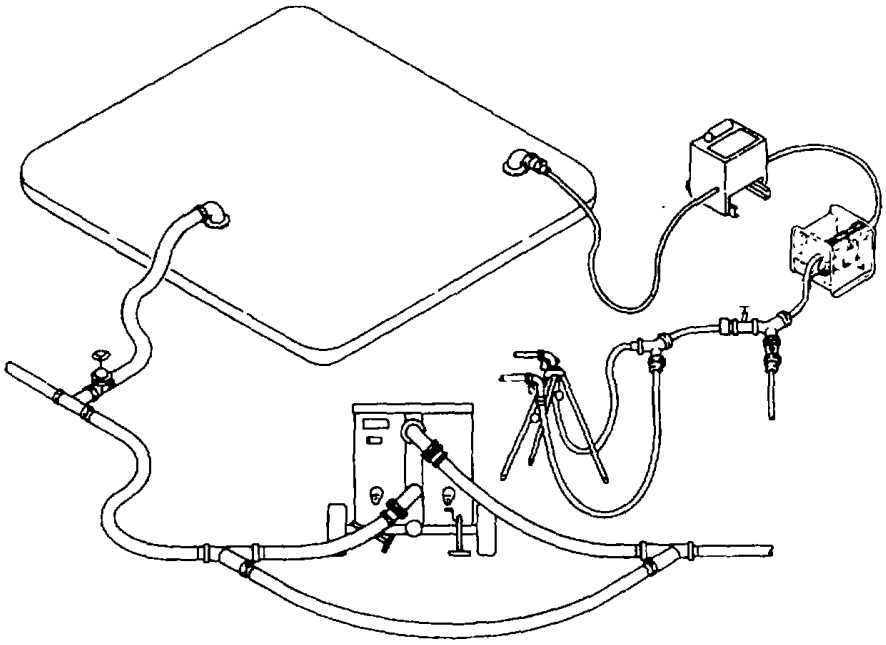
TECHNICAL MANUAL

OPERATOR'S, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL



TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM, 10 MILE SEGMENT (NSN 4320-01-323-0305) MODEL NO.6IN-TWDS EIC: ZHS

HEADQUARTERS, DEPARTMENT OF THE ARMY
28 February 1995

WARNING

DANGEROUS CHEMICALS

- Calcium hypochlorite can cause serious injury if not handled properly. Heed all safety measures below.
- If calcium hypochlorite comes into contact with skin or eyes, flush right away with water. Get medical help.
- Store calcium hypochlorite in a cool, dry place. Keep container closed.
- Mix only in accordance with direction for use.
- DO NOT allow calcium hypochlorite to mix with any other materials, such as fuels, oils, paint products, or ammonia. This may cause fire or hazardous gases.

WARNING

SOLVENT

- Solvent may cause toxic fumes. To prevent personal injury, work only in a well-ventilated area. DO NOT breathe fumes for a long time.
- Solvent is flammable. To prevent fire or explosion, DO NOT bring open flame or sparks near solvent.

WARNING

HEARING DAMAGE

Hearing protection must be worn by personnel standing within 50 ft (15 m) of operating pump when enclosure doors are opened. Hearing loss may occur.

WARNING

HIGH VOLTAGE

To prevent electric shock, or death, always disconnect power before performing maintenance.
FOR FIRST AID, SEE FM 4-25.11.

CHANGE NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *2 February 2007*

C2

OPERATOR'S, UNIT AND DIRECT SUPPORT MAINTENANCE MANUAL FOR

TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM, 10. MILE SEGMENT
NSN: 4320-01-323-0305
MODEL No. 6IN-TWDS
EIC:ZHS

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Operator's, Unit and Direct Support
Maintenance Manual

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10-MILE SEGMENT
NSN 4320-01-323-0305
MODEL NO. 6IN-TWDS
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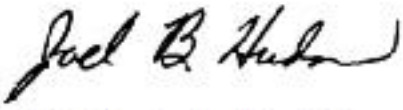

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ii thru vi	0	E-1 and E-2	0
1-0 thru 1-14	0	F-1/(F-2 blank)	0
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C-7	1		
C-8 thru C-13	0		
C-14 and C-15	1		
C-16 and C-17	0		
C-18 thru C-23	1		
C-24	0		
C-25	1		
C-26	0		
C-27	1		

TECHNICAL MANUAL

NO: 10-4320-317-13

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OPERATOR'S, UNIT AND DIRECT SUPPORT MAINTENANCE MANUAL

TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM, 10. MILE SEGMENT
NSN: 4320-01-323-0305
MODEL NO. 6IN-TWDS
EIC: ZHS

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or e-mail your letter or DA Form 2028 directly to: AMSTA-LC-LPIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is ROCK-TACOM-TECH-PUBS@conus.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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HOW TO USE THIS MANUAL

The manual has been divided into chapters, sections, and paragraphs which are all numbered sequentially; figures and tables have also been numbered in the same manner. The operator's portion of the manual identifies major components and their location which will aid you, the operator and maintainer, in performing your PMCS. Detailed lubrication instructions, which are mandatory, are also included within the operator's maintenance section.

Use the front cover locators and "marked/tabbed" pages to quickly find the parts of the manual shown on the cover. The "blocked" titles in the table of contents are the titles for these locators. These portions of the manual were chosen because they are used most often.

Maintenance procedures used by Operator, Unit and Direct Support personnel are described in a step by step manner, ensuring the correct, and safe removal or repair of equipment. An alphabetical index at the back of the manual is referenced to the appropriate paragraph in the manual for ease of locating a specific task or procedure.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Scope.

a. Type of Manual. Operator's, Unit and Direct Support Maintenance Manual.

b. Model Number and Equipment Name. Tactical Water Distribution Equipment System, 10-Mile Segment, Model No. 6 X 6 SP6, NSN 4320-01-323-0305 (hereafter called TWDS).

c. Purpose of Equipment. The system covered by this manual receives water from large storage and distribution units. These are supplied by shipboard trailers or desalination operations. The TWDS transports this water to small distribution points or to another large storage and distribution unit.

d. Special Limitations. TWDS is not intended for use with brackish or contaminated water or at temperatures below 32°F (0°C).

1-2. **Maintenance Forms, Records, and Reports**. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 750 -8, The Army Maintenance Management System (TAMMS).

1-3. **Corrosion Prevention and Control (CPC) of Army Materiel**. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent this problem in future items. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using Standard Form 368, Product Quality Deficiency Report. Use of keywords such as "corrosion", 'rust", "deterioration", or "cracking" will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA PAM 750 -8.

1-4. **Destruction of Army Material to Prevent Enemy Use**. Command decisions, according to tactical situation, will determine when destruction of the trailer pump unit will be accomplished. A destruction plan will be prepared

by the using organization, unless one has been prepared by higher authority. For general destruction procedures for this equipment, refer to TM 750-244-3, Procedures for Destruction of Equipment to Prevent Enemy Use.

1-5. **Preparation for Storage or Shipment**. Refer to Section III of Chapter 4 for requirements concerning these preparations.

1-6. **Quality Assurance/Quality Control (QA/QC)**. The quality of TWDS must at all times be in compliance with the requirements set forth by AMCPM-PWL. If a discrepancy is found to exist, notify your supervisor.

1-7. **Hand Receipt (-HR) Manuals. Not applicable.**

1-8. **Reporting Equipment Improvement Recommendations (EIRs)**. If your TWDS unit 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. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at Commander, U. S. Army Aviation and Troop Command, ATTN: AMSAT-I-MDO, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120-1798. We'll send you a reply.

1-9. **Safety, Care, and Handling**. Safe and efficient TWDS unit operations depend on the observance of well established safety practices and a thorough knowledge of operating procedures. The operating procedures often involve using equipment and materials that are potentially hazardous. Injury to personnel and damage to equipment caused by fire, and misuse of equipment can be avoided by alert and responsible operators and technicians. Strict observance to established safety, care, and handling practices and procedures will allow personnel to perform their duties in a safe and hazard-free environment.

a. General Precautions. The following are general safety precautions that need to be observed by all operators of the TWDS.
Always be mindful to operations in progress. Never allow horseplay or loud talking that would divert the attention of operators or technicians. If the TWDS is left unattended, be sure no safety hazard will result because of absence.
Whenever in doubt concerning this operation, consult qualified authority for advice.
Do not attempt unauthorized shortcuts to save time, as they generally are not in accordance with safe procedures.
Be prepared for any emergencies which may arise, and be familiar with the proper action to take in event of emergencies.
When ending daily operations, make a thorough and orderly check of equipment to be sure that no hazards may develop during the time that TWDS is unattended.

b. Preventing Fire. The following fire prevention rules must be observed:
Do not smoke in the vicinity of the engine or fuel tank.
Never use open flames in the vicinity of the engine or fuel tank.
Clean up liquid spills immediately.
Always pour acid into water; never pour water into acid.
Store oily rags in metal, airtight container.

c. Extinguishing Fires. Do not use water for extinguishing oil fires because it will spread the fire. Water is a conductor of electricity and should not be used on electrical fires.

1-10. **Warranty Information**. The TWDS is warranted by Reddy Buffaloes Pump Inc. for 12 months. It starts on the date found in block 23, DA Form 2408-9, in the log book. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your organizational maintenance shop.

1-11. **List of Abbreviations**.

cm	centimeter
GPM	gallons per minute
lb	pound
m	meter
mm	millimeter
mph	miles per hour
MTOE	Modified Table of Organization and Equipment
N•m	Newton meter
NSN	National Stock Number
para	paragraph
psi	pound-force per square inch
psig	pound-force per square inch gage
TAMMS	The Army Maintenance Management System
TMDE	Test, Measurement, and Diagnostic Equipment
TOE	Table of Organization and Equipment
TRICON	Triple Container
TWDS	Tactical Water Distribution Equipment S ystem
°C	degrees Celsius
°F	degrees Fahrenheit

Section II. EQUIPMENT DESCRIPTION

1-12. **Equipment Characteristics, Capabilities, and Features**.

a. Characteristics. Consists of two storage assemblies, two distribution points, a 10-mile hoseline segment, and five or six pumping stations. The number of pumping stations required depends upon the terrain and distance that the stations are spread across. Smooth terrain requires five pumping stations with the sixth as a spare. Rough terrain requires all six pumping stations.

b. Capabilities and Features.
(1) Capable of transporting water at 600 GPM across level terrain.
(2) Can transport approximately 720,000 gallons of water within a 24-hour period.
(3) Can be unpacked and readied for operation within 48 hours.
(4) All weather operational (except below 32 °F (0°C)).
(5) Highly mobile.

1-13. **Location and Description of Major Components**.

a. Pumping Station (Figure 1-2).

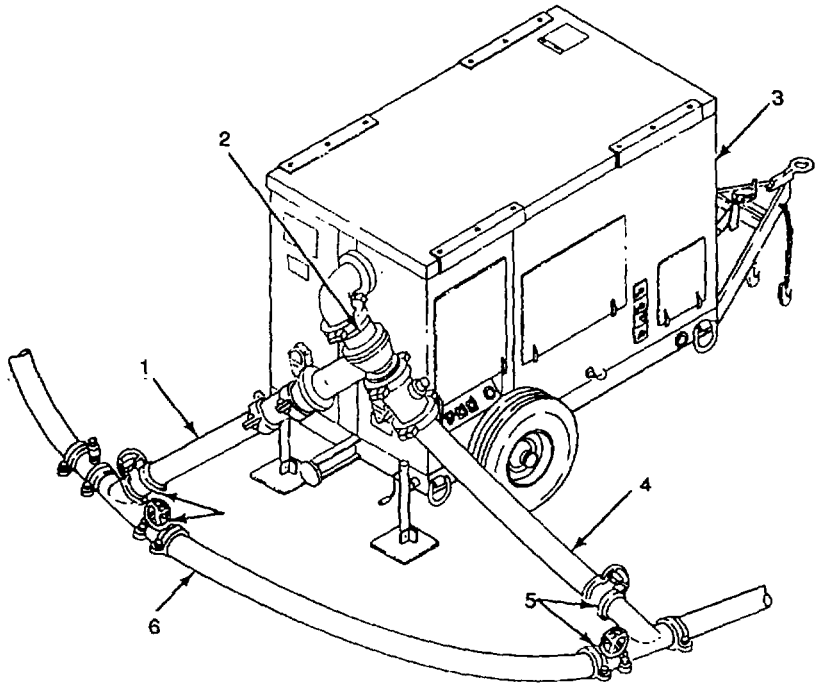


Figure 1-2. Pumping Station

(1) **SUCTION HOSE ASSEMBLY (1)**. The 6 in. X 10 ft, rigid-walled, wire reinforced hose assembly connects pump to water source. Equipped with quick disconnect fittings for rapid installation.

(2) **CHECK VALVE (2)**. Allows water to flow in only one direction. The check valve mounts on the discharge side of the pumping assembly to prevent backflow to the pump from the TWDS system.

(3) **TRAILER PUMP UNIT (3)**. Mobile pumping assembly rated at 600 GPM. Draws water from source or upline boost pump and feeds reservoir or next downline boost pump. Fitted with suction and discharge elbows suitable for connection to 6-inch boltless couplings. Utilizes noise enclosure for noise reduction. Refer to applicable technical manual for operating procedures.

(4) **DISCHARGE HOSE ASSEMBLY (4)**. The 6 in. X 20 ft collapsible hose assembly directs waterflow to hoseline.

(5) **BUTTERFLY VALVES (5)**. The Butterfly valves isolate the pumping station when it is not in operation.

(6) **BYPASS HOSE ASSEMBLY (6)**. The 6 in. X 75 ft collapsible hose assembly allows water to bypass the pump by manually opening and dosing butterfly valves when station shuts down.

b. Storage Assemblies (Figure 1-3).

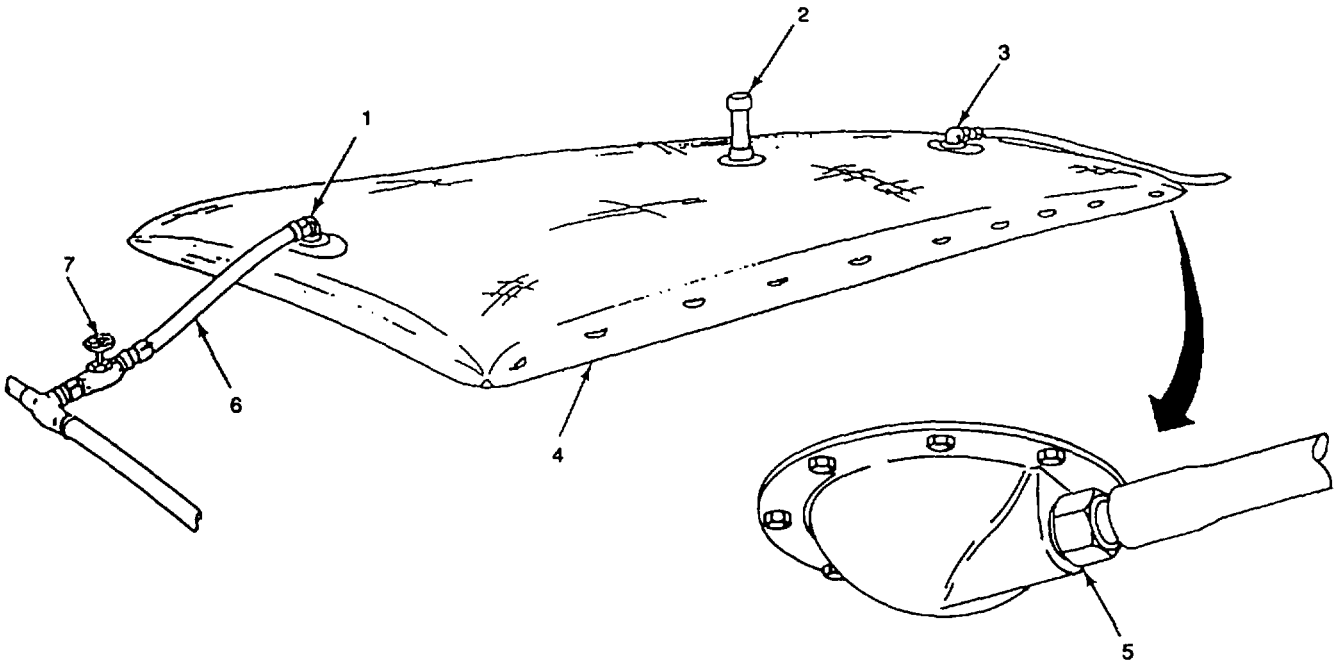


Figure 1-3. Storage Assemblies

(1) **FILLER/DISCHARGE ELBOWS (1 and 3)**. Directs waterflow from hose assembly into storage tank when filling tank Directs waterflow from tank during discharge.

(2) **VENT ASSEMBLY (2)**. Opens when internal pressure reaches 0.1 psi.

(3) **STORAGE TANK (4)**. The 20,000 gallon, collapsible, rubberized-nylon fabric storage tank supplies TWDS distribution point or may be used for water storage. Comes with kit for temporary and permanent repairs. Refer to applicable technical manual for setup and maintenance procedures.

(4) **DRAIN HOSE AND DRAIN ASSEMBLY (5)**. Allows water to drain from storage tank

(5) **DISCHARGE HOSE ASSEMBLY (6)**. The 4 in. X 10 ft hose assembly feeds water from hoseline and gate valve assembly to filler fitting on storage tank.

(6) **4-INCH GATE VALVE (7)**. Used to control water flow into storage assembly.

c. Distribution Points (Figure 1-4).

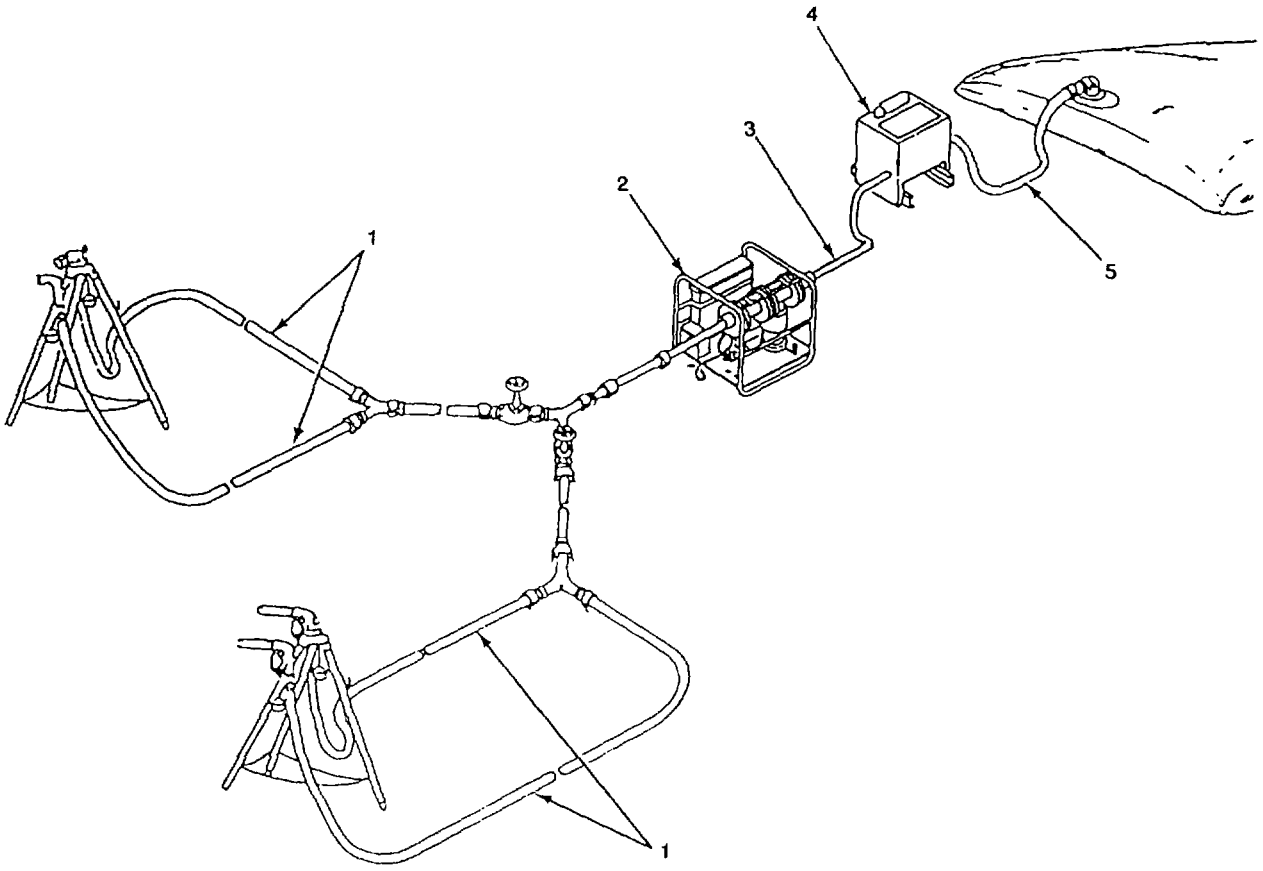


Figure 1-4. Distribution Points

(1) **DISCHARGE HOSE ASSEMBLIES (1)**. Each 2 in. X 20 ft hose assembly directs flow of water from hypochlorination unit to manual disbursing stations. Equipped with quick-disconnect fittings and manually operated valves.

(2) **HYPOCHLORINATION UNIT (2)**. Skid-mounted portable. Provides automatic chlorination of water before it is distributed. Refer to applicable technical manual for operation and maintenance procedures.

(3) **DISCHARGE HOSE ASSEMBLY (3).** The 2 in. X 10 ft hose assembly directs flow of water from 125 GPM pump to hypochlorination unit. Equipped with quick-disconnect fitting.

(4) **125 GPM PUMP (4)**. Side-mounted, portable with noise enclosure. Draws water from storage tank and delivers it to hypochlorination unit. Refer to applicable technical manual for operation and maintenance procedures.

(5) **SUCTION HOSE ASSEMBLY (5)**. The 2 in. X 20 ft, rigid-walled hose assembly directs flow of water from a storage tank to 125 GPM pump. Equipped with quick-disconnect fittings.

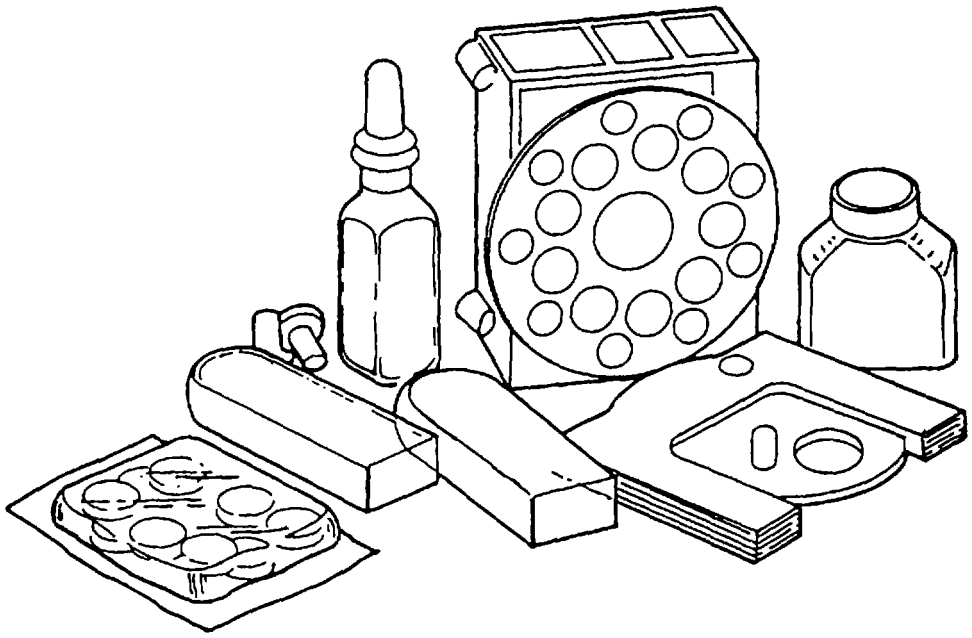


Figure 1-5. Color Comparator Kit

(6) COLOR COMPARATOR KIT (Figure 1-5). Used to measure chlorine content and pH value of distributed water.

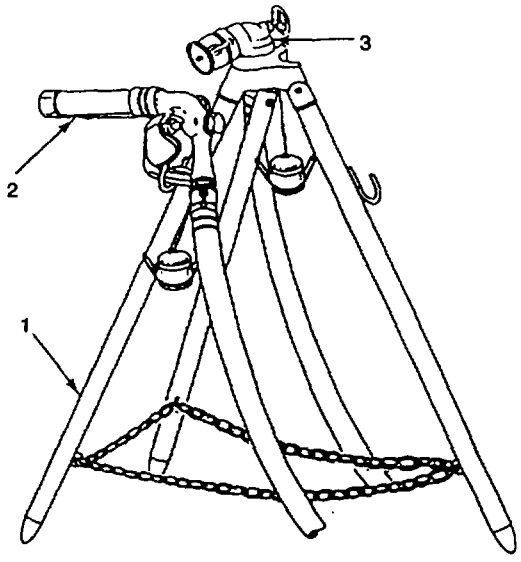


Figure 1-6. Nozzle Stand Assembly

(7) **NOZZLE STAND ASSEMBLY (1, Figure 1-6)**. Collapsible tripod. Provides a place to support manual disbursing station nozzles when they are not being used.

(8) **NOZZLE (2)**. Used to fill 5-gallon cans, canteens, etc.

(9) **ELBOW VALVE (3)**. Used to fill tank trucks, tank trailers, etc.

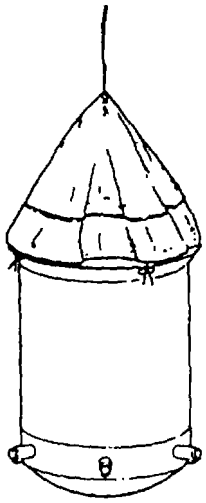


Figure 1-7. Drinking Water Storage Bag

(10) DRINKING WATER STORAGE BAG (Figure 1-7). 36gallon capacity, cotton duck Hanging bag with faucets at bottom of bag distribute water to personnel.

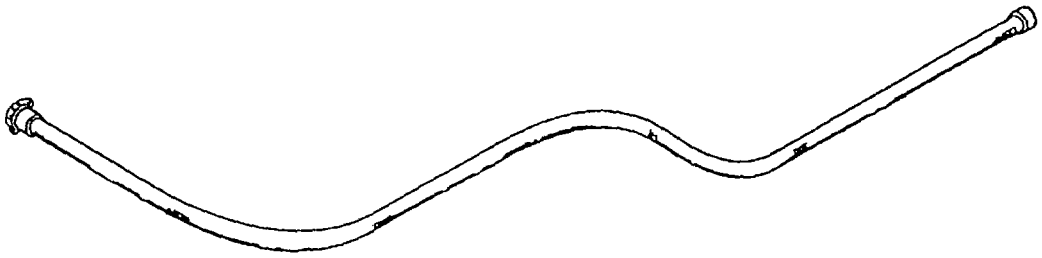


Figure 1-8. Collapsible Hose

(11) COLLAPSIBLE HOSES (Figure 1-8). The 6 in. X 500 ft, lightweight, collapsible rubber hoses transport water up to 10 miles from source. Interconnect TWDS components. Equipped with 6-inch boltless couplings for interconnection.

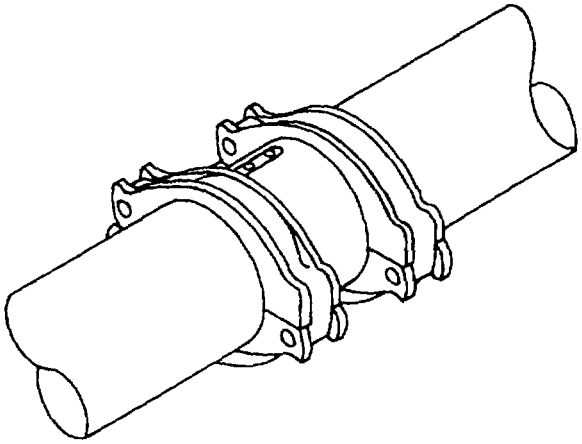


Figure 1-9. Swivel Joint

(12) **SWIVEL JOINT (Figure 1-9)**. Installed every 1000 feet to relieve any twisting in hoseline.

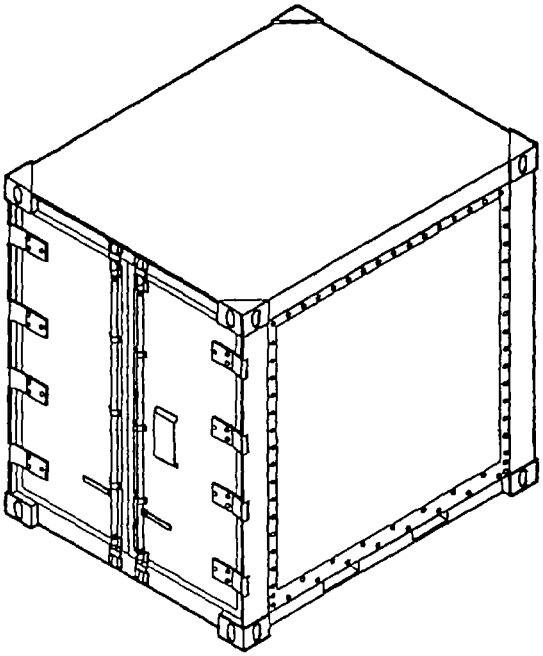


Figure 1-10. Tricon

(13) **TRICON (Figure 1-10)**. Provides for system components storage. Refer to applicable technical manual for operation and maintenance procedures.

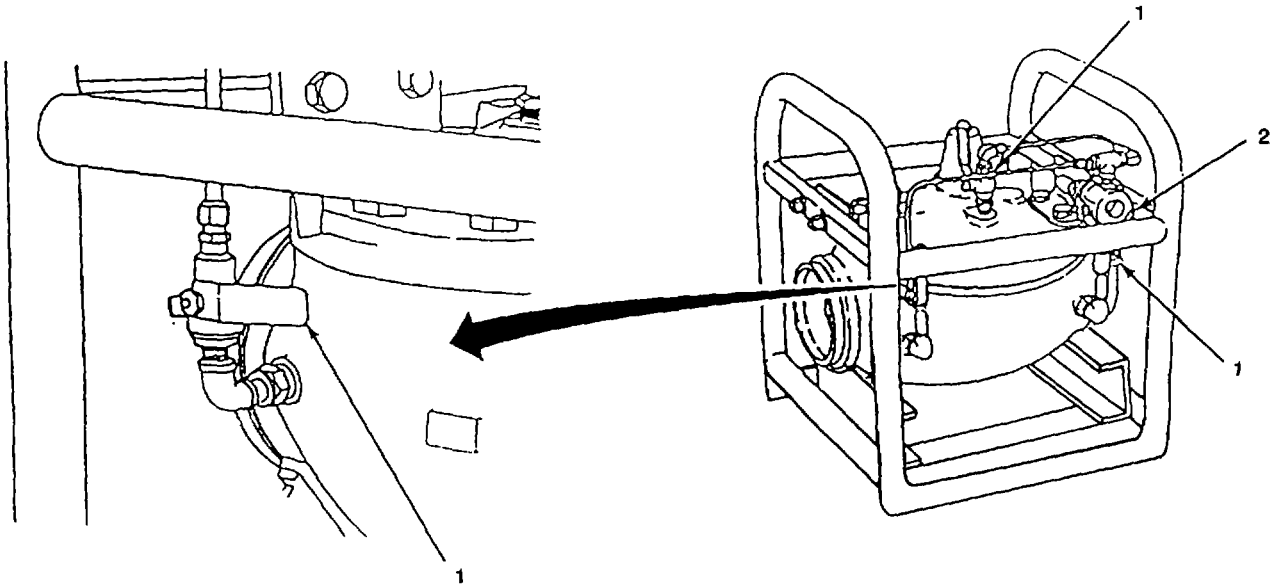


Figure 1-11. Pressure-Reducing Valve

(14) **PRESSURE-REDUCING VALVE (Figure 1-11)**. Skid-mounted. Protects hoseline and other components from excess pressure. Installed in hoseline where water pressure is expected to exceed 225 psi (1551 kPa). Equipped with boltless fittings at inlet and outlet ports for attachment to hoseline. Preset to release outlet pressure at a rate of 75 psig (517 kPa). Three isolation cockvalves (1) are manually operated to isolate pressure-reducing valve control (2).

