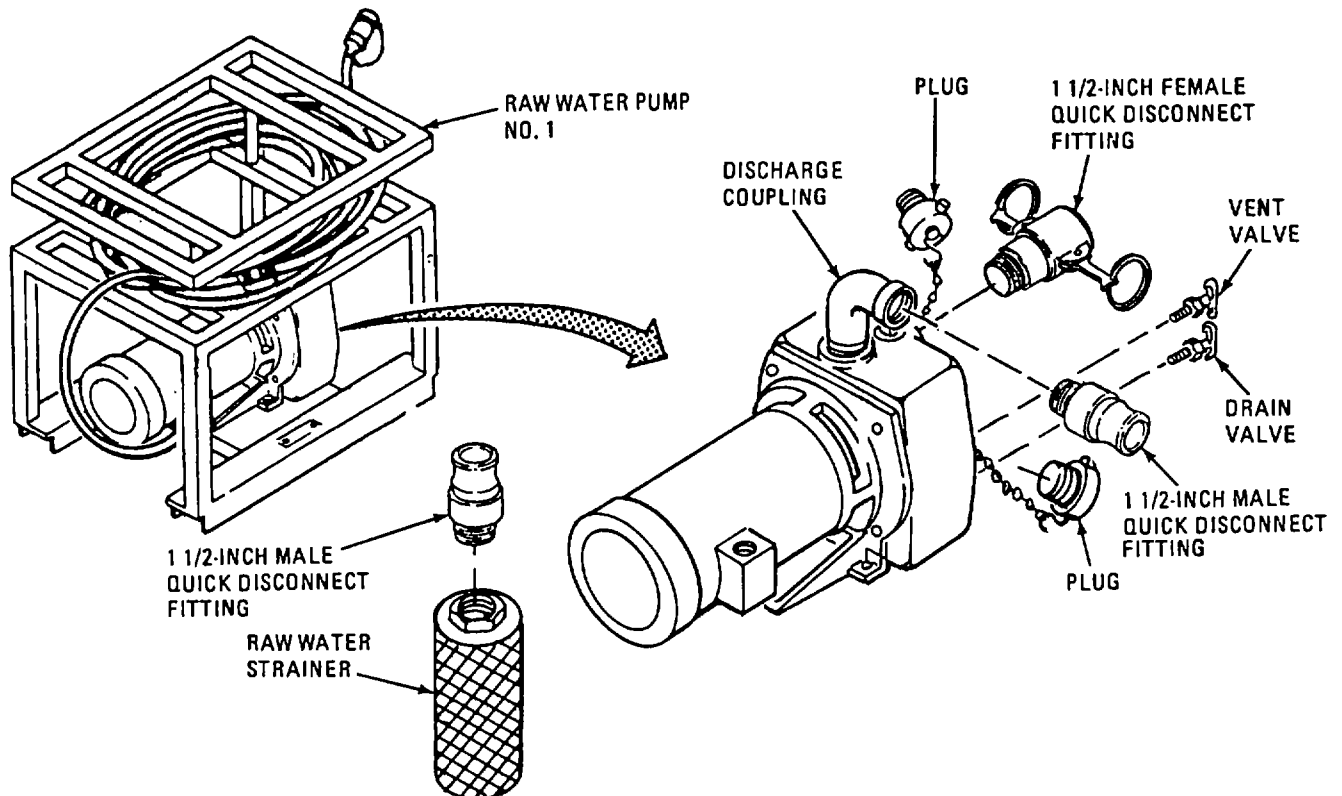


Figure 2-26. Raw Water Pump No. 1 Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- f. Install Raw Water Pump No. 2 Quick Disconnect Fittings. Refer to figure 2-27.

NOTE

- During installation, apply antiseize tape (from storage chest) to pipe threads of quick disconnect fittings.
- Raw water pump No. 1 uses both a male and female quick disconnect fitting. Raw water pump No. 2 uses two female quick disconnect fittings.

- (1) If required, mark frame of remaining raw water pump as "No. 2".
- (2) Unscrew plugs from suction and discharge couplings of raw water pump No. 2.
- (3) Install 1 1/2-inch female quick disconnect fitting on suction coupling of raw water pump No. 2.
- (4) Install 1 1/2-inch female quick disconnect fitting on discharge coupling of raw water pump No. 2.
- (5) Close drain and vent valves on raw water pump No. 2.

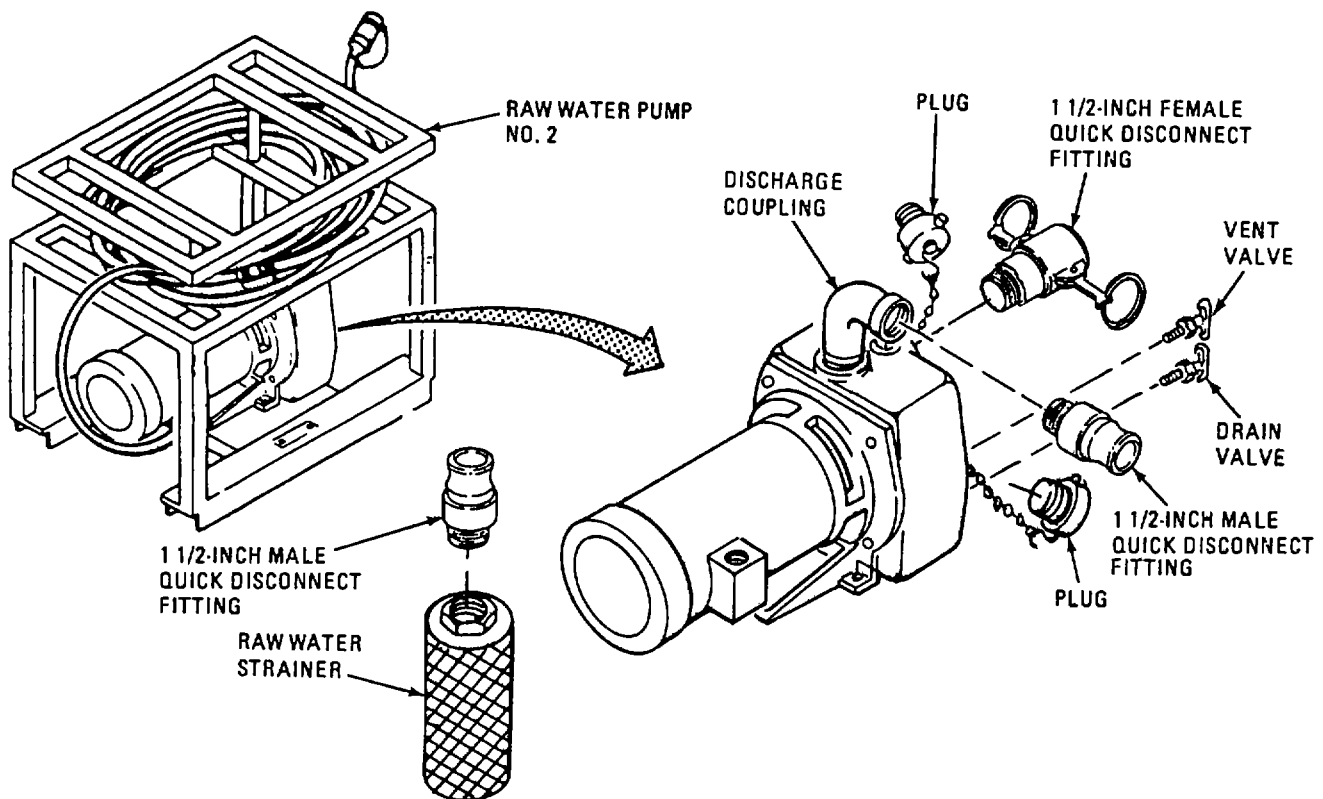


Figure 2-27. Raw Water Pump No. 2 Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- g. Install Backwash Pump Quick Disconnect Fittings. Refer to figure 2-28.
- (1) Remove tie straps securing strainer to backwash pump.
 - (2) Unscrew plug from suction coupling.
 - (3) Unscrew plug from discharge coupling.
 - (4) Remove the two mounting bolts, nuts and flat washers from the backwash strainer bracket.
 - (5) Connect strainer to discharge coupling on backwash pump.
 - (6) Place backwash strainer bracket against frame and line up the holes.
 - (7) Mount strainer to frame with two flat washers, bolts, lockwashers and nuts .

NOTE

During installation, apply antiseize tape (from storage chest) to male pipe threads of quick disconnect fittings.

- (8) Install 2-inch female quick disconnect fitting on backwash strainer.
- (9) Install 2-inch male quick disconnect fitting on suction coupling of backwash pump.
- (10) Close draincock on bottom of backwash pump.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

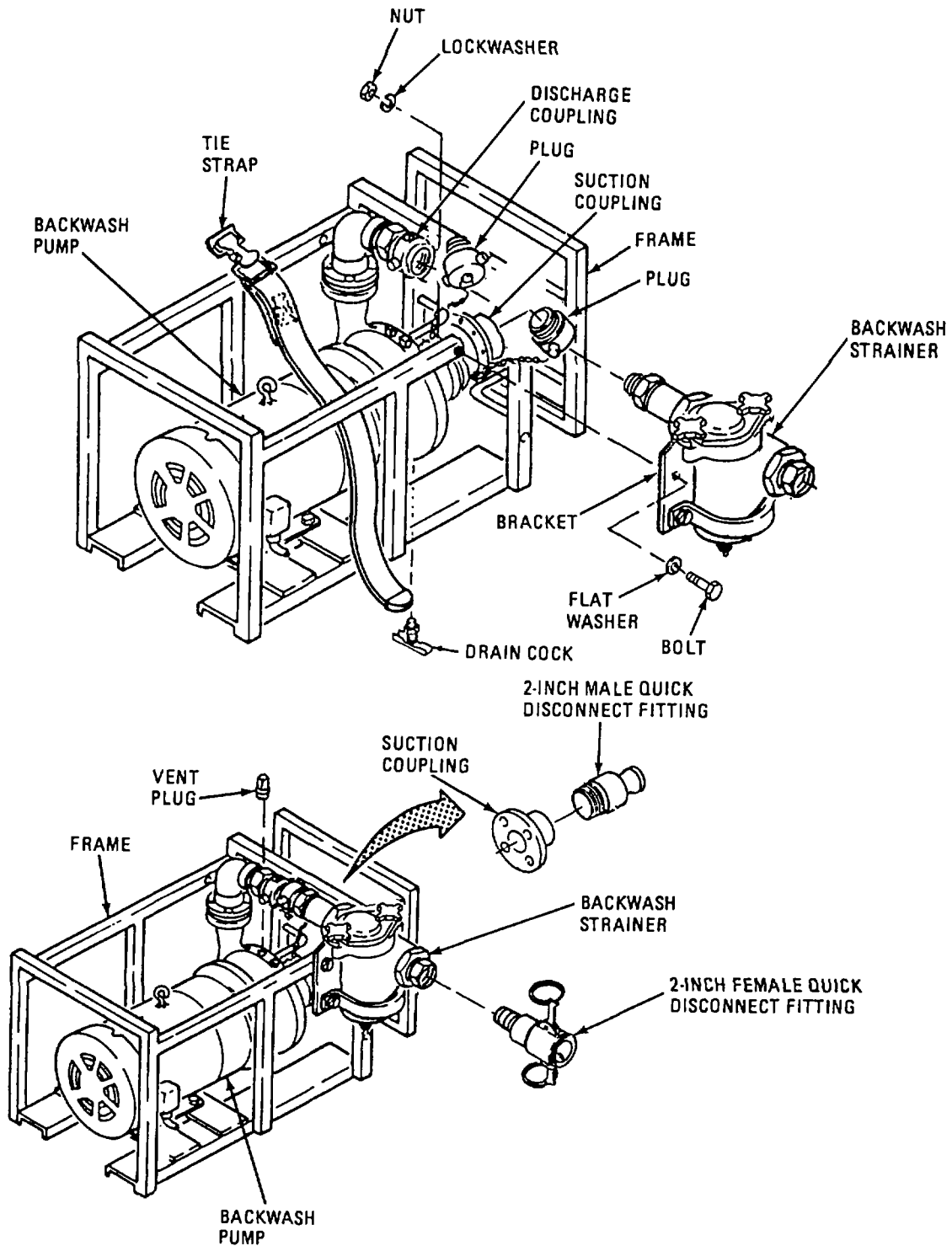


Figure 2-28. Backwash Pump Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- h. Install Distribution Pump Quick Disconnect Fittings. Refer to figure 2-29.

NOTE

During installation, apply antiseize tape (from storage chest) to pipe threads of quick disconnect fittings.

- (1) Unscrew plugs from suction and discharge couplings of distribution pump.
- (2) Install 1 1/2-inch female quick disconnect fitting on suction coupling of distribution pump.
- (3) Install 1 1/2-inch male quick disconnect fitting on discharge coupling of distribution pump.

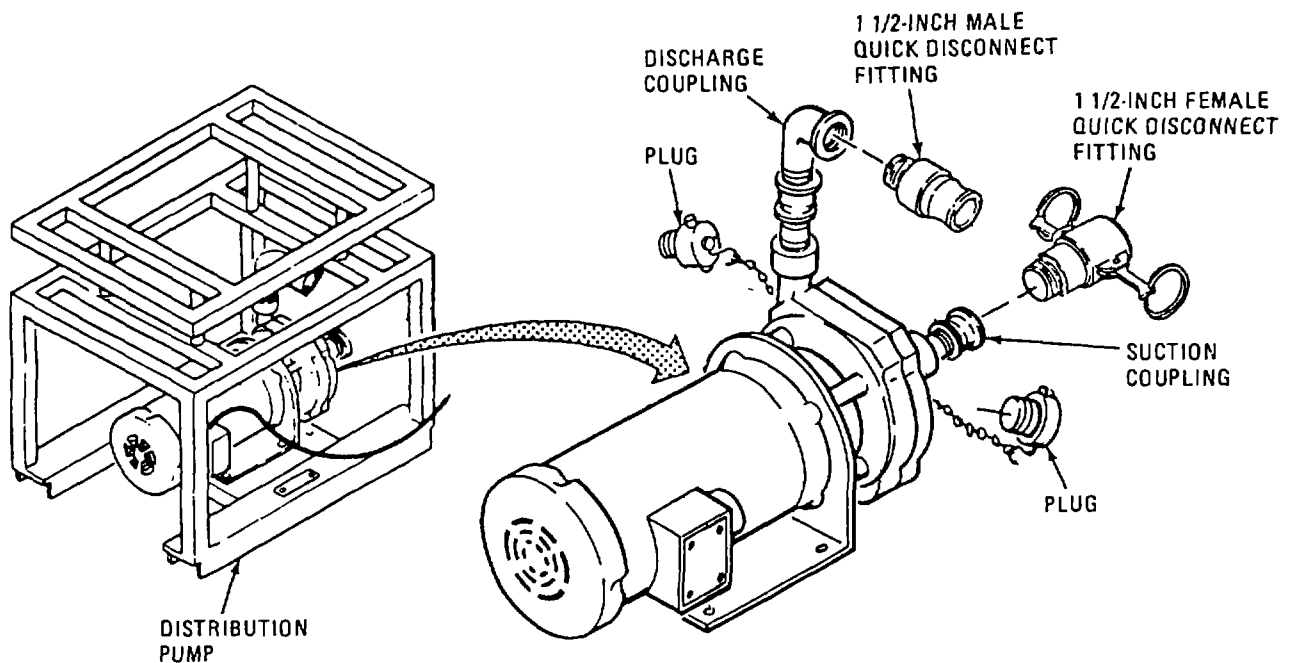


Figure 2-29. Distribution Pump Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- i. Install Distribution Nozzle Quick Disconnect Fitting. Refer to figure 2-30.

NOTE

During installation, apply antiseize tape (from storage chest) to pipe threads of quick disconnect fittings.

Install 1 1/2-inch female quick disconnect fitting on distribution nozzle.

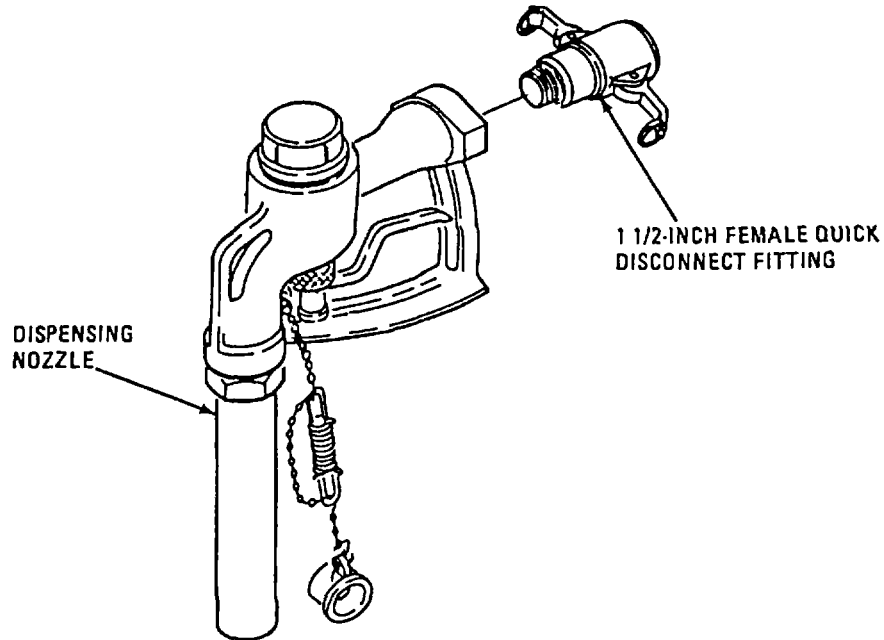


Figure 2-30. Dispensing Nozzle Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- j. Install 1 1/2-inch and 2-inch Gate Valve Quick Disconnect Fittings. Refer to figure 2-31.

NOTE

During installation, apply antiseize tape (from storage chest) to pipe threads of quick disconnect fittings.

- (1) Install one 2-inch female quick disconnect fittings on each end of the 2-inch gate valve.
- (2) Install a 1 1/2-inch female quick disconnect fitting on the 1 1/2-inch gate valve.
- (3) Install one 2-inch male quick disconnect fitting on the other end of the 1 1/2-inch gate valve.

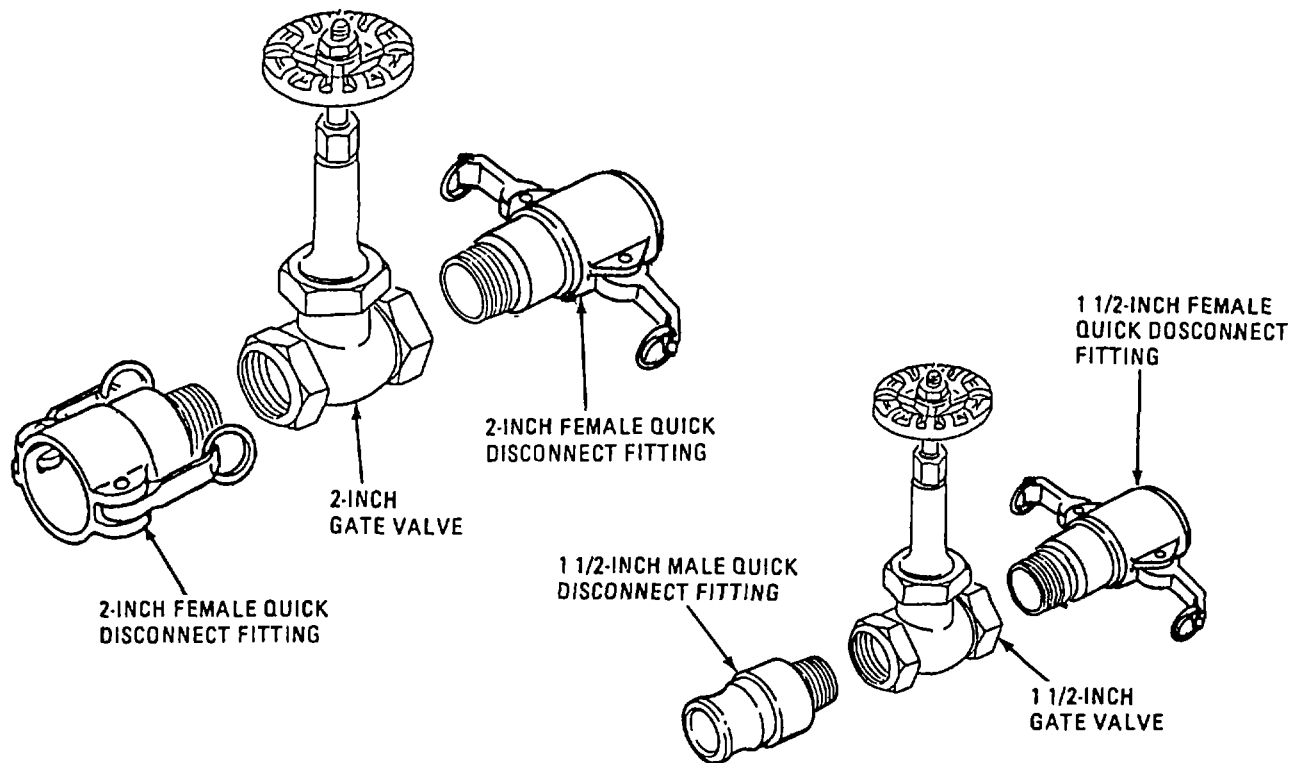


Figure 2-31. Gate Valve Quick Disconnect Fittings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- k. Unpack Total Dissolved Solids (TDS) Meter. Refer to figure 2-32.

NOTE

The total dissolved solids (TDS) meter is factory calibrated to give conductivity characteristics closely representing natural fresh waters. When treating sea-water and brackish water, it will be necessary to recalibrate the meter (paragraph 2-15c(2) or paragraph 2-15c(3) in order to get accurate readings on the product water and raw water.

- (1) Remove the calibrated measuring container (250 ml sample beaker) and the TDS meter from the storage chest.
- (2) Carefully unpack meter and beaker.

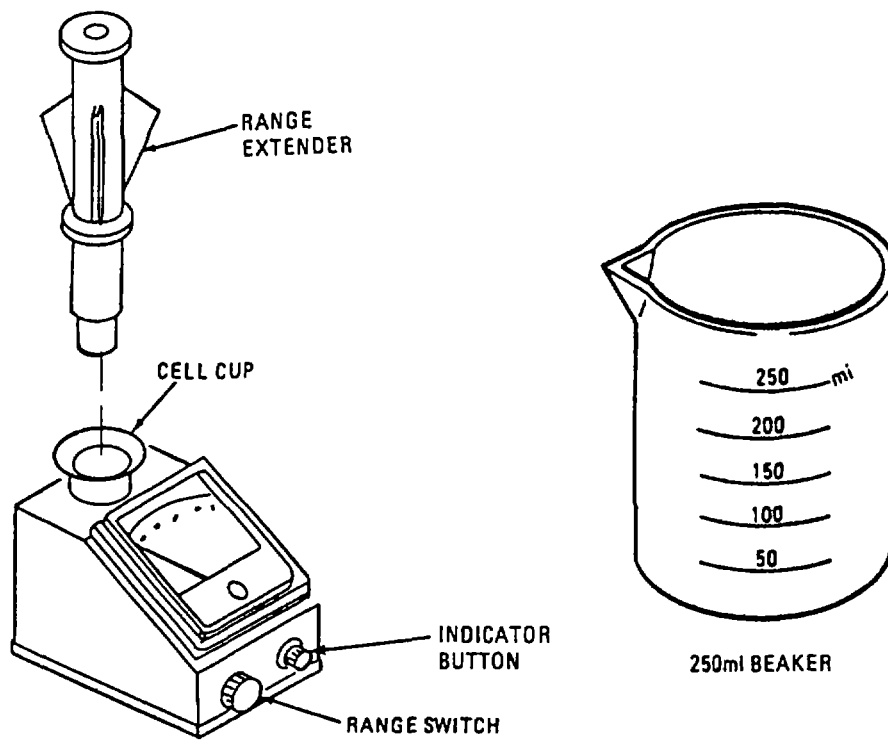


Figure 2-32. Total Dissolved Solids (TDS) Meter.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- I. Install TDS Monitor. Refer to figure 2-33.

NOTE

The in-line TDS monitor is factory calibrated to give conductivity characteristics closely representing seawater and brackish water. This monitor cannot be recalibrated in the field. When treating natural fresh water, the TDS reading will not be accurate, but may be used for comparison purposes.

- (1) Remove TDS monitor (1) from storage chest. Carefully unpack monitor.
- (2) While depressing detent button (2) with thumb, pull quick release pin (3) from control panel (4).
- (3) Position and slide base of TDS monitor (1) under two brackets (5).
- (4) While depressing detent button (2) with thumb, push quick release pin (3) through hole (6) in base of TDS monitor (1) and into control panel (4).
- (5) Remove plug (7) from sensor cable connector (8).
- (6) Remove cap (9) from TDS MONITOR SENSOR receptacle (10).
- (7) Aline sensor cable connector (8) with TDS MONITOR SENSOR receptacle (10) on control panel (4). Push connector into receptacle and tighten knurled ring onto receptacle.
- (8) Remove plug (11) from power cable connector (12).
- (9) Remove cap (13) from TDS MONITOR POWER receptacle (14).
- (10) Aline power cable connector (12) with TDS MONITOR POWER receptacle (14) on control panel (4). Push connector into receptacle and tighten knurled ring onto receptacle.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

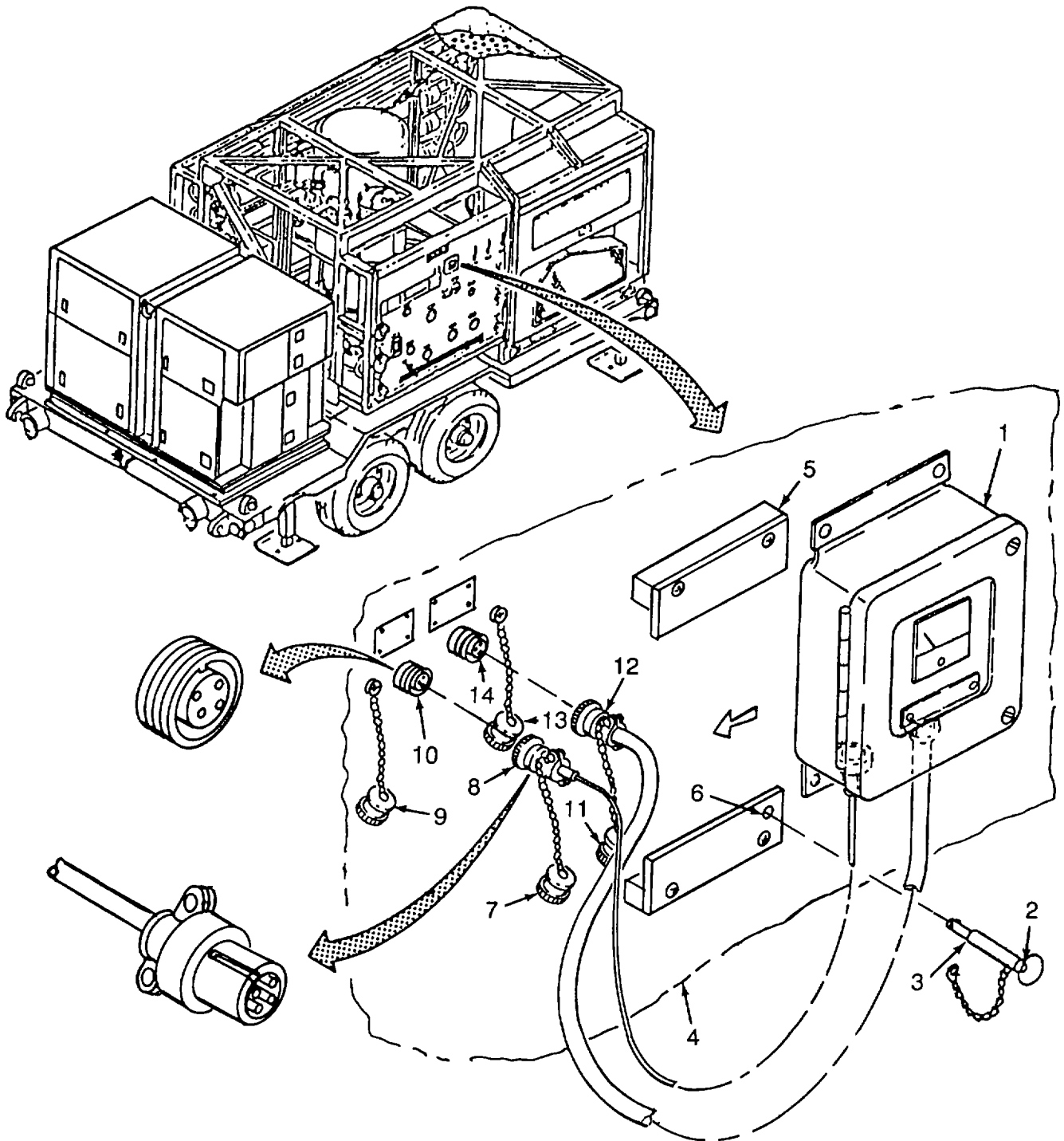


Figure 2-33. TDS Monitor Installation.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

m. Position operational equipment as shown in figure 2-34.

NOTE

Pumps must not be placed so far from the unit that their power cables will not reach the control panel.

CAUTION

Avoid kinking or excessive looping of hoses.

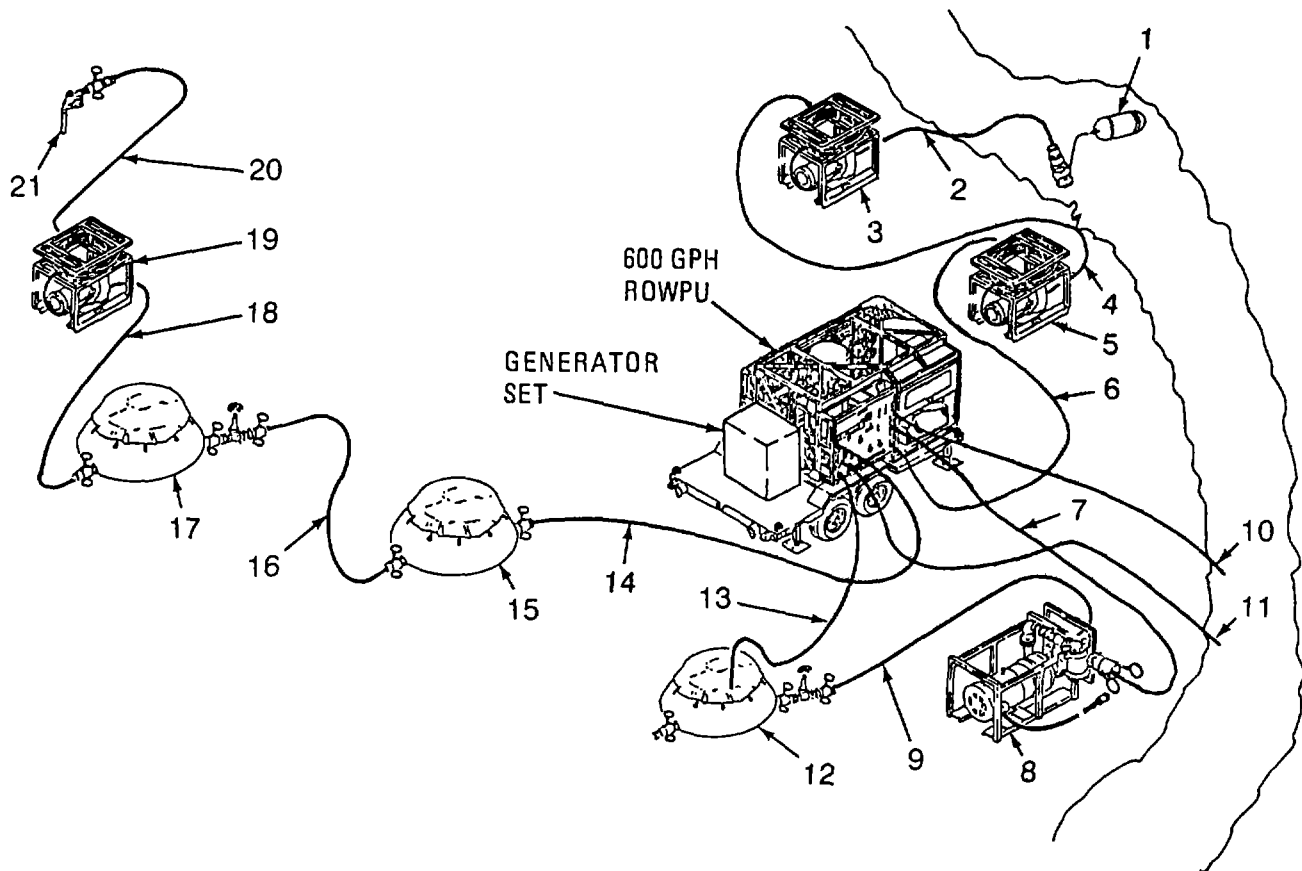


Figure 2-34. Typical Field Installation.

- | | |
|--|--|
| 1. Raw water strainer and float | 12. Backwash water tank |
| 2. Up to three 1 1/2-inch suction hoses | 13. 1 1/2-inch fabric brine discharge hose |
| 3. Raw water pump No. 1 | 14. 1 1/2-inch suction hose/1 1/2-inch discharge |
| 4. One 1 1/2-inch canvas discharge hose | 15. Product water tank |
| 5. Raw water pump No. 2 | 16. Product 1 1/2-inch suction hose |
| 6. Two 1 1/2-inch canvas discharge hoses | 17. Product water tank |
| 7. 2-inch canvas Backwash discharge hose | 18. Product water 1 1/2-inch suction hose |
| 8. Backwash pump | 19. Distribution pump |
| 9. 2-inch Backwash suction hose | 20. Product water 1 1/2-inch canvas discharge hose |
| 10. 2-inch fabric Waste water discharge hose | 21. Distribution nozzle |
| 11. 2-inch Vent Vessels suction hose | |

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- n. Quick Disconnect Couplings. Refer to figure 2-35.

NOTE

All suction and discharge hoses, gate valves, and fitting used in the raw, product, and backwash water systems use quick disconnect couplings. The following instructions apply to all operator installation tasks.

- (1) Pull both locking arms (1) out away from hose (2) and toward end of female coupling (3).
- (2) Pull plug (4) from female coupling (3).
- (3) Push both locking arms (5) out away from cap (6) and toward hose (7).
- (4) Remove cap (6) from male coupling (8).
- (5) Verify gasket inside female coupling (3) is not damaged or missing.
- (6) Pull locking arms (1) out away from hose (1).
- (7) Position male coupling (8) in female coupling (3).

CAUTION

To prevent damage to female couplings, both locking arms should be pulled back and locked at the same time.

NOTE

- Effort required to move locking arms will increase as internal gasket is compressed.
 - If locking arms are loose or will not remain secured against hose when couplings are connected, internal coupling gasket may be missing or badly worn.
- (8) While holding male coupling (8) and female coupling (3) together, pull both locking arms (1) down against hose (2) until firmly locked.
 - (9) Check for proper coupling connection by pulling on connected hoses (2 and 7). Hoses must remain connected and locking arms (2) must be tight against hose.
 - (10) Install cap (6) over male coupling (8) and push locking arms (5) down against cap (6).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE -cont.

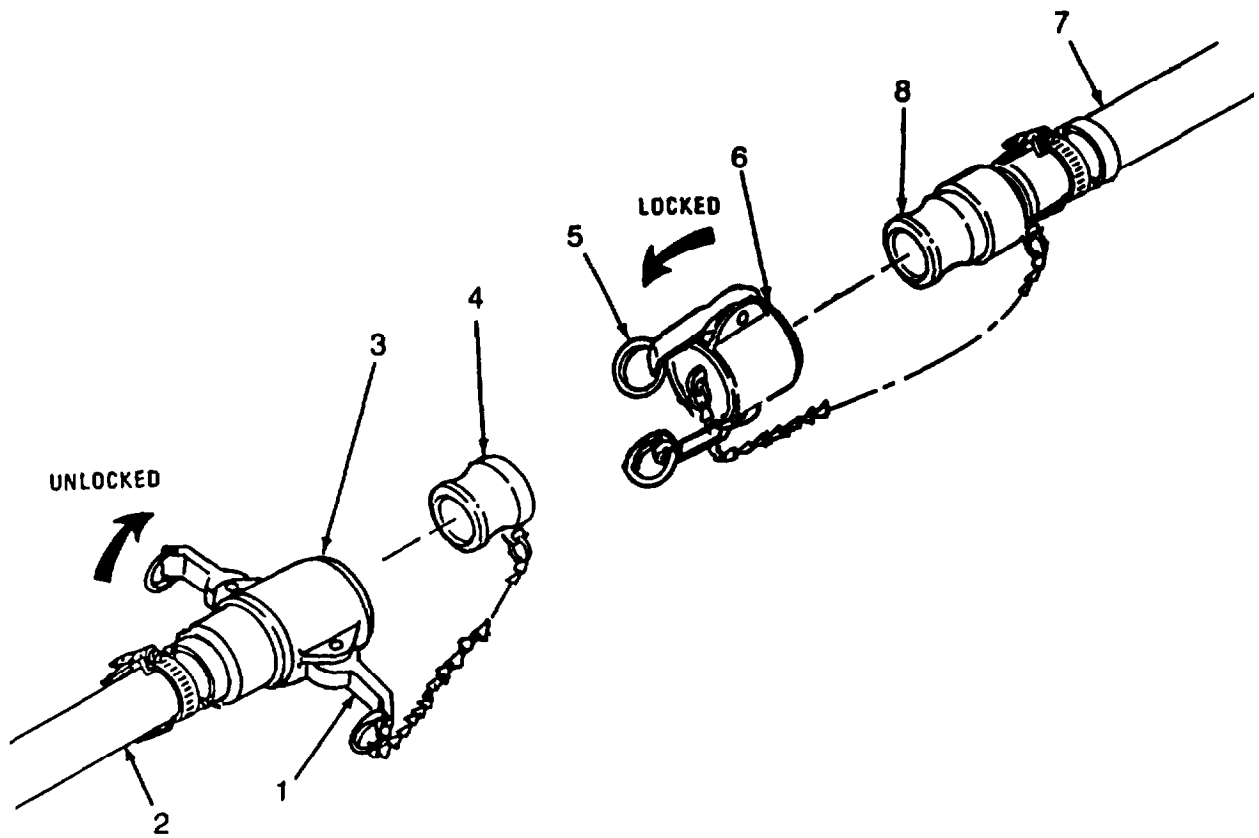


Figure 2-35. Quick Disconnect Couplings.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- o. Setup Raw Water System. Refer to figure 2-36. Working from the ROWPU control panel to the water source, connect components of the raw water system as follows:

WARNING

- To prevent contamination of product water system, do not use hoses intended for potable product water in the raw water system. Product water hoses are identified by a blue stripe running the full length of the hose.
- Position hoses so that a tripping hazard does not exist in front of control panel.

CAUTION

Ensure all gaskets are in place and quick disconnect couplings are locked. Raw water pumps will not prime if suction hoses draw air.

NOTE

- ROWPU should be positioned as close as possible to the water source. If ROWPU is less than 60 feet from water source, only raw water pump No. 2 is required for operation.
 - Raw water pump No. 1 has a female coupling on the pump suction port and male on the discharge port. Pump No. 2 has female couplings on both suction and discharge port.
 - Ensure all gaskets are in place and quick disconnect couplings are locked.
 - Use the minimum number of hoses required to connect raw water pump to No. 2 to control panel.
- (1) Connect canvas discharge hoses between the RAW WATER coupling on the control panel and discharge coupling of raw water pump No. 2.
 - (2) Connect canvas discharge hose between suction coupling of raw water pump No. 2 and discharge coupling of water pump No. 1.

NOTE

Use the minimum number of suction hoses required to reach the water source.

- (3) Connect three hard rubber suction hoses to suction coupling of raw water pump No. 1.

CAUTION

To prevent damage to the ROWPU, do not operate raw water pumps without strainer or ocean intake structure.

NOTE

On Models H-9518-1, H-9518-2, and H-9518-3, an ocean intake system is included with the ROWPU. The ocean intake system allows seawater to be extracted from the ocean. However, it can also be used with freshwater sources (lakes, streams, etc.) as well. Depending on the site, the ocean intake system can be used or the strainer and float can be used. Refer to para. 2-7o.1 for installation instructions.

- (4) Connect strainer to end of suction hoses.
- (5) Connect float to strainer with enough rope to allow strainer to go under water, but not touch bottom.
- (6) Place strainer and float in water source. Avoid placing strainer near sandy areas.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

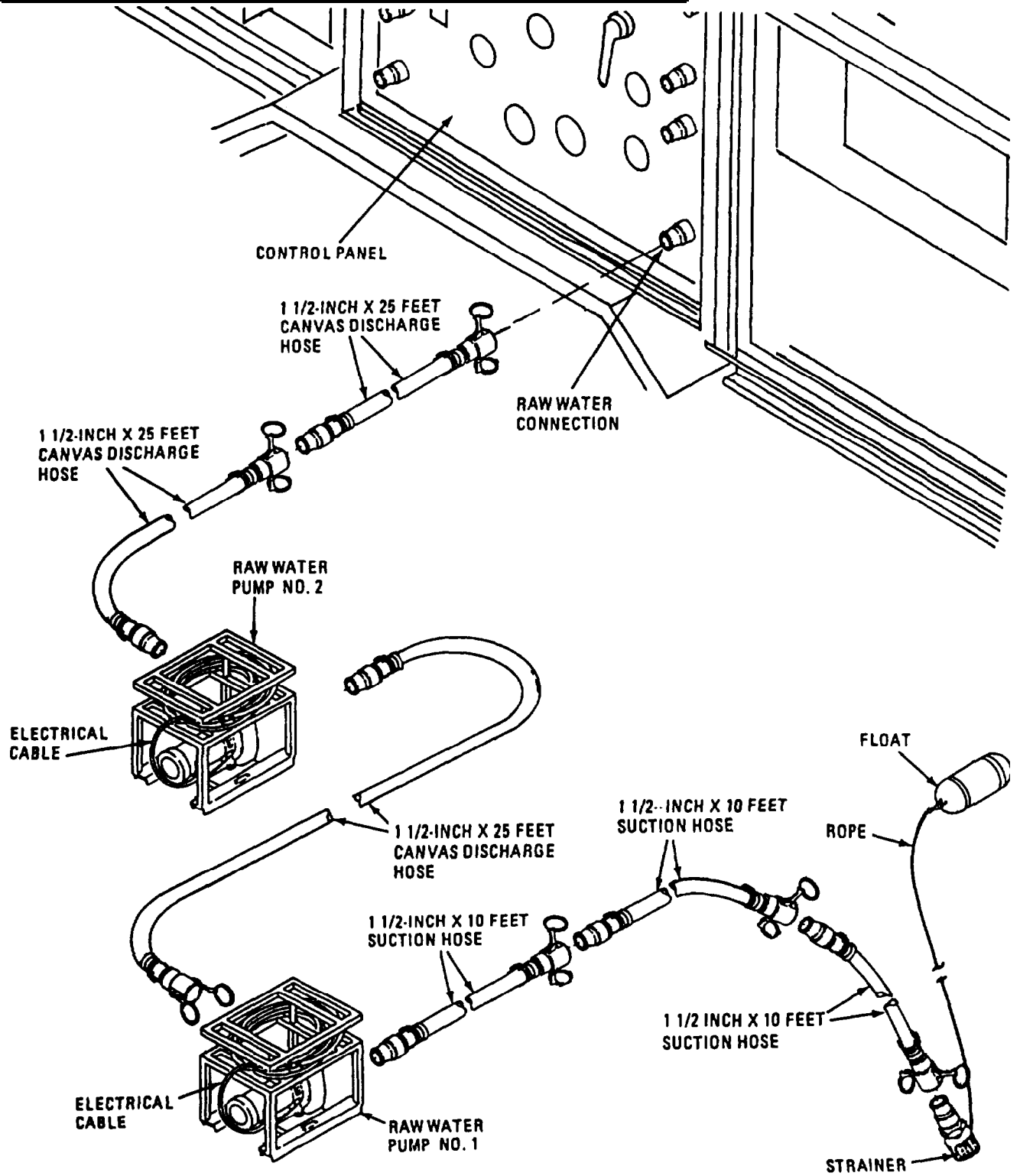


Figure 2-36. Raw Water System Setup.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

o. Setup Raw Water System - cont.

WARNING

Pass electrical cable under water hoses to prevent tripping hazard.

- (7) Remove cover from RAW WATER PUMP NO. 2 receptacle on junction box. Connect raw water pump No. 2 electrical cable to receptacle.
- (8) Remove cover from RAW WATER PUMP NO. 1 receptacle on junction box. Connect raw water pump No. 1 electrical cable to receptacle.
- (9) Check security of all hose coupling connections.

o.1 Setup Raw Water System Using: Ocean Intake Structure Refer to Figure 2-36a. This procedure applies the Ocean Intake Structure which is supplied with Models H-9518-1) H-9518-2 and H-9518-3 only. The Ocean Intake Structure is used in place of the strainer and float.

WARNING

- To prevent contamination of product water system, do not use hoses intended for potable product water in the raw water system. Product water hoses are identified by a blue stripe running the full length of the hose.
- Position hoses so that a tripping hazard does not exist in front of control panel.

CAUTION

Ensure all gaskets are in place and quick disconnect couplings are locked. Raw water pumps will not prime if suction hoses draw air.

NOTE

- ROWPU should be positioned as close as possible to the water source. If ROWPU is less than 60 feet from water source, only raw water pump No. 2 is required for operation.
 - Raw water pump No. 1 has a female coupling on the pump suction port and male on the discharge port. Pump No. 2 has female couplings on both suction and discharge port
 - Ensure all gaskets are in place and quick disconnect couplings are locked.
 - Use the minimum number of hoses required to connect raw water pump to No. 2 to control panel.
- (1) Connect canvas discharge hoses between the RAW WATER coupling on the control panel and discharge coupling of raw water pump No. 2.
 - (2) Connect canvas discharge hose between suction coupling of raw water pump No. 2 and discharge coupling of water pump No. 1.

NOTE

The installation of the Ocean Intake Structure should be performed at maximum low tides. This should eliminate the need to move the wellpoints as tides change.

- (3) Install pump adapter fittings on the inlet and outlet of raw water pump No. 1.
- (4) Attach the 1 1/2 " pipe nipple, 2" gate valve and adapter fitting to the outlet of raw water pump No. 1.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

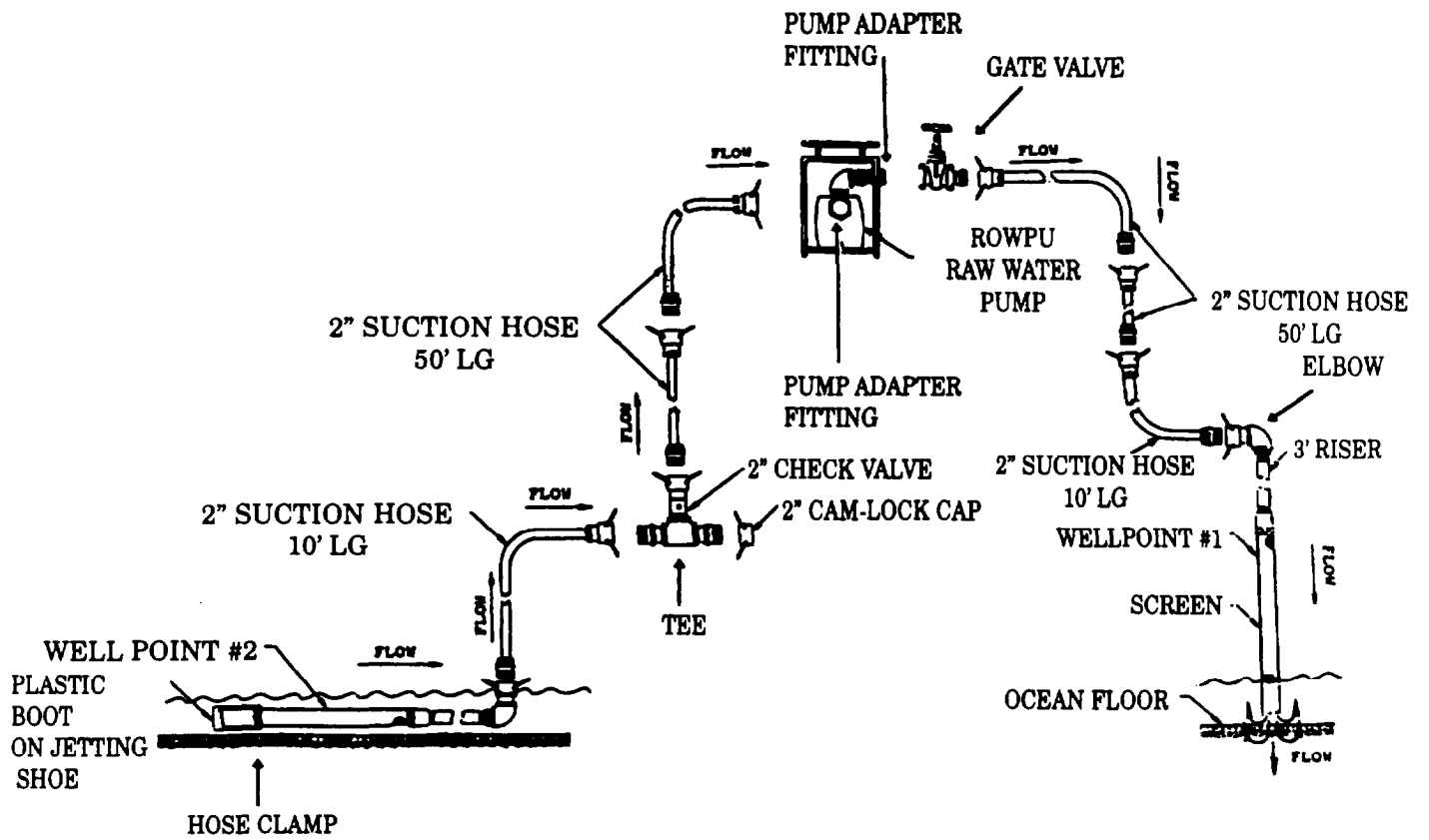


Figure 2-36a.Ocean Intake Structure Setup

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

o.1 Setup Raw Water System - cont.

NOTE

During initial installation, one of the two wellpoints is used for source water when jetting the other wellpoint. The wellpoint used for source water may be either laid flat on the ocean floor (beach) or attached to a vertical metal stake while the jetting operation is conducted. Ensure that the source wellpoint, whether laid flat or attached to stakes, is completely submerged. Refer to figure 2-36a.

- (4) Assemble both wellpoints by attaching the 36" long nipples to the top of the wellpoint. Then install bushing, elbow, and quick disconnect fitting.

NOTE

Install check valve so that water flows from tee.

- (5) Assemble the tee by attaching the male quick disconnect fittings to opposite ends. Attach the check valve and female quick disconnect fitting.
- (6) Attach the male end of one 10-foot suction hose to the source wellpoint.
- (7) Attach the female end of the 10-foot source wellpoint suction hose to the tee assembly.
- (8) Attach the 2-inch Cam-lock cap to the tee assembly.
- (9) Attach the male end of 50-foot suction hose to the female Cam-lock fitting on the tee assembly.
- (10) Add additional 50-foot lengths of suction hose as needed.
- (11) Attach the female Cam-lock of the 50-foot suction hose to the inlet adapter of the ROWPU raw water pump No. 1.
- (12) Attach one or more lengths of 50-foot, 2-inch suction hose to the gate valve at the discharge of the pump. Attach the other end of the hose to the wellpoint to be drilled
- (13) Attach the plastic boot to the jetting shoe of source wellpoint by sliding plastic boot over bottom of wellpoint and then fastening with a hose clamp.

WARNING

When installing the wellpoint(the area near the hole may fluidize creating a wide hole. This could result in loss of solid footing and the operator could fall into the hole being drilled. This could result in death by drowning. Ensure that there is someone nearby who may render assistance while wellpoints are being drilled.

NOTE

- Any unchlorinated water source can be used for installing the first wellpoint. Normally, ocean water available at the wellpoint installation site will be used. However, a 3,000-gallon tank filled with any available unchlorinated water can be substituted for raw sea water.
- The wellpoints should be installed in ankle-deep water during the lowest tide of the day.

WARNING

Pass electrical cable under water hoses to prevent tripping hazard.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

o.1 Setup Raw Water System Using Ocean Intake Structure - cont.

- (14) Remove cover from raw water pump No. 1 receptacle on junction box. Connect raw water pump No. 1 electrical cable to the receptacle.
- (15) Check security of all hose coupling connections.
- (16) At this time, fill the suction hose and pump with water and start the pump. Depending on the amount of water in the suction hose, the pump should prime within a few minutes. Once the pump has been primed, water will begin gushing from the jetting shoe of the first wellpoint.
- (17) With water flowing from the jetting shoe and while holding the wellpoint in the vertical position, proceed to drill the wellpoint into the ocean floor by gently pushing wellpoint downward. The wellpoint will drive itself down because of the water pressure.

NOTE

An up-and-down, as well as a turning motion may ease the drilling of the wellpoint. Depending on ocean floor conditions, it may be necessary to support the wellpoint and riser because of the fast drilling action of the wellpoint as it goes downward through the ground.

- (18) Drill the wellpoint until the elbow fitting on the end of the riser is approximately one foot above the ocean floor.

NOTE

The first wellpoint will be used as the source of water for the installation of the second wellpoint.

- (19) Disconnect the 10-foot length of 2-inch suction hose from the 50-foot length of hose on the driven wellpoint.
- (20) Disconnect the 2-inch Cam-Lock cap that is on the tee assembly and the hose opposite it.
- (21) Attach the 10-foot length of 2-inch suction hose from the driven wellpoint to the tee assembly.
- (22) On the opposite end of the tee, attach the 2-inch Cam-Lock cap.
- (23) Connect hose from discharge of pump to the 10-foot hose on the second wellpoint.

WARNING

When installing the wellpoint(s), the area near the hole may fluidize creating a wide hole. This could result in loss of solid footing and the operator could fall into the hole being drilled. This could result in death by drowning. Ensure that there is someone nearby who may render assistance while wellpoints are being drilled.

NOTE

Remove the plastic boot from the second wellpoint before pumping water into it.

- (24) Prime and energize the pump. Depending on the amount of water in the suction hose, water will start pumping and begin gushing from the jetting shoe of the second wellpoint.
- (25) Position the second wellpoint in the vertical position, at least 10 to 20 feet from the first wellpoint.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

o.1 Setup Raw Water System Using Ocean Intake Structure - cont.

- (26) Drill the second wellpoint into the ocean floor using techniques performed in the installation of the first wellpoint (step 17).

NOTE

An up-and-down, as well as a turning motion may ease the drilling of the wellpoint. Depending on ocean floor conditions, it may be necessary to support the wellpoint and riser because of the fast drilling action of the wellpoint as it goes downward through the ground.

- (27) Position the second wellpoint so that the elbow fitting on the end of the riser is approximately one foot above the ocean floor.

NOTE

After both wellpoints have been positioned, hoses must be repositioned to use wellpoints for a raw water source.

- (28) Remove cap from tee assembly.
- (29) Remove the 10-foot length of 2-inch suction hose that is connected to the second wellpoint and attach it to the opposite end of the tee assembly.
- (30) Remove and store the hose from the outlet of raw water pump No. 1. Remove and store the quick disconnect fitting, the gate valve and pipe nipple.
- (31) Attach a 1-1/2" male quick disconnect fitting to the outlet of raw water pump No. 1.
- (32) Connect a canvas discharge hose from the discharge side of raw water pump No. 1 to raw water pump No. 2 which is already connected to the ROWPU (refer to figure 2-36b).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

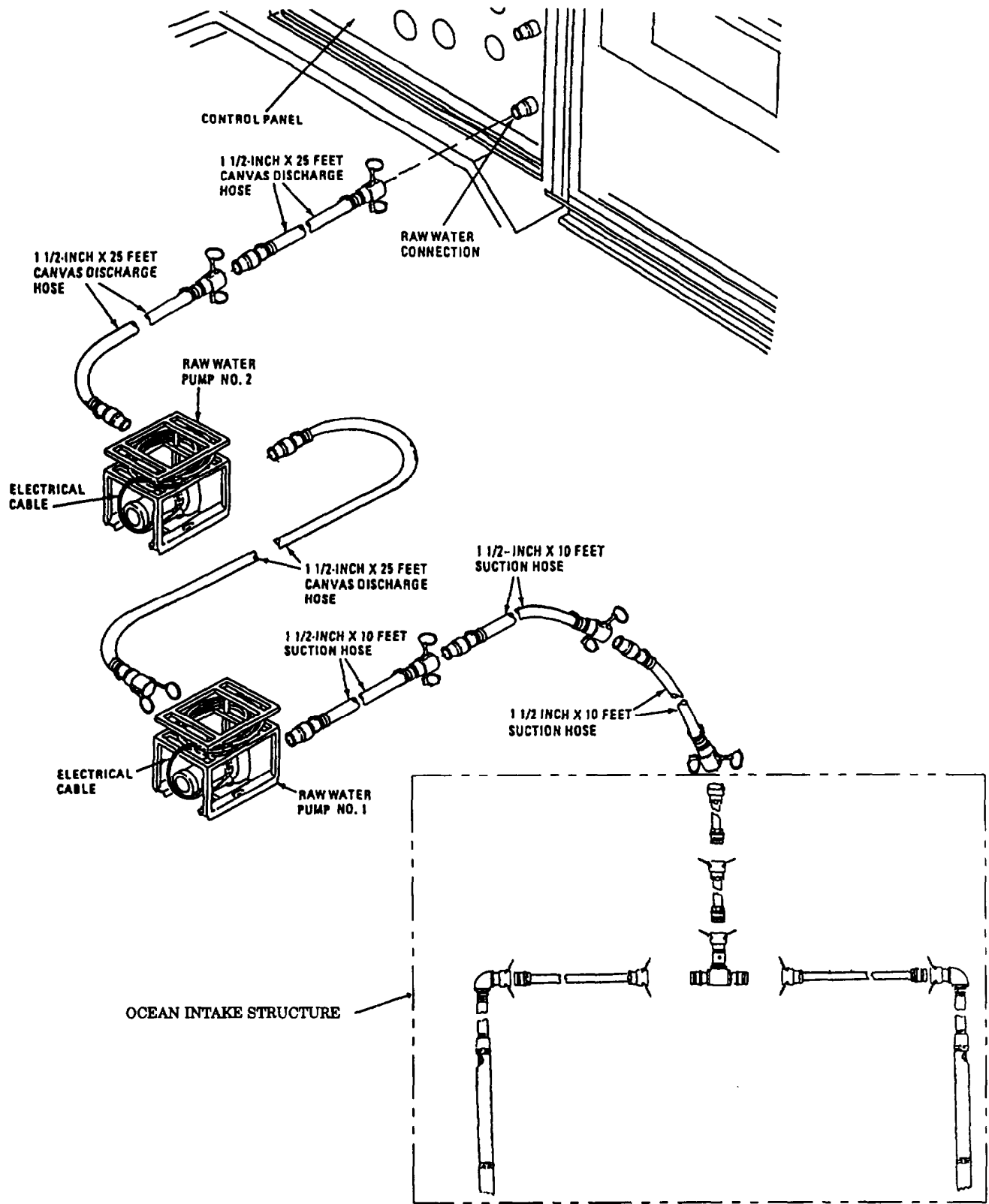


Figure 2-36b. Setup of Raw Water System Using Ocean Intake Structure.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont

- p. Setup Backwash Water System. Refer to figure 2-37.

WARNING

To prevent contamination of product water system, do not use discharge hoses intended for potable product water in the raw water system. Product water hoses are identified by a blue stripe running the full length of the hose.

CAUTION

Ensure all gaskets are in place and quick disconnect couplings are locked.

- (1) Connect canvas discharge hose between BACKWASH coupling on control panel and discharge coupling on backwash strainer.
- (2) Remove plug from BACKWASH PUMP electrical receptacle on junction box.

WARNING

Pass electrical cable under water hoses to prevent tripping hazard.

- (3) Tip backwash pump on end and unwrap electrical cable from frame. Connect backwash pump electrical cable to BACKWASH PUMP receptacle on junction box.
- (4) Connect suction hose to suction coupling on backwash pump.
- (5) Connect gate valve to suction hose.
- (6) Setup backwash water tank in accordance with TM 5-5430-227-12&P/TO 37A12-1-121.
- (7) Connect gate valve to backwash tank.

WARNING

To prevent injury to personnel, secure end of hose in backwash tank. Hose end may whip when pressure is applied.

- (8) Connect canvas discharge hose to BRINE coupling on control panel and place other end canvas discharge hose in backwash tank. Make sure cap is removed from end of canvas discharge hose.
- (9) Check security of all coupling connections.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

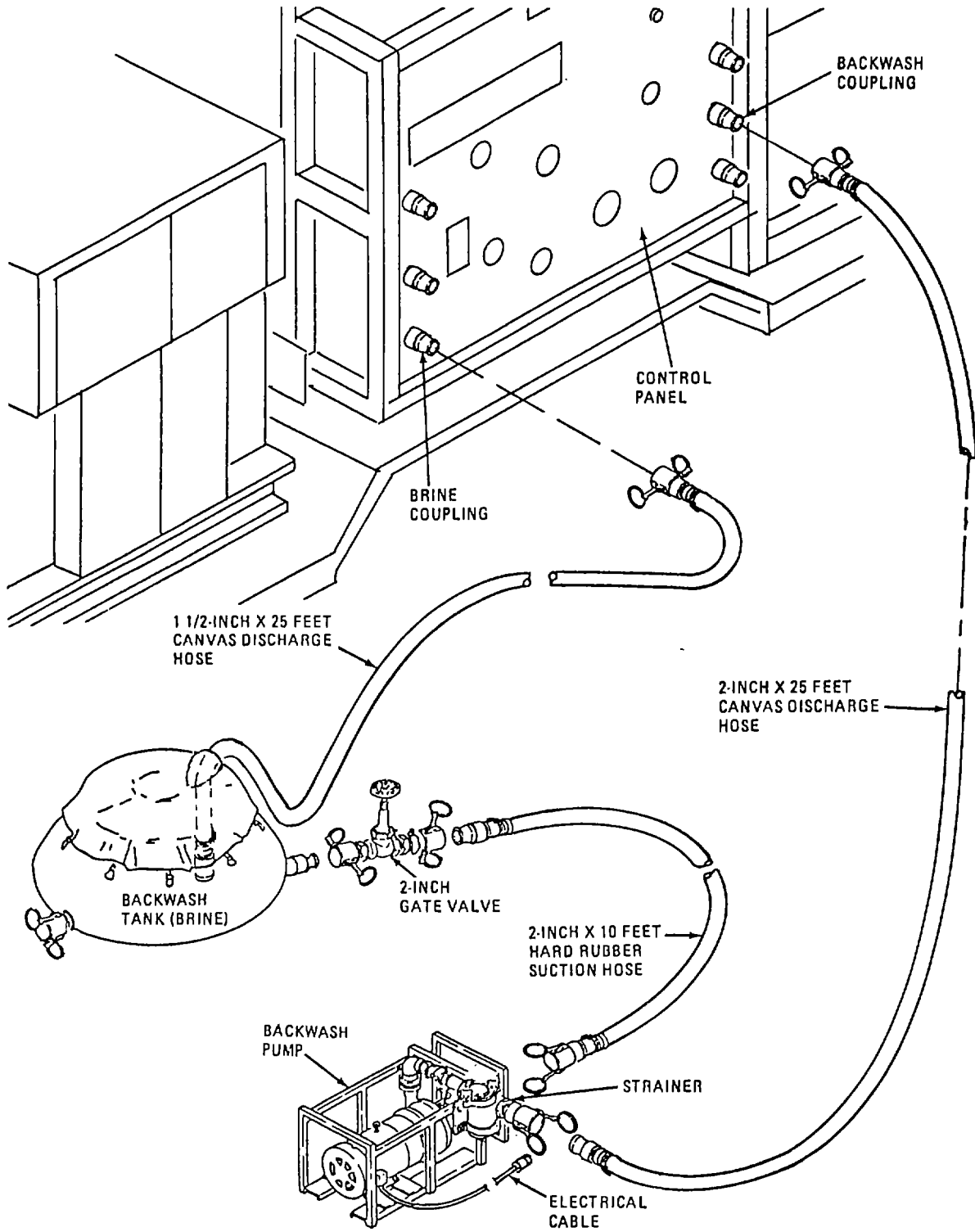


Figure 2-37. Backwash System Setup.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

- q Setup Product Water System. Refer to figure 2-38. Working from the ROWPU control panel to product water dispensing point, connect components of the product water system as follows:

WARNING

To prevent contamination of product water system, do not use discharge hoses intended for raw or brine water in the product water system. Product water hoses are identified by a blue stripe running the full length of the hose.