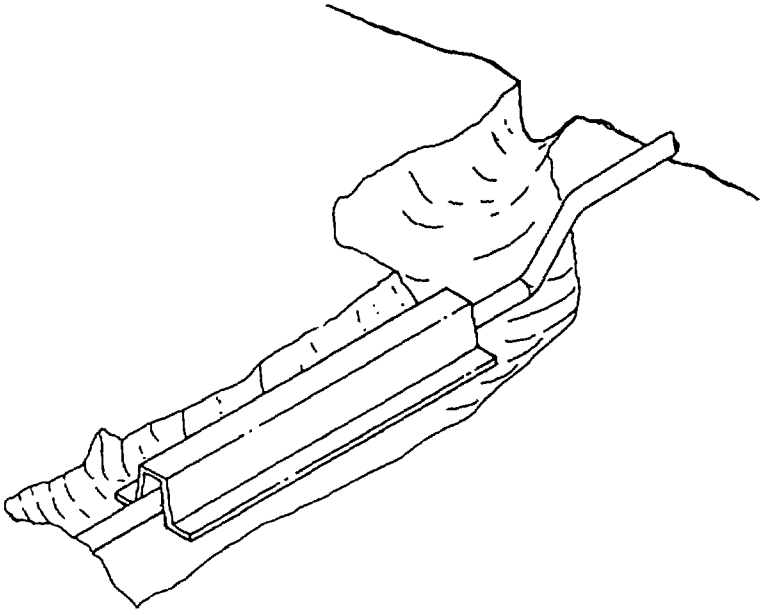


Figure 1-12. Road Crossing Guards

(15) **ROAD CROSSING GUARDS (Figure 1-12)**. Protects hoseline buried beneath a road from damage.

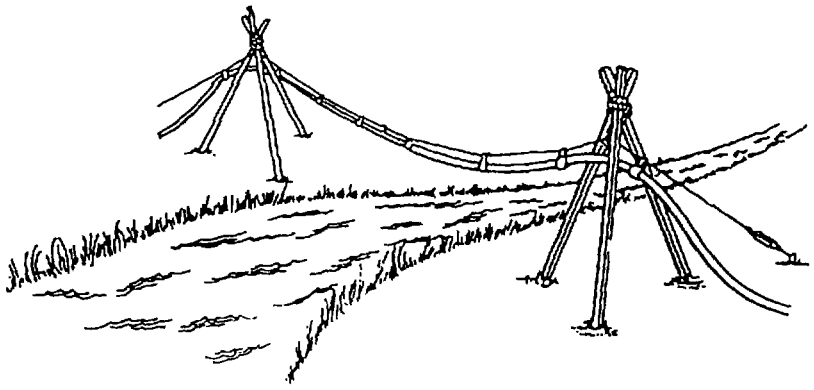


Figure 1-13. Suspension Kit

(16) **SUSPENSION KIT (Figure 1-13)**. Used to construct suspensions across streams, ponds, or gulleys.

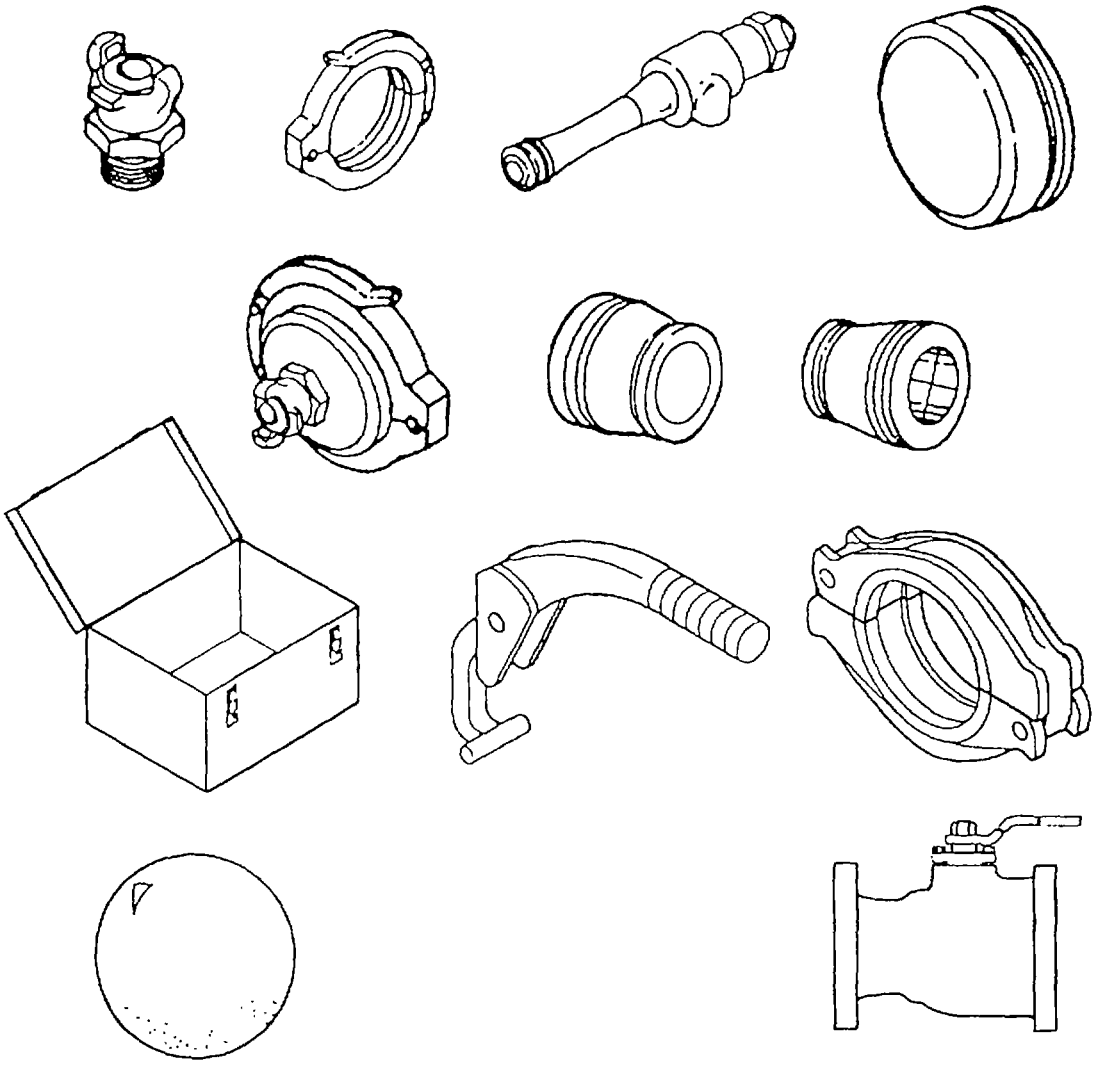


Figure 1-14. Displacement and Evacuation Kit

(17) **DISPLACEMENT AND EVACUATION KIT** (Figure 1-14). Used to remove water and air from hoses prior to repacking.

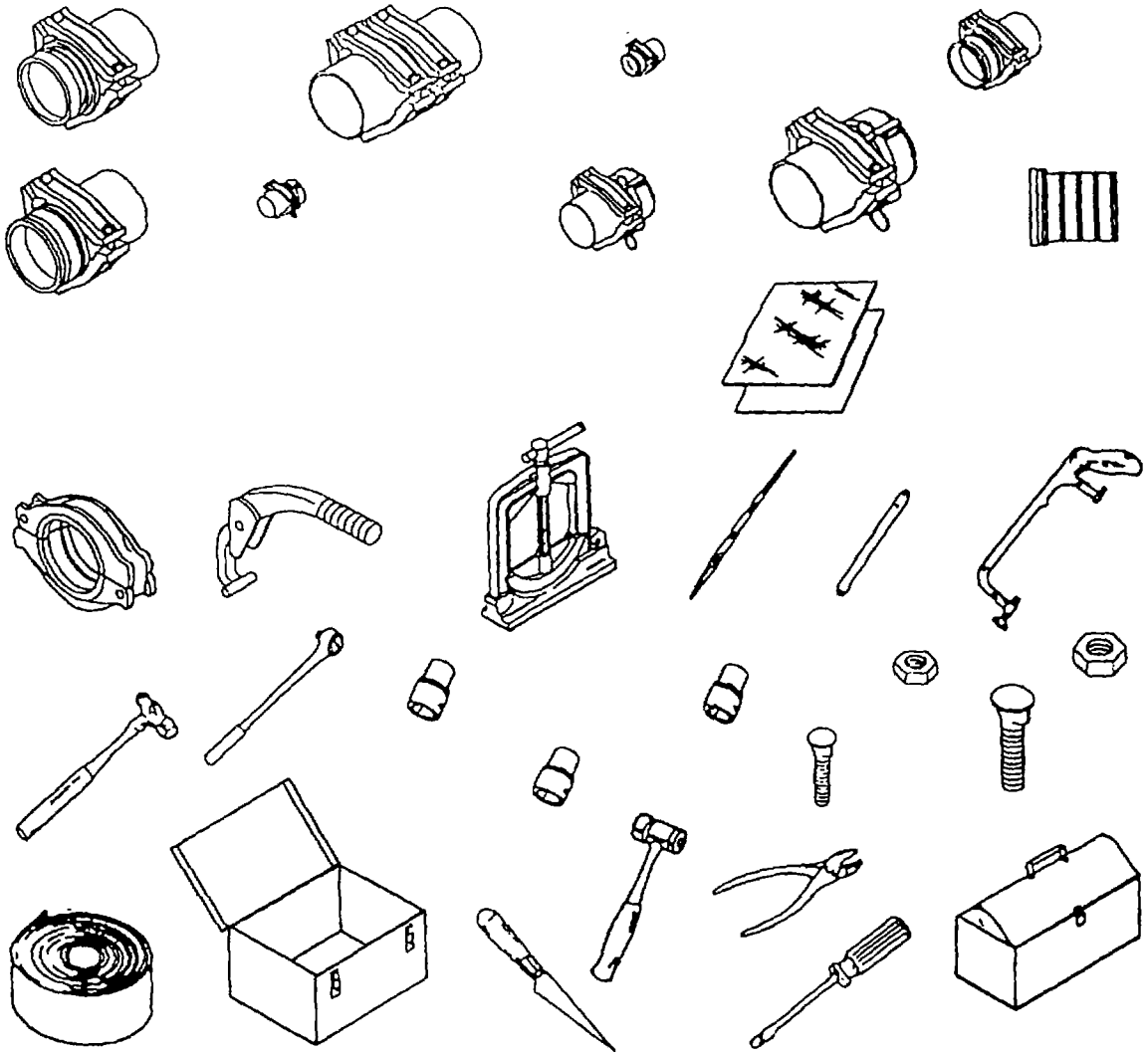


Figure 1-15. Repair Kit

(18) **REPAIR KIT (Figure 1-15)**. Used to repair hoseline.

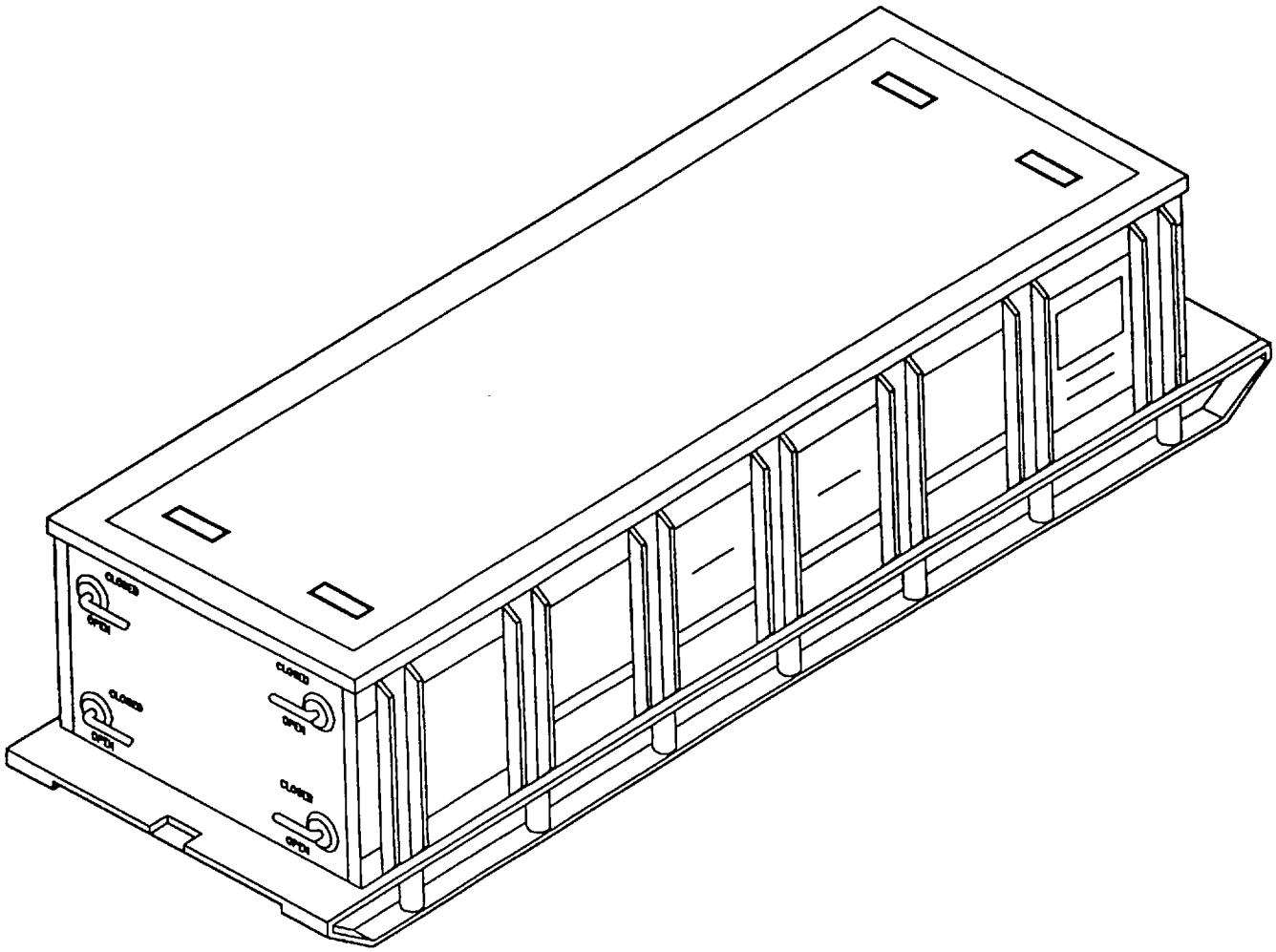


Figure 1-16. Water Tank Chest

(19) **WATER TANK CHEST (Figure 1-16)**. A 50,000-gallon tank used with lead pumping station.

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-14. **Functional Description of TWDS**. The Model 6 x 6 SP6 TWDS is a highly mobile water transport system. It consists of pumping stations, storage assemblies, and distribution points. It is designed to distribute water for distances up to 10 miles on level terrain.

1-15. **Components of TWDS Group**. The following paragraphs describe TWDS components.

a. Pumping Stations. Each pumping station consists of a trailer-mounted 600 GPM pump assembly, a check valve, pressure-relief valve, butterfly valves, and several 6-inch diameter hose assemblies. The pump assembly is powered by a 6-cylinder diesel engine. Refer to the applicable technical manual for operating instructions.

(1) Leading Pump Station. Draws water from a large storage and distribution unit that is supplied by wells or desalination operations. Feeds water downline through hoseline to first boost pumping station. Operated in manual mode. Flow of water through unit is controlled by manually operating butterfly valves on suction and discharge hoses. Pressure is regulated by adjusting engine speed.

(2) Boost Pumping Stations. Draws water from hoseline and feeds it downline to next boost pumping station or storage assembly. After initial startup, boost pumps can be switched to automatic mode. Engine speed will be regulated automatically. If pumping station fails, water can be routed through bypass hose assembly to keep downline pumps primed. Flow of water is controlled by manually operating in line butterfly valves. Pressure is regulated by adjusting engine speed.

b. Storage Assemblies. Each assembly can collect up to 20,000 gallons of water tapped from hoseline. Tank fill rate is controlled by manually operating gate valve. The tanks are used for storage and to supply water to distribution point.

c. Distribution Points. Each distribution point is made up of a 125 GPM pump, hypochlorination unit, and network of hoses. The pump draws water from the storage assembly and feeds it through the hypochlorination unit to be purified for drinking. Water is then routed through network of hoses to manual disbursing stations for distribution.

(1) 125 GPM Pump. Skid-mounted, manually controlled, and directly driven by a small diesel engine.

(2) Hypochlorination Unit. Skid-mounted unit, powered by impulse diaphragm motor which operates on water pressure. Amount of chlorine injected into water is controlled by adjusting pump stroke. Rate of waterflow through unit is controlled by adjusting in-line valves. Once controls are set, unit usually requires no further adjustments. It will inject the same dosage of chlorine into the water, regardless of changes in flow rate. Operator must periodically refill the 5-gallon chlorine solution reservoir. Water at manual disbursing stations is tested periodically by using color comparator kit.

(3) Hose Network and Manual Dispersing Stations. Rate of waterflow through the network is controlled by adjusting in-line gate valves. Network ends at four manual dispersing stations where elbow valves or nozzles are attached to hose ends. A 36gallon drinking water storage bag, suspended and fitted with faucets, is used to dispense water to personnel for canteens and other small containers. The water bag requires periodic refilling by operator.

d. 10-Mile Hoseline Segment. Transfers water to each major component in system. Consists of 500 feet segments of collapsible hoseline that connect pumping stations and storage assemblies. A skid-mounted pressure-reducing valve is installed in the hoseline to protect it from excessive pressure. Suspension devices are used to route hose over obstacles in terrain, and road crossing guards protect hoseline when it crosses roads. Hoseline can be capped if dead-end service is required, or it can feed another large storage and distribution unit.

CHAPTER 2
OPERATING INSTRUCTIONS

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

2-1. **General.** This section provides a description and use of operator controls and indicators that are used to operate TWDS. The operator should become thoroughly familiar with the controls and indicators and with the proper operating procedures for TWDS.

NOTE
If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.

2-2. **Operator's Controls and Indicators**. Table 2-1 contains controls and indicators for level pumping stations. Table 2-2 contains controls and indicators for boost pumping stations. Table 2-3 contains controls and indicators for storage assemblies. Refer to applicable technical manual for controls and indicators for 600 GPM pumping assembly, 125 GPM pumping assembly, hypochlorination unit, and storage tank.

Table 2-1. Lead Pumping Stations Controls and Indicators

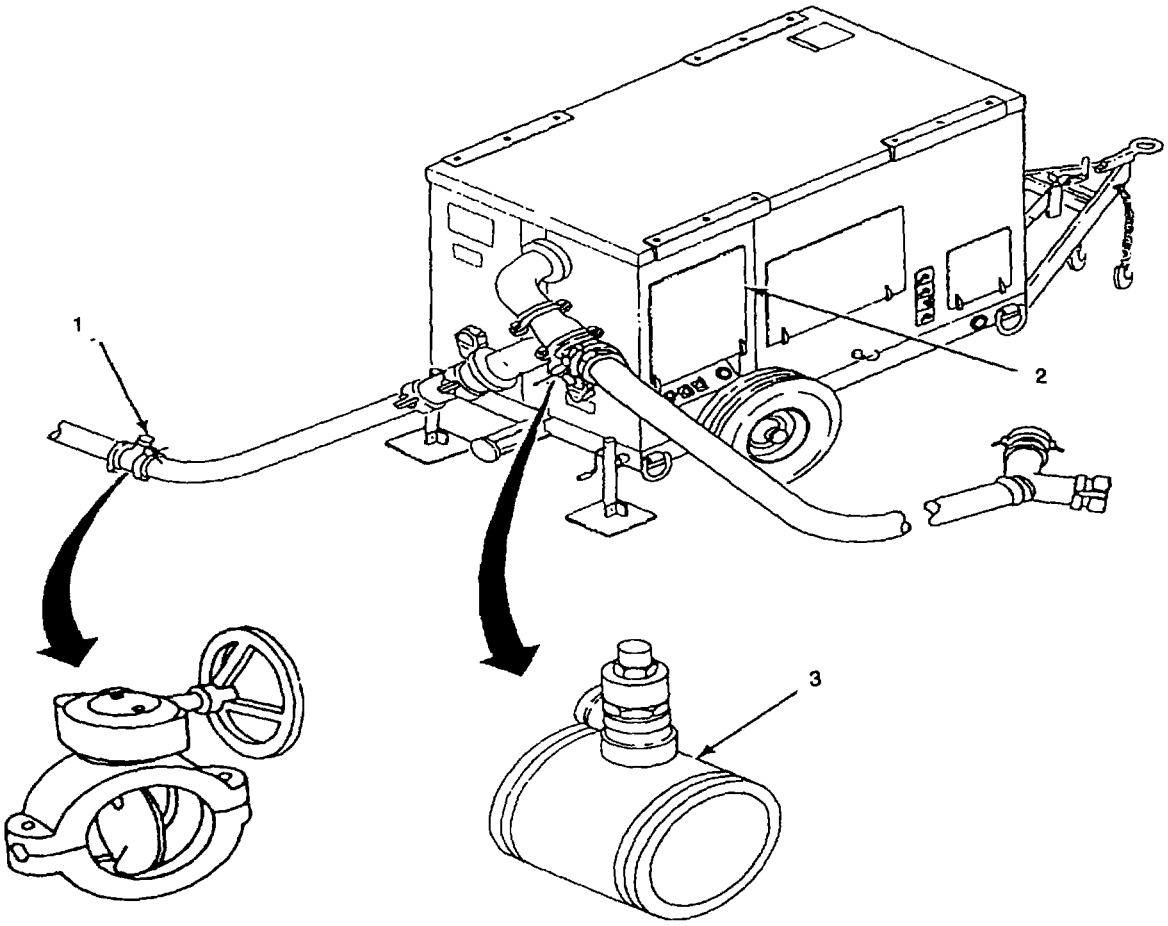
Control or Indicator	Function
	
1. Butterfly Valve (Suction)	Open to route waterflow from water source through pump. Close to shut off pump from water source.
2. Control Panel	Controls pump station operation. Refer to applicable technical manual for control panel controls and indicato rs.
3. Pressure-Relief Valve	Releases pressure in 10-mile hoseline segment when pressure exceeds 200 pound per square inch (psi).

Table 2-2. Boost Pumping Station Controls and Indicators

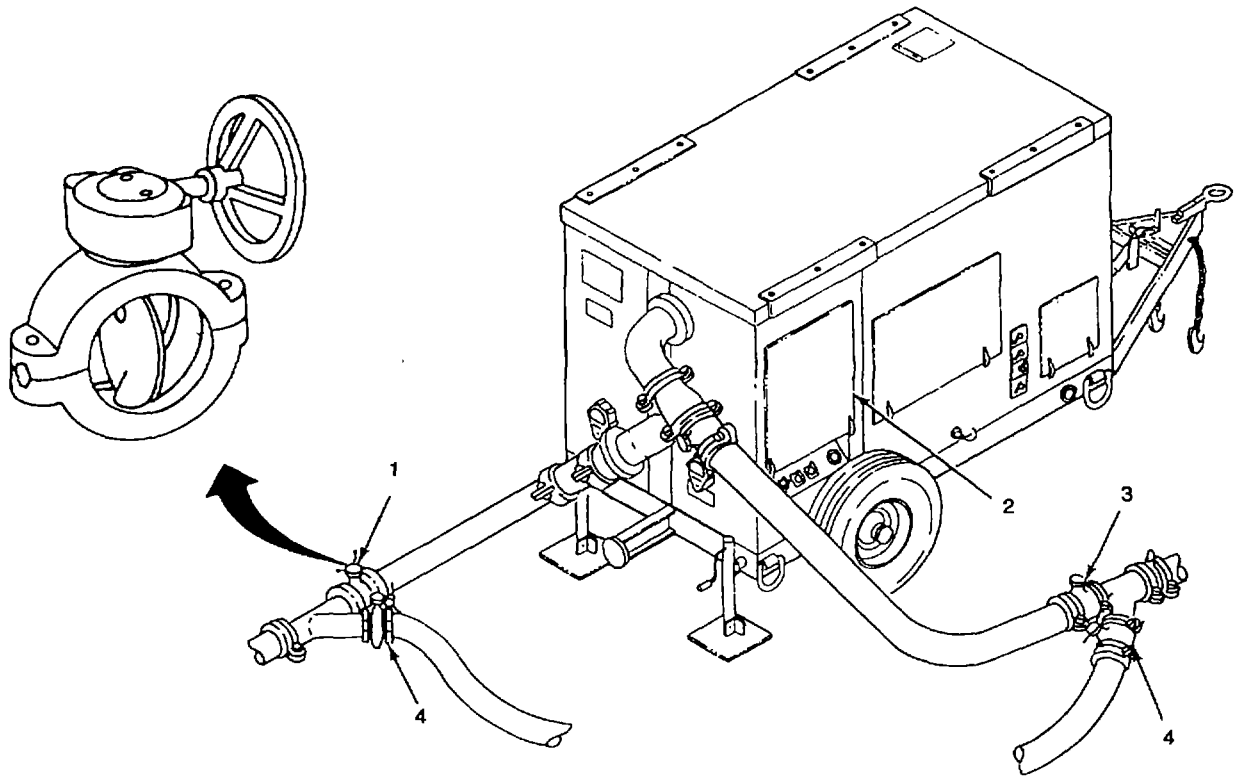
Control or Indicator	Function
	
1. Butterfly Valves (Suction)	Open to route waterflow through pump. Close to shut off pump from waterflow.
2. Control Panel Controls pump station operation.	Refer to applicable technical manual for control panel controls and indicators.
3. Butterfly Valve (Discharge)	Open to allow water to flow downline. Close to shut off downline waterflow.
4. Butterfly Valve (Bypass)	Close to shut off bypass hose. Open to route water through bypass hose.

Table 2-3. Storage Assembrnlies Cotlrols and Indicators

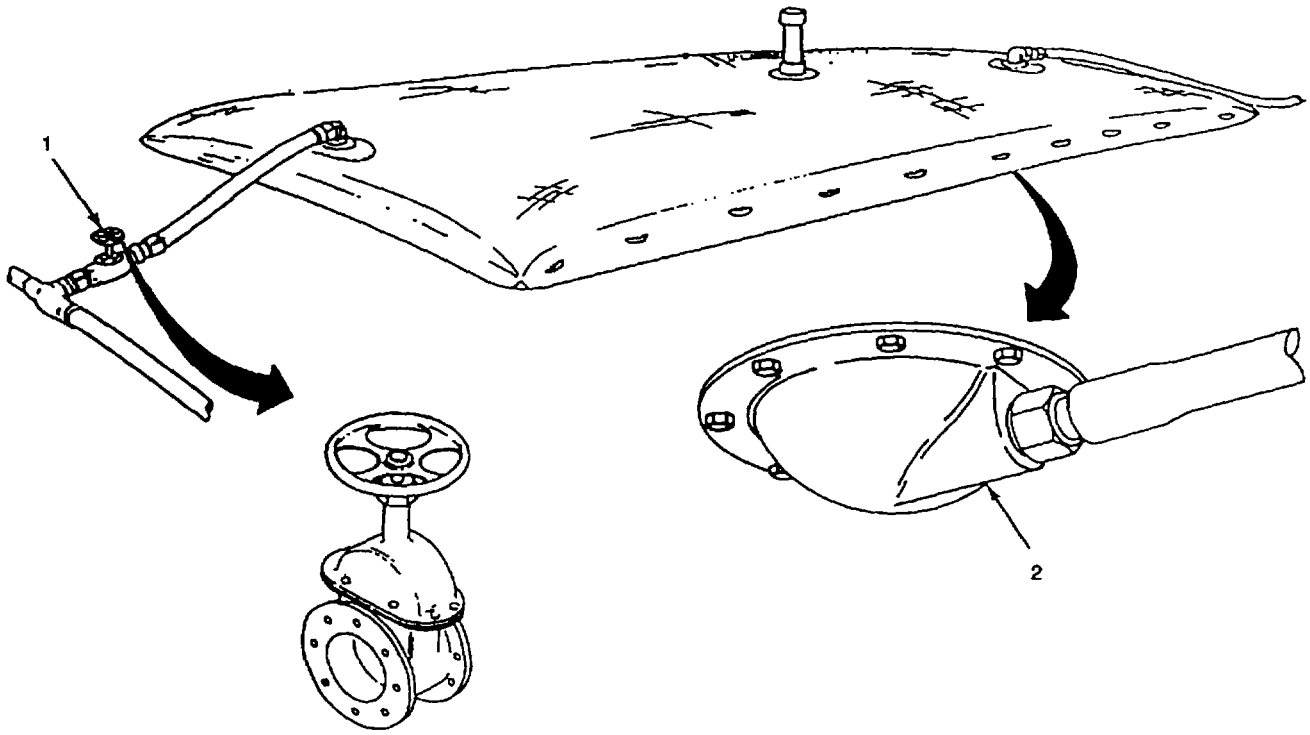
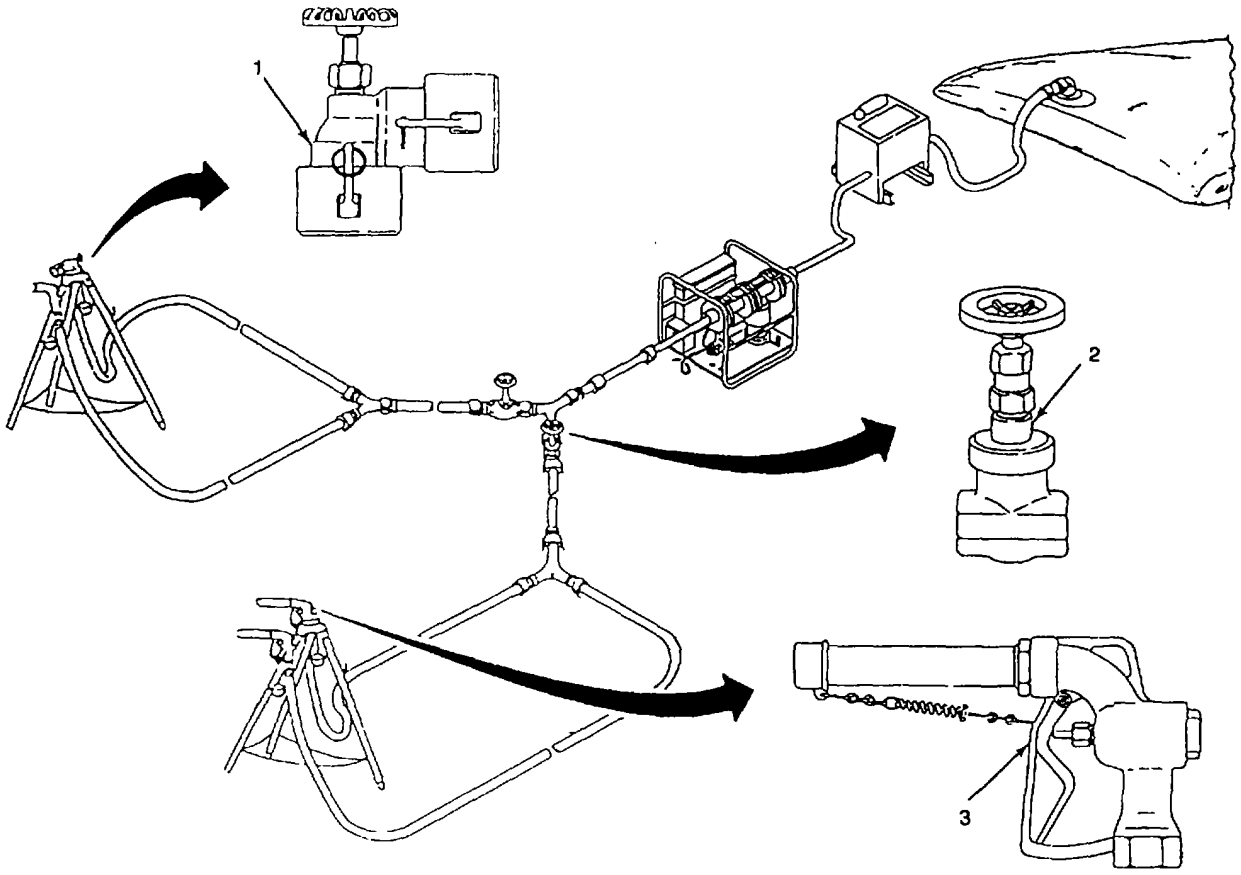
Control or Indicator	Function
	
1. Gate Valve	Used to control flow of water to storage tank.
2. Drain Assembly	Used for draining water from storage tank.