- (1) Position and setup two product water tanks in accordance with TM 5-5430-227-12&P/TO 37A12-1-121.
- (2) Connect adapter to product water tank No. 1 as shown.
- (3) Connect adapter to product water tank No. 2 as shown.

WARNING

To prevent contamination of product water hose, do not place hose end in mud, dirt or sand.

- (4) Connect one suction and one canvas discharge hose to PRODUCT WATER coupling on the control panel. Place end of canvas discharge hose at least 25 yards down stream of water source.
- (5) Connect suction hose and 1-1/2 inch gate valve between product water tank No. 1 and No. 2.
- (6) Connect suction hose between product water tank No. 2 and the suction coupling on the distribution pump.

WARNING

To prevent contamination of product water, do not drop dispensing nozzle in dirt, mud or sand. Keep cover on end of nozzle.

- (7) Connect one canvas discharge hose and dispensing nozzle to discharge coupling on distribution pump.

WARNING

Pass electrical cable under water hoses to prevent tripping hazard.

- (8) Remove cover from DISTRIBUTION PUMP receptacle on junction box. Connect distribution pump electrical cable to receptacle.

CAUTION

Ensure all gaskets are in place and quick disconnect coupling are locked.

- (9) Check security of all coupling connections.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

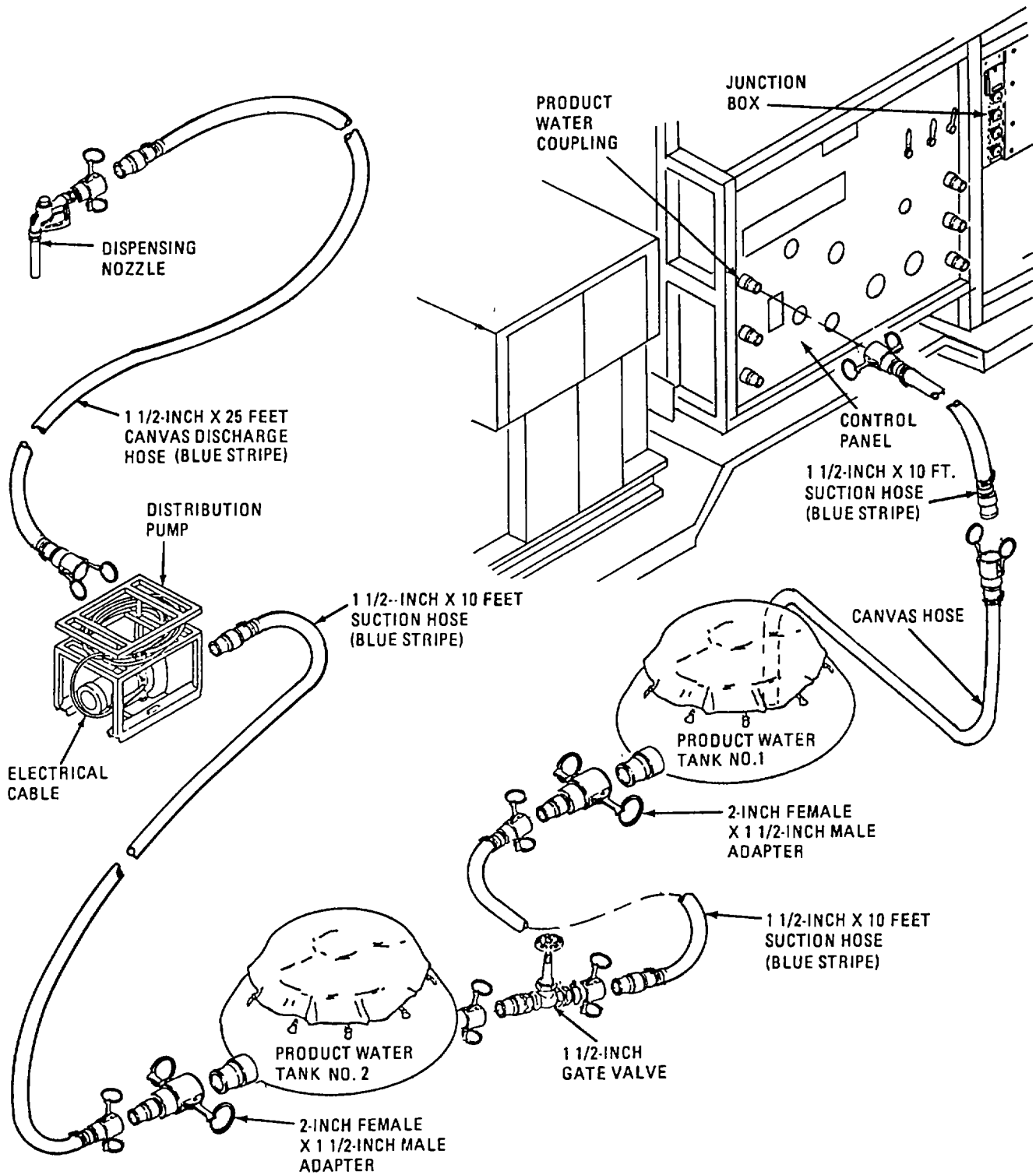


Figure 2-38. Product Water System Setup.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont

- r. Setup Waste Water System. Refer to figure 2-39. Connect components of the waste water system as follows:

WARNING

- To prevent contamination of product water system, do not use discharge hoses intended for potable product water in the waste water system. Product water hoses are identified by a blue stripe running the full length of the hose.
- VENT VESSELS and WASTE hoses must be placed at least 25 yards down stream of raw water intake.
 - (1) Connect canvas discharge hose to VENT VESSELS coupling on control panel. Position free end of hose on ground as far from the ROWPU as possible. Make sure cap is removed from end of hose.
 - (2) Connect canvas discharge hose to WASTE coupling on control panel. Position free end of hose on ground as far from the ROWPU as possible. Make sure cap is removed from end of hose.

CAUTION

Ensure all gaskets are in place and quick disconnect coupling are locked.

- (3) Check security of coupling connections.

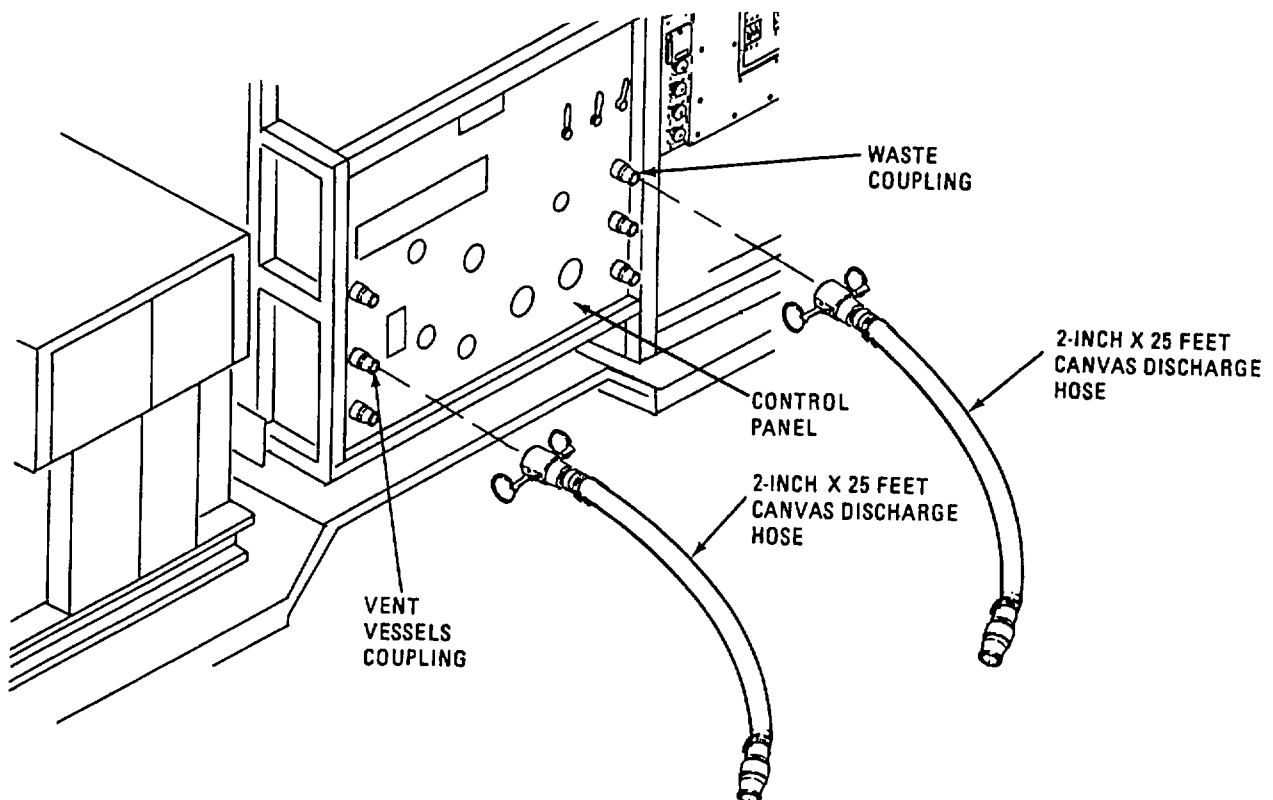


Figure 2-39. Waste Water System Setup.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

Prepare Chemical Solutions.

- (1) Open storage chest and remove wood paddles.
- (2) Open storage chest and remove sodium hex, polyelectrolyte and calcium hypochlorite measures.
- (3) Remove polymer, sodium hex, citric acid and calcium hypochlorite chemicals from storage chest.

CAUTION

To prevent contamination of chemicals, mix chemical solutions in separate pails. Use separate wood paddles for each mixing task.

- (4) Using pen, pencil or marker, label four utility pails as POLYMER, SODIUM HEX, CHLORINE and CITRIC ACID. The fifth utility pail remains unmarked.

WARNING

Chemicals used for operating the ROWPU can kill you. The chemicals alone or in mixture can be dangerous. ALWAYS wear protective apron, goggles and gloves and make sure area is well ventilated.

CAUTION

Use only chlorine free water for mixing to prevent damage to ROWPU membranes. If this is the first time the ROWPU is being started, use raw water to mix chemicals. If you are restarting the unit, use brine from storage tank.

- (5) Mix polymer solution as follows:
 - (a) Fill POLYMER measure HALF FULL, approximately 53 ml, (figure 2-40) with liquid polymer chemical (there is no half full mark on measure).
 - (b) Pour liquid polymer into pail marked POLYMER.
 - (c) Add brine (if available) or raw water to POLYMER pail up to the 3-gallon mark.
 - (d) Stir pail with wooden paddle for at least a minute.
 - (e) Pour solution into chemical feed can marked POLYMER.

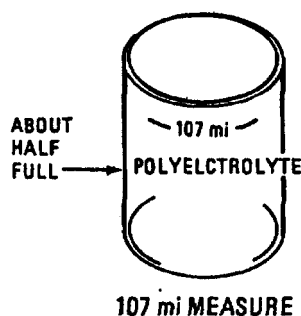


Figure 2-40. Polyelectrolyte Measure.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

WARNING

Always add chemicals to water, not water to chemicals.

WARNING

Use one pail for chlorine use only. DO NOT use for other chemicals.

- (6) Mix chlorine solution as follows:
- (a) Place 3 gallons of non-chlorinated product water (if available) or best filtered non-chlorinated water into unmarked pail.
 - (b) Fill calcium hypochlorite measure with 0.2 pounds (91 grams) of calcium hypochlorite.
 - (c) Pour non-chlorinated product water or best filtered non-chlorinated water available from unmarked pail into chlorine pail.
 - (d) Pour calcium hypochlorite into pail marked chlorine.

NOTE

Mixing calcium hypochlorite with water produces a chlorine solution. It is normal to see white particles in the solution.

- (e) Stir pail with wooden paddle for 1 minute.
 - (f) Pour chlorine solution into chemical feed can marked chlorine.
- (7) Mix sodium hexametaphosphate (sodium hex) solution as follows:
- (a) Place 3 gallons of non-chlorinated product water (if available) or best filtered non-chlorinated water into pail marked sodium hex.
 - (b) Pour 0.1 lbs (45 grams) of sodium hex into sodium hex measure.
 - (c) Pour 0.1 lbs sodium hex into pail marked sodium hex.
 - (d) Stir pail with wooden paddle for 1 minute.
 - (e) Pour sodium hex solution into chemical feed can marked sodium hex.
- (8) Mix Sodium Bisulfite as follows when operating on a chlorinated source water using the chemical feed can marked Citric Acid:

NOTE

Bisulfite is only used in conditions where chlorine is present and citric acid feed is not needed. Most likely scenario is operating using an existing public water system, which is sometimes the safest source of water because it has been treated to some extent.

NOTE

Bisulfite is only used when chlorine levels are greater than 0 and less than or equal to 5 PPM. Refer to instructions in color comparator test kit to determine chlorine concentration in raw water. In cases of water that contains over 5 PPM chlorine, operators should contact the local environmental or public health office for disposal and/or treatment recommendations.

- (a) Pour 32-ounce bag of sodium bisulfite into citric acid pail.
- (b) Add non-chlorinated product water (if available) or best filtered non-chlorinated water to the pail up to the 3-gallon mark.
- (c) Stir with wooden paddle until all chemical is dissolved, approximately one minute.
- (d) Let pail sit for 5-minutes to allow for off gassing of sulfur dioxide.
- (e) Pour solution into 5-gallon container marked CITRIC ACID.

2.7 ROWPU ASSEMBLY AND PREPARATION FOR USE – cont.

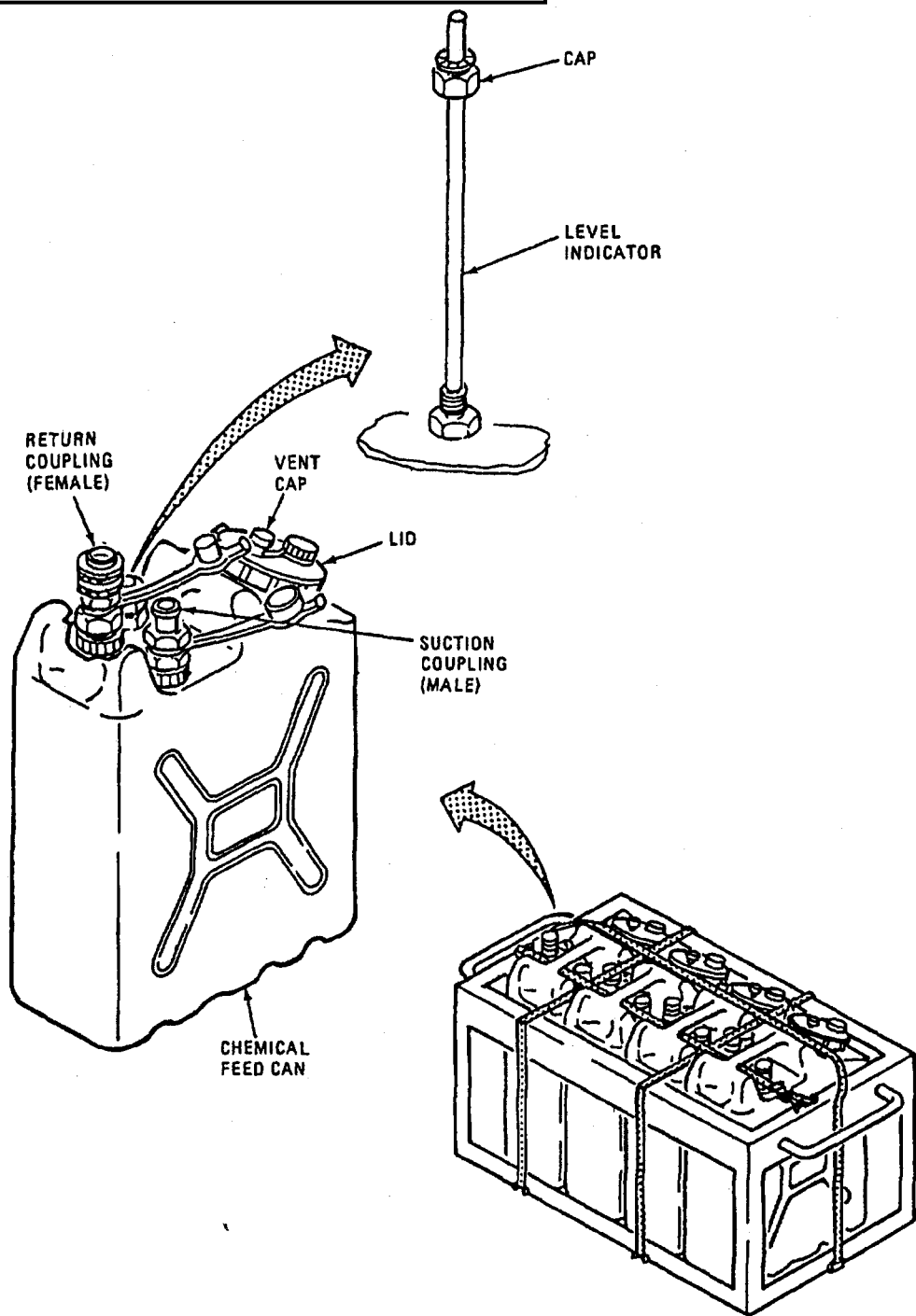


Figure 2-41. Chemical Feed Can Indicator.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE – cont.

WARNING

Do not close the vent vessel valve until neutralization of the chlorine has been verified. Take a sample from the media filter vent line and measure the chlorine residual, it should be zero. Chlorine is an oxidizer and will damage the RO elements.

- (9) Check chemical feed can solution levels by loosening the cap on the indicator, and then gently letting go. Indicators should remain raised approximately 1/4 the length of the indicator (1/4 full). Refer to figure 2-41.
 - (10) Make sure lids are installed and vents are open.
- t. Connect Chemical Feed Cans. Refer to figure 2-42. Connect chemical feed suction and return tubes to chemical feed cans as follows:
- (1) Position chemical feed cans and rack next to stand.
 - (2) Connect flexible tubes with blue sleeve to POLYMER chemical feed can as follows:

NOTE

Connection of POLYMER flexible hoses is shown. Connection of SODIUM HEX, CHLORINE and CITRIC ACID flexible hoses is similar.

- (a) Remove caps and plugs from couplings on blue flexible hoses.
 - (b) Remove caps and plugs from POLYMER chemical feed can.
 - (c) Pull back female coupling locking sleeve on flexible hose.
 - (d) Push flexible hose female coupling down over male coupling on chemical can, then release female coupling locking sleeve.
 - (e) Push down female coupling locking sleeve on chemical can.
 - (f) Push flexible hose male coupling into female coupling on chemical can, then release female coupling locking sleeve.
- (3) Connect flexible tubes with green sleeve to SODIUM HEX chemical feed can.
 - (4) Connect flexible tubes with red sleeve to CHLORINE chemical feed can.
 - (5) Connect flexible tubes with yellow sleeve to CITRIC ACID chemical feed can.
 - (6) Check security of all coupling connections.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

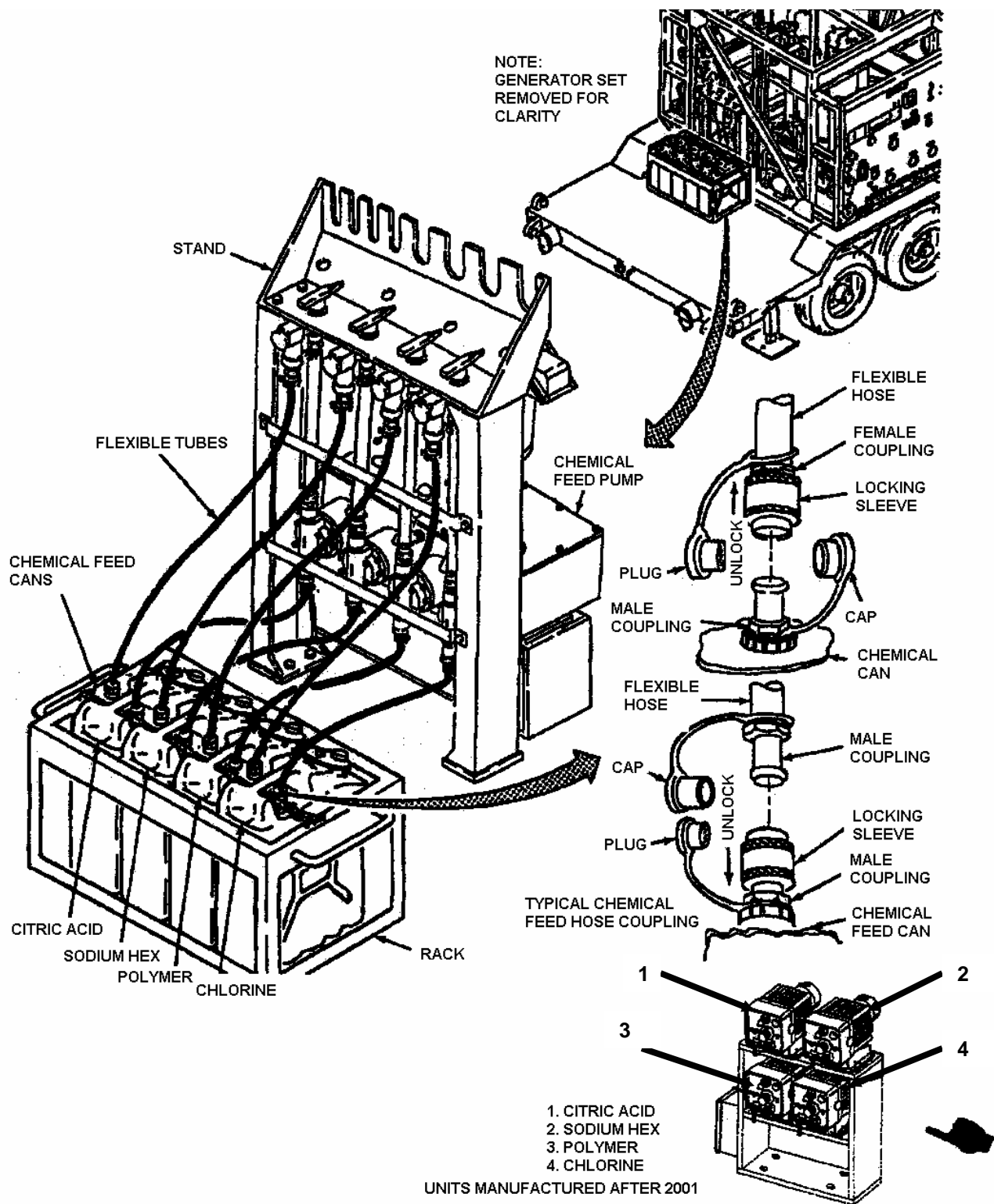


Figure 2-42. Chemical Feed Can Connections.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

u. Install Ground Rod. Refer to figure 2-43 and ground the ROWPU as follows:

WARNING

ELECTRICAL HIGH VOLTAGE CAN KILL YOU

- **Electrical high voltage cannot be seen but it can kill you. Electricity is unlike most other dangerous things you can come in contact with because it gives no warning and no symptoms to be wary of. Its effect is immediate. It can kill you, render you unconscious, or severely burn you. To ensure your safety and that of other personnel, always observe the following precautions:**
 - **ALWAYS make sure the unit is properly grounded.**
 - **Extreme care must be taken to prevent injury to fingers or hands when driving the ground rods. Do not place hands between the ram and drive collar. Gloves should be worn. Be sure all connections are tight so as to avoid a possible spark between the units and ground rod.**
- (1) Loosen both bolts on plates securing ground rods to control panel.
 - (2) Swing plates out from under lower bolts, and remove three ground rod sections from control panel.
 - (3) Locate ground rod section with the drive bolt screwed into the coupler. The drive bolt prevents damage to the coupler when the rod is driven into the ground.
 - (4) Drive the first 3-foot round rod section into the ground with the 8-pound hammer.

NOTE

If driving gets too hard, soak the earth with water and try driving rod until eight feet of rod is in the ground. If this does not work initially, continue alternately soaking ground and driving rod. If unable to get eight feet of rod into the soil, then keep soil moist around the rod for the duration of the operation.

- (5) When the rod coupler of the first ground rod section is about 6 inches above ground, remove the driving bolt.
- (6) Screw another ground rod section into the one already in the ground. Install the drive bolt into the coupler and drive the ground rod section the same as the first section. Continue until there are 8 feet of rod in the ground.
- (7) (Model WPES-10) Remove nut from GROUND lug located on the GENERATOR frame. Insert ground strap in GROUND lug and install nut. Connect other end of ground strap to clamp on ground rod and tighten clamp.
- (8) (Models WPES-20 and WPES-30) Remove nut from GROUND lug on ROWPU frame. Insert ground strap in GROUND lug and install nut. Connect other end of ground strap to clamp on ground rod and tighten clamp.

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

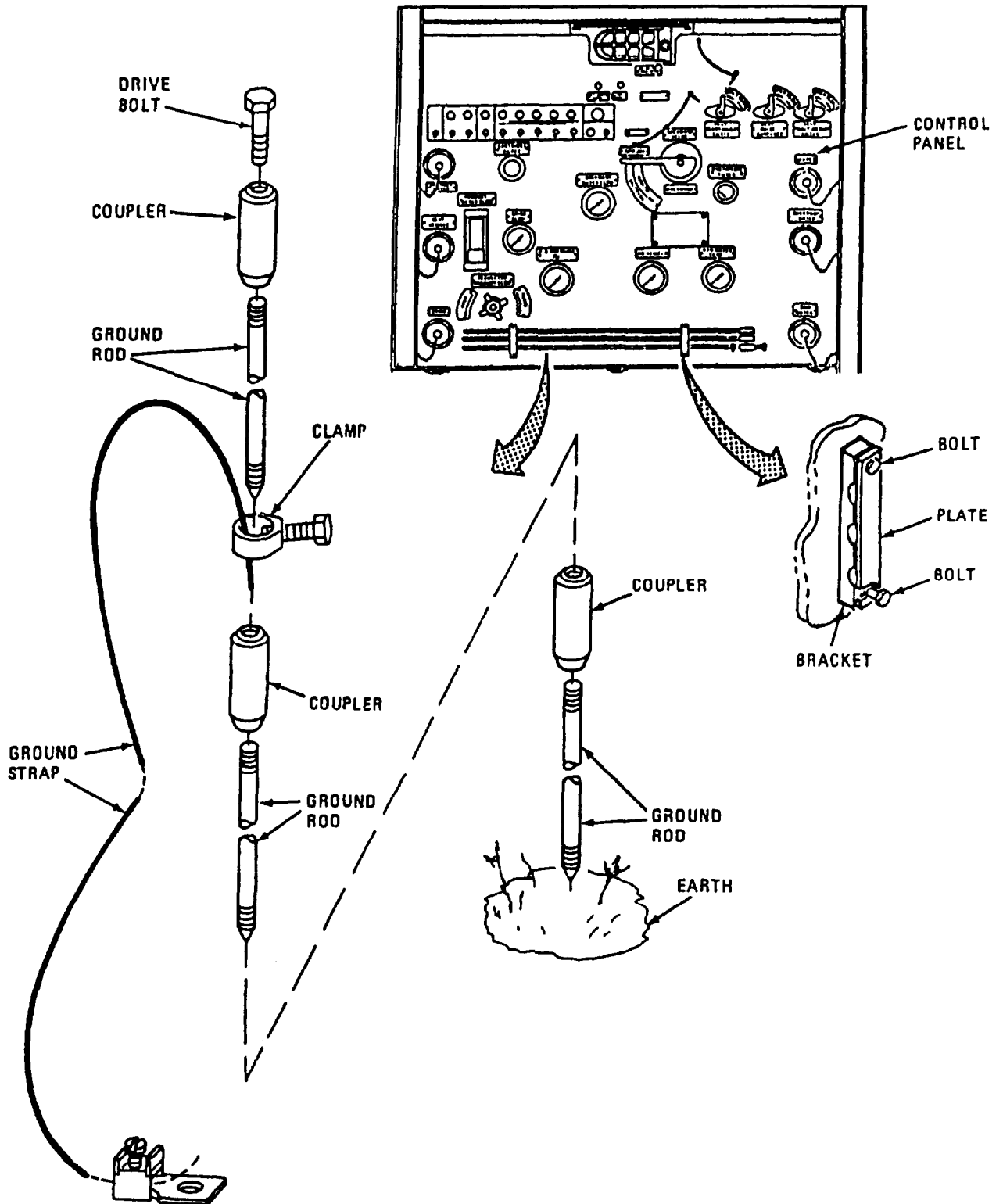


Figure 2-43. Ground Rod Installation (Sheet 1 of 2).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

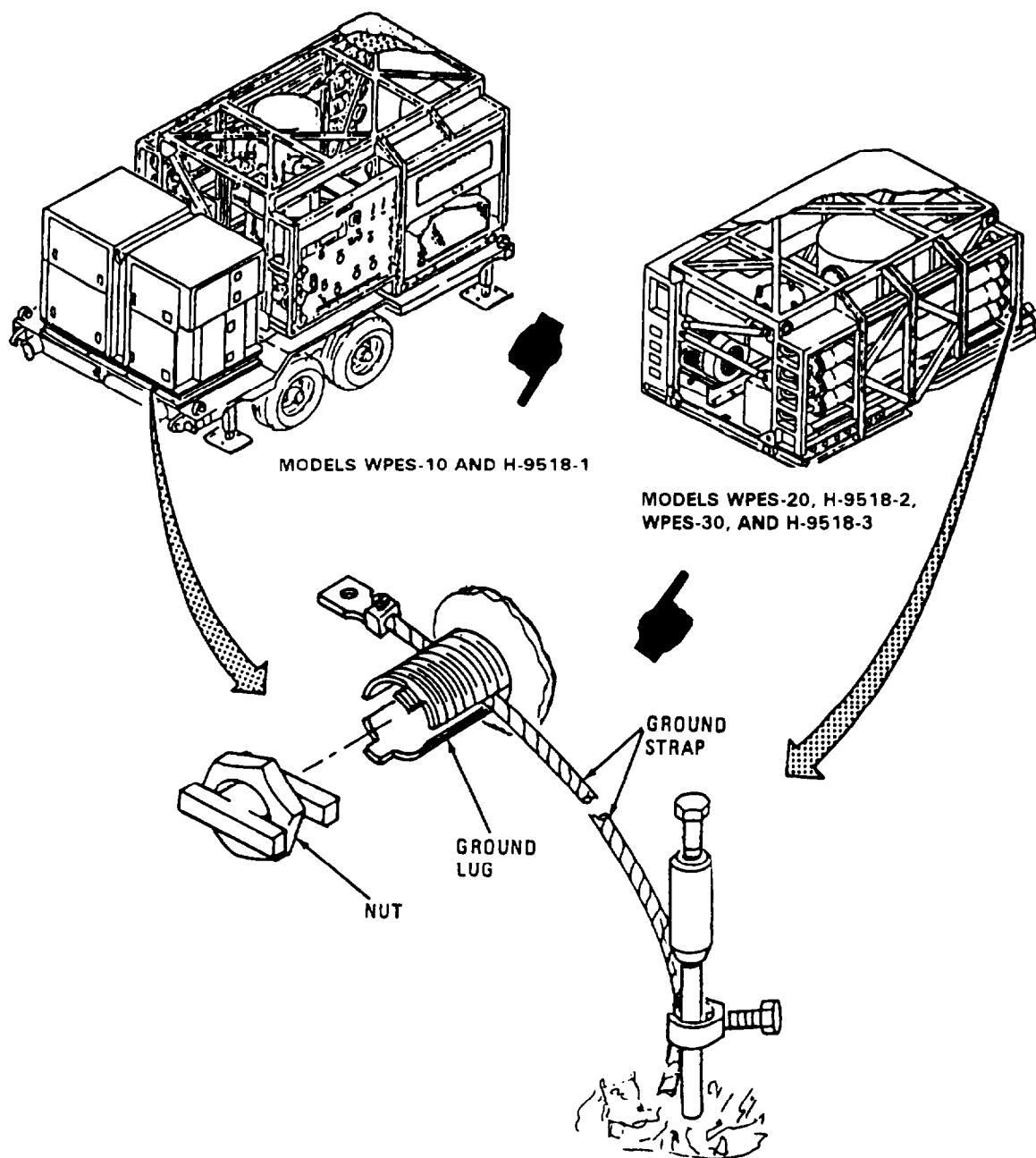


Figure 2-43. Ground Strap Installation (Sheet 2 of 2).

2-7. ROWPU ASSEMBLY AND PREPARATION FOR USE - cont.

V. Connect Power Source to ROWPU. Refer to Figure 2-44.

- (1) (Models WPES-20 and H-9518-2) Remove cover from power receptacles J1 and J10 on bottom of junction box. Connect two power cables from power source to receptacles J1 and J10.
- (2) (Model WPES-30 and H-9518-3) Remove cover from power receptacle J1 on bottom of junction box. Connect power cable from power source to receptacle J1.

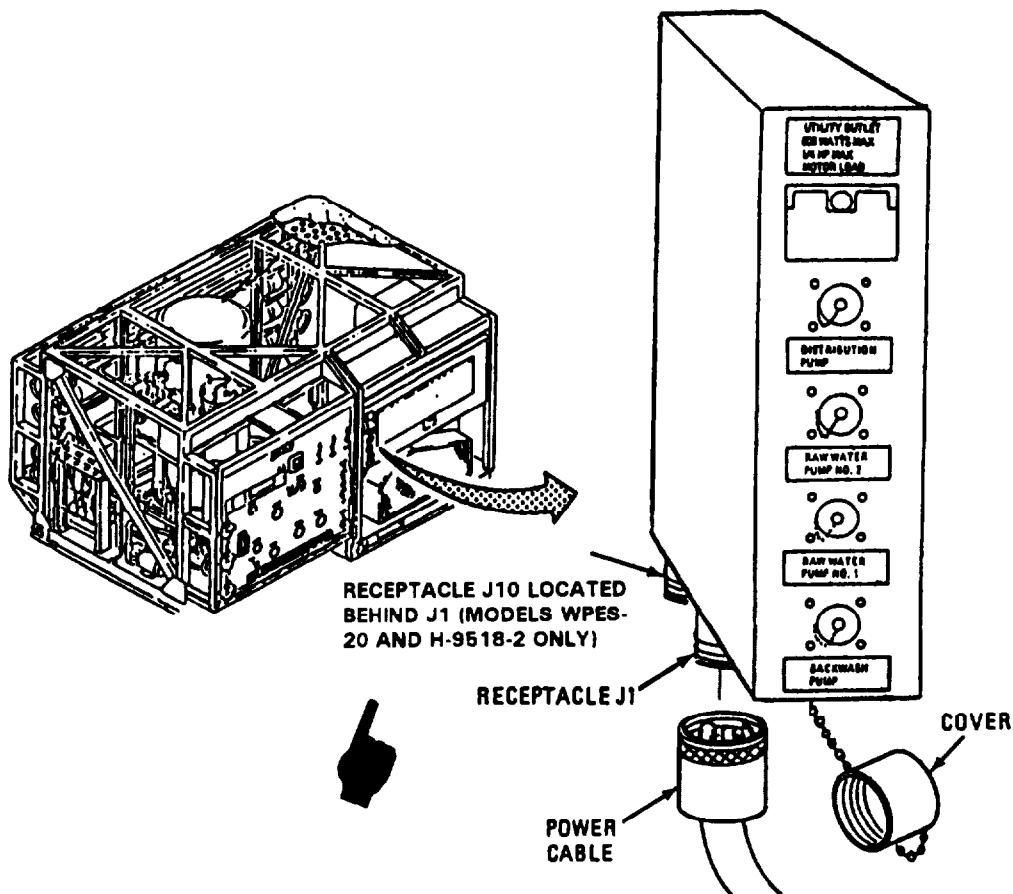


Figure 2-44. Power Cable Connection.

2-8. INITIAL ADJUSTMENTS AND CHECKS.

- a. Close Drain Valves. Refer to figure 2-45. Close all drain valves (seven valves on Models WPES-10, WPES-20 and WPES-30; six valves on Models H-9518-1, H-9518-2, and H-9518-3). Drain valves are normally closed during operation.

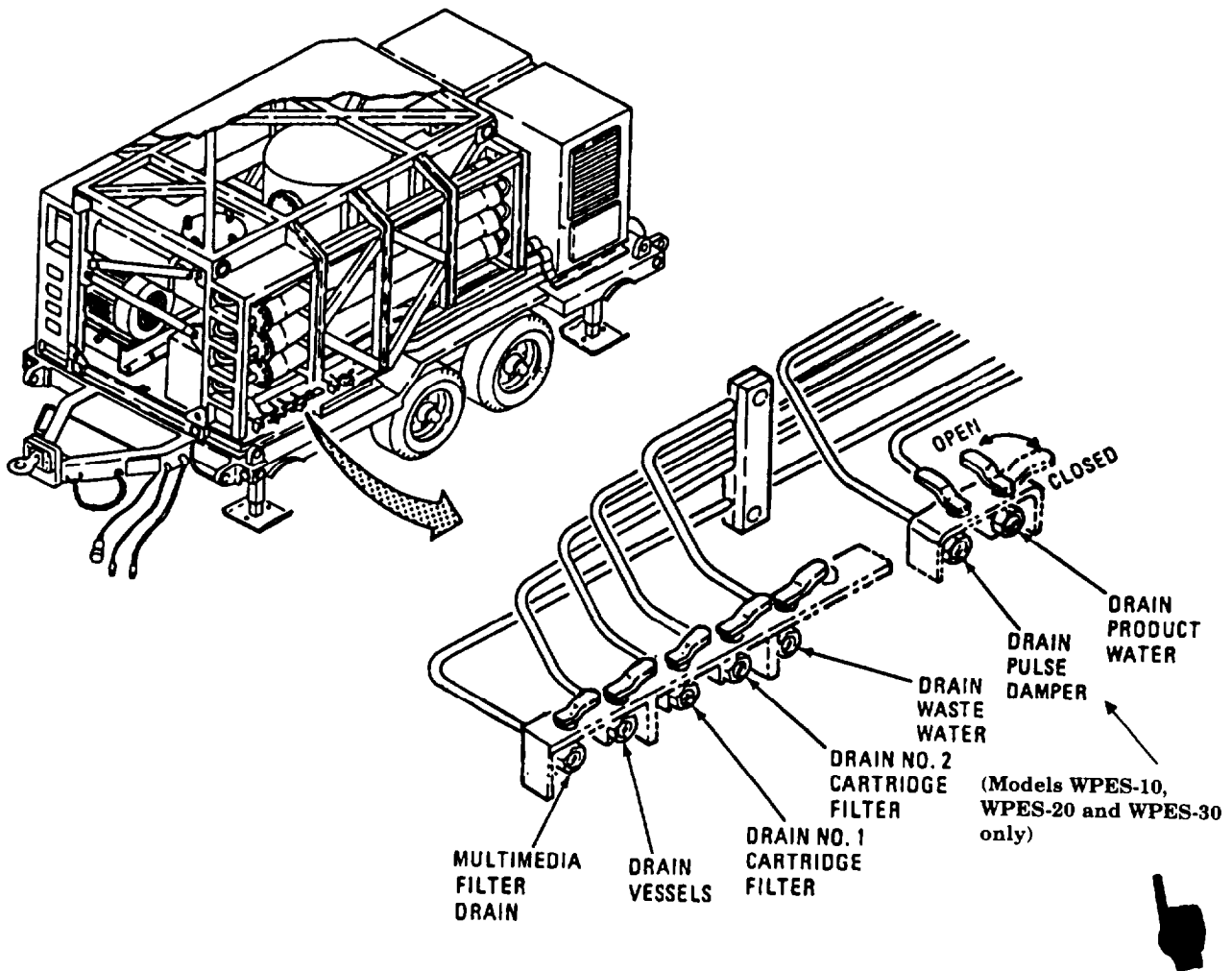


Figure 2-45. Drain Valves

2-8. INITIAL ADJUSTMENTS AND CHECKS.

- b. Open Vent Valves. Refer to figure 2-46. Open all five valves (Models WPES-10, WPES-20 and WPES-30) or four valves (Models H-9518-1, H-9518-2, and H-9518-3) as listed below. Three valves (Models WPES-10, WPES-20 and WPES-30) or two valves (Models H-9518-1, H-9518-2, and H-9518-3) are on the control panel, one is behind the control panel and one is at the front of the top R-O. pressure tube.
- (1) Set VENT CARTRIDGE FILTER valve (1) to OPEN.
 - (2) Set VENT PULSE DAMPENER valve (Models WPES-10, WPES-20 and WPES-30 only) (2) to OPEN.
 - (3) Set VENT MULTIMEDIA FILTER valve (3) to OPEN.
 - (4) Open VENT VESSELS gate valve (5). Turn handwheel fully counterclockwise.
 - (5) Set VENT PRODUCT WATER valve (7) to open. Valve is open when control handle is pointing down.

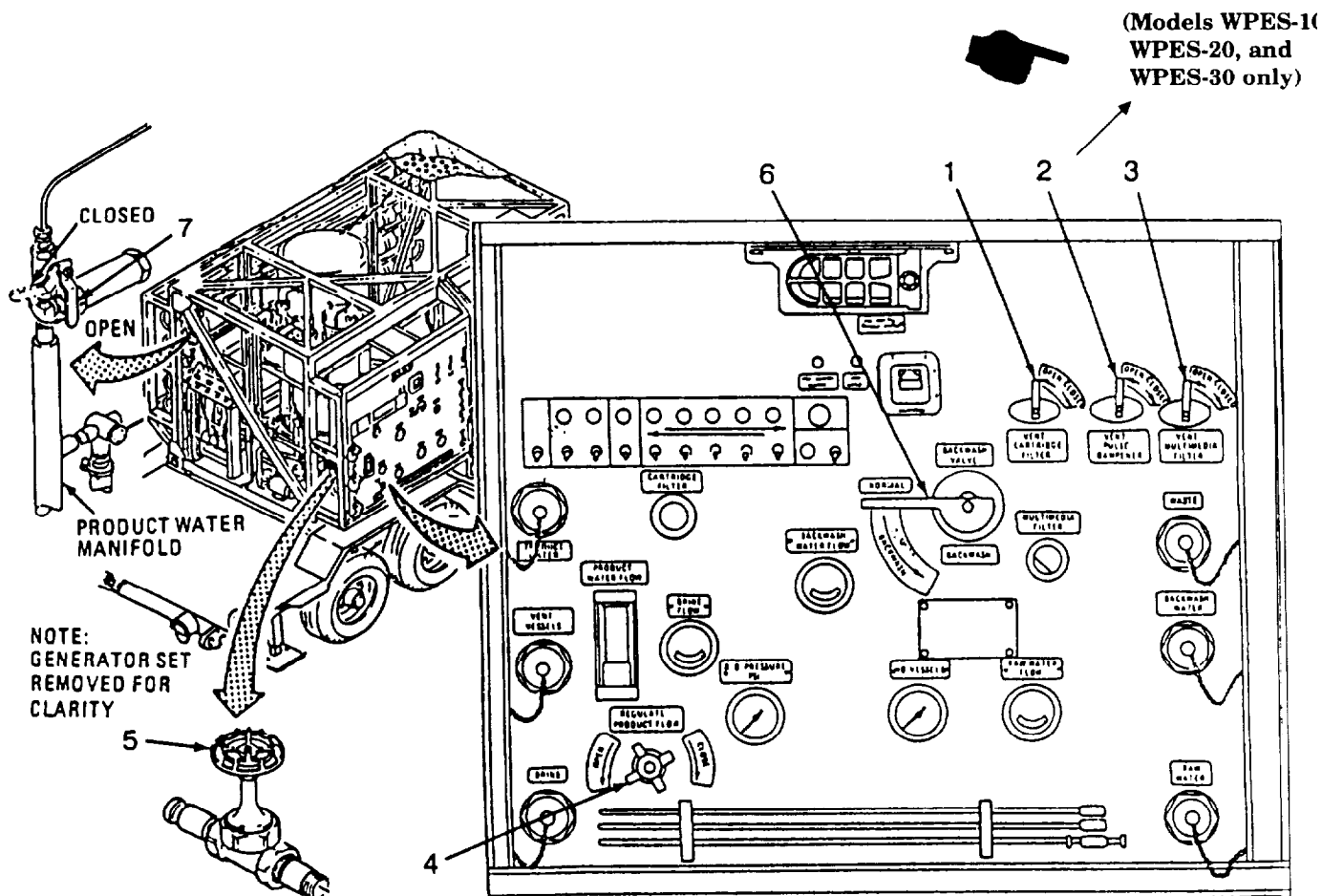


Figure 2-46. Control Valves.

2-8. INITIAL ADJUSTMENTS AND CHECKS - cont.

- c. Set Backwash Valve. Set backwash valve handle (6, figure 2-46) to NORMAL. Valve is set to NORMAL when handle is horizontal.
- d. Set Regulate Product Flow Valve. Set REGULATE PRODUCT FLOW valve (4, figure 2-46) to OPEN. Valve is open when handwheel is turned fully counterclockwise.
- e. R.O. Pressure Tube Vent/Sample Valves. Refer to figure 2-47.

NOTE

Vent/sample valves are connected to the R.O. vessels by clear, braided plastic hose.

- (1) Close four front R.O. pressure tube vent/sample valves located at forward end R.O. pump end) of each R.O. pressure tube. Valves are closed when control handles are horizontal.
- (2) Set four rear R.O. pressure tube vent/sample valves to normal position.

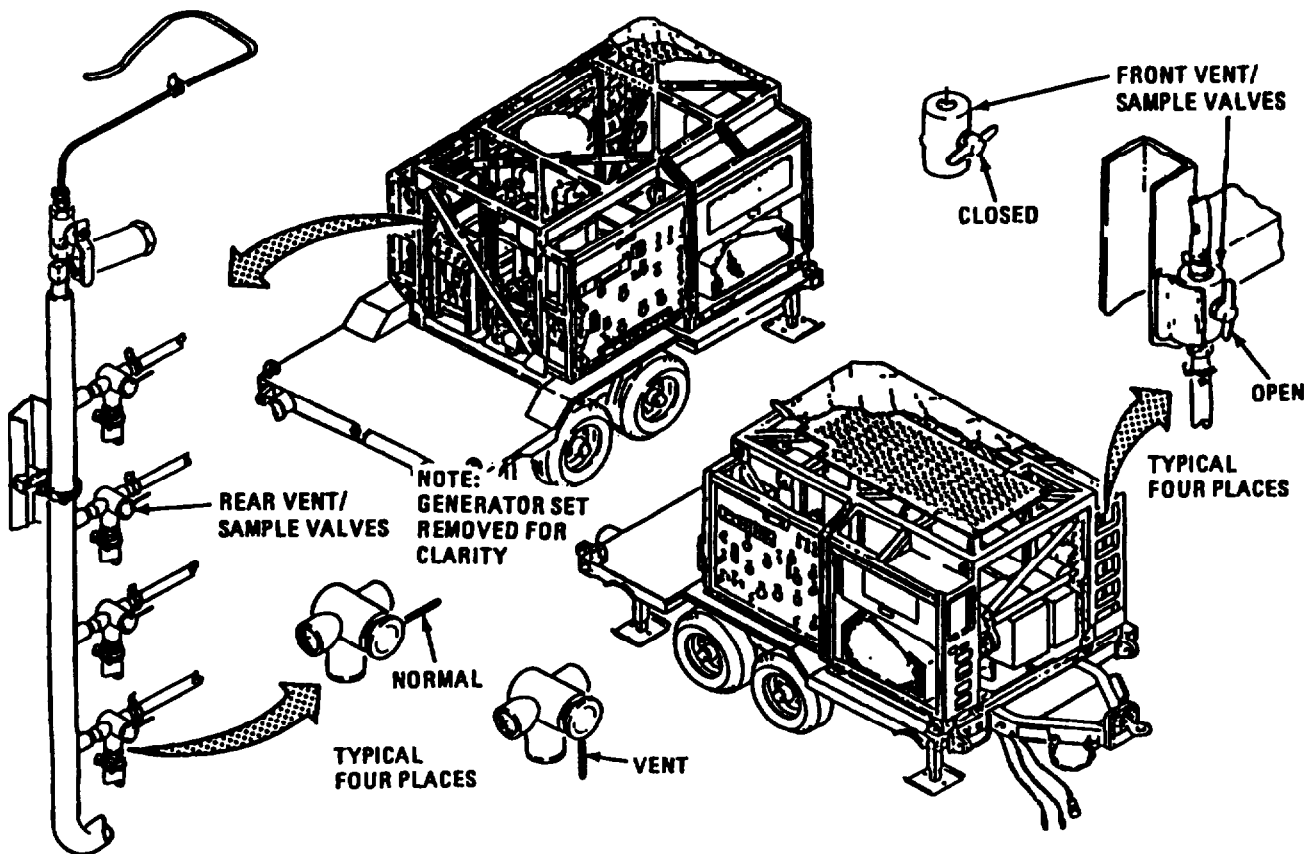


Figure 2-47. R.O. Tube Vent/Sample Valves.

2-8. INITIAL ADJUSTMENTS AND CHECKS - cont.

h. Chemical Feed Run/Prime Valves. Refer to figure 2-50. Ensure all valves are set to PRIME.

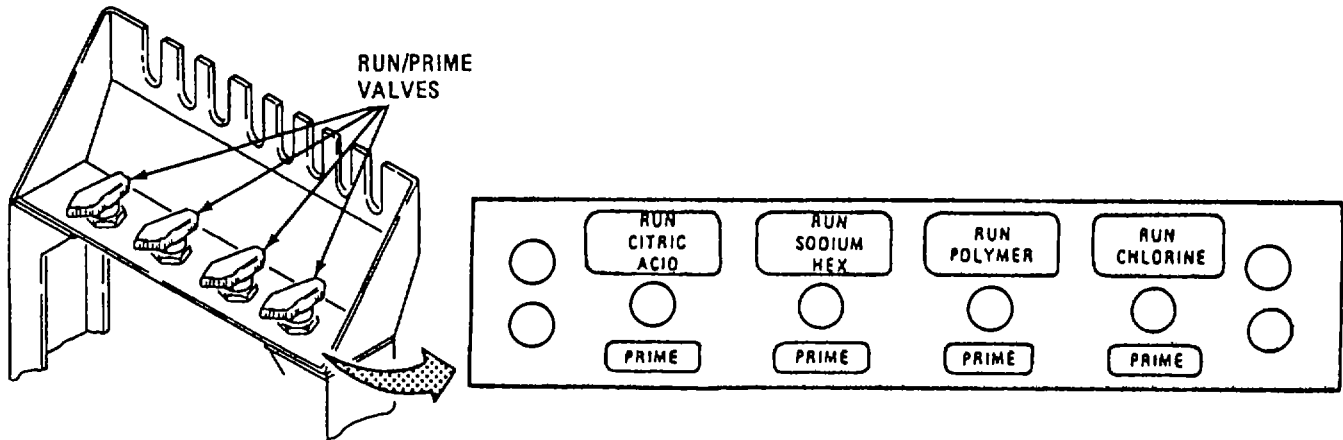


Figure 2-50. Chemical Feed Run/Prime Valves.

i. Prime Raw Water Pumps. Refer to figure 2-51.

- (1) Verify that raw water strainer is under water. With the unmarked pail, draw some raw water from the water source. Take it to raw water pump No. 1.
- (2) If open, close drain and vent valves on raw water pump No. 1.
- (3) Remove priming plug from top of raw water pump No. 1 using wrench from storage chest. Fill pump housing with raw water. Screw priming plug back into pump. Return wrench to storage chest.

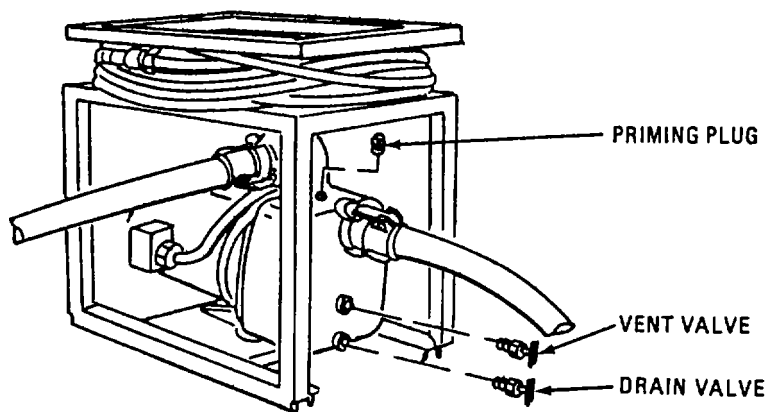


Figure 2-51. Raw Water Pump Valves.

2-9. OPERATING PROCEDURES.

a. Apply Electrical Power.

- (1) Twist and unlock seven fasteners (figure 2-52) on junction box cover.
- (2) Open junction box cover.
- (3) Push circuit breakers CB-1 thru CB-9 (45 to 53, figure 2-5) to on position (up).
- (4) Ensure that EMERGENCY STOP button (5, figure 2-5) on control box (9) is pulled out.
- (5) Push PANEL LIGHT switch (8) to TEST INDICATOR LIGHTS position. Check all lamps and adjust dimmer knobs (10) as required.

NOTE

R.O. PUMP LOW PRESSURE lamp on control box comes on as soon as power is applied to the ROWPU.

- (6) Push EMERGENCY STOP button (5) whenever the following conditions exist:

WARNING

Operating personnel could be injured or the equipment could be damaged if operation of the ROWPU is allowed to continue.

- R.O. PUMP HIGH PRESSURE lamp (2) comes on, but R.O. Pump does not automatically stop.
- R.O. PUMP LOW PRESSURE lamp (1) comes on, but R.O. Pump does not automatically stop.
- High pressure relief valve opens.
- Rupture disc opens (ruptures) (Models WPES-10, WPES-20 and WPES-30 only).
- Some other serious trouble (malfunction) indicated by noise, vibration, large water leaks, etc.

NOTE

If low or high pressure switches shut down the ROWPU automatically, they can only be reset with the R.O. PUMP RESET switch. After emergency shutdown, distribution of potable water can still be made by pulling out the EMERGENCY STOP button and running the distribution pump as required.

b. Start Raw Water Pump No. 1. Refer to figure 2-53.

- (1) Locate the lamp (3) and switch (7) for RAW WATER PUMP No. 1 on control box (9).
- (2) Set RAW WATER PUMP No. 1 switch (7) upward to START.
- (3) Hold switch (7) up until RAW WATER PUMP NO. 1 lamp (3) comes on.
- (4) Release RAW WATER PUMP No. 1 switch (7). Switch will return to RUN.

2-9. OPERATING PROCEDURES - cont.

NOTE

It may be necessary to kink raw water discharge hose to get pump to prime.

- (5) Look at discharge hose from raw water pump No. 1. (Hose goes into suction side of raw water pump No. 2.) Hose should expand with water and straighten out.

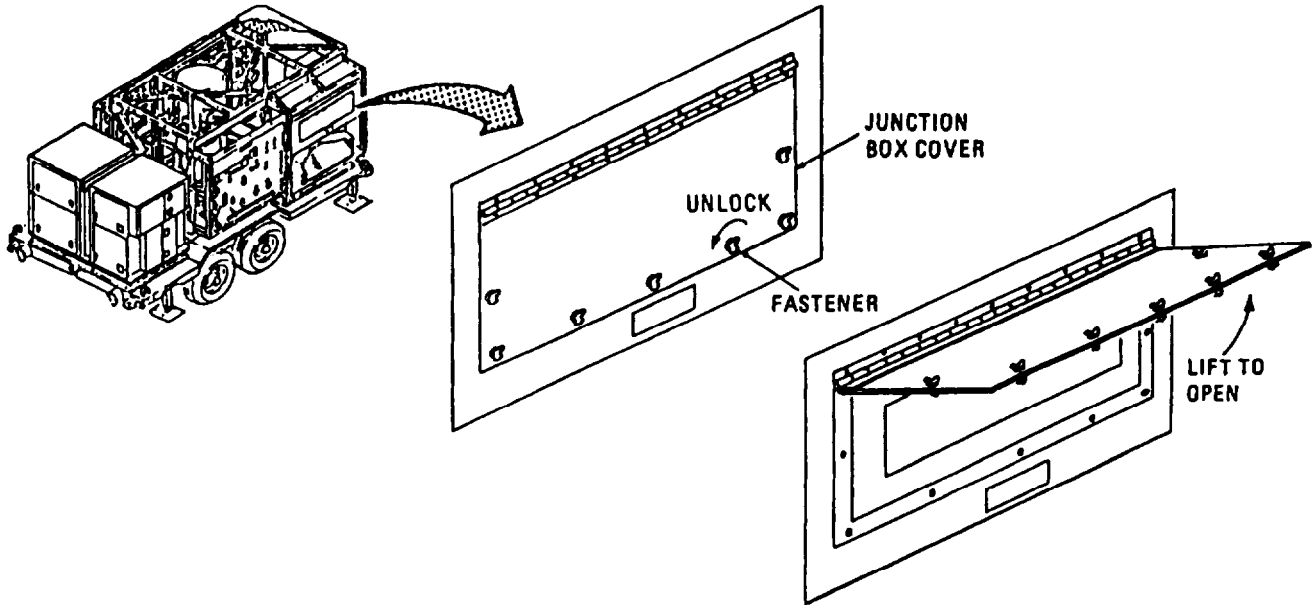


Figure 2-52. Junction Box Cover.

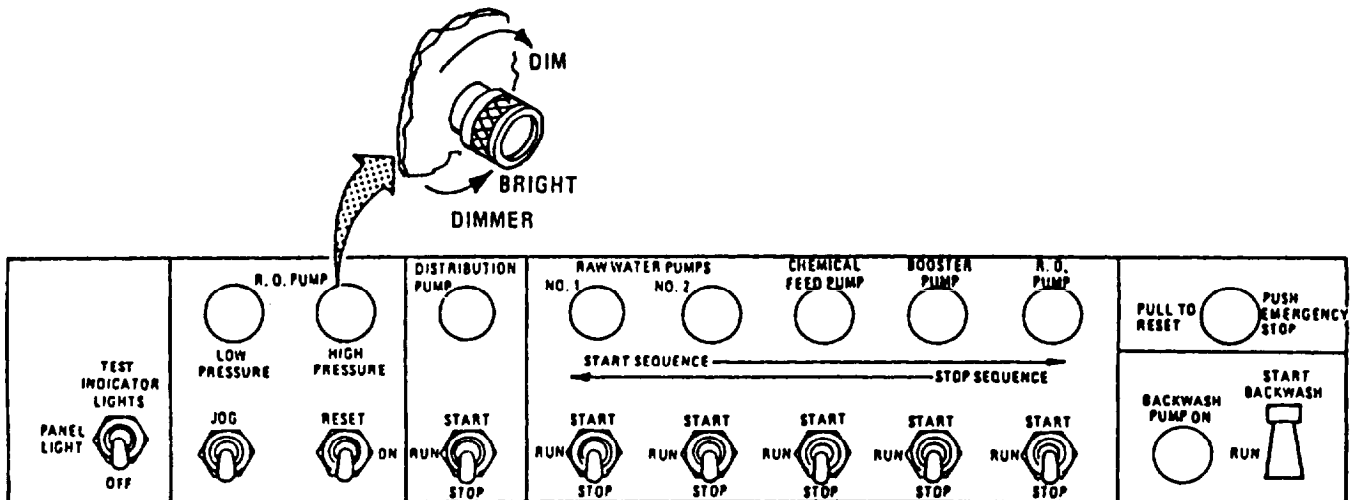


Figure 2-53. Control Box Emergency Stop Button, Switches and Lamps.

2-9. OPERATING PROCEDURES - cont.

c. Start Raw Water Pump No. 2.

- (1) Set RAW WATER PUMP No. 2 switch (6, figure 2-53) upward to START.
- (2) Hold RAW WATER PUMP No. 2 switch (6) until lamp No. 2 (4) comes on.
- (3) Release RAW WATER PUMP No. 2 switch (6). Switch will return to RUN position.
- (4) Check raw water discharge hose connected to RAW WATER coupling on control panel (figure 2-54). Hose should expand and straighten out.
- (5) Check RAW WATER FLOW gage on control panel. Gage should indicate 27 to 40 gpm. If raw water flow is not between 27 and 40 gpm, proceed as follows to establish prime:
 - (a) Set RAW WATER PUMP NO.1 switch (7, figure 2-53) and RAW WATER PUMP NO.2 switch (6) to STOP.

CAUTION

To prevent damage to raw water pump No. 2, shut off raw water pump No. 1 first.

- (b) Reprime raw water pump No. 1 (para. 2-8i)
- (c) Restart raw water pump No. 1 (para. 2-9b).
- (d) Set RAW WATER PUMP NO. 2 switch (6, figure 2-53) to START, then release.
- (e) Repeat steps (a), (b), and (c) until prime is established and RAW WATER FLOW gage indicates 27 to 40 gpm.

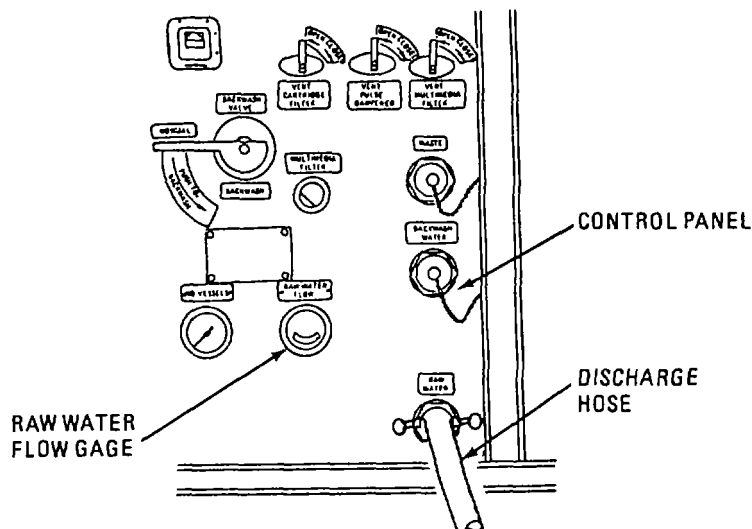


Figure 2-54. Control Panel and Raw Water Pump No. 2 Discharge Hose.

2-9. OPERATING PROCEDURES - cont.

d. Start Chemical feed Pump. Refer to figure 2-55.

- (1) Set CHEMICAL FEED PUMP switch on control box to START.
- (2) Hold switch at START position until CHEMICAL FEED PUMP lamp comes on.
- (3) Release switch. Switch will return to RUN.

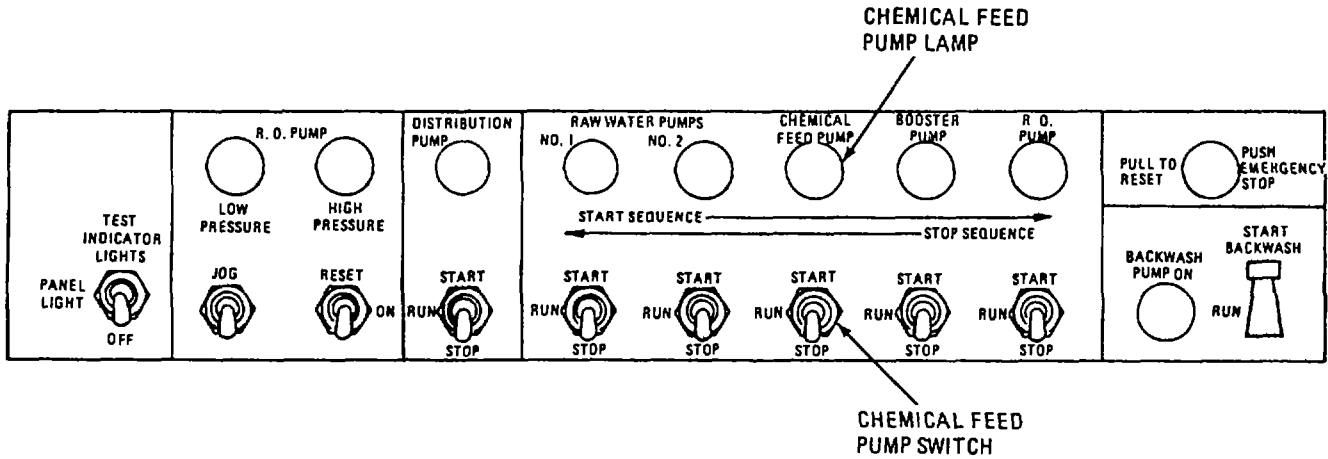


Figure 2-55. Chemical Feed Pump Start Switch.

2-9. OPERATING PROCEDURES – cont.

- e. Adjust Chemical Feed Pump. Refer to figure 2-56.

CAUTION

To prevent damage to chemical feed pump, only turn STROKE SETTING Knobs with pumps running (After 2001).

- (1) Turn all four chemical feed pump control knobs to 10 on pumps made before 2001 (do not turn past 10). On pumps made after 2001, turn the speed setting to 90% and the stroke to 100%

NOTE

If pump fails to prime, there may particles of dirt in the suction or discharge valves. Check Section II, Chapter 3, Troubleshooting.

- (2) With the chemical feed pump control knobs set as above and RUN/PRIME valves set to PRIME, allow chemical pump to operate until solution flow has been established in all chemical feed hoses.
- (3) When solution flow has been established, adjust POLYMER flow as follows:

CAUTION

It is extremely important that polymer optimization is performed to achieve the clearest RO feed water possible, otherwise fouling of the RO element may occur. If possible, use a turbidity meter from the WQAS-P instead of the turbidity tube when optimizing polymer dosage. When using fairly clear source water, an RO feed turbidity of 2 NTU or less should be your objective.

NOTE

Control knob settings identified in the following procedure are for reference only. Chemical flow must be measured and the control knob settings adjusted as required until correct flow is obtained. On units made after 2001, the flow is adjusted by varying both speed and stroke. Set up speed and stroke at 45. If the output is too low or great, adjust speed and/or stroke using best estimate of the required correction.

- (a) For noticeably turbid (dirty or murky) source water, set POLYMER control knob on chemical feed pump to 2. For slightly turbid or clear source water, set POLYMER control knob to 1.
- (b) Locate the 100-ml graduated plastic cylinder out of Storage chest No. 3.
- (c) With the chemical feed pump operating, disconnect return hose (male connector) from POLYMER chemical can coupling (female) and direct solution flow into 100 ml cylinder for 1 minute.
- (d) After one minute, remove the POLYMER hose from the cylinder and measure the amount of POLYMER in the cylinder.
- (e) If POLYMER control knob was set to 2 for turbid water, POLYMER flow should be about 60 ml/min. If POLYMER control knob was set to 1 for clear water, flow should be at least 20 ml/min.
- (f) If flow rate is too high, turn control knob clockwise to reduce flow. If flow rate is too low, turn control knob counterclockwise to increase flow.
- (g) Repeat steps (c) through (f) until flow rate is correct.
- (h) Reconnect POLYMER return hose to POLYMER chemical can.
- (i) Record setting of POLYMER control knobs for future reference.

2-9. OPERATING PROCEDURES - cont.

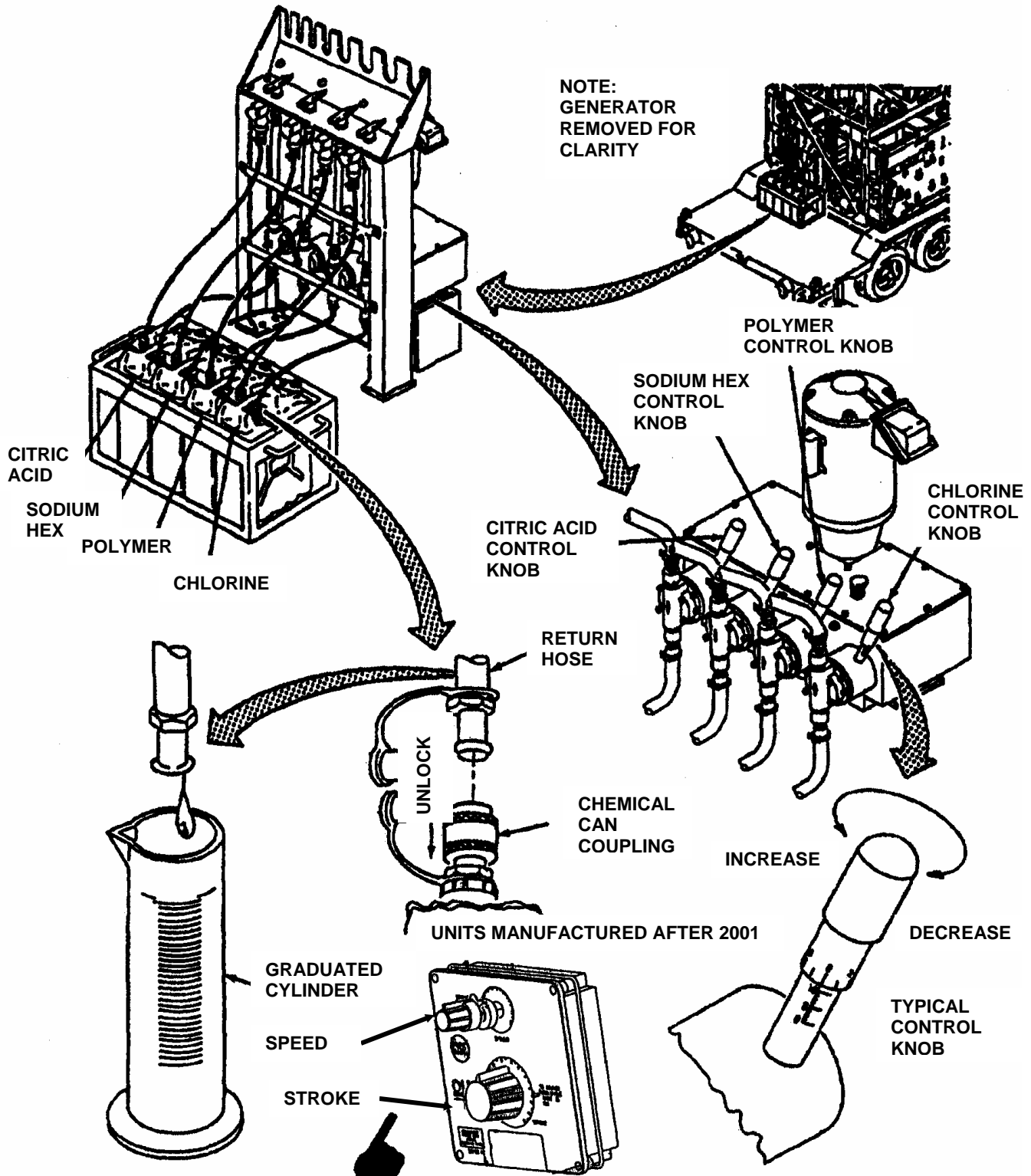


Figure 2-56. Chemical Feed Pump Adjustment.

2-9. OPERATING PROCEDURES - cont.

- (4) When solution flow has been established in SODIUM HEX and CHLORINE hoses, calibrate the flows as follows (refer to figure 2-56): (On pumps made after 2001 adjust both the stroke and speed to get desired flows)
- Set SODIUM HEX control knob on chemical feed pump to 3.
 - Locate the 100-ml graduated plastic cylinder out of storage chest No. 3.
 - Disconnect SODIUM HEX return hose (male connector) from SODIUM HEX chemical can (female coupling).
 - With the chemical feed pump operating, direct solution flow from SODIUM HEX return hose into 100 ml cylinder for 1 minute.
 - After one minute, remove the SODIUM HEX return hose from the cylinder.
 - Measure the amount of SODIUM HEX solution in the cylinder. SODIUM HEX flow rate should be 60 ml/min.
 - If flow rate is too high, turn SODIUM HEX control knob clockwise to reduce flow. If flow rate is too low, turn control knob counterclockwise to increase flow.
 - Repeat steps (d) through (h) until flow rate is correct.
 - Repeat steps (a) through (h) for CHLORINE flow.
 - Do NOT turn RUN/PRIME valves to RUN; leave them in PRIME position.
- (5) When using the chemical feed can marked Citric Acid to feed Sodium Bisulfite to neutralize the chlorine present in the feed water solution and flow has been established in hose, calibrate the flow as follows:
- Set speed control knob to 2.6.
 - Locate the 100-ml graduated plastic cylinder out of storage chest No.3.
 - Disconnect CITRIC ACID return (male connector) from CITRIC ACID chemical can (female coupling).
 - With the chemical feed pump operating, direct solution flow from CITRIC ACID return into 100 ml cylinder for 1 minute.
 - After one minute, remove the CITRIC ACID return hose from the cylinder.
 - Measure the amount of SODIUM BISULFITE solution in the cylinder. CITRIC ACID flow rate should match injection rate next to the chlorine residual initially measured.
 - Turn CITRIC ACID to RUN.

Chlorine PPM	Injection Rate (ml/min)
1	4
2	8
2.5	10
3	12
4	16
5	20

- (6) With both raw water pumps working, and the chemical feed pump running, set POLYMER chemical feed RUN/PRIME valve to RUN (figure 2-50).

2-9. OPERATING PROCEDURES - cont.

- f. Vent Multimedia Filter. Refer to figure 2-57. Vent multimedia filter and check for vent line blockage as follows:
- (1) Set VENT MULTIMEDIA FILTER valve, VENT PULSE DAMPENER valve (only on Models WPES-10, WPES-20, and WPES30), and VENT CARTRIDGE FILTER valves to CLOSE.

NOTE

There should be air venting from the vent pipe (figure 2-58) as the multimedia filter fills, followed by a steady stream of water when the filter is full. If not, the vent line is probably blocked by a small piece of filter media. Notify unit maintenance.

- (2) Set VENT MULTIMEDIA FILTER valve to OPEN.
- (3) Set VENT MULTIMEDIA FILTER valve to CLOSE as soon as a full stream of water flows out vent pipe below R.O. pump belt guard (Models WPES-10, WPES-20 and WPES-30) or below R.O. pump cover (Models H-9518-1, H-9518-2 and H-9518-3) (figure 2-58).

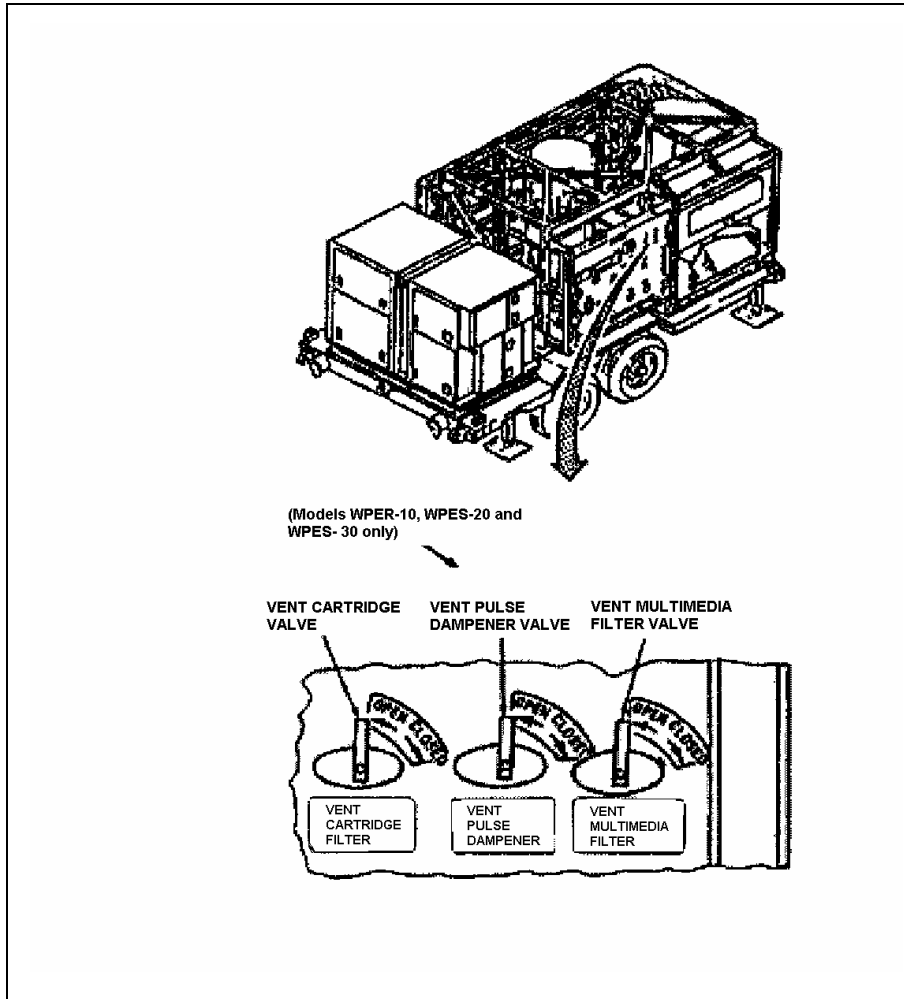


Figure 2-57. Vent Valves

2-9. OPERATING PROCEDURES - cont.

g . Start Booster Pump. Refer to figure 2-58.

- (1) Set VENT CARTRIDGE FILTER valve to OPEN.
- (2) Push BOOSTER PUMP switch upward to START and hold.
- (3) When BOOSTER PUMP lamp comes on, release switch. Switch will return to RUN.
- (4) Set VENT CARTRIDGE FILTER valve to CLOSE as soon as a full stream of water flows out of vent pipe (located at bottom, right of R.O. pump screen belt guard).

h . Start R.O. Pump. Refer to figure 2-58.

WARNING

(Models WPES-10, WPES-20, and WPES-30) To prevent injury to personnel, do not stand in front of the vent pipe when venting pulse dampener.

- (1) Make sure VENT VESSELS gate valve (5, figure 2-46) and REGULATE PRODUCT FLOW valves (4) are open.
- (2) Set VENT PULSE DAMPENER (Models WPES-10, WPES-20, and WPES-30) valve (figure 2-58) to OPEN.
- (3) Push R.O. PUMP RESET switch upward, R.O. PUMP LOW PRESSURE lamp goes OFF and switch returns to ON.
- (3a) (Models H-9518-1, H-9518-2, and H-9518-3) Make sure that water is coming out of the waste water line.

CAUTION

To prevent damage to the pump, on Models H-9518-1, H-9518-2 and H-9518-3, water must be flowing through the pump and into the drain line before it is turned on.

- (4) Hold R.O. PUMP switch upward to START.
- (5) As soon as R.O. PUMP lamp comes on, release switch. Switch will return to RUN.
- (6) Set the VENT PULSE DAMPENER valve (Models WPES-10 , WPES-20, and WPES-30) to CLOSE as soon as you see a full stream of water coming from the vent pipe.

WARNING

VENT VESSELS and WASTE hoses must be placed at least 25 yards down stream of raw water intake.

NOTE

Filtered water is bypassing the R.O. vessels.

- (7) Observe end of VENT VESSELS hose for water flow and clarity. Note that the water coming out of VENT VESSELS hose should be getting clearer. Within 10 minutes, water should be clear. As soon as water appears completely clear or after 10 minutes, proceed to next step.

2-9. OPERATING PROCEDURES - cont.

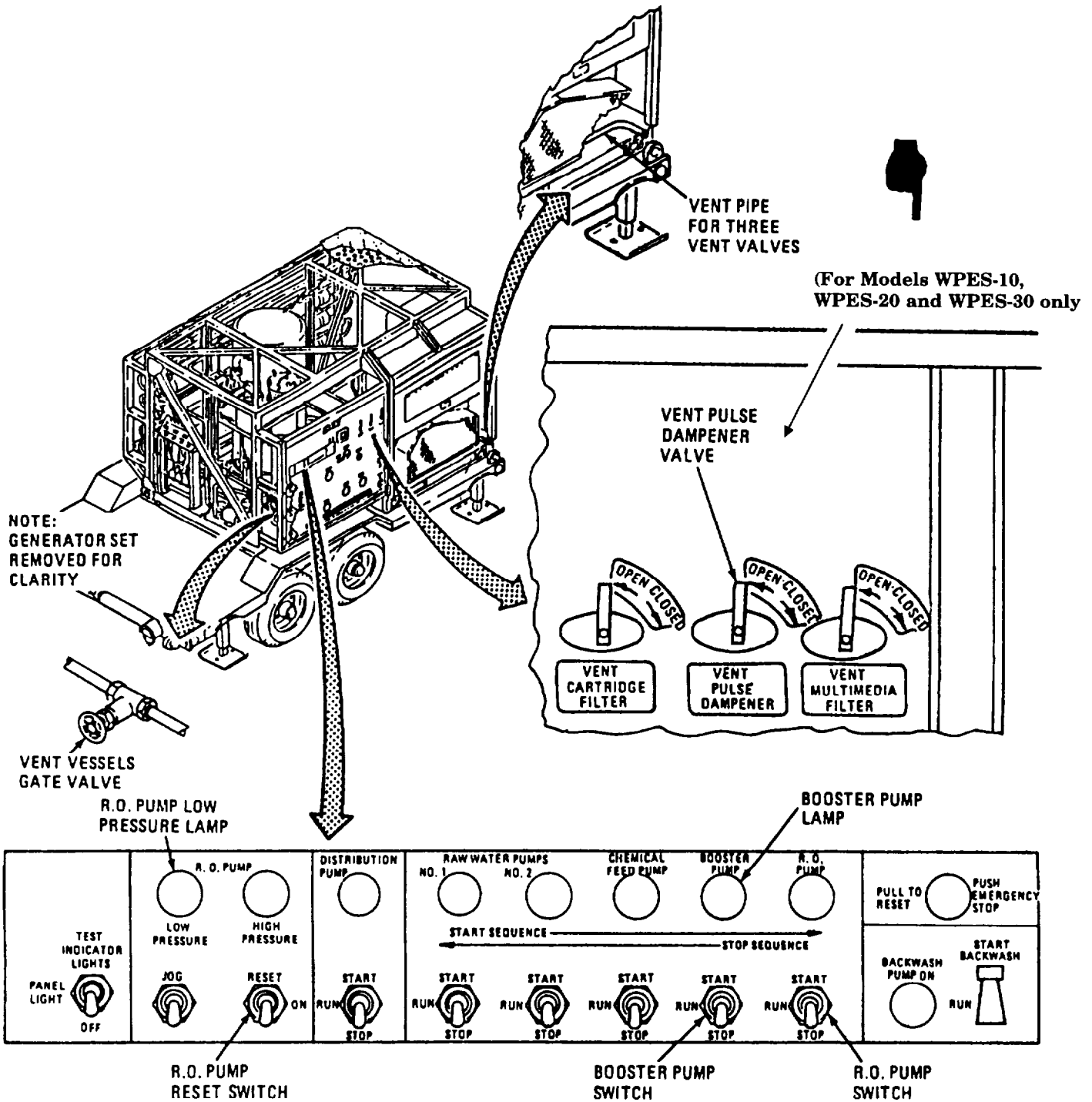


Figure 2-58.

2.9. OPERATING PROCEDURES – cont.

i. Examine Clarity of Filtered Water. Refer to figure 2-59.

- (1) Get plastic 1000 ml graduated cylinder (called turbidity tube) used for checking clarity of water. The turbidity tube is identified by a white bullseye set in a black background disc.
- (2) Go to the drain valves on the left side of the ROWPU (below R.O. tubes).
- (3) Slowly open DRAIN NO. 1 CARTRIDGE FILTER valve and allow water to flow for 20 to 30 seconds. Draw a sample of 600 milliliters of water into the turbidity tube. Close valve.
- (4) Look down into turbidity tube and you should be able to see clearly both the white bullseye and black disc at the bottom of the tube.
- (5) If both white bullseye and black disc cannot be seen clearly, run the ROWPU another 10 minutes, then repeat steps (3 and 4).
- (6) If after second sampling, white bullseye and black disc still cannot be seen clearly, proceed as follows:
 - (a) Increase chemical feed pump POLYMER control knob (figure 2-56) setting by two index marks (turn knob to the left). On pumps made after 2001, increase speed or stroke as necessary.

NOTE

The previous settings of 20 or 60 ml/min polymer flow was an initial setting to prevent overdosing of polymer. This rate may be adjusted during operation to improve water clarity.

- (b) Run ROWPU for 5 minutes, then take another water sample as described in steps (3) and (4).

NOTE

Unless source water is noticeably turbid, it should not be necessary to increase POLYMER setting beyond 5.

- (c) Repeat steps (a) and (b) until bullseye and black disc in turbidity tube can be seen clearly.

2-9. OPERATING PROCEDURES - cont.

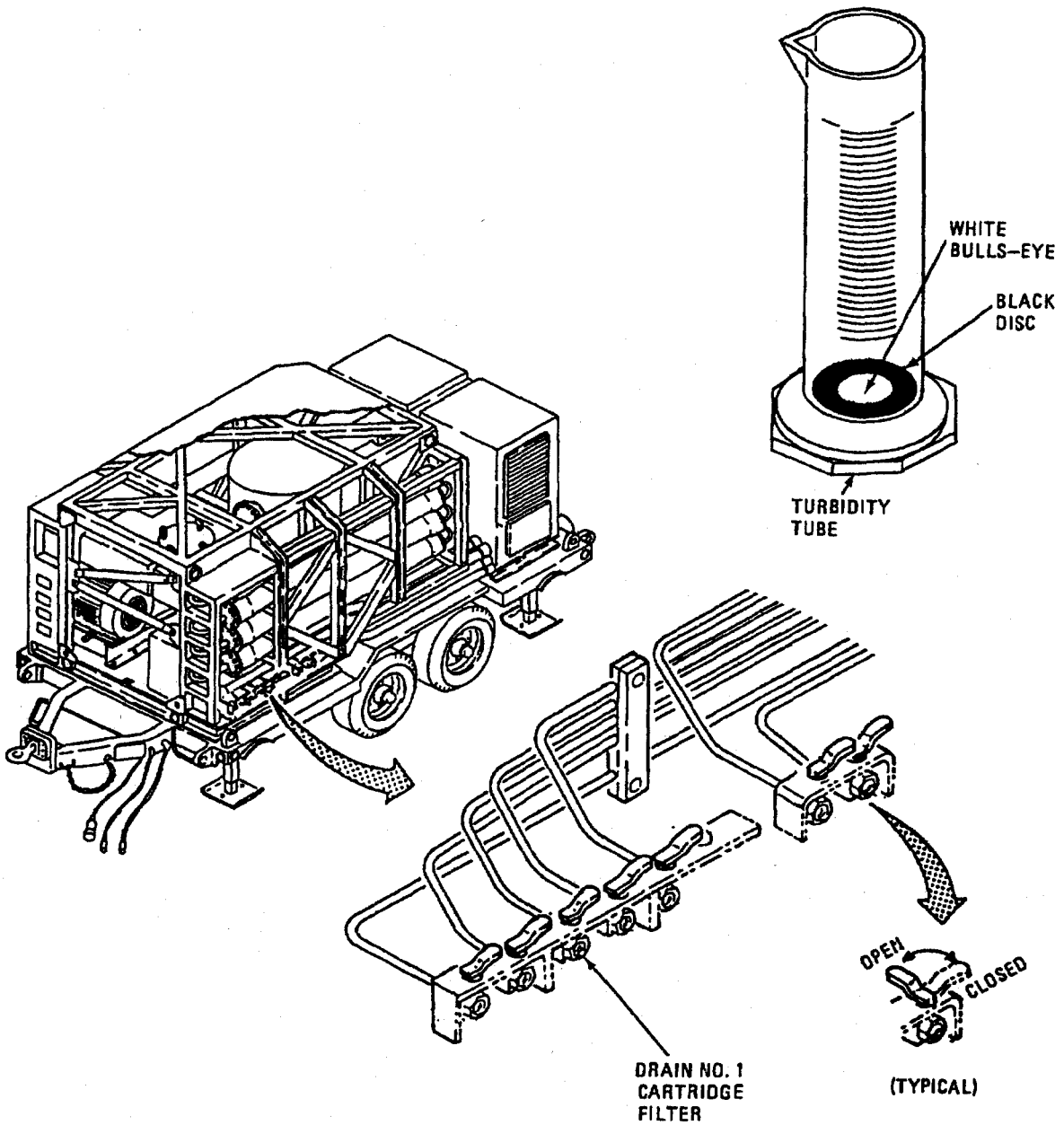


Figure 2-59. Drain Valves and Turbidity Tube.

2-9. OPERATING PROCEDURES - cont.

j. Final Adjustments.

- (1) Set SODIUM HEX RUN/PRIME valve to RUN position (figure 2-60).

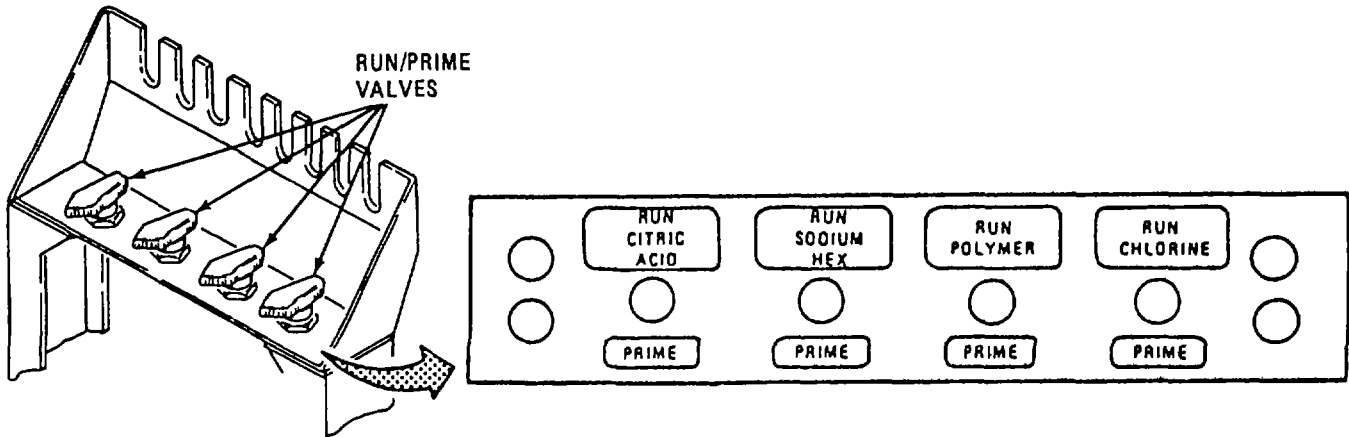


Figure 2-60. RUN/PRIME Valves.

- (2) Check that the VENT PRODUCT WATER valve (7, figure 2-46) is in the open position. The vent product water valve allows air to escape from the product water line
- (3) Check that the REGULATE PRODUCT flow valve (4, figure 2-61) is fully open.
- (4) Slowly close VENT VESSELS gate valve (5). This allows filtered water to enter R.O. vessels.

CAUTION

To prevent damage to the R.O. elements, closely observe R.O. PRESSURE PSI gauge when adjusting REGULATE PRODUCT FLOW valve. R.O. pressure will increase very rapidly toward end of adjustment range.

- (5) Slowly adjust REGULATE PRODUCT FLOW valve (4) to the right (clockwise). Watch for an increase in PRODUCT WATER FLOW gauge (3), a decreased flow in BRINE FLOW gauge (1), and increased pressure in the R.O. PRESSURE PSI gauge (2).

CAUTION

PRODUCT WATER FLOW should not exceed 12 gpm for seawater conditions or 16 gpm for fresh or brackish water. R.O. PRESSURE PSI gauge should not exceed 960 psi (seawater), 500 psi (fresh or brackish water). If gauge readings exceed these limits, refer to Section II, Chapter 3, Troubleshooting.

- (6) Close REGULATE PRODUCT FLOW valve (4) very slowly. Watch gauges until you obtain proper balance shown in table 2-3.

2-9. OPERATING PROCEDURES - cont.

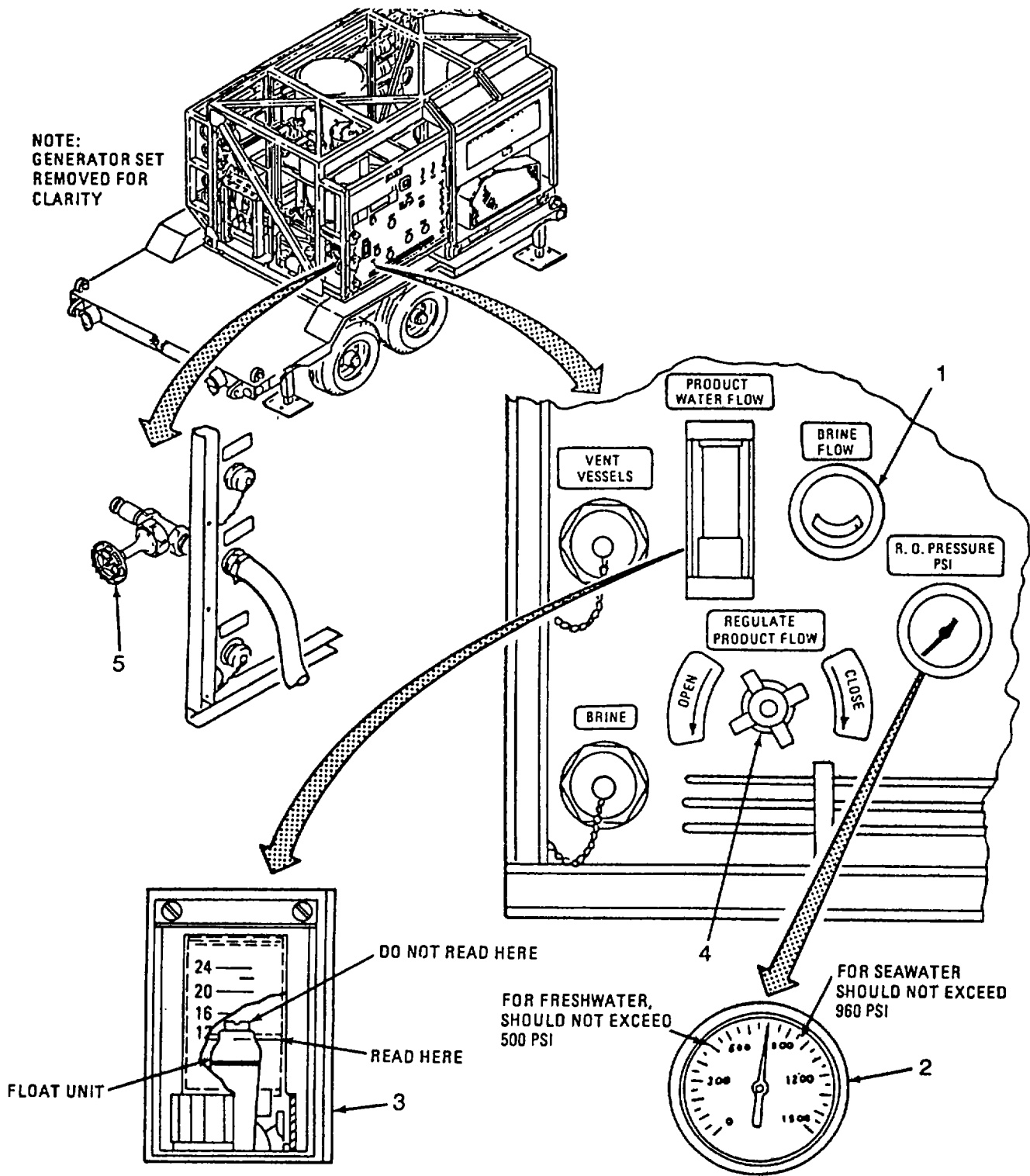


Figure 2-61. Final Adjustments

2-9. OPERATING PROCEDURES - cont.

- (7) Close VENT PRODUCT WATER valve (7, figure 2-46) when no air bubbles are visible in PRODUCT WATER FLOW meter (3, figure 2-58) and a steady stream of water (no bubbles) is coming out of the VENT PRODUCT WATER vent pipe.
- (8) Set CHLORINE RUN/PRIME valve to RUN position (figure 2-60).
- (9) The ROWPU is now in full operation. Check the TDS of the product water (para. 2-15c), and calculate the percent rejection. Check Table 2-3.2 to ensure proper TDS rejection is occurring, and record the findings in operator's log. If reading is above proper TDS percent rejection level or product water is above 1000 ppm, refer to Section II, Chapter 3, Troubleshooting. Keep watching your gauges and lamps. Complete the operator's record (log) hourly. Refer to Table 2-3 for normal and trouble point indications.
- (10) Check chlorine residual. It should be 2 ppm unless otherwise specified by medical personnel.
- (11) Check pH. It should be between 5 and 9 units.

Table 2-3. Normal and Trouble Point Gauge Indications.

Gauge/Indicator	Normal Reading	Trouble Point Reading
CARTRIDGE FILTER	0 to 20 psid	Over 20 psid
MULTIMEDIA FILTER	10 psid or less, not to exceed 5 psid of log reading at startup	Either over 10 psid or not within 5 psid of log reading at startup
RAW WATER FLOW	27 to 40 gpm	Drop to 25 gpm or less
BRINE FLOW	16 to 24 gpm	Below 15 gpm
PRODUCT WATER FLOW:		
SALT WATER	6 to 12 gpm	Below 6 and above 12 gpm
FRESH WATER	Up to 16 gpm	Above 16 gpm
BRACKISH WATER	Up to 16 gpm	Above 16 gpm
R.O. PRESSURE PSI:		
SALT WATER	Not to exceed 960 psig	Above 960 psig
FRESH WATER	Not to exceed 500 psig	Above 500 psig
BRACKISH	Not to exceed 500 psig	Above 500 psig
R.O. VESSELS	50 to 100 psid	Above 100 psid
TDS OF PRODUCT WATER	Below 1000 ppm and rejection above 96.5%	1000 ppm or above or below 96.5% rejection

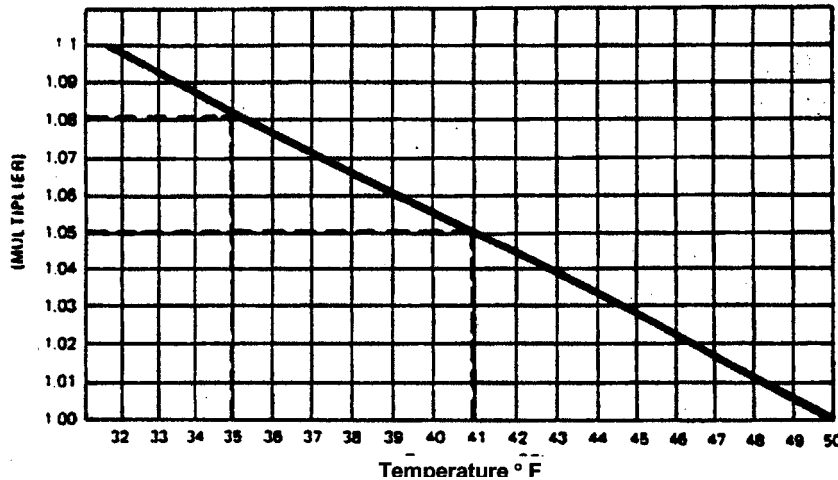
2-9. OPERATING PROCEDURES – cont.

NOTE

During first start-up with new RO elements, continue to direct the product water to waste for at least 30 minutes to flush out preservative.

- (12) The TDS meter is designed for use with water temperatures of 50°F (10°C) and above. If water being tested is below 50°F, then reading obtained must be adjusted. Use water temperature along base of graph (Table 2-3.1) to obtain the multiplier on the left side of the graph. Multiply reading by the multiplier obtained to correct the reading for temperature. (Example: 35°F = 1.08 multiplier, 41 °F = 1.05 multiplier.)

Table 2-3.1. TDS Temperature Graph



- (13) Use the portable TDS meter to measure the TDS from the concentrated sample valve (Item 20, Figure 2-6).
- (14) Table 2-3.2 presents the maximum product water TDS as a percentage of the water source TDS. Use the portable TDS meter to measure the water source TDS.
- (15) Calculate the maximum product water TDS as shown in the examples.

CAUTION

Before placing the product hose end into a tank, be sure mud and dirt have been washed off.

NOTE

If after 20 minutes the product water TDS has not dropped below the calculate maximum, refer to RO elements Troubleshooting, Table 3-2. The product water may only be directed to storage if released by the medical team.

- (16) Compare the actual measured product water TDS with the maximum TDS. If the measured sample is less, and the water is released by the medical team, proceed and direct the product water into the storage tanks by inserting the product water hose in the middle tank and strapping it down.

2-9. OPERATING PROCEDURES – cont.

Table 2-3.2. Maximum Product TDS as % of Water Source

FRESH WATER			BRACKISH WATER			SEA WATER		
Temperature	Up to 1000 ppm		Temperature	1000 to 10,000 ppm		Temperature	Over 10,000 ppm	
32-34 F	1.25	(0.0125)	32-35 F	1.5	(0.015)	32-35 F	2.0	(0.010)
35-37 F	1.3	(0.013)	36-39 F	1.55	(0.0155)	36-39 F	2.1	(0.011)
38-40 F	1.35	(0.0135)	40-43 F	1.6	(0.016)	40-43 F	2.2	(0.012)
41-43 F	1.4	(0.014)	44-47 F	1.65	(0.0165)	44-47 F	2.3	(0.013)
44-46 F	1.45	(0.0145)	48-51 F	1.7	(0.017)	48-51 F	2.4	(0.014)
47-49 F	1.5	(0.015)	52-55 F	1.75	(0.0175)	52-55 F	2.5	(0.025)
50-52 F	1.55	(0.0155)						
53-55 F	1.6	(0.016)						
56-61 F	1.7	(0.017)	56-63 F	1.8	(0.018)	56-59 F	2.6	(0.026)
62-66 F	1.8	(0.018)	64-70 F	1.9	(0.019)	60-64 F	2.7	(0.017)
67-72 F	1.9	(0.019)	71-77 F	2.0	(0.020)	65-68 F	2.8	(0.028)
73-77 F	2.0	(0.020)				69-73 F	2.9	(0.029)
						74-77 F	3.0	(0.030)
78-81 F	2.1	(0.021)	78-81 F	2.1	(0.021)			
82-84 F	2.2	(0.022)	82-84 F	2.2	(0.022)	78-81 F	3.1	(0.031)
85-88 F	2.3	(0.023)	85-88 F	2.3	(0.023)	82-84 F	3.2	(0.032)
89-91 F	2.4	(0.024)	89-91 F	2.4	(0.024)	85-88 F	3.3	(0.033)
92-95 F	2.5	(0.025)	92-95 F	2.5	(0.025)	89-91 F	3.4	(0.034)
						92-95 F	3.5	(0.035)

Examples:

Fresh water 75 ppm at 38°F
 Adjust for temperature - $1.07 \times 75 \text{ ppm} = 80.25$ or 80 ppm
 Maximum TDS - 1.35% or 0.0135
 $0.0135 \times 80 = 1.08 \text{ ppm}$ or 1 ppm
 1 ppm is maximum product water TDS, for this condition.

Brackish water 3500 ppm at 63°F
 Maximum TDS - 1.8% or 0.018
 $0.018 \times 3500 = 63 \text{ ppm}$
 63 ppm is maximum product water TDS for this condition.

Sea water 47,000 ppm at 95°F
 Maximum TDS - 3.5% or 0.035
 $0.035 \times 47,000 = 1645 \text{ ppm}$
 1645 ppm is not consumable under Army Regulations.
 Repurify as brackish water
 Brackish water 1645 ppm at 95°F
 Maximum TDS - 2.5% or 0.025
 $0.025 \times 1645 = 41.12$ or 41 ppm
 41 ppm is maximum water TDS for this condition.

2-9. OPERATING PROCEDURES – cont.

k. Fill Backwash (Brine) Tank. Refer to figure 2-62. During operation of the ROWPU, brine water is produced by the R.O. process. The brine water leaves the ROWPU through the BRINE coupling on the control panel. The brine water is stored in the backwash tank for use during the backwash cycle and for cleaning R.O. elements.

- (1) Allow backwash water tank to fill during operation of the ROWPU. Tank should be filled to within 3 inches of top of tank.

WARNING

VENT VESSELS and WASTE hoses must be placed at least 25 yards down stream of raw water intake.

- (2) When backwash water tank is full, remove the brine hose draped over the top of the tank. Allow excess brine to drain from the hose onto the ground.
- (3) Allow brine hose to drain until water in backwash tank is used for the backwash cycle, then put the hose back into backwash tank until full.
- (4) Continue to periodically check water level in brine tank during operation.
- (5) Make sure backwash tank cover is installed (TM 10-5430-237-12&P/TO 35E31-3-4-1).

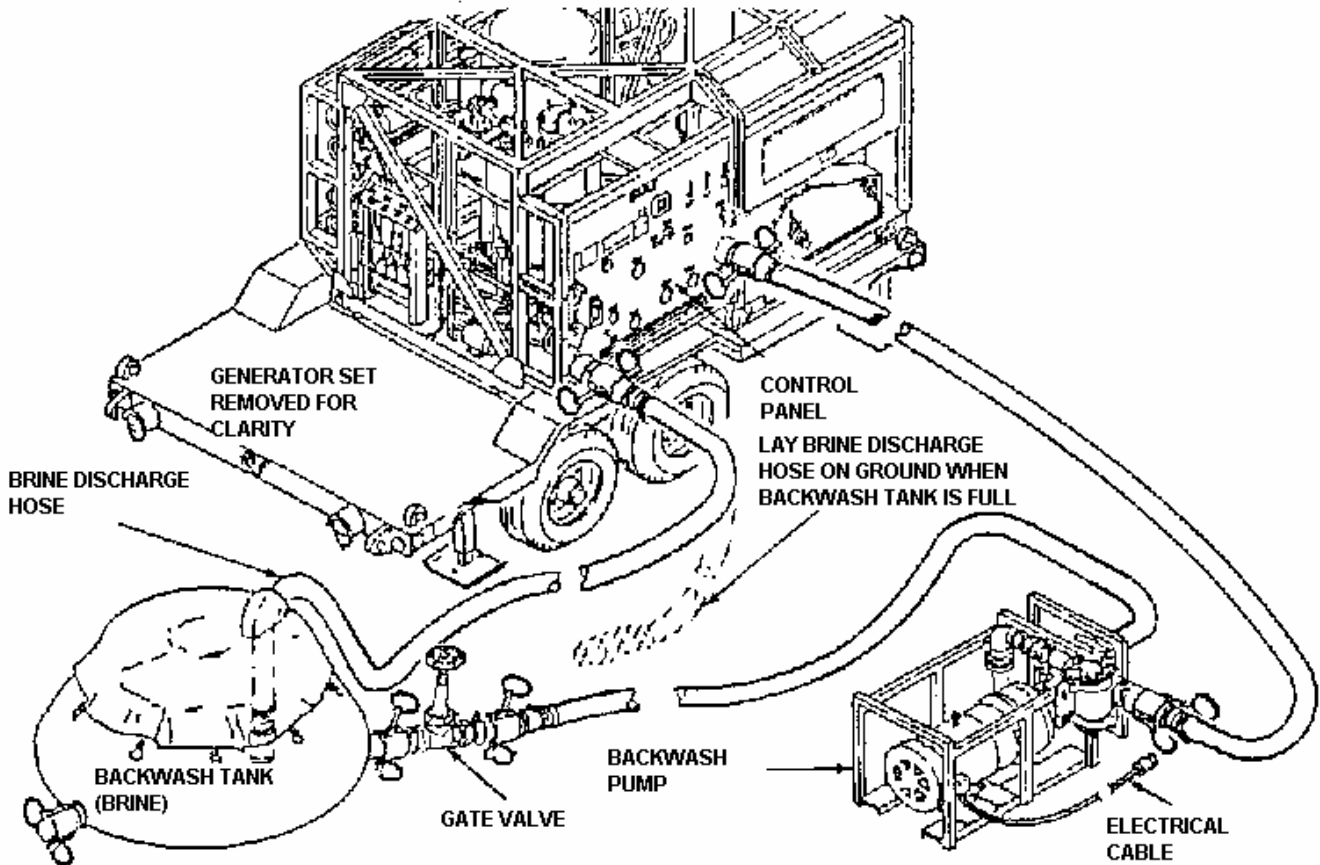


Figure 2-62. Fill Backwash Tank.

2-9. OPERATING PROCEDURES - cont.

- I. Fill Product Water Tanks. Refer to figure 2-63. Product water produced by the ROWPU is stored in two product water tanks. Product water tank No. 2 must be at the same level or lower (down hill) than tank No. 1 for proper water flow.

WARNING

To prevent injury to personnel, do not fill product water tanks until TDS is less than 1000 and chlorine residual is 2 ppm or as directed by medical personnel.

- (1) Open gate valve between product water tanks No. 1 and No. 2.
- (2) Allow product water to flow through tank No. 1 into tank No. 2.
- (3) If product water tanks are at the same level, both tanks will fill at about the same rate.
- (4) If water tank No. 2 is lower than tank No. 1, allow tank No. 2 to fill first. Then, close gate valve and allow tank No. 1 to fill.
- (5) When both product water tanks are full, shutdown the ROWPU (para. 2-14) until more water is needed.
- (6) Make sure product water tank covers are installed (TM 10-5430-237-12&P/TO 35E31-3-4-1).

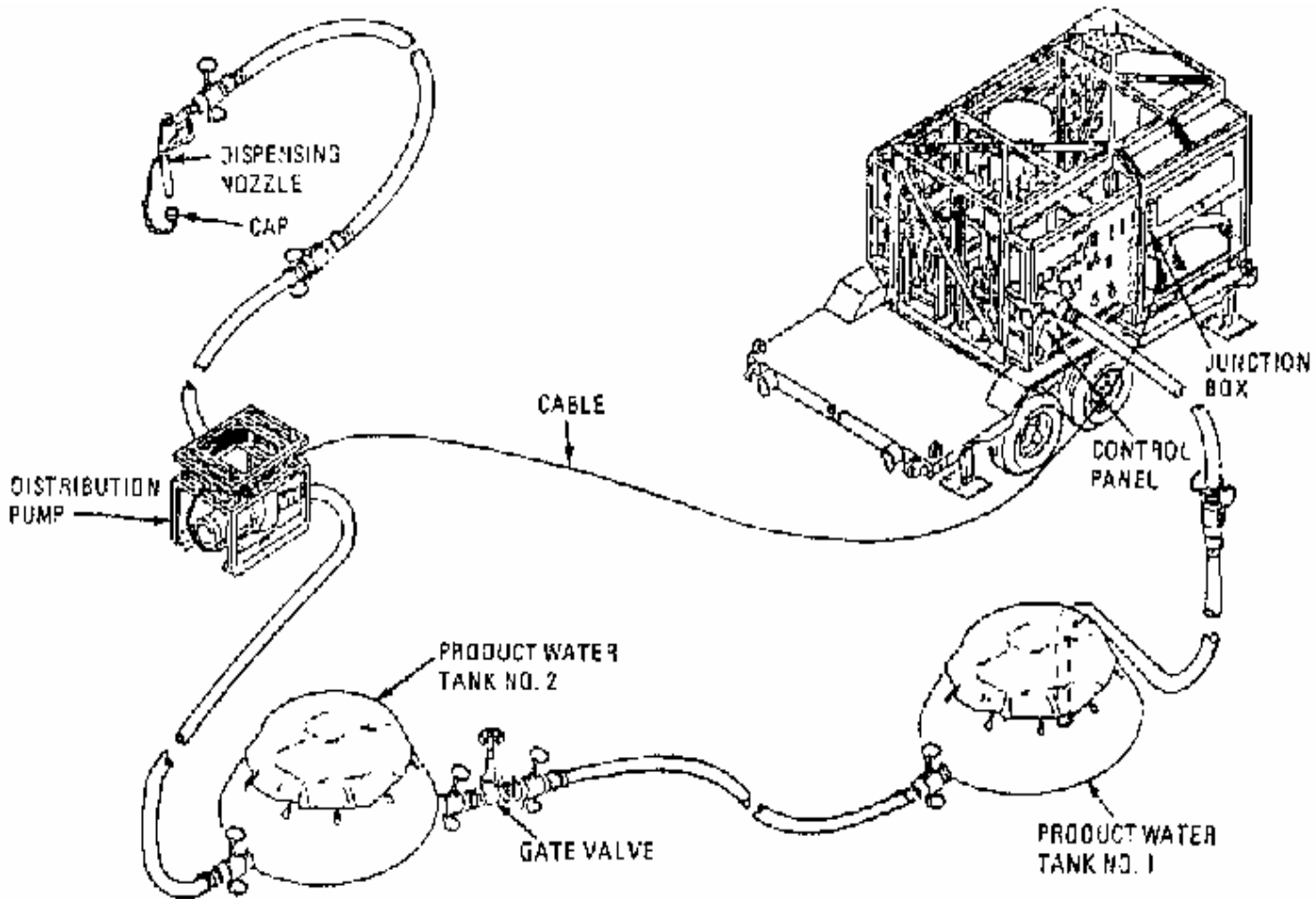


Figure 2-63. Filling Product Water Tanks

2-9. OPERATING PROCEDURES - cont.

m. Maintaining Polymer Dosage.

NOTE

Test will be performed hourly or more often as environmental conditions change.

- (1) Go to the drain valves on the left side of the ROWPU (below R.O. tubes) (figure 2-59).
- (2) Slowly open DRAIN NO. 1 CARTRIDGE FILTER valve and allow water to flow for 20 to 30 seconds. Draw a sample of 600 milliliters of water into the turbidity tube. Close valve.
- (3) Look down into turbidity tube and you should be able to see clearly both the white bulls eye and black disc at the bottom of the tube.
- (4) If both white bulls eye and black disc cannot be seen clearly, run the ROWPU another 10 minutes, then repeat steps (2 and 3).
- (5) If after second sampling white bulls eye and black disc still cannot be seen clearly, proceed as follows:
 - (a) Increase chemical feed pump POLYMER control knob (figure 2-56) setting by two index marks (turn knob to the left).

NOTE

The previous setting of 20 or 60 ml/min polymer flows was an initial setting to prevent overdosing of polymer. This rate may be adjusted during operation to improve water clarity.

- (b) Run ROWPU for 5 minutes, then take another water sample as described in steps (2) and (3).

NOTE

Unless source water is noticeably turbid, it should not be necessary to increase POLYMER setting beyond 5.

- (c) Repeat steps (a) and (b) until bulls eye and black disc in turbidity tube can be seen clearly.

2-9. OPERATING PROCEDURES - cont.

n. Maintaining Chlorine Dosage.

NOTE

Test will be performed hourly or more often as environmental conditions change.

- (1) Draw water sample from product water line.
- (2) Perform chlorine residual test in accordance with instructions supplied with color comparator kit.
- (3) If chlorine residual is less than 2 ppm (or less than amount directed by medical personnel), increase CHLORINE control knob (figure 2-56) setting by two index marks.
- (4) Wait five minutes then repeat steps (1) and (2).
- (5) If chlorine residual is still too low, repeat steps (3) and (4).
- (6) Repeat steps (1 thru 4) until correct chlorine residual is obtained.

o. Water Distribution.

WARNING

Potable water must be checked by medical personnel before issuing water.

- (1) Set DISTRIBUTION PUMP switch (figure 2-64) on control box to START. DISTRIBUTION PUMP lamp will come on.
- (2) Remove cap from dispensing nozzle (figure 2-63). Squeeze handle on dispensing nozzle to start water flow.
- (3) As required, open gate valve between product water tanks No. 1 and No. 2 to ensure water flow to distribution pump.
- (4) Operate distribution pump until user has enough water, then set DISTRIBUTION PUMP switch (figure 2-64) to STOP.
- (5) Release handle on dispensing nozzle (figure 2-63). Install cap on end of dispensing nozzle.

p. Monitor R.O. Pump Pressure. Refer to figure 2-64.

NOTE

The R.O. VESSELS gage on the control panel is a good indicator of the condition of the R.O. elements. Gage should indicate 50 to 100 psid while R.O. elements are in good condition.

- (1) Check R.O. PUMP LOW PRESSURE lamp on the control box. It must be off during normal operation. If the lamp comes on, the R.O. pump will shut down at once. Check Table 3-2 for troubleshooting procedures.

2-9. OPERATING PROCEDURES - cont.

- (2) Check R.O. PUMP HIGH PRESSURE lamp in upper left of control box assembly. It must be off during operation. If that lamp ever comes on, the R.O. pump will shut down at once. (Other pumps will continue to run). Check Table 3-2 for troubleshooting procedures.

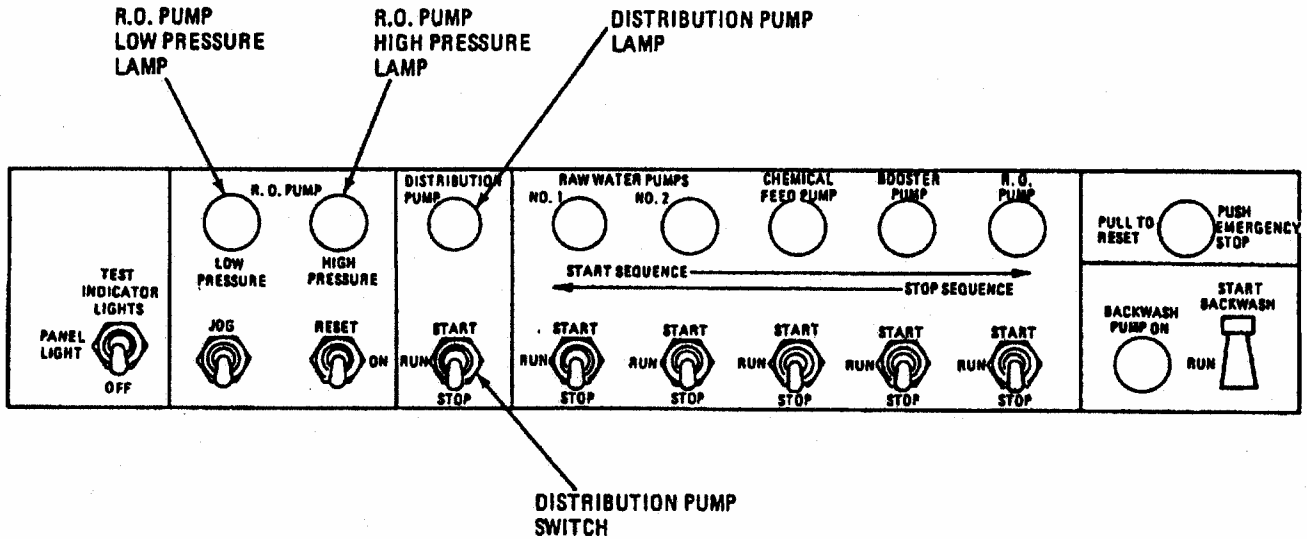


Figure 2-64. Start Distribution Pump.

2-10. BACKWASH OF MULTIMEDIA FILTER.

- a. General. Refer to figure 1-5. During the backwash process, water flow through the multimedia filter is reversed so that water flows from the bottom to the top of the multimedia filter tank.

The direction and rate of water flow through the multimedia filter during backwash is maintained by the control and backwash diaphragm valves mounted on the multimedia filter frame.

CAUTION

On, Models WPES-10, WPES-20, and WPES30, to prevent damage to the equipment, the OVER-CURRENT PROTECTION PUSH TO RESET switch on the timer must not be depressed during operation. RESET switch should only be depressed when required by troubleshooting or maintenance procedures.

- b. Solid State Backwash Timer.

(1) *Models WPES-10, WPES-20, and WPES-30 (Refer to figure 2-65):*

The solid state timer controls the duration and sequence of the backwash cycle. Inside the timer box is an OVER-CURRENT PROTECTION PUSH TO RESET switch and six LED (light emitting diode) indicator lights. The solid state timer operates automatically and does not contain any operator controls. The six indicator lights illuminate in response to the following backwash functions:

- REGEN - Flashing light indicates backwash timer is in operation.
- 0 - IN SERVICE (Backwash cycle not in operation)
- 1 - SLOW BACKWASH
- 2 - FAST BACKWASH
- 3 - SLOW BACKWASH
- 4 - RINSE

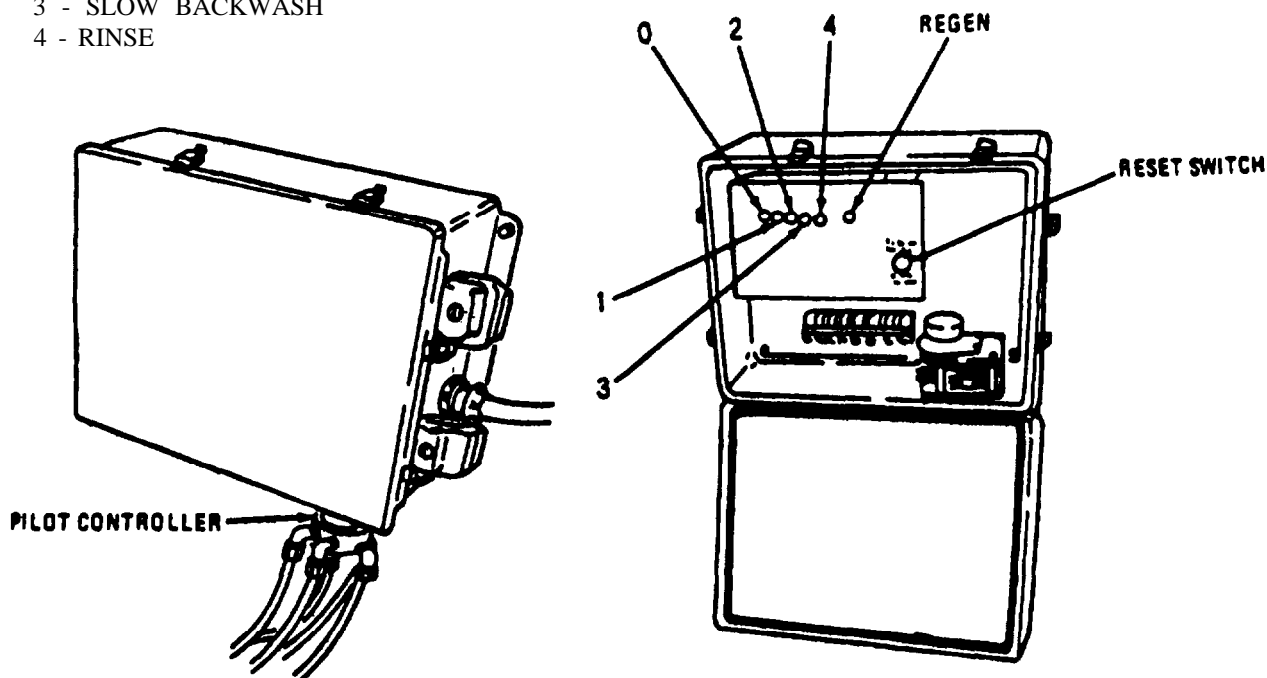


Figure 2-65. Solid State Timer.
(Models WPES-10, WPES-20, and WPES-30 only)

2-10. BACKWASH OF MULTIMEDIA FILTER - cont.

(2) Models H-9518-1, H-9518-2 and H-9518-3 (refer to figure 2-65a):

The solid state timer controls the duration and sequence of the backwash cycle. There are three LED indicator lights on the outside of the timer box and on the inside of the box, there is a CIRCUIT BREAKER. The solid state timer operates automatically and does not contain any operator controls. The three indicator lights illuminate in response to the following backwash functions below.

1- (Green) In Service (Backwash cycle not in operation)

2- (Red) Backwash

3- (Red) Rinse

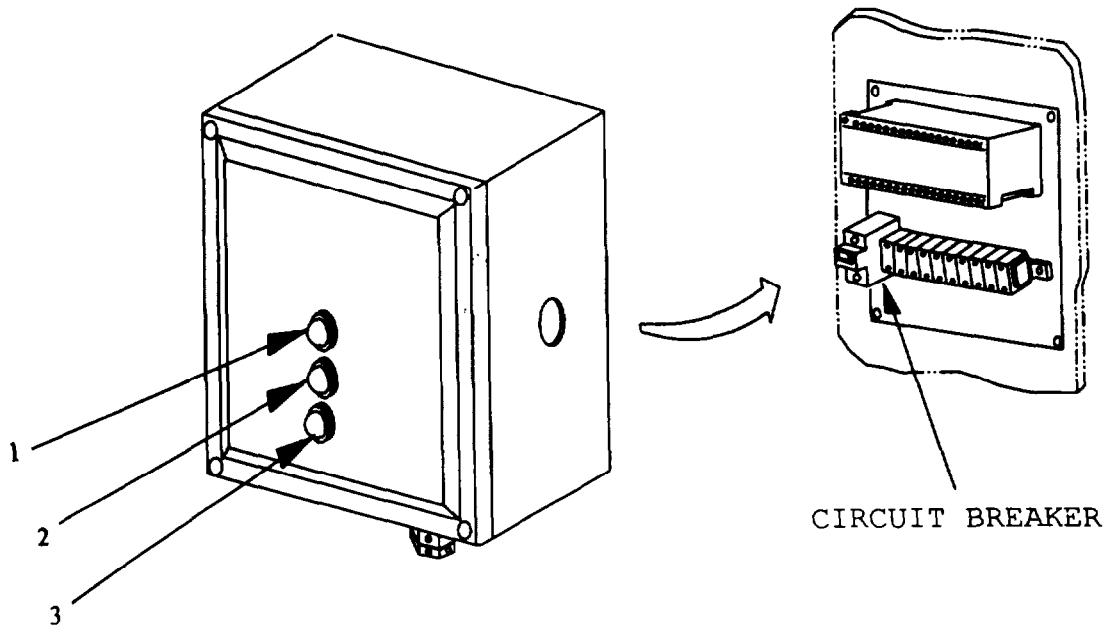


Figure 2-65a. Solid State Timer.
(Models H-9518-1, H-9518-2, and H-9518-3 only)

2-10. BACKWASH OF MULTIMEDIA FILTER - cont.

c. Normal Backwash.

NOTE

The multimedia filter should be backwashed:

- After 20 hours of ROWPU operation, or
 - Multimedia filter gage reading is over 10 psid, or
 - Multimedia filter gage reading exceeds 5 psid above log reading at startup, or
 - ROWPU is to be shut down for more than 24 hours.
- (1) Perform normal shutdown of ROWPU (para. 2-14).
 - (2) Make sure R.O. ELEMENT CLEANING switch (4, figure 2-66) on side of control panel is down (off).
 - (3) Check brine water level in backwash tank (figure 2-62). Tank should be full.
 - (4) Ensure strainer on backwash pump is not clogged (para. 3-6).
 - (5) Open gate valve between backwash tank and backwash pump (figure 2-62).
 - (6) To aid priming, loosen vent plug on top of backwash pump (figure 2-28). Tighten plug when a steady stream of water flows from vent plug.
 - (7) Turn BACKWASH VALVE (1, figure 2-66) handle downward to BACKWASH.

CAUTION

Do not hold START BACKWASH switch up for more than 5 seconds to avoid damage to the controls.

NOTE

Solid-state timer will come on immediately. BACKWASH PUMP ON lamp will come on, pump will start and backwash water will flow through the multimedia filter and out the WASTE water hose. The MULTIMEDIA FILTER gage needle will move to full right. During backwash, the BACKWASH WATER FLOW rate varies automatically from 0 to 70 to 120 gpm while washing and rinsing. Backwash operation is automatic and lasts about 13 minutes.

- (8) Push BACKWASH switch (2) up to START position and release immediately.
- (9) When backwash is complete, BACKWASH PUMP ON (3) lamp will go off and MULTIMEDIA FILTER gauge (6) and BACKWASH WATER FLOW gauge (5) will return to "0". When backwash pump shuts off, turn BACKWASH VALVE (1) handle upward to NORMAL position.
- (10) Close gate valve between backwash tank and backwash pump (figure 2-62).

2-10. BACKWASH OF MULTIMEDIA FILTER - cont.

CAUTION

Since the multimedia filter uses brine water to backwash, the filter should not be drained or left inoperative following backwash without first flushing with raw water for 5 minutes. Flush by operating filter normally.

(11) Perform normal ROWPU startup after backwash (para. 2-9).