Table 2-4. Distribution Points Controls and Indicators

Control or Indicator	Function
	
1. Elbow Valves	Used to control flow of water at manual dispersing station when attached to hose end.
2. Gate Valves	Used to control flow of water to manual dispersing stations.
3. Nozzles	Used to control flow of water at manual dispersing station when attached to hose end.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-3. **General.** Figure 2-1 (PMCS) routing diagram and Table 2-5 (PMCS table) have been provided so you can keep your TWDS equipment in good operating condition and ready for its primary mission. Refer to the applicable technical manuals for specific component PMCS:

a. 125 GPM Pumping Assembly

b. 20,000-Gallon Pillow Tank

c. Hypochlorination Unit

d. 600 GPM Pumping Assembly

2-4. **Warnings and Cautions** Always observe the WARNINGS and CAUTIONS appearing in your PMCS table. WARNINGS and CAUTIONS appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or prevent your equipment from being damaged.

2-5. Explanation of Table Entries The following paragraphs describe your PMCS table:

a. Item No. Column. Numbers in this column are for reference. When completing DA Form 2404 (Equipment Inspection and Maintenance Worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.

b. Interval Column. This column tells you when you must do the procedure in the procedure column. BEFORE procedures must be done before you operate or use the equipment for its intended mission. DURING procedures must be done during the time you are operating or using the equipment for its intended mission. AFTER procedures must be done immediately after you have operated the equipment.

c. Location and Item to Check/Service Column. This column provides the location and the item to be checked or serviced. The item location is underlined.

d. Procedure Column. This column gives the procedure you must do to check or service the item listed in the Check/ Service column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.

e. Not Fully Mission Capable if: Column. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

f. Other Table Entries. Be sure to observe all special information and notes that appear in your table.

g. Special Instructions. Preventive maintenance is not limited to performing only those checks and services listed in the PMCS table. Covering unused receptacles, stowing unused accessories, and other routine procedures such as equipment inventory, cleaning components, and touch-up painting are not listed in the table. These are things you should do any time you see that they need to be done. If a routine check is listed in the PMCS Table, it is because experience has shown that problems may occur with this item. Take along tools and cleaning cloths needed to perform the required checks and services.

h. Leakage Definitions. Leakage definitions operator/crew PMCS are classified as follows:

Class I Seepage of fluid (indicated by wetness or discoloration) not great enough to form drops.

Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

Class III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

NOTE

- The TWDS can be operated with Class I and Class II leaks. When in doubt notify supervisor of leak
- Do not operate TWDS with a Class III leak. Class III leaks must be reported to your supervisors or to Unit Level Maintenance for corrective action.
- if the equipment must be kept in continuous operation, do only the procedures that can be done without disturbing operation. Make the complete checks and services when the equipment can be shutdown.

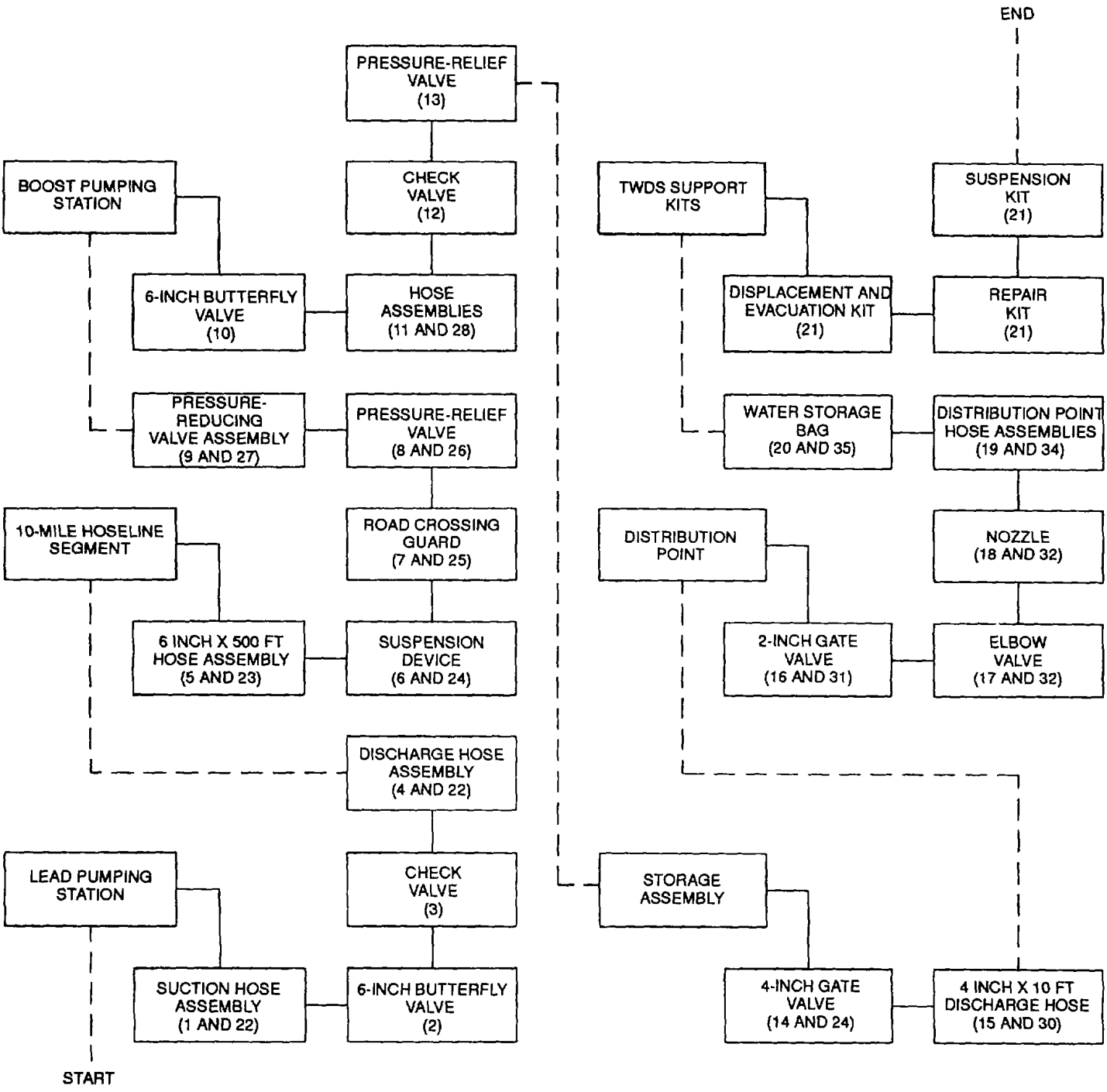


Figure 2-1. PMCS Routing Diagram

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS

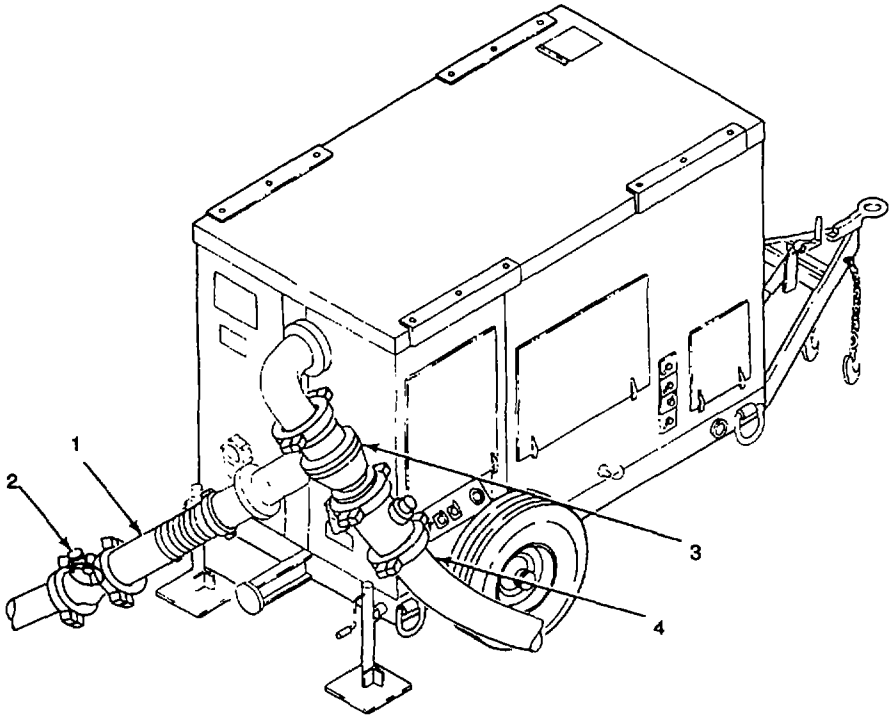
Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
		LEAD PUMPING STATION		
				
1	Before	Suction Hose Assembly	Inspect for damage, leaks, and loose connections. Tighten loose connections. If hose is damaged or Class III leaks are present, notify supervisor.	Hose is damaged or collapsed. Class III leak. Connection is loose.
2	Before	6-Inch Butterfly Valve	Ensure butterfly valves on hose assemblies are in open position. If valve will not open, notify supervisor. Ensure butterfly valve on bypass hose assembly is closed when not in use. If valve will not close, notify supervisor.	Valve on suction and discharge hose will not fully open. Valve on bypass hose assembly is open.
3	Before	Check Valve	Ensure check valve is installed properly. Arrow on body casing must point in direction of water flow. If valve is not installed correctly, notify supervisor. Inspect for leakage and loose connections. Tighten loose connections. If Class III leak is present, notify supervisor.	Check valve is not installed properly. Connection is loose. Class III leak.
4	Before	Discharge Hose Assembly	Inspect for damage, leaks, and loose connections. Tighten loose connections. If hose is damaged or Class III leak is present, notify supervisor.	Hose is damaged or collapsed. Class III leak. Connection is loose.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
		10-MILE HOSELINE SEGMENT		
5	Before	6 Inch x 500 Foot Hose Assembly	Inspect for damage, leaks, kinks, twists, and loose connections. Tighten loose connections. If hose is damaged or Class III leaks are present, notify supervisor. Inspect for rubbing or chafing against trees, rocks, suspension device tripods, or other objects that might damage hoseline. Reposition hose as required.	Hose is damaged. Class III leak. Connection is loose, kinked, or twisted.

WARNING

Suspension wire for hose assembly is under tension. Death or personal injury may result if care is not used. Always wear helmet and gloves while working with suspension components.

6	Before	Suspension Device	Inspect for damage. Inspect security of suspended hoseline. Inspect for damaged or broken saddle assemblies. Ensure saddles are spaced at 5-foot intervals. Inspect wire rope for damage and fraying. Ensure wire rope is securely anchored.	Suspension device damaged or suspended hoseline not secure. Saddle assemblies damaged or broken. Wire rope damaged, frayed, or not securely anchored.

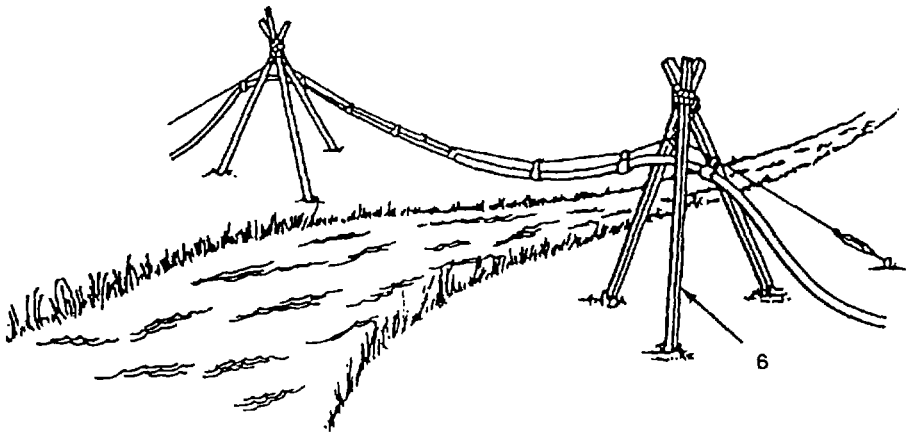


Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

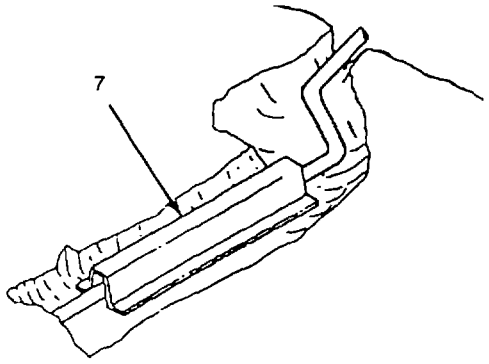
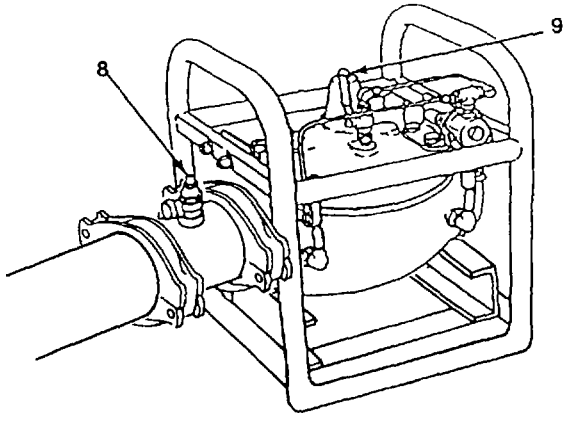
Item No.	Interval	Location Item to Check/Service	Procedure	*Not Fully* Mission Capable if:
		10-MILE HOSELINE SEGMENT - (CONT)		
				
7	Before	Road Crossing Guard	Ensure road crossing guards are providing protection for the hose line. If road crossing guard has collapsed or hose line is damaged, notify supervisor.	Road crossing guard is not providing protection to the hose line.
8	Before	Pressure-Relief Valve	Inspect valve for presence of grit, sand, or dirt. If dirty, clean using soft brush. Inspect for damage or leaks. If damaged or Class III leaks are present, notify supervisor.	Dirty pressure-relief valve. Pressure relief valve damaged. Class III leak.
9	Before	Pressure-Reducing Valve Assembly	Inspect skid for cracks and damaged welds. Inspect valves, lines, and assembly for damage and leaks. If skid is damaged, valves are damaged, or Class III leaks are present, notify supervisor. Make sure isolation cock valves are open.	Skid has cracks or damaged welds. Valve and lines are damaged. Isolation cock valve(s) is closed. Class III leak.
				

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

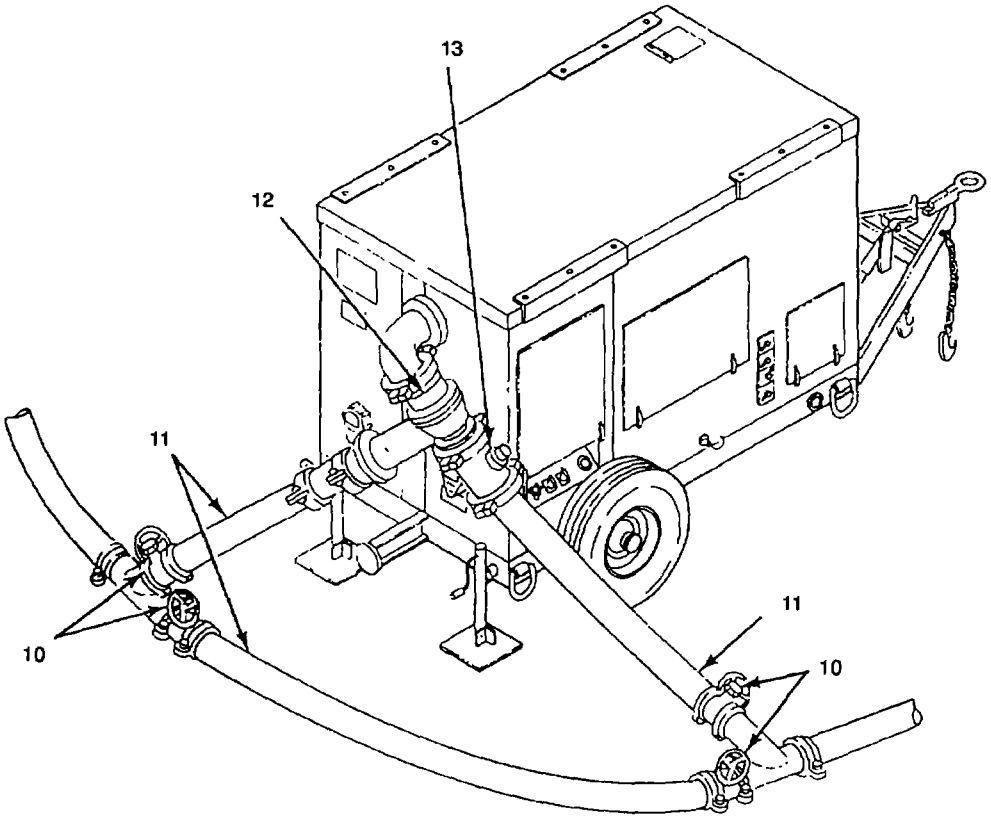
Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
		BOOST PUMPING STATION		
				
10	Before	6-Inch Butterfly Valves	Ensure butterfly valves on hose assemblies move freely.	Valves do not move freely.
11	Before	Hose Assemblies	Inspect for damage, leaks, and loose connections. Tighten loose connections. If hose is damaged or Class III leaks are present, notify supervisor.	Class III leaks.
12	Before	Check Valve	Ensure check valve is installed properly. Arrow on body casing must point in direction of water flow. Inspect for leakage and loose connections. Tighten loose connections.	Check valve is not installed properly. Connection is loose. Class III leaks.
13	Before	Pressure-Relief Valve	Inspect valve for presence of grit, sand, or dirt. If dirty, clean using soft brush. Inspect for damage or leaks.	Dirty pressure-relief valve. Pressure relief valve damaged. Class III leak. If discharge port is obstructed.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

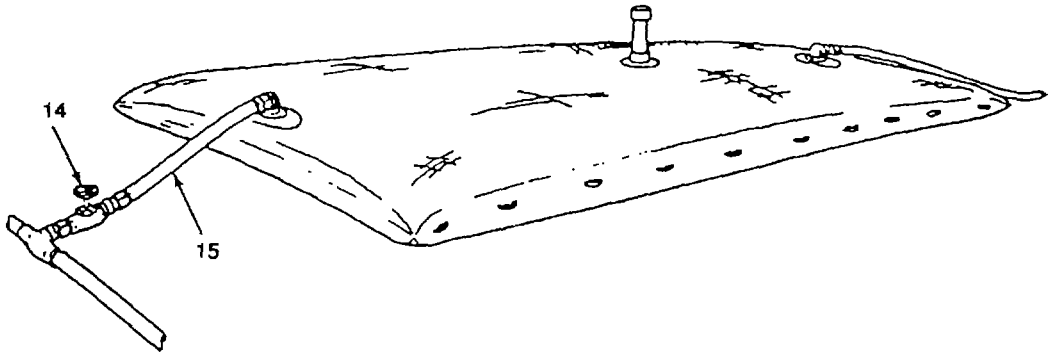
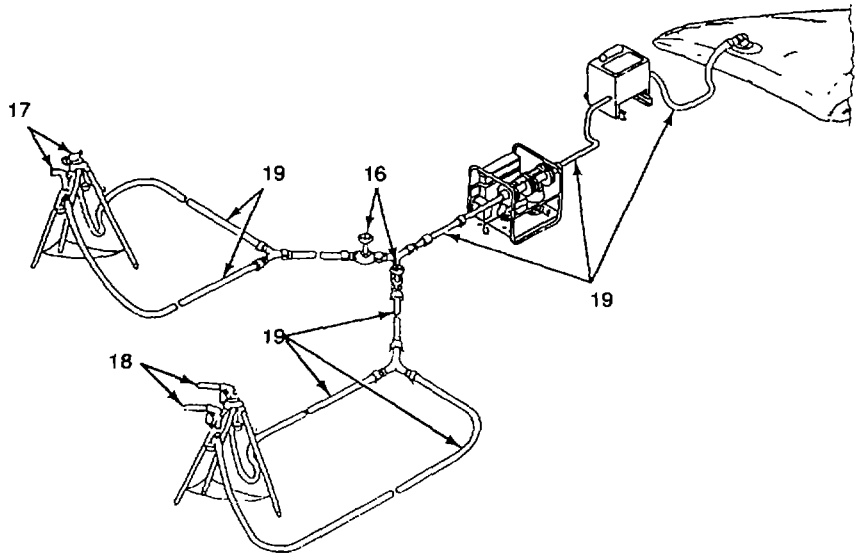
Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable *if:*
		STORAGE ASSEMBLY		
				
14	Before	4-Inch Gate Valve	Inspect for damage and improper operation. Check to be sure valve turns freely. Check for leaks.	*4-inch gate valve is* damaged or does not turn freely. Class III leak.
15	Before	4 Inch x 10 Foot Discharge Hose	Inspect for damage, leaks, and loose connections. Tighten loose connections.	Hose is damaged. Class III leak. Connection is loose.
		DISTRIBUTION POINT		
				
16	Before	2-Inch Gate Valve	Inspect for damage, leaks, and turns freely. If valve is leaking, damaged, or not operating properly, notify supervisor.	2-inch gate valve is damaged. Class III leak. Valve does not rotate freely.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

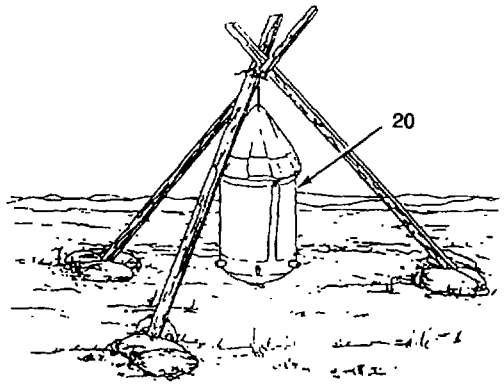
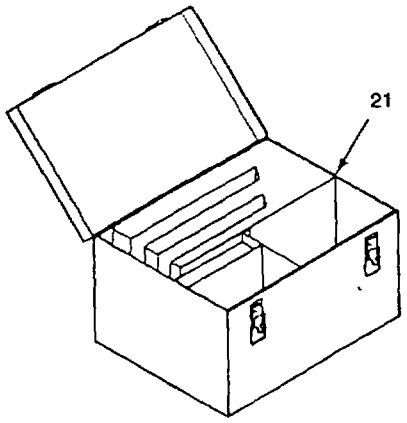
Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
17	Before	Elbow Valve	Inspect for damage, leaks, and improper operation. Inspect for damaged or missing gasket. If valve is damaged, not operating properly, or Class III leaks are present, notify supervisor.	Elbow valve is damaged or not operating properly. Class III leak. Damaged or missing gasket.
18	Before	Nozzle	Inspect for damage and leaks. Ensure triggers work properly.	Nozzle is damaged. Class III leak. Trigger is not properly operating.
19	Before	Distribution Point Hose Assemblies	Inspect for damage and leaks. If hose is damaged, or Class III leaks are present, notify supervisor.	Connection is loose. Hose is damaged. Class III leak.
				
20	Before	Water Storage Bag TWDS SUPPORT KITS	Inspect bag and faucets for damage and leaks. Ensure bag has adequate support.	Water storage bag or faucet is damaged. Class III leak. Water storage bag does not have enough support.
				

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

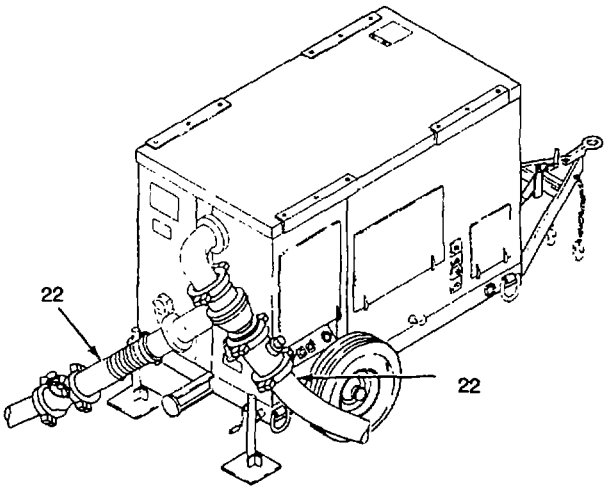
Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
21	Before	TWDS Support Kits LEAD PUMPING STATION	Inspect displacement and evacuation, repair, and suspension kits for damage. Inspect each kit for damaged or missing items. Ensure items in each kit are clean and dry. Inspect latches, hinges, lid, and box on each kit for damage.	Item in kit is damaged or missing.
				
22	During	Hose Assemblies 10-MILE HOSELINE SEGMENT	Inspect for damage, leaks and loose connections. Tighten loose connections. If hose is damaged or Class III leaks are present, notify supervisor.	Hose is damaged or collapsed. Class III leak. Connection is loose.
				
23	During	6 Inch x 500 Foot Hose Assembly	Inspect for damage, leaks, and loose connections. Tighten loose connections. Inspect for kinks, twists, rubbing or chafing against trees, rocks, suspension device tripods, or other objects that might damage hoseline. Reposition hose as required.	Hose is damaged or Class III leak. Connection is loose.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

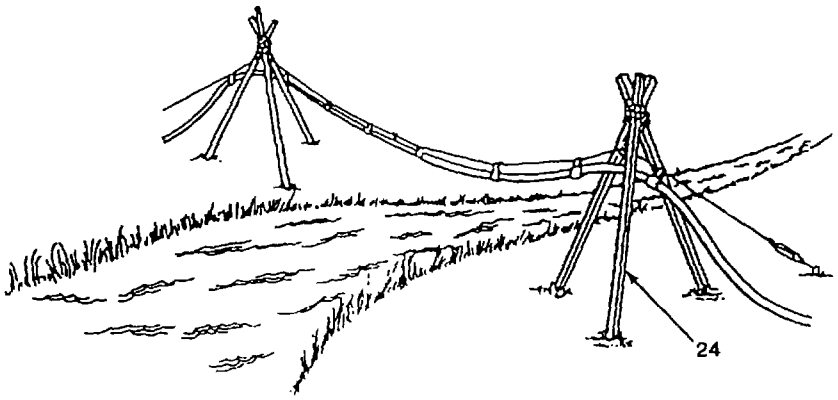
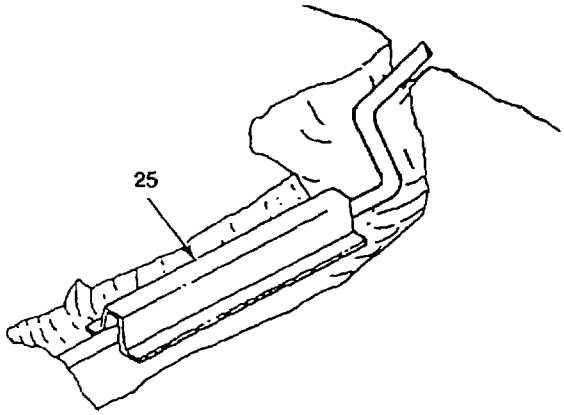
Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
		10-MILE HOSELINE SEGMENT - CONT		
				
24	During	Suspension Device	Inspect for damage. Inspect security of suspended hoseline. Inspect for damaged or broken saddle assemblies. Ensure saddles are spaced at 5-foot intervals. Inspect wire rope for damage and fraying. Ensure wire rope is securely anchored.	Suspension device damaged or suspended hoseline not secure. Saddle assemblies damaged or broken. Wire rope damaged, frayed, or not securely anchored.
				