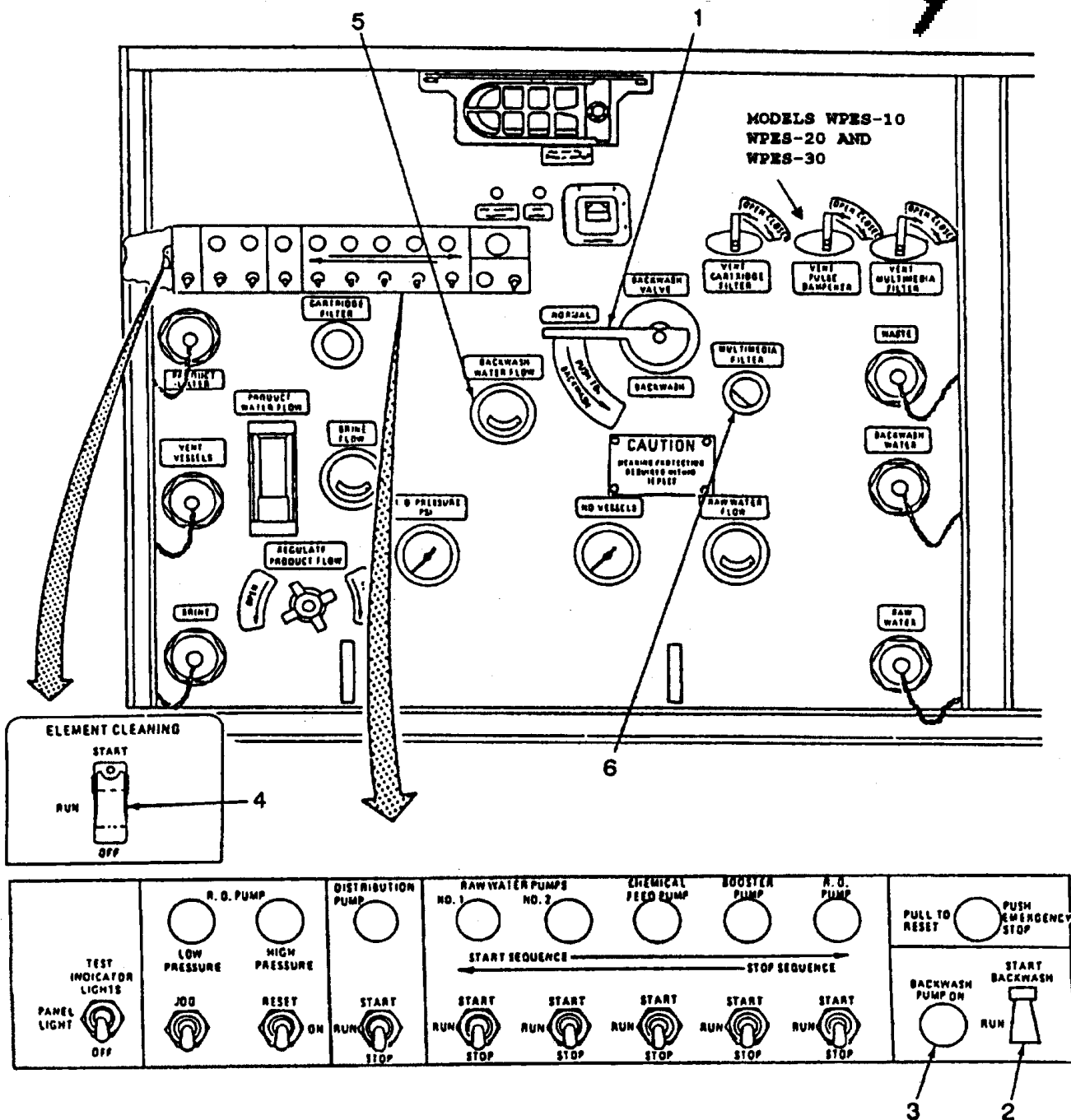


Figure 2-66. Backwash of Multimedia Filter.

2-11. CITRIC ACID FEED

NOTE

Skip the following section when operating on a chlorinated source water and using the citric acid chemical feed can for addition of sodium bisulfite to the feed water.

After 20 hours of continuous operation or when pH of brine water rises above 8, feed citric acid solution into filtered water to remove minor amounts of scale which accumulate during normal operation. Product water will be produced during citric acid feed.

WARNING

Chemicals used for operating ROWPU can kill you. The chemicals alone or in mixture can be dangerous. ALWAYS wear protective apron, goggles and gloves and make sure area is well ventilated.

- a. Using citric acid measure, put 0.75 (3/4) pound of citric acid in pail previously marked CITRIC ACID.
- b. Fill CITRIC ACID pail with 3 gallons of brine water.
- c. Stir chemical and brine water with wooden paddle from storage box.
- d. Remove lid from chemical feed can (figure 2-41) marked CITRIC ACID.
- e. Carefully pour solution into chemical feed can. Use care to avoid making bubbles in the solution as you pour.
- f. Install lid on chemical feed can. Make sure vent cap is open.
- g. Set CITRIC ACID chemical feed pump control knob (figure 2-56) to 10.
- h. While the ROWPU is operating normally, set the CITRIC ACID RUN/PRIME valve to RUN (figure 2-60).
- i. Allow unit to operate for 10 minutes.
- j. Draw a 250-ml water sample from brine hose at backwash tank and check for a pH reading of 5 to 8 (para. 2-15).
- k. If pH reading is over 8, repeat steps a through j as required using 1.5 (1-1/2) pounds citric acid mixed with 3 gallons of brine water.
- l. Set CITRIC ACID RUN/PRIME valve to PRIME. CITRIC ACID feed is complete when pH is between 5 and 8.

2-12. R.O. ELEMENT CLEANING METHODS

It will be necessary to clean the R.O. elements to improve total dissolved solids (TDS) rejection, and reduce operating pressure (P.S.I.). Two methods of cleaning elements are available. One method, used to remove mineral deposits such as CaCO₃, CaSO₄, BaSO₄, SrSO₄, Fe, and metal oxides is to circulate a low pH cleaning solution through the vessels (para. 2-13a). The second method is to circulate the high pH cleaning solution through the vessels (para. 2-13b). High pH chemicals are more effective for removing silt, colloids, biofilm, and organics. The R.O. elements **MUST** be cleaned:

- a. When the pressure in the R.O. vessels shown on R.O. PRESSURE P.S.I. indicator rises to either 960 for seawater or 500 for fresh water.
- b. Product water output drops several gallons per minute on PRODUCT WATER FLOW indicator, with no changes in temperature.

2-12. R.O. ELEMENT CLEANING METHODS-cont.

- c. BRINE FLOW increases noticeably, and the adjustment of REGULATE PRODUCT FLOW valve does not correct the PRODUCT WATER FLOW indication.
- d. When R.O. vessels pressure increase by 20% over initial reading.

2-13. R.O. ELEMENT CLEANING PROCEDURE.

- a. Low pH clean
 - (1) Perform multimedia filter backwash (para. 2-10).

WARNING

Be sure that the drained vent vessel water runs toward lower ground at least 25 yards downstream of raw water intake.

NOTE

To correctly mix low pH chemical, water level in backwash tank must be lowered to a depth of seven inches, approximately 550 gallons.

- (2) Disconnect backwash water inlet hose from control panel and place down stream at least 25 yards from raw water inlet (figure 2-67).
- (3) Open brine tank gate valve.

WARNING

To prevent injury to personnel and damage to equipment, hold end of backwash water hose during pumping operations.

- (4) Push ELEMENT CLEANING switch (24, figure 2-5) up to START.
- (5) Using telescopic aluminum paddle, measure water level in backwash tank (figure 2-68). When water level is seven inches in backwash tank, set ELEMENT CLEANING switch (24, figure 2-5) to OFF.
- (6) Close brine tank gate valve (figure 2-67).

2-13. R.O. ELEMENT CLEANING PROCEDURE – cont.

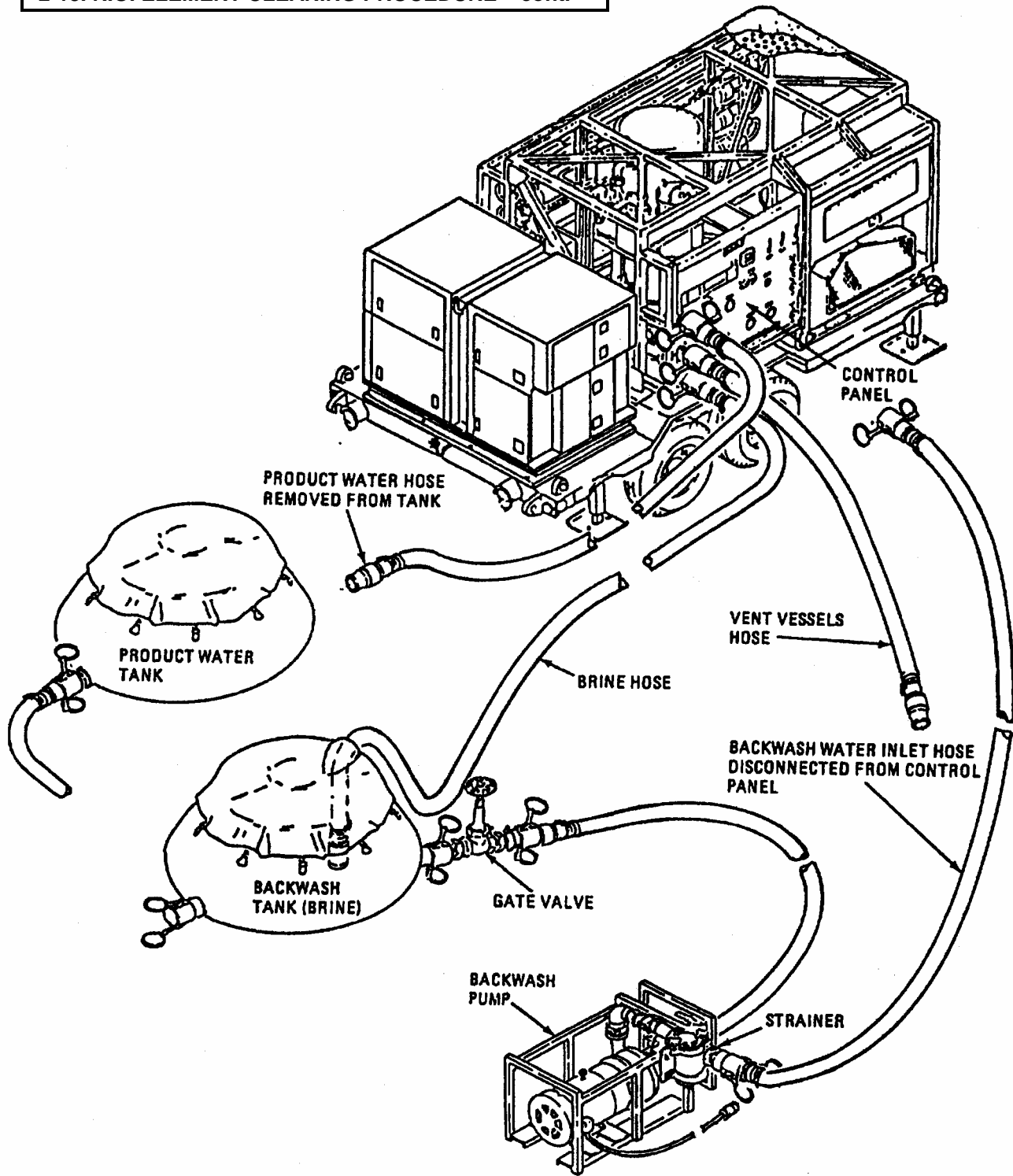


Figure 2-67. Lowering Water Level in Backwash Tank

2-13. R. O. ELEMENT CLEANING PROCEDURE - cont.

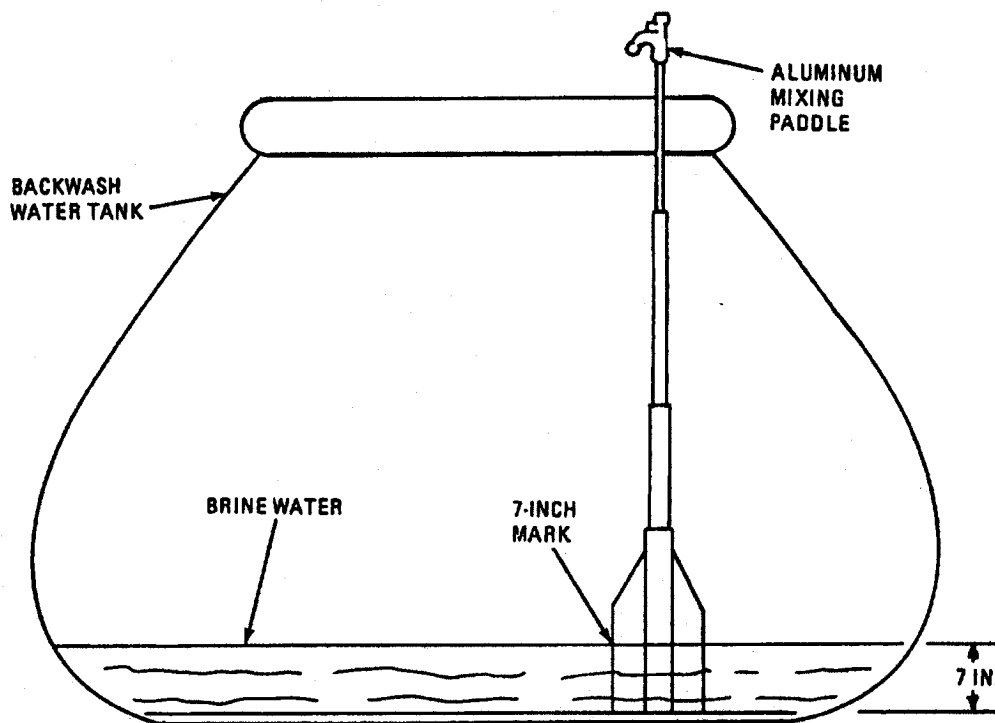


Figure 2-68. Backwash Water Tank Level.

- (7) Connect backwash water inlet hose (figure 2-69) to BACKWASH coupling on control panel.
- (8) Mix the amount specified on the low pH membrane cleaner label according to the amount of water remaining in the backwash water tank when drained to the 7" mark. Stir with aluminum paddle until all granules are dissolved (figure 2-68). **Example: If cleaner states** one pound per ten gallons and the tank holds 550 gallons when water is drained to the 7" mark. This would require 55 pounds of cleaner. If using the tank that comes with the Reverse Osmosis Element Cleaning and Preservation System (ROCEPS) NSN 4610-01-450-5022 that holds 50 gallons, only five pounds of cleaner would be needed.
- (9) Disconnect backwash hose from backwash pump strainer (figure 2-69) and place end of hose at least 25 yards down stream of raw water source.
- (10) Connect vent vessels hose to backwash pump strainer.
- (11) Make sure REGULATE PRODUCT FLOW valve (18, figure 2-5) is open (counterclockwise).
- (12) Make sure VENT VESSELS gate valve (5, figure 2-61) is open. This valve should remain open at all times except when producing purified water.
- (13) Open gate valve (figure 2-69) between backwash tank and backwash pump (turn hand wheel counterclockwise until it stops).

2-13. R.O. ELEMENT CLEANING PROCEDURE – cont.

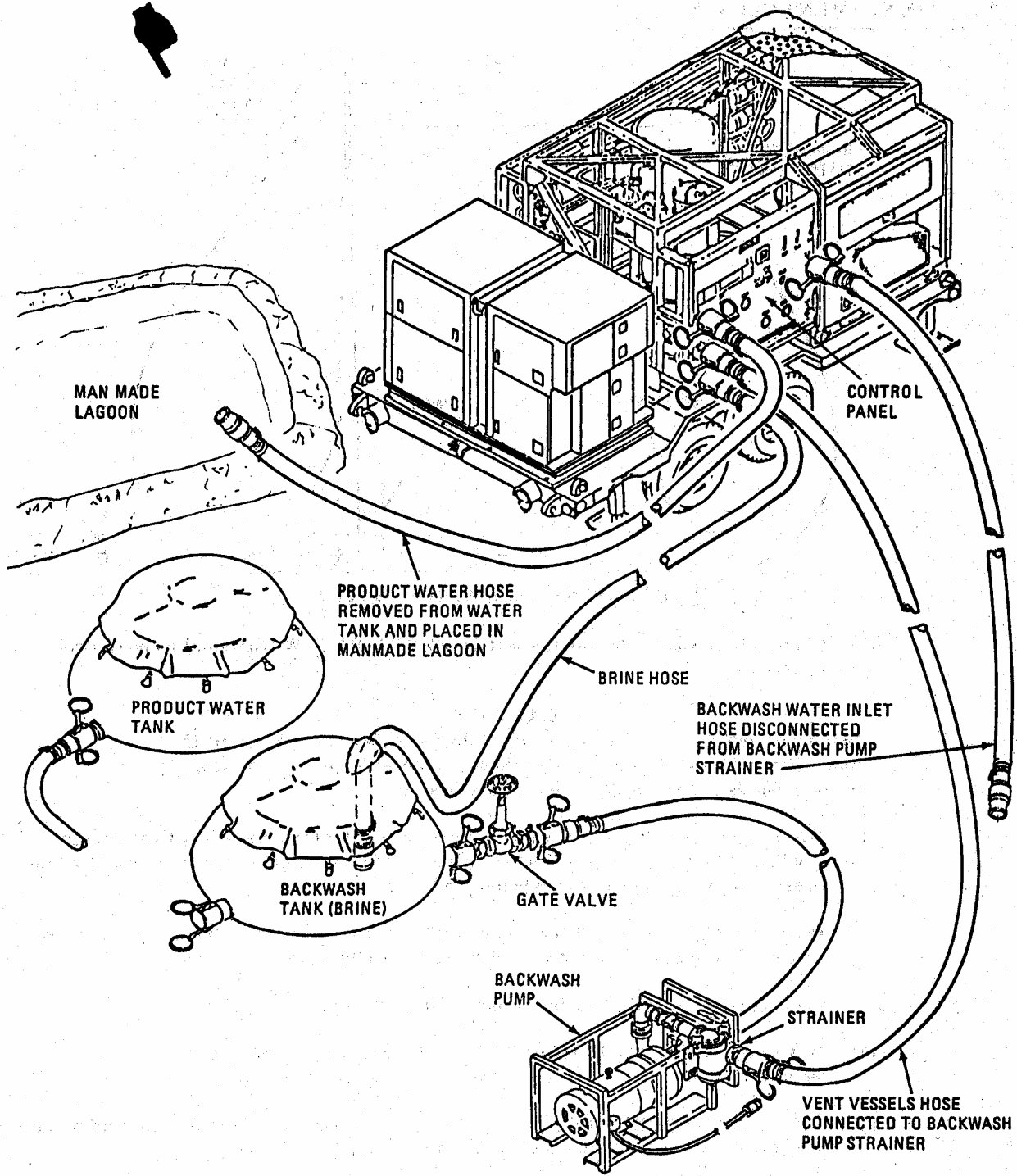


Figure 2-69. Low pH Element Cleaning

2-13. R.O. ELEMENT CLEANING PROCEDURE - cont.

- (14) Remove product water hose from product water tank and place in backwash water tank. Place brine water hose in backwash water tank.

CAUTION

To prevent damage to equipment, if backwash pump does not prime it may be necessary to loosen vent plug on backwash pump to purge air. Tighten vent plug when pump is primed.

- (15) Start element cleaning. Push ELEMENT CLEANING switch (24, figure 2-5) up to START position. Release switch. Switch automatically goes to RUN position. Element Cleaning starts.
- (16) Within a few seconds, BRINE FLOW indicator (17, figure 2-5) should show a flow of 16 GPM or more.
- (17) After five minutes of operation, check pH (para. 2-15b) of water discharging back into brine tank; it should be near, but not below, 2.5.
- (18) Continue checking pH to make sure pH is near, but not below, 2.5.

CAUTION

Temperature of solution will rise during element cleaning. At no time should it exceed 120 degrees, stop circulating low pH solution and resume normal operation.

- (19) Allow low pH solution to circulate for 45 minutes. Periodically check the temperature of the water discharging back into brine tank; use thermometer from storage chest.
- (20) Stop recirculation by pushing the ELEMENT CLEANING switch (24, figure 2-5) down to OFF.

CAUTION

Disposal of cleaning solution must be in accordance with EPA regulation.

- (21) Disconnect VENT VESSELS hose from control panel and place in approved collection container.

2-13. R.O. ELEMENT CLEANING PROCEDURE – cont.

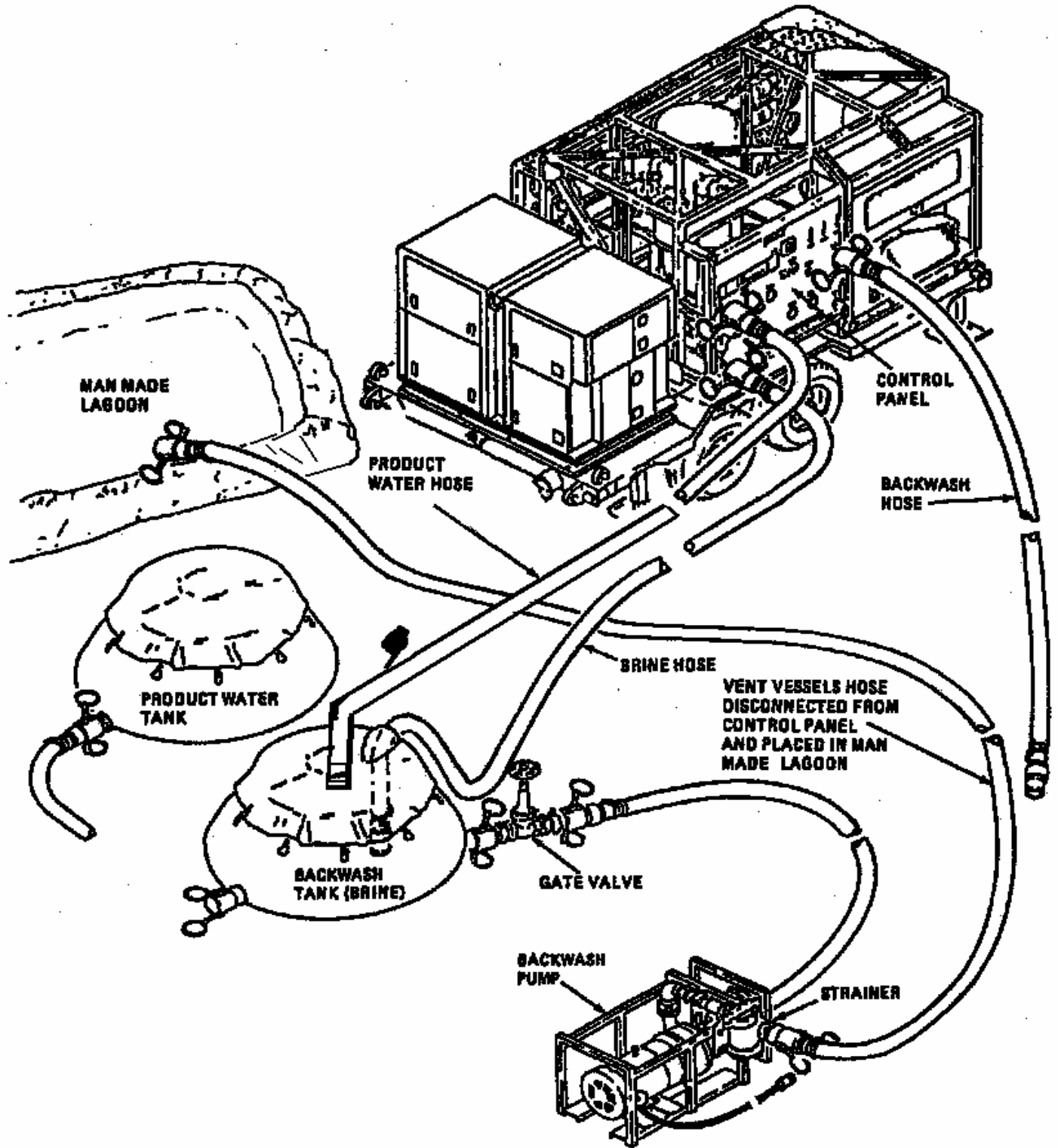


Figure 2-70. High pH Cleaning Methods

2-13. R.O. ELEMENT CLEANING PROCEDURE - cont.

- (22) Push ELEMENT CLEANING switch (24, figure 2-5) to START.
- (23) When backwash tank is empty, push ELEMENT CLEANING switch (24, figure 2-5) to OFF.
- (24) Reconnect vent vessel hose to VENT VESSELS coupling on control panel (figure 2-71).

WARNING

To prevent injury to personnel, vent vessels hose must be placed at least 25 yards down stream of raw water intake.

- (25) Disconnect vent vessel hose from backwash pump strainer and place end of hose at least 25 yards down stream of raw water source.
- (26) Reconnect backwash hose to backwash pump strainer.
- (27) Remove brine hose from opening in backwash tank and allow to drain on ground.
- (28) Perform normal ROWPU startup (para. 2-9).
- (29) Operate ROWPU for 10 minutes with the brine and product water hoses out of the tanks and REGULATE PRODUCT FLOW valve (18, figure 2-5) fully open (turned fully to the left until it stops) to rinse the R.O. pressure vessels. If suds are noted, continue operating ROWPU until no suds are coming out.

2-13. R.O. ELEMENT CLEANING PROCEDURE – cont.

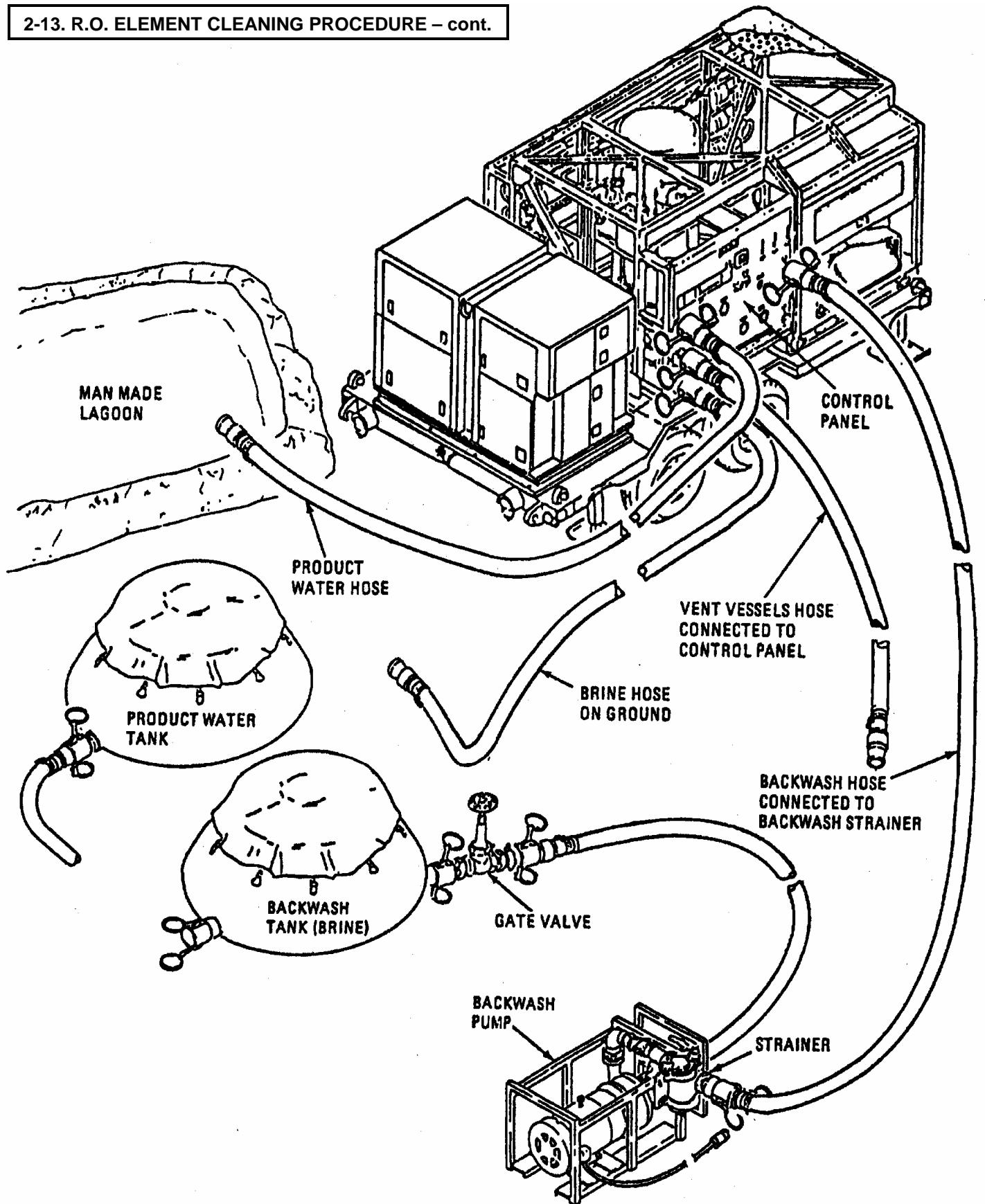


Figure 2-71. Rinsing R.O. Pressure Tubes.

2-13. R.O. ELEMENT CLEANING PROCEDURE – cont.

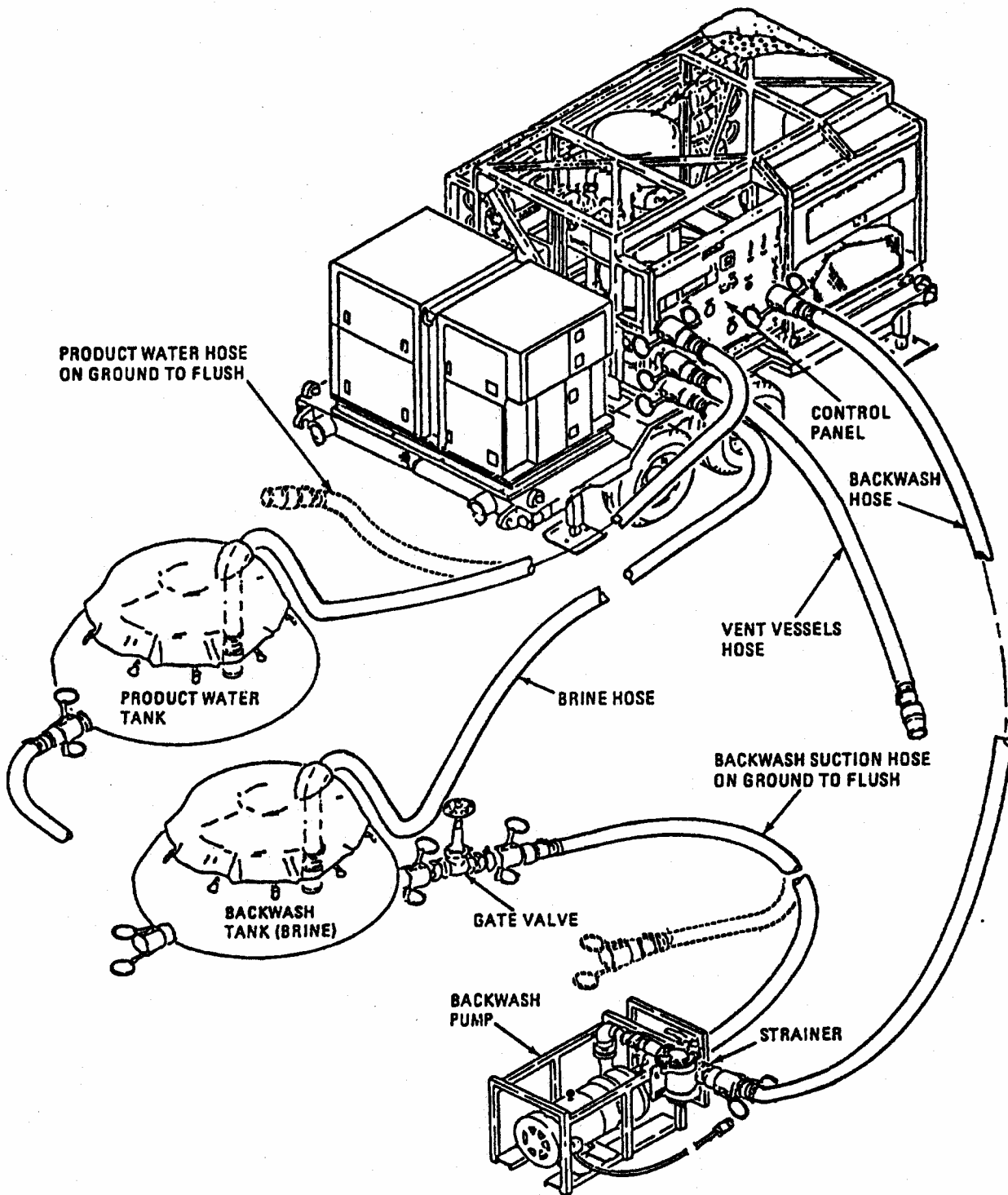


Figure 2-72. Rinsing Cleaning Solutions from Product Water Hose.

2-13. R.O. ELEMENT CLEANING PROCEDURE - cont.

- (30) Disconnect suction hose from backwash pump inlet (figure 2-72).
- (31) Place brine hose in backwash tank to flush chemical residue from tank and suction hose.
- (32) Close gate valve between backwash tank and backwash pump.
- (33) Reconnect backwash pump suction hose to backwash pump when hose is clean.
- (34) Adjust REGULATE PRODUCT FLOW valve (18, figure 2-5) until PRODUCT WATER FLOW gage (figure 2-73) indicates under 16 GPM (fresh/brackish water) or 12 (seawater), and R.O. PRESSURE PSI gage indicates under 500 (fresh/brackish water) or 960 (seawater).

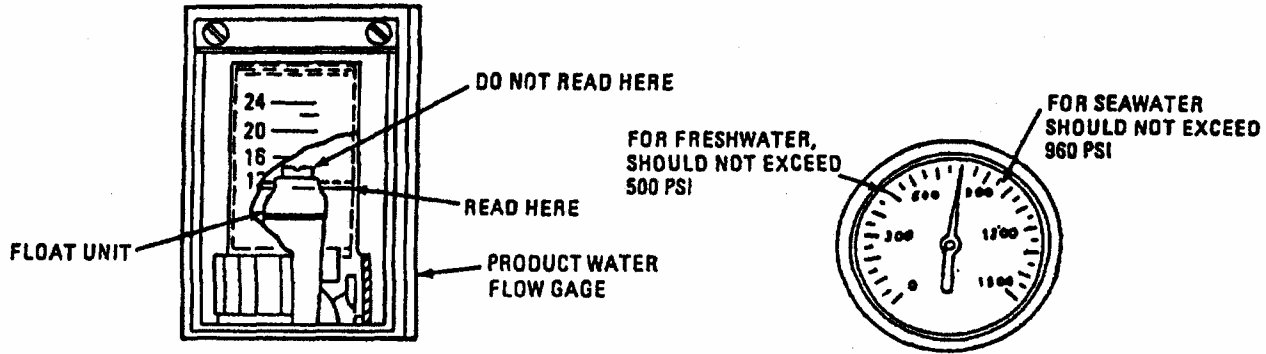


Figure 2-73. Product Water Flow Adjustment.

- (35) Close VENT PRODUCT WATER valve (7, figure 2-46).
- (36) Allow ROWPU to run 3 minutes, check product water TDS.

NOTE

Some elements require 24-72 hours of operating before TDS decreases to acceptable standards. If TDS is still over 1000 PPM after cleaning, allowing ROWPU to run longer may lower TDS.

- (37) Only after obtaining TDS level less than 1000 PPM, and no suds are coming out of product water hose, turn CHLORINE PRIME/RUN valve (figure 2-60) to RUN.
- (38) Wait 5 minutes, then perform chlorine residual and pH test (para. 2-15b).

2-13. R.O. ELEMENT CLEANING PROCEDURE - cont.

NOTE

Chlorine residual should be 2 PPM, unless otherwise directed by medical personnel.

(39) When chlorine residual and pH are within required limits, place product water line in product water tank (figure 2-72).

(40) Continue normal operating procedure (para. 2-9) unless ROWPU is to be secured, continue with instructions provided in para. 2-14 Shutdown Procedures.

b. High pH Clean:

(1) Perform steps (1) thru (7) in paragraph 2-13a.

(2) Mix the amount specified on the high pH membrane cleaner label according to the amount of water remaining in the backwash water tank when drained to the 7" mark. Stir with aluminum paddle until all granules are dissolved (figure 2-68). **Example: If cleaner states** one pound per ten gallons and the tank holds 550 gallons when water is drained to the 7" mark. This would require 55 pounds of cleaner. If using the tank that comes with the Reverse Osmosis Element Cleaning and Preservation System (ROCEPS) NSN 4610-01-450-5022 that holds 50 gallons, only five pounds of cleaner would be needed.

(3) Perform steps (9) thru (16) in paragraph 2-13a.

(4) After 5 minutes of operation, check pH (para. 2-15b) of water discharging back into brine tank; it should be near, but not above, 10.5.

(5) Continue checking pH to make sure pH is near, but not above, 10.5

CAUTION

Temperature of solution will rise during element cleaning. At no time should it exceed 120 degrees, stop circulating high pH solution and resume normal operation.

(6) Allow high pH solution to circulate for 45 minutes. Periodically check the temperature of the water discharging back into brine tank; use the thermometer in storage chest.

(7) Perform steps (20) thru (40) in paragraph 2-13a.

c. Preservation:

NOTE

Preserving elements is required as a part of short and long term shutdown to secured status to prevent bacterial growth with RO elements. It always immediately follows high pH cleaning when preparing for extended shutdown.

NOTE

When done in sequence as a part of short and long term secured shutdown, the ROWPU has been flushed. This procedure follows flushing.

(1) Perform steps (1) thru (7) in paragraph 2-13a.

(2) Pour in the contents of six 2 pound bags of bisulfite, if the ROWPU will be subject to freezing temperatures use NSN 6850-01-429-9840 Membrane Preservative instead. Mix the amount specified on the preservative label according to the amount of water remaining in the backwash water tank when drained to the 7" mark. Stir with aluminum paddle until all granules are dissolved (figure 2-68). **Example: If preservative states** one pound per ten gallons and the tank holds 550 gallons when water is drained to the 7" mark, this would require 55 pounds of preservative. If using the tank that comes with the Reverse Osmosis Element Cleaning and Preservation System (ROCEPS) NSN 4610-01-450-5022 that holds 50 gallons, only five pounds of preservative would be needed.

NOTE

This leaves the RO vessels full of the appropriate preservative solution.

- (3) Perform steps (9) thru (16) in paragraph 2-13a.
- (4) Allow preservative solution to circulate for 30 minutes. Periodically check the temperature of the water discharging back into brine tank; use thermometer in storage chest.
- (5) Stop recirculation by pushing the ELEMENT CLEANING switch (24, figure 2-5) down to OFF.

2-14. SHUTDOWN PROCEDURES.

a. Normal Shutdown (Less Than 24 Hours

NOTE

Table 2-5 lists the normal shutdown (less than 24 hours) sequence in tabular form.

- (1) Set chemical feed RUN/PRIME valves to PRIME (figure 2-60).
- (2) Set chemical feed pump control knobs to 10 (figure 2-56).
- (3) Turn REGULATE PRODUCT FLOW valve (1, figure 2-74) to fully OPEN.
- (4) Set VENT PRODUCT WATER valve (7, figure 2-46) to OPEN.
- (5) Turn VENT VESSELS gate valve (5, figure 2-46) to full open position.
- (6) Set VENT CARTRIDGE FILTER valve (2, figure 2-74) to OPEN.
- (7) Set VENT PULSE DAMPENER valve (3, figure 2-74) (Models WPES-10, WPES-20, and WPES-30) to OPEN.
- (8) Set VENT MULTIMEDIA FILTER valve (4, figure 2-74) to OPEN.
- (9) Set R.O. PUMP switch (5, figure 2-74) to STOP.
- (10) Set BOOSTER PUMP switch (6, figure 2-74) to STOP.
- (11) Set CHEMICAL FEED PUMP switch (7, figure 2-74) to STOP.
- (12) Set RAW WATER PUMP NO. 2 switch (8, figure 2-74) to STOP.
- (13) Set RAW WATER PUMP NO. 1 switch (9, figure 2-74) to STOP.

NOTE

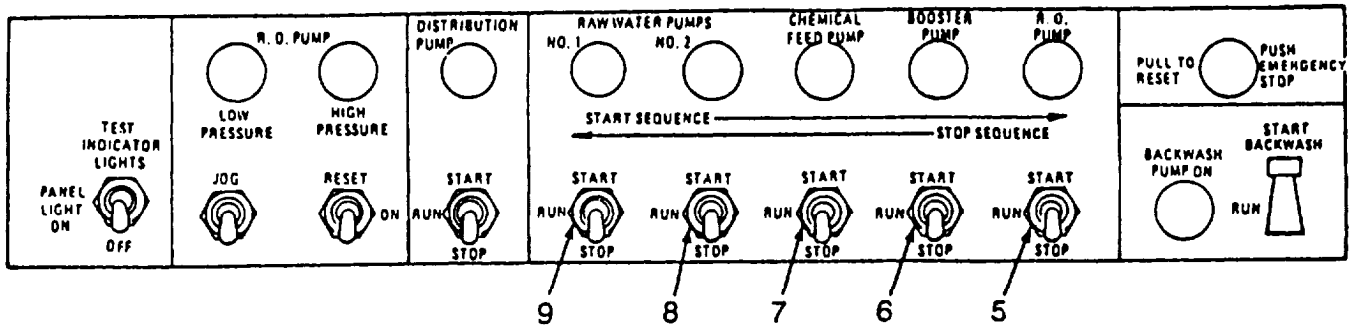
- CB-2, CB-8 and CB-9 must remain on (up) to perform backwash procedures.
- Leave circuit breakers on if extended shutdown will be performed.

- (14) Set circuit breakers CB-1 thru CB-9 to off (down) (figure 2-5).

b. Extended Shutdown (72 hours or more).

- (1) Perform R.O. element cleaning (para 2-13).
- (2) Perform procedures contained in Operation in Saltwater areas (para. 2-25) if unit was operated on saltwater or brackish water.

2-14. SHUTDOWN PROCEDURES - cont.



(Models WPES-10, WPES-20,
AND WPES-30 only)

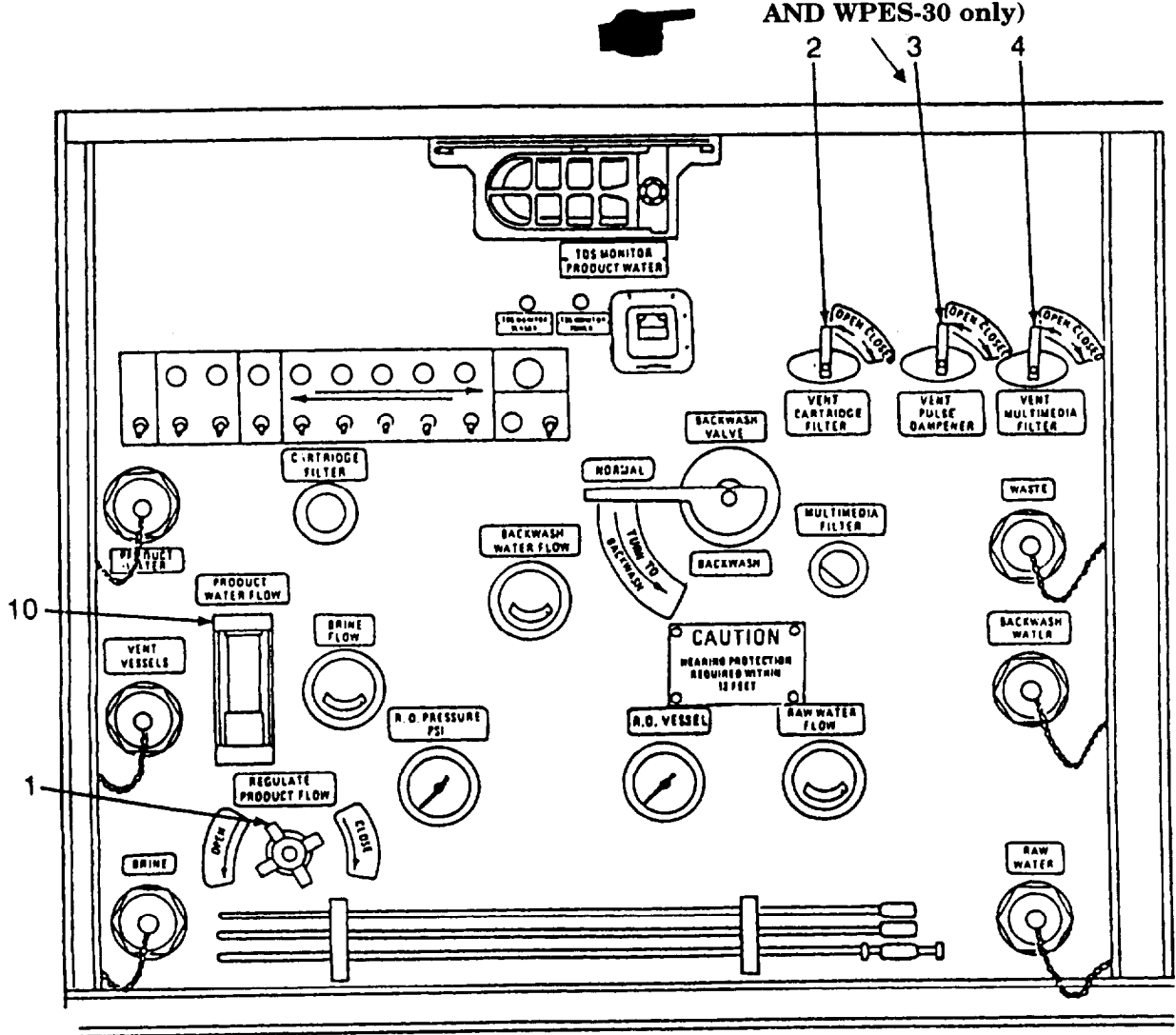


Figure 2-74. Shutdown Position of Control Panel Switches and Valves.

2-14. SHUTDOWN PROCEDURES - cont.

CAUTION

Follow the exact sequence of shutdown steps in table 2-5 to prevent damage to the ROWPU.

Table 2-5. Shutdown Position of Valve or Switch

Order	Valve or Switch	Position
1	CHEMICAL FEED RUN/PRIME valves (figure 2-60)	PRIME
2	CHEMICAL FEED PUMP control knobs (figure 2-56)	10
3	REGULATE PRODUCT FLOW valve (1, figure 2-74)	OPEN
4	VENT PRODUCT WATER valve (7, figure 2-46)	OPEN
<p><u>CAUTION</u> After opening the REGULATE PRODUCT FLOW valve fully, wait 5 minutes before opening vent vessels valve.</p>		
5	VENT VESSELS gate valve (5, figure 2-46)	OPEN
6	VENT CARTRIDGE FILTER VALVE (2, figure 2-74)	OPEN
7	VENT PULSE DAMPENER valve (Model WPES-10, WPES-20, and WPES-30)(3, figure 2-74)	OPEN
8	VENT MULTIMEDIA FILTER valve (4, figure 2-74)	OPEN
9	R.O. PUMP SWITCH (5, figure 2-74)	STOP
10	BOOSTER PUMP switch (6, figure 2-74)	STOP
11	CHEMICAL FEED PUMP switch (7, figure 2-74)	STOP
12	RAW WATER PUMP NO. 2 switch (8, Figure 2-74)	STOP
13	RAW WATER PUMP NO. 1 switch (9, figure 2-74)	STOP
<p><u>NOTE</u></p> <ul style="list-style-type: none"> • CB-2, CB-8 AND CB-9 must remain on (up) to perform backwash procedures. • Leave circuit breakers on if extended shutdown will be performed. 		
14	Circuit Breakers CB-1 THRU CB-9 (figure 2-5)	Off (Down)

2-15. OPERATION OF AUXILIARY EQUIPMENT.

WARNINGS

- Generator sets must not be operated in enclosed areas unless exhaust discharge is properly vented to the outside. Be alert at all times during operation for odors and exposure symptoms to carbon monoxide.
 - Operating noise level of the generator set can cause hearing damage. Ear protectors, as recommended by medical/safety personnel, must be worn working near unit.
- a. Generator Set (Models WPES-10 and H-9518-1). Instructions for operating the generator are contained in the applicable generator set manual (TM 5-6115-465-12 for NSN 6115-00-118-1240).

WARNING

Chemicals used for operating ROWPU can kill you. The chemicals alone or in mixture can be dangerous. ALWAYS wear protective apron, goggles and gloves and make sure area is well ventilated.

- b. Color Comparator Test Kit. Instructions to determine the pH values and chlorine residual in water are contained in the color comparator test kit (para. 2-2m, figure 2-20). The Diethyl-P-Phenylene diamine (DPD) tablets are not part of the test kit, but are included in the storage chest.
- c. TDS Meter. Refer to figure 2-75. The total dissolved solids (TDS) meter is a calibrated meter that measures how much electric current can flow through a sample of water. Pure water passes almost no current.
- (1) Description of the TDS meter:
- (a) Reads in ppm (parts per million) or in mg/l (milligrams per liter). Ppm is the same as mpl.
 - (b) Has four modes:
 - S - Calibration mode
 - 10 Mode - Range is from 0 to 50. Result is achieved by multiplying indication times 10.
 - 100 Mode - Range is from 0 to 500. Result is achieved by multiplying indication times 100.
 - 1000 Mode - Range is from 0 to 500. Result is achieved by multiplying indication times 1000.
 - (c) When using range extender (in 1000 mode) range is 0 to 10,000. Result is achieved by multiplying indication times 10,000.

2-15. OPERATION OF AUXILIARY EQUIPMENT-cont.

CAUTION

Always start with meter set in the 1000 mode. If you use a lower mode first, you may damage the meter.

NOTE

The TDS meter is factory calibrated and suitable for use when treating fresh (lake, stream, pond, river) water. When treating seawater and brackish water, it is necessary to recalibrate the meter. If your meter has both "442" and "NaCl" internal standards stamped on the bottom plate, obtain a standard sodium chloride (NaCl) solution (ARMY-SC-4610-97-CL-E16); and refer to subpara. (3).

- (2) Recalibration instructions for meters with both internal standards (442 and NaCl) stamped on the bottom of the meter.
 - (a) Set mode switch to "S" (internal standard).
 - (b) Remove bottom plate to gain access to master calibration control.
 - (c) Press indicator button and hold it in.
 - (d) Adjust the master calibration control with your finger until meter reads same as the value stamped on the bottom plate for the water you will be treating (442 for fresh water and NaCl for seawater).
 - (e) Release indicator button.
 - (f) Replace bottom plate.
- (3) Recalibration instructions for meters with "442" internal standard only stamped on bottom plate:
 - (a) Obtain a standard sodium chloride (NaCl) solution and note the ppm (parts per Million) value printed on bottle.
 - (b) Remove snap-in disc or bottom cover of TDS meter to gain access to the master calibration control.
 - (c) Rinse cell cup three times with the standard sodium chloride (NaCl) solution, then fill again.

2-15. OPERATION OF AUXILIARY EQUIPMENT - cont.

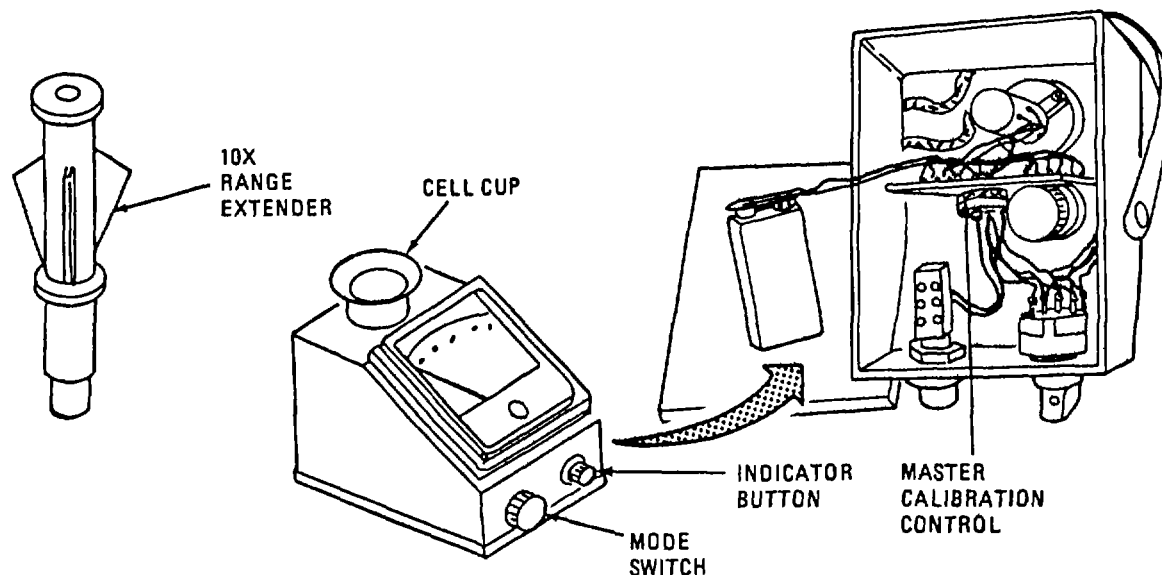


Figure 2-75. Total Dissolved Solids (TDS) Meter

- (d) Set mode switch to the 1000 scale.
- (e) Press indicator button and hold it in.
- (f) Adjust the master calibration control until the meter reads the value on solution bottle, then release indicator button. Remember to multiply meter reading by 1000.
- (g) Set mode switch to "S" (internal standard).
- (h) Press indicator button, and hold it in.
- (i) Note the dial reading and write it down for future reference, then release indicator button. This value is the internal standard for a sodium chloride (NaCl) solution.
- (j) Replace snap-in disc in bottom cover.

2-15. OPERATION OF AUXILIARY EQUIPMENT - cont

- (4) Calibration Check:
- (a) Set mode switch to "S" (an internal standard).
 - (b) Press indicator button. Read the 0 to 5 scale to the nearest tenth.
 - (c) For fresh water, meter is ready for use if it matches the 442 ppm internal standard marked on bottom plate. For seawater or brackish water, meter is ready if its reading matches the "NaCl" internal standard, which, if not stamped on bottom plate, was noted in step (3)(i).
 - (d) If reading is not the same, notify unit maintenance to replace TDS meter.

CAUTION

To avoid shorting TDS meter, keep the meter dry. Do not spill water or any other liquid on the meter. Do not damage meter by removing or twisting cell cup.

- (5) Test in.

NOTE

Be sure cell cup is clean; if required, wash with soap and the purest water available.

- (a) Rinse cell cup three times with water to be tested.
- (b) Fill cell cup to 1/2-inch from top with water to be tested.

CAUTION

To prevent damage to TDS meter, use range extender when testing source water of unknown salinity.

NOTE

Do not use range extender when testing product water or fresh water.

- (c) Push range extender into cup, seating the preformed packing.

CAUTION

Always start with meter set in 1000 mode. If a lower scale is used first, the meter may be damaged.

- (d) Set mode switch to 1000 mode.
- (e) Press indicator button. If reading is more than 5,000, record reading. If reading is less than 5,000, remove range extender.
- (f) Press indicator button. If reading is more than 500, record reading. If reading is less than 500, place mode switch to 100.

2-15. OPERATION OF AUXILIARY EQUIPMENT - cont.

- (g) Press indicator button. If reading is more than 50, record reading. If reading is less than 50, place mode switch to 10.
- (h) Press indicator button and record reading.

2-16. DECALS AND INSTRUCTION PLATES.

Decals and Instruction plates used on the ROWPU and accessories are shown in figure 2-76.

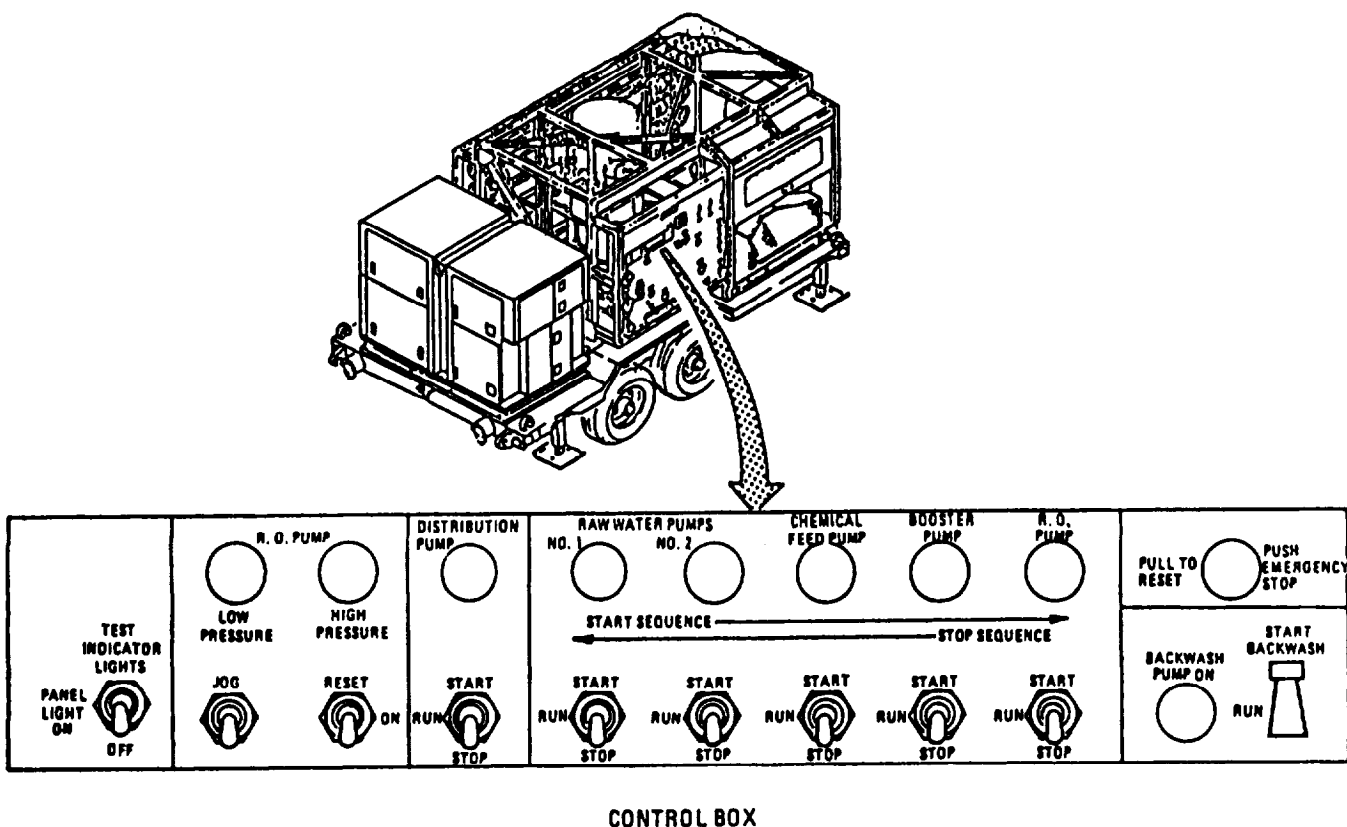


Figure 2-76. Decals and Instruction Plates (sheet 1 of 6)

2-16. DECALS AND INSTRUCTION PLATES - cont.

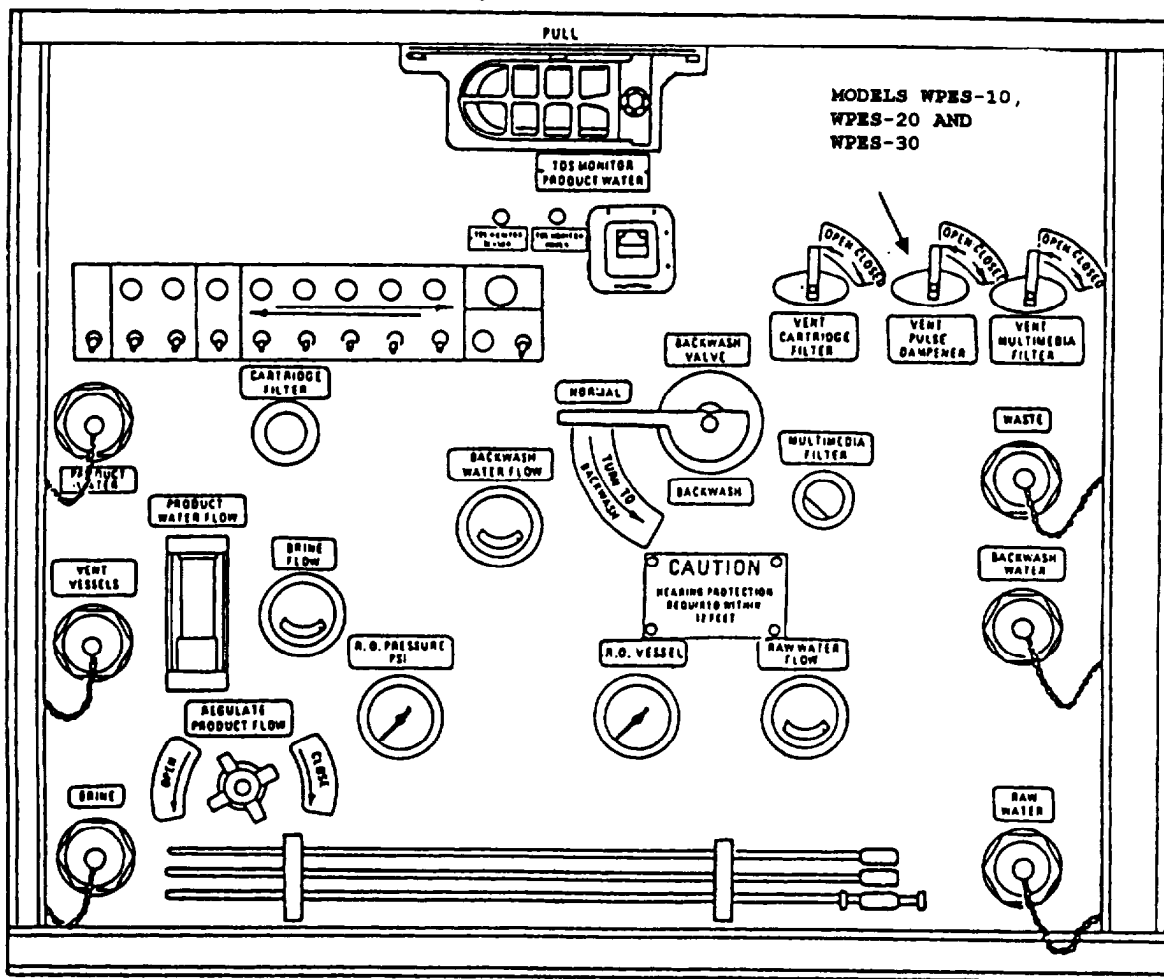
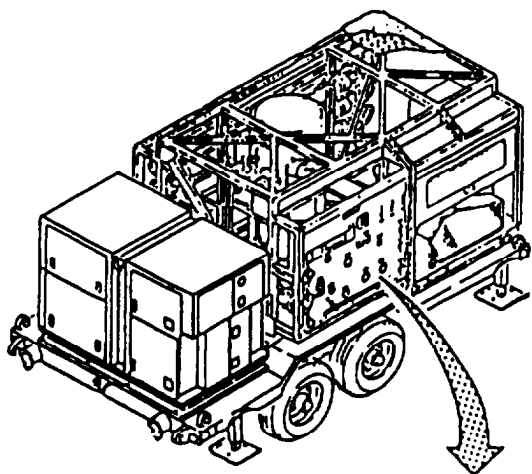


Figure 2-76. Decals and Instruction Plates (sheet 2 of 6).