25	During	Road Crossing Guard	Ensure road crossing guards are providing protection for the hose line. If road crossing guard has collapsed or hose line is damaged, notify supervisor.	Road crossing guard is not providing protection to the hose line.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

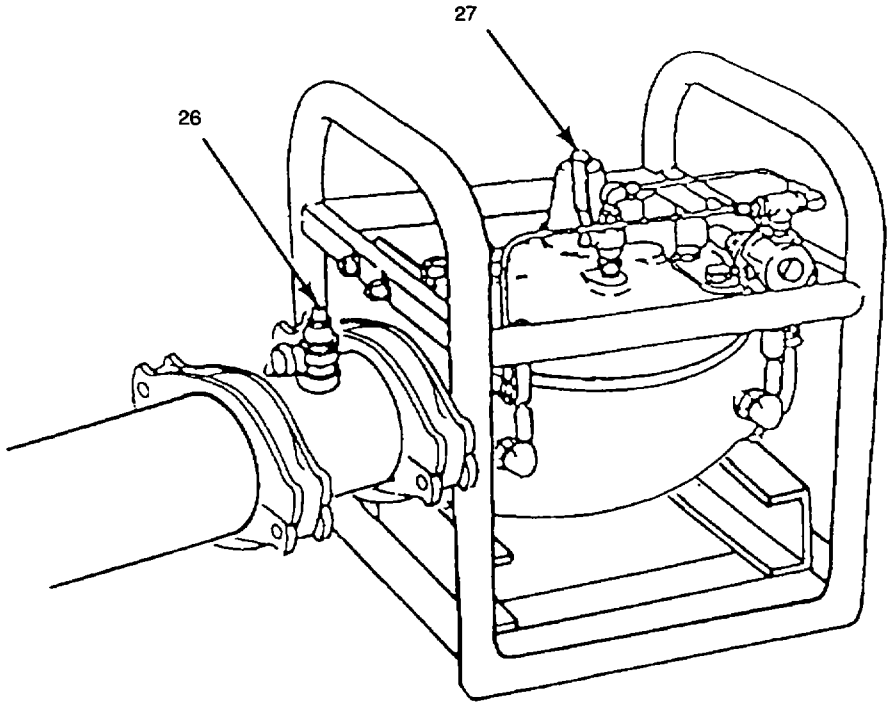
Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
		10-MILE HOSELINE SEGMENT - CONT		
				
26	During	Pressure-Relief Valve	Inspect valve for presence of grit, sand, or dirt. If dirty, clean using soft brush. Inspect for damage or leaks. If damaged or Class III leaks are present, notify supervisor.	Dirty pressure-relief valve. Pressure relief valve damaged or Class III leak.
27	During	Pressure-Reducing Valve Assembly	Inspect skid for cracks and damaged welds. Inspect valves, lines, and assembly for damage and leaks. If skid is damaged, valve is damaged, or Class III leaks are present, notify supervisor. Make sure isolation cock valves are open.	Skid has cracks or damaged welds. Valve and lines are damaged. Isolation cock valve(s) is closed. Class III leak.
		BOOST PUMPING STATION		
28	During	Hose Assemblies	Inspect for damage, leaks, and loose connections. Tighten loose connections. If hose is damaged, or Class III leak is present, notify supervisor.	Hose is damaged, collapsed, or leaking. Connection is loose.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

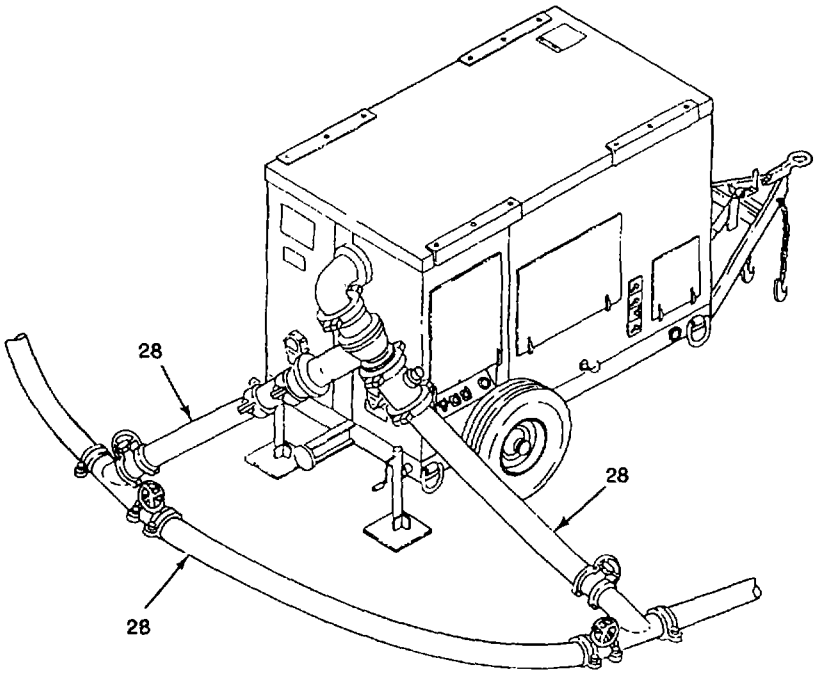
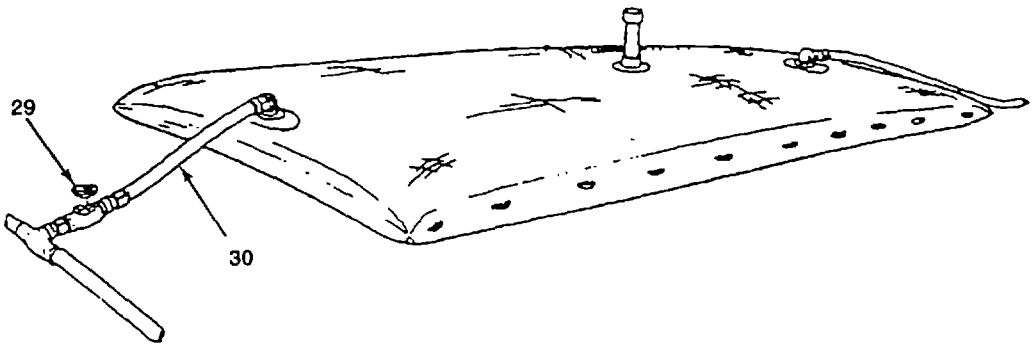
Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
		BOOST PUMPING STATION - CONT		
				
		STORAGE ASSEMBLY		
				
29	During	4-Inch Gate Valve	Inspect for damage, improper operation, and leaks. If valve is damaged, or not operating properly, notify unit maintenance. If Class III leaks are present, notify supervisor.	4-inch gate valve is damaged or not operating properly. Class III leak.
30	During	4 Inch x 10 Foot Hose Assembly	Inspect for damage, leaks, and loose connections. Tighten loose connections. If hose is damaged or Class III leaks are present, notify supervisor.	Hose is damaged or leaking. Class III leak. Connection is loose.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

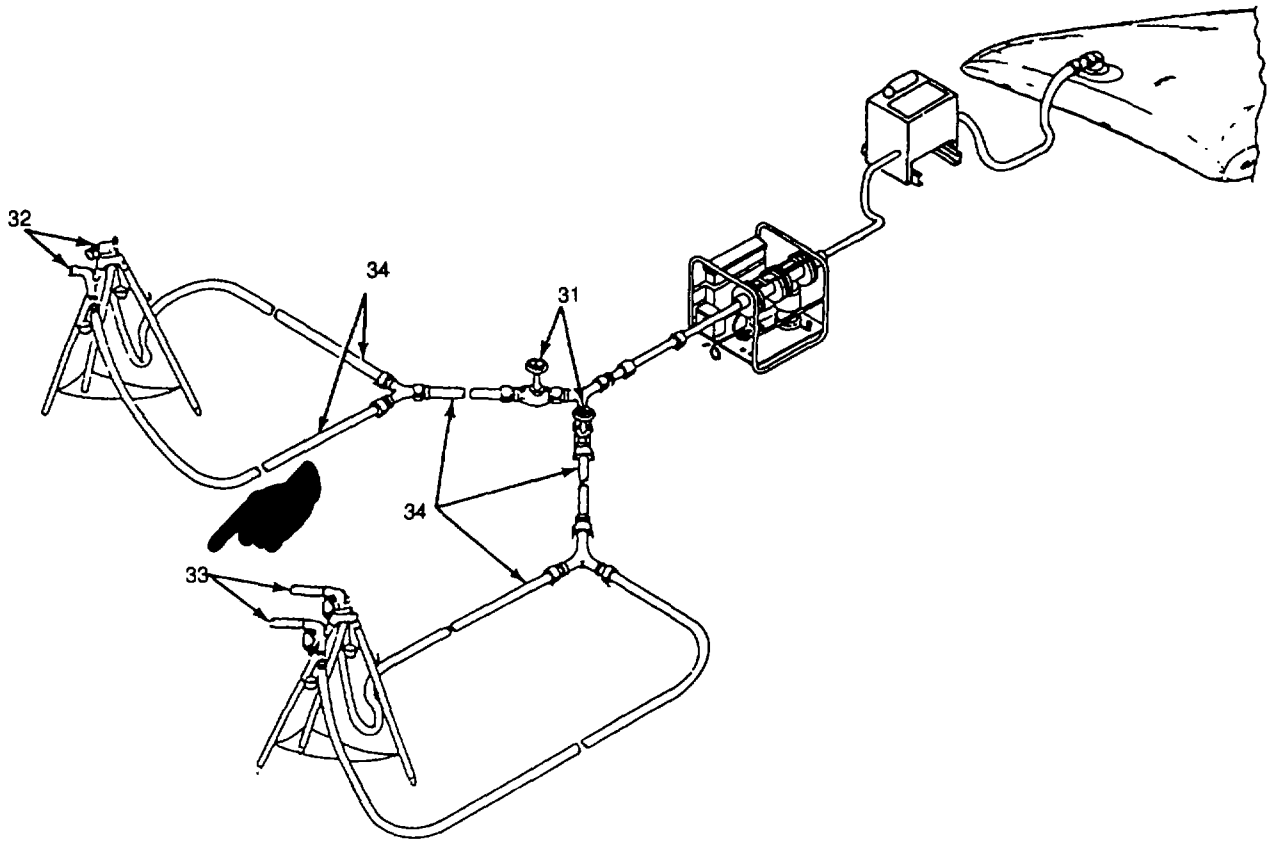
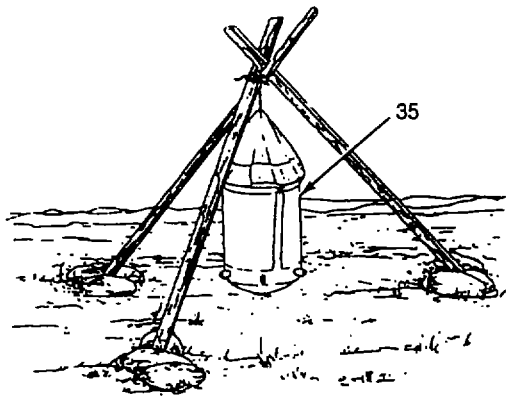
Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
		DISTRIBUTION POINT		
				
31	During	2-Inch Gate Valve	Inspect for damage, leaks, and improper operation. If valve is damaged, not operating properly, or Class III leaks are present, notify supervisor.	2-inch gate valve is damaged or not operating properly. Class III leak.
32	During	Elbow Valve	Inspect for damage, leaks, and improper operation. If valve is damaged, not operating properly, or Class III leaks are present, notify supervisor.	Elbow valve is damaged or not operating properly. Class III leak.
33	During	Nozzle	Inspect for damage and leaks. Ensure triggers work properly. If nozzle is damaged, trigger is not working properly, or Class III leaks is present, notify supervisor.	Nozzle is damaged. Trigger is not properly operating. Class III leak.
34	During	Distribution Point Hose Assemblies	Inspect for loose connections. Disconnect and reconnect loose connections. Inspect for damage and leaks. If hose is damaged or Class III leaks are present, notify supervisor.	Connection is loose. Hose is damaged. Class III leak.

Table 2-5. Operator Preventive Maintenance Checks and Services for TWDS - (Cont)

Item No.	Interval	Location: Item to Check/Service	Procedure	Not Fully Mission Capable if:
		DISTRIBUTION POINT - CONT		
				
35	During	Water Storage Bag	Inspect bag and faucets for damage and leaks. If bag or faucet is damaged or Class III leak is present, notify supervisor. Ensure bag has adequate support.	Water storage bag or faucet is damaged. Water storage bag does not have enough support. Class III leak.

Section III. OPERATION UNDER USUAL CONDITIONS

2-6. Site Requirements.

a. Terrain. Prior to installing TWDS equipment, a thorough study of the terrain is required. A general route for hoseline and general locations for the pumping stations, storage assemblies, and distribution points can be determined from examination and comparison of maps, photographs, and charts. Some elements to be considered in selecting a route and installation sites for TWDS are:

(1) If TWDS will operate independently or as part of a large system.

(2) The assigned mission for TWDS (i.e., dispensing, storing, or transferring water).

(3) Expected length of time TWDS will be required to operate.

(4) Elevation differences and distances TWDS will encounter along its route.

b. Site Location. Organize ground reconnaissance prior to installation of TWDS to determine exact locations for pumping stations, storage assemblies, and distribution points. If possible, site locations should be near or parallel to existing roads to ease transportation, assembly,-inspection, maintenance, and disassembly of the system. Avoid routes along the banks of streams, marshes, ponds, gullies, ravines, or other areas subject to flooding. Whenever possible, the hoseline should be laid out on firm, dry, level ground that allows easy access and is not subject to flooding.

c. Minimum Requirements. Minimum requirements for selecting the route are as follows:

(1) A sketch of the proposed hoseline route.

(2) Odometer distances.

(3) Enough topographic information (surveying altimeter elevations) to establish relative altitude at various points along the hoseline route.

d. Route Guidelines. The following guidelines should be utilized to gain maximum effectiveness for installation and operation of the system:

(1) The route should be direct and present a minimum number of obstacles and obstructions.

(2) A route parallel to a secondary all-weather road is preferable to one along a heavily traveled road.

(3) If roadways do not exist or cannot be utilized, select a route that is accessible to vehicles required for laying the hoseline.

(4) Plan to locate junction of two hoseline lengths at installation sites for each boost pumping station and storage assembly.

(5) Keep security precautions in mind. Utilize natural camouflage wherever possible and avoid routing hoseline through populated areas.

e. Pumping Station Sites. In selecting pumping station sites, the location of the lead or first pumping station will be determined by location of the water source. Boost pumping stations are intended to be spaced at approximately 2-mile intervals, assuming that the route is reasonably direct and the terrain is level. However, a substantial rise or fall in elevation along the hoseline route may require adjustment of standard spacing intervals:

(1) If the next downline pumping station is substantially higher in elevation than the upline pumping station, the distance between them must be shortened.

(2) If the next downline pumping station is substantially lower in elevation than the upline pumping station, the distance between them must be lengthened.

f. Spacing Adjustments. Adjustments to spacing between pumping stations (due to elevation change) assure that water pressure will be maintained within optimum operational range. Under normal conditions, TWDS will deliver water to the suction port of each boost pumping station at a pressure of 20 psig (139 kPa). Whenever suction pressure falls below 20 psig (139 kPa), boost pumping stations are designed to begin reducing speed, when operated in the automatic mode. Therefore, if an upline pumping station is substantially lower than the next downline station, and the elevation difference has not been offset by spacing adjustment, suction pressure at the downline pumping station may fall below 20 psig (139 kPa) and cause that pump to slow down. This in turn will cause remaining downline boost pumping stations to slow down, seriously degrading overall performance of TWDS.

g. Ground Profile. A ground profile (drawn on graph paper) and a pump spacing triangle can be utilized to determine the location of each boost pumping station. To construct a ground profile, first obtain a topographical map or other source material which provides accurate information concerning terrain along projected hoseline route. Then, using this information, draw a ground profile (see Figure 2-2) of the hoseline route on graph paper as follows:

(1) Divide the horizontal base of the graph into spaces that represent uniform distances, such as 1000 ft (305 m) intervals. However, any suitable scale can be used. The base of the graph represents the horizontal distance that the hoseline will cross.

(2) Divide the vertical, left-hand edge of the graph into spaces that represent uniform changes in elevation, such as 100 ft (30.5 m) intervals. Again, any suitable scale can be used. However, the scale must include at least the highest and lowest elevations along the hoseline route.

(3) At the left-hand edge of the graph, mark a point that represents the elevation of the lead pumping station.

(4) Continuing across the graph, mark points where significant changes in elevation occur along the hoseline route.

(5) To complete the ground profile, join the points marked on the graph with a straight line.

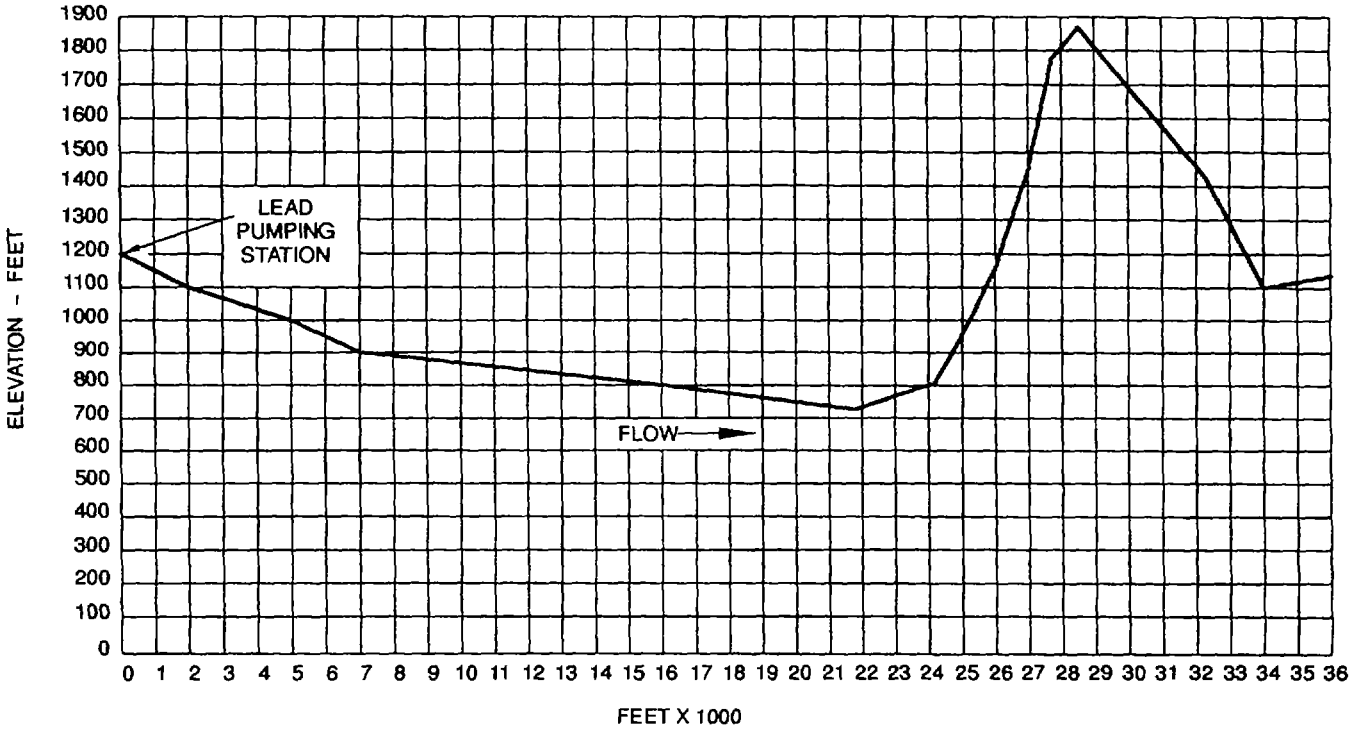


Figure 2-2. Ground Profile Graph

h. Spacing Triangle. To construct a spacing triangle (Figure 2-3), obtain a piece of paper, transparent sheet, or cardboard thick enough to be used as a straightedge. Then proceed as follows:

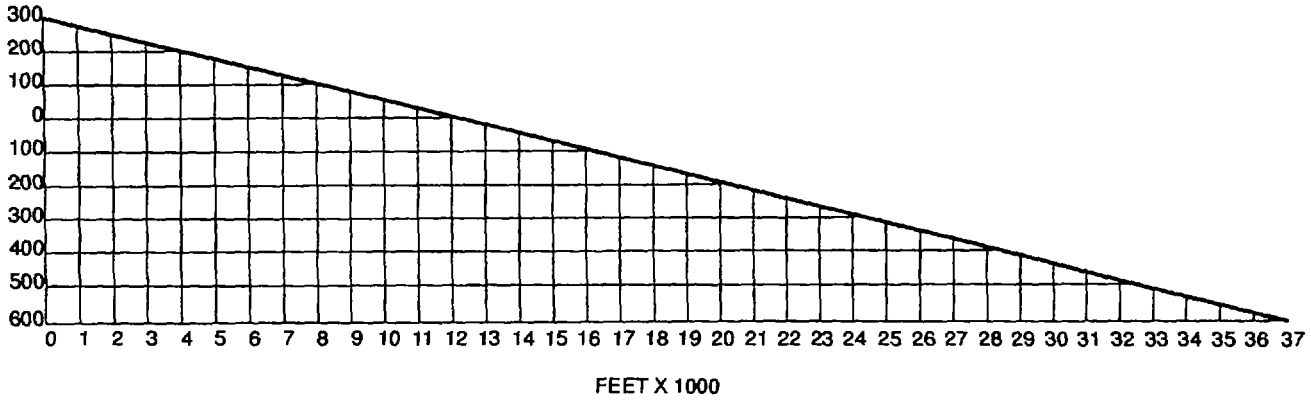


Figure 2-3. Spacing Triangle

(1) Divide the horizontal base of the triangle into spaces on the same uniform scale used to divide the base of the ground profile graph. Mark off spaces along the triangle base to at least 39,000 ft (11,895 m).

(2) Divide the vertical, left-hand edge of the triangle into spaces on the same uniform scale used to represent elevation changes on the ground profile. Mark off spaces along the vertical side of the triangle as follows:

(a) Zero represents the elevation of the pumping station.

(b) The upper left-hand comer represents 300 ft (91.5 m) above the pumping station.

(c) The lower left-hand comer represents 600 ft (183 m) below the pumping station.

(3) Draw a straight, diagonal line from the 300 ft (91.5 m) mark on the vertical scale to the 39,000 ft (11,895 m) mark on the horizontal scale. This line will form the hypotenuse or long side of the triangle.

(4) Making sure all lines have a straight edge, cut the triangle along the three sides drawn (horizontal, vertical, and diagonal).

i. First Boost Pumping Station. Using the ground profile and pump spacing triangle (Figure 2-4), determine the location of the first boost pumping station as follows:

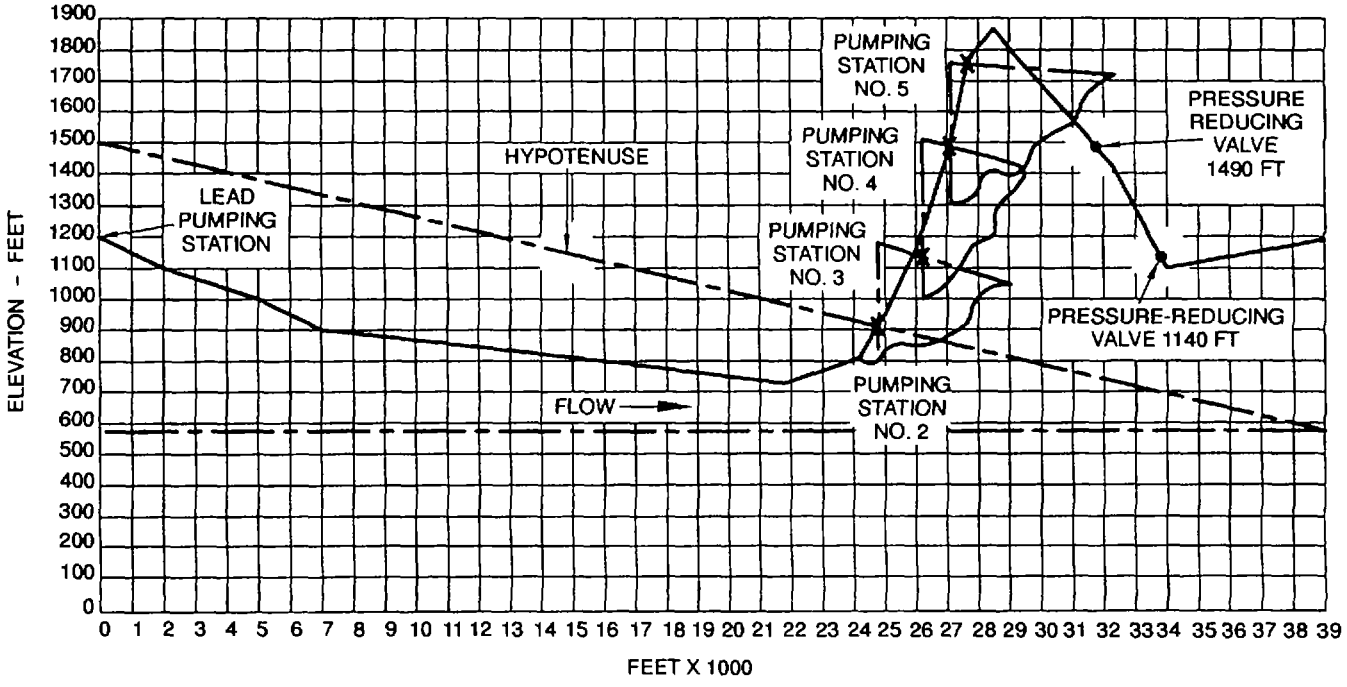


Figure 2-4. Ground Profile and Pump Spacing Triangle

(1) Place the pump spacing triangle on the ground profile.

(2) Align the vertical side of the pump spacing triangle with the vertical (elevation) side of the ground profile, so that the zero mark of the spacing triangle is on the lead pumping station mark of the ground profile.

(3) Make sure the horizontal side of the spacing triangle is exactly parallel with the horizontal base of the ground profile. Horizontal spacing marks on both the pump spacing triangle and ground profile should be exactly aligned.

(4) Mark the point at which the hypotenuse (or long side of the spacing triangle) crosses the ground profile. This will be the location of the first boost pumping station.

NOTE

If level of ground profile is below base of pump spacing triangle, extend the line of the spacing triangle hypotenuse until it crosses the ground profile.

j. Second Boost Pumping Station. To determine the location of the second boost pumping station, place the zero mark of the spacing triangle on the first boost pumping station mark of the ground profile. Mark the point at which the spacing triangle hypotenuse crosses the ground profile. This will be the location of the second boost pumping station. Locations of successive boost pumping stations are determined in the same way.

K. Elevation Drops. After locations of pumping stations have been plotted, check ground profile for any sharp declines in elevation along hoseline route. An excessive drop in elevation will significantly increase the pressure of water as it flows downhill. If pressure builds to 225 psig (155 kPa), hoseline can rupture and equipment failure will result. Therefore, when the ground profile indicates a sharp elevation drop along the route, a pressure-reducing valve must be installed in the hoseline.

I. Pressure-Reducing Valve Location. To determine the location of the pressure-reducing valve (Figure 2-5), refer to the ground profile and proceed as follows:

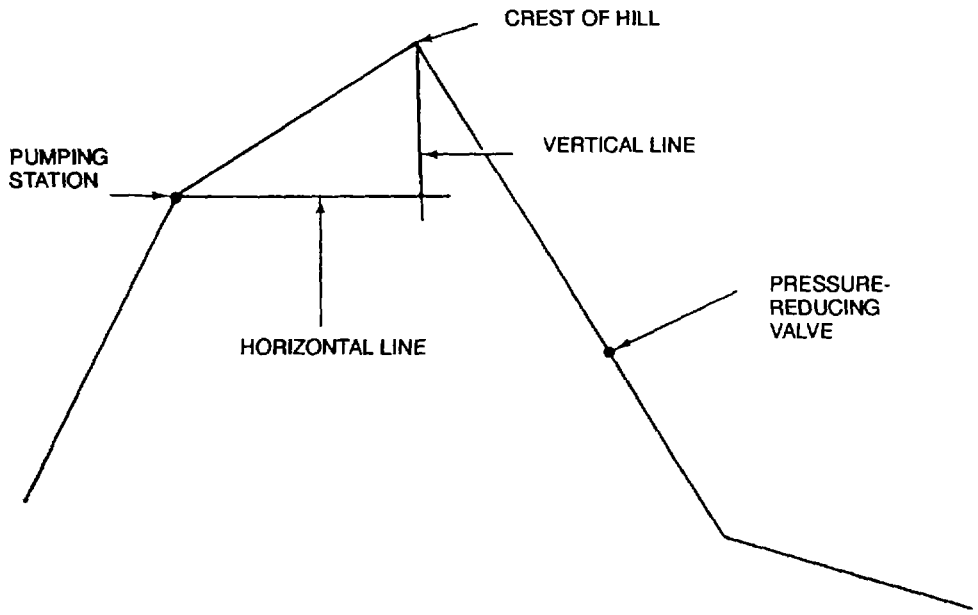


Figure 2-5. Pressure- Reducing Valve Location

(1) Mark crest of hill on ground profile.

(2) Draw a vertical line downward from the hill crest.

(3) Determine location of pumping station closest to the crest (on uphill side).

(4) Draw a horizontal line outward from pumping station until it intersects with the vertical line.

(5) Measure footage of horizontal line and footage of vertical line.

(6) Using formula provided below, determine total hoseline footage between pumping station and hill crest:

Total hoseline footage = $\sqrt{a^2 + b^2}$
(a = horizontal line footage)
(b = vertical line footage)

(7) Using formula provided below, determine friction loss of total hoseline footage in terms of vertical feet:

Total hoseline footage x 0.024 = Vertical feet of friction loss in hoseline

(0.024 = friction loss conversion factor)

(8) Using formula provided below, determine total feet of friction loss:

Vertical feet of friction loss in hoseline	+	Feet of elevation between pumping station and hill crest	friction loss	=	Total feet of friction loss

(9) Using formula provided below, convert total feet of friction loss into psi:

$\frac{\text{Total feet of friction loss}}{2.31}$ = friction loss in psi

(2.31 = psi conversion factor)

(10) Using formula provided below, determine existing psi at hill crest:

150 psi - psi of friction loss = psi at hill crest

(150 psi = pumping station discharge pressure)

(11) Using formula provided below, determine allowed additional psi bef ore safety limit is reached:

225 psi - psi at hill crest = Allowed additional psi before reaching safety limit

(225 psi = safety limit of pressure)

(12) Using formula provided below, convert allowed additional psi into vertical feet:

Allowed additional psi X 2.31 = Allowed additional vertical footage before reaching safety limit

(2.31 psi = vertical footage conversion factor)

(13) Using formula provided below, determine point at which pressure-reducing valve must be installed in hoseline:

Altitude at hill crest - Allowed additional vertical footage = Pressure-reducing valve installation point

m. Second Pressure-Reducing Valve. If elevation continues to drop excessively beyond first pressure-reducing valve installation point, a second pressure-reducing valve must be installed in hoseline. Using formula provided below, determine point at which second pressure-reducing valve must be installed in hoseline:

Altitude at first pressure-reducing - 346.5 = Second pre ssure-reducing valve installation point

(346.5 = allowed additional vertical footage before reaching safety limit)

2-7. TWDS Packing.

a. Save all packing materials and store them in their opened containers after removal of contents.

b. Return unused components to crates.

c. Return all fiberboard and plywood boxes to original crates.

d. Retain all packing materials at installation site. This will speed repacking when moving to a new site or returning to storage.

2-8. Assembly and Preparation For Use.

a. General. This paragraph provides general instructions for assembly of the 10-mile hoseline segment.

(1) Use enough hoseline to provide slack so that connections to pumping stations and storage assemblies are easily made.

(2) Hoseline is installed by flaking hose from rear of truck and manually positioning hose. The lengths of hose are connected together using grooved pipe couplings. Every 1000 ft (305 m), a swivel joint is installed.

(3) As truck moves forward along route, hose flakes out and is manually laid out behind the truck. Any bends, twists, or kinks in hoseline must be straightened.

CAUTION

Hose lengths should be snaked slightly to allow at least 3 ft (0.92 m) of slack for each hoseline length. Contraction of taut hoseline during startup will damage equipment.

(4) A minimum of two trucks with crews of five men each is recommended for hose-laying operations. Crews alternate between laying hose and reloading trucks. Individual task assignments for each crew member are as follows:

(a) One supervisor (1, Figure 2-6) is needed per truck (2) to oversee hose-laying operations. Should a problem develop during hose-laying operations, the supervisor (1) is responsible for contacting operators at pumping stations who are packing the hoseline.

(b) One driver (3) is needed to operate each truck (2).

(c) An assistant driver (4) is needed to observe hose-laying operation, tell driver (3) to speed up, slow down, or stop truck (2) depending on needs of the linewalkers (5) straightening and repositioning hoseline (6). He must also observe hose for catching or binding as it flakes out of box.

(d) A minimum of two linewalkers (5) are needed to follow behind each truck (2) and perform following tasks:

1 Straighten out kinks or bends in hoseline.

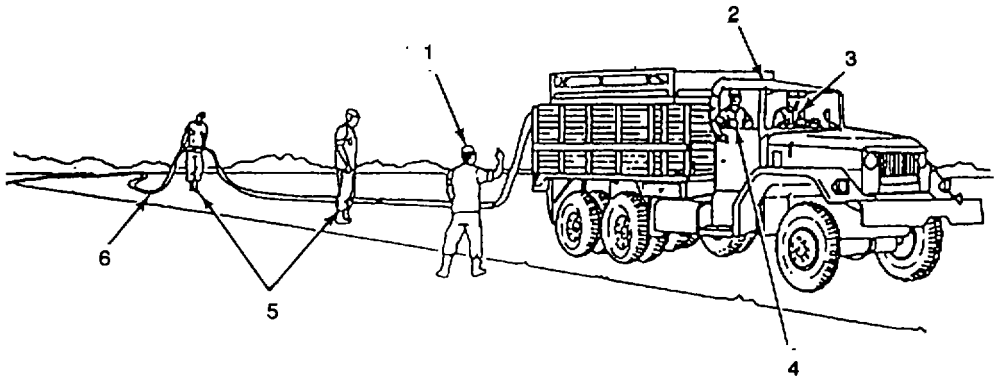


Figure 2-6. Hose-Laying Operations

2 Remove small obstructions, branches, and sharp rocks which can dama ge hoseline.

3 Check that swivel joint is installed at every 1000 ft (305 m) connection.

(5) Empty hose is easily blown by strong winds, causing damage to installations and equipment. To avoid high wind problems, fill newly-laid hose with water as soon as possible. Once lead pump and first boost pump are connected by hoseline, see operating procedures and fill hoseline.

(6) During hose-laying operations, it is essential that operators at pumping stations and storage assemblies communicate with each other and with hose-laying crews. If a problem develops with the hose-laying operation, immediately notify operators who are packing hoseline. If a problem occurs when hoseline is packed, immediately notify hose-laying supervisor and other operators.

b. Boltless Coupling Installation (Figure 2-7). Follow this procedure when using a boltless coupling to connect two grooved TWDS components.

NOTE

- This is a general procedure for installation of 6-inch boltless couplings throughout the system. Follow this procedure when using a boltless coupling to connect two TWDS components.

- In some cases, boltless couplings are part of a hose assembly and must be installed over the hose end for packing purposes. When step instructs to do so, follow this procedure when installing a boltless coupling over the end of a hose.

(1) Check gasket (6) for damage. If gasket is damaged, replace it.

(2) Apply thin coat of gasket lubricant (Item 6, Appendix E) to gasket lips and outside of gasket (6).

(3) Place gasket (6) over grooved fitting (4) on first component, being sure that it does not overhang end of fitting.

(4) Align end of second grooved fitting (5) with first one. Slide gasket to center position between grooves. No portion of gasket (6) should overhang grooves.

(5) Place boltless coupling (2) and dose coupling halves together over gasket (6). Make sure that coupling half keys are in grooves.

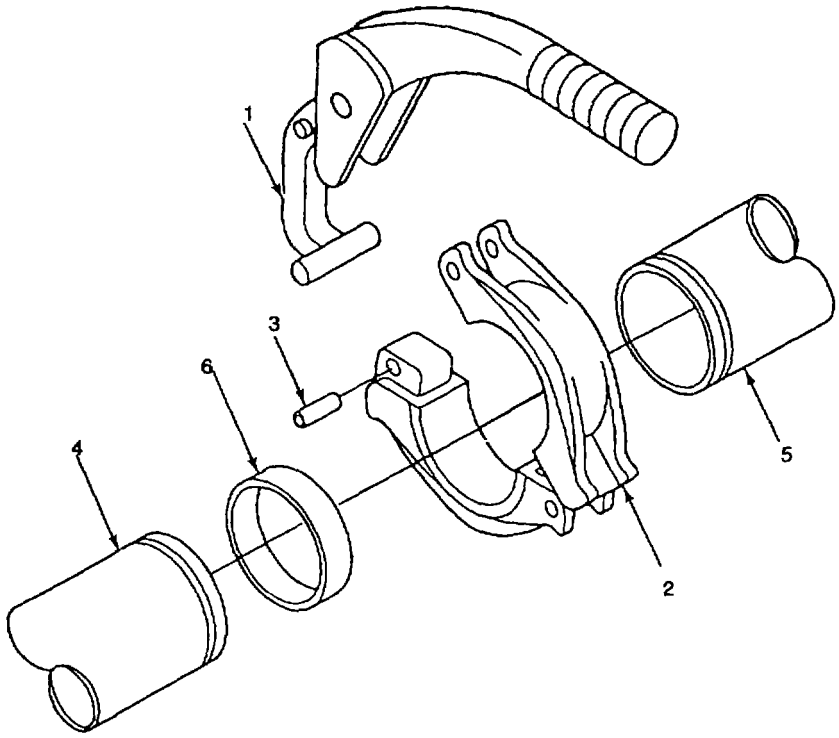


Figure 2-7. Boltless Coupling

(6) Install damping wrench (1) on boltless coupling (2) and depress coupling.

(7) Install pin (3) to secure coupling halves together.

(8) Release and remove clamping wrench (1).

c. Boltless Coupling Removal (Figure 2-7). Follow this procedure when removing a boltless coupling that connects TWDS components.

(1) Install damping wrench (1) on boltless coupling (2) and depress coupling.

(2) Using drive pin punch (Item 3, Appendix B), drive out pin (3).

(3) Release damping wrench (1) from boltless coupling (2).

(4) Open up boltless coupling (2) from grooved fittings (4 and 5).

(5) Slide gasket (6) away from center position between grooved fittings (4 and 5).

d. Assemble 10-Mile Hoseline Segment.

(1) Assembly of the 10-mile hoseline segment requires the equipment and personnel outlined in paragraph 2-8.a. These requirements generally remain the same in each situation. However, the number of components required for assembly will vary depending on the route and terrain being crossed, as well as the assigned mission.

(2) Hoseline is packed in crates marked HOSE ASSEMBLY, 6 INCH, 500 FEET.

(3) One 6-inch boltless coupling is required for each 500 ft (152.5 m) hoseline assembly used. One swivel joint is required for every 1000 ft (305 m) of hoseline.

(4) Road crossing guards and suspension kits are used when the hoseline crosses roads or obstacles in the terrain (such as streams, rivers, gullies, and ravines). Each road crossing guard is 5 ft (1.5 m) in length. If the width of a road being crossed is 15 ft (4.58 m), for example, then three or four road crossing guards are required to protect the hoseline. Each suspension kit contains enough wire rope to construct a span of 200 ft (61 m). Therefore, one suspension kit is required to cross a 150 ft (45.75 m) wide ravine; or one suspension kit can be used to construct spans across two 75 ft (22.88 m) wide gullies.

(5) The pressure-reducing valve is needed when pressure at a certain point in the hoseline is expected to exceed 225 psi (1551.15 kPa). If the hoseline crosses over a steep hill or ridge, then a pressurereducing valve may be required on the "downhill" side of the hoseline route.

(6) Other components contained in the 10-MILE SEGMENT crate are used for various purposes. The end cap is used when dead-end service is required (end of hoseline route does not connect to a storage and/or distribution assembly). The repair kit is used to repair damaged hoseline. The displacement and evacuation kit is used to recover and pack hoseline.

(7) Contact unit maintenance and load tricons on trucks as follows:

WARNING

Make sure crane or forklift has minimum lifting capacity of 6000 lb (2724 kg). DO NOT stand under load being lifted. Death or serious injury may result.

(a) Using crane or forklift with 6000 lb (2724 kg) lifting capacity, lift and stack tricons with hoselines on truck bed.

(b) If truck does not have sidewalls, use lifting devises as attachment points an d securely tie tricons to truck.

(c) Refer to applicable technical manual for preparing tricons for hose-laying operations.

(8) Lay out and install hoses as follows:

CAUTION

After removing components from boxes, be sure to protect them from sand and grit. Sand and grit may cause equipment failure.

NOTE

Remove caps or packaging material from ends of hose.

(a) Remove 6-inch boltless coupling (para. 2-8.c) from leading ends of hose.

CAUTION

After removing components from boxes, be sure to protect them from sand and grit. Sand and grit may cause equipment failure.

(b) Connect leading end of fourth hose to trailing end of hose of third hose with 6-inch boltless coupling (para. 2-8.b.).

(c) Connect swivel joint to leading end of third hose with 6-inch boltless coupling (para. 2-8.b.).

(d) Connect trailing end of second hose to swivel joint with 6-inch boltless coupling (para. 2-8.b.).

(e) Connect leading end of hose of second hose to trailing end of hose of f irst hose with 6-inch botless coupling (para. 2-8.b.).

(f) Connect swivel joint to trailing end of hose of fourth hose with 6-inch boltless coupling (para. 2-8.b.).

(g) Connect leading end of first hose (1, Figure 2-8) to relief valve (2) on discharge of lead pumping station. Attach hose with 6-inch boltless coupling (3) (para. 2-8.b.).

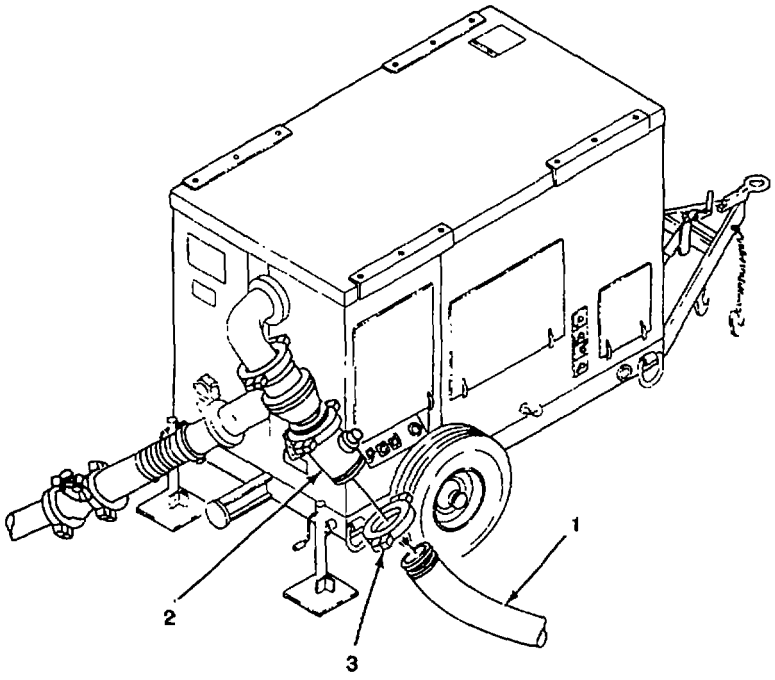


Figure 2-8. Connecting 10-Mile Segment to Lead Pumping Station

CAUTION

Do not leave hose on roadway or track that will be used by other vehicles. Hoseline is easily damaged by rough handling or abrasive contact with rocks.

(h) Restrain hose manually until first 50 ft (15 m) of hose is in position. After 50 ft (15 m) of hose is in position, the weight of the hose will hold line in place.

(i) Continue to lay hose until hoseline in all four hoselines have been laid.

(j) Connect hoseline to each boost pumping station and storage assembly as those installation sites are reached.

(k) Connect end cap on last segment with 6-inch boltless coupling (para. 2-8.b.).

(I) Retain empty tricons for reuse.

e. Install Road Crossing Guards. Perform the following (Figure 2-9):

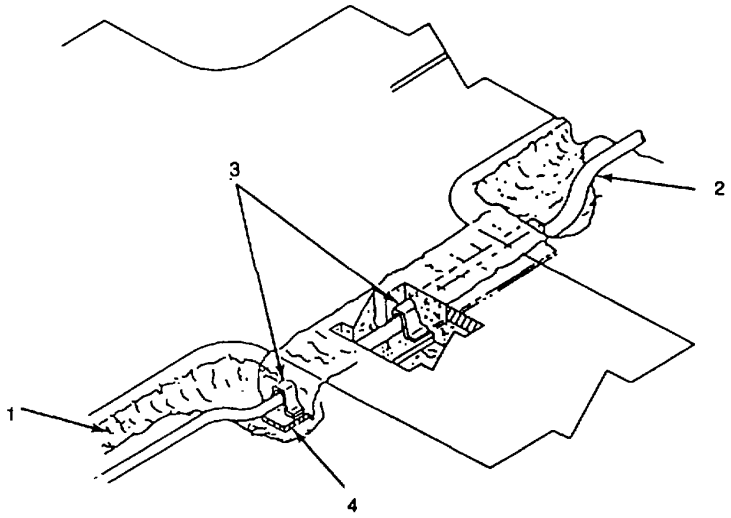


Figure 2-9. Road Crossing Guard

(1) Dig trench (1)18-inches (45.7 cm) deep across road.

(2) Engineering support is required if hoseline is being run beneath a railway bed.

(3) Lay hoseline (2) in trench (1).

(4) Position roadway crossing guards (3) over hoseline at appropriate intervals. Nail roadway crossing guards

(3) to plank (4) if used.

(5) Backfill trench (1) using dirt removed in step (1). Fill trench (1) to a level 1 - 2-inches (2.54 - 5.1 cm) above original road bed before packing earth down.

f. Install Suspension Devices. Install suspension kits as follows:

(1) Using available materials, construct a tripod (1, Figure 2-10) on either side of stream, gap, o r other obstruction to be spanned. Tripods should be strong and high enough to support hoseline.

NOTE

Depending on the type of suspension kit issued with the equipment, anchor stakes will either be angled or round.

(2) Using driving head, drive an anchor stake (2) into ground at a 30 ° angle approximately 15 ft (4.6 m) from each tripod (1). Stakes (2) should be in line with tripods and extend approximately 6 in. (15 cm) above ground.

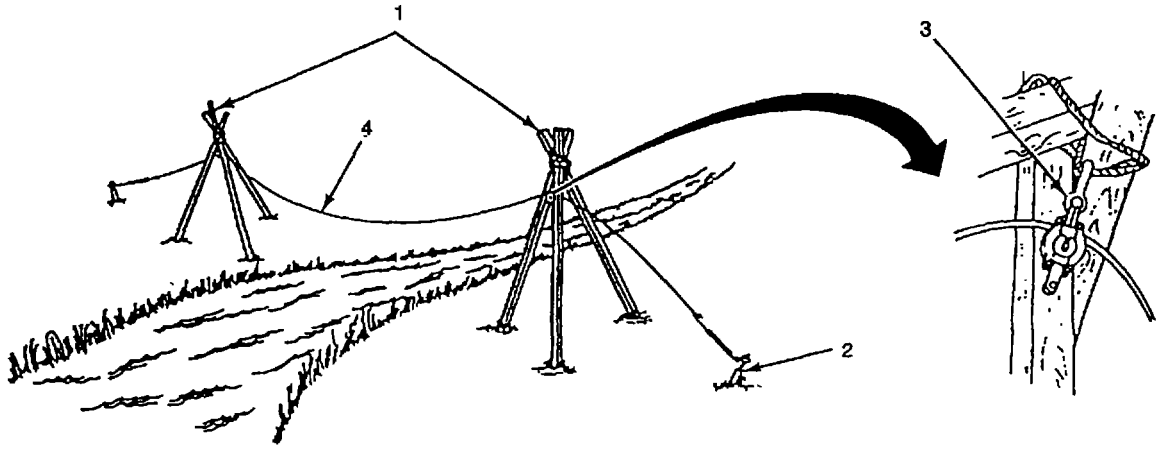


Figure 2-10. Suspension Kit

(3) Hang a pulley block (3) from each tripod (1) and thread wire rope (4) through pulley (3) on near side.

(4) Using manila rope, pull wire rope (4) across stream or obstruction.

(5) Thread wire rope (4) through pulley block (3) on far side and remove manila rope.

(6) Construct loop of wire rope (1, Figure 2-11) about 9 in. (23 cm) from one end of rope and insert thimble (2) into loop.

(7) Locate two clamp assemblies. Remove two nuts (3) and one clamp (4) from each U-bolt (5).

(8) Place one U-bolt (5) over doubled portion of wire rope (1) approximately 1/2 in. (1.3 cm) from thimble (2).

(9) Install one damp (4) onto one U-bolt (5) using nuts (3). Tighten nuts (3) until doubled portion of wire rope (1) is held firmly together.

(10) Place second U-bolt (5) over doubled portion of wire rope (1), approximately 4 in. (10 cm) down from first damp.

(11) Install damp (4) using two nuts (3). Tighten nuts (3) until d oubled portion of wire rope is held firmly together.

(12) Unscrew turnbuckle (6) until it is almost fully extended. This will allow for adjustment to take up wire rope sag.

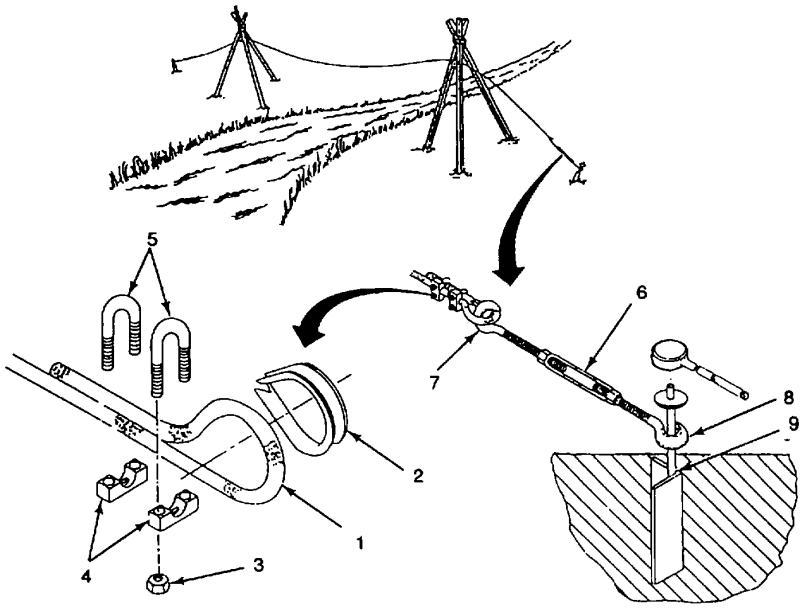


Figure 2-11. Wire Rope Loop

(13) Attach one tumbuckle hook (7) to loop in wire rope. Attach other tumbuckle hook (8) to stake (9).

(14) Repeat steps (6) through (13) with opposite end of wire rope.

(15) Using turnbuckles, adjust sag in wire rope (with no load) until rope is taut.

(16) Tie manila rope (1, Figure 2-12) to leading end of hoseline (2). Make sure rope is long enough to cross span.

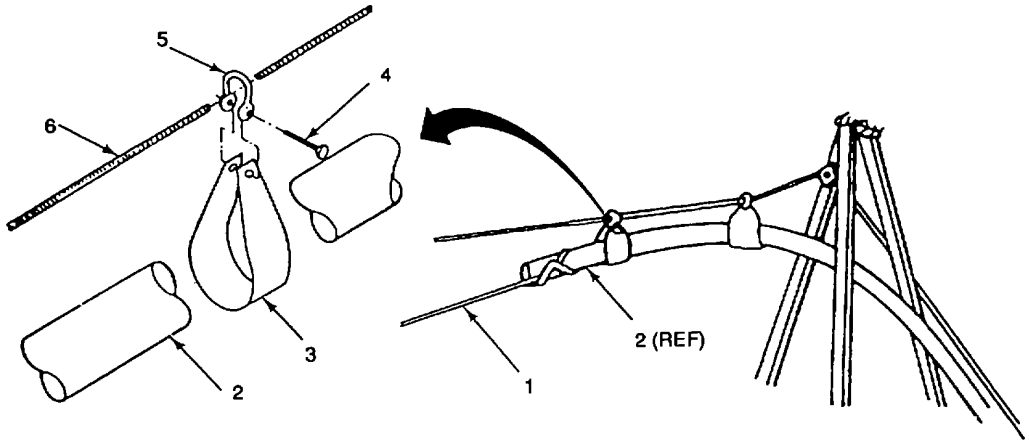


Figure 2-12. Installing Saddle on Hoseline

NOTE

As each saddle assembly is assembled, inspect saddle for tears and damaged or missing metal eyelets. Replace damaged saddles.

(17) Locate saddles (3), bolts (4), and shackles (5).

(18) Place shackle (5) over wire rope (6) beyond pulley on span side.

(19) Lift hose end and wrap saddle (3) around hose (2).

(20) Install bolt (4) through eyes of saddle (3) and shackle (5). Tighten bolt (4) until saddle assembly is secured to wire rope (6).

(21) Using manila rope, pull hoseline across stream, gap, or obstruction. Repeat steps (17) through (20), attaching additional saddles to hoseline at 5 ft (1.5 m) intervals. Saddles (1, Figure 2-13) will travel along wire rope (2), providing support for hoseline (3).

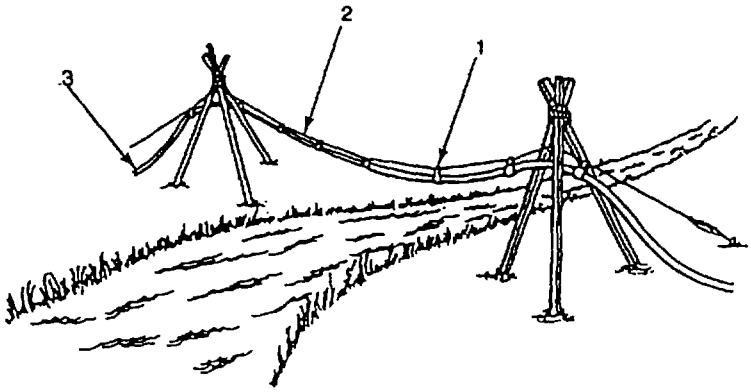


Figure 2-13. Hoseline and Suspension Kit

(22) When hoseline is in place, use three or more U-bolt clamps (1, Figure 2-14) to secure end shackles (2) to wire rope (3).

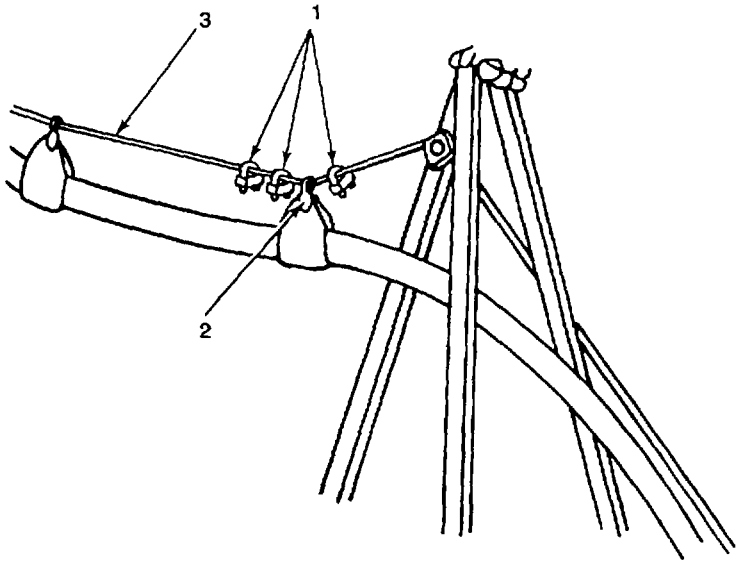


Figure 2-14. Securing End Shackles

g. Install Pressure-Reducing Valves. Perform the following (Figure 2-15):

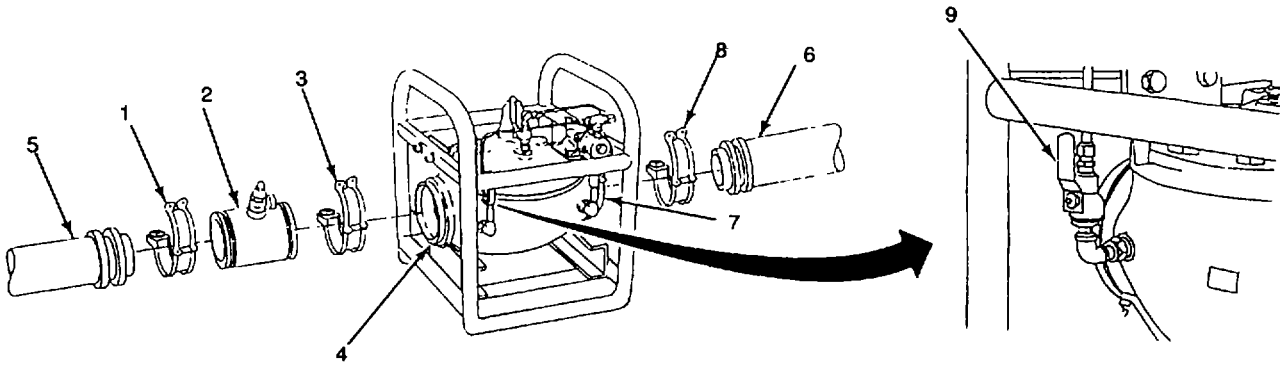


Figure 2-15. Pressure-Reducing Valve

(1) Locate 6-inch boltless coupling (1) connecting hoseline lengths where pressure-reducing valve is to be installed.

(2) Locate 6-inch pressure-relief valve (2) with attached 6-inch boltless coupling (3). Remove 6-inch boltless coupling (3) (para. 2-8.c.).

(3) Install 6-inch pressure-relief valve (2) on inlet connection (4) of pressure-reducing valve. Use 6-inch boltless coupling (3) removed from pressure-relief valve (2) in step (2).

(4) Connect upline hoseline length (5) to 6-inch pressure-relief valve (2). Use 6-inch boltless coupling (1) from hose connection in step (1) above (para. 2-8.b.).

(5) Connect downline hoseline length (6) to outlet connection (7) on pressure-reducing valve with 6-inch boltless coupling (8) (para. 2-8.b.).

(6) Place isolation cock valves (9) in open position.

h. Assemble Lead Pumping Station. Perform the following (Figure 2-16):

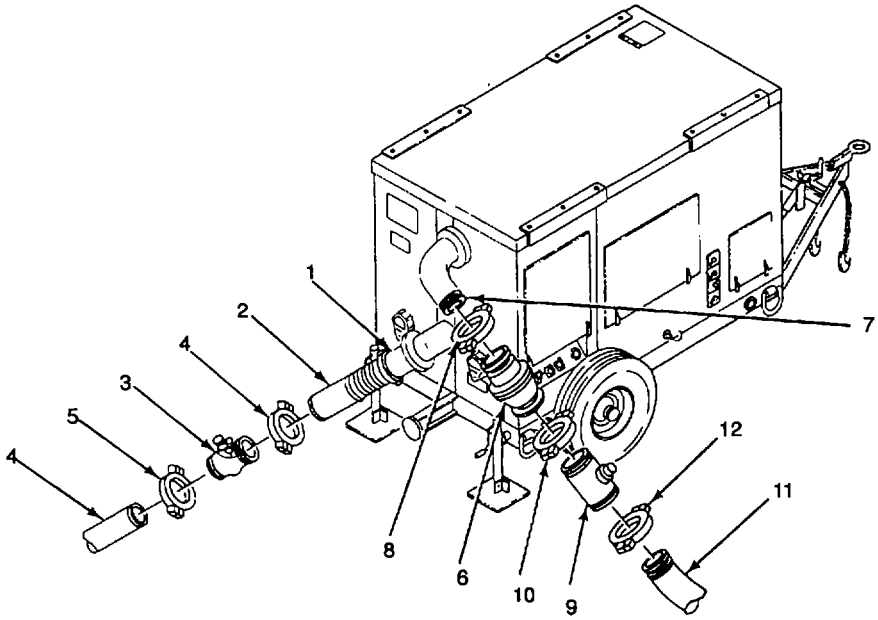


Figure 2-16. Lead Pumping Assembly

(1) Disconnect pumping assembly from tow vehicle. Refer to appropriate pumping assembly technical manual.

(2) Remove plastic cap from suction port (1) on pump. Retain cap for movement or storage.

(3) Locate 6 in. X 10 ft lengths of rigid-walled, wire reinforced suction hose (2) with quick-disconnect fittings.

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms to close. Damage to couplings could result.**

(4) Connection suction hose (2) to suction port (1). Close cam arms.

(5) Install 6-inch butterfly valve (3) on suction hose (2) with 6-inch boltless coupling (4) (para. 2-8.b). Set valve to fully opened position.

(6) Install additional 6-inch hose lengths (4) with boltless couplings (5) (para 2-8.b) to butterfly valve (3) until pump is connected to water source.

(7) Remove plastic cap from discharge port (7) on pump. Retain cap for movement or storage.

CAUTION

Make sure arrow on check valve points away from pump. Damage to pump may occur if pump discharge is blocked.

(8) Install 6-inch check valve (6) on pump discharge port (7) with 6-inch boltless coupling (8) (para. 2-8.b.). Install valve with arrow pointing away from pump.

WARNING

Personal injury may result from high pressure water if pressure-relief valve faces butterfly valve. Ensure pressure-relief valve is installed as shown in Figure 2-16 to avoid personal injury.

(9) Install pressure-relief valve assembly (9) to 6-inch check valve (6) with 6-inch boltless coupling (10).

(10) Connect end of 10-mile segment collapsible hose (11) to pressure-relief valve assembly (9) with 6-inch boltless coupling (12).

(11) Restrain hose manually until first 50 ft (15 m) of hose is in position. After 50 ft (15 m) of hose is in position, the weight of the hose will hold line in place.

i. Assemble Boost Pumping Stations. Perform the following (Figure 2-17):

(1) Disconnect pumping assembly from tow vehicle. Refer to applicable pumping assembly technical manual.

(2) Remove plastic cap from suction port (1) on pump. Retain cap for movement or storage.

(3) Locate 6 in. X 10 ft lengths of rigid-walled, wire reinforced suction hose (2) with quick-disconnect fittings.

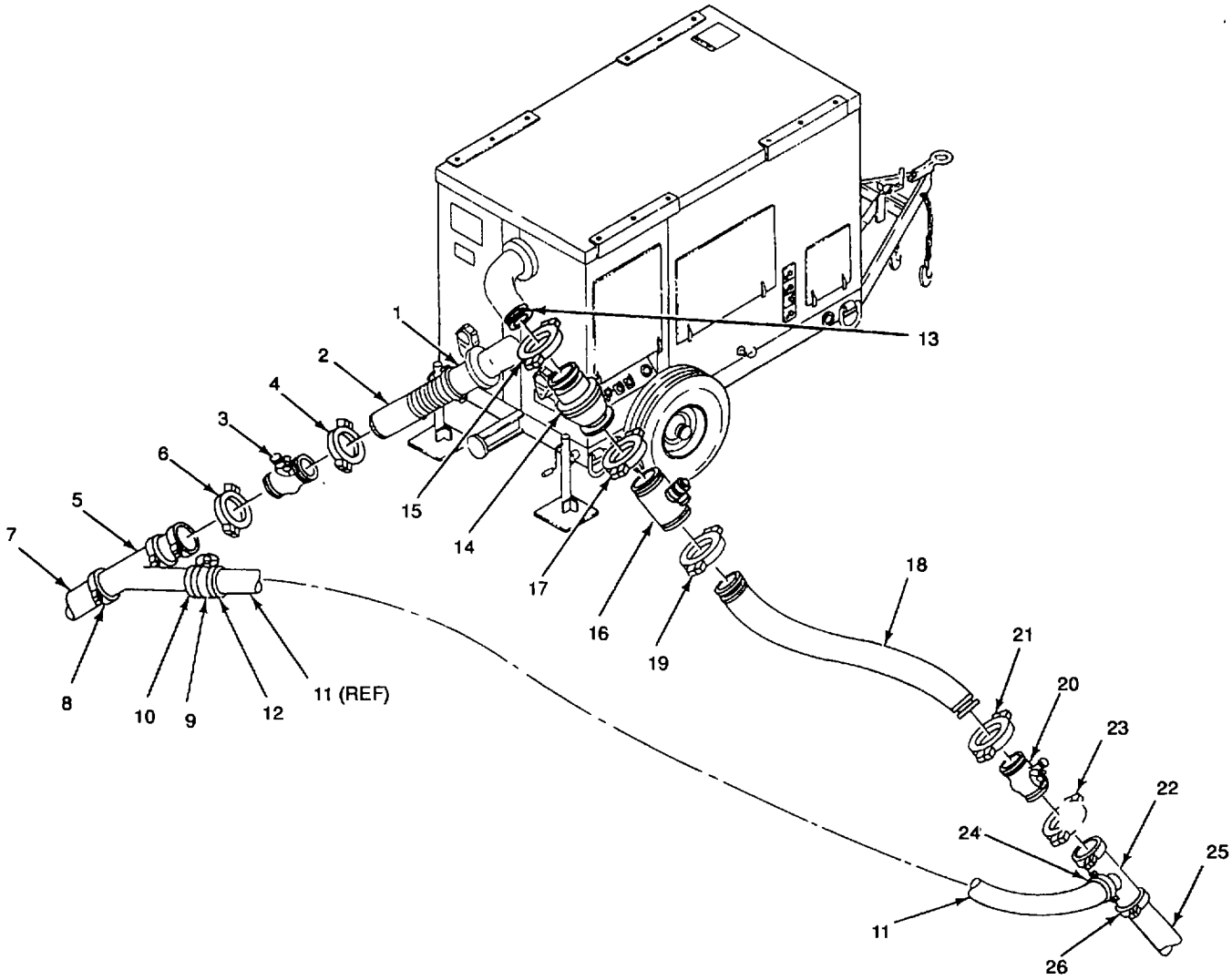


Figure 2-17. Boost Pumping Assembly

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms to close. Damage to couplings could result.**

(4) Connect suction hose (2) to suction port (1). Close cam arms.