2-16. DECALS AND INSTRUCTION PLATES - cont. I

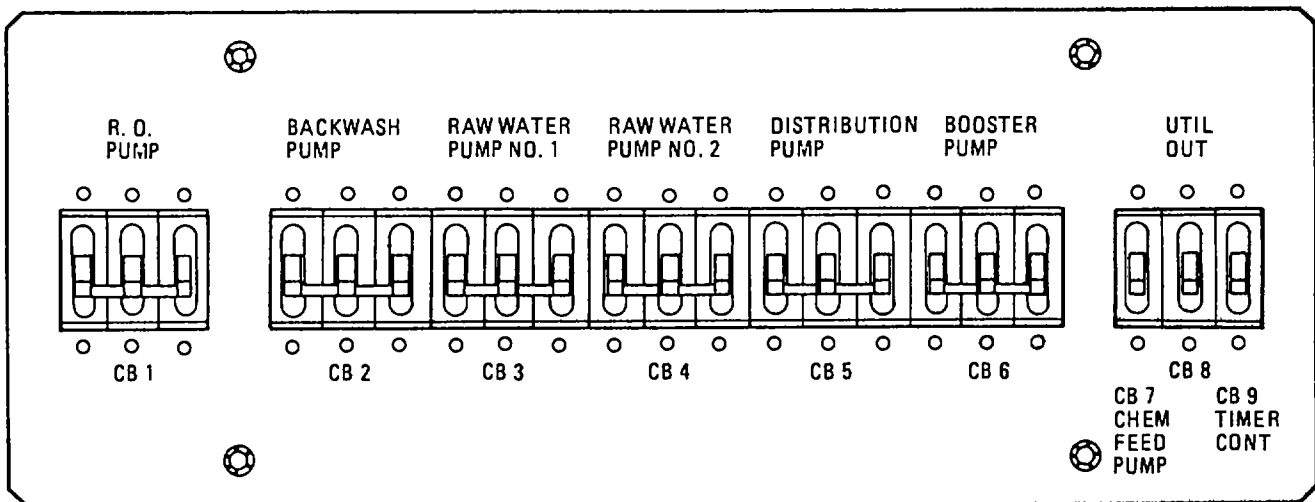
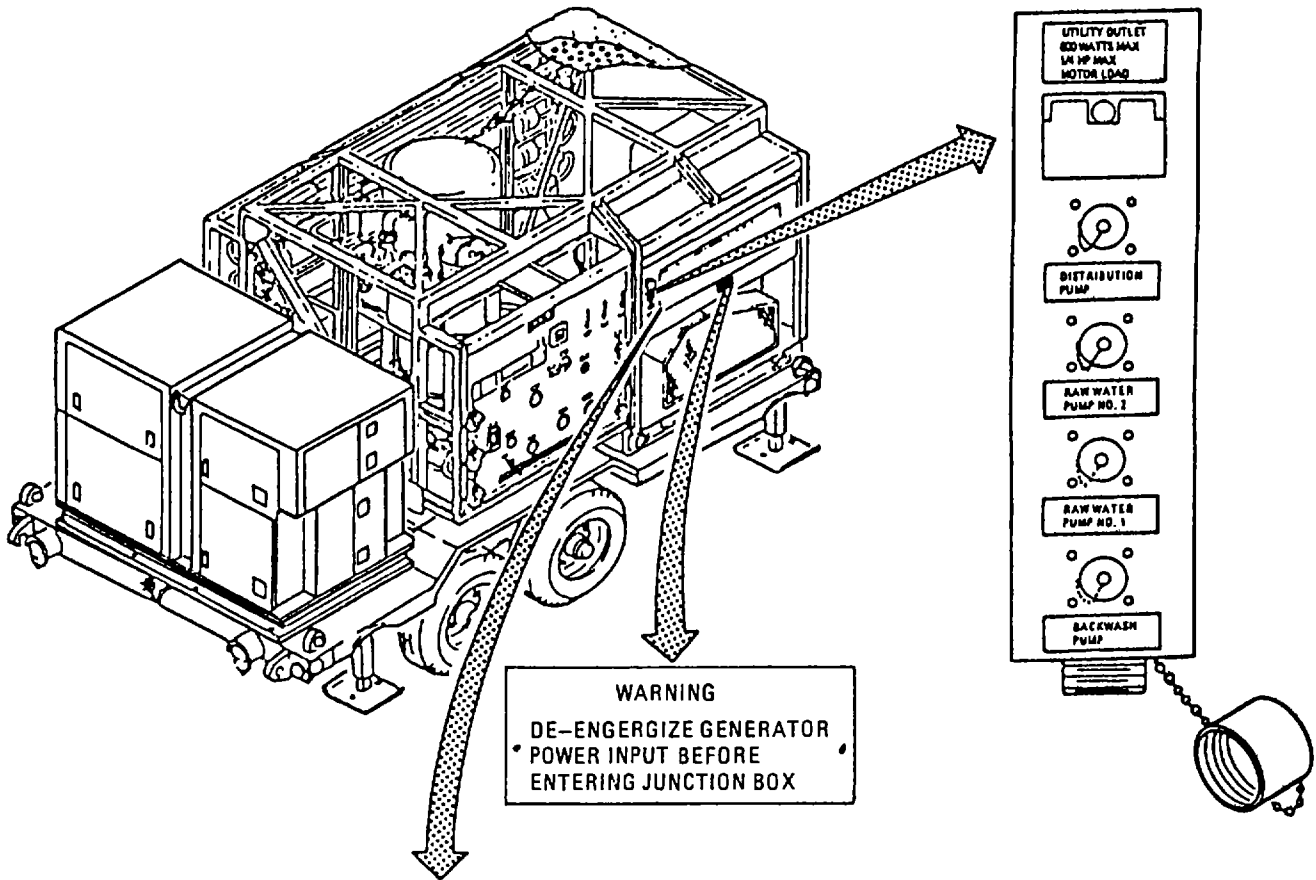


Figure 2-76. Decals and Instruction Plates (sheet 3 of 6).

2-16. DECALS AND INSTRUCTION PLATES - cont.

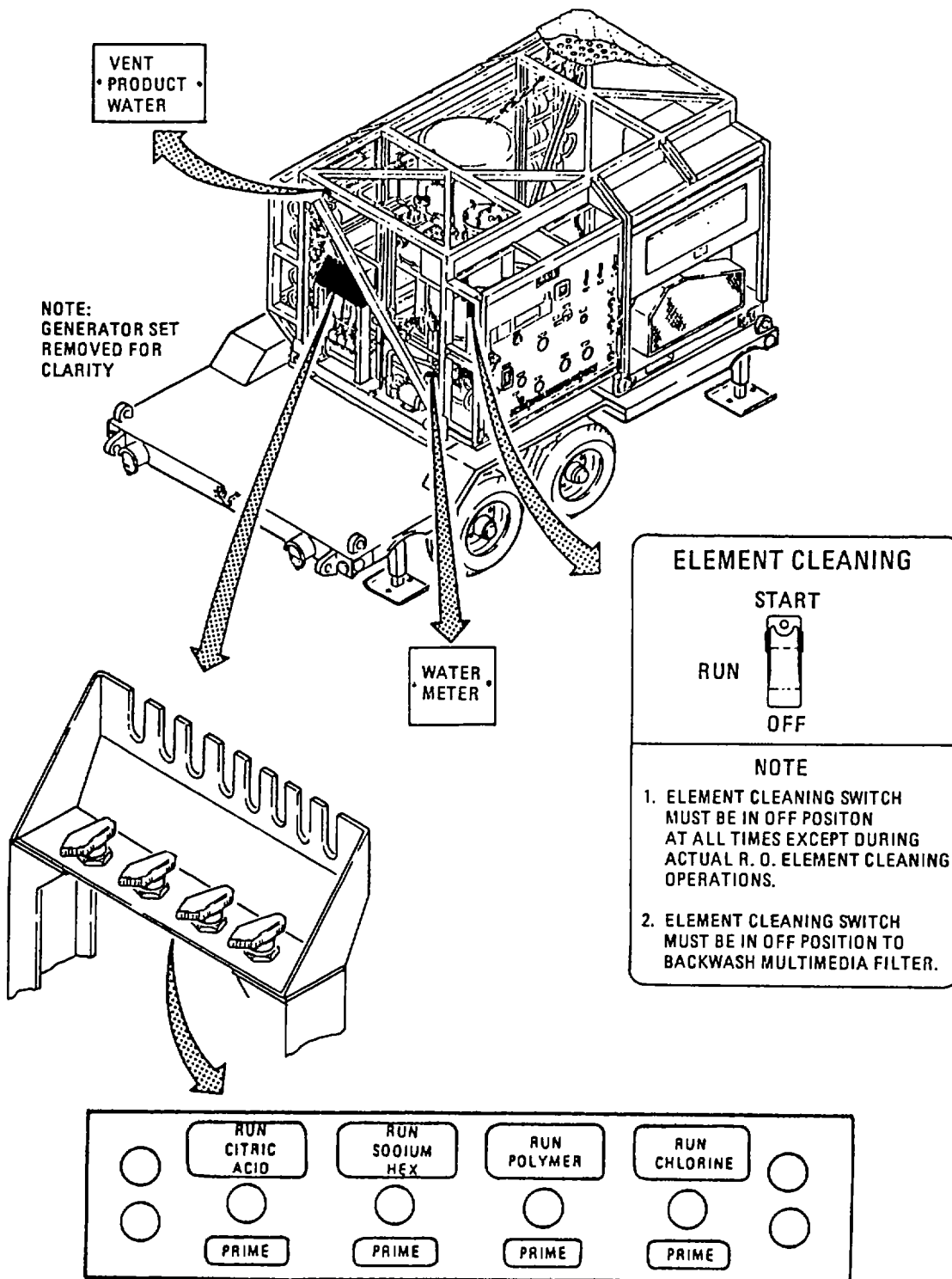


Figure 2-76. Decals and Instruction Plates (sheet 4 of 6).

2-16. DECALS AND INSTRUCTION PLATES- cont.

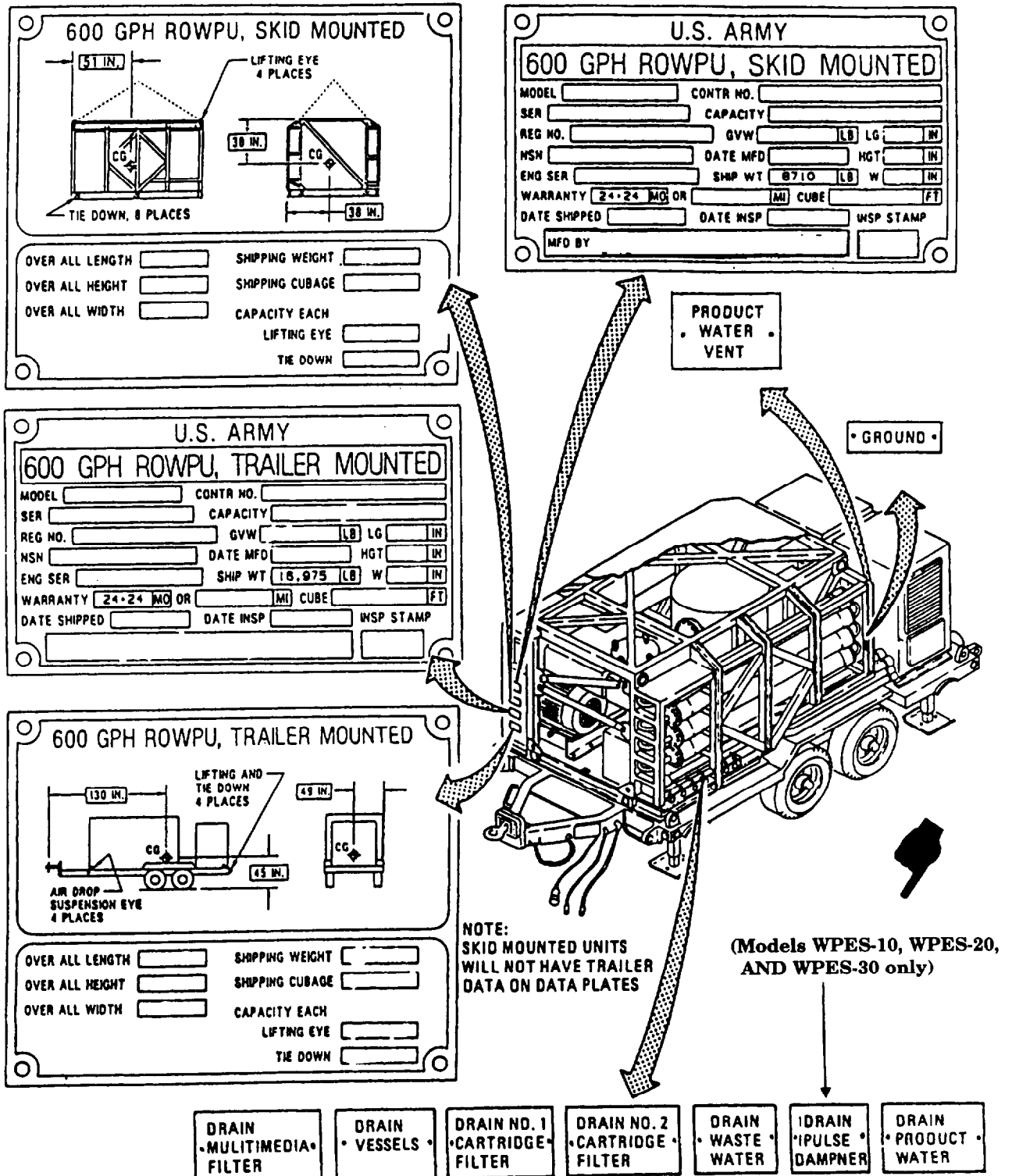


Figure 2-76. Decals and Instruction Plates (sheet 5 of 6).

2-16. DECALS AND INSTRUCTION PLATES- cont.

LUBRICATION CHART

**TRAILER, FLATBED, CARGO, 5 TON, 4 WHEEL
RO-600**

ANNUAL { WITH GAA (Grease automobile and artillery) LUBRICATE THE THROUGH BUSHINGS (2 PLINGS) AND THE WHEEL-BEARINGS (Remove, clean, and repack each), AND

SEMI-ANNUAL { NL-G-109240 - GREASE ONE GREASE ZIRC PER LANDING JACK; NO OIL.

WITH PL (Lubricating oil, general purpose) LUBRICATE AS REQUIRED: SAFETY STEP WHEEL, SPARE TIRE CARRIER WINCH AND RACKET, LANDING-JACK-SWIVEL PINS, BRACKETS, LATCHES, ETC.

For other operations refer to FM 8-207; other extremes refer to Manual-CLS. **DO NOT LUBRICATE THE SPRINGS**

<p>TRAILER, FLATBED 5 TON, 4 WHEEL NATIONAL STOCK NO: MANUFACTURED BY</p> <p>MFG SERIAL NO. MFG MODEL NO. CONTRACT NO.</p>	<p style="text-align: center;">WEIGHTS AND DIMENSION DATA</p>																				
<p style="text-align: center;">PUBLICATIONS</p> <p>TECHNICAL MANUAL LUBRICATION ORDER</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">WEIGHTS</td> <td style="width: 25%;">EMPTY</td> <td style="width: 25%;">CROSS COUNTRY</td> <td style="width: 25%;">HIGHWAY</td> </tr> <tr> <td>PAYLOAD</td> <td></td> <td></td> <td></td> </tr> <tr> <td>ON WHEELS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>ON LUNETTE</td> <td></td> <td></td> <td></td> </tr> <tr> <td>TOTAL</td> <td></td> <td></td> <td></td> </tr> </table>	WEIGHTS	EMPTY	CROSS COUNTRY	HIGHWAY	PAYLOAD				ON WHEELS				ON LUNETTE				TOTAL			
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Figure 2-76. Decals and Instruction Plates (sheet 6 of 6).

2-132 Change 2

2-17. PREPARATION FOR MOVEMENT

Prepare the ROWPU for movement as follows:

NOTE

If unit will be shutdown for more than 24 hours, perform normal shutdown. If unit will be shutdown for more than 72 hours, perform extended shutdown.

- a. Shutdown ROWPU. Perform shutdown procedures (normal shutdown para 2-14a, extended shutdown para. 2-14b).
- b. Drain ROWPU Pines, Filters, and Connections.
 - (1) Open seven drain valves on models WPES-10, WPES-20 and WPES-30; open six drain valves on models H-9518-1, H-9518-2 and H-9518-3 (para. 2-2i).
 - (2) (WPES-10 and H-9518- 1) Facing trailer from towing end, use leveling jacks to raise left side of trailer permit maximum drainage through drain valve.
 - (3) Set front sample valves to open and rear sample valves to sample position (figure 2-47) to allow R.O. vessels to drain. When fully drained, close front sample valves and set rear sample valve to sample position.
- c. Drain Chemical Feed Pump.

WARNING

Chemicals used for operating ROWPU can kill you. The chemicals alone or in the mixture can be dangerous. Always wear protective gloves, goggles and apron, Make sure area is well ventilated.

- (1) Empty and rinse all utility pails. Fill one pail with water from backwash tank and place it next to the chemical feed pump.
- (2) Place both pails on top of chemical feed cans.
- (3) Disconnect four chemical feed suction (female) hoses (figure 2-56) from the chemical cans and place ends of hoses in pail full of water.
- (4) Disconnect four chemical feed return (male) hoses (figure 2-56) from the chemical cans and place ends of hoses in empty pail.
- (5) Set CHEMICAL FEED PUMP switch (38, figure 2-5) to START. Allow chemical feed pump to operate (about five minutes) until chemicals are rinsed from chemical feed hoses, valves and pumps. Ensure all control knobs (figure 2-56) are set to 10.
- (6) Remove chemical feed suction hoses from pail and allow chemical feed pump to run until water is pushed from pump.
- (7) Set CHEMICAL FEED PUMP switch (38, figure 2-5) to STOP.
- (8) Remove chemical feed return hoses from pail and allow to drain.

2-17. PREPARATION FOR MOVEMENT - cont.

- (9) Empty chemical feed cans and rinse with brine water.
 - (10) Install caps and plugs on chemical cans.
 - (11) Install caps and plugs on chemical feed hoses.
 - (12) Install tie strap over chemical cans.
 - (13) (WPES-10 and H-9518-1) Secure chemical feed can frame to trailer frame with tie down straps.
- d. Take down product water system. Refer to figure 2-38.

Steps 1-6 are only applicable if the ocean intake structure was used.

- (1) Make sure storage tank holds at least 100 gallons.
- (2) Close dispensing nozzle.
- (3) Turn on distribution pump.
- (4) Use nozzle to thoroughly wet sand around wellpoints.
- (5) Turn off pump.
- (6) Pull out wellpoints by hand.
- (7) Disconnect dispensing nozzle from discharge hose.
- (8) Open gate valve between product water tank No. 1 and No. 2.
- (9) Set DISTRIBUTION PUMP switch (41, figure 2-5) to START. Allow pump to operate until all water is drained from both product water tanks.
- (10) Set DISTRIBUTION PUMP switch to OFF, Set DISTRIBUTION PUMP circuit breaker CB-5 (49, figure 2-5) to off (down).
- (11) Disconnect distribution pump electrical cable from DISTRIBUTION PUMP connector on control panel. Install plug on end of electrical cable and cap on DISTRIBUTION PUMP connector.
- (12) Roll up electrical cable onto distribution pump frame (figure 2-38).
- (13) Turn distribution pump on end so that pump end is down toward ground, and allow all water to drain from pump.
- (14) Disconnect gate valve, adapters and all hoses (para 2-7n). Allow components to drain and dry.
- (15) Install caps and plugs on hoses.
- (16) Roll up collapsible hoses.
- (17) Prepare water tanks for movement (TM 5-5430-227-12&P/TO 37A12-1-121).

2-17. PREPARATION FOR MOVEMENT- cont.

e Take down backwash water system Refer to figure 2-37).

- (1) Remove hose from top of backwash tank. Secure hose away from unit.
- (2) Disconnect discharge hose from BACKWASH coupling on control panel. Place end of hose down stream.
- (3) Open gate valve at backwash tank.

CAUTION

Use the ELEMENT CLEANING SWITCH (24, figure 2-5) to start the backwash pump, NOT the START BACKWASH SWITCH (unit will go into automatic backwash cycle).

- (4) Set ELEMENT CLEANING switch (24, figure 2-5) to START. Run backwash pump until all water is drained from brine water tank.
- (5) Set ELEMENT CLEANING switch (24) to OFF.
- (6) Set BACKWASH circuit breaker CB-2 (46) to off (down).
- (7) Disconnect backwash pump electrical cable from BACKWASH PUMP connector on distribution panel.
- (8) Roll up electrical cable onto backwash pump frame (figure 2-37).
- (9) Open draincock on bottom of backwash pump and allow water to drain, then close draincock.
- (10) Disconnect gate valve and all backwash hoses. Allow components to drain and dry.
- (11) Install caps and plugs on all hoses.
- (12) Roll up collapsible hoses.
- (13) Remove two nuts, lockwashers, flat washers, and bolts from strainer (figure 2-28).
- (14) Disconnect strainer coupling from backwash pump and remove strainer.
- (15) Reinstall two bolts, flat washers, lockwashers and nuts on strainer for future use.
- (16) Secure strainer to frame of backwash pump with tie strap.
- (17) Prepare water tank for movement (TM 5-5430-227-12&P/TO 37A12-1-121).

2-17. PREPARATION FOR MOVEMENT - cont.

f. Take down raw water system.

- (1) Set RAW WATER PUMP NO. 1 CB-3 circuit breaker (47, figure 2-5) and RAW WATER PUMP NO. 2 CB-4 circuit breaker (48) to off (down).
- (2) Disconnect RAW WATER PUMP NO.1 and NO. 2 electrical cables from distribution panel. Install caps on electrical receptacle.
- (3) Install plug on raw water pump electrical cables and wind cable onto pump frames.
- (4) Open drain and vent valves on both raw water pumps (figure 2-26 and 2-27). Allow water to drain, then close drain and vent valves.
- (5) Disconnect strainer and float from suction hose (figure 2-35). Untie float from strainer.
- (6) Disconnect all hoses and allow to drain.
- (7) Install caps and plugs on hoses.
- (8) Roll up collapsible hoses.

g. Take down waste water system. Refer to figure 2-39.

- (1) Disconnect canvas discharge hoses from WASTE and VENT VESSELS couplings on ROWPU control panel.
- (2) Allow hoses to drain, then install caps and plugs.
- (3) Roll up collapsible hoses.

h. Remove TDS Monitor. Refer to figure 2-33.

- (1) Unscrew knurled ring on power cable connector (12) from TDS MONITOR POWER receptacle (14). Pull power cable connector from receptacle.
- (2) Install cap (13) on TDS MONITOR POWER receptacle (14).
- (3) Install plug (11) in power cable connector (12).
- (4) Unscrew knurled ring on sensor cable connector (8) from TDS MONITOR SENSOR receptacle (10). Pull cable connector from receptacle.
- (5) Install cap (9) on TDS MONITOR SENSOR receptacle (10).
- (6) Install plug (7) in sensor cable connector (8).
- (7) While depressing detent button (2) with thumb, pull quick release pin (3) from hole (6) in base of TDS monitor (1) and into control panel (4).
- (8) Slide base of TDS monitor (1) out from under two brackets (5).

2-17. PREPARATION FOR MOVEMENT - cont.

- (9) While depressing detent button (2) with thumb, push quick release pin (3) into control panel (4).
- (10) Stow TDS monitor (1) in storage chest.

i. Drain Booster Pump.

CAUTION

To prevent damage to booster pump, do not operate booster pump switch more than 5 seconds at a time.

NOTE

Two personnel are required to drain booster pump; one person to operate booster pump switch, the other to watch drain valve.

- (1) Set BOOSTER PUMP switch (37, figure 2-5) to START. Allow pump to run for 5 seconds then set to STOP.
- (2) Repeat step (1) until no more water comes out of DRAIN No. 1 CARTRIDGE FILTER and DRAIN No. 2 CARTRIDGE FILTER. (figure 2-10).
- (3) (WPES-20 and H-9518-2) Disassemble and drain boost pump (TO 4OW4-13-41).

j. Drain R.O. Pump.

CAUTION

To prevent damage to R.O. pump, do not operate R.O. PUMP JOG switch more than 5 seconds at a time.

NOTE

- The JOG switch can be used when the R.O. Pump LOW PRESSURE lamp is on.
- Two personnel are required to drain R.O. Pump; one person to operate jog switch, the other to watch drain valve.

For Models WPES-10, WPES-20, and WPES-30:

- (1) After water stops flowing out of drain valves, push R.O. PUMP JOG switch (43, figure 2-5) to JOG. Hold it there for 3 to 5 seconds to force water from pump.
- (2) Repeat operation of R.O. pump with JOG switch until no more water comes from the DRAIN PULSE DAMPENER drain (figure 2-10). After jogging the R.O. PUMP, some dripping from the drain is allowable.

For Models H-9518-1, H-9518-2, and H-9518-3:

- (1) Remove eight screws retaining edge of pump cover closest to operator (1, figure 2-76a).
- (2) Remove pump cover (2, figure 2-76a).

2-17. PREPARATION FOR MOVEMENT - cont.

- (3) Remove the high pressure hose (3) from the end of the pump by turning fitting counterclockwise while holding collar (figure 2-76a).
- (4) Remove the low pressure hose (4) by separating the quick disconnect fitting (figure 2-76a)
- (5) Disconnect drain line (5) from fitting (figure 2-76a).
- (6) With both hoses out of the way, operate the jog switch (figure 2-76) momentarily (2-3 seconds max) two times. This removes excess water and places all Of the pistons in a top dead position (43, figure 2-5).
- (7) Reconnect the high pressure hose (3) and low pressure hose (4).
- (8) Reposition pump cover (2) and secure with screws (1).

k. Shut Off Electrical Power.

- (1) Ensure all circuit breakers (CB-1 through CB-9) (figure 2-5) in distribution panel are off (down),
- (2) (Models WPES-10 and H-9518-1) Shutdown generator set (TM 5-6115-465-12).
- (3) (Models WPES-20 and H-9518-2) Shutdown power source and disconnect power cables from junction box receptacles J-1 and J-10. Install caps on receptacles (figure 2-44).

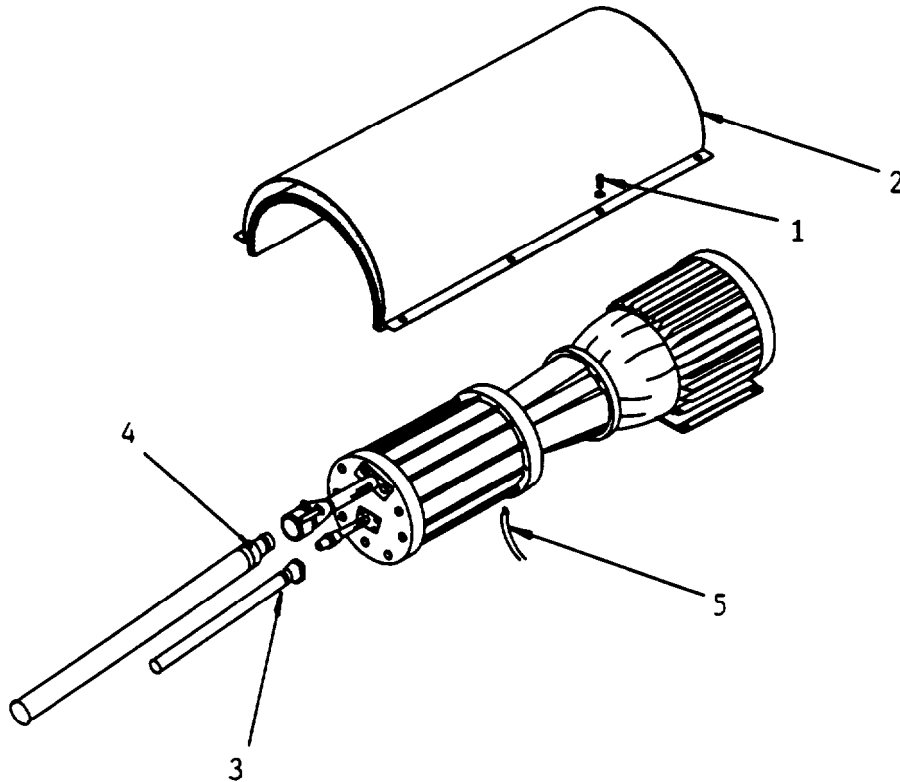


Figure 2-76a. Draining of R.O. Pump
(Models H-9518-1, H-9519-2, and H-9518-3)

2-17. PREPARATION FOR MOVEMENT - cont.

- (4) (Models WPES-30 and H-9518-3) Shutdown power supply and disconnect power cable from junction box receptacle J-1. Install cap on receptacle (figure 2-44).
1. Remove Ground Rod. Refer to figure 2-43.
 - (1) (WPES-10 and H-9518- 1) Disconnect ground strap from generator set.
 - (2) (WPES-20, H-9518-2 and WPES-30, H-9518-3) Disconnect ground strap from ROWPU frame.
 - (3) Loosen clamp and disconnect ground strap from ground rod.
 - (4) Remove drive bolt from ground rod coupler.
 - (5) Pull first section of ground rod until coupler is six inches above ground.
 - (6) Remove first section of ground rod from section still in ground.
 - (7) Repeat steps (4) and (5) and (6) until all ground rod sections are removed.
 - (8) Position ground rod sections on control panel.
 - (9) Swing plates into position over lower bolts, then tighten upper and lower bolts on both plates.
- m. Remove Distribution Pump Quick Disconnect Fittings. Refer to figure 2-29.
 - (1) Remove 1 1/2-inch male quick disconnect fitting from discharge coupling on distribution pump.
 - (2) Remove 1 1/2-inch female quick disconnect fitting from suction coupling on distribution pump.
 - (3) Screw plugs into suction and discharge couplings on distribution pump.
- n. Remove Backwash Pump Quick Disconnect Fittings. Refer to figure 2-28.
 - (1) Open draincock on bottom of backwash pump.
 - (2) Remove 2-inch male quick disconnect fitting from suction coupling on backwash pump.
 - (3) Remove 2-inch female quick disconnect fitting from backwash pump strainer.
 - (4) Remove two nuts, lockwashers, bolts, and flat washers from frame.
 - (5) Disconnect strainer from discharge coupling on backwash pump.
 - (6) Remove bracket from backwash strainer.
 - (7) Install two bolts, flat washers, lo&washers and nuts in bracket.

2-17. PREPARATION FOR MOVEMENT - cont.

- (8) Screw plug into discharge coupling.
- (9) Screw plug into suction coupling.
- (10) Position backwash strainer on top of backwash pump and secure with tie strap.

O. Remove Raw Water Pump No. 2 Quick Disconnect Fittings. Refer to figure 2-27.

NOTE

Raw water pump No. 2 has two female quick disconnect fittings.

- (1) Open drain and vent valves on raw water pump No. 2.
- (2) Remove 1 1/2-inch female quick disconnect fitting from discharge coupling of raw water pump No. 2.
- (3) Remove 1 1/2-inch female quick disconnect fitting from suction coupling of raw water pump No. 2.
- (4) Screw plugs into suction and discharge couplings of raw water pump No. 2.

p. Remove Raw Water Pump No. 1 Quick Disconnect and Strainer Fittings. Refer to figure 2-26.

NOTE

Raw water pump No. 1 has both a male and female quick disconnect fitting.

- (1) Open drain and vent valve on raw water pump No. 1.
- (2) Remove 1 1/2-inch male quick disconnect fitting from raw water strainer.
- (3) Remove 1 1/2-inch male quick disconnect fitting from discharge coupling.
- (4) Remove 1 1/2-inch female quick disconnect fitting from suction coupling.
- (5) Screw plugs into suction and discharge couplings on raw water pump No. 1.

q. Remove Control Panel Quick Disconnect Fittings. Refer to figure 2-25.

- (1) Remove 1 1/2-inch male quick disconnect fittings from PRODUCT WATER, BRINE, and RAW water hose couplings on control panel.
- (2) Install caps on PRODUCT WATER, BRINE, and RAW water hose couplings on control panel.
- (3) Remove 2-inch male quick disconnect fittings from WASTE, VENT VESSELS, and BACKWASH water hose couplings on control panel.
- (4) Install caps on WASTE, VENT VESSELS, and BACKWASH water hose couplings on control panel.

2-17. PREPARATION FOR MOVEMENT - cont.

- r. Stow accessories. (Applies only to Models WPES-10, WPES-20, and WPES-30). Refer loading plan in figure 2-24 and stow accessories as follows:

CAUTION

To prevent damage to R.O. elements, elements must not be stored or exposed to freezing temperatures.

- (1) If ROWPU will be placed in administrative storage or subject to freezing temperatures, remove R.O. elements (para. 3-4) and store in boxes supplied with the unit.
- (2) Pack loose components in storage chests. Refer to loading plans on storage chest lids for position and quantity of components within each chest.

First Layer (bottom)

WARNING

Some accessories are heavy/difficult to handle. To prevent injury to personnel and damage to the equipment, four personnel are required to lift the backwash pump onto the ROWPU frame. Two personnel are required to lift the raw water pumps and distribution pump.

- (3) Stow raw water pump No. 1 and No. 2 (1 and 2) and secure to floor of ROWPU with hold down straps.
- (4) Stow backwash pump (3) and secure to floor of ROWPU with hold down straps.
- (5) Stow canvas hoses (5) behind backwash pump (3).
- (6) Stow five utility pails (11) between multimedia filter and pulse dampener.
- (7) Stow float (4) between backwash pump (3) and canvas hoses (5).
- (8) Stow lug wrench (9), R.O. element tool (6), paddle (7) and sledge hammer (8) on floor between R.O. pump and backwash pump (3).

Second Layer (middle)

NOTE

Water tanks must be positioned vertically (on end) when stowed to provide space for remaining accessories.

- (9) Stow three water tanks (15, 16 and 17) on top of R.O. pump and pulse dampener. Push tanks as far back against cartridge filter as possible.
- (10) Secure hooks of three cargo straps (24) to ROWPU frame. Pull free end of straps to front of ROWPU.
- (11) Stow one storage chest (18) on top of raw water pumps (1 and 2) and one on top of backwash pump (3). Pull chests forward until even with front of ROWPU frame.

2-16. PREPARATION FOR MOVEMENT - cont.

CAUTION

Canvas pump covers may be stowed on top of storage chest to prevent excessive wear to deionization cartridges. Stacking covers in a pile may cause difficulty stowing remaining accessories.

- (12) Fold four canvas pump covers (20) so they lay flat. Lay covers out evenly on top of storage chests (18 and 19).

Third Layer (top)

- (13) Secure both deionization cartridges (21) together with hold down, traps, then stow on top of canvas covers (20).
- (14) Stow one 1-1/2 inch hard rubber hose (22) and three 2-inch hard rubber hoses (23) on top of deionization cartridges (21).

CAUTION

Cargo straps must crisscrossed over top of stowed accessories to prevent movement of components during transport. To prevent damage to the equipment, use care not to crush components when tightening cargo straps.

- (15) Position cargo straps over accessories and connect ratchet end of strap to front of ROWPU frame. Operate ratchets until straps are tight (figure 2-22).

ROWPU Frame

- (16) (WPES-10) Stow eight 1-1/2 inch hard rubber hoses (10) in ROWPU frame.
- (17) (WPES-20 and 30) Stow eight 1-1/2 inch suction hoses (10) in ROWPU frame. Position hose ends behind chemical feed pump so that hoses will not hang off back of ROWPU frame.
- (18) Secure suction hoses to ROWPU frame with hold down straps.

NOTE

On Models WPES-20 and WPES-30 the distribution pump, chemical cans and frame, and calcium hypochlorite are shipped separately.

Rear of Trailer (WPES-10 only)

- (19) (WPES-10) Stow chemical feed cans and rack (12) on trailer. Secure chemical cans to rack, and rack to trailer frame with hold down straps.
- (20) (WPES-10) Stow distribution pump (13) on trailer frame and secure with hold down straps.
- (21) (WPES-10) Place ladder (14) on distribution pump frame and secure with hold down straps.
- (22) (WPES-10) Stow calcium hypochlorite crate on trailer frame and secure with hold down straps.

2-17. PREPARATION FOR MOVEMENT - cont.

- r. 1 Stow accessories. (Applies to Models H-9518-1, H-9518-2, and H-9518-3 only.) Refer to figure 2-24a and stow accessories as follows:

CAUTION

To prevent damage to R.O. elements, elements must not be stored or exposed to freezing temperatures.

- (1) If ROWPU will be placed in administrative storage or subject to freezing temperatures, remove R.O. elements (para. 3-4) and store in boxes supplied with the unit.
- (2) Pack loose components in storage chests. Refer to loading plans on storage chest lids for position and quantity of components within each chest.

First Layer (bottom)

WARNING

Some accessories are heavy/difficult to handle. To prevent injury to personnel and damage to the equipment, four personnel are required to lift the backwash pump onto the ROWPU frame. Two personnel are required to lift the raw water pumps and distribution pump.

- (3) Stow raw water pumps No. 1 and No. 2 (6 and 7) and secure to floor of ROWPU with hold down straps.
- (4) Stow backwash pump (9) and secure to floor of ROWPU with hold down straps.
- (5) Stow suction hoses (4) behind raw water pumps (6 and 7).
- (6) Stow canvas discharge hoses (5 and 8) between multimedia filter and raw water pumps (6 and 7).
- (7) Stow four utility pails (10), R.O. Element Tool (11), Paddle (12) and Sledge Hammer (13) on floor next to backwash pump (9).
- (8) Stow two water tanks (14 and 15) between cartridge filter and R.O. Pump.

Second Layer (middle)

- (9) Stow the two storage chest (16 and 17) on top of the raw water pumps (6 and 7)
- (10) Stow the wellpoint assembly (18) and stakes (19) on top of the backwash pump (9).
- (11) Stow the float next to the multimedia filter (20).
- (12) Stow the deionization cartridges (22) on top of the R.O. pump.
- (13) Stow a water tank (21) next to the cartridge filter.

Third Layer (Top)

- (14) Stow suction hoses (4 and 23) on top of the deionization cartridges (22) and the storage chests (16 and 17).

2-17. PREPARATION FOR MOVEMENT - cont.

CAUTION

Cargo straps must crisscross over top of stowed accessories to prevent movement of components during transport. To prevent damage to the equipment, use care not to crush components when tightening cargo straps.

- (15) Position cargo straps over accessories and connect ratchet end of strap to front of ROWPU frame. Operate ratchets until straps are tight.

NOTE

On Models H-9518-2, and H-9518-3 the distribution pump, chemical cans, frame, and calcium hypochloride are shipped separately.

Rear of Trailer (H-9518-1 only)

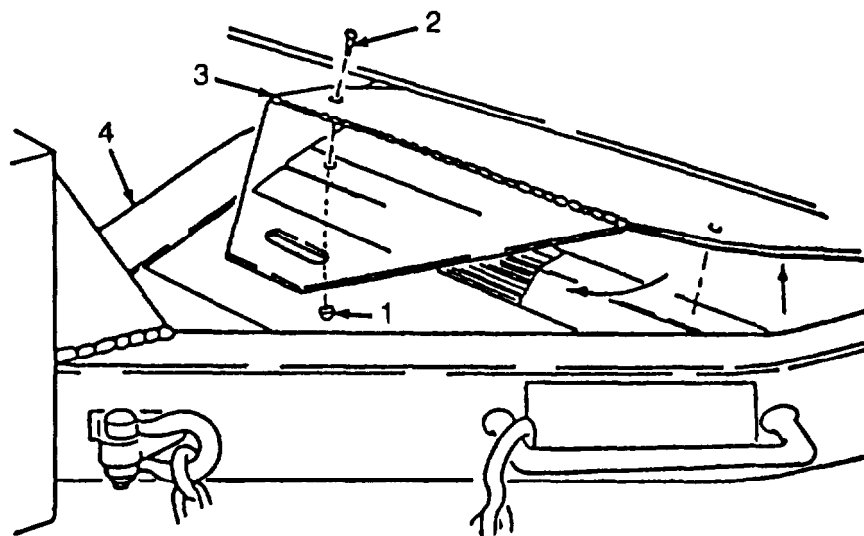
- (16) (H-9518-1) Stow chemical feed cans and rack (1) on trailer. Secure chemical cans to rack, and rack to trailer frame with hold down straps.
 - (17) (H-9518-1) Stow distribution pump (2) on trailer frame and secure with hold down straps.
 - (18) (H-9518-1) Place ladder (3) on distribution pump frame and secure with hold down straps.
 - (19) (H-9518-1) Stow calcium hypochlorite crate on trailer frame and secure with hold down straps.
- s. Install Cross Braces. Refer to figure 2-21.
- (1) Position top cross brace on ROWPU frame. While depressing detent pin with thumb, push quick release pins in both ends of top cross brace.
 - (2) Position bottom cross brace on ROWPU frame. While depressing detent pin with thumb, push quick release pins in both ends of bottom cross brace.
- t. Lower canvas cover. Refer to figure 2-20.
- (1) Unfasten tie straps and lower all four sides of canvas cover.
 - (2) Fasten corner tie straps to secure front, rear, left and right canvas panels.
 - (3) Fasten tie straps along bottom of canvas cover to ROWPU frame.

CAUTION

In order to release trailer air brake system, towing vehicle must have 90-130 psi of air pressure.

- u. (Models WPES-10 and H-9518-1) Refer to figure 2-77 and prepare trailer for movement.

2-17. PREPARATION FOR MOVEMENT - cont.

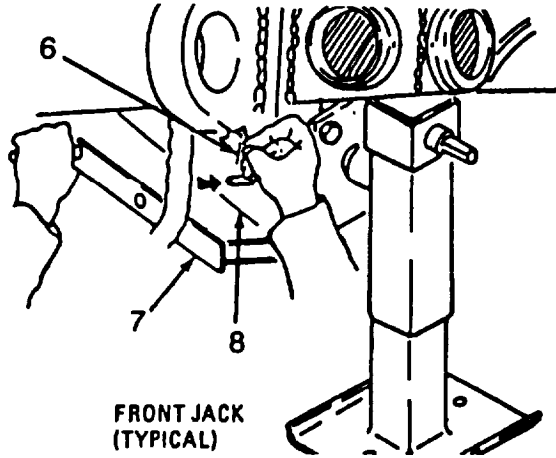


1. REMOVE NUTS (1) AND SCREWS (2) SECURING SAFETY STEP IN PLACE. LIFT STEP UP AND FOLD END PLATE (3) UNDER PLATE (4). LAY BOTH PLATES BACK DOWN AND FASTEN BOTH TO TRAILER DRAWBAR (5) WITH SECURING NUTS (1) AND SCREWS (2).

Figure 2-77. Trailer Preparation for Movement (Sheet 1 of 6)
(Models WPES-10 and H-9518-1)

2-17. PREPARATION FOR MOVEMENT - cont.

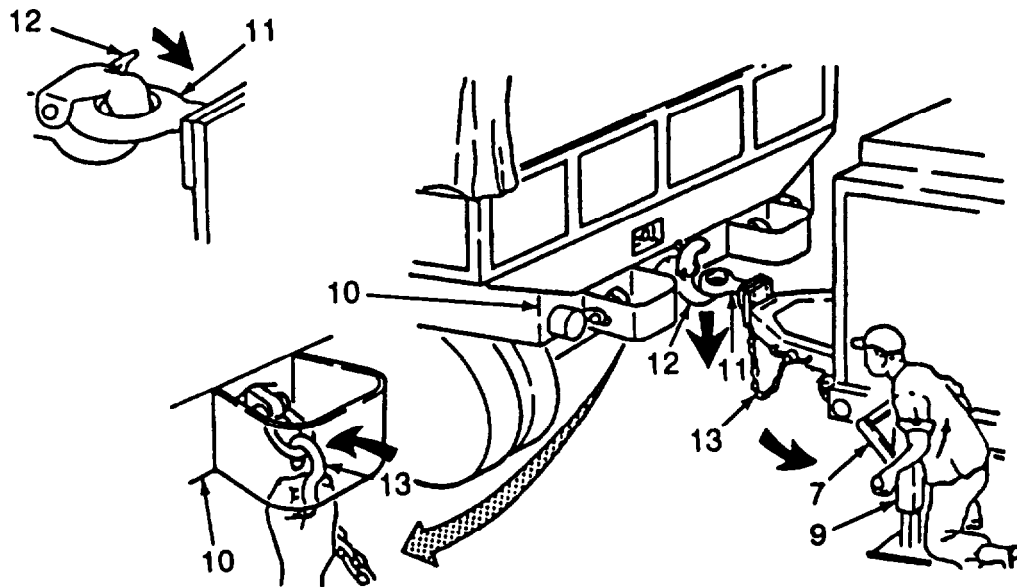
2. BACK TOWING VEHICLE INTO POSITION.



**FRONT JACK
(TYPICAL)**

3. REMOVE SAFETY PIN (6) AND CRANK HANDLE (7) FROM REAR OF JACK SUPPORT BRACKET (8).

NOTE: TWO PERSONNEL OPERATING BOTH FRONT LEVELING JACKS ARE REQUIRED TO RAISE TRAILER.

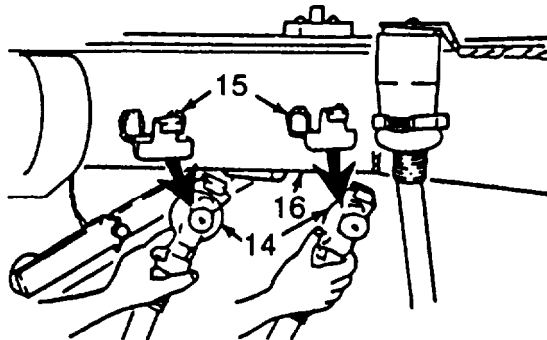


4. PLACE CRANK HANDLE (7) ON FRONT JACK (9). SLOWLY BACK TOWING VEHICLE (10) INTO POSITION SO THAT LUNETTE (11) ALIGNS WITH PINTLE (12). RAISE OR LOWER FRONT OF TRAILER AS NECESSARY TO POSITION LUNETTE (11) IN PINTLE (12). CLOSE PINTLE (12).

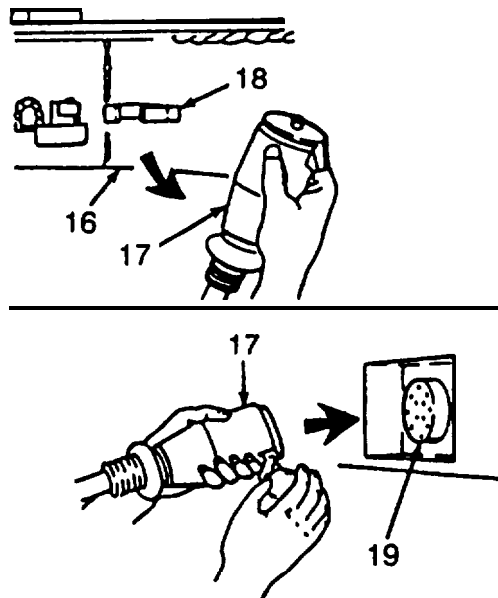
5. SECURE TRAILER SAFETY CHAINS (13) TO TOWING VEHICLE (10).

**Figure 2-77. Trailer Preparation for Movement (Sheet 2 of 6)
(Models WPES-10 and H-9518-1)**

2-17. PREPARATION FOR MOVEMENT - cont.



6. REMOVE AIR HOSES (14) FROM DUMMY COUPLINGS (15) ON TRAILER DRAWBAR (16) AND CONNECT TO TOWING VEHICLE.



7. REMOVE ELECTRICAL CONNECTOR (17) FROM STOWAGE CLIP (18) ON TRAILER DRAWBAR (16) AND CONNECT IT TO MATING RECEPTACLE (19) ON TOWING VEHICLE.

**Figure 2-77. Trailer Preparation for Movement (Sheet 3 of 6)
(Models WPES-10 and H-9518-1)**

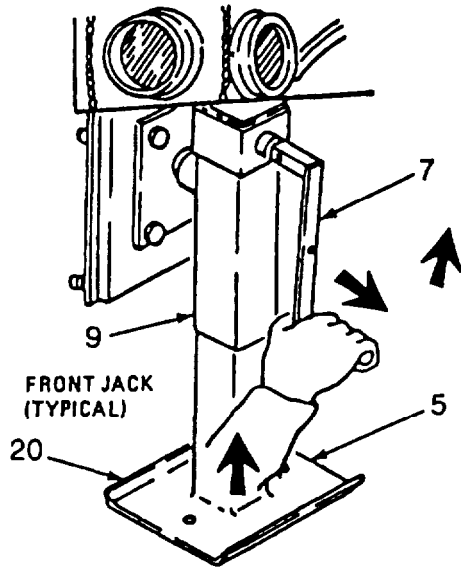
2-17. PREPARATION FOR MOVEMENT - cont.

CAUTION

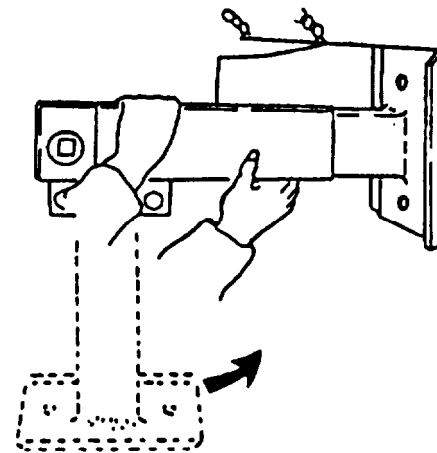
Movement of trailer without proper positioning of jacks will result in damage or destruction of jacks.

WARNING

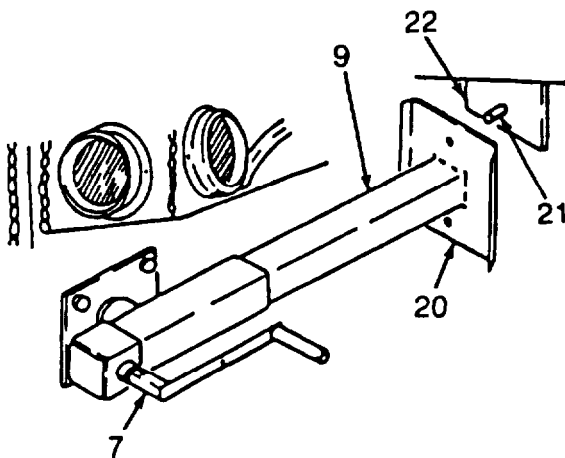
Leveling jack is spring loaded. Use care when pulling out leveling jack to prevent personal injury.



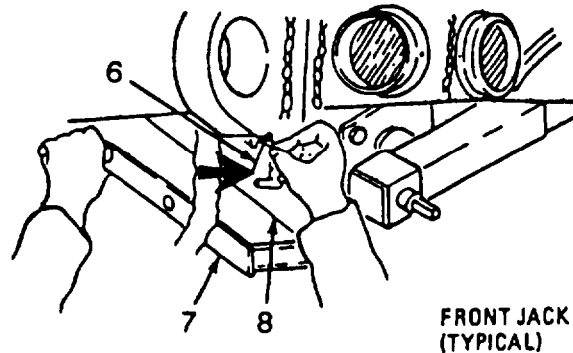
8. WITH CRANK HANDLE (7) IN POSITION ON FRONT JACK (9), TURN CRANK HANDLE COUNTERCLOCKWISE AND FULLY RAISE JACK PAD (20)



9. TO ROTATE FRONT LEVELING JACK TO HORIZONTAL POSITION, REMOVE CRANK HANDLE, GRASP JACK AND PULL STRAIGHT OUT AGAINST SPRING TENSION. ROTATE JACK UP TO HORIZONTAL POSITION. ALLOW JACK TO SPRING BACK TO COCKED POSITION.



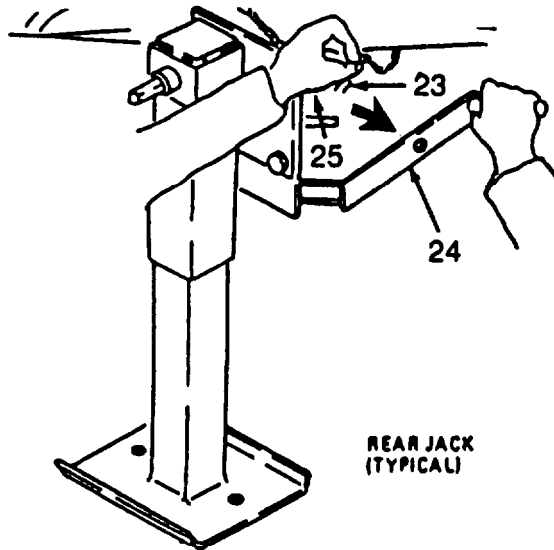
10. POSITION CRANK HANDLE (7) ON FRONT JACK (9) AND TURN HANDLE CLOCKWISE TO EXTEND JACK PAD (20). LINE UP HOLES IN JACK PAD WITH ROUND BAR (2) ON SECUREMENT PLATE (22). EXTEND JACK UNTIL JACK PAD RESTS FIRMLY AGAINST SECUREMENT PLATE.



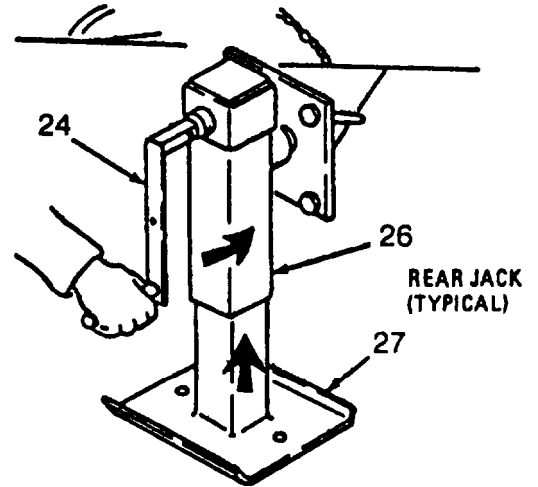
11. REPLACE CRANK HANDLE (7) ON REAR OF JACK SUPPORT BRACKET (8); INSTALL SAFETY PIN (6)

**Figure 2-77. Trailer Preparation for Movement (Sheet 4 of 6)
(Models WPES-10 and H-9518-1)**

2-16. PREPARATION FOR MOVEMENT - cont.



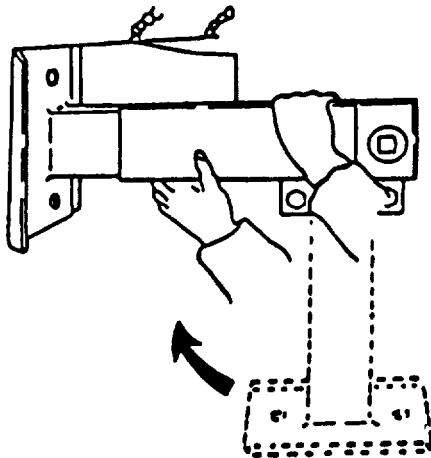
12. REMOVE SAFETY PIN (23) AND CRANK HANDLE (24) FROM REAR OF JACK SUPPORT BRACKET (25).



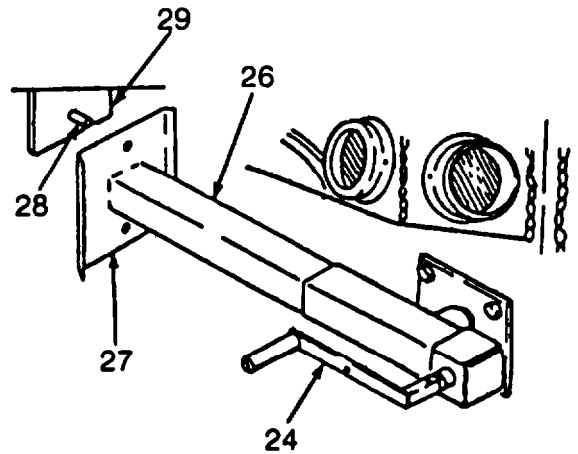
13. POSITION CRANK HANDLE (24) ON REAR JACK (26) AND TURN HANDLE COUNTERCLOCKWISE TO RAISE JACK PAD (27).

WARNING

LEVELING JACK IS SPRING LOADED. TO PREVENT INJURY TO PERSONNEL, USE CARE WHEN PULLING OUT JACK.



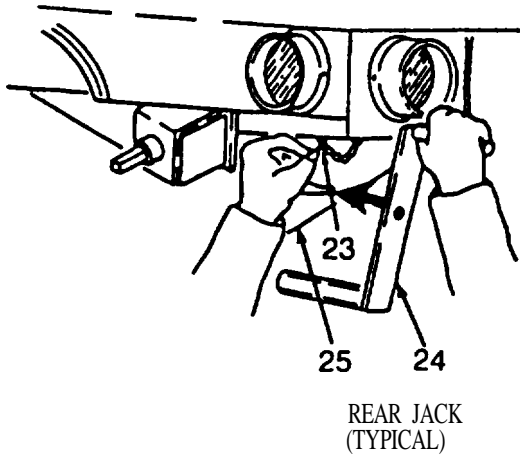
14. TO ROTATE REAR LEVELING JACK TO HORIZONTAL POSITION, REMOVE CRANK HANDLE, GRASP JACK AND PULL STRAIGHT OUT AGAINST SPRING TENSION. ROTATE JACK UP TO HORIZONTAL POSITION. ALLOW JACK TO SPRING BACK TO LOCKED POSITION.



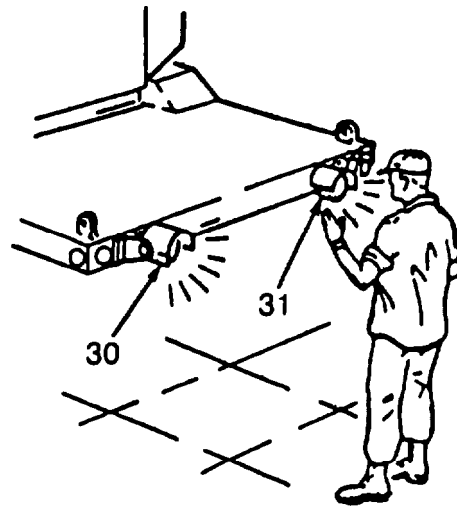
15. POSITION CRANK HANDLE (24) ON REAR JACK (26) AND TURN HANDLE CLOCKWISE TO EXTEND JACK PAD (27). LINE UP HOLE IN JACK PAD WITH ROUND BAR (28) ON SECUREMENT PLATE (29). EXTEND JACK UNTIL JACK PAD RESTS FIRMLY AGAINST SECUREMENT PLATE.

**Figure 2-77. Trailer Preparation for Movement (Sheet 5 of 6)
(Models WPES-10 and H-9518-1)**

2-16. PREPARATION FOR MOVEMENT - cont.



- 16. REPLACE CRANK HANDLE (24) ON REAR OF JACK SUPPORT BRACKET (25); INSTALL SAFETY PIN (23)



- 17. CHECK OPERATION OF TRAILER LIGHTS (30 AND 31)

**Figure 2-77. Trailer Preparation for Movement (Sheet 6 of 6)
(Models WPES-10 and H-9518-1)**

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

	Page
Emergency Procedures	2-149
Fording	2-149
Operation in Dusty and Sandy Areas.....	2-152
Operation in Extreme Cold	2-150
Operation in Extreme Heat	2-152
Operation in Nuclear, Biological or Chemical Contaminated Areas.....	2-153
Operation in Rainy and Damp Areas.	2-152
Operation in Saltwater Areas.	2-152
Water Depth/Wave Conditions.	2-149

NOTE

Refer to TM 5-6115-465-12 for operation of the generator set under unusual conditions.
Refer to TM 5-5430-227-12&P/TO 37A12-1-121 for operation of the collapsible water tanks under unusual conditions.

2-18. FORDING

Avoid submerging the ROWPU during fording. Make sure canvas cover is down and securely fastened. Large volumes of water entering the ROWPU skid may cause malfunctions in electrical devices, motors, and cabling. When fording models WPES-20, H-9518-2, WPES-30, and H-9518-3, ensure skid is mounted high enough above stream (or water source) to prevent flooding. After fording (Models WPES-10 and H-9518-1), wash the trailer with fresh water to remove mud and other contaminants as soon as possible. Pay special attention to the electrical connections and brake hoses, the leaf springs, and suspension assembly. Lubricate the entire vehicle in accordance with the instructions in the Lubricating Order, LO 10-4610-241-12/TO 40W4-13-51.

2-19. EMERGENCY PROCEDURES.

(Models WPES-10 and H-9518-1) If the air supply between the towing vehicle and the trailer air reservoir is interrupted, the emergency spring brakes will lock. Notify unit maintenance to reset locked spring brake.

In the event of a fire, electrical short, or severe equipment malfunction during operation of the ROWPU, press the EMERGENCY STOP button on the control panel.

2-20. WATER DEPTH/WAVE CONDITIONS.

When operating the ROWPU from a beach, special attention must be directed to sand conditions. Use care in placing the suction hose strainer in the raw water source. Avoid turbulent water if possible. Waves stir up silt, sand, and debris which can enter the raw water system. If waves of 2-4 feet at source water exist, or when water depth is too low to prevent sand or debris from entering raw water suction hose strainer, it will be necessary to backwash the multimedia filter more often.

2-21. OPERATION IN EXTREME COLD.

WARNING

Do not operate heater in fuel vapor areas or areas lacking adequate ventilation. Inhalation of fumes will result in serious illness or death.

- a. Locating, installing and operating the equipment at subfreezing temperatures requires taking precautions. Adequate shelter and heating are required when operating in temperatures below 32°F (0°C).
- b. When locating the equipment, take advantage of existing shelter and windbreaks.
- c. Erect tenting shelters for protection. The product water storage tanks may be installed inside a tent or other shelter. Filtered water may be recirculated with the distribution pump between the two product water storage tanks to prevent freezing in the hose lines, tank outlets and pump. Fuel, coal or wood burning heaters or other heating devices may be installed inside the erected tents to protect the equipment and prevent freezing of water. During cold weather, keep in mind all warnings, cautions, and procedures.
- d. Install canvas covers on pumps.

WARNING

To prevent hands from freezing to metal, wear rubber gloves when handling hose couplings and setting valves.

CAUTION

- If raw water hoses freeze, poor water flow will reduce pressure in R.O. pump. The R.O. PUMP LOW PRESSURE lamp will come on and R.O. pump will shut itself off. Bring hoses under cover until ice melts.
- Turn valves slowly during cold weather, because metal contracts and becomes very brittle.

NOTE

The ROWPU produces less product water when the temperature of raw water drops.

- e. During operation in extreme cold, inspect the ROWPU closely for split or frozen hoses, clogged suction and backwash strainers, and cracked couplings.

12-21. OPERATION IN EXTREME COLD - cont.

- f. When the ROWPU is shut down during cold weather (temperature falls below 32°F (0°C), remove the R.O. elements (para. 3-4), and cartridge filters (para. 3-5). Store the elements indoors or in a tent where the temperature is above freezing and allow them to dry.

WARNING

To prevent injury to personnel and damage to equipment, make sure water is drained toward lower ground at least 25 yards downstream from raw water inlet.

- g. When the equipment is shut down during cold weather (temperature falls below 32°F (0°C), perform the following steps to ensure water is drained from ROWPU piping, filters, pumps and connections.

CAUTION

To prevent damage to the equipment, all hoses must be disconnected from pumps, and all pumps, hoses, pipes and tanks drained quickly. All drain and vent valves must be opened and all equipment inspected to assure complete drainage.

- (1) Drain ROWPU pipes, filters and connections (para 2-17 b.).
- (2) Drain chemical feed pump (para 2-17 c.).
- (3) Drain booster pump (para 2-17 i.).
- (4) Drain R.O. pump (para 2-17j.).
- (5) Drain distribution pump and raw water pumps No. 1 and No. 2:
 - (a) Disconnect inlet and outlet hoses from pumps.
 - (b) Tip pumps toward each connection to permit drainage.
 - (c) Open drain and vent valves on raw water pumps No. 1 and No. 2 (figure 2-51).
 - (d) Operate pumps (39-41, figure 2-5) for less than 5 second intervals until all water is out.
 - (e) Shut off pumps.
- (6) Drain backwash pump:
 - (a) Disconnect backwash suction hose at backwash pump.
 - (b) Open draincock on bottom of backwash pump (figure 2-28). Drain pump and backwash strainer.
 - (c) Close draincock on pump.

12-22. OPERATION IN EXTREME HEAT.

CAUTION

To prevent damage to R.O. elements, keep elements out of high temperatures (100°F).

- a. When the air temperature is 90°F. (32°C.) or above, position ROWPU in the shade and leave canvas cover open and over the ROWPU. Leave control panel uncovered.

NOTE

The motors will automatically shut off if they overheat.

- b. Check water levels in raw water and product water tanks more often during hot weather.

NOTE

Plant life in water will clog multimedia filter and, therefore, reduce time between backwash cycles during hot weather.

- c. Carefully inspect wire insulation for damage.

2-23. OPERATION IN DUSTY AND SANDY AREAS.

- a. Protect equipment. Leave side covers down except over control panel.
- b. Keep ground around ROWPU damp to prevent loose, blowing sand and dirt.
- c. Cover all water storage tanks and chemical pails.

12-24. OPERATION IN RAINY AND DAMP AREAS.

CAUTION

To avoid electrical shorts, keep electrical items dry.

- a. Protect equipment. Leave canvas cover down except over control panel.
- b. Provide good water drainage.
- c. Protect chemicals from humidity and rain. Make sure chemical packages, boxes and containers are tightly closed.

12-25. OPERATION IN SALTWATER AREAS.

NOTE

This procedure should be used to flush salt deposits and bacteria from the system and the R.O. elements to slow corrosion and bacterial growth.

- a. After saltwater operations, in addition to the following steps, perform extended shutdown procedures (para 2-14b).

2-25. OPERATION IN SALTWATER AREAS - cont.