(5) Install 6-inch butterfly valve (3) on suction hose (2) with 6-inch boltless coupling (4) (para. 2-8.b.). Set valve to fully opened position.

(6) Install lateral grooved wye-fitting (5) to 6-inch butterfly valve (3) with 6-inch boltless coupling (6).

(7) Connect end of 10-mile segment hose (7) to lateral grooved wye-fitting (5) with 6-inch boltless coupling (8) (para. 2-8.b.).

(8) Install butterfly valve (9) to lateral grooved wye-fitting (5) with 6-inch boltless coupling (10).

(9) Connect 6 in. X 75 ft discharge hose (11) to butterfly valve (9) with 6-inch boltless coupling (12).

CAUTION

To prevent damage to pump, make sure arrow on check valve points away from pump.

(10) Install 6-inch check valve (14) on pump discharge port (13) with 6-inch boltless coupling (15) (para. 2-8.b.) Install valve with arrow pointing away from pump.

WARNING

Personal injury may result from high pressure water if pressure-relief valve faces butterfly valve. Ensure pressure-relief valve is installed as shown in Figure 2-17 to avoid personal injury.

(11) Install pressure-relief valve assembly (16) to 6-inch check valve (14) with 6-inch boltless coupling (17) (para. 2-8.b.).

(12) Connect 6 in. X 20 ft discharge hose (18) to pressure-relief valve assembly (16) with 6-inch boltless coupling (19) (para 2-8.b.).

(13) Install butterfly valve (20) to 6 in. X 20 ft discharge hose (18) with 6-inch boltless coupling (21). Set valve to closed position.

(14) Install lateral grooved wye-fitting (22) to 6-inch butterfly valve (20) with 6-inch boltless coupling (23).

(15) Connect other end of 6 in. X 75 ft discharge hose (11) to lateral grooved wye-fitting (22) with 6-inch boltless coupling (24) (para. 2-8.b.).

(16) Connect lateral groove wye-fitting (22) to 10-mile segment collapsible hose (25) with 6-inch boltless coupling (26) (para. 2-8.b.).

(17) Restrain hose manually until first 50 ft (15 m) of hose is in position. After 50 ft (15 m) of hose is in position, the weight of the hose will hold line in place.

j. Assemble Storage Assemblies. Perform the following (Figure 2-18):

CAUTION

DO NOT choose site subject to flooding or high water. Damage to storage assembly may occur.

NOTE

For best tank operation, the site should not slope more than 3 inches per 100 ft (7.6 cm per 30.5 m) in any direction.

(1) Select a level site (1) that will extend at least 2 ft (0.5 m) beyond the empty flat storage tank dimensions (2).

(2) Clean and level an area 28 ft X 32 ft (8.54 m X 9.76 m).

(3) Inspect area closely. Remove all sharp objects that might puncture or scrape tank

NOTE

Center should be no more than 9 in. (22.86 cm) below ground level.

(4) Slope all four sides of leveled area toward center (3).

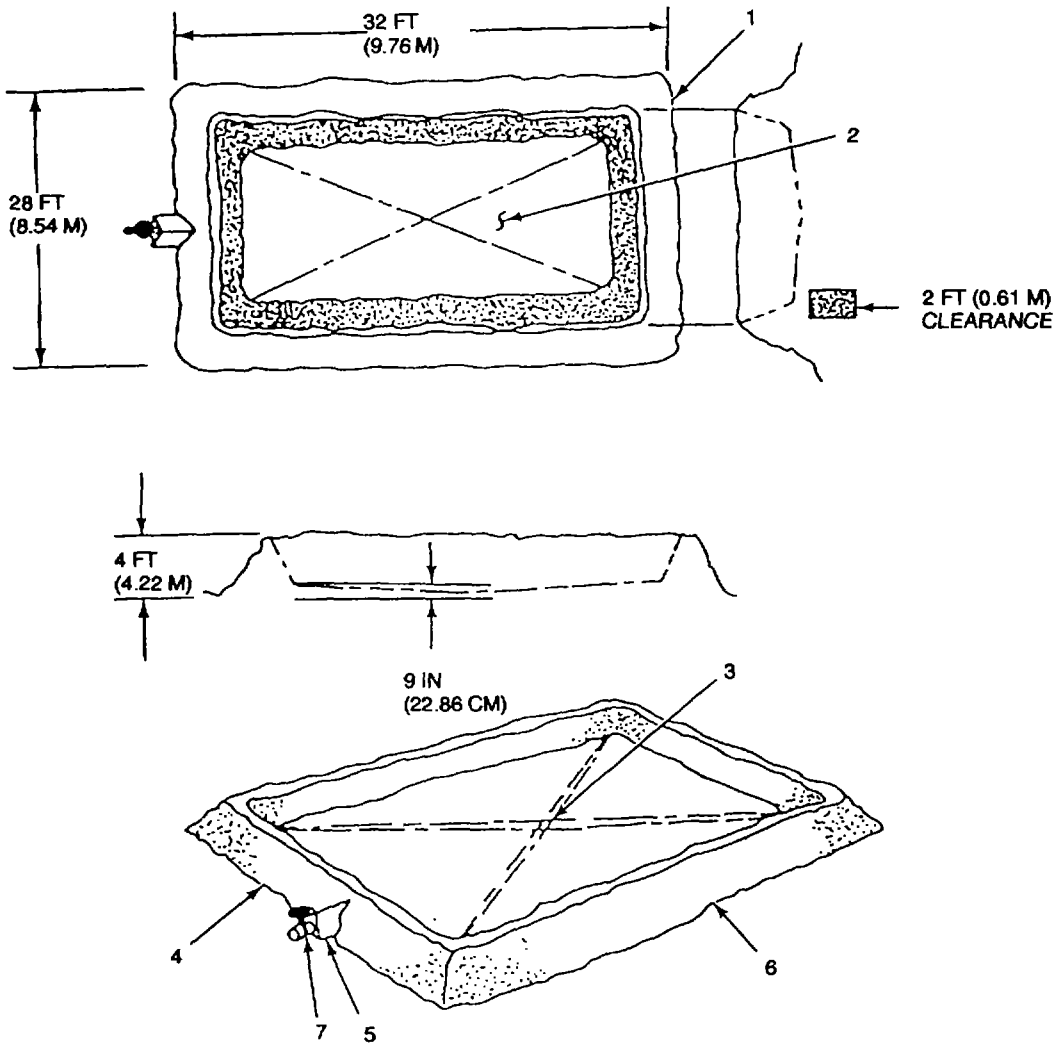


Figure 2-18. Storage Tank Location Preparation

NOTE

Berm should be able to contain at least 20,000 gallons of water.

(5) Designate end of berm (6) as discharge end (4). Discharge end (4) should face away from distribution point installation site, and if possible, away from 10-mile hoseline segment.

NOTE

Make sure valve on discharge pipe is closed after installation. Failure to do so would allow water to drain from berm should tank rupture. Open valve only to drain water from berm area.

(6) Place 2 in. (5.1 cm) pipe (5) with gate valve through bottom of discharge end (4) of berm (6).

(7) Erect a 4 ft (1.22 m) high earth berm (6) around site.

(8) Secure area, if necessary, by fencing or other means.

CAUTION

DO NOT walk on tank unless you must. DO NOT drop sharp objects on tank. Damage to tank may occur.

(9) Unroll storage tank (1, Figure 2-19) and unfold sides. Drain end (2) of tank will unroll first. Refer to applicable technical manual for storage tank assembly procedures.

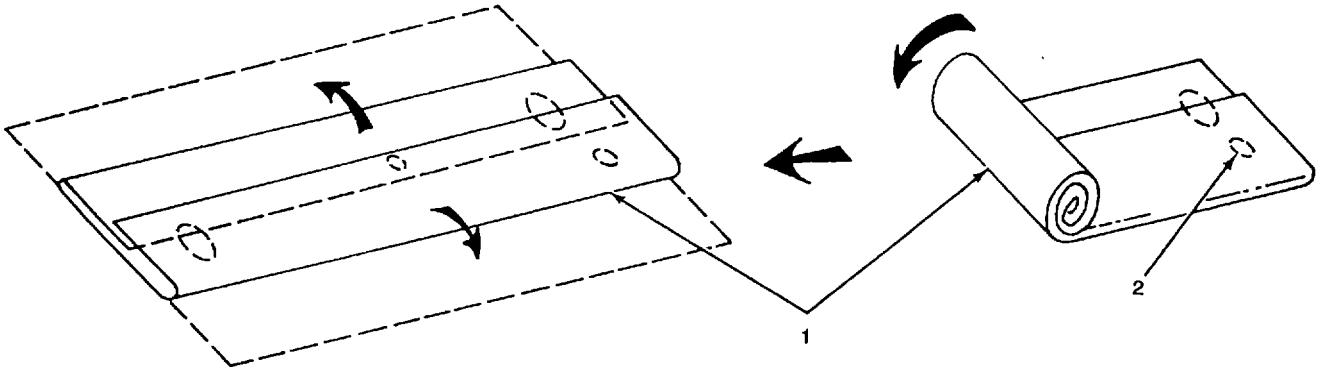


Figure 2-19. Proper Unroll and Unfold of Storage Tank

(10) Dig 3 ft X 3 ft X 2 in. (0.915 m X 0.915 m X 5.1 cm) sump under drain fitting.

CAUTION

After removing components from boxes, be sure to protect them from sand and grit. Sand and grit may cause equipment failure.

(11) Place gasket (1, Figure 2-20) on 4-inch flange adapter (2). Place 4-inch gate valve (3) on flange adapter (2). Align holes in each part of assembly.

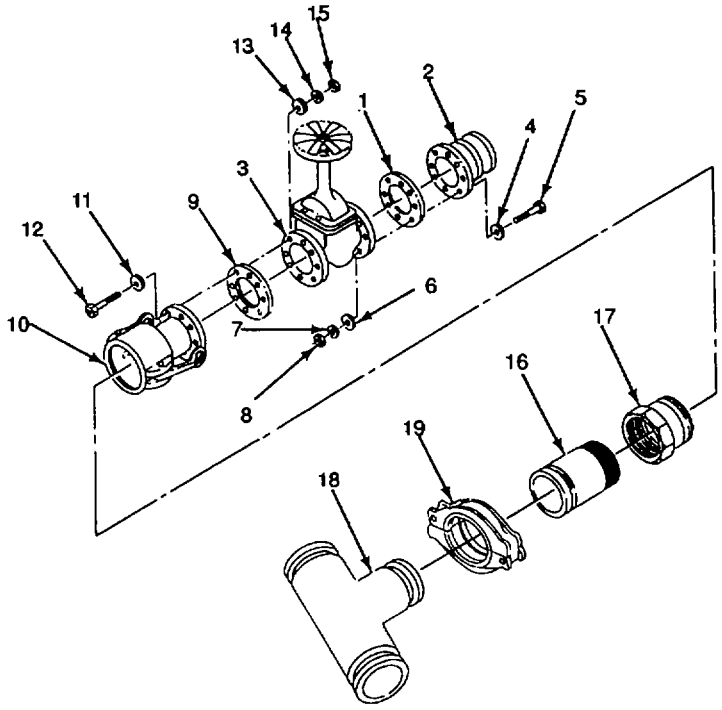


Figure 2-20. Discharge/Filler Hose Assembly

(12) Place flat washers (4) on eight bolts (5). Insert bolts (5) through openings in adapter (2), gasket (1), and gate valve (3).

(13) Place flat washer (6), lockwasher (7), and hex nut (8) on each end of eight bolts (5).

(14) Tighten hex nuts (8) until lockwashers (7) engage and parts are firmly together.

(15) Place gasket (9) between 4-inch female coupling half (10) a nd Cinch gate valve (3).

(16) Align holes in each part of assembly, and place flat washers (11) on eight bolts (12). Insert bolts (12) through openings in coupling half (10), gasket (9), and gate valve (3).

(17) Place flat washer (13), lockwasher (14), and hex nut (15) on each end of eight bolts (12).

(18) Tighten hex nuts (15) until lockwashers (14) engage and parts are firmly together.

NOTE

The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(19) Wrap anti-seize tape (Item 1 0, Appendix E) around threads of Cinch coupling pipe fitting (16). Screw coupling pipe fitting (16) into male coupling half (17).

(20) Connect 6 in. X 6 in. X 4 in. reducing tee (18) to coupling pipe fitting (16) with 4-inch boltless pipe coupling (19) (para. 2-8.b.).

NOTE

When installing female coupling half on reducing tee, make sure two 6-inch ends on tee are at right angles to stem on gate valve.

(21) Push cam arms on female coupling half (10) (attached to gate valve (3)) forw ard to open position.

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms to close. Damage to couplings could result.**

(22) Connect female coupling half (10) on gate valve (3) to male coupling half (17). Close cam arms.

(23) Place reducing tee/gate valve assembly at point where junction with 10-mile hoseline segment is expected.

(24) Install 6-inch boltless coupling (para. 2-8.b.) to connect 10-mile hoseline segment (para. 2-8.d.).

(25) Connect 4 in. X 10 ft discharge hose assembly (1, Figure 2-21) to female-to-female elbow (2) on storage tank (3). Close cam arms.

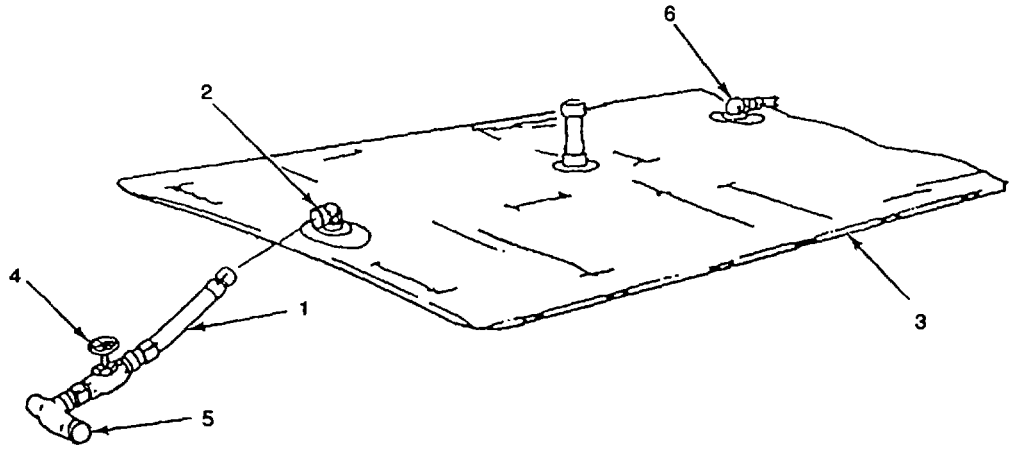


Figure 2-21. Connecting Discharge Hose Assembly

(26) Connect additional hose lengths as necessary to reach reducing tee/gate valve assembly (5).

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms to close. Damage to couplings could result.**

(27) Connect female coupling on the last hose length with flange adapter attached to Cinch gate valve (4). Close cam arms.

NOTE

Hose-laying crew should provide enough slack in hoseline to allow for connection of reducing tee/gate valve assembly.

(28) Move reducing tee/gate valve assembly (5) to a location that will be out of the way of hose-laying crews.

k Assemble Distribution Points. Perform the following:

(1) Locate male filler/discharge elbow (6) on storage tank (3).

CAUTION

After removing components from boxes, protect components from sand and grit. Sand and grit may cause equipment failure.

(2) Push cam arms (4, Figure 2-22) on female end of reducer (2) forward to open position.

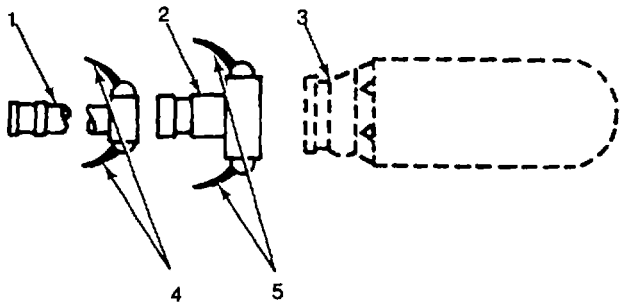


Figure 2-22. Tank, Reducer and Hose Assembly

CAUTION

- **To prevent leakage, dose both cam arms at the same time.**
- **Do not strike cam arms too close. Damage to couplings could result.**

(3) Connect female end of reducer (2) to male fitting on stor age tank fitting (3). Close cam arms (4).

(4) Push cam arms (5) on 2 in. X 20 ft rigid-walled suction hose (1) forward to open position.

(5) Connect hose (1) to reducer (2) attached to storage tank fitting (3). Close cam arms (5).

(6) Locate suction and discharge ports (1 and 2, Figure 2-23) on 125 GPM pump.

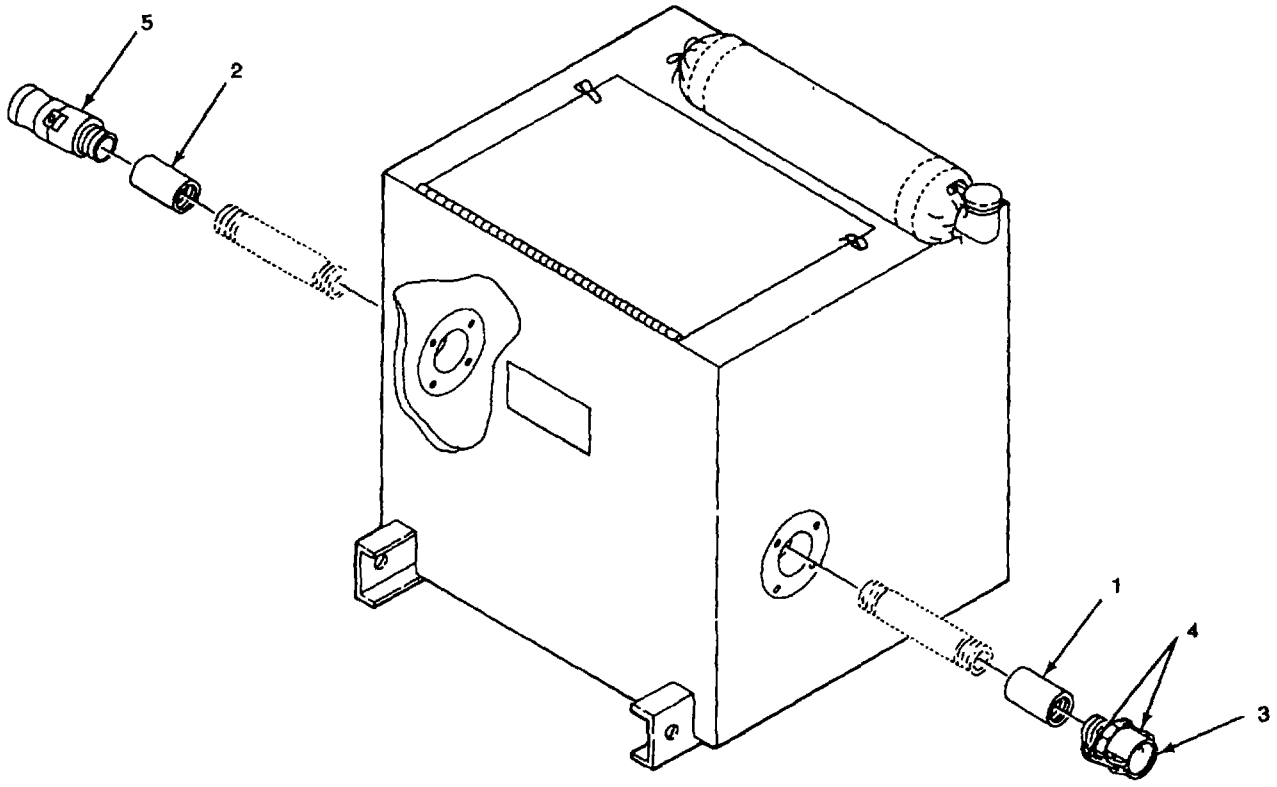


Figure 2-23. 125 GPM Pump

NOTE

The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(7) Wrap anti-seizing tape (Item 10, Appendix E) around threads on female quick-disconnect coupling half (3). Screw coupling half (3) into suction port (1) of 125 GPM pump.

(8) Push cam arms (4) on quick-disconnect coupling half (3) forward to open position.

CAUTION

- **To prevent leakage, dose both cam arms at the same time.**
- **Do not strike cam arms too dose. Damage to couplings could result.**

(9) Connect 2 in. X 20 ft rigid wall section hose assembly from storage tank to femal e quick-disconnect coupling half (3) on pump. Close cam arms (4).

(10) Wrap anti-seize tape (Item 10, Appendix E) around threads on male quick-disconnect coupling half (5). Screw male quick-disconnect coupling half (5) into discharge port (2) of 125 GPM pump.

(11) Connect 2 in. X 10 ft discharge hose to male quick-disconnect coupling half (5) on pump. Close cam arms.

(12) Locate inlet (1, Figure 2-24) and outlet (2) ports of hypochlorination unit. Unscrew plastic dust caps from both ports. Store caps for later use.

(13) Wrap anti-seize tape (Item 10, Appendix E) around threads on nipple (3). Screw nipple (3) into inlet (1) port on hypochlorination unit.

(14) Screw female quick-is connect coupling half (4) onto nipple (3).

(15) Push cam arms on female quick-disconnect coupling half (4) forward to open position.

(16) Connect male end of reducer (5) to female quick-disconnect coupling half (4). Close cam arms.

(17) Push cam arms on female end of reducer (5) to open position.

(18) Connect 2 in. X 10 ft hose (6) from 125 GPM pump to female end of reducer (5). Close cam arms.

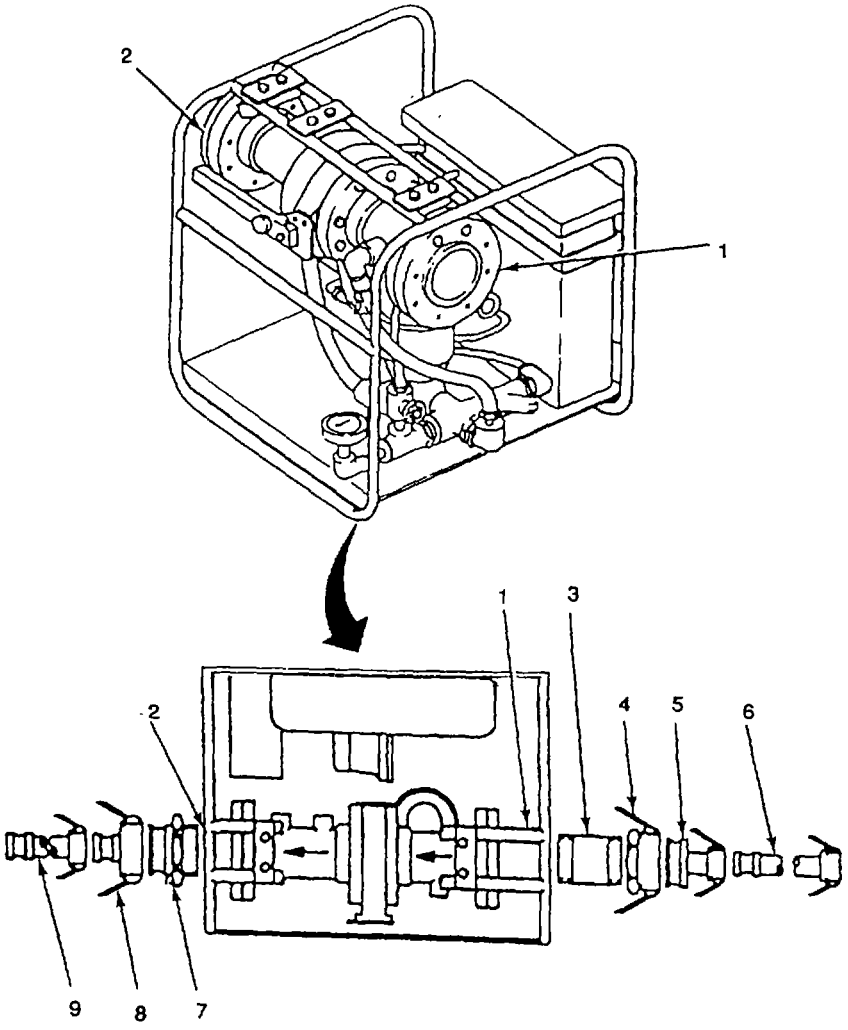


Figure 2-24. Hypochlorination Unit

NOTE
The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(19) Wrap anti-seize tape (Item 10, Appendix E) around threads on male quick-disconnect coupling half (7). Screw male quick-disconnect coupling half (7) into outlet port (2) of hypochlorination unit.

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms too close. Damage to couplings could result.**

(20) Push cam arms on 4 in. X 2 in. reducer (8).

(21) Connect 4 in. X 2 in. reducer (8) to male quick-disconnect coupling half (7). Close cam arms.

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms too close. Damage to couplings could result.**

(22) Push cam arms on 2 in. X 20 ft discharge hose (9) forward to open position.

(23) Connect hose (9) to 4 in. X 2 in. reducer (8) of hypochlorination unit. Close cam arms.

(24) Push cam arms on female quick-disconnect adapter on wye-connection (4, Figure 2-25) forward to open position.

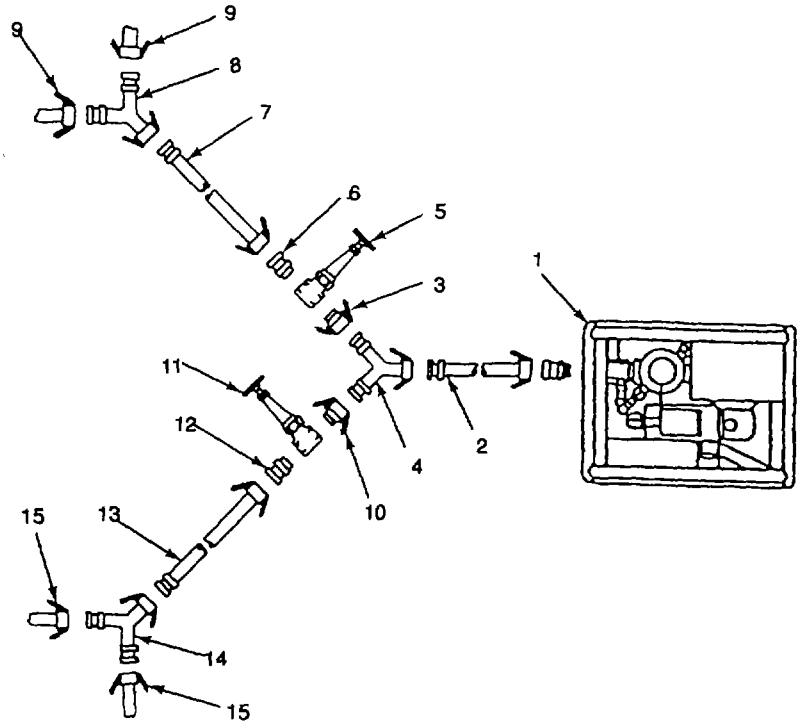


Figure 2-25. Hypochlorination Unit and First Wye-Connection

(25) Connect female quick-disconnect adapter on wye-connection (4) to hose (2) attached to hypochlorina tion unit (1). Close cam arms.

NOTE

The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(26) Wrap anti-seize tape (Item 10, Appendix E) around threads of male end of quick-disconnect coupling half (3). Screw male end of quick-disconnect coupling half into one end of 2-inch gate valve (5).

(27) Push cam arms on female end of coupling half (3) forward to open position.

(28) Connect female end of coupling half (3) on gate valve (5) to male adapter on first wye-connection (4). C lose cam arms.

NOTE

The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(29) Wrap anti-seize tape (Item 10, Appendix E) around threads of male quick-disconnect coupling half (6). Screw male quick-disconnect coupling half (6) into other end of gate valve (5) attached to wye-connection (4).

(30) Push cam arms on 2 in. X 20 ft discharge hose (7) forward to open position.

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms too close. Damage to couplings could result.**

(31) Connect hose (7) to male quick-disconnect coupling half (6) on gate valve (5). Close cam arms.

(32) Push cam arms on second wye-connection (8) forward to open position.

(33) Connect female adapter on second wye-connection (8) to hose (7) attached to first wye-connection (4). Close cam arms.

(34) Push cam arms on two 2 in. X 20 ft discharge hose assemblies (9) forward to open position.

(35) Connect each hose assembly (9) to male adapters on second wye-connection (8). Close c am arms.

(36) Repeat steps (25) through (32) to connect female quick-disconnect coupling half (10), 2-inch gate valve (11), male quick-disconnect coupling half (12), discharge hose (13), wye connection (14), and discharge hoses (15).

NOTE

- **If tank trucks are to be filled, reducers to be installed on discharge hoses to match truck fittings.**
- **When reducers are installed on hose ends, water flow is controlled by 2 inch gate valves.**
- **The anti-seizing tape is to be wrapped in the same direction as the pipe threads.**

(37) Wrap anti-seize tape (Item 10, Appendix E) around threads of male end on two reducers (1, Figure 2-26). Screw reducers (1) into two hose swivels (2).

(38) Wrap anti-seize tape (Item 10, Appendix E) around threads of hose swivels (2). Screw hose swivels (2) into each of the two nozzles (3).