- b. When backwash cycle is complete, drain the backwash tank. Place the product water discharge hose into the backwash water tank.
- c. Operate the ROWPU to produce nonchlorinated product water (minimum 1,000 gallons).
- d. When the tank is full, or a minimum of 1000 gallons is produced, shutdown the ROWPU (para. 2- 14).
- e. Remove the raw water strainer and suction hose from the raw water source and place it in the tank (backwash tank) of NONCHLORINATED product water.

CAUTION

To prevent damage to the R.O. elements, do not operate the ROWPU on chlorinated water.

Chemical feed pump RUN/PRIME valves must remain in the PRIME position in the following step.

- f. Follow initial adjustments and checks (para. 2-8) and operating procedures (para. 2-9), except do not set RUN/PRIME valves to RUN. No chemicals shall be injected into the system during this procedure until the nonchlorinated tank is empty.
- g. Shutdown the ROWPU (para. 2-14a).
- h. Using distribution pump, rinse down ROWPU and all accessories.

2-26. OPERATION IN NUCLEAR, BIOLOGICAL OR CHEMICAL CONTAMINATED AREAS.

- a. General. The ROWPU is supplied with accessories that provide additional water treatment when nuclear or chemical contaminants are present in your operating area. The accessories consist of a deionization cartridge to remove nuclear contaminants, a deionization cartridge to remove chemical contaminants, and the adapters, bushing, clamps, couplings, reducers, and tubing needed to connect the cartridges to the system.

NOTE

Setup of operational equipment for use in nuclear or chemical contaminated areas requires changes in the layout and connection of both the product water and raw water systems. All other setup and preparation for use procedures are the same as operation under usual conditions.

- b. (Models WPES-10 and H-9518-1) Trailer Assembly Preparation for Use. Perform trailer assembly and preparation for use procedures (para. 2-6).
- c. Assembly and Preparation for use. Perform ROWPU assembly and preparation for use procedures, except raw water system setup (para. 2-7o) and product water system setup (para. 2-7q).

2-26. OPERATION IN NUCLEAR, BIOLOGICAL OR CHEMICAL CONTAMINATED AREAS - cont.

- d. Setup Raw Water System. Refer to figure 2-78. Working from the ROWPU control panel to the water source, connect components of the raw water system as follows:

WARNING

To prevent contamination of product water system, do not use discharge hoses intended for potable product water in the raw water system. Product water hoses are identified by a blue stripe running the full length of the hose.

NOTE

- ROWPU should be positioned as close as possible to the water source.
- Raw water pump No. 1 has a female coupling on the pump suction port and male on the discharge port. Pump No. 2 has a female fitting on both suction and discharge PO-.
- Use the minimum number of discharge hoses required between control panel and raw water pump No. 2.

- (1) Connect discharge hoses between RAW WATER coupling on control panel and discharge coupling of raw water pump No. 2.

CAUTION

Ensure all seals are in place and quick disconnect coupling are locked. Raw water pumps will not prime if suction hoses draw air.

NOTE

Use the minimum number of suction hoses required to reach the water source.

- (2) Connect three hard rubber suction hoses to suction coupling of raw water pump No. 2.

CAUTION

To prevent damage to the ROWPU, do not operate raw water pump without strainer.

- (3) Connect strainer to end of last suction hose.
- (4) Connect float to strainer with enough rope to allow strainer to go under water, but not touch bottom.
- (5) Place strainer and float in water source. Avoid placing strainer near sandy areas.
- (6) Connect raw water pump No. 2 electrical cable to RAW WATER PUMP NO. 2 receptacle on control panel.
- (7) Check security of all hose connections.

2-26. OPERATION IN NUCLEAR, BIOLOGICAL OR CHEMICAL CONTAMINATED
AREAS - cont.

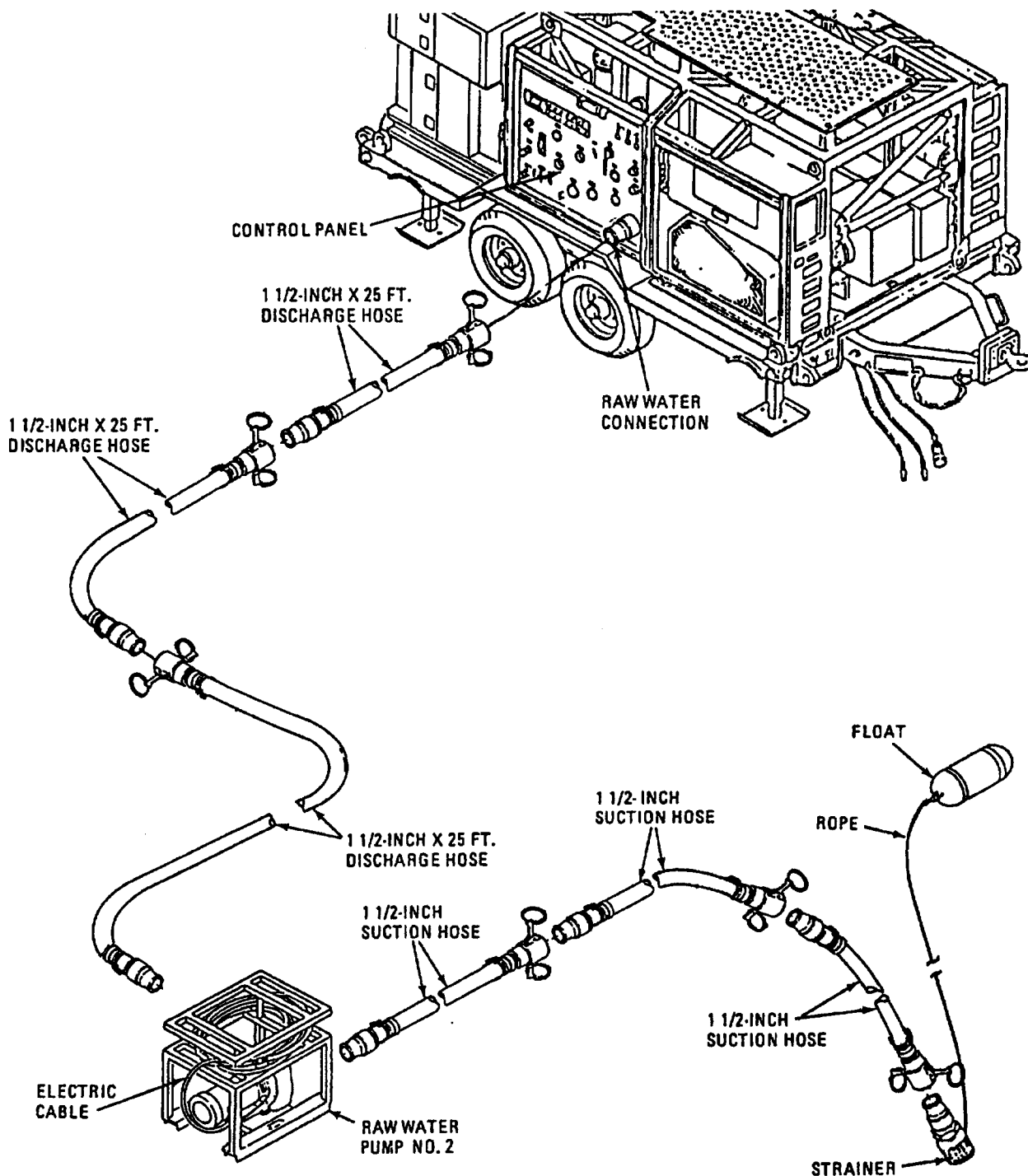


Figure 2-78. Raw Water System Setup for Operation in Nuclear, Biological or Chemical Contaminated Areas

2-26. OPERATION IN NUCLEAR, BIOLOGICAL, OR CHEMICAL CONTAMINATED
AREAS - cont.

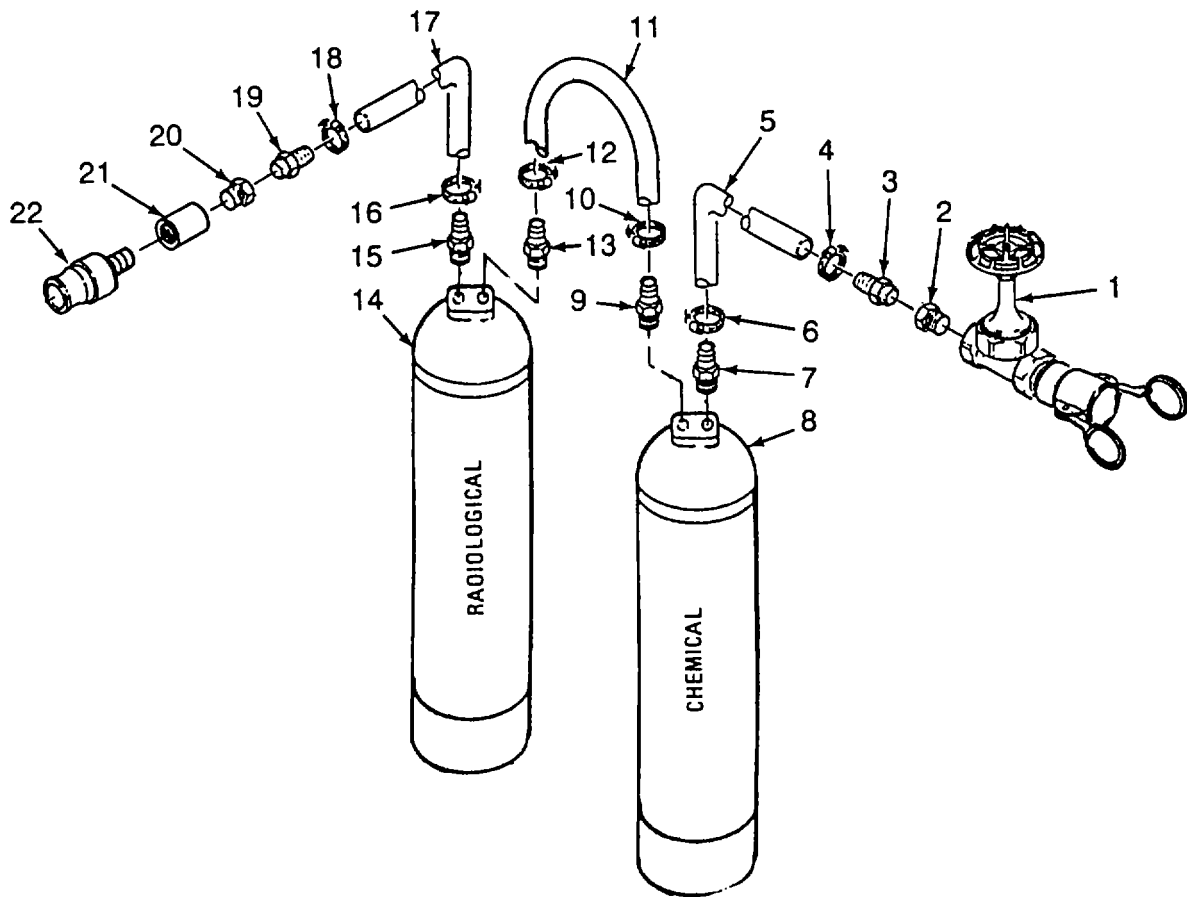


Figure 2-79. Nuclear, Biological and Chemical Filter System Assembly.

2-26. OPERATION IN NUCLEAR, BIOLOGICAL OR CHEMICAL CONTAMINATED AREAS - cont.

- (11) Connect tube section (11) to barbed adapter (9) on OUTLET port of chemical cartridge (8). Position hose clamp (10) over barbed adapter, then tighten clamp.
 - (12) Connect other end of tube section (11) to barbed adapter (13) on INLET port of nuclear cartridge (14). Position hose clamp (12) over barbed adapter, then tighten clamp.
 - (13) Connect tube section (17) to barbed adapter (15) on OUTLET port of nuclear cartridge (14). Position hose clamp (16) over barbed adapter, then tighten clamp.
 - (14) Install male coupling (22) and bushing (20) on pipe coupling (21).
 - (15) Install barbed adapter (19) on bushing (20).
 - (16) Connect tube section (17) to barbed adapter (19) and install hose clamp (18). Position hose clamp (18) over barbed adapter, then tighten clamp.
- g. Setup Product Water System. Refer to figure 2-80. Working from the ROWPU control panel to product water dispensing point, connect components of the product water system with the nuclear and chemical filter system as follows:

WARNING

To prevent contamination of product water system, do not use discharge hoses intended for raw or brine water in the product water system. Product water hoses are identified by a blue stripe running the full length of the hose.

- (1) Position and setup two product water tanks in accordance with TM 5-5430-227-12&P/TO 37A12-1-121.
- (2) Install adapter on product water tank No. 1 and plug in tank inlet coupling.
- (3) Install adapter on product water tank No. 2 outlet coupling and plug in tank inlet coupling.
- (4) Connect suction hose and canvas discharge hose to PRODUCT WATER coupling on control panel. Place end of canvas discharge hose in product water tank No. 1.
- (5) Connect suction hose between adapter on outlet coupling of product water tank No. 1 and suction coupling of raw water pump No. 1.
- (6) Connect gate valve (1, figure 2-79) of nuclear and chemical filter system to discharge coupling on raw water pump No. 1.
- (7) Connect discharge hose (figure 2-80) to male quick disconnect coupling (22, figure 2-79) on nuclear and chemical filter system. Place other end of discharge hose in top of product water tank No. 2 (figure 2-80).
- (8) Connect suction hose between product water tank No. 2 outlet adapter and distribution pump suction coupling.
- (9) Connect discharge hose to discharge coupling on distribution pump.

2-26. OPERATION IN NUCLEAR, BIOLOGICAL OR CHEMICAL CONTAMINATED AREAS - cont.

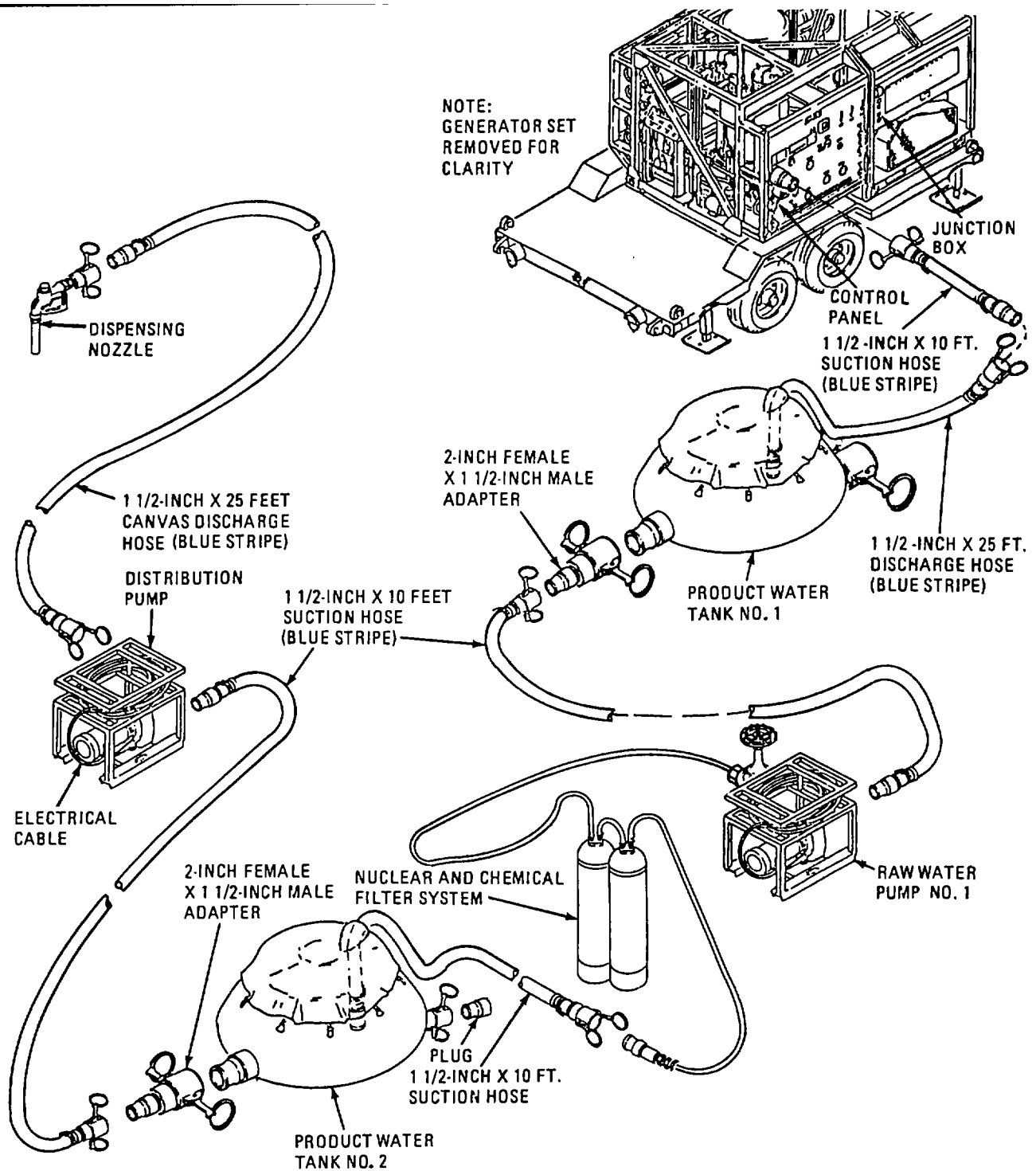


Figure 2-80. Product Water Setup for Operation in Nuclear, Biological or Chemical Contaminated Areas.

2-26. OPERATION IN NUCLEAR, BIOLOGICAL, OR CHEMICAL CONTAMINATED AREAS - cont.

- (10) Connect dispensing nozzle to end of discharge hose.
- (11) Connect distribution pump electrical cable to DISTRIBUTION PUMP receptacle on junction box.
- (12) Connect raw water pump No.1 electrical cable to RAW WATER PUMP NO. 1 receptacle on junction box.

CAUTION

Ensure all seals are in place and quick disconnect coupling are locked.

- (13) Check security of all coupling connections.
 - (14) Set CHLORINE RUN/PRIME valve (figure 2-60) to PRIME position.
 - (15) Disconnect chemical feed hoses from CHLORINE chemical can (figure 2-42).
 - (16) Remove lid (figure 2-41) from CHLORINE chemical can and insert chemical feed hoses into top of can. Make sure suction hose (female quick disconnect fitting) is not submerged in the chlorine solution.
- h. During NBC operation, manually chlorinate product water tank No. 2. You MUST check with base medical personnel for safe chlorinating instructions.
 - i. With exception of the CHLORINE chemical feed pump, operate the ROWPU using normal operating procedures.

WARNING

To prevent injury to personnel, deionization cartridges must be replaced after 100 hours of use.

NOTE

(Model WPES-10) The generator set hourmeter may be used to record start, stop and operating time of deionization cartridges.

- j. After 100 hours of use, remove both deionization cartridges and replace with new cartridges.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

Section I.	Lubrication Instructions
Section II.	Operator Troubleshooting
Section III.	Operator Maintenance Procedures

Section I. LUBRICATION INSTRUCTIONS

Refer to Lubrication Order LO 10-4610-241.12/TO 40W4-13.51 for lubrication instructions for the flatbed cargo trailer and ROWPU.

Section II. OPERATOR TROUBLESHOOTING

3-1. INTRODUCTION.

- a. The troubleshooting table lists the common malfunctions which you may find during operation of the ROWPU and flatbed cargo trailer. You should perform the tests, inspections and corrective actions in the order they appear in the table.
- b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify the appropriate supervisor.

3-2. MALFUNCTION INDEX.

Malfunction	Page
Flatbed Cargo Trailer (Models WPES-10 and H-9518-1) (Table 3-1)	
Electrical	
Lights not operating properly	3-2
Air Brake System	
System inoperative or brakes remain locked	3-3
ROWPU (Table 3-2)	
1 Lamp indicator failure	3-3
2 Raw water flow indicator drops to near zero; both raw water pump lamps are on	3-4
3 Cartridge filter gauge rises above 20 psid	3-5
4 Reduced product water flow; R.O. pressure psi adjusted to 960 for saltwater, 500 for fresh and brackish water	3-5
5 Product water flow reading rises above 16 gpm (fresh/brackish), 12 (seawater) and cannot be lowered using regulate product flow valve	3-6

3-2. MALFUNCTION INDEX - cont.

Malfunction	ROWPU - cont.	Page
6 R.O. pressure psig goes above 960 psi in saltwater operation, 500 in fresh or brackish water operation		3-8
7 Backwash pump runs continuously		3-8
8 Backwash water flow reading drops to near zero during backwash		
9 Distribution nozzle delivers little or no product water; Distribution pump lamp is on		3-10
10 Rump lamp on control box assembly does not light when switch is set to start.....		3-10
11 R.O. pump shuts down by itself; R.O. Rump low pressure lamp comes on		3-12
12 R.O. pump shuts down automatically; R.O. pump high pressure lamp goes on.....		3-13
13 Backwash pump does not start when start backwash switch is set to start.....		3-13
14 Multimedia filter vent line doesn't discharge water.....		3-14
15 Chemical feed pump fails to operate		3-14
16 Product water total dissolved solids (TDS) level is above 1000 ppm		3-14

3-3. TROUBLESHOOTING FLATBED CARGO TRAILER (MODELS WPES-10 and H-9518-1).

Refer to Table 3-1.

Table 3-1. Troubleshooting Flatbed Cargo Trailer (Models WPES-10 and H-9518-1)

WARNING

Be sure to read ALL Warnings in front of manual before troubleshooting.

**MALFUNCTION
 TEST OR INSPECTION
 CORRECTIVE ACTION**

ELECTRICAL

LIGHTS NOT OPERATING PROPERLY.

Notify unit maintenance.

Table 3-1 .Troubleshooting Flatbed Cargo Trailer (Models WPES-10 and H-9518-1)- cont.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

AIR BRAKE SYSTEM.

SYSTEM INOPERATIVE OR BRAKES REMAIN LOCKED.

- Step 1. Inspect air line hookup to be sure lines are not crossed.
Disconnect air lines and reconnect correctly.
- Step 2. Listen for escaping air, and locate defective line or fixture.
Notify unit maintenance.
- Step 3. Check the air system of the towing vehicle for leaks or lack of pressure.
Notify unit maintenance.

3-4. TROUBLESHOOTING ROWPU.

Refer to table 3-2.

WARNING

Be sure to read ALL Warnings in front of manual before troubleshooting.

Table 3-2. Operator Troubleshooting (ROWPU)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. LAMP INDICATOR FAILURE.

- Step 1. Check that dimmer lens is open.
- Step 2. Test control panel using TEST INDICATOR LIGHTS switch (44, figure 2-5) on control box.
Replace defective bulb using lamp puller (para. 3-8).
If lamp still does not operate, notify unit maintenance.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

- Step 3. Check to see if associated pump is operating. For R.O. pump (on Models WPES-10, WPES-20, and WPES-30) see if sheave is turning; for other pumps, set hand lightly on the motor casing to feel for motor vibrations.
- a. If pump is not operating, check and reset respective circuit breaker (figure 2-5) in junction box and then immediately try to restart pump. Do so only one time.
 - b. If pump fails to start, notify unit maintenance.
 - c. Shut down ROWPU in normal manner (para. 2-14a) except when only one raw water pump fails or distribution pump fails. In these two cases the ROWPU can still be operated.

2. RAW WATER FLOW INDICATOR DROPS TO ZERO; BOTH RAW WATER PUMP LAMPS ARE ON.

- Step 1. Check to see that both raw water pumps are operating. Listen to motor and rest hand lightly on motor casing to feel for vibration.
- a. If pump is not operating, check and reset circuit breaker (figure 2-5) and then immediately attempt to restart. Do so only one time.
 - b. If pump fails to start, notify unit maintenance and remove defective raw water pump from system.

Step 2. Check to see if suction strainer is completely under water.

- a. Lengthen strainer rope.
- b. Move suction strainer to deeper water.

Step 3. Check to see if suction strainer is clogged.

- a. Clean debris from suction strainer (par-a. 3-6).
- b. Shorten strainer rope so strainer does not rest on bottom of raw water source.
- c. Make sure raw water pump is sufficiently close to raw water source.

Step 3.1 If ocean intake structure is being used, check to insure that wellpoints are secure and have not been dislodged.

Install wellpoints (para. 2-7o.1).

Step 4. Check and reprime pumps.

Step 5. Check for loose hose connections or damaged hose sections.

- a. Tighten loose connections.
- b. Replace damaged hose sections.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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c. Replace damaged gaskets.

Step 6. Check for kinked hoses.

Unkink hoses.

3. CARTRIDGE FILTER GAUGE RISE ABOVE 20 PSID.

Make a turbidity tube check (para. 2-9i) of water taken from DRAIN NO. 1 CARTRIDGE FILTER valve (figure 2-59).

- a. If water is turbid, shutdown ROWPU in normal manner (para. 2-14a) and change cartridge filter tubes (para. 3-5).
- b. If water is clear, notify unit maintenance (gage may be defective).

4. REDUCED PRODUCT WATER FLOW; R.O. PRESSURE PSI ADJUSTED TO 960 FOR SALTWATER, 500 FOR FRESH AND BRACKISH WATER.

NOTE

ROWPU produces less product water when raw water source temperature drops.

Step 1. Check R.O. vessels for leakage past end caps.

- a. Tighten loose nuts (para. 3-4).
- b. If vessel continues to leak, notify unit maintenance.

Step 2. Check R.O. vessel gauge for reading higher than 100 psid.

NOTE

Membrane scaling will cause reduced product water flow and increased R.O. vessels pressure. Cleaning elements when vessel pressure is under 100 psid may improve flow.

- a. Clean R.O. elements (para. 2-12).
- b. If cleaning R.O. elements does not improve product water flow, replace R.O. elements (para. 3-4).

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

5. PRODUCT WATER FLOW READING RISES ABOVE 16 GPM (FRESH/BRACKISH), 12 (SEAWATER) AND CANNOT BE LOWERED USING REGULATE PRODUCT FLOW VALVE.

Step 1. Check the TDS of product water from each R.O. vessel:

WARNING

Water is under pressure and will discharge rapidly. DO NOT disconnect product water hoses.

- a. Use sample valves (figure 2-47) to collect product water sample. DO NOT disconnect product water hoses.
- b. Check TDS of sample from each R.O. vessel using TDS meter without range extender (para. 2-15c(5)).
- c. Use readings to make a chart similar to the following:

R.O. Vessel	TDS (ppm)
1 (Top)	600
2	900
3	1100
4 (Bottom)	1400

NOTE
Numbers on charts are examples only. Yours may vary

- d. Examine pattern of chart. TDS readings should get larger from top to bottom.
 - (1) If any R.O. vessel does not follow this pattern, there is something wrong inside; disassemble faulty vessel and replace defective items (para. 3-4).
 - (2) If R.O. vessels all follow this pattern, proceed to Step 2.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

5. **PRODUCT WATER FLOW READING RISES ABOVE 16 GPM (FRESH/BRACKISH), 12 (SEAWATER) AND CANNOT BE LOWERED USING REGULATE PRODUCT FLOW VALVE cont.**

CONDITION	MEASURED TDS		CAUSE
	FRONT SAMPLE	REAR SAMPLE	
1	NORMAL	NORMAL	Vessel operation OK
2	HIGH	NORMAL	Leak at front end connector preformed packing*
3	NORMAL	HIGH	Leak at rear end connector Preformed packing*
4	HIGH	HIGH	Leak at front and rear end connector Preformed packing and/or R.O. element interconnector Preformed packing* *Condition could also be caused by defective R.O. element.

Step 2. Check product water flow from each R.O. vessel.

- a. Use same method as in Step 1 to collect product water sample, but this time measure the time in minutes it takes to fill a 3-gallon bucket with product water from each vessel. Divide the number of minutes by three.
- b. Make a chart like the following:

R.O. Vessel	Flow in GPM
1 (-Top)	4
2	3
3	2
4 (Bottom)	1

- c. Examine your chart for a similar pattern. Flow rate should get smaller from top to bottom.
 - (1) If any R.O. vessel does not follow this pattern, disassemble that vessel and replace defective items (para. 3-4).

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	(2)	If all vessels follow this pattern, notify unit maintenance to check for defective PRODUCT FLOW indicator.
6. R.O. PRESSURE PSIG. GOES ABOVE 960 PSI IN SALTWATER OPERATION, 500 IN FRESH OR BRACKISH WATER OPERATION.		
	Step 1.	Check R.O. VESSELS gage. If indication is above 100 psid, clean R.O. element (para. 2-13).
	Step 2.	Check PRODUCT WATER FLOW gage. a. If flow is less than 10 gpm (fresh and brackish water), clean R.O. elements (para. 2-13). b. If flow is less than 6 gpm (salt water), clean R.O. elements (para. 2-13).
	Step 3.	Check raw water TDS, if TDS has increased noticeably, open REGULATE PRODUCT FLOW valve to adjust R.O. pressure and maintain 10 gpm (fresh/brackish water) or 6 gpm (saltwater). If product water flow cannot be maintained, clean R.O. elements (para. 2-13).
7. BACKWASH PUMP RUNS CONTINUOUSLY.		
	Step 1.	Check position of R.O. ELEMENT CLEANING switch (24, figure 2-5). Switch must be OFF except during R.O. element cleaning. Set ELEMENT CLEANING switch to OFF position.
	Step 2.	Notify unit maintenance to troubleshoot BACKWASH TIMER and its electrical wires.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

**8. BACKWASH WATER FLOW READING DROPS TO NEAR ZERO DURING BACKWASH OPERATION;
BACKWASH PUMP LAMP IS ON.**

Step 1. Check water level in backwash water tank.

NOTE

There is a period of about 15 seconds when the flow gauge will drop to "0" before returning to normal reading. This is normal.

- a. If water level is below backwash pump intake, immediately shut off backwash pump (set circuit breaker CB-2 to off). Wait until backwash cycle is complete, then start normal operation and allow backwash tank to fill. When backwash tank is filled, perform backwash cycle.
- b. Patch any leaks in backwash water tank (refer to TM 5-5430-227-12&P/TO 37A12-1-121).

Step 2. Check for closed or clogged gate valve at backwash water tank (figure 2-37).

- a. Open closed gate valve by turning handle fully to the left until it stops (counterclockwise).
- b. Clean clogged valve.

Step 3. Check for clogged backwash strainer or BACKWASH PUMP suction opening.

Flush remove and clean backwash strainer screen (para. 3-6).

Step 4. Check for leaking hoses, gaskets and fittings.

Replace defective hoses and fittings.

Step 5. Check for kinked hoses.

Unkink hoses.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

8. BACKWASH WATER FLOW READING DROPS TO NEAR ZERO DURING BACKWASH OPERATION; BACKWASH PUMP LAMP IS ON. cont.

Step 6. Check that backwash pump is primed.

Prime backwash pump.

9. DISTRIBUTION NOZZLE DELIVERS LITTLE OR NO PRODUCT WATER; DISTRIBUTION PUMP LAMP IS ON.

Step 1. Check for kinked hoses.

Unkink hoses.

Step 2. Check for water level below distribution pump intake in product water tank.

a. Patch any leaks in product water tanks (refer to TM 5-5430-227-12&P/TO 37A12-1-121).

b. Continue operations to produce product water.

Step 3. Check for loose hose connections, leaking hose, or gaskets.

a. Tighten loose connections.

b. Replace defective gaskets.

c. Replace leaking hose.

Step 4. Check distribution nozzle for broken parts or inoperative handle.

Replace defective distribution nozzle.

10. PUMP LAMP ON CONTROL BOX ASSEMBLY DOES NOT LIGHT WHEN SWITCH IS SET TO START.

NOTE

Step 1 and 2 applies only to normal start of the raw water pump. If other pump lamps do not light when started in proper order, go to step 3.

Step 1. Ensure the EMERGENCY STOP button (33, figure 2-5) is pulled out.

Pull EMERGENCY STOP button out.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

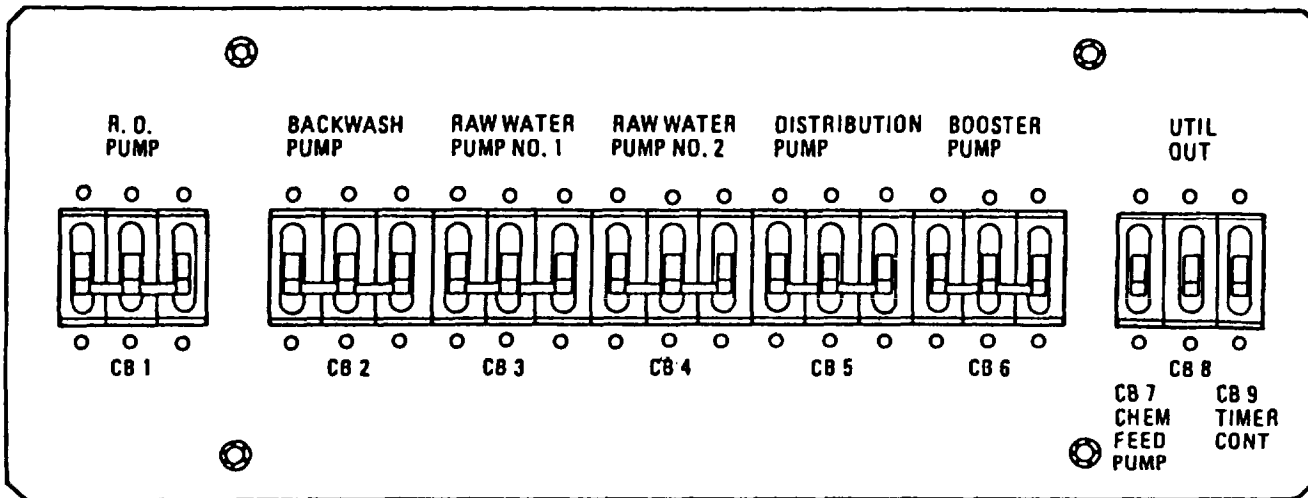
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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10. PUMP LAMP ON CONTROL BOX ASSEMBLY DOES NOT LIGHT WHEN SWITCH IS SET TO START - cont.		
	Step 2. Check to see if ROWPU is receiving power from power source. R.O. pump LOW PRESSURE LAMP should be on and panel light should work if ROWPU is receiving power. Check that dimmer on lamp is open.	
	a.	Set TEST INDICATOR LIGHT switch (44, figure 2-5) to TEST- If no lights come on, make sure power source is securely plugged into junction box.
	b.	Troubleshoot power source using applicable manual.
	Step 3. Check to see if associated pumps are operating. For R.O. pump, see if sheave is turning.	
	a.	If motor is running, replace switch indicator lamp bulb (para. 3-8).
		NOTE
		If new bulb does not light, notify unit maintenance to troubleshoot lamp socket and wiring.
	b.	If motor is not running, go to step 4.
		<u>WARNING</u>
		Electric shock can cause severe injury or death. Do not touch anything in the junction box except the circuit breaker handle.
	Step 4. Check circuit breakers in junction box.	
	a.	Reset circuit breaker.
	b.	Attempt to start pump.
	c.	If pump will not start, notify unit maintenance.

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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10. PUMP LAMP ON CONTROL BOX ASSEMBLY DOES NOT LIGHT WHEN SWITCH IS SET TO START - cont.



11. RO. PUMP SHUTS DOWN BY ITSELF; R.O. PUMP LOW PRESSURE LAMP COMES ON.

Step 1. Check RAW WATER gauge for normal flow.

- a. Check that raw water pump is operating.
- b. Check for clogged suction strainer (para. 3-6) and that strainer is completely under water.
- c. Check raw water suction hose for air leaks.
- d. If low flow still exists, move raw water pump closer to water source.
- e. If raw water flow is normal, go to step 2.
- f. See 3.1, page 3-4.

Step 2. Check to see if booster pump is operating.

- a. If pump is not operating, reset circuit breaker if necessary and try to restart pump. If pump will not start notify unit maintenance.
- b. If booster pump is operating, check for clockwise rotation (from fan end).

Step 3. Check to see if cartridge filter gauge reads over 20 psid.

If over 20 psid, change cartridge filter tubes (para. 3-5).

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

11. R.O. PUMP SHUTS DOWN BY ITSELF; R.O. PUMP LOW PRESSURE LAMP COMES ON - cont.

Step 4. Check to see if MULTIMEDIA FILTER gauge has risen 5 psid over reading at startup.

- a. If yes, backwash multimedia filter (para. 2- 10).
- b. If no, go to step 5.

Step 5. Make turbidity test of water taken from DRAIN NO. 1 CARTRIDGE FILTER valve (figure 2-59).

- a. If water is turbid, shut down ROWPU in normal manner (para. 2-14) and change cartridge filter tubes (para. 3-5).
- b. If water is clear, notify unit maintenance.

12. R.O. PUMP SHUTS DOWN AUTOMATICALLY; R.O. PUMP HIGH PRESSURE LAMP GOES ON.

WARNING

If high pressure relief valve did not activate before R.O. pump high pressure switch, notify unit maintenance. Continued operation may injure personnel or damage the equipment.

Step 1. If high pressure relief valve did not open, notify unit maintenance.

Step 2. Check brine hose for kinks.

Unkink hose.

Step 3. Clean R.O. elements (para. 2-13) then attempt to start normal operation (para. 2-9).

Step 4. If R.O. PUMP RESET switch does not turn off R.O. PUMP HIGH PRESSURE lamp, there may be a defective switch. Notify unit maintenance.

13. BACKWASH PUMP DOES NOT START WHEN START BACKWASH SWITCH IS SET TO START.

Step 1. Check that BACKWASH PUMP CB-2 circuit breaker in junction box is set to on (up).

Reset BACKWASH PUMP CB-2 circuit breaker to on (up).

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

13. BACKWASH PUMP DOES NOT START WHEN START BACKWASH SWITCH IS SET TO START - cont.

Step 2. Open backwash timer cover and press OVERCURRENT PROTECTION PUSH TO RESET switch (figure 2-65) (On Models WPES-10, WPES-20, and WPES-30). On Models H-9518-1, H-9518-2, and H-9518-3, reset the circuit breaker inside the timer (figure 2-15).

- a. Check for loose power cable on backwash timer and backwash pump.
- b. If backwash cycle still will not start, notify unit maintenance.

14. MULTIMEDIA FILTER VENT LINE DOESN'T DISCHARGE WATER

Notify unit maintenance.

15. CHEMICAL FEED PUMP FAILS TO OPERATE.

Step 1. Check for closed vent on chemical feed can lid (figure 2-41). Open vent.

step 2. Check solution level in chemical can.

Refill chemical can as required.

Step 3. If pump fails to prime after setting chemical feed pump control knob to 10, inspect the chemical feed suction hose from the chemical can to the chemical feed pump. Movement of chemical solution in hose should be visible.

- a. Lift and hold chemical can above frame until solution can be seen flowing through chemical feed hose.
- b. If chemical feed pump still will not operate, notify unit maintenance.

Step 4. Clean chemical feed pump check valves (para. 3-11).

16. PRODUCT WATER TOTAL DISSOLVED SOLIDS (TDS) LEVEL IS ABOVE 1000 PPM.

Step 1. Check product water from each R.O. pressure tube as follows:

- a. Operate the ROWPU (para. 2-9).
- b. Adjust product water flow for 6-12 gpm (not to exceed 960 psi for saltwater) up to 16 gpm (not to exceed 500 psi for fresh/brackish water).

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

16. PRODUCT WATER TOTAL DISSOLVED SOLIDS (TDS) LEVEL IS ABOVE 1000 PPM cont.

- c. Using vent/sample valves (figure 2-47), collect sample product water from each R. O. pressure tube.
- d. Using clean container, collect a sample of product water from front and rear vent/sample valves of R.O. Vessel 1. Be sure to rinse container three times with sample water before collecting sample. Record reading as front and rear sample.
- e. Measure TDS of each product water sample using the TDS meter (para. 2-15).
- f. Based on the TDS measurements of the collected samples, one of the following four conditions can exist:

CONDITION	MEASURED TDS		CAUSE
	FRONT SAMPLE	REAR SAMPLE	
1	NORMAL	NORMAL	Vessel operation OK
2	HIGH	NORMAL	Leak at front end connector preformed packing*
3	NORMAL	HIGH	Leak at rear end connector Preformed packing*
4	HIGH	HIGH	Leak at front and rear end connector Preformed packing and/or R.O. element interconnector Preformed packing* *Condition could also be caused by defective R.O. element.

Condition 1: Repeat steps c through f for all remaining vessels to determine the correct source(s) of high TDS.

Condition 2: Remove front end cap and end connector and check condition, lubrication, and size of preformed packings. Replace damaged or wrong-size preformed packing(s) lubricating with lubricant found in Storage chest before installation. Carefully reinstall end connector and end cap (para. 3-4).

Condition 3: Remove rear end cap and end connector and check condition, lubrication, and size of preformed packings. Replace damaged or wrong-size preformed packing(s), lubricating Preformed packing with lubricant found in storage chest before installation. Carefully reinstall end connector and end cap (para. 3-4).

Table 3-2. Operator Troubleshooting (ROWPU) - cont.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

16. PRODUCT WATER TOTAL DISSOLVED SOLIDS (TDS) LEVEL IS ABOVE 1000 PPM cont.

Condition 4: Remove the R.O. elements from the pressure vessel (para. 3-4). Check condition, lubrication, and size of all preformed packings and installation of end connectors. Replace damaged or wrong-size preformed packing(s), lubricating preformed packings with lubricant found in Storage chest No. 2 before installation. Carefully install elements and end caps (para. 3-4).

- g. Adjust product water flow for 6-12 gpm (not to exceed 960 psi for saltwater) up to 16 gpm (not to exceed 500 psi for fresh/brackish water).
- h. For each R.O. vessel in which preformed packings were inspected, collect a sample of product water from each end of vessel, rinsing container three times with sample water before collecting sample. Do one vessel at a time. Record sample as front or rear sample.
- i. Measure TDS of each product water sample (para. 2-15c(5)). If one or both samples are still high, leaky preformed packing or faulty (cracked) connectors may still be present, or one or both R.O. elements may be faulty. Depending upon availability of time, either repeat steps a through h, or replace the elements (para. 3-4).
- j. Resume normal operation.

Step 2. R.O. elements may be scaled or fouled.

Clean R.O. elements (para. 2-13).

Section III. OPERATOR MAINTENANCE INSTRUCTIONS

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This section provides maintenance instructions for performing operator maintenance on the ROWPU.

3-4. R.O. ELEMENT REPLACEMENT.

This task consists of: a. Removal b. Installation

INITIAL SET-UP:

Material/Parts:

Silicone grease (from storage chest)

Equipment Condition:

ROWPU shutdown (para. 2-14)
R.O. vessels drained (para. 2-17)

Personnel Required: Two (2)

General Safety Instructions:

WARNING

ROWPU piping and equipment can contain extremely high pressure during and after operation. If this pressure is not relieved before performing maintenance, serious injury or death may result. Be sure to open R.O. vessels vent valve before performing maintenance.

- a. Removal. The R.O. elements are replaced when TDS of product water exceeds 1000 parts per million and cannot be corrected by using procedures described in Troubleshooting Table 3-2, MALFUNCTION 16. Each R.O. pressure tube contains two R.O. elements.

3-4. R.O. ELEMENT REPLACEMENT - cont.

Remove R. O. Pressure Tube End Caps. Refer to figure 3-1.

CAUTIONS

- **When removing end caps from more than one R.O. pressure tube, mark end caps with pencil or chalk to ensure they are replaced on correct pressure tube and correct end.**
- **To reduce chances of leaks, mark end caps and R.O. tube (alignment marks) with chalk or pencil so that end caps are installed in the same position.**
- **Shutdown ROWPU and relieve all pressure before removing or loosening any parts on the R.O. pressure tube.**

NOTES

- To aid movement of piping during end cap removal, remove forward end caps first.
 - Replacement of R.O. elements in one R.O. pressure tube are shown. Replacement R.O. elements in other R.O. tubes is similar.
- (1) Loosen hose clamp (1) and disconnect hose (2) from adapter (3).
 - (2) Remove two nuts (4), bolts (5), clamp halves (6), and gasket (7) from elbow/piping (8).
 - (3) Swing elbow/piping (8) away from end cap (1).
 - (4) Remove ten nuts (9) and flat washers (10) from studs (11).

CAUTION

Use extreme caution when separating end cap from vessel. R.O. tube studs and seal are easily damaged. Do not attempt to pry end cap from pressure tube with a screwdriver. Pressure tube and end cap will be damaged.

- (5) Screw four end cap puller bolts (12) (from storage chest) into threaded holes in end cap (13). Turn puller bolts alternately until end cap is separated from R.O. pressure tube (14). Slowly, separate end cap from R.O. pressure tube.
- (6) Repeat steps (1) through (5) for opposite end cap (13).

3-4. R.O. ELEMENT REPLACEMENT- cont.

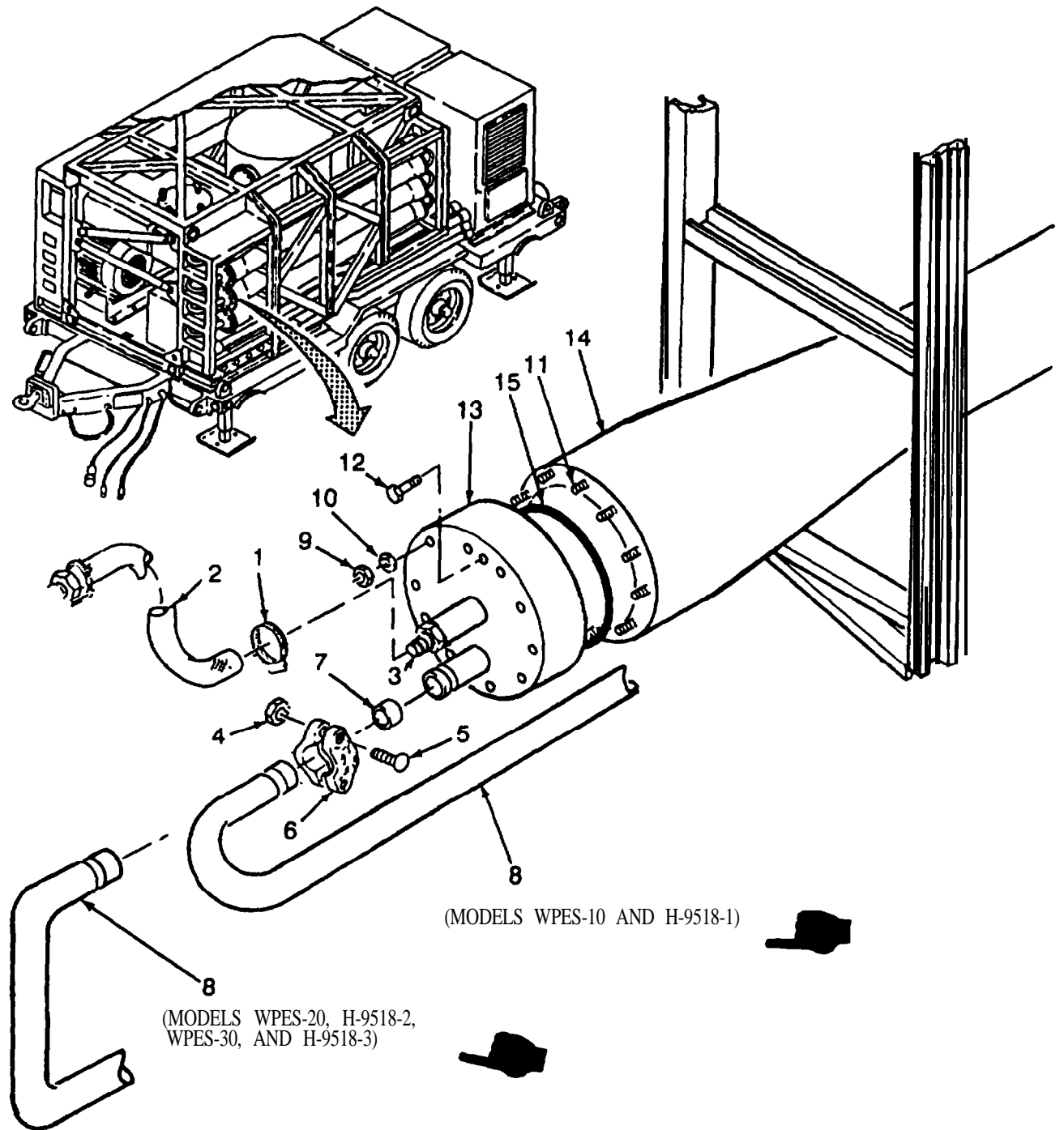


Figure 3-1. R.O. Pressure Tube End Cap.

3-4. R.O. ELEMENT REPLACEMENT - cont.

Remove R.O. Elements.

NOTE

- Because of obstruction by generator set, Models WPES-10 and H-9518-1 users must remove and install R.O. elements from front of unit. Elements are removed opposite direction of flow and installed in direction of flow. Refer to figure 3-2.
 - Models WPES-20, H-9518-2, WPES-30 and H-9518-3, users must remove top and second from bottom elements from front of unit, and install through rear of unit. The bottom and second from top elements are removed from the rear of the unit and installed through the front of the unit. Remove elements in direction of flow and install in direction of flow. Refer to figure 3-2.
- (1) Screw puller rod handle (1) into puller rod (2) (Models WPES-10 and H-9518-1 refer to figure 3-3. Models WPES-20, H-9518-2, WPES-30 and H-9518-3 refer to figure 3-4).
 - (2) Push element puller rod (1) and attached handle (2) through center of end connector (7), R.O. element (8), interconnector (9), R.O. element (10) and out through end connector (11).
 - (3) Place element puller plate (3) on end of element puller rod (2) and secure with flat washer (4) and nut (5).

NOTE

Placing one hand on frame while pulling with the other hand will help keep the element puller centered.

- (4) Slowly pull both R.O. elements (8 and 10) and attached parts from R.O. pressure tube (6). Support components to keep element puller centered in R.O. tube.
- (5) Remove nut (5), flat washer (4) and puller plate (3) from element puller rod (2).
- (6) Pull element puller rod (2) and handle (1) from R.O. elements (8 and 10).

CAUTION

To prevent damage to the equipment, do not bend R.O. elements at interconnector.

- (7) With one person on each end of assembled R.O. elements (8 and 10), twist and pull R.O. elements apart.
- (8) Remove end connectors (7 and 11) and interconnector (9) from R.O. elements (8 and 10).
- (9) Clean inside of R.O. pressure tube (6) with brine water and inspect for nicks, cracks, and gouges.

3-4. RO. ELEMENT REPLACEMENT - cont.

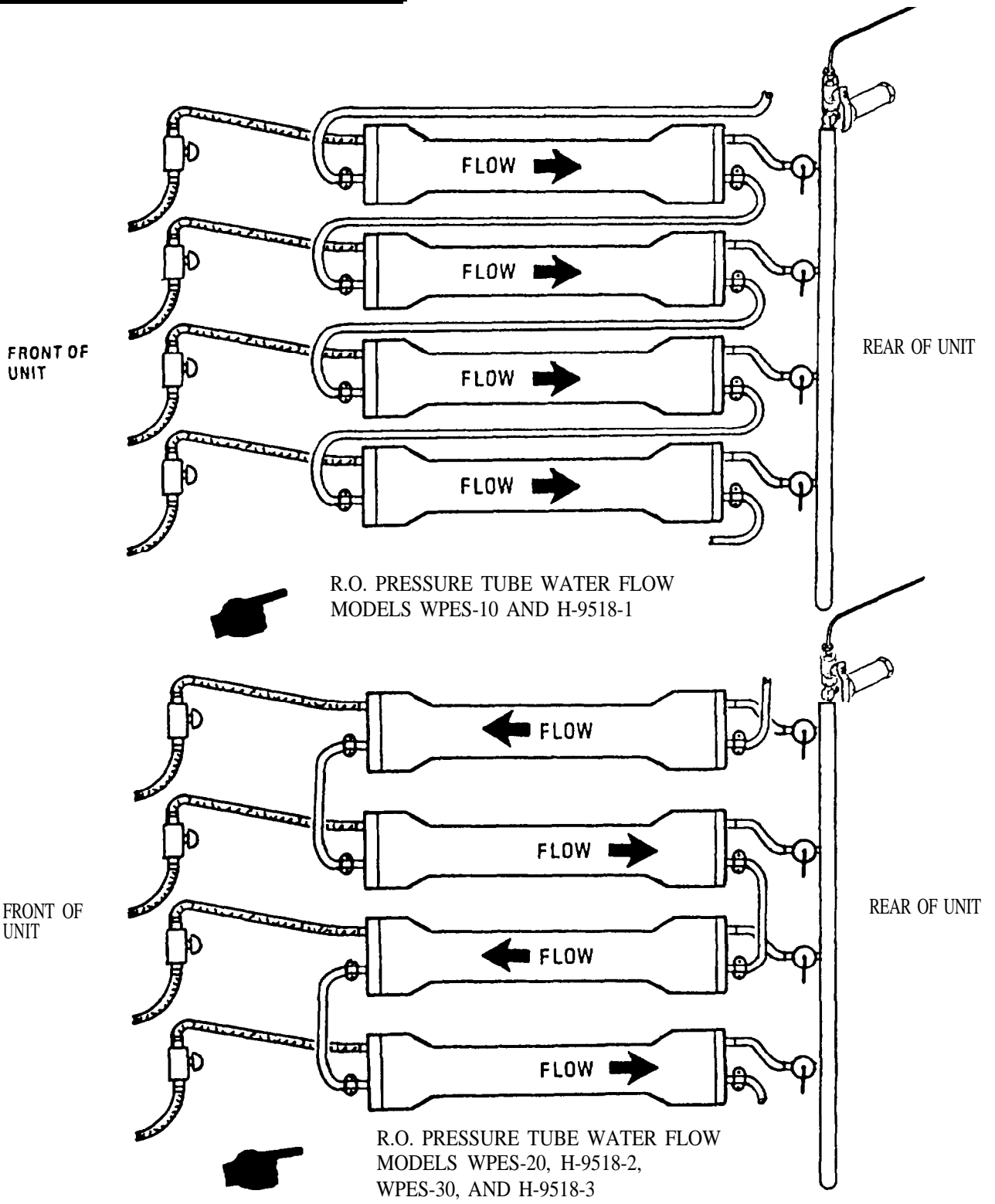


Figure 3-2. R.O. Pressure Tube Water Flow.

3-4. R.O. ELEMENT REPLACEMENT - cont.

- (10) Wipe any dirt from end connectors (7 and 11) and interconnector (9) using a clean cloth.
- (11) Check interconnector (9) and both end connectors (7 and 11) and all preformed packings for deep scratches and cracks.

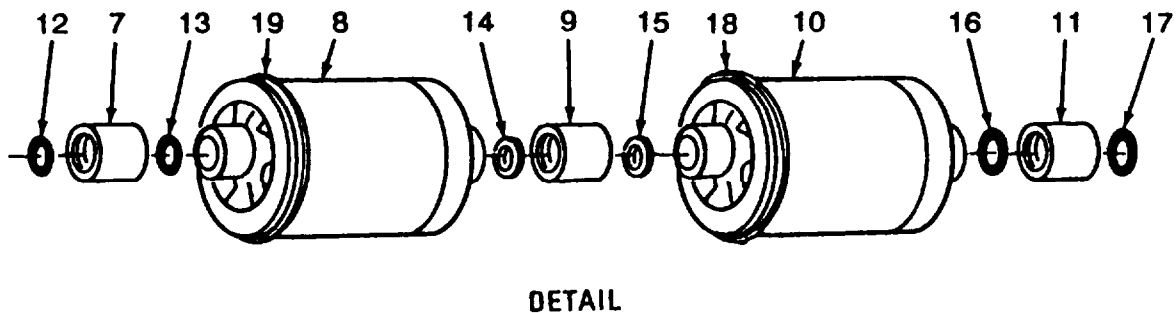
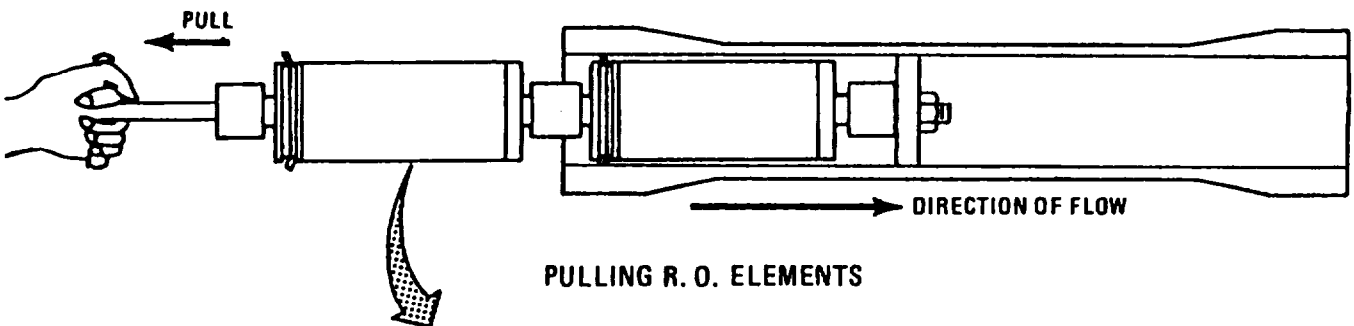
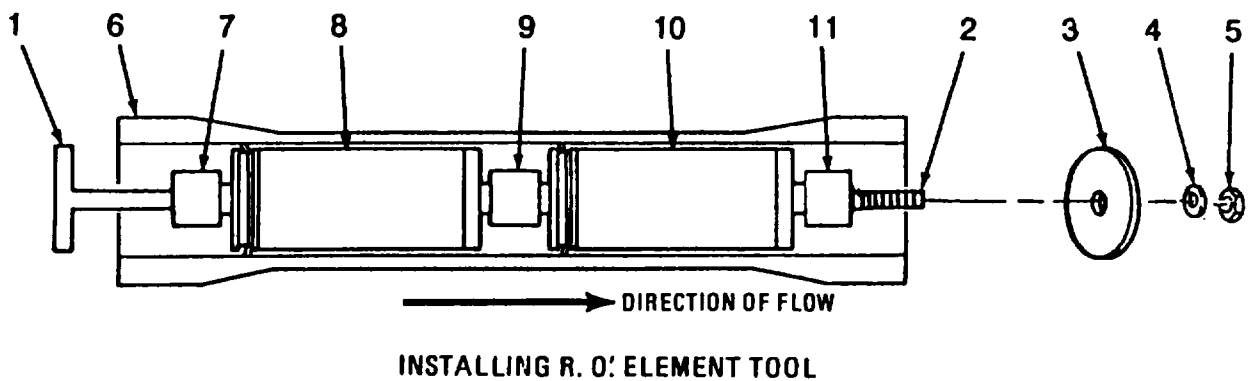
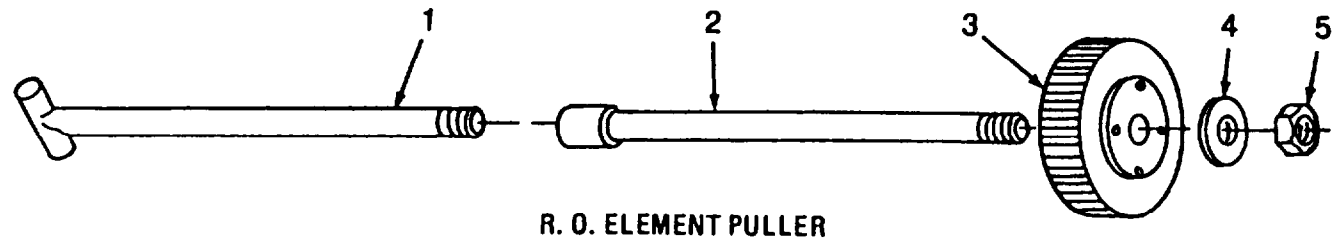


Figure 3-3. R.O. Element Removal (Models WPES-10, H-9518-1).

3-4. R.O. ELEMENT REPLACEMENT - cont.

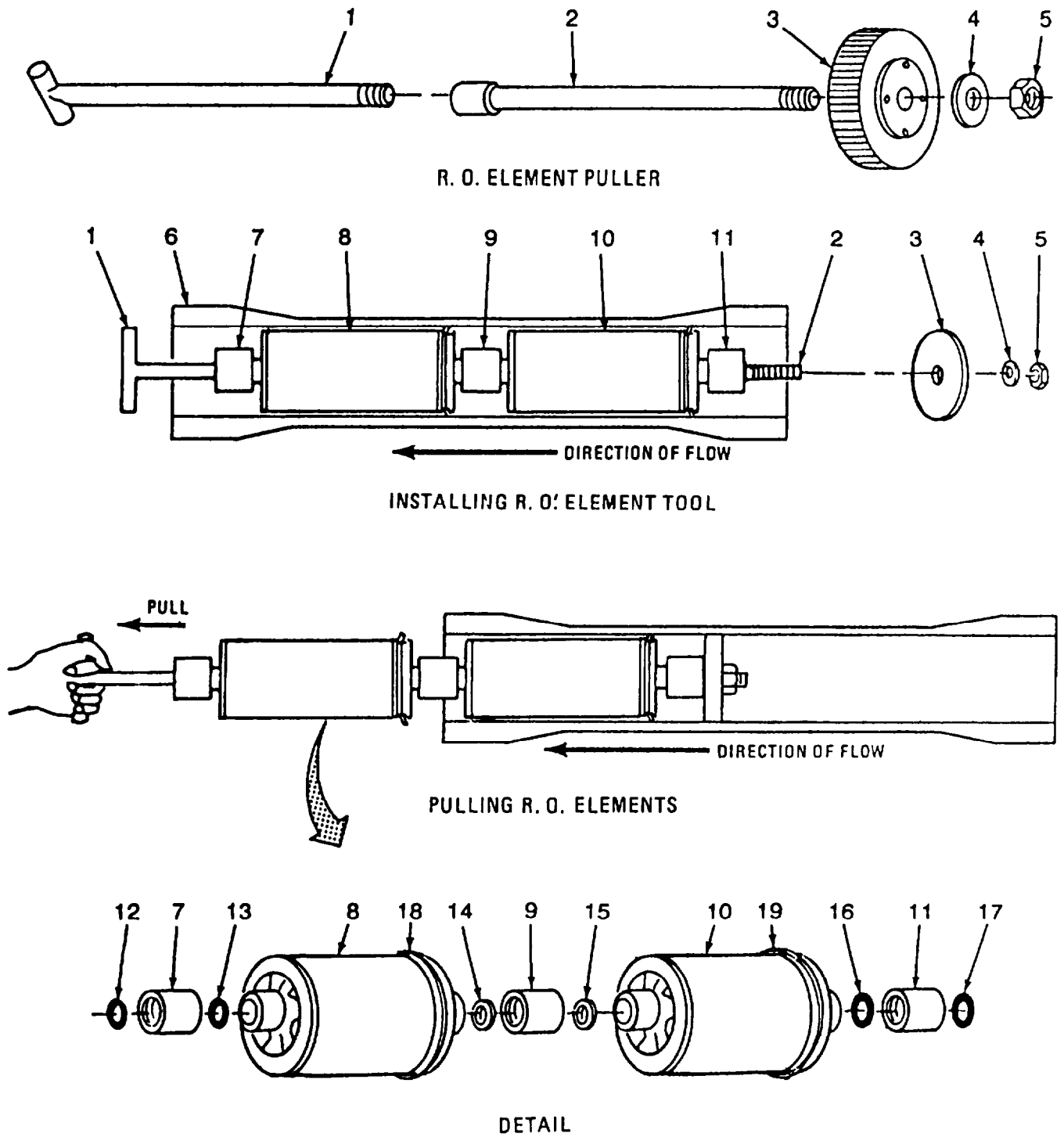


Figure 3-4. R.O. Element Removal
(Models WPES-20, WPES-30, and H-9518-3)

3-4. R.O. ELEMENT REPLACEMENT - cont.

- b. Installation.

Install R.O. Elements.

NOTE

Installation of two R.O. elements in one R.O. pressure tube is shown. Installation of R.O. elements in other R.O. pressure tubes is similar.

- (1) Remove puller bolts (11, figure 3-3 or 3-4) from end cap (1).
- (2) Lubricate preformed packings (12 through 17) with silicone grease from storage chest.

NOTE

- There are two different size preformed packings on the end connectors. The side of the end connector which will fit on the end of the R.O. element has a lip on the inside. This side of the end connectors uses the large preformed packing. The interconnector preformed packings are the same size as the large end connector preformed packings. Remember, preformed packings 12 and 17 are only slightly smaller than preformed packings 13, 14, 15, and 16. Use care not to get them mixed up. Notify unit maintenance if preformed packings are damaged.