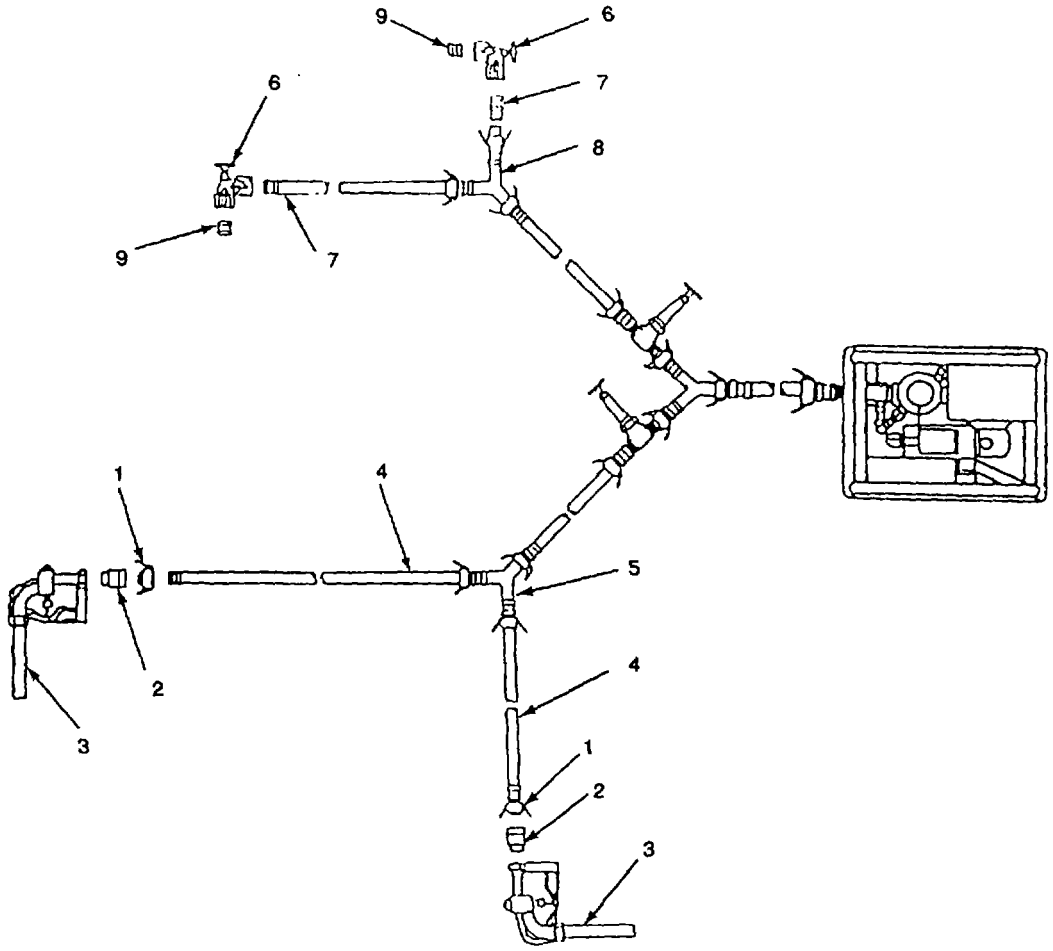


Figure 2-26. Distribution Point

(39) Push cam arms on two reducers (1) forward to open posi tion.

CAUTION

- **To prevent leakage, dose both cam arms at the same time.**
- **Do not strike cam arms too close. Damage to couplings could result.**

(40) Connect two reducers (1) to two discharge hoses (4) of third wye-connection (5). Close cam arms.

(41) Push cam arms on ends of two 2-inch elbow valves (6) forward to open position.

(42) Connect two elbow valves (6) to two discharge hoses (7) on second wye-connection (8). Close cam arms.

(43) Push cam arms on open ends of two elbow valves (6) forward to open position.

CAUTION

- **To prevent leakage, close both cam arms at the same time.**
- **Do not strike cam arms too close. Damage to couplings could result.**

(44) Connect two dust plugs (9) to two elbow valves (6). Close cam arms.

(45) Install two nozzle stand assemblies. Spread tripod legs (1, Figure 2-27) and secure legs with rocks or embed pointed ends in ground. Locate nozzle stand assemblies at convenient spots for hanging up distribution point nozzles (2) and elbow valves (3).

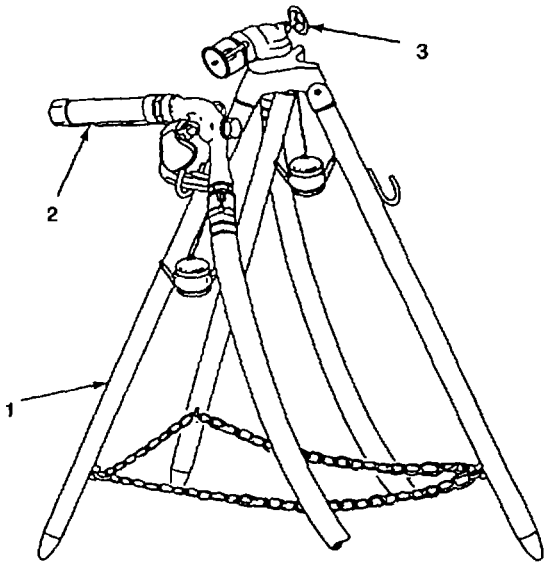


Figure 2-27. Nozzle Stand Assembly

(46) Using locally available materials, construct tripod supports (1, Figure 2-28) on which to hang drinking water storage bags (2). Hang water bags on tripods.

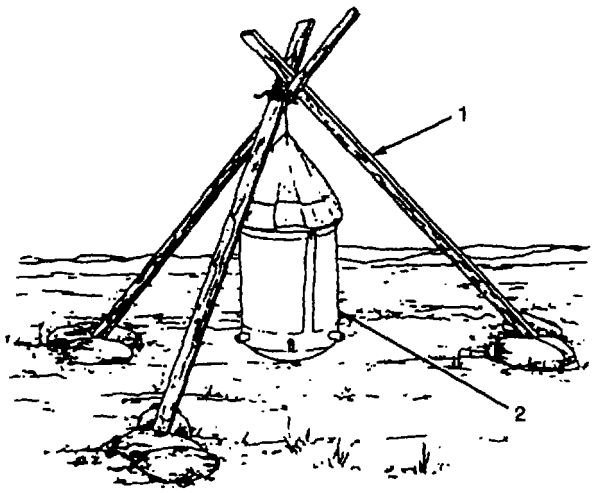


Figure 2-28. Potable Water Storage Bag

NOTE

Tripods must be at least 6 ft (1.83 m) tall and capable of supporting 400 lbs (181.6 kg).

2-9. **General Operating Procedures**. This paragraph provides general instructions for operation of the entire TWDS under usual conditions.

CAUTION

If suction pressure falls below 20 psi (boost pump only) or if discharge pressure rises above 150 psi (1034 kPa) on any pump, damage may result to system.

NOTE

Hoseline packing - initial filling of hoseline with water.

a. When packing hoseline, monitor suction and discharge pressures on pumps. If pressure is too low or too high, IMMEDIATELY shut down pumps. Notify supervisors on hose-laying crews and operators at other pumping stations who are packing hoseline. Cease operation until problem is corrected.

CAUTION

Trapped air can cause hoseline to collapse and pressure at downline pumping stations to fall below 20 psi (68.9 kPa). To prevent damage to pump, take precautions to vent air from hoseline.

b. As hose-laying crews connect major components, prepare TWDS for operation by packing hoseline. As soon as lead pumping station and first boost pumping station are installed and connected by hoseline, perform the following steps:

(1) Notify operator(s) on lead pumping station to begin pump operation in manual mode. Refer to applicable pumping assembly technical manual.

(2) Notify operator(s) on lead pumping station to shut down pump operation when hoseline is packed. Refer to applicable technical manual for shutdown procedures.

(3) Close butterfly valve on boost pump discharge hose to contain water column.

c. Begin moving water again when next downline station is installed and connected by hoseline. Repeat applicable steps b.(1) through (3). Start up lead pump. Start up first boost pump. When water column reaches second boost pumping station, shut down pumps, and cease operation of system. Close butterfly valve on second boost pump discharge hose to contain water column.

d. Continue packing hoseline as each boost pumping station is installed and connected.

NOTE

Before storage tanks are filled, or complete operation of system begins, flush hoseline of sediment and debris.

CAUTION

To protect hose from damage in high winds, do not begin filling storage tanks until hoseline is packed.

e. When system is ready for operation, refer to appropriate technical manual for instructions on filling storage tanks.

f. Complete operation of TWDS may begin as soon as all pumping stations, storage assemblies, and distribution points have been installed, connected, and hoseline packed.

g. During startup of the complete system, the boo st pumping stations are operated in automatic mode. The lead pump should always be operated in manual mode. Refer to appropriate pumping assembly technical manual.

h. When storage tanks are approaching maximum holding capacity, reduce speed on lead pump to decrease rate of downline waterflow. In automatic mode, the rate of boost pumps should decrease automatically. When storage tanks are filled to maximum capacity (height of tank reaches 5-1/2 ft (1.7 m)), dose gate valve on each storage assembly and shut down operation of pumping stations. Refer to applicable technical manual for additional storage assembly operating procedures.

i. Pumping rates during operation will vary, depending on amount of water being discharged at either distribution points, large storage and distribution units, or both. Pumping stations operate at intervals long enough to refill storage tanks if discharge rate is minimal. When water is pumped on a continual basis and boost pumping stations are operating in automatic mode, perform DURING PMCS on pumping assemblies at a minimum of every 3 hours. Refer to applicable technical manual for the pumping assembly.

j. During all phases of operation, operators at pumping stations and storage assemblies must be in communication with each other. Any unusual situations or difficulties must be reported immediately.

(1) Storage assembly operators should report beginning and completion of tank filling operations.

(2) Operators at lead pumping station should track stat us of advancing water column during packing operation. During startup, they should monitor overall performance of system.

(3) Once operation of complete system begins, operators on each pumping station must continue to monitor suction and discharge pressures. They must report low suction pressure or high discharge pressure and take corrective action immediately.

2-10. Operation of Lead Pumping Station. Open butterfly valves on pump suction. Refer to applicable technical manual for the operation of the 600 GPM pump.

2-11. Operation of Boost Pumping Station. Open butterfly valves on suction and discharge lines and close the butterfly valve on the bypass line. Reference applicable technical manual for the operation of the 600 GPM pumping assembly.

2-12. Operation of Storage Assemblies. Reference applicable technical manual for the operation of 20,000 gallon storage tank.

2-13. Operation of Distribution Points. Operation of distribution points can begin when storage tanks contain enough water to allow a normal discharge rate. Refer to applicable technical manuals for the operation procedures for the 125 GPM centrifugal pump and the hypochlorination unit.

a. Set flow rate of hypochlorination unit to 14 GPM.

NOTE

- **Do not confuse the terms "dosage" and "residual".**
- **Dosage refers to the amount of chlorine added to the water.**
- **Residual refers to the amount of chloride remaining in the water after 10 minutes.**

b. If chlorine requirement is unknown, start with 1.0 percent solution strength (5.00 ppm, 10 oz of hypochlorite).

NOTE

Thirty minute contact time is required to obtain an accurate chlorine residual as prescribed by TB-MED-577 or by area medical officer.

c. Perform chloride residual tests as follows (Figure 2-29):

(1) Place chlorine color disc (1) in the comparator (2).

(2) Place prism eyepiece (3) over sample cell windows (4).

(3) Select two clean comparator cells (5).

(4) Fill one cell (1, Figure 2-30) to the mark with the water under test.

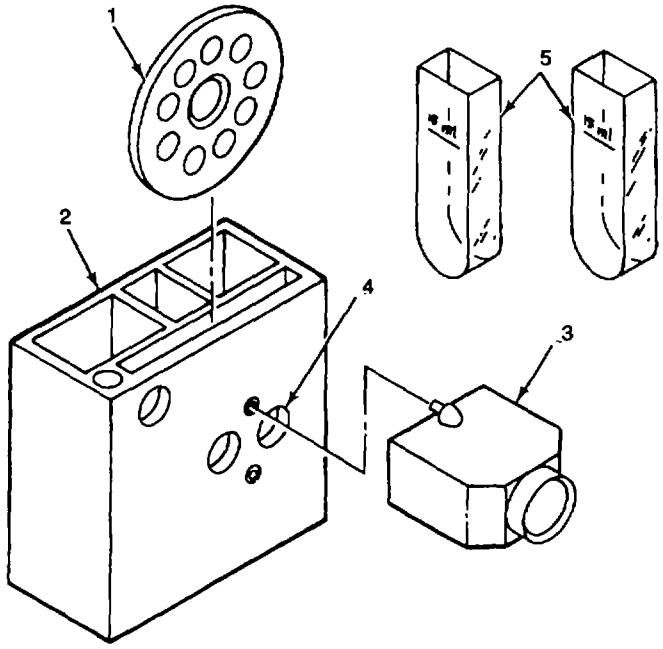


Figure 2-29. Color Comparator

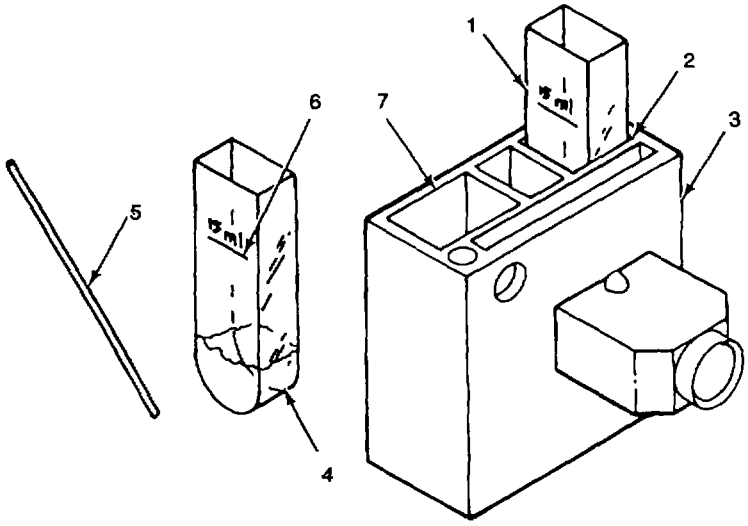


Figure 2-30. Comparator Cells

(5) Insert this cell in the right hand cell space (2) of the comparator (3).

NOTE

This cell, when filled to the mark with the water under test compensates for color and turbidity. The omission of this step may cause serious errors.

(6) Collect just enough water to cover the bottom of the second ce ll (4).

(7) Add two DPD No. 1 tablets and crush with the plastic rod (5).

(8) Fill this cell to the mark (6) with the water under test and insert it in the left hand cell space (7) of the comparator (3). Compare with the color standards of the appropriate disc as rapidly as possible. Record the result which is the closest match as the value of the free residual chlorine level of the test sample. Interpolation between two values may be necessary.

d. Perform chloride pH test as follows (Figure 2-31):

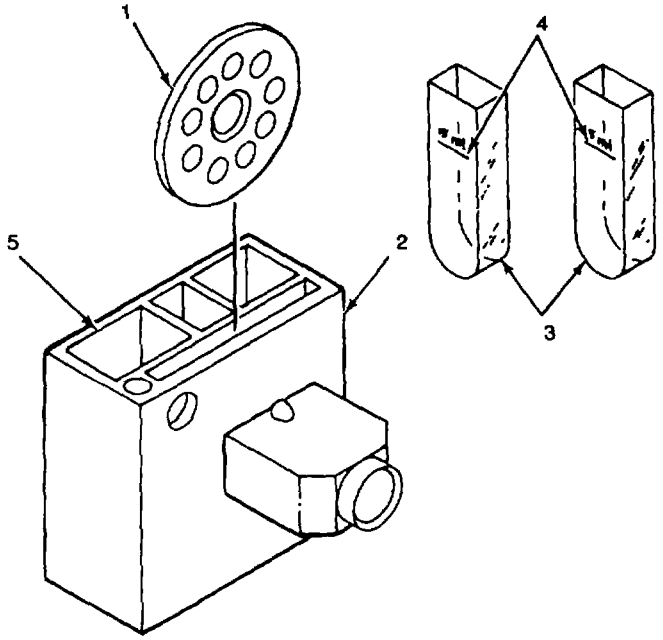


Figure 2-31. Chloride pH Test

(1) Place the pH color disc (1) in the comparator (2).

(2) Rinse and fill two dean cells (3) with water sample to the mark (4).

(3) Hold the comparator (2) with the eye piece facing you and place the two water-filled cells (3) into the openings at the top.

(4) Fill the dropper (1, Figure 2-32) of the wide range indicator solution (white cap) bottle to the 0.50 m L mark (2).

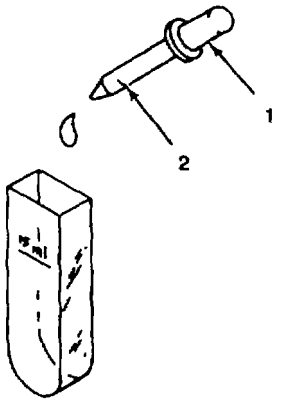


Figure 2-32. pH Test Cell

(5) Add the indicator solution to the cell in the LEFT (5, Figure 2-31) opening only. (Water sample without indicator solution in right opening compensates for color and turbidity.)

(6) Hold the comparator (2) to your eye and face a good light source (daylight but not the direct rays of the sun or artificial light reflected from a white surface). Be sure your fingers do not cover the light window in the back of the comparator. Rotate the pH color disc until a color on the disc matches the color of the cell in the left opening. The readings can be made directly from the round window in the front of the comparator. The value is expressed as the pH number.

(7) If the color of the cell in the left opening is between two colors on the pH color disc, the value must be estimated.

(8) In making the pH test, be careful to avoid touching the sample or the ce ll with the dropper. Never place the pH dropper on a laboratory bench or other surface because the adherence of the slightest amount of acid or alkali to it will produce erroneous results.

(9) When test has been completed, empty the samples and wash the cells with dean water.

2-14. Operation of Auxiliary Equipment. Not applicable.

2-15. Preparation for Movement. Perform the following:

a. General.

(1) Preparing TWDS for movement requires the following:

(a) Removing water from system.

(b) Shutting down and disassembling major components.

(c) Repacking major components.

(2) Remove water at the lead pumping station first, then move down the line to the last boost pumping station. After hoseline water has been removed, empty storage tanks and begin to disassemble major components.

(3) To begin emptying hoseline, shut down lead pump (refer to applicable pumping assembly technical manual). Close butterfly valves on suction and discharge ports of lead pump. Continue to run downline boost pumping stations.

(4) Allow first boost pump to operate until suction pressure falls to 20 psi (68.9 kPa). At that time, shut down the pump (refer to applicable pumping assembly technical manual). Isolate pump assembly from hoseline by opening butterfly valve on bypass system and closing butterfly valves on suction and discharge hoses. Repeat procedure with each downline pump.

b. Evacuate and Disassemble 10-Mile Hoseline Segment.

NOTE

Evacuating hoseline begins at lead pumping station and proceeds downline.

(1) Remove 6-inch boltless coupling (para. 2-8.c.) connecting end of hoseline segment to next downline hose segment (or swivel joint).

(2) Separate two hoseline segments (or hoseline segment and swivel joint).

(3) Locate ball receiver (4, Figure 2-33), consisting of two 8 X 6 inch reducers (5 and 6, Figure 2-33). One reducer has been modified to prevent displacement ball from being ejected from ball receiver.

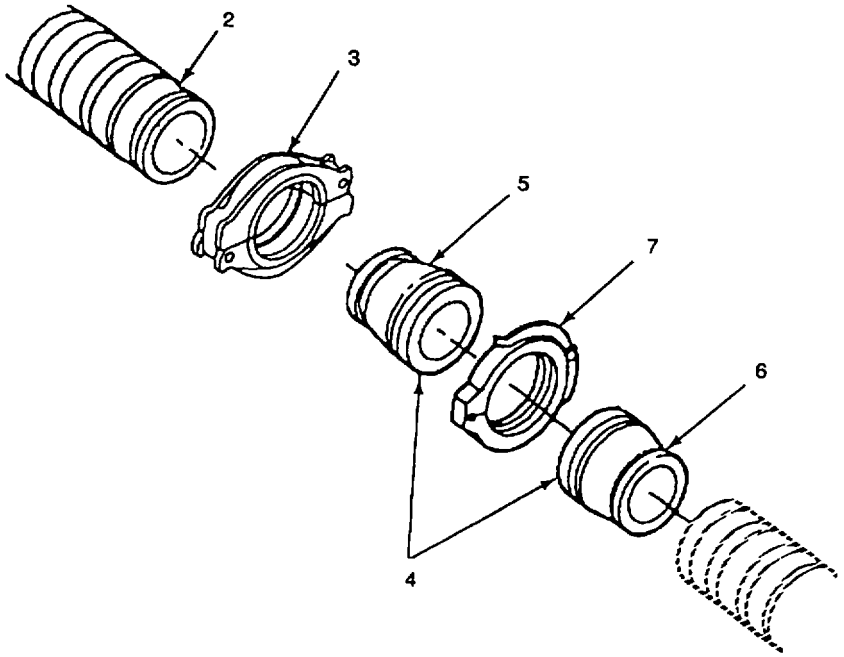


Figure 2-33. Ball Receiver

(4) Connect 6-inch end of unmodified reducer (5) to downline end of first hoseline segment (2) using grooved-end pipe boltless coupling (3) (para. 2-8.b.).

(5) Locate 8-inch snaplock coupling (7). Open coupling.

(6) Fit halves of snaplock coupling (7) over joined ends of reducers (5 and 6). Close coupling (7) over reducer (5 and 6) ends. Lock snaplock coupling (7).

(7) Connect nipple (1, Figure 2-34) to upline end of first hoseline segment (2) using boltless coupling (3) (para. 2-8.b.).

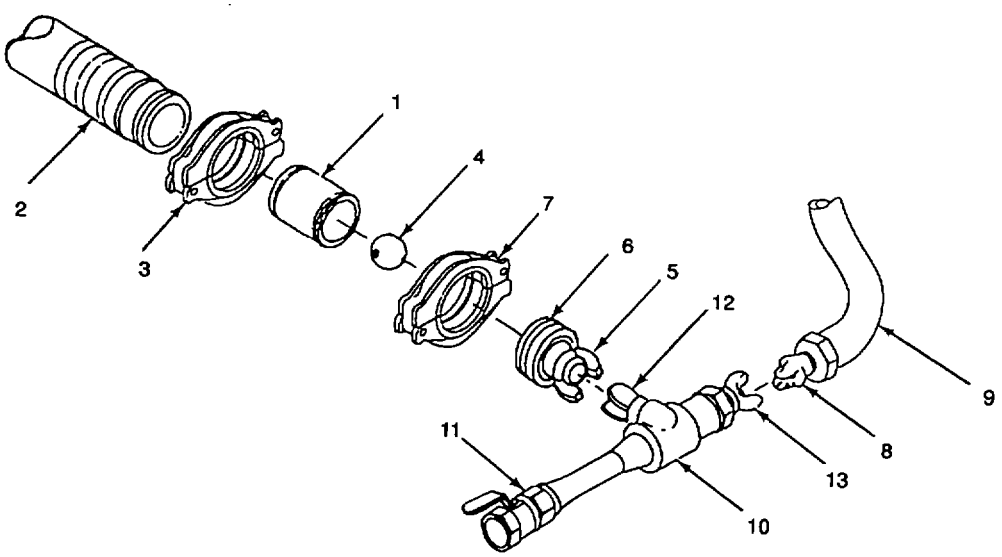


Figure 2-34. Displacement Ball

(8) Place wet displacement ball (4) inside nipple (1).

(9) Locate pneumatic coupler (5) and modified end cap (6) (with tapped hole). Attach pneumatic coupler (5) to modified end cap (6).

(10) Connect modified end cap (6) with pneumatic coupler (5) to end of nipple (1). Use boltless coupling (7) (para. 2-8.b.) from displacement and evacuation kit.

(11) Locate pneumatic coupler (8). Screw pneumatic coupler (8) into air compressor line (9).

(12) Locate ejector assembly (10), ball valve (11), and two pneumatic couplers (12 and 13). Install pneumatic couplers (12 and 13) on threaded fittings on ejector assembly (10).

(13) Install ball valve (11) on end of ejector assembly (10). Close ball valve (11).

(14) Connect ejector assembly (10) to end cap (6) by connecting pneumatic couplers (5 and 12).

WARNING

Stand clear of receiver during displacement process. Hoseline may jump when displacement ball arrives at receiver.

(15) Pressurize hoseline to 80 to 90 psi (551 to 620 kPa). Displacement ball (4) will be forced through hose, displacing any residual water. A sound will be heard when the ball reaches receiver.

NOTE

If ball gets stuck, straighten kinks in hoseline. It may be necessary to increase air pressure. Do not exceed 150 psi (1034 kPa).

(16) Shut off compressor when displacement ball (4) reaches receiver (6, Figure 2-33).

(17) Open snaplock coupling (7) connecting two reducers (5 and 6). Pull snaplock coupling (7) back and separate two hinged coupling halves of snaplock coupling (7). Set snaplock coupling (7), displacement ball (4, Figure 2-33), and modified reducer (6, Figure 2-34) aside.

(18) Remove boltless coupling (3) (para. 2-8.c.) connecting unmodified reducer (5) to hoseline segment (2).

(19) Locate end cap (1, Figure 2-35). Connect end cap (1) to end of hoseline segment (2) with boltless coupling (3) (para. 2-8.b.).

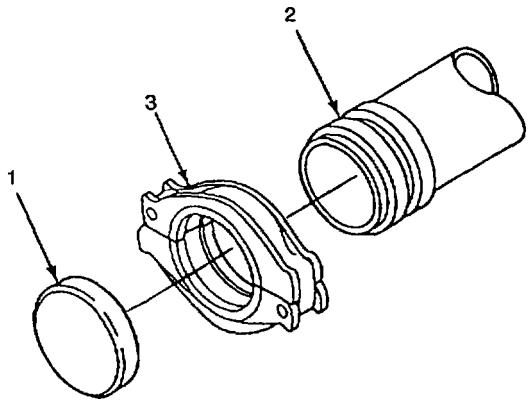


Figure 2-35. End Cap

(20) Open ball valve (1, Figure 2-36) on ejector assembly.

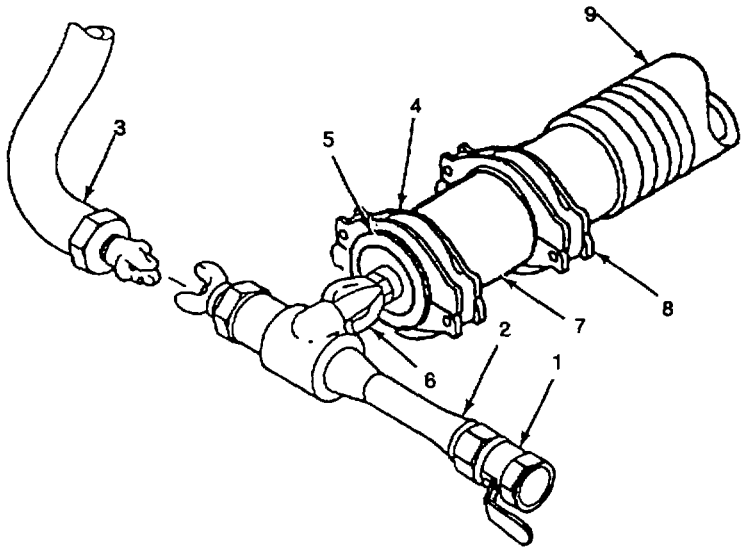


Figure 2-36. Ejector Assembly

(21) Apply air pressure to ejector assembly (2). Operate compressor until hoseline collapses for repacking.

(22) Turn off air compressor and disconnect air compressor line (3).

(23) Disconnect ejector assembly (2) and set aside.

(24) Remove boltless coupling (4) (para. 2-8.c.) connecting end cap (5) with pneumatic coupler (6) to nipple (7).

(25) Remove boltless coupling (8) (para. 2-8.c.) connecting nipple (7) to hoseline segment (9).

NOTE

End caps must be installed on collapsed hoseline to prevent hose from expanding before it is packed.

(26) Connect end cap (1, Figure 2-35) to hoseline segment (2) using boltless coupling (3) (para. 2-8.b.).

(27) Repeat steps (1) through (25) (omitting steps (9) thr ough (13)) for each hoseline segment down the line.

(28) When a hoseline length has been evacuated, collapsed, and capped, it is ready for packing in a tricon box.

(29) When a swivel joint is removed, return it and one 6-inch boltless coupling to lead pumping station installation site.

c. Disassemble Suspension Devices.

NOTE
Set aside all removed components for repacking.

(1) Remove 6-inch boltless coupling (para. 2-8.c.) connecting upline hoseline length to suspended hoseline len gth.

(2) Install 6-inch boltless coupling (para. 2-8.b.) onto leading end of suspended hoseline length.

(3) Repeat steps (1) and (2) with trailing end of suspended hoseline length and downline hoseline segment. Install boltless coupling on leading end of downline segment (para. 2-8.b.).

CAUTION

When removing saddle assemblies, manually support hose until assemblies have been removed. A sudden release of saddles may add stress to hose causing damage.

(4) Remove U-bolt damps (1, Figure 2-37) used to secure end shackles (2) to wire rope (3).

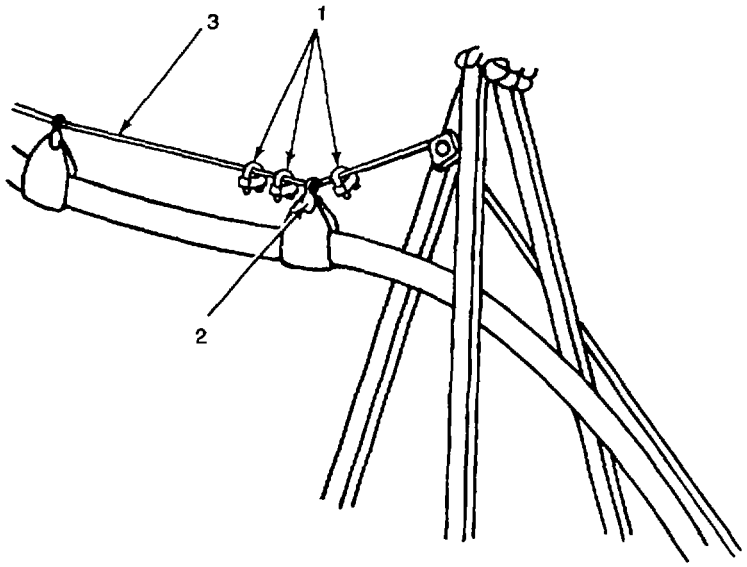


Figure 2-37. End Shackle Clamps

(5) Remove bolt (1, Figure 2-38), saddle (2), and shackle (3) from each saddle assembly (4) to outside of upline tripod (5).

(6) Remove shackles (3) from wire rope (8).

(7) Remove bolt (1), saddle (2), and shackle (3) from each saddle assembly to outside of downline tripod (6).

(8) Remove shackles (3) from wire rope (8) and install bolts (1) throu gh saddles (2) and shackles (3).

(9) Pull hose (7) across span. Saddles (2) should drag with hose (7) along wire rope (8).

(10) As saddles (2) arrive at pulley block (9) on tripod tower (5), remove each one by removing bolt (1), saddle (2), and shackle (3). Install bolt (1), and shackle (3) on each saddle (2).

(11) After all saddles (2) have been removed and hose has been retrieved, loosen tumbuckles (10) to release tension on wire rope (8).

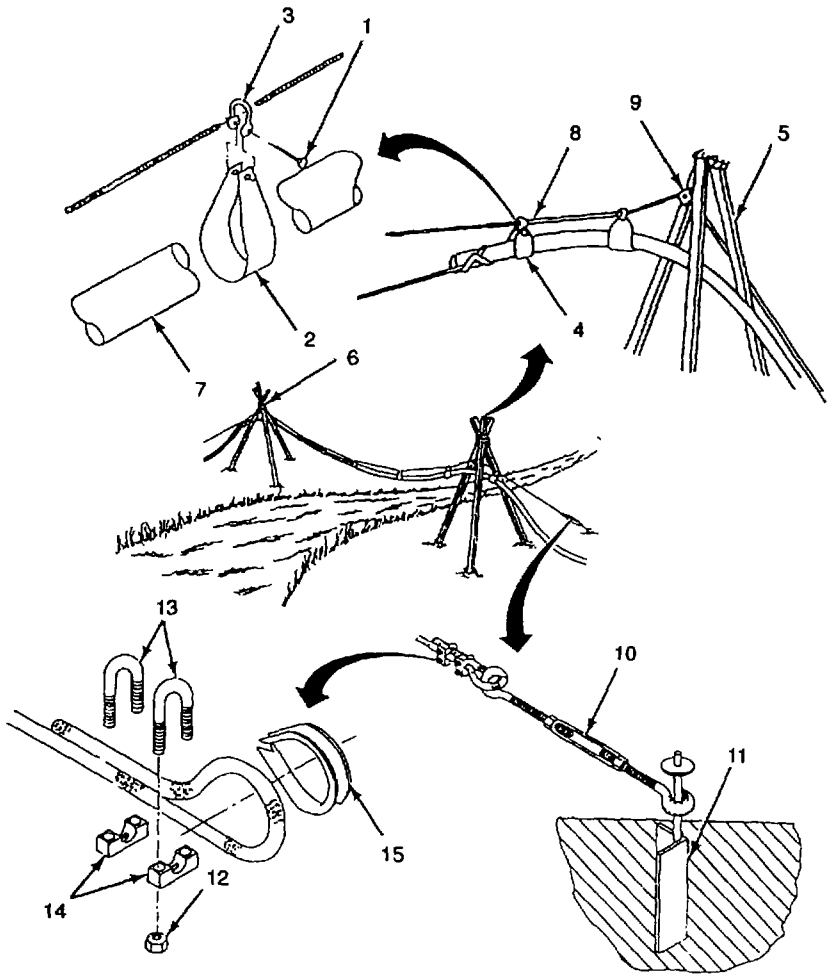


Figure 2-38. Disassembly of Suspension Device

(12) Remove turnbuckles (10) from ends of wire rope (8).

(13) Remove tumbuckles (10) from stakes (11). Remove stakes (11).

(14) Pull wire rope (8) across span and coil it.

(15) Remove both damp assemblies and thimble (15) by removing nuts (12) from U-bolts (13).

(16) Install one damp (14) and two nuts (12) onto each U-bolt (13).

(17) Remove pulley blocks (9) from tripods (5 and 6).

(18) Disassemble tripods (5 and 6).

(19) Locate chests for suspension kits and remove any contents.

(20) Wipe out inside of chest and clean kit items.

(21) Using loading diagram on chest lid, pack kit items as indicated.

(22) Transport suspension kit chest to lead pumping station installation site for final packing.

d. Disassemble Pressure-Reducing Valve.

NOTE

Set aside all removed components for repacking.

(1) Remove 6-inch boltless coupling (1, Figure 2-39) (para. 2-8.c.) connecting pressure-reducing valve (2) to downline hoseline segment (3).

(2) Install 6-inch boltless coupling (1) (para. 2-8.b.) on end of hoseline segment (3).

(3) Remove 6-inch boltless coupling (4) (para. 2-8.c.) connecting pressure-relief valve (5) to upline hoseline segment (6).

(4) Remove 6-inch boltless coupling (7) (para. 2-8.c.) connecting pressure-relief valve (5) to pressure-reducing valve (2).

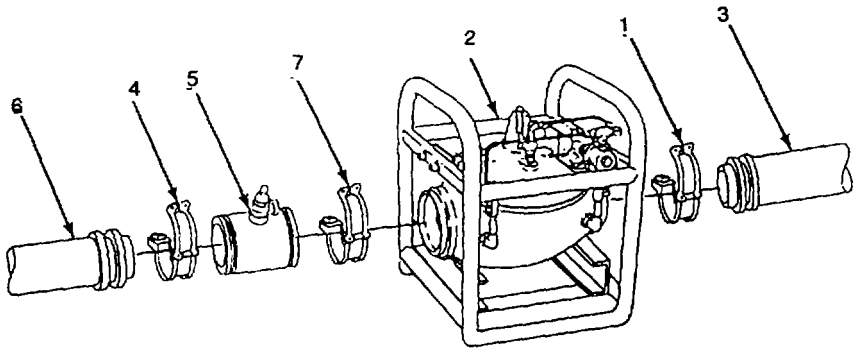


Figure 2-39. Disassemble Pressure-Reducing Valve

e. Disassemble Road Crossing Guards.

NOTE

Road crossing guards should be removed and packed after buried hoseline has been removed free from guards.

(1) Dig out road crossing guard (1, Figure 2-40).

(2) If planks (2) were nailed to bottom of road crossing guards (1), remove nails. Remove planks and fill hole in ground.

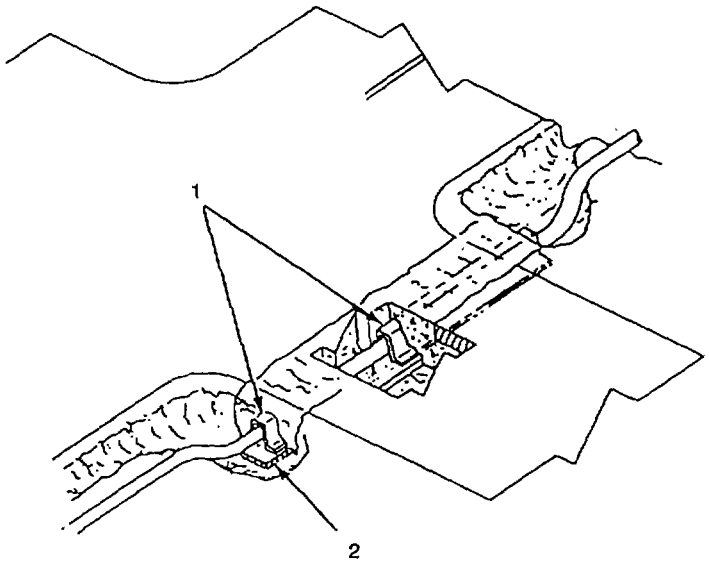


Figure 2-40. Disassemble Road Crossing Guard

(3) Clean road crossing guards and transport them to lead pumping installation site for final packing.

f. Disassemble Boost Pumping Station. Perform the following (Figure 2-41):

(1) Disconnect 10-mile segment collapsible hose assembly (1, Figure 2-41) from lateral grooved wye-coupling

(2) by removing 6-inch boltless coupling (3) (para. 2-8.c).

(2) Disconnect 6 in. X 75 ft discharge hose (4) from lateral grooved wye-fitting (2) by removing 6-inch boltless coupling (5) (para. 2-8.c.).

(3) Remove lateral grooved wye-fitting (2) from 6-inch butterfly valve (6) by removing 6-inch boltless coupling (7) (para. 2-8.c.).

(4) Remove butterfly valve (6) from 6 in. X 20 ft discharge hose (7) by removing 6-inch boltless coupling (8) (para. 2-8.c.).

(5) Remove 6 in. X 20 ft discharge hose (7) from pressure-relief valve assembly (9) by removing 6-inch boltless coupling (10) (para. 2-8.c.).

(6) Remove pressure-relief valve assembly (9) from 6-inch check valve (11) by removing 6-inch boltless coupling (12) (para 2-8.c.).

(7) Remove 6-inch check valve (11) from pump discharge line (13) by removing 6-inch boltless coupling (14) (para. 2-8.c.).

(8) Install plastic cap on pump discharge line (13).

(9) Remove 6 in. X 75 ft discharge hose (4) from 6-inch butterfly valve (15) by removing boltless coupling (16) (para. 2-8.c.).

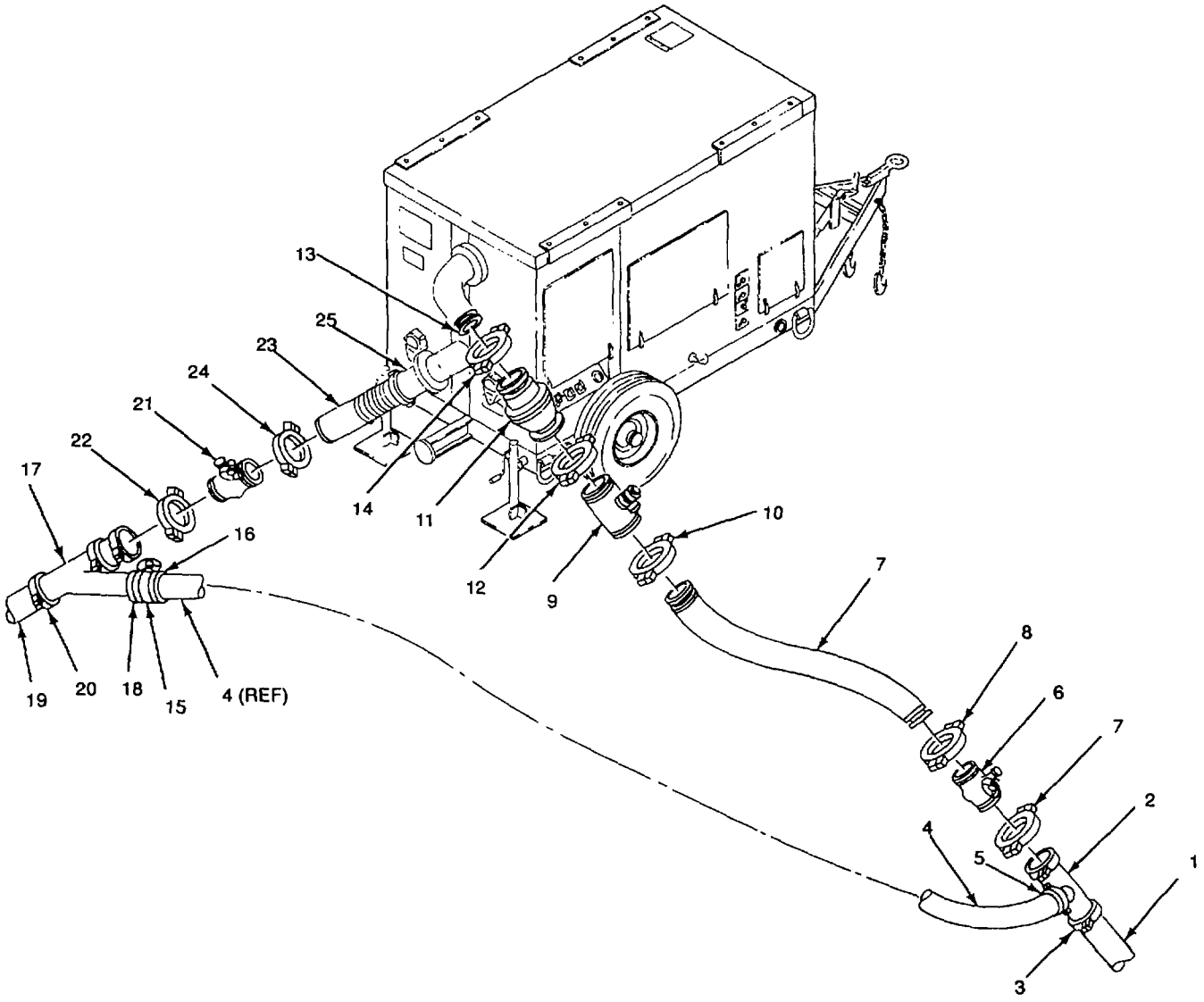


Figure 2-41. Disassemble Boost Pumping Station

(10) Remove 6-inch butterfly valve (15) from lateral grooved wye-fitting (1 7) by removing 6-inch boltless coupling (18) (para. 2-8.c.).

(11) Disconnect 10-mile segment collapsible hoseline (19) from lateral groove wye-fitting (17) by removing 6-inch boltless coupling (20) (para. 2-8.c.).

(12) Remove lateral grooved wye-fitting (17) from 6-inch butterfly valve (21) by removing 6-inch boltless coupling (22) (para. 2-8.c.).

(13) Remove 6-inch butterfly valve (21) from suction hose (23) by removing 6-inch boltless coupling (24) (para. 2-8.c.).

(14) Open cam arms and disconnect suction hose (23) from pump suction line (25).

(15) Install plastic cap on pump suction line (25).

(16) Prepare pumping assembly for movement by tow vehicle. Refer to applicable technical manual for water pumping assembly 600 GPM trailer mounted.

g. Disassemble Lead Pumping Station. Perform the following (Figure 2-42):

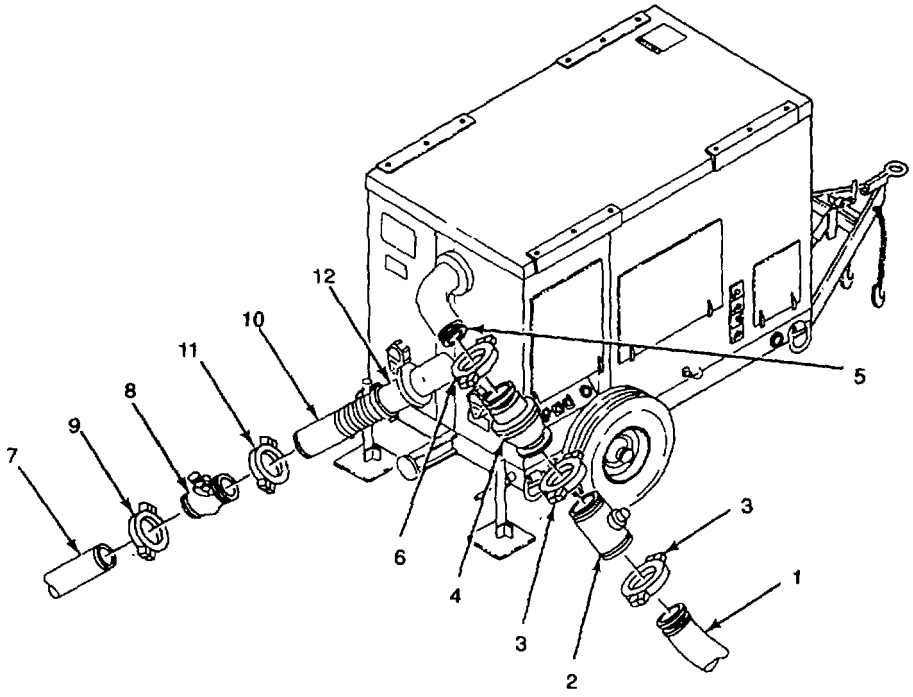


Figure 2-42. Disassemble Lead Pump Station

(1) Disconnect 10-mile segment collapsible assembly (1) from relief valve (2) by removing 6-inch boltless coupling (3) (para. 2-8.c.).

(2) Remove relief valve (2) from check valve (4) by removing 6-inch boltless coupling (3) (para. 2-8.c.).

(3) Remove check valve (4) from pump discharge port (5) by removing 6-inch boltless coupling (6).

(4) Disconnect 6-inch suction hose (7) from butterfly valve (8) by removing 6-inch boltless coupling (9).

(5) Disconnect any remaining 6 in. X 10 ft suction hose lengths.

(6) Remove butterfly valve (8) from 6 in. X 10 ft, rigid-walled, wire reinforced suction hose (10) by removing 6-inch boltless coupling (11) (para. 2-8.c.).

(7) Disconnect suction hose (10) from pump discharge port (12) by releasing cams.

(8) Install plastic cap on pump discharge port (12).

h. Disassemble Storage Assembly.

NOTE
Set aside all removed components for repacking.

(1) Remove 6-inch boltless coupling (1, Figure 2-43) (para. 2-8.c.) connecting reducing tee (7) to upline hoseline (2).

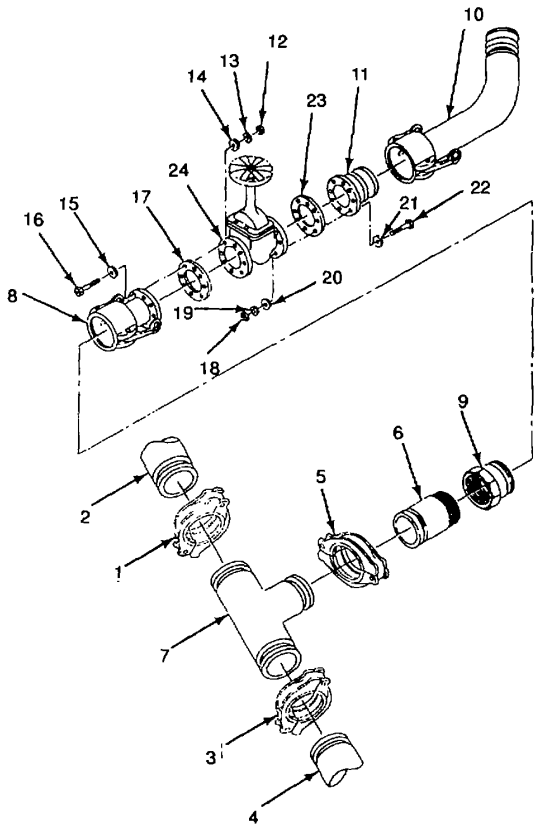


Figure 2-43. Disassemble Storage Assembly

(2) Install 6-inch boltless coupling (1) (para. 2-8.b.) on end of upline hoseline (2).

(3) Remove 6-inch boltless coupling (3) (para. 2-8.c.) connecting reducing tee (7) to downline hoseline (4).

(4) Remove 6-inch boltless coupling (5) (para. 2-8.c.) connecting coupling pipe fitting (6) to reducing tee (7).

(5) Remove reducing tee (7).

(6) Push cam arms on female coupling half (8) forward to open. Remove male coupling half (9) (with attached coupling pipe fitting) (6) from female flanged quick is connect coupling half (8).

(7) Unscrew male coupling half (9) and remove from coupling pipe fitting (6).

(8) Push cam arms on hose (10) forward to open. Remove flange adapter (11) from end of discharge hose (10).

(9) Remove 8 nuts (12), lockwashers (13), flat washers (14 and 15), and bolts (16). Remove female flanged quick-disconnect coupling half (8) from gate valve (24).

(10) Carefully remove gasket (17).

(11) Remove 8 nuts (18), lockwashers (19), flat washers (20 and 21), and bolts (22). Remove flange adapter (11) from gate valve (24).

(12) Carefully remove gasket (23).

(13) Push cam arms forward to open. Remove first discharge hose (1, Figure 2-44) from female-to-female filler/ discharge elbow (2) of storage tank (3).

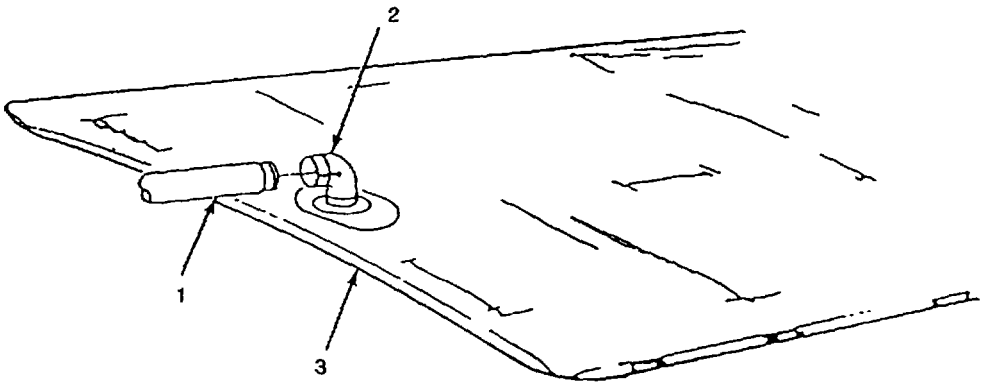


Figure 2-44. Discharge Hose and Storage Tank

(14) Separate remaining discharge hoses.

(15) Refer to applicable technical manual for storage tank disassembly procedures.

i. Disassemble Distribution Points.

WARNING

DANGEROUS CHEMICALS

- Calcium hypochlorite can cause injury if not handled properly. Heed safety measures below.
- If calcium hypochlorite comes into contact with skin or eyes, flush right away with water. Seek medical help.
- Mix only in accordance with directions for use.
- DO NOT allow calcium hypochlorite to mix with any other materials. This may cause fire or hazardous gases.

(1) Locate packing crate marked DISTRIBUTION POINT. Remove tubes of calcium hypochlorite (Item 2, Appendix E).

(2) Wearing chemical resistant apron and gloves (Items 1 and 4, Appendix E), dissolve one tube in each gallon of potable water used to make a cleaning solution.

(3) Remove drinking water storage bags from tripods. Disassemble tripods.

(4) Scrub inside of each drinking water storage bag with solution.

(5) Rinse each bag several times with potable water to get rid of all traces of cleaning solution. Do not use cleaning solution to rinse bags.

(6) Dry bags completely and set aside.

(7) Push cam arms on discharge hose (1, Figure 2-45) forward to open. Remove discharge hose (1) attached to male end of coupling half (2) of hypochlorination unit outlet port (4).

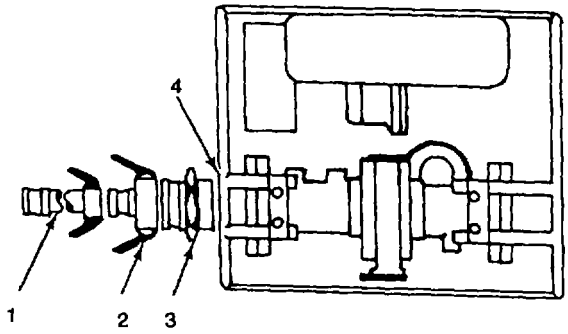


Figure 2-45. Discharge Hose Couplings and Hypochlorination Unit

(8) Push cam arms forward to open and remove female end of coupling half (2) from male quick-disconnect coupling (3).

(9) Unscrew and remove male quick-disconnect coupling (3) from discharge port (4).

(10) Refer to appropriate technical manual for cleaning and disassembly procedures for the hypochlorination unit.

(11) Push cam arms on reducers (2) forward to open. Remove two nozzles (4, Figure 2-46) with attached hose swivels (3) from ends of hose assemblies (1).

(12) Unscrew and remove male end of reducers (2) fr om hose swivels (3) attached to nozzles (4).

(13) Remove hose swivels (3) from nozzle (4).

(14) Push cam arms on discharge hose (1) forward to open. Remove hose (1) from end of wye-connection (5).

(15) Push cam arms on wye-connection (5) forward to open. Remove wye-connection (5) from end of hose (6).

(16) Push cam arms on discharge hose (6) forward to open. Remove hose (6) from male quick-disconnect coupling half (7) attached to gate valve (8).

(17) Push cam arms on female male quick-disconnect coupling half (9) forward to open. Remove gate valve (8) with attached coupling half (9) from end of wye-connection (10).

(18) Remove male quick-disconnect coupling half (7) and female quick-disconnect coupling half (9) from ends of gate valve (8).

(19) Push both sets of cam arms on elbow valves (11) forward to open. Remove two dust plugs (12) from ends of elbow valves (11).

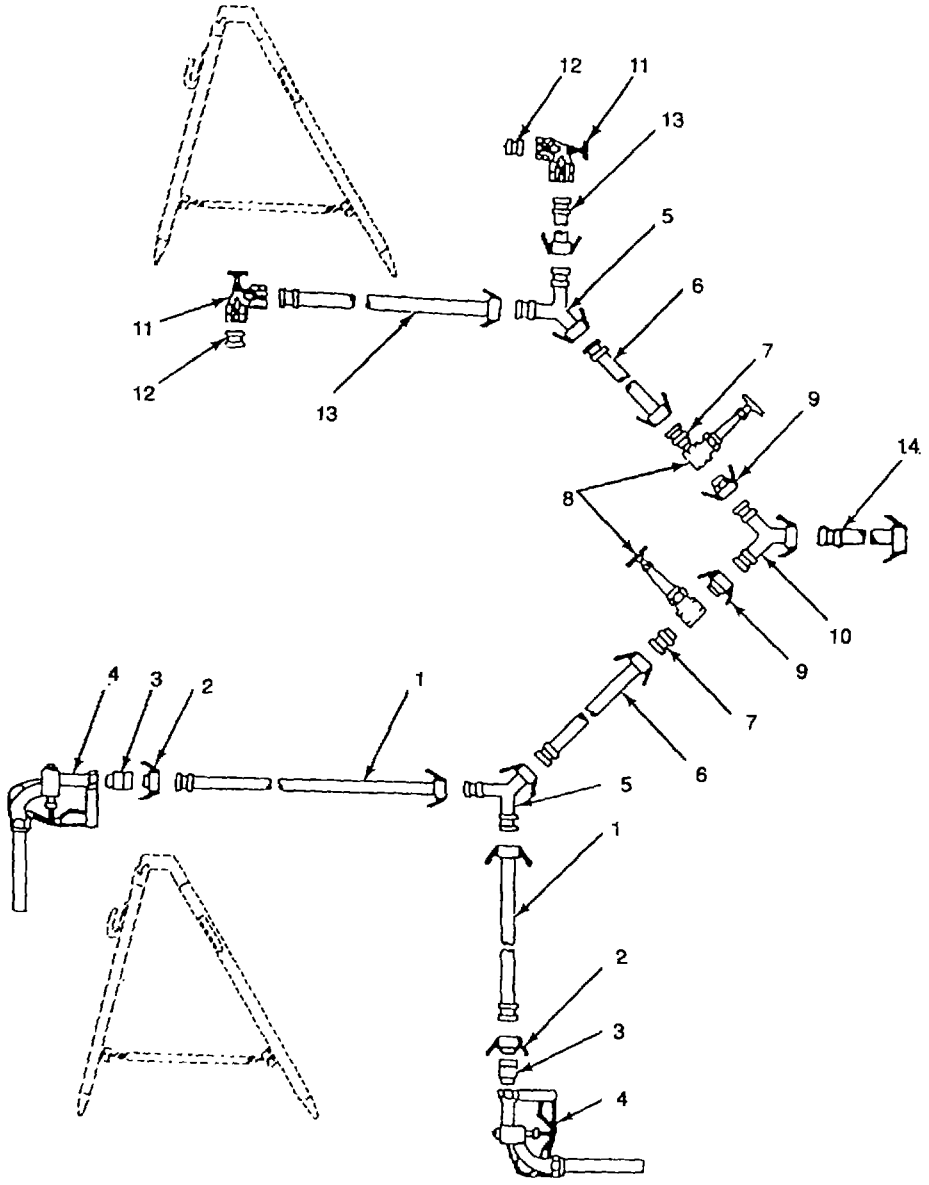


Figure 2-46. Disassemble Distribution Point

(20) Remove elbow valves (11) from ends of two hoses (13).

(21) Push cam arms on discharge hoses (13) forward to open. Remove hoses (13) from end of wye-connection (5).

(22) Repeat steps (15) through (18) with second set of hoses, wye-connection, and gate valve.

(23) Push cam arms on wye-connection (10) forward to open. Remove wye-connection (10) from end of hose (14).

(24) Push cam arms on female reducer (1, Figure 2-47) forward to open. Remove end of hose (2) from female reducer (1) on suction port of hypochlorination unit (12).

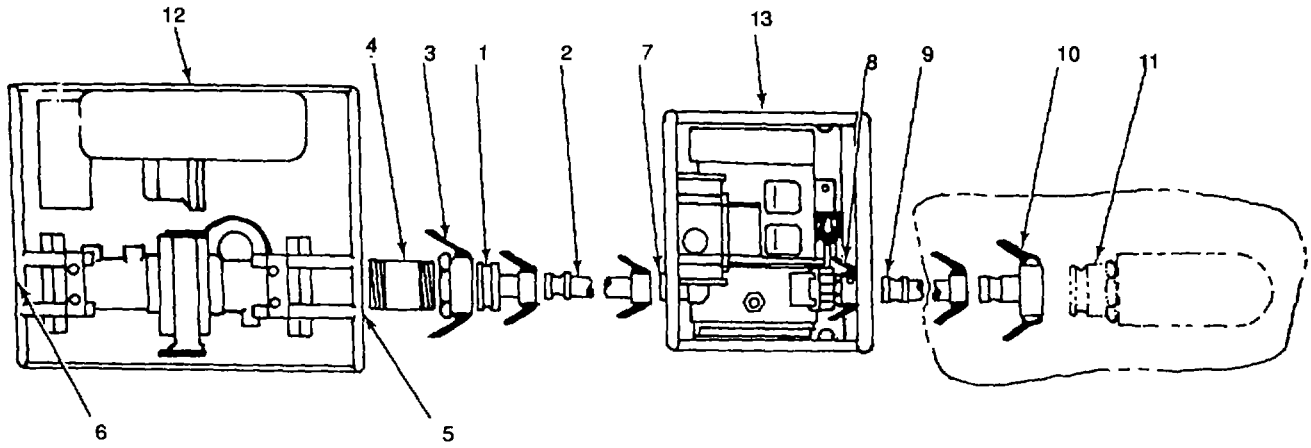


Figure 2-47. Hypochlorination Unit, 125 GPM Pump, and Storage Tank Assemblies

(25) Push cam arms on female quick-disconnect coupling half (3) forward to open position.

(26) Remove reducer (1) from female quick-disconnect coupling half (3).

(27) Unscrew female quick-disconnect coupling half (3) from nipple (4) of unit suction port (5).

(28) Remove nipple (4) from hypochlorination unit suction port (5).

(29) Install plastic dust caps onto hypochlorination unit suction port (5) and discharge ports (6).

(30) Push cam arms on hose (2) forward to open. Remove hose (2) from male coupling half (7) on discharge port of 125 GPM pump (13).

(31) Unscrew and remove male coupling half (7) from 125 GPM pump (13) discharge port.

(32) Push cam arms on female coupling half (8) forward to open. Remove end of hose (9) from fe male coupling half (8) on suction port of 125 GPM pump (13).

(33) Unscrew and remove female coupling half (8) from pump suction port.

(34) Push cam arms on discharge hose (9) forward to open. Remove hose from 2-inch end of reducer (10) attached to filler/discharge elbow (11) on storage tank.

(35) Push cam arms forward to open. Remove reducer (10) from elbow (11) on tank.

2-16. **Operating Instructions on Decals and Instruction Plates**. Refer to applicable technical manuals for TWDS components.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-17. **General.** This section provides instructions for operating TWDS in unusual conditions. Refer to applicable technical manuals for instructions for TWDS components.

a. Cold Climates. If freezing conditions exist, below 32 °F (0°C), water in lines will freeze. If TWDS system is shut down for extended periods, isolate storage tanks and drain hoselines of the 10-mile segment.

b. Extreme Heat. Protect storage tank either by placing it in shade or by covering it with leafy branches, camouflage net, shade cloths, tarpaulins, or a tent. Covering should be supported so that air may circulate around tank. Storage tank and pressure-reducing valve may also be cooled by covering with burlap or other fabric and soaking with water.

c. Salt Water Area. Notify unit maintenance if rust or aluminum oxide formations are present on TWDS components.

d. High Winds. Pack hoseline as soon as possible (refer to para. 2-9).

2-18. **Nuclear, Biological, and Chemical (NBC) Decontamination**. Refer to FM3-3, FM3-4, FM3-4-1, FM3-5, FM3-6, and FM3-8 for decontamination procedures.

2-19. Emergency Procedures.

a. General. Performance of the entire TWDS depends on continuous operation of each major component. In most cases, when part of the equipment fails, the entire system must be shut down. Procedures for partial operation are limited. The only emergency procedures possible are listed below. In all other situations, the entire TWDS must be shut down until problem is corrected.

b. Failure of Boost Pumping Station.

CAUTION

Do not attempt to operate other pumping stations when one unit fails. The bypass hose assembly is used only to keep