- (3) If removed, install two preformed packings (12 and 13) in end connector (7).
- (4) If removed, install two preformed packings (16 and 17) in end connector (11).
- (5) If removed, install two preformed packings (14 and 15) in interconnector (9).

WARNING

Some R.O. elements are packaged in sealed plastic bags with the protective chemical formaldehyde, which is poisonous; avoid fumes and keep away from eyes and mouth. Handle with extreme care. After handling, wash hands thoroughly with soap and water.

CAUTION

- After removing R.O. element from sealed bag, take care to keep element clean. Failure to do so will bring dust and dirt into R.O. elements and cause early element failure.
 - Do not expose elements to direct sunlight for an extended period of time. Sunlight may damage the elements.
- (6) Remove one new R.O. element from sealed plastic bag or element container.

3-4. R.O. ELEMENT REPLACEMENT - cont.

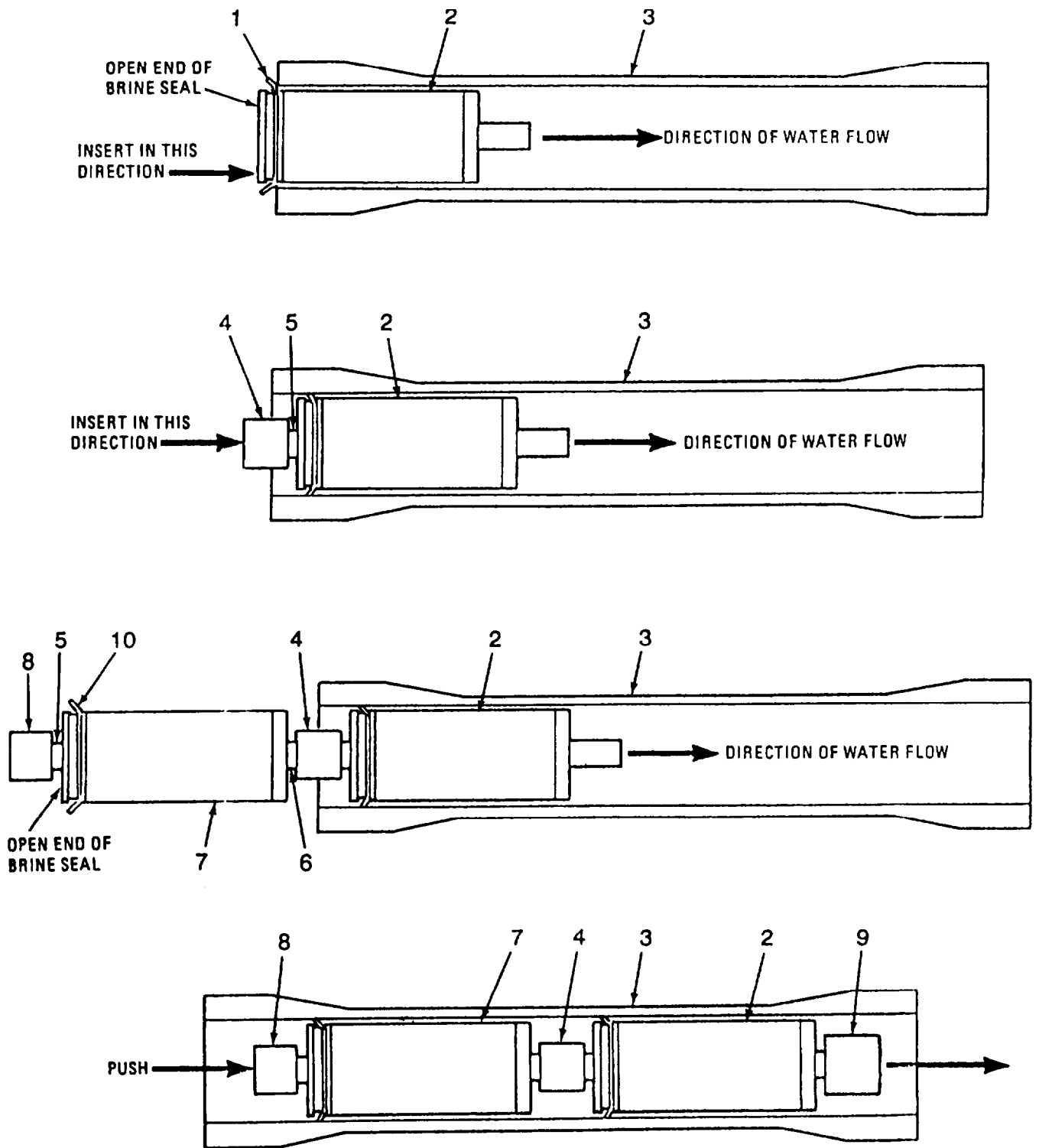


Figure 3-5. R.O. Element Installation

3-4. R.O. ELEMENT REPLACEMENT - cont.

NOTE

On Models WPES-20, H-9518-2, WPES-30, and H-9518-3 the top and second from bottom R.O. pressure tubes have reverse flow direction. Open end of brine seal must face opposite the direction of flow. Refer to figure 3-2.

- (7) Lubricate brine seal (1, figure 3-5) with silicone grease from storage chest. Insert the first R.O. element (2) into the R.O. pressure tube (3) until brine seal (1) touches end of R.O. pressure tube.

CAUTION

To prevent premature failure of equipment, do not confuse interconnector with end connectors. End connectors have a lip on the inside that seals against R.O. elements.

- (8) Place interconnector (4) on product water tube (5) of first R.O. element (2).
- (9) Remove second R.O. element from sealed plastic bag. Lubricate brine seal (10) with silicone grease from storage chest.
- (10) Insert product water tube (6, figure 3-3) of the second R.O. element (7) into interconnector (4). Make sure that the open end of the brine seal (10) is opposite the direction of water flow.
- (11) Slide both R.O. elements (2 and 7) and interconnector (4) into R.O. pressure tube (3) until they are centered in the tube.
- (12) Place end connector (8) on R.O. element (7).
- (13) Place other end connector (9) on R.O. element (2).

Install R. O. Tube End Caps. Refer to figure 3-1.

- (1) Lubricate preformed packing on end cap (13) with silicone grease from storage chest.
- (2) Align end cap (13) with alignment marks on R.O. pressure tube (14) made during removal.
- (3) Push end cap (13) onto R.O. pressure tube (14) while connecting tube on inside of end cap with end connector (8, figure 3-3 or figure 3-4).
- (4) Press end cap (13) onto R.O. pressure tube (14) until seated on studs (11). Make sure alignment marks match up.
- (5) Loosely install ten flat washers (10) and nuts (9) on studs (11).

3-4. R.O. ELEMENT REPLACEMENT cont.

CAUTION

To prevent damage to R.O. pressure tubes, do not tighten nuts more than 1/8 turn past hand tight.

- (6) Slowly and evenly tighten nuts (9) until hand tight (snug). Never turn one nut more than two turns at a time. Once hand tightened, evenly tighten each nut 1/8 turn with wrench.
- (7) Place gasket (7) on coupling extending from end cap (13).
- (8) Swing elbow/piping (8) back into place and position end in gasket (7).
- (9) Position clamp halves (6) over gasket (7).

NOTE

Only tighten nuts until clamp halves meet, and nuts are snug.

- (10) Install two bolts (5) and nuts (4) in clamp halves (6).
- (11) Connect hose (2) to adapter (3) and tighten clamp (1).

NOTE

During installation of opposite end cap, push on cap until it mates with end connector and is seated flush against pressure tube.

- (12) Repeat steps (1) through (11) for other end cap.
- (13) Operate the ROWPU (para. 2-9) and check for leaks.

3-5. CARTRIDGE FILTER TUBE REPLACEMENT.

This task consists of: a. Removal b. Installation

INITIAL SET-UP:

Material/Parts:

Silicone grease (from storage chest)

General Safety Instructions:

Equipment Condition:

ROWPU shutdown (para 2-14)

Cartridge filter drains No.1 and No. 2 open.

WARNING

ROWPU piping and equipment can contain extremely high pressure during and after operation. If this pressure is not relieved before performing maintenance, serious injury or death may result. Be sure to open all drains and vent valves before performing maintenance.

- a. Removal. Refer to figure 3-6. The cartridge filter contains eight filter tubes. Cartridge filter tubes should be changed when CARTRIDGE FILTER gage differential pressure rises above 20 psid.

NOTE

- **Cover is installed under spring tension. Relieve tension by loosening eyebolts a few turns at a time in an alternating pattern.**
- **Mark position of cover on shell to aid installation.**

- (1) Unzip access hole in top of canvas cover.
- (2) Disconnect hose (1) from coupling (2) on filter cover (3).
- (3) Loosen six eyebolts (7) and rotate them out of notches in filter cover (3).
- (4) Remove filter cover (3) and attached parts from shell (8).
- (5) Remove eight filter tubes (5) from shell (8). Discard filter tubes.

- b. Installation. Refer to figure 3-6.

- (1) Install eight new filter tubes (5) in shell (8) making sure that the tubes seat in the bottom cartridge seats (9).
- (2) Inspect preformed packing (6) for damage and replace if required. Lubricate preformed packing (6) with silicone grease.

3-5. CARTRIDGE FILTER TUBE REPLACEMENT - cont.

CAUTION

Ensure all filter tubes are properly seated and filter cover is properly aligned before tightening eyebolts.

- (3) Position filter cover (3) and attached parts on shell (8) and align marks made during removal. Make sure cartridge seats (4) align with filter tubes (5).

CAUTION

To ensure proper seal between cap and shell, eyebolts must be tightened evenly.

- (4) Rotate eyebolts (7) into notches on cover (3) and alternately hand tighten in the sequence shown.
- (5) Connect hose (1) to coupling (2) on filter cover (3).
- (6) Zip access hole in top of canvas cover.
- (7) Operate ROWPU (para. 2-9) and check for leaks.

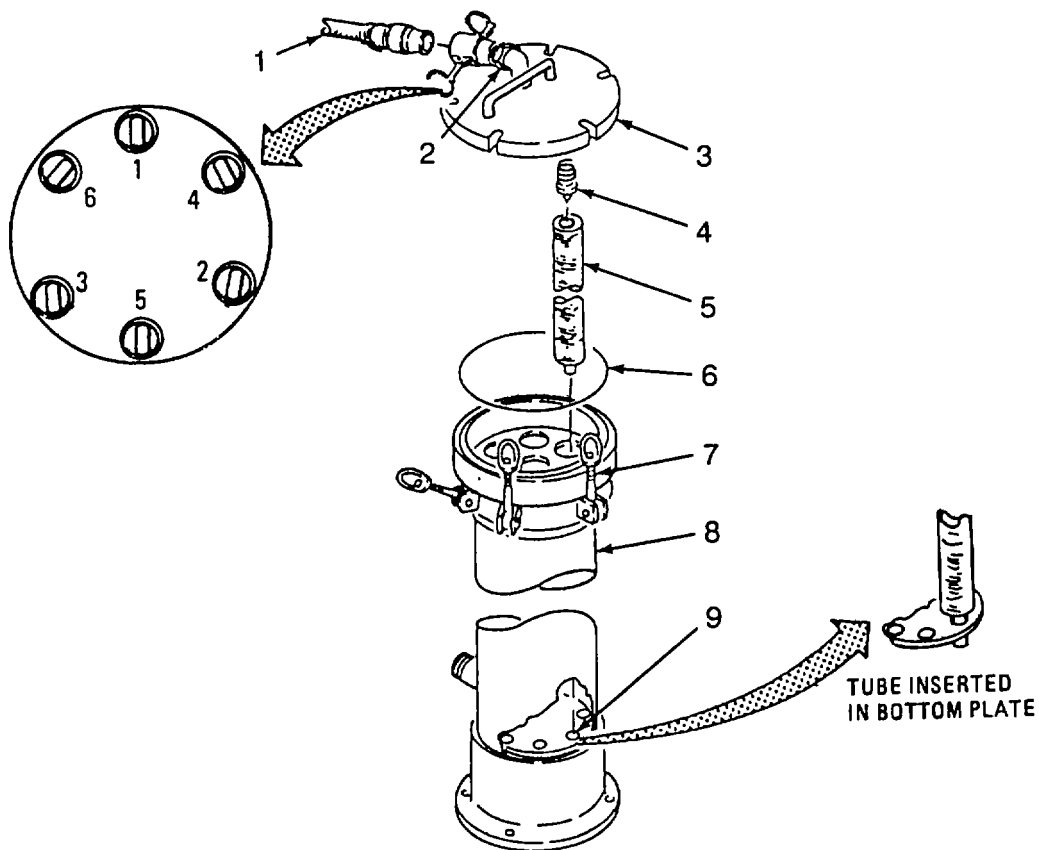


Figure 3-6. Cartridge Filter Tube Replacement.

3-6. BACKWASH PUMP STRAINER CLEANING - cont.

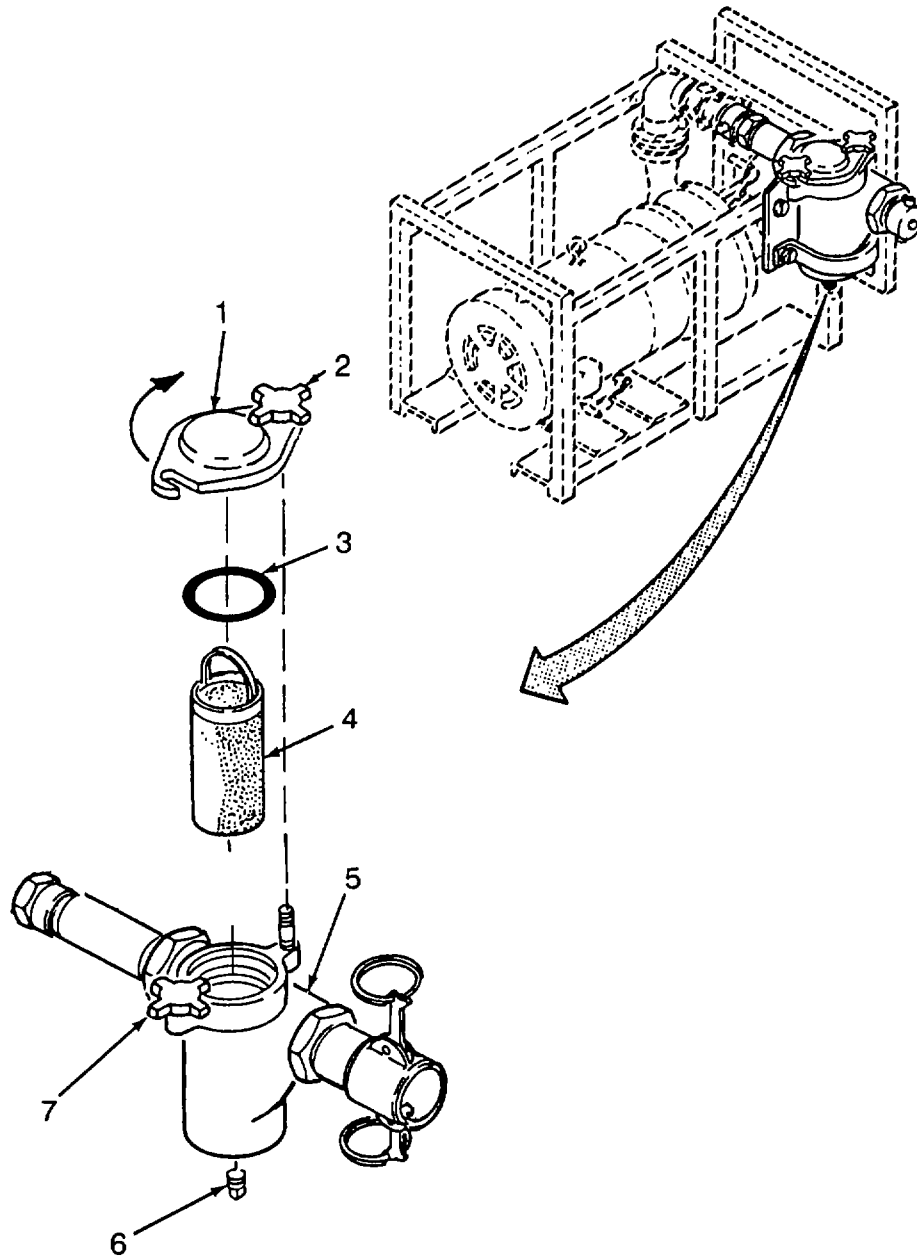


Figure 3-7. Backwash Pump Strainer Cleaning.

3-7. TDS METER (PORTABLE) BATTERY REPLACEMENT - cont.

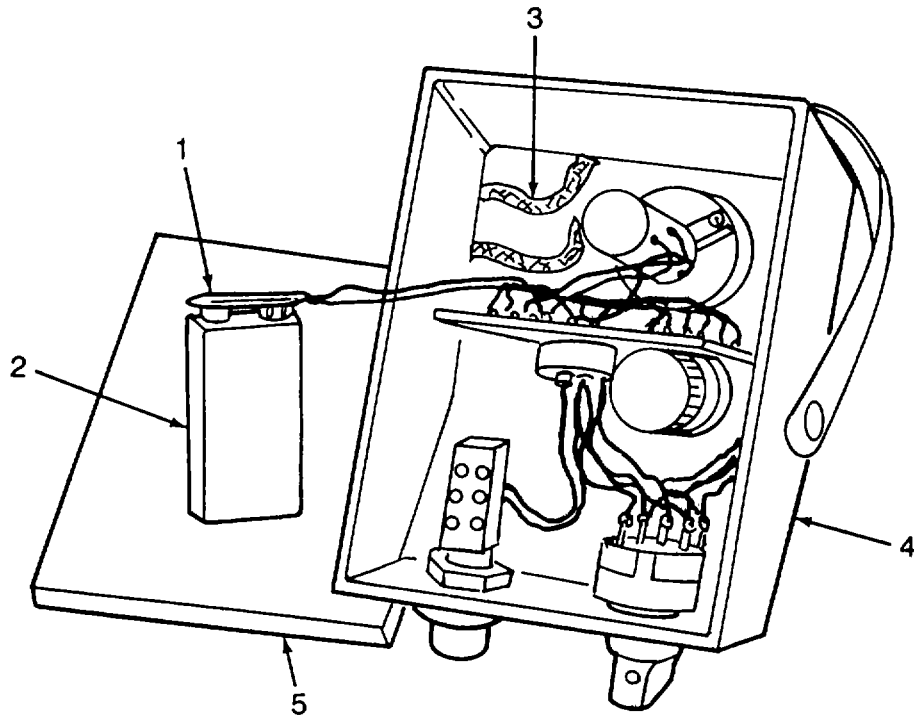


Figure 3-8. TDS Meter Battery Replacement.

3-8. SWITCH INDICATOR LAMP REPLACEMENT.

This task consists of: a. Removal b. Installation

INITIAL SET-UP:

Tools Required:

Lamp extractor (from Storage Chest)

Equipment Condition:

ROWPU shutdown (para 2-14)

Material/Parts:

Lamp (from Storage Chest)

NOTE

Replacement of R.O. PUMP HIGH PRESSURE switch indicator lamp is shown. Replacement of other switch indicator lamps is similar.

a. Removal. Refer to figure 3-9.

(1) Remove lens cover (4) from lamp socket (2)

(2) Using lamp extractor (5) from storage chest, remove lamp (3) from socket (2) on control box (1).

b. Installation. Refer to figure 3-9.

(1) Using lamp extractor (5), install lamp (3) in lamp socket (2) on control box (1).

(2) Install lens cover (4) on lamp socket (2).

3-8. SWITCH INDICATOR LAMP REPLACEMENT.

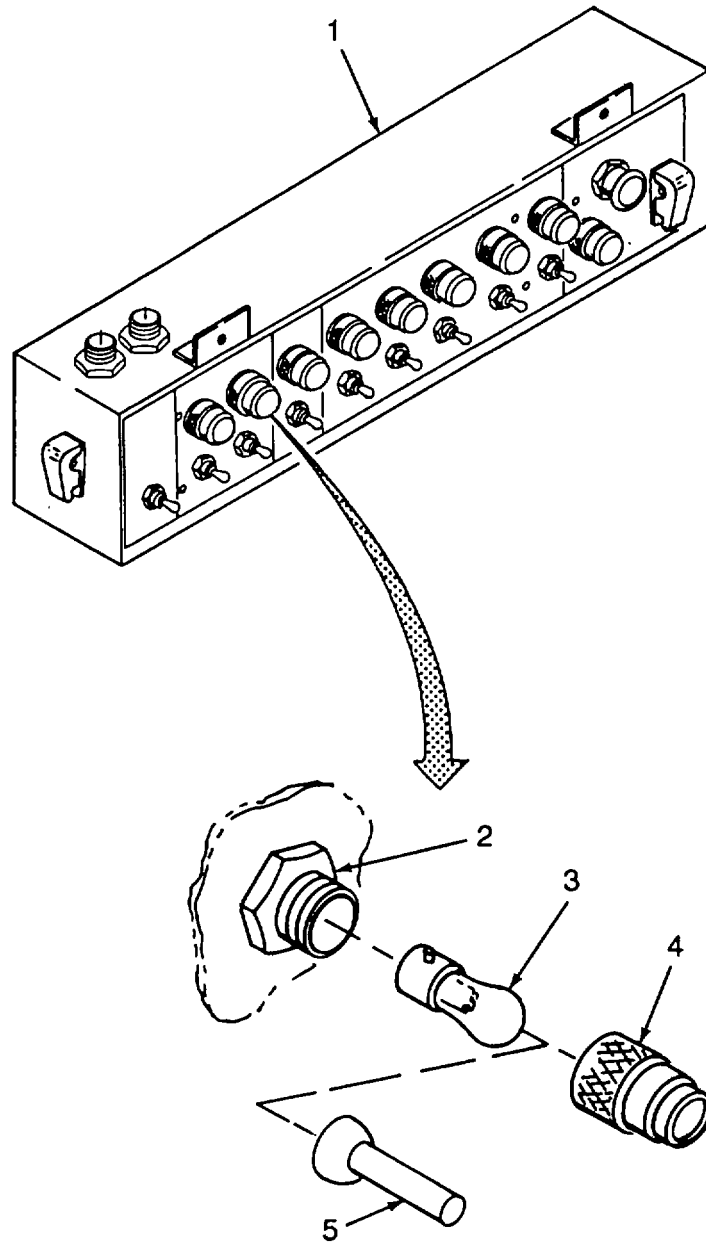


Figure 3-9. Switch Indicator Lamp Replacement.

3.9. CONTROL PANEL LAMP REPLACEMENT.

This task consists of: a. Removal b. Installation

INITIAL SET-UP:

Material/Parts:	Equipment Condition:
------------------------	-----------------------------

Lamp (from Storage Chest)	ROWPU shutdown (para 2-14)
---------------------------	----------------------------

a. Removal. Refer to figure 3-10.

- (1) While depressing detent button (8) with thumb, pull quick release pin (9) from light bracket (1).
- (2) Pull out panel light bracket (1) from control panel (8).
- (3) Loosen screw (6) and remove guard (7) from fixture body (2).
- (4) Unscrew globe (5) from fixture body (2).
- (5) Unscrew lamp (4) from socket (3).

b. Installation. Refer to figure 3-10.

- (1) Screw lamp (4) into socket (3).
- (2) Screw globe (5) onto fixture body (2).
- (3) Position guard (7) on fixture body (2) and tighten screw (6).
- (4) Push panel light bracket (1) into control panel (8).
- (5) While depressing detent button (8) with thumb, push quick release pin (9) through light bracket (1) and into frame of control panel (8).

3-9. CONTROL PANEL LAMP REPLACEMENT - cont

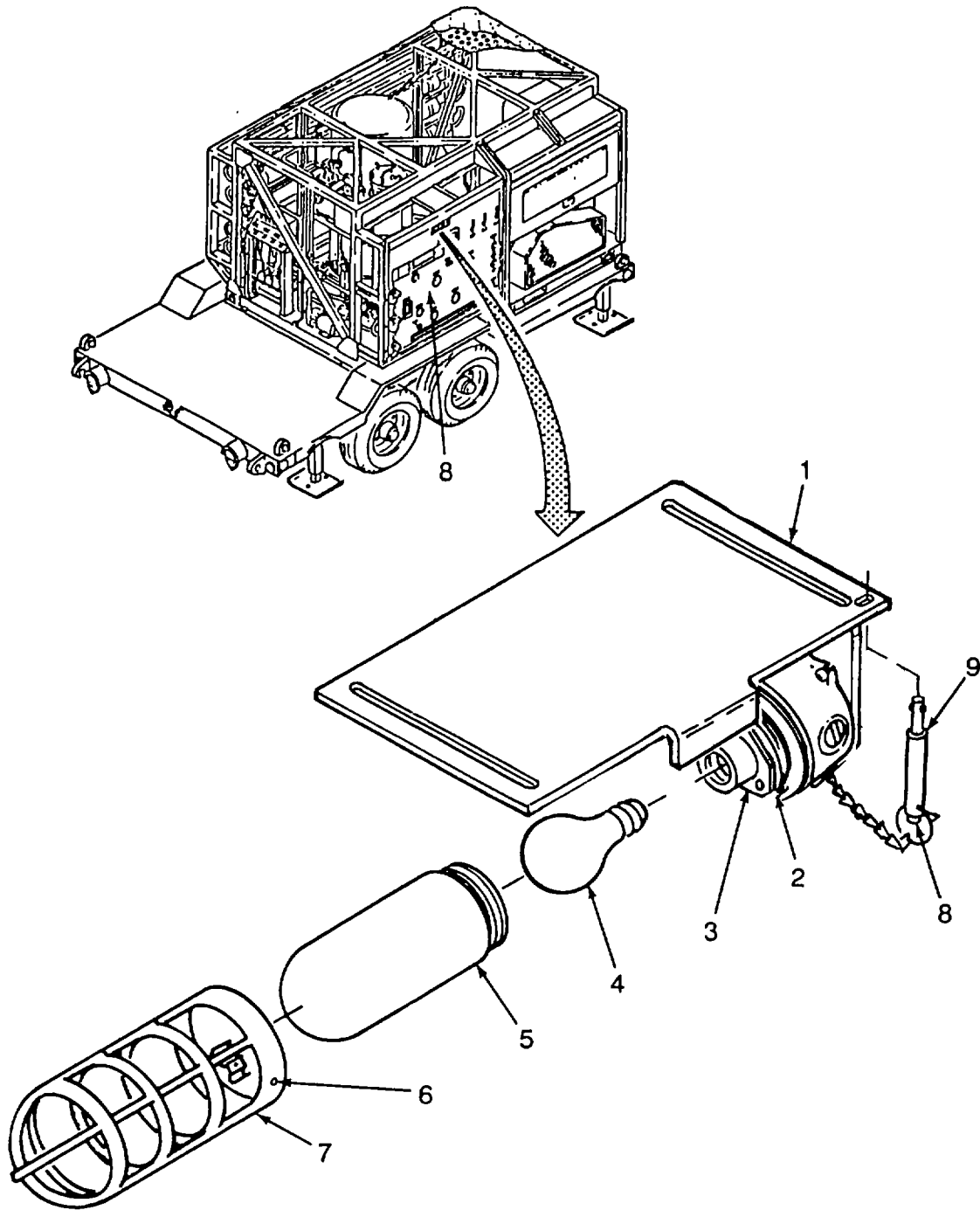


Figure 3-10. Panel Lamp Replacement.

3-10. CANVAS COVER REPLACEMENT - cont.

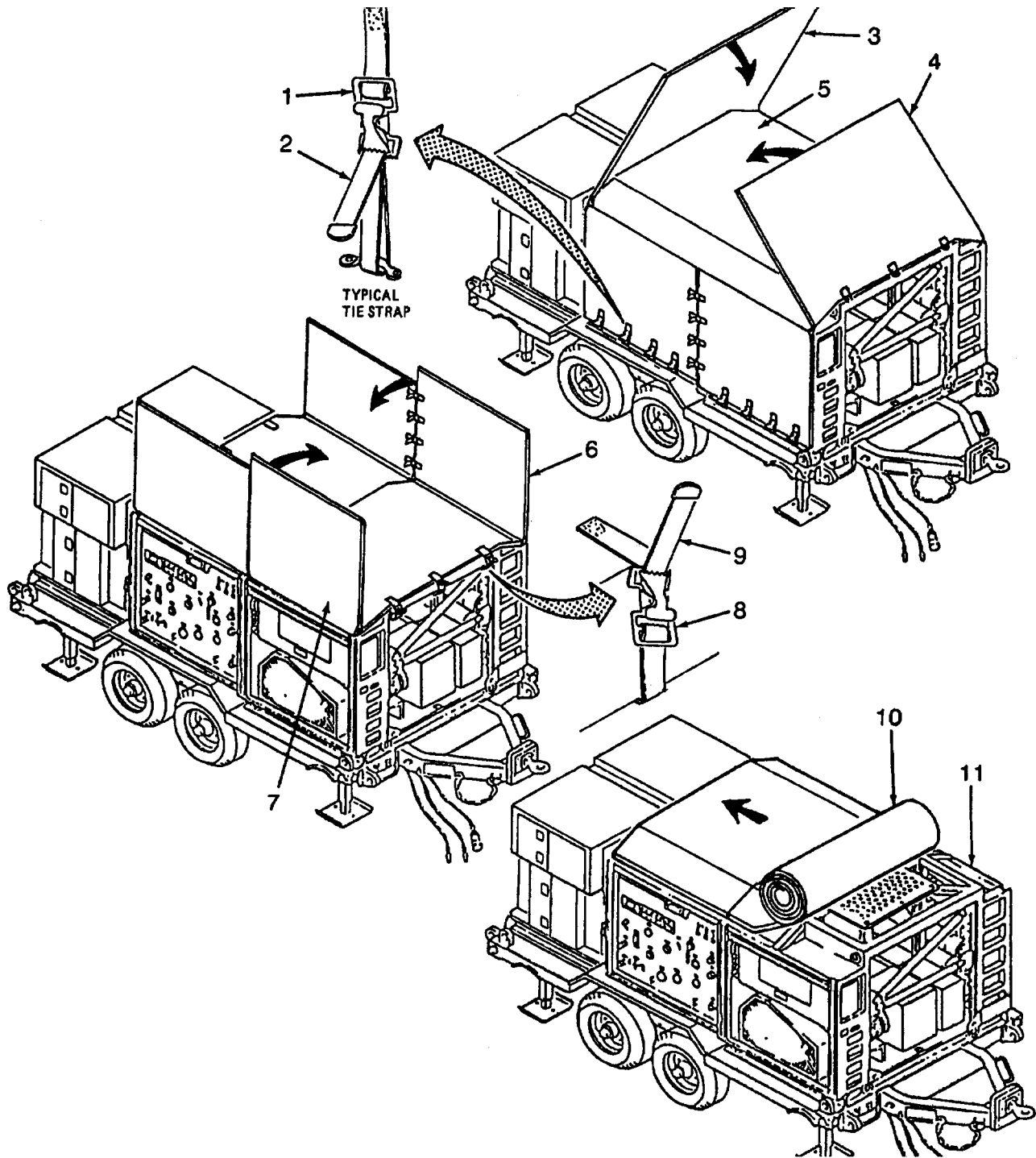


Figure 3-11. Canvas Cover Replacement

3-11. CHEMICAL FEED PUMP SERVICING - cont.

Units made before 2001

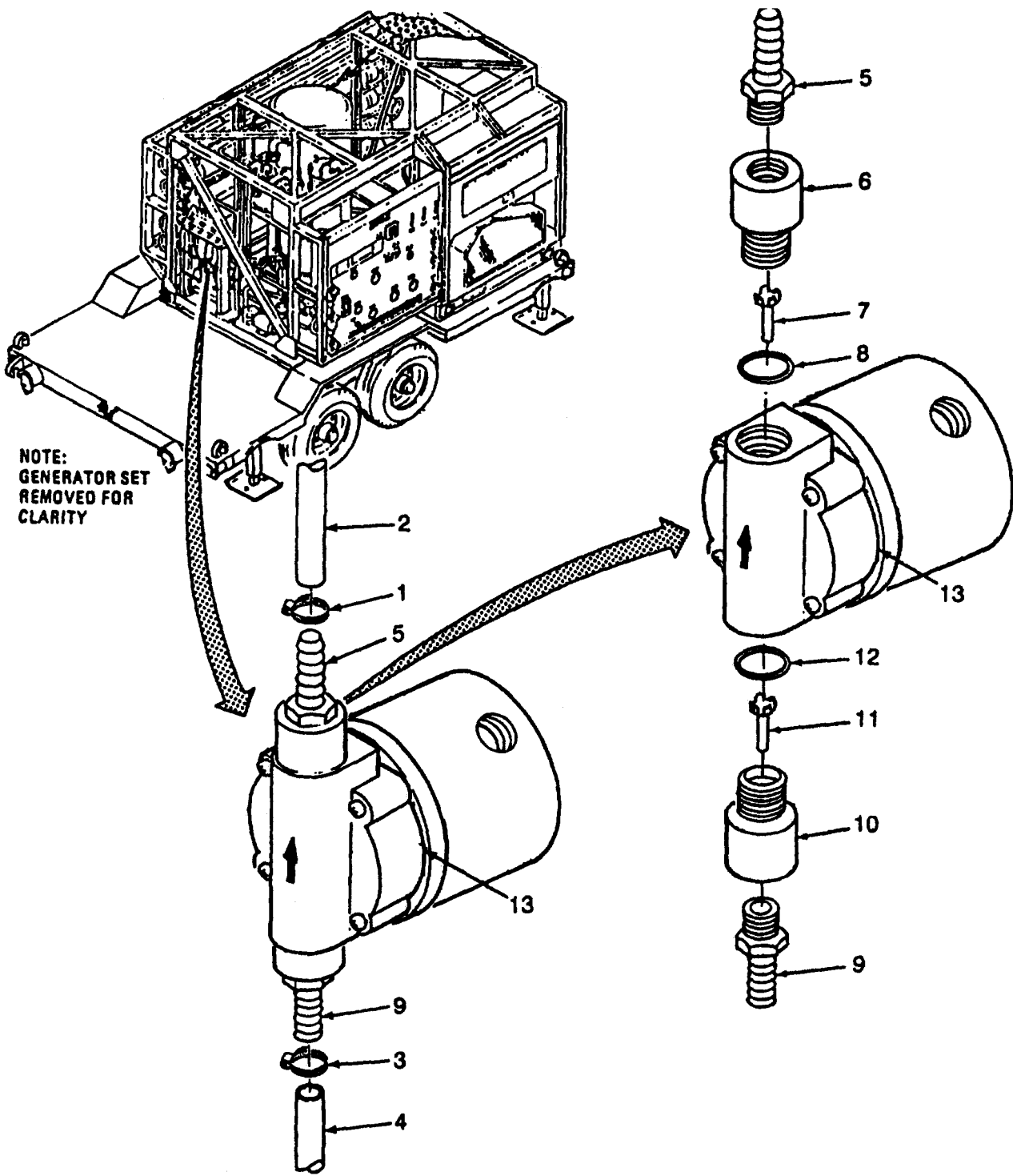


Figure 3-12. Chemical Feed Pump Disassembly

3-11. CHEMICAL FEED PUMP SERVICING - cont.

Units made before 2001

c. Assembly. Refer to figure 3-13.

- (1) Install preformed packing (12) in liquid head (13).

CAUTION

To prevent damage to the equipment, poppet must be installed with seat (crown) positioned as shown.

- (2) Install poppet (11) in check valve body (10).
- (3) Screw check valve body (10) into liquid head (13).
- (4) If removed, apply antiseize tape to threads of barbed fitting (9). Screw barbed fitting (9) into check valve body (10).
- (5) Install preformed packing (8) in liquid head (13).

CAUTION

To prevent damage to the equipment, poppet must be installed with seat (crown) positioned as shown.

- (6) Install poppet (7) in liquid head (13).
- (7) Screw check valve body (6) into liquid head (13).
- (8) If removed, apply antiseize tape to threads of barbed fitting (9). Screw barbed fitting (5) into check valve body (6).
- (9) Connect flexible hose (4) to barbed fitting (9).
- (10) Slide clamp (3) up flexible hose (4) and position over barbed fitting (9). Tighten clamp.
- (11) Connect flexible hose (2) to barbed fitting (5).
- (12) Slide clamp (1) down flexible hose (2) and position over barbed fitting (5). Tighten clamp.

3-11. CHEMICAL FEED PUMP SERVICING - cont.

Units Made Before 2001

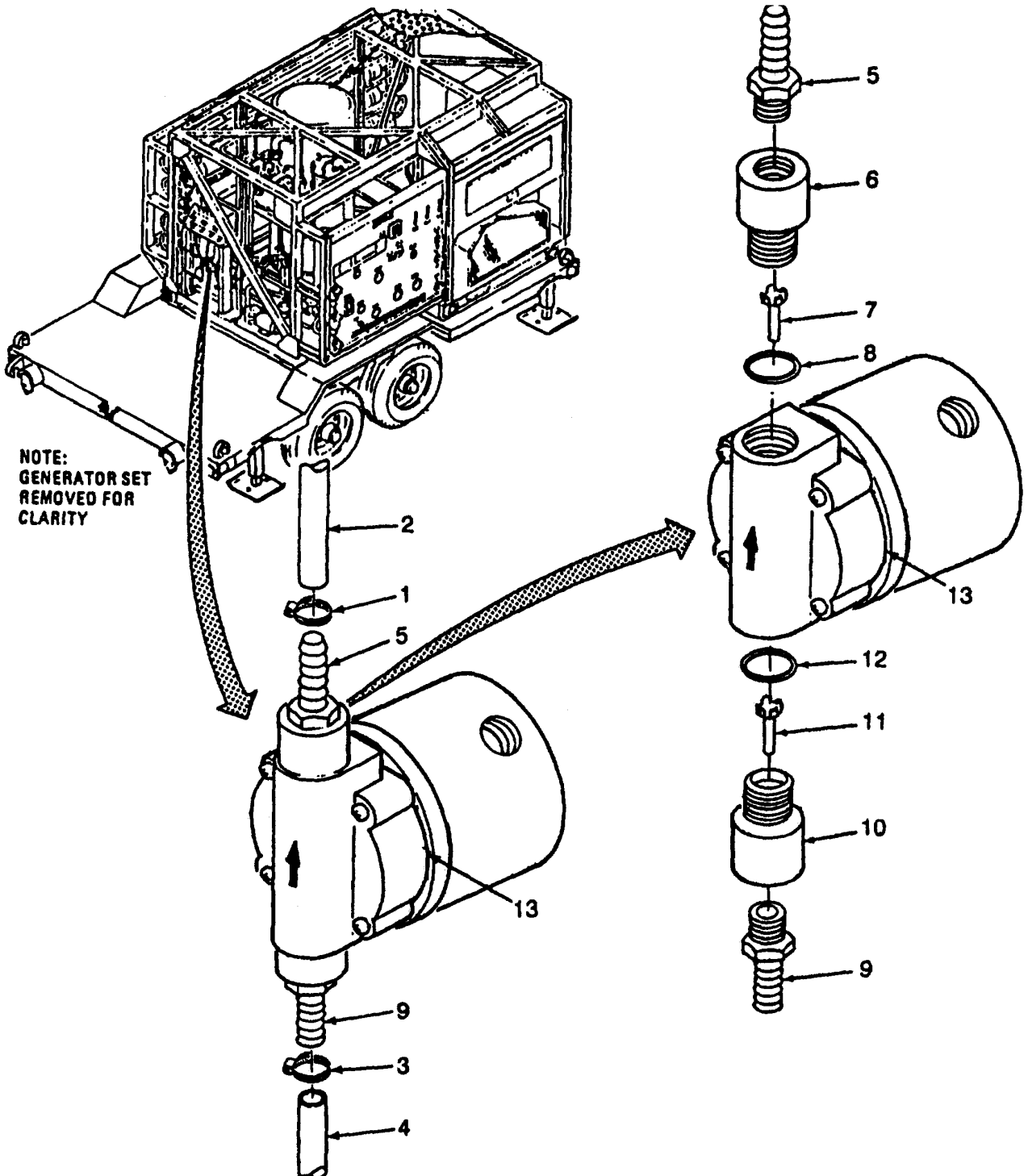
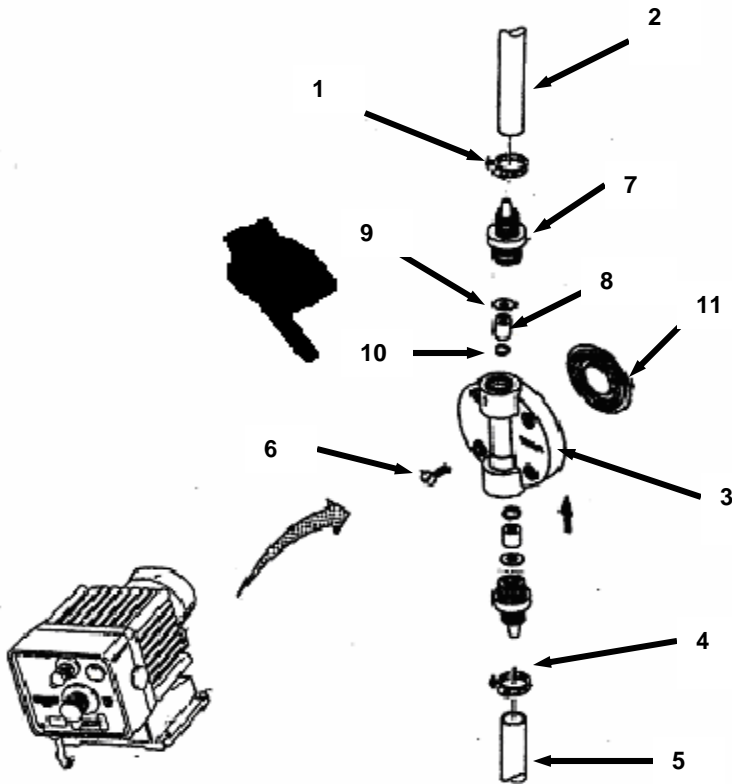


Figure 3-13. Chemical Feed Pump Assembly.

3-11.1 CHEMICAL FEED PUMP SERVICING - Cont.

Units made after 2001



3-11.1 CHEMICAL FEED PUMP SERVICING - Cont.

Units made after 2001

b. Disassembly.

- (1) Unscrew and remove barbed fittings (7), check valves (8) washers (9) and O-Rings (10).
- (2) Remove the liquidfram (11) from the pump by turning counterclockwise.

c. Cleaning.

- (1) Wash all components with clean water and detergent.
- (2) Rinse components in clean water and dry with wiping rags.

d. Inspection.

- (1) Inspect all threaded components for damaged threads.
- (2) Inspect liquid head housing (3) for clogged passages.
- (3) Inspect barbed fittings (7) for deformation.
- (4) Inspect check valves (8), washers (9), O-Rings (10) and liquidfram (11) for wear, deterioration and damage.

e. Assembly.

NOTE

Be sure check valves are installed the correct way - Flow should be from bottom to top.

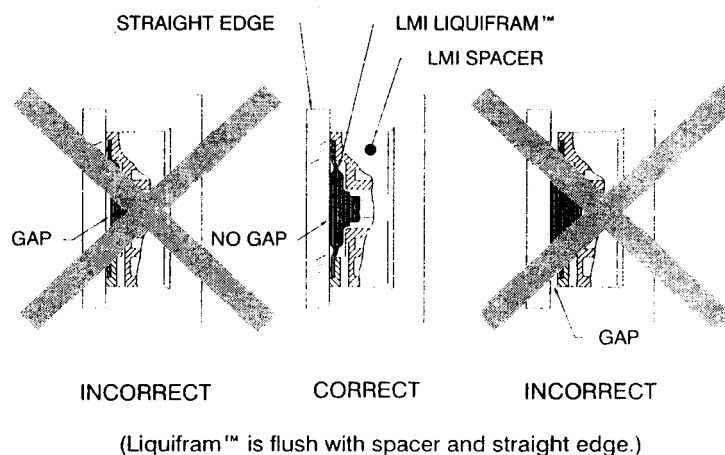
- (1) Position O-Ring (10), washer (9) and check valve (8) into liquid head (3).
- (2) Install barbed fittings (7) into liquid head (3).

3-11.1 CHEMICAL FEED PUMP SERVICING - Cont.

Units made after 2001

f. Installation.

- (1) Turn on the pump and turn the stroke knob to 90%.
- (2) With the pump running, screw on the liquidfram (11) by turning clockwise.
- (3) Screw on until the center begins to buckle inwards. When that happens, stop and turn off the pump.
- (4) Adjust the liquidfram (11) by turning the outside. Adjust so the center is flush with a straightedge.
- (5) Use the diagram below to properly position the liquidfram.
- (6) Position liquid head assembly (3) and secure it with four screws (6). Tighten in a criss-cross pattern.
- (7) Install flexible hoses (2 and 5) on liquid head assembly (3) and secure with clamps (1 and 4).



3-12. TIRE AND WHEEL ASSEMBLY SERVICING (MODELS WPES 10 AND H 9518-1)

This task consists of a. Removal b. Installation

INITIAL SET-UP

Tools Required:

Lugnut wrench and handle (from towing vehicle)

Personnel Required:

Two (2)

Equipment Condition:

ROWPU shutdown (para 2-14)

Trailer on flat and solid ground

Trailer prepared for use (figure 2-19)

General Safety Instructions:

WARNING

Lifting heavy equipment can cause serious injury.

NOTE

Replacement of one tire and wheel assembly is shown. Replacement of tire and wheel on opposite end of axle is similar.

a. Removal.

Remove tire and wheel from hub (Refer to figure 3-14)

WARNING

- **To avoid injury to personnel, tire removal should ONLY be done on solid ground (concrete, asphalt, hard ground or similar hard surfaces).**
- **To prevent the trailer from rolling or sliding, use blocks under the tires.**

(1) If front (trailer hitch end) tire and wheel (1) will be removed, block both rear (generator end) tires (2).

(2) If rear (generator end) tire and wheel (2) will be removed, block both front (trailer hitch end) tires (1).

WARNING

To prevent injury to personnel and damage to the equipment, do not remove lug nuts before tire and wheel are off ground.

NOTE

Lugnuts on left side of trailer (roadside) have left hand threads. Lugnuts on right side of trailer (curbside) have right hand threads. Lugnuts and studs are marked to aid identification.

(3) Using lugnut wrench and handle, loosen lugnuts (3 through 8) one turn only.

NOTE

Leveling jacks should be lowered at the same time and at the same speed.

(4) If front tire and wheel (1) will be removed, lower both front leveling jacks (9) until front tires are off ground (figure 2-18).

3-12. TIRE AND WHEEL ASSEMBLY SERVICING (MODELS WPES-10 AND H-9518-1) - cont.

- (5) If rear tire and wheel (2) will be removed, lower both rear leveling jacks (10) until rear tires are off ground (figure 2-18).
- (6) Using lugnut wrench and handle, remove lugnuts (3 through 8) from studs (11).

WARNING

- Tire and wheel weigh about 122 pounds (55.39 kg). To prevent injury to personnel, use two people to remove tire and wheel from hub. Place block or lug wrench under tire before removing wheel.
- To prevent damage to the equipment, do not drag tire and wheel across threads of studs.

- (7) Remove defective tire and wheel (11) from from hub (12).

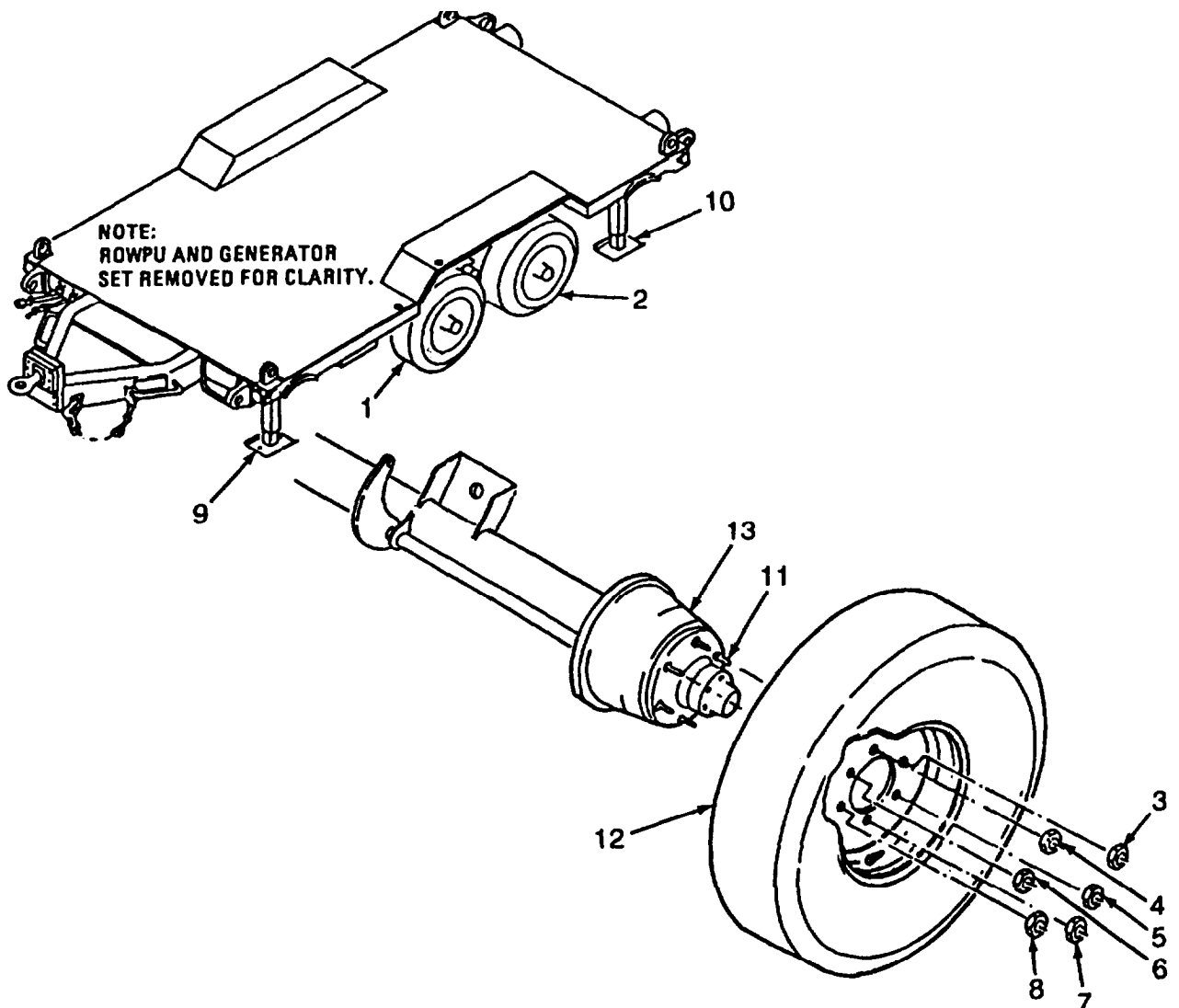


Figure 3-14. Tire and Wheel Replacement.

**3-12. TIRE AND WHEEL ASSEMBLY SERVICING (MODELS WPES-10
AND H-9518-1) - cont.**

Remove spare tire from trailer (Refer to figure 3-15)

- (8) Using lugnut wrench and handle, remove two nuts (1) from studs (2).
- (9) Remove safety pin (3) and separate crank handle (4) from jack assembly (5).
- (10) Install crank handle (4) on end of ratchet (6).

WARNING

Tire and wheel weigh about 122 pounds (55.39 kg). Use care when releasing pawl to prevent injury to personnel or damage to the equipment.

Do not allow personnel under trailer when lowering tire and wheel.

- (11) While pushing down on pawl (7), turn crank handle (5) to the left to lower spare tire and wheel (8) to the ground.
- (12) Remove tire carrier support (9) and attached cable (10) from center of spare tire and wheel (8).

3-12. TIRE AND WHEEL ASSEMBLY SERVICING (MODELS WPES-10 AND H-9518-1) - cont.

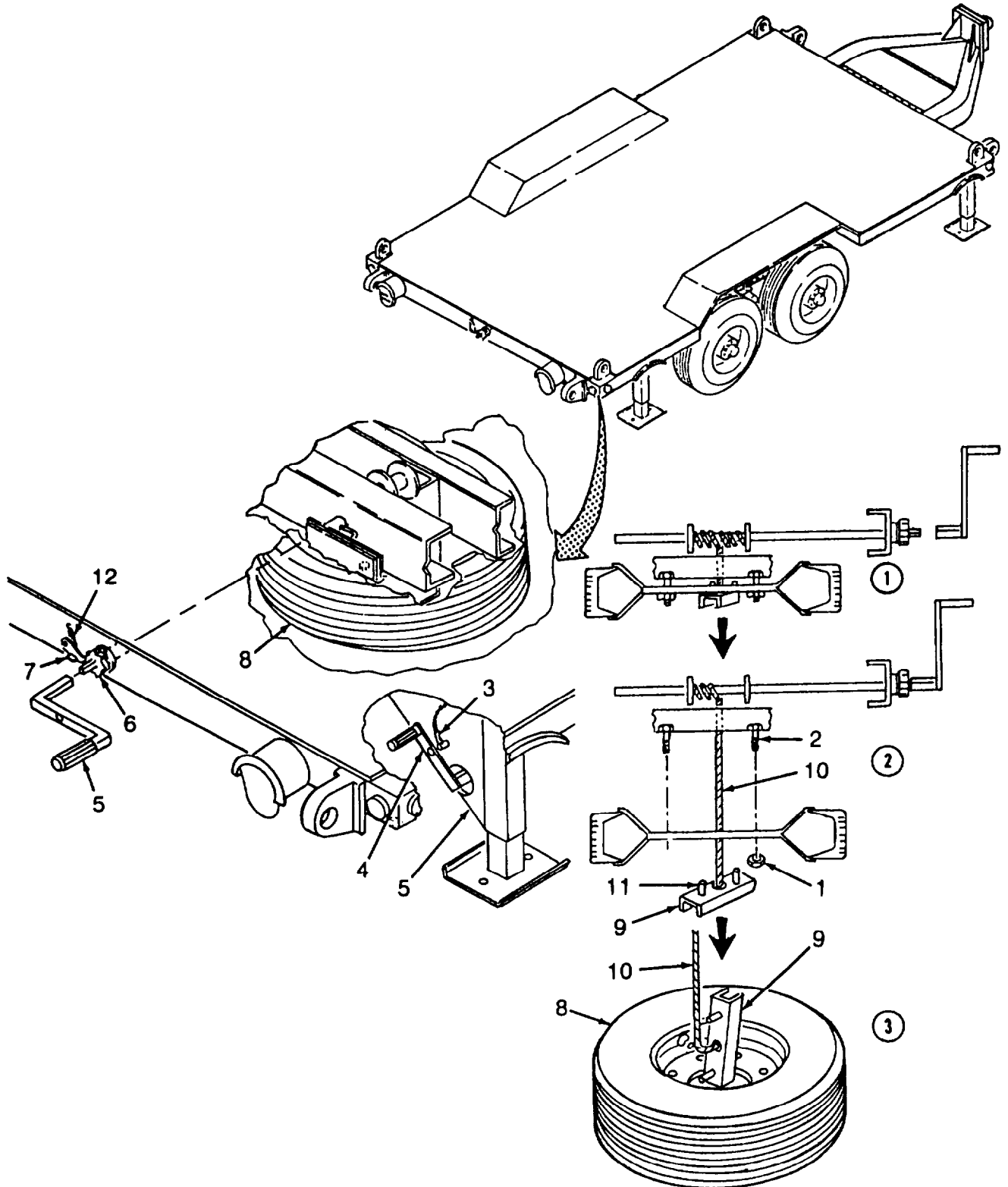


Figure 3-15. Spare Tire Replacement.

**3-12. TIRE AND WHEEL ASSEMBLY SERVICING (MODELS WPES-10
AND H-9518-1) - cont.**

b. Installation.

Install tire and wheel on hub (Refer to Figure 3-14)

WARNING

Tire and wheel weighs about 122 pounds (55.39 kg). To prevent injury to personnel and damage to the equipment, use two people to lift spare tire and wheel onto hub.

CAUTION

To prevent damage to hub, do not drag wheel across threads of studs.

- (1) While alining mounting holes in tire and wheel (12) with studs (11), position wheel on hub (13).

NOTE

Lugnuts on left side of trailer (roadside) have left hand threads. Lugnuts on right side of trailer (curbside) have right hand threads. Lugnuts and studs are marked to aid identification.

- (2) Screw six lugnuts (3 through 8) onto studs (11) until finger tight.
- (3) Using lugnut wrench, tighten lugnuts (3 through 8) until snug.

NOTE

Leveling jacks should be raised at the same time and at the same speed.

- (4) If front tire and wheel (1) has been changed, raise both front leveling jack (9) until front tires are firmly on ground (figure 2-18).
- (5) If rear tire and wheel (2) is has been changed, raise both rear leveling jacks (10) until rear tires are firmly on ground (figure 2-18).
- (6) Using lugnut wrench, tighten lugnuts (3 through 8) in cross pattern (sequence 3, 8, 7, 4, 5, and 6).

**3-12. TIRE AND WHEEL ASSEMBLY SERVICING (MODELS WPES-10
AND H-9518-1) - cont.**

Install spare tire on trailer (Refer to figure 3-15)

- (7) Place tire carrier support (9) and attached cable (10) inside spare tire and wheel (8) and position support so that studs (11) fit in lug mounting holes.

WARNING

- Tire and wheel weigh about 122 pounds (55.39 kg). Use care when releasing pawl to prevent injury to personnel or damage to the equipment.
- Do not allow personnel under trailer when raising tire and wheel.

- (8) Turn crank handle (5) to the right and raise tire and wheel (8) up to studs (2). Aline mounting holes in wheel with stud, then raise wheel until seated against bottom of trailer.
- (9) Using lugnut wrench, install two nuts (1) on studs (2).
- (10) Remove crank handle (4) from end of ratchet (6) and stow on jack assembly (5).
- (11) Secure crank handle (4) in place with safety pin (3).

CHAPTER 4
MAINTENANCE OF AUXILIARY EQUIPMENT

4-1. GENERAL MAINTENANCE. I

Maintenance of Army generator set is covered in TM 5-6115-465-12 for NSN 6115-00-118-1240.

Maintenance of 3,000 gallon water tank is covered in TM 5-5430-227-12&P/TO 37A12-1-121.

Air Force users will refer to applicable publications referencing power sources used by that organization.

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APPENDIX A

REFERENCES

A-1. SCOPE

This appendix lists all forms, field manuals, and technical manuals, referenced in this manual.

A-2. FORMS

Maintenance Request.....	DA Form 2407
Quality Deficiency Report.....	SF 368
Recommended Changes to DA Publications	DA Form 2028-2
Technical Orders System Publication Improvement Report and Reply	AFTO Form 22

A-3. TECHNICAL MANUALS.

First Aid Manual	FM 21-11
General Repair of Tents, Canvas and Webbing	FM 10-16
Hand Receipt Covering End Item/Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List Items (AAL), for Water Purification Unit, Reverse Osmosis.....	TM 10-4610-241-10-HR
Lubrication Order for Water Purification Unit, 600 GPH Trailer Mounted, Flatbed Cargo, 5 Ton 4 Wheel Tandem ROWPU Models WPES-10 and H-9518-1 and 600 GPH Skid Mounted Models WPES-20, H-9518-2, WPES-30, and H-9518-3.....	LO 10-4610-241-121 TO 40W4-13-51
Operator and Organizational Maintenance Manual; Generator Set, Diesel Driven, Tactical Skid Mtd. 30 KW, 3 Phase, 4 Wire, 120/208 and 240/416 Volts, NSN 6115-00-118-1240 (ARMY)	TM 5-6115-465-12
Operation and Maintenance Manual; 3,000 Gallon Self-Supporting Water Tank.....	TM 5-5430-227-12&P/ TO 37A12-1-121
The Army Maintenance Management Systems (TAMMS)	DA PAM 738-750
Unit, Direct Support and General Support Maintenance Manual for Water Purification Unit,600 GPH Trailer Mounted, Flatbed Cargo, 5 Ton 4 Wheel Tandem ROWPU Models WPES-10 and H-9518-1 and 600 GPH Skid Mounted Models WPES-20, H-9518-2, WPES-30, and H-9518-3	TM 10-4610-241-24/ TO 40W4-13-42

APPENDIX A
REFERENCES - cont.

A-3. TECHNICAL MANUALS - cont.

Unit, Direct Support and General Support Maintenance Repair Parts and Special Tools List for Water Purification Unit, 600 GPH Trailer Mounted, Flatbed Cargo, 5 Ton 4 Wheel Tandem ROWPU Models WPES-10 and H-9518-1 and 600 GPH Skid Mounted Models WPES-20, H-9518-2, WPES-30, and H-9518-3	TM 10-4610-241-24P/ TO 40W4-13-44
Warranty Program for 600 GPH Reverse Osmosis Water Purification Unit (ROWPU), Model Number WPES-10 and H-9518-1	TB 10-4610-241-24

APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B-1. SCOPE

This appendix lists components of end item and basic issue items for the ROWPU to help you inventory items required for safe and efficient operation.

B-2. GENERAL

The Components of End Item and Basic Issue Items List are divided into the following sections:

- a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.
- b. Section III. Basic Issue Items. These are the minimum essential items required to place the ROWPU in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the ROWFW during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

B-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listing:

- a. Column (1) - Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.
- b. Column (2) - National Stock Number. Indicates the national stock number assigned to the item and will be used for requisitioning purposes.
- c. Column (3) - Description. Indicates the Federal item and name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.
- d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).
- e. Column (5)- Quantity required (Qty reqd). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQD
1	4730-01-432-2552	Adapter, Male By Male, Quick Disconnect, Cam-Locking Type, Type XXI. MIL-C-27487,2 X 2 NOM Size, Class 2 (96906) MS39352-10		EA	1
2	5140-00-772-4142	Bag, Tool, Envelope Type: Cotton Duck; Size 4, 10 - 1/8 Inch H, 20 - 1/4 Inch Long, (8 1349) MIL-B-43648		EA	2
3	6135-00-850-3 177	Battery, Dry: 9 Volt; 2 Terminals Snap-On Terminal; Rectangular Shape (81348) W-B-101		BX	1
4	4730-00-277-1873	Bushing, Pipe: Shoulder (96906) MS 14315-20Y		EA	2
5	7240-01-223-3439	Can Assembly, Chemical Feed, Chlorine: (97403) 13226E7990-4		EA	1
6	7240-01-224-2852	Can Assembly, Chemical Feed, Citric Acid: (97403) 13226E7990-3		EA	1
7	7240-01-223-3438	Can Assembly, Chemical Feed, Polymer: (97403) 13226E7990-1		EA	1
8	7240-01-223-3437	Can Assembly, Chemical Feed, Sodium Hex: (97403) 13226E7990-2		EA	1
9	4610-01-128-1844	Cartridge, Chemical Agent Removal; (97403) 13221E8341-2		EA	1
10	4610-01-116-0501	Cartridge, Radiological Contaminant Removal; No. D9001 (05852); (97403) 13221E8341-1		EA	1
11	7520-00-559-9618	Case, Maintenance and Operational Manuals; Cotton Duck, Mildew Resistant, Water, Repellant, 22 Inch H, 12.75 Inch Lg. (81349) MIL-C-11743		EA	1
12	5140-01-223-3440	Chest Assembly, Storage (97403) 13221E8380-1		EA	1
13	5140-01-223-3441	Chest Assembly, Storage (97403) 13221E8380-2		EA	1

Section II. COMPONENTS OF END ITEM - cont.

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQD
14	4730-00-908-3194	Clamp, Hose; Low Pressure, Type "F", (96906) MS35842-11		EA	4
15	6630-01-044-0334	Comparator, Color: (12308) U25337		EA	1
16	4730-01-115-5175	Coupling Half, Quick Disconnect, Cam-Locking Type, Female, MIL-C-27487, 1-1/2 NOM Size, Class 2, External Pipe Threads, Type VII, (96906) MS27026-10		EA	6
17	4730-00-410-9530	Coupling Half, Quick Disconnect, Cam-Locking Type, Female, External Pipe Threads, Type VII, MIL-C-27487,2 NOM Size, Class 2 (96906) MS27026-12		EA	3
18	4730-00-958-7117	Coupling Half, Quick Disconnect, Cam-Locking Type, Male, External Pipe Threads, Type III, MIL-C-27487, 1-1/2 NOM Size, Class 2 (96906) MS27022-10		EA	3
19	4730-00-115-3740	Coupling Half, Quick Disconnect, Cam-Locking Type, Male, External Pipe Threads, Type III, MIL-C-27487,2 NOM Size, Class 2 (96906) MS27022-12		EA	3
20	4730-01-245-9148	Coupling Half, Quick Disconnect, Cam-Locking Type, Male, Internal Straight Thread, Type XVII, MIL-C-27487, 1-1/2 NOM Size (96906) MS70095-3		EA	3
21	4730-01-353-2984	Coupling Half, Quick Disconnect, Cam-Locking Type, Male, Internal Straight Threads, Type XVII, MIL-C-27487,2 NOM Size (96906) MS70095-4		EA	3
22	4730-01-125-4456	Coupling, Pipe: Corrosion Resistant: (97403) 13218E0439-8		EA	1
23	6640-01-086-7603	Cylinder, Graduated, Plastic: 100 ml (22527) NO. 8-572D		EA	1
24		(WPES-10, WPES-20, and WPES-30) Discharge Valve Cover Capscrew Adapter, 1/2 Inch Hex Bar, 2 Inch Long (61748) 001		EA	1

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQD
25	4240-00-022-2946	Ear Muff-Type Hearing Protectors		EA	1
26	6515-00-137-6345	Ear Plugs, Disposable: 400 per box		BX	1
27	4610-01-105-2075	Element, Reverse Osmosis, Spiral Wound (97403) 13226E2212		EA	8
28	5120-00-243-7326	Extension, Socket Wrench: 5 Inch Log: (8 1348) GGG-W-641		EA	1
29	5120-00-288-7679	Extractor, Lamp		EA	1
30	4610-01-128-6277	Filter, Tube: For Cartridge Filter: (97403) 13226E2210		EA	1
31	6230-00-264-8261	Flashlight: Type I, Style 2, (81349) MIL-F-3747		EA	1
32	4820-00-066-2478	Float, Figure 4, (81349) MIL-W-52482		EA	1
33	6115-00-118-1240	(WPES-10 and H-9518-1) Generator Set, Diesel Engine Driven Tactical, Utility, Skid Mtd, 30 KW, 3 phase, 4 Wire, 120/208 and 240/416 Volts, 50/60 Hertz (81349) MIL-G-5288415		EA	1
34	5120-01-397-4406	(WPES-10, WPES-20 and WPES-30) Gland Adjusting Tool, 3/16 Inch Dia Rod, 8 Inch Long (61748) 003		EA	1
35	5120-00-061-8545	Hammer, Hand: 1 - 1/2 lb Head Weight; Type 2, Style B, Class 1, (81348) GGG-H-86		EA	1
36	5120-00-251-4489	Hammer, Hand: 8 lb Head Weight; Double Face, Type X, Class 1, (81348) GGG-H-86		EA	1
37	5120-00-249-1071	Handle, Socket Wrench: Brace Speeder Type; 16 Inch to 20 Inch, (81348) GGG-W-641		EA	1
38	5120-00-230-6385	Handle, Socket Wrench: Ratchet Type Reversible; 9 Inch; (81348) GGG-W-641		EA	1

Section II. COMPONENTS OF END ITEM - cont.

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) Usable on U/M Code	(5) QTY RQD
39	4720-01-388-8864	Hose Assembly, Cotton, Rubber Lined, Single Jacket, 1-1/2 IN ID, 25 FT Long, BRDEC Drawing 13229E37952 (90598) 13229E3795-2	EA	4
40	4720-01-388-8856	Hose Assembly, Cotton, Rubber Lined, Single Jacket, 1-1/2 IN ID, 25 FT Long, Color Coded For Product Water, BRDEC Drawing 13229E37951 (90598) 13229E3795-1	EA	2
41	4720-01-388-8884	Hose Assembly, Cotton, Rubber Lined, Single Jacket, 2 IN ID, 25 FT Long, BRDEC Drawing 13229E3795-3 (90598) 13229E3795-3	EA	3
42	4720-01-388-8840	Hose Assembly, Rubber, Suction and Discharge, Wire Reinforced, 1-1/2 IN ID, 10 FT Long, BRDEC Drawing 13229E3794-2 (90598) 13229E3794-2	EA	5
43	4720-01-388-8838	Hose Assembly, Rubber, Suction and Discharge, Wire Reinforced, 1-1/2 IN ID, 10 FT Long, Color Coded for Product Water, BRDEC Drawing 13229E3794-1 (90598) 13229E3794-1	EA	4
44	4720-01-388-8847	Hose Assembly, Rubber, Suction and Discharge, Wire Reinforced, 2 IN ID, 10 FT Long, BRDEC Drawing 13229E3794-3 (90598) 13229E3794-3	EA	3
45	5120-00-900-9344	Key, Socket Head Screw: 5 mm (57719) AWM-SC	EA	1
46		Lamp, Incandescent: 120 Volts, 100 Watts (96906) W-L-101/77	EA	1
47	6240-01-355-4422	Lamp, Incandescent: Bulb Size S-6; 6 Watts (96906) MS 15567-2	EA	9
48	6240-00-901-9755	Light, Extension: Closed End Guard w/Hook; Plastic Body w/Switch, Lamp Accommodation Include; 50 Ft Lg; (81348) W-L-661	EA	1

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQD
49	5120-00-293-3399	Mallet, Rubber: Barrel-Shaped, 20 Oz, Type III, Class 3, (81348) GGG-H-33		EA	1
50	4610-00-542-4639	Measure, Dry Chemical, Water Purification: Plastic, Calcium Hypochlorite; 0.05 lb Graduations; 0.20 lb; (81349) MIL-M-52372, Figure 6		EA	1
51	4610-01-115-7521	Measure, Dry Chemical, Water Purification: Sodium Hexametaphosphate; 0.1 lb; (97403) 13221E8334		EA	1
52	6640-01 - 168-03 12	Measure, Liquid, Water Purification: Poly-electrolyte, 107 ml (97403) 13221E8329		EA	1
53	6630-01-346-7271	Meter Assembly, Monitor, Dissolved Solids (97403) 13227E7585		EA	1
54	6630-00-127-4774	Meter, Dissolved Solids (97403) 13222E5258		EA	1
55	2910-01-188-8198	Nozzle, Distribution, Water, 1-1/2 NPT (81349) MIL-N-52110, Type I, Size 2		EA	1
56	7330-00-972-52 11	Paddle (81349) MIL-W-52482, Fig 2		EA	4
57	4610-01-088-3233	Paddle, Aluminum (97403) 13221E8328		EA	1
58	7240-00-943-7 105	Pail, Utility: Plastic or Rubber, Pouring LIP, with Bail (81348) L-P-65, Size 4		EA	4
59	5120-00-223-7396	Pliers, Slip-Joint: 6 Inch Lg; (81348) GGG-P-471, Type 2, Style A, Class 2		EA	1
60	5120-01-135-0062	Puller, Reverse Osmosis Element: (97403) 13221E8330		EA	1

Section II. COMPONENTS OF END ITEM - cont.

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) Usable on U/M Code	(5) QTY RQD
61	4320-01-083-9863	Pump Assembly, Backwash (97403) 13222E5260	EA	1
62	4320-01-083-9859	Pump Assembly, Distribution (97403) 13222E5265	EA	1
63	4320-01-084-2235	Pump Assembly, Raw Water (97403) 13222E5250	EA	2
64	7125-01-232-7686	Rack, Chemical Feed Can (97403) 13226E8331	EA	1
65	4730-01-432-9468	Reducer, External Pipe Thread By Quick Disconnect, Cam-Locking Type, Type XII. MIL- C-27487, 1-1/2 X 2 NOM Size, Class 2 (96906) MS49001-10	EA	2
66	4730-01-432-4747	Reducer, Female By Male, Quick Disconnect, Cam-Locking Type, Type XI. MIL-C-27487, 2 X 1-112 NOM Size, Class 2 (96906) MS49000-6	EA	2
67	4730-01-432-4746	Reducer, Male By Female, Quick Disconnect, Cam-Locking Type, Type XI. MIL-C-27487, 2 X 1-1/2 NOM Size, Class 2 (96906) MS49000-14	EA	1
68	5975-01-053-3991	Rod, Ground: Three 3-Ft Sections; w/attachments; W-R-550, Type III, Class B	EA	1
69	4020-00-289-86 16	Rope, Fibrous: Manila Hemp; Type M Class 1, .75 Inch Dia (8 1348) T-R-605	FT	3
70	5305-01-088-7419	Screw, Machine-Steel, Hex HD, Slotted, Carbon Steel, CAD PLTD, 1/4 - 20 UNC-2A, 2 Inch Lg, (96906) MS5 1849-102	EA	8
71	5120-00-234-8913	Screwdriver, Cross Tip: Phillip; Plastic Handle; No. 2 Tip; 4-Inch Blade; Type VI, Class 1, Style 1 (81348) GGG-S-121	EA	1

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) U/M Usable on Code	(5) QTY RQD
72	5120-00-596-8502	Screwdriver, Flat Tip: Flared Tip; Plastic Handle; 1/4 Inch Width Tip; 1-1/2 Inch Nom Blade Lg; (81348) GGG-S-121, Type I, Class 3	EA	1
73	5120-00-234-8910	Screwdriver, Flat Tip: Flared, Plastic Handle; 5/16-Inch Width Tip; 6-Inch Lg Blade; (81348) GGG-S-121, Type 1, Design A, Shape A	EA	1
74	5120-00-237-0984	Socket, Socket Wrench: 1/2-Inch (8 1348) GGG-W-641	EA	1
75	5120-00-235-5870	Socket, Socket Wrench: 11 - 16 Inch; (81348) GGG-W-641	EA	1
76	5120-00-189-7985	Socket, Socket Wrench: 3/4 - Inch; (81348) GGG-W-641	EA	1
77	5120-00-189-7934	Socket, Socket Wrench: 7/8 - Inch; (81348) GGG-W-641	EA	1
78	5120-00-189-7932	Socket, Socket Wrench: 9/16 - Inch; (81348) GGG-W-641	EA	1
79	5120-00-189-7935	Socket, Socket Wrench: 15/16 - Inch; (8 1348) GGG-W-641	EA	1
80	5120-00-189-7946	Socket; Socket Wrench: 5/8 - Inch; (81348) GGG-W-641	EA	1
81	2540-01-115-1513	(WPES-10 and H-9518-1 only) Step, Portable, (97403) 13221E8342	EA	1
82	4730-00-684-4296	Strainer, Suction Hose: Brass; Cylindrical, (97403) 13228E38307	EA	1
83		(Models WPES-10, WPES-20, and WPES-30) Stuffing Box Flange Capscrew Adapter, 3/8 Inch Hex Bar, 4 Inch Long (61748) 002	EA	1
84	5430-01-170-6984	Tank, Assy Fabric, Collapsible: Water Storage, 3000 Gal; (81349) MIL-T-53048	EA	3
85	6685-00-255-0392	Thermometer, Self-Indicating; 0-220° F; 5 Inch Stem (65092) Model 2291	EA	1

Section II. COMPONENTS OF END ITEM - cont.

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQD
86	2330-01-226-0709	(WPES- 10 and H-95181) Trailer, Flatbed: 600 GPH ROWPU (97403) 13222E7100		EA	1
87	6630-01-105-2058	Tube, Turbidity (97403) 13221E8335		EA	1
88	4720-01-132-0800	Tubing, Flexible, Reinforced; 80.00 Inch Lg (97403) 13221E8367-2		EA	2
89	4820-00-288-7568	Valve, Gate, Bronze, MSS-SP-80, Type 2, 125 Psi 1-1/2 Inch - 11-1/2NPT (81348) WWV-54		EA	1
90	4820-00-595-1847	Valve, Gate, Bronze, MSS-SP-80, Type 2, 125 Psi 2-11 - 1/2 NPT (81348) WWV-54		EA	1
91	4610-01-193-4349	(WPES-10) Water Purification Unit, Trailer Mounted, Type I (97403) 13222E5235		EA	1
92	4610-01-193-4348	(WPES-20) Water Purification Unit, Skid Mounted, Type II, (97403) 13226E0121		EA	1
93	4610-01-341-6287	(WPES-30) Water Purification Unit, Skid Mounted, Type III (97403) 13225E8940		EA	1
94	5120-00-148-7917	Wrench Set, Combination Box and Open End: 15 DEG Offset Box; Opening, 5/16 to 1 Inch Openings; w/Roll (81348) GGG-W-636		SET	1
95	5120-00-264-3796	Wrench, Adjustable: Chromium Plated Open End; Single Head (81348) GGG-W-631, Type I Class 1; Size 12		EA	1
96	5120-00-264-3795	Wrench, Adjustable: Steel, Chromium Plated; Open End; Single Head (8 1348) GGG-W-631, Type I, Class I, Size 6		EA	1
97	5120-00-228-9517	Wrench, Box and Open End: 1-1/2 Inch (81348) GGG-W-636		EA	1

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) Usable on U/M Code	(5) QTY RQD
98	5120-00-242-3249	Wrench, Pipe-Strap: 1/8"-2" Pipe Size; 12 Inch Lg (8 1348) GGG-W-651	EA	1
99	5120-00-277-1479	Wrench, Pipe: Adjustable Jaw, Stillson Pattern; Aluminum Alloy; 1 to 2 Inch IPS: 18 Inch Lg (81348) GGG-W-651, Type II, Class C	EA	2
100	5120-00-277-4244	Wrench, Plier: Straight Jaw Style: 10 Inch Nom Lg; Type 1, Class 1, Style A, (81348) GGG-W-00649	EA	1
101	5120-00-293-1602	Wrench, Spanner: Universal Hose Couplings; 1 - 3 Inch Hose Coupling: 11 Inch Lg (81348) GGG-W-665	EA	2
102	5120-00-378-4411	(Models WPES-10 and H-9518-1) Wrench, Wheel Stud Nut: 1-1/2 Inch Hex Opening One End and .812 Inch Sq Opening Other End; w/Removable Handle: (87641) 151	EA	1
103		(Models H-9518-1, H-9518-2, and H-9518-3) Adapter, Straight, Pipe to Hose, 1/2-inch Pipe to 3/4-inch Hose (97403) 13228E3312-14	EA	4
104		(Models H-9518-1, H-9518-2, and H-9518-3) Adapter, Straight, Pipe to Hose, 3/4-inch Pipe to 3/4-inch Hose (97403) 13228E3312-16	EA	2
105	4730-01-267-0001	(Models H-9518-1, H-95 18-2, and H-9518-3) Adapter Assembly, Female NPSH to Female Cam- Lock (97403) 13227E8836	EA	1
106		(Models H-9518-1, H-9518-2, and H-9518-3) Adhesive-Sealants, Silicone, RTV, One- Component MIL-A-46106	EA	1

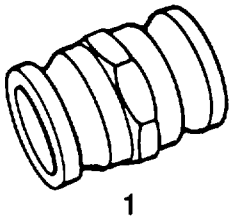
Section II. COMPONENTS OF END ITEM - cont.

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) Usable on U/M Code	(5) QTY RQD
107	4610-01-042-5042	(Models H-9518-1, H-9518-2, and H-9518-3) Bag, Wellpoint (97403) 13229E0519	EA	2
108	4730-00-909-8627	(Models H-9518-1, H-9518-2, and H-9518-3) Clamp, Hose: Low Pressure Type "F" (96906) MS35842-13	EA	25
109	4730-00-908-6292	(Models H-9518-1, H-9518-2, and H-9518-3) Clamp, Hose: Low Pressure Type "F" (96906) MS35842-14	EA	15
110		(Models H-9518-1, H-9518-2, and H-9518-3) Coupling (97403) 13229E0532-1	EA	3
111		(Models H-9518-1, H-9518-2, and H-9518-3) Coupling (97403) 13229E0532-2	EA	5
112	4730-01-086-6157	(Models H-9518-1, H-9518-2, and H-9518-3) Coupling Half, Quick Disconnect, Cam-Locking Type, Cap, Dust, Type IX (96906) MS27028-12	EA	1
113	4730-01-347-8544	(Models H-9518-1, H-9518-2, and H-9518-3) Coupling Half, Quick Disconnect, Cam-Locking Type, Female, Internal Pipe Thread (96906) MS27024-12	EA	1
114	4730-00-115-3740	(Models H-9518-1, H-9518-2, and H-9518-3) Coupling Half, Quick Disconnect, Cam-Locking Type, Male External Pipe Thread, Type 1 (96906) MS27022-12	EA	1
115	4720-01-442-5058	(Models H-9518-1, H-9518-2, and H-9518-3) Hose Assembly, 2 inch Hose, 10 ft. Long (97403) 13229E0509-1	EA	2
116	4720-01-442-5060	(Models H-9518-1, H-9518-2, and H-9518-3) Hose Assembly, 2 inch Hose, 50 ft. Long (97403) 13229E0509-2	EA	4

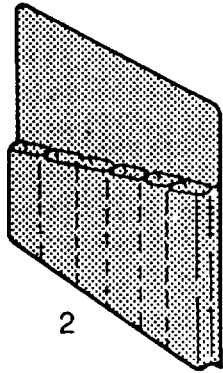
Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) Usable on Code	(5) U/M QTY RQD
117	4730-00-196-2028	(Models H-9518-1, H-9518-2, and H-9518-3) Nipple, Pipe, Standard, Brass or Copper, 1-1/2 Nom Pipe Size x 6 L Long Type BRS (96906) MS51846-144	EA	1
118	4610-01-408-2390	(Models H-9518-1, H-9518-2, and H-9518-3) Plug, Simulator (97403) 13229E0159	EA	1
119	4610-0 1-408-0690	(Models H-9518-1, H-9518-2, and H-9518-3) Orifice, Simulator (97403) 13229E0160	EA	1
120		(Models H-9518-1, H-9518-2, and H-9518-3) Stake (97403) 13229E0513	EA	8
121		(Models H-9518-1, H-9518-2, and H-9518-3) Tee, Pipe, Cast Bronze, 2-inch x 2-inch x 2-inch (80204) ANS B16.15	EA	1
122	4820-01-326-7879	(Models H-9518-1, H-9518-2, and H-9518-3) Valve, Check (97403) 13229E0516-2	EA	1
123	4820-00-268-9 157	(Models H-9518-1) H-9518-2, and H-9518-3) Valve, Gate, Type I, Class 125,1-1/2-inch NPT Bronze (59646) MSS-SP-80	EA	1
124	4610-01-442-5036	(Models H-9518-1, H-9518-2, and H-9518-3) Wellpoint Assembly (97403) 13229E0512		
125	4610-01-420-7547	(Model H-9518-1) Water Purification Unit, Trailer Mounted, Type I (97403) 13222E5235	EA	1
126	4610-01-420-7546	(Model H-9518-2) Water Purification Unit, Skid Mounted, Type II (97403) 13226E0121	EA	1
127	4610-01-420-7548	(Model H-95 18-3) Water Purification Unit, Skid Mounted, Type III (97403) 13225E8940	EA	1

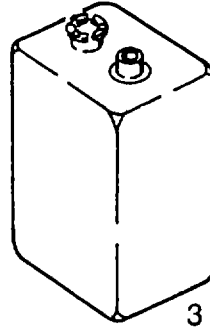
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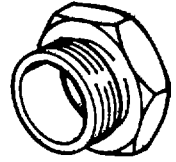
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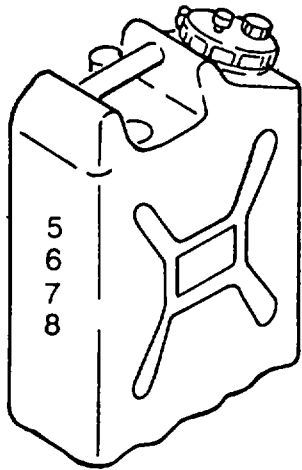
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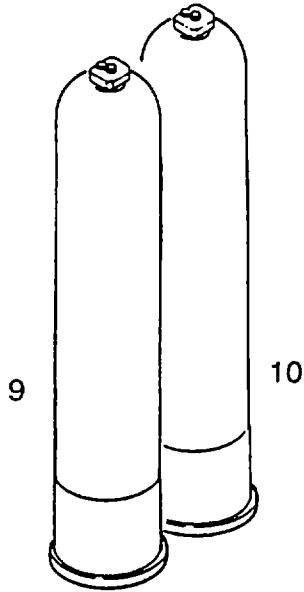
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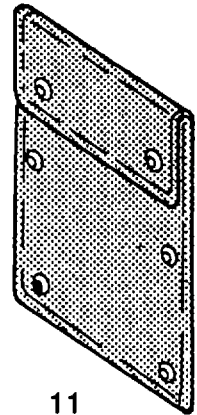


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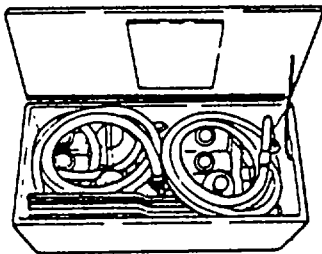


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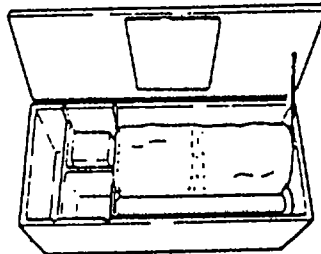
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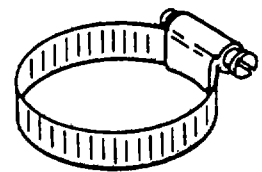


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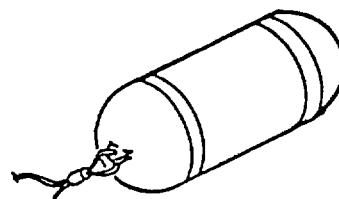
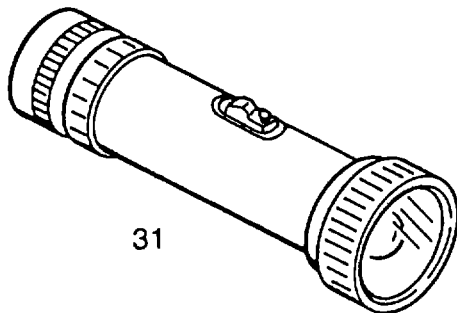
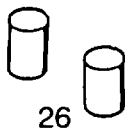
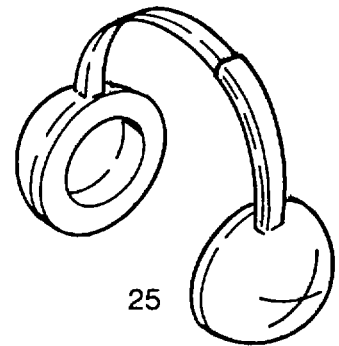
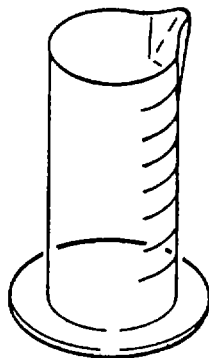
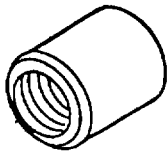
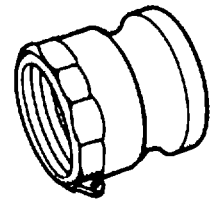
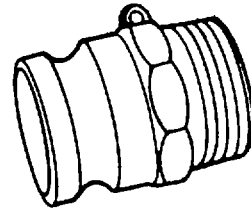
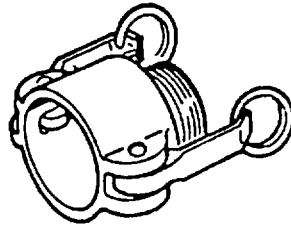
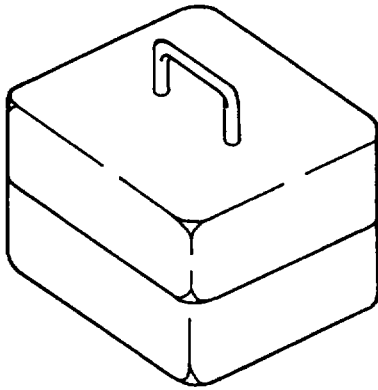
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B-11

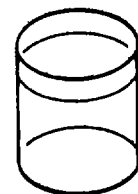
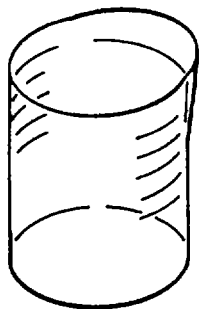
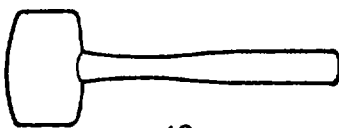
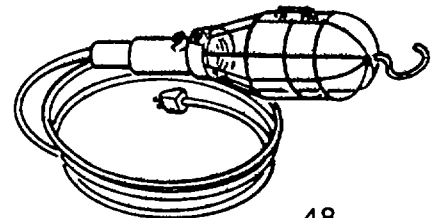
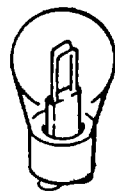
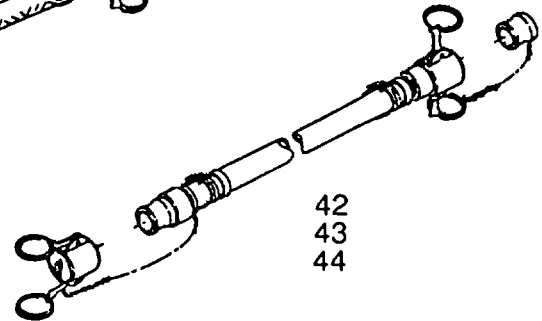
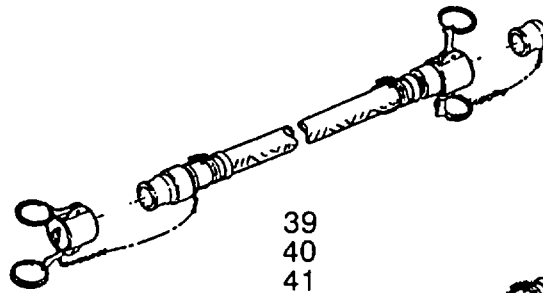
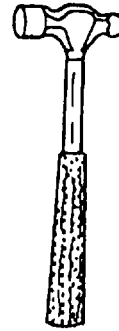
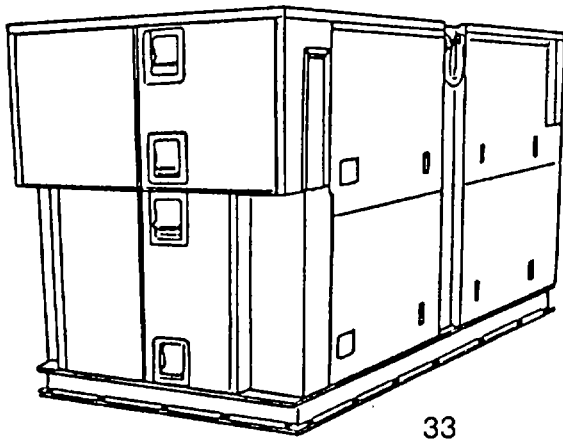


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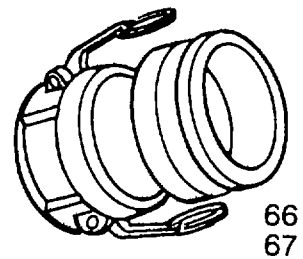
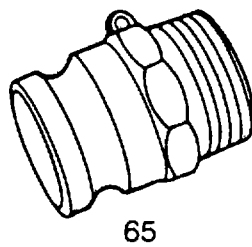
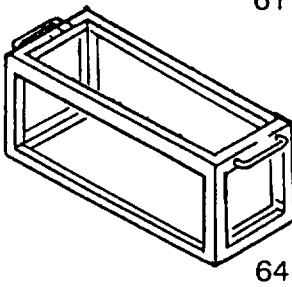
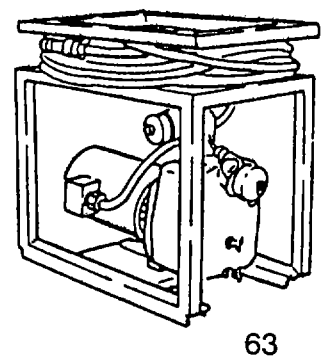
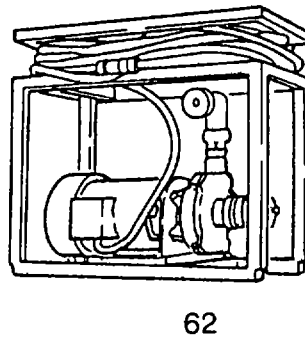
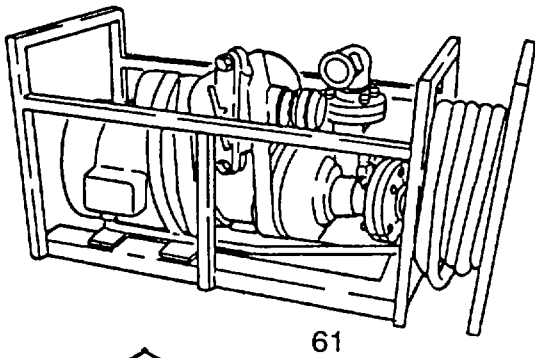
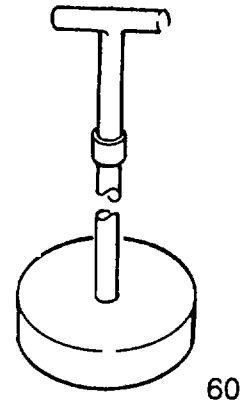
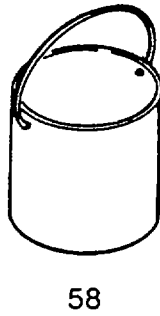
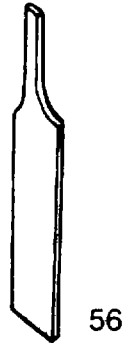
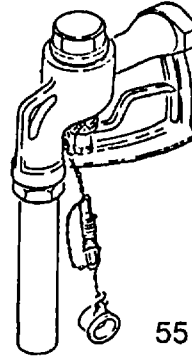
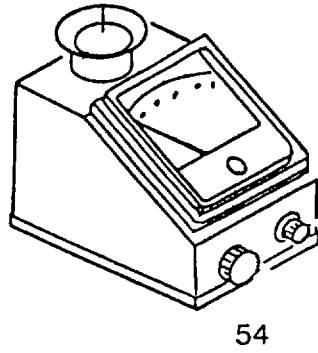
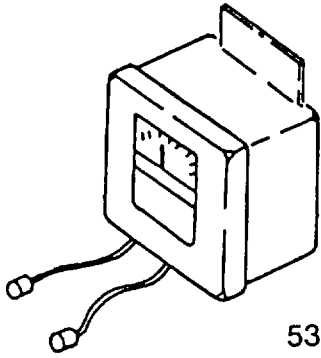
Section II. COMPONENTS OF END ITEM - cont



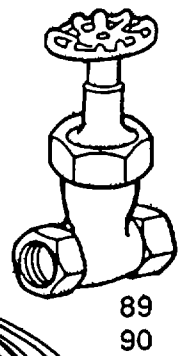
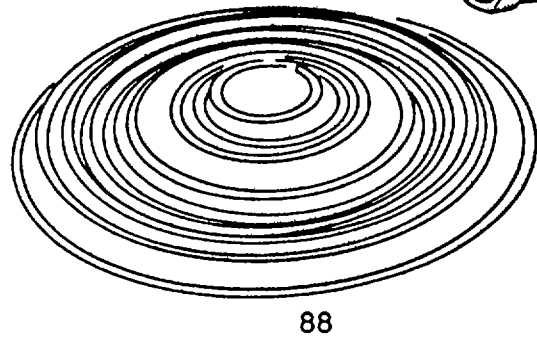
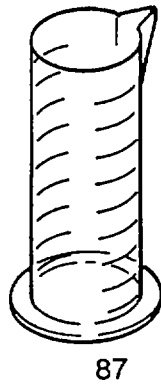
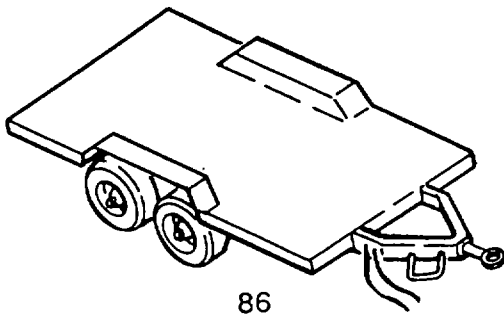
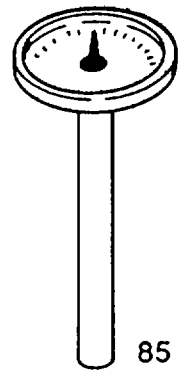
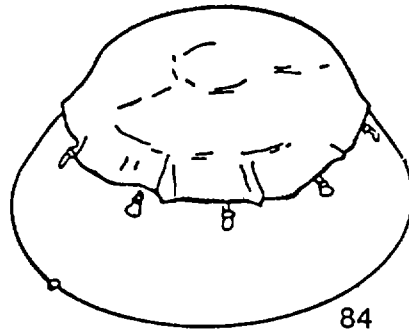
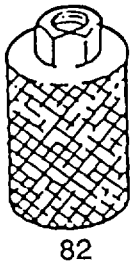
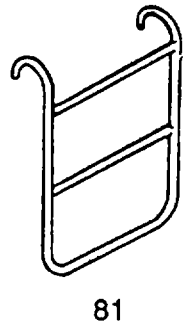
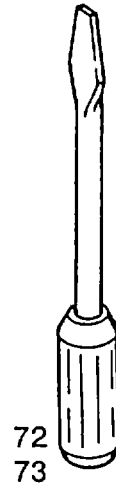
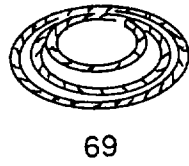
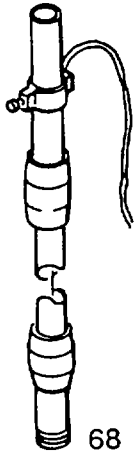
Section II. COMPONENTS OF END ITEM - cont



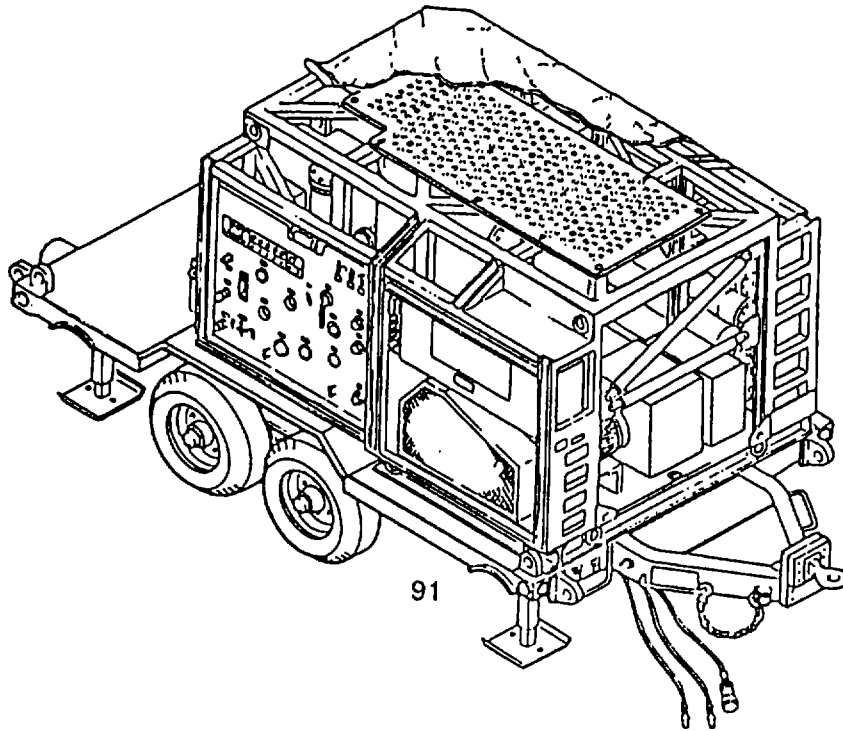
Section II. COMPONENTS OF END ITEM - cont



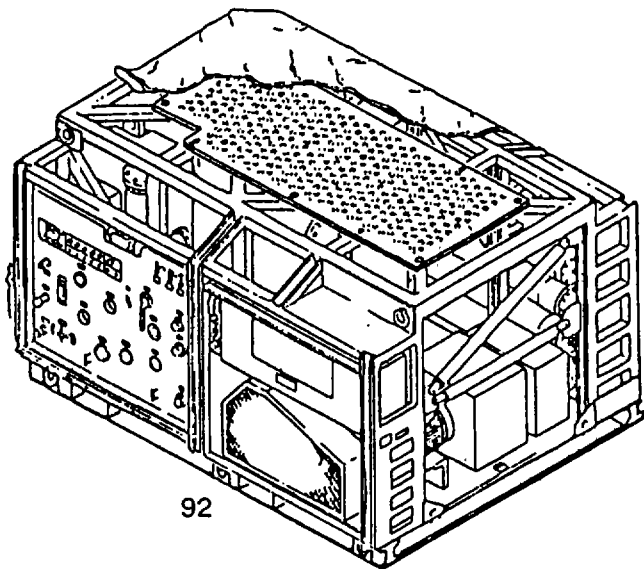
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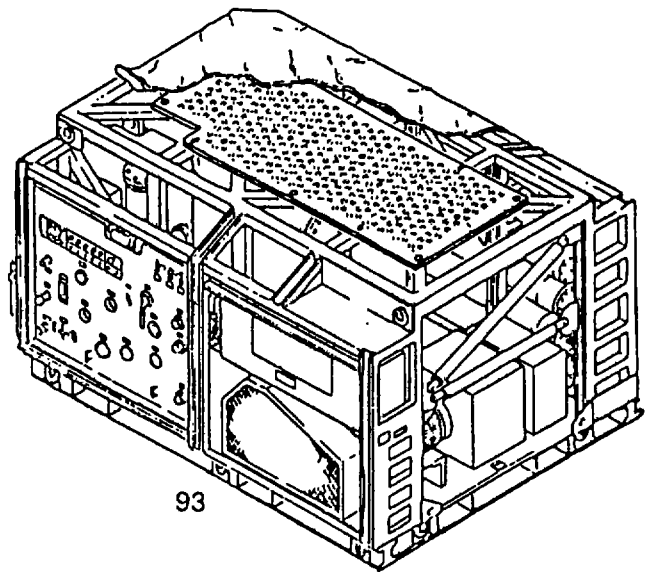
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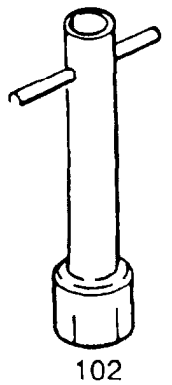
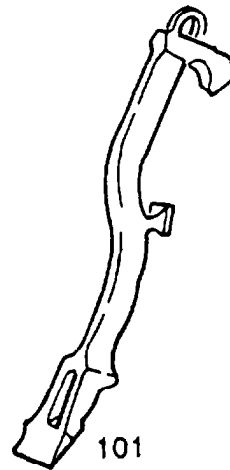
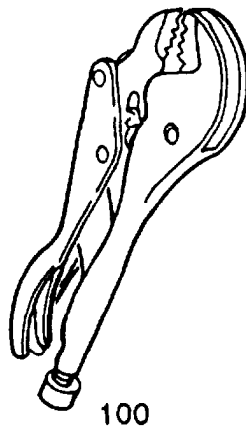
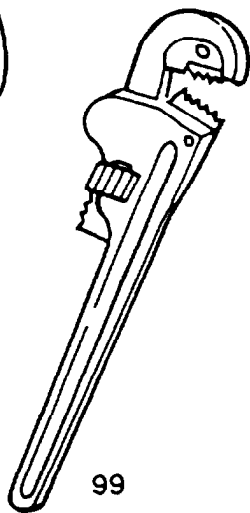
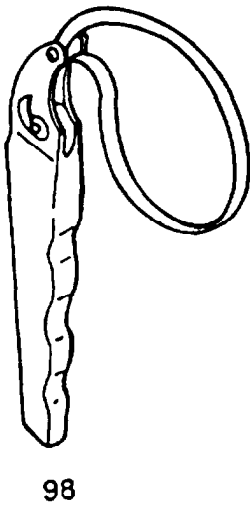
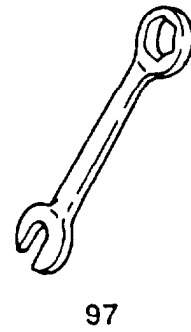
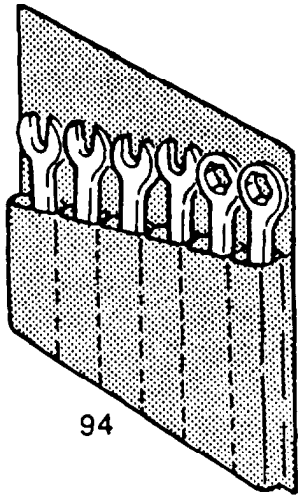


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Section II. COMPONENTS OF END ITEM - cont

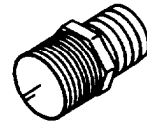


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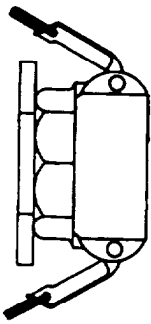
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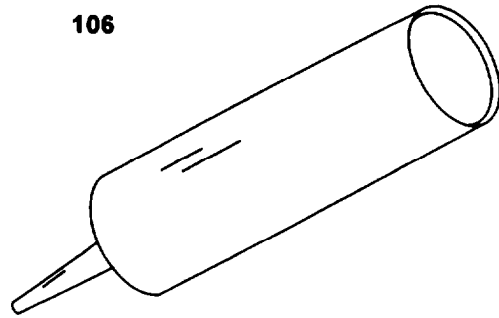
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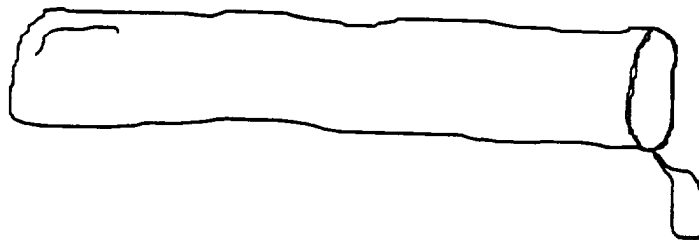
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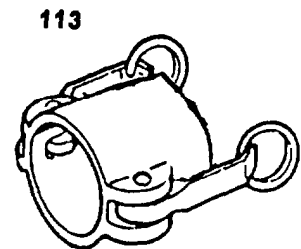
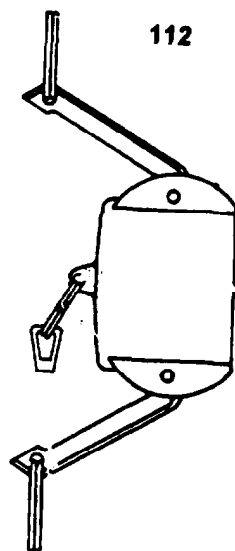
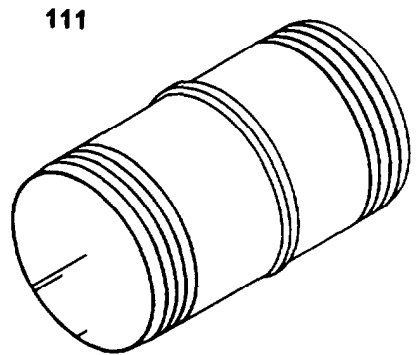
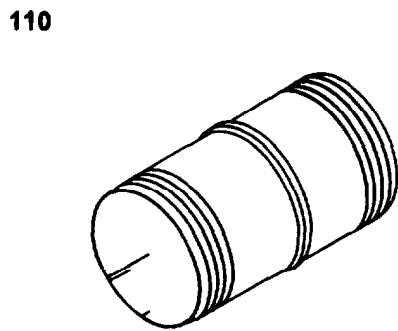
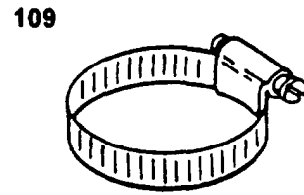
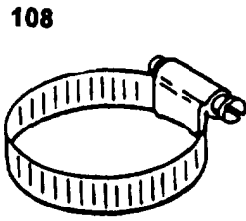
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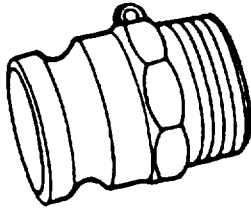


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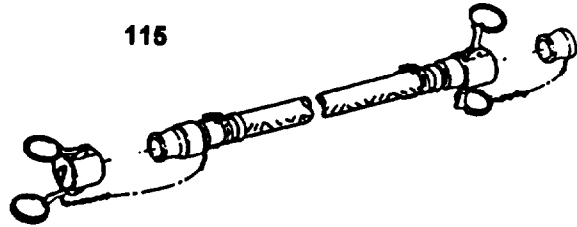


Section II. COMPONENTS OF END ITEM - cont.

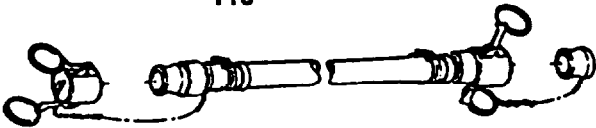
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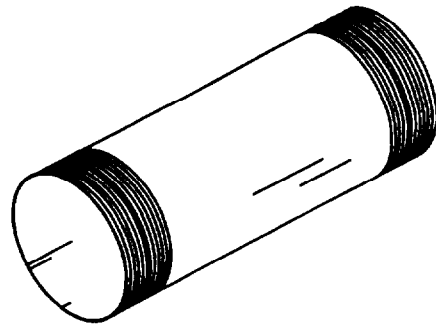
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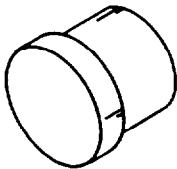
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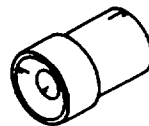
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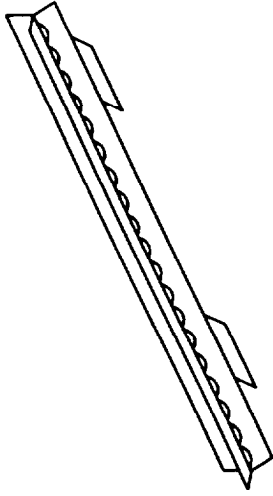


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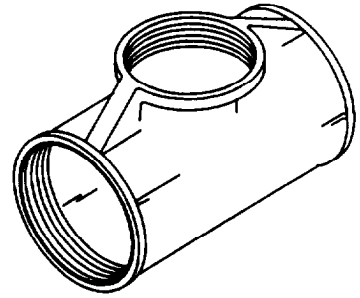


Section II. COMPONENTS OF END ITEM - cont.

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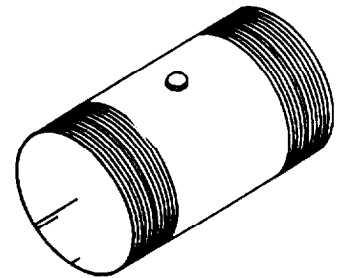
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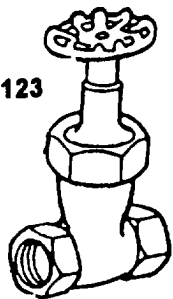
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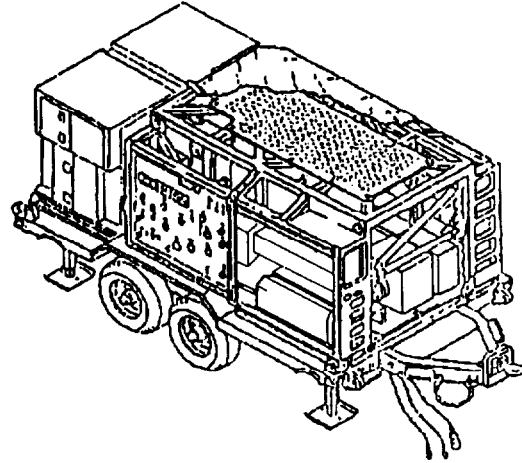


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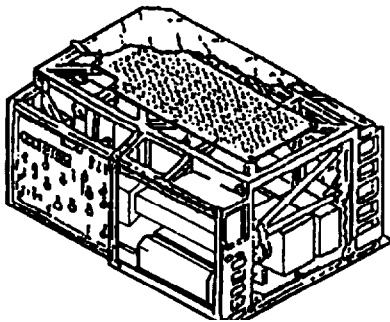


Section II. COMPONENTS OF END ITEM - cont.

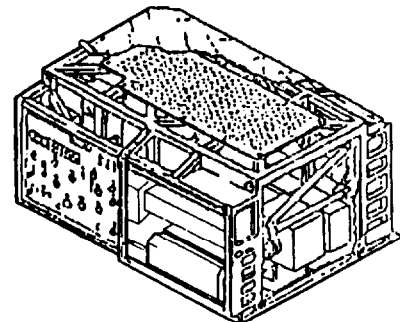
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(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) Usable on U/M Code	(5) QTY RQD
1		TM 10-4610-241-24P/TO 40W4-13-44 Operator's Manual for Water Purification Unit, 600 GPH Trailer Mounted, Flatbed Cargo, 5 Ton 4 Wheel Tandem ROWPU, Models WPES- 10 and H-9518-1 and 600 GPH Skid Mounted Models WPES-20, H-9518-2, WPES-30, and H-9518-3	EA	1
2		LO 10-4610-241-12/TO 40W4-13-51 Lubrication Order for Water Purification Unit, 600 GPH Trailer Mounted, Flatbed Cargo, 5 Ton 4 Wheel Tandem ROWPU, Models WPES-10 and H-9518-1 and 600 GPH Skid Mounted Models WPES-20, H-9518-2, WPES-30, and H-9518-3	EA	1
3		TB 10-4610241-24 Warranty Program for 600 GPH Reverse Osmosis Water Purification Unit (ROWPU). Model Number WPES-10 and H-9518-1		
4	5330-00-360-0595	Gasket (96906) MS27030-5, 1-1/2 Inch	EA	6
5	5330-00-612-2414	Gasket (96906) MS27030-6, 2-Inch	EA	6

Section III. BASIC ISSUE ITEMS - cont.

**US ARMY TM 10-4610-241-10
US AIR FORCE TO 40W4-13-41**

<p style="text-align: center;">TECHNICAL MANUAL OPERATOR'S MANUAL FOR WATER PURIFICATION UNIT, REVERSE OSMOSIS, 600 GPH TRAILER MOUNTED, FLATBED CARGO, 5 TON 4 WHEEL TANDEM ROWPU, MODEL WPES-10 (4610-01-341-4287) MODEL H-9518-1 (4610-01-420-7547) AND 600 GPH SKID MOUNTED ROWPU, MODEL WPES-20 (4610-01-341-4288) MODEL H-9518-2 (4610-01-420-7546) MODEL WPES-30 (4610-01-341-4287) MODEL H-9518-3 (4610-01-420-7548)</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">EQUIPMENT DESCRIPTION</td> <td style="text-align: right; padding: 2px;">1-3</td> </tr> <tr> <td style="padding: 2px;">PREVENTIVE MAINTENANCE CHECKS AND SERVICES</td> <td style="text-align: right; padding: 2px;">3-25</td> </tr> <tr> <td style="padding: 2px;">OPERATION UNDER USUAL CONDITIONS</td> <td style="text-align: right; padding: 2px;">3-27</td> </tr> <tr> <td style="padding: 2px;">OPERATOR TROUBLESHOOTING</td> <td style="text-align: right; padding: 2px;">3-1</td> </tr> <tr> <td style="padding: 2px;">OPERATOR MAINTENANCE PROCEDURES</td> <td style="text-align: right; padding: 2px;">3-17</td> </tr> <tr> <td style="padding: 2px;">SUBJECT INDEX</td> <td style="text-align: right; padding: 2px;">INDEX I</td> </tr> </table>	EQUIPMENT DESCRIPTION	1-3	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	3-25	OPERATION UNDER USUAL CONDITIONS	3-27	OPERATOR TROUBLESHOOTING	3-1	OPERATOR MAINTENANCE PROCEDURES	3-17	SUBJECT INDEX	INDEX I
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**HEADQUARTERS, DEPARTMENTS OF THE ARMY
AND AIR FORCE
16 SEPTEMBER 1992**

LUBRICATION ORDER **LO 10-4610-241-12 (ARMY)
TO 40W4-13-51 (AIR FORCE)**

Supersedes LO 10-4610-241-12, 15 September 1992

**WATER PURIFICATION UNIT, 600 GPH TRAILER MOUNTED,
FLATBED CARGO, 5 TON 4 WHEEL TANDEM ROWPU,
MODEL WPES-10 NSN 4610-01-341-4287
AND MODEL H-9518-1 NSN 4610-01-420-7547
AND 600 GPH SKID MOUNTED MODELS
WPES-20 NSN 4610-01-341-4288
AND H-9518-2 NSN 4610-01-420-7546
AND WPES-30 NSN 4610-01-341-4287
AND H-9518-3 NSN 4610-01-420-7548**

References: TM 10-4610-241-10/TO 40W4-13-41, TM 10-4610-241-12/TO 40W4-13-42

REPORTING OF ERRORS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2025 (Recommended Changes to Publications and Blank Forms) or DA Form 2025-2 (located in the back of this manual, priority is Comusmater, U. S. Army Aviation and Troop Command, Attn: AUSA/T-1/AFAP, 3300 Conant Drive, Ft. Belvoir, St. Louis, MO 63120-1798. You may also submit your recommendations through the E-mail address to comusmater25@hqs.mil. A reply will be furnished directly to you. Instructions for sending an electronic 2025 may be found in the back of this manual immediately preceding the hard copy 2025.

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This LO is for operator (O) or user (U) maintenance. Lubrication intervals (on-condition or hard time) are based on normal operation. Lubricate during downtime and late during recovery periods. The task name specified in this manual may not be all the services prescribed for a particular interval. Use correct grade of lubricant for seasonal temperature expected.

For equipment under manufacturer's warranty, hard time of service intervals shall be followed. Intervals shall be shortened if lubrication is known to be contaminated or if operation is under adverse conditions (such as longer than usual operating hours, extended idling periods, extreme dust).

Chemical feed pump (all models) and R.O. pump oils (only on Models WPES-10, WPES-20 and WPES-30) must be replaced at 100-hour intervals as prescribed by TB 43-0106. Chemistries (OIL) oil sample intervals shall be applied unless changed by the Army Oil Analysis Program (AOAP) laboratory.

Ensure ROWPU is level before checking oil levels in chemical feed pump (on all models) and R.O. pump (only on Models WPES-10, WPES-20 and WPES-30). Drain oils while they are warm.

Lubricate greaser immediately after finishing, or as soon after rest movement permits. Dry equipment before lubricating.

On the picture, a dashed line (---) means there are lubrication points on both sides of the equipment.

Card 1 of 3

*TB10-4610-241-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

**WARRANTY PROGRAM
FOR
600 GPH REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU)
MODEL NUMBERS: WPES-10 AND H-9518-1**

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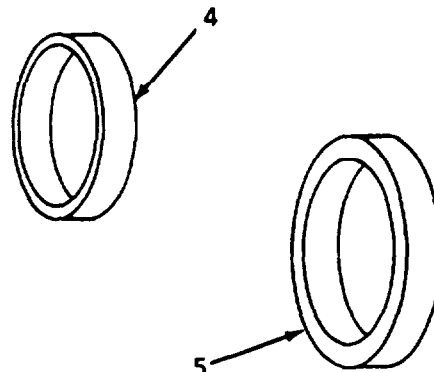
HEADQUARTERS, DEPARTMENT OF THE ARMY, WASHINGTON, D.C.

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this bulletin. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2025 (Recommended Changes to Publications and Blank Forms) or DA Form 2025-2 (located in the back of this manual, priority is Comusmater, U. S. Army Aviation and Troop Command, Attn: AUSA/T-1/AFAP, 3300 Conant Drive, Ft. Belvoir, St. Louis, MO 63120-1798. You may also submit your recommendations through the E-mail address to comusmater25@hqs.mil. A reply will be furnished directly to you. Instructions for sending an electronic 2025 may be found in the back of this manual immediately preceding the hard copy 2025.

1. **Coverage.** This warranty technical bulletin identifies warranty conditions and procedures that apply to the 600 GPH Reverse Osmosis Water Purification Unit (ROWPU) NSN 4610-01-341-4287 and NSN 4610-01-420-7547, as outlined under Contract DAAG81-91-C-0176 and Contract DAAG81-95-D-0854. Warranty coverage is for the period of two years from date of issue and not to exceed four years from date of delivery in stores on the Material Inspection and Reporting Action (DIR) Form 230.
2. **Exclusions of Forces.** The following items apply to the ROWPU warranty program:
 - a. Abuse. The improper use, repair or handling of warranted items such that the warranty may become void. Failure to perform preventive maintenance or improperly performed corrective maintenance also constitutes abuse.
 - b. Anticipated Dism. The date on date of replacement is assigned and DOD priority by the condition and signing of a DO Form 230 or an approved replacement document by an authorized Government representative.

*This manual supersedes TB10-4610-241-24, dated 16 September 1992.



APPENDIX C
ADDITIONAL AUTHORIZATION LIST

Not Applicable

C-1/(C-2 blank)

APPENDIX D

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the Reverse Osmosis Water Purification Unit. This listing is for informational purpose only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

D-2. EXPLANATION OF COLUMNS.

- a. Column 1 Item Number. This number is assigned to the entry in the listing and is referenced in the task Initial Setup instructions to identify the material; e.g., "Drycleaning solvent (Item 24, App D)".
- b. Column 2 Category. This column identifies the lowest category of maintenance that requires the listed item:

C - Operator/Crew

O - Unit Maintenance

F - Direct Support Maintenance

H - General Support Maintenance

- c. Column 3 National Stock Number. This is the national stock number assigned to the item; use it to request or requisition the items.
- d. Column 4 Description. Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Commercial And Government Entity (CAGE) Code for Manufacturer in parenthesis, if applicable.
- e. Column 5 Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two character alphabetical abbreviation (e.g. ea, in, pr). If the unit of measure differs from the rest of the issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item No.	(2) Category	(3) National Stock Number	(4) Description	(5) U/M
1	F	8040-00-262-9005	Adhesive (81348) MMM-A-1617, Type 11	TB
2	O	5610-01-355-7780	Anthracite No. 2 (410 lbs required) (71762) 01001296	LB
3	O	6810-00-238-8115	Calcium Hypochlorite, Technical: 3-3/4 lb Plastic Bottle (81348) 0-C1 14, Type 1	EA
4	O	6810-01-044-0315	Chlorine Test Tablets: Palin, DPD Chlorine #1: 100 Per Box; (79172) U-2510	BX
5	O	6810-01-164-3975	Citric Acid, Anhydrous, Technical: Crystalline; 3/4 Lb Plastic Bottle; (81349) MIL-C-52947	EA
6	F	8305-00-059-5074	Cloth, Cheesecloth (24064) BEP66	LB
7	O	6850-01-167-5318	Coagulant Liquid, Water Treatment: 2.35 lb Plastic Bottle; (81549) MIL-I-52701	EA
8	O	7930-00-282-9699	Detergent, GP, Liq, WS, A (81349) MIL-D-16791	GL
9	O	5610-01-355-7783	Garnet, Course, No.12 (71762) 001638-11 CULLSAN U (170 lbs required)	LB
10	O	5610-01-355-7782	Garnet Fine No.50 (71762) 01001345 (180 lbs required)	LB
11	O	5610-01-355-7784	Gravel, 1/4-inch (240 pounds required) (71762) 1621-10	LB
12	O		Grease (70878) 35-616	LB
13	O	9150-00-190-0904	Grease, Automotive and Artillery, GAA (81349) MIL-G-10924	EA
14	O	9150-01-161-4600	Grease, Silicone (71984) DC-18	TB

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST (continued)

(1) Item No.	(2) Category	(3) National Stock Number	(4) Description	(5) U/M
15	O	6810-00-087-2340	Indicator Solution, pH Wide Range 16 Oz Plastic Bottle (81349) MIL-1-52701	EA
16	O	6505-00-153-8220	Glycerin, USP: (47908) NDC51552-0094-16	LB
17			Deleted	
18	O	9150-01-035-5395	Oil, Lubricating, Internal Combustion Engine (81349) MIL-L-2105	GL
19	O	9150-01-152-4117	Oil, Lubricating, Internal Com- bustion Engine (81349) MIL-L-2104	GL
20	O	7920-00-205-1711	Rags, Wiping (58536) A-A-531	LB
21	O	5610-01-355-7781	Sand, Filter (230 lbs required) (76371) 5100191000	LB
22	O	5350-01-279-6314	Sanding Strip, Abrasive (77068) 8225A25	EA
23	O	6810-01-164-3941	Sodium hexametaphosphate, Technical, 2 LB Plastic Bottle; (81349) MIL-S-51078	BT
24	F	6850-00-664-5685	Solvent, Dry-cleaning (81349) PD-680	GL
25			Deleted	
26	O	8030-00-889-3534	Tape, Antiseize, Roll (81349) MIL-T-27730	EA

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST (continued)

(1) Item No.	(2) Category	(3) National Stock Number	(4) Description	(5) U/M
27	O	5970-00-147-5674	Tape, electrical (81349) MIL-1-24391	RO
28	O		Tape, Insulating (Nomex) (97403) 13221 E8320-4)	RO
29	O	4020-00-138-7042	Twine, ball (81349) MIL-T-713	EA
30	O	6850-01-429-9839	Cleaner, membrane (To Low pH Cleaner) (ORDP2) KLEEN MCT 442	LB
31	O	6850-01-446-9518	Cleaner, membrane (To High pH Cleaner) (ORDP2) KLEEN MCT 411	LB
32	O	6850-01-429-9840	To Membrane Preservative (Antifreeze) (ORDP2) PROGARD SPC	GL
33	O	6810-01-359-4918	Sodium Bisulfite (97403) P/N13229E0922	OZ

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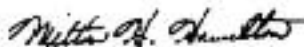
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By Order of the Secretaries of the Army and Air Force:

Official: 

MILTON H. HAMILTON
*Administrative Assistant to the
Secretary of the Army*
02500

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

MERRILL A. McPEAK
General, USAF
Chief of Staff

Official:
CHARLES C. McDONALD
General, USAF
Commander, Air Force Logistics Command

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25-E, block 5933, requirements for TM 10 4610-241-10.

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9,10, 13,15,16,17 and 27.

From: "Whoever" whoever@avma27.armv.mil
To: tacom-tech-pubs@ria.army.mil

Subject: DA Form 2028

1. **From:** Joe Smith
2. **Unit:** home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT-93
8. **Pub no:** 55-1915-200-10
9. **Pub Title:** TM
10. **Publication Date:** 11-APR-88
11. **Change Number:** 12
12. **Submitter Rank:** MSG
13. **Submitter Fname:** Joe
14. **Submitter Mname:** T
15. **Submitter Lname:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 1
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. **Text:**

This is the text for the problem below line 27.

<p align="center">RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</p> <p>For use of this form, see AR-25-30; the proponent agency is ODISC4.</p>	<p>Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).</p>	<p>DATE</p>
---	---	-------------

<p>TO: (<i>Forward to proponent of publication or form</i>) (<i>Include ZIP Code</i>)</p>	<p>FROM: (<i>Activity and location</i>) (<i>Include ZIP Code</i>)</p>
--	--

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

<p>PUBLICATION/FORM NUMBER</p>	<p>DATE</p>	<p>TITLE</p>
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ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

Reference to line numbers within the paragraph or subparagraph.

<p>TYPED NAME, GRADE OR TITLE</p>	<p>TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION</p>	<p>SIGNATURE</p>
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TO: <i>(Forward direct to addressee listed in publication)</i>	FROM: <i>(Activity and location) (Include ZIP Code)</i>	DATE
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PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
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<p align="center">RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</p> <p>For use of this form, see AR-25-30; the proponent agency is ODISC4.</p>	<p>Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).</p>	<p>DATE</p>
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<p>TO: (<i>Forward to proponent of publication or form</i>) (<i>Include ZIP Code</i>)</p>	<p>FROM: (<i>Activity and location</i>) (<i>Include ZIP Code</i>)</p>
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PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

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<p align="center">RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</p> <p>For use of this form, see AR-25-30; the proponent agency is ODISC4.</p>	<p>Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).</p>	<p>DATE</p>
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TO: <i>(Forward direct to addressee listed in publication)</i>	FROM: <i>(Activity and location) (Include ZIP Code)</i>	DATE
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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigram = .035 ounce
 1 decagram = 10 grams = .35 ounce
 acres
 1 hectogram = 10 decagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit	5/9 (after	Celsius	°C
	temperature	subtracting 32)	temperature	

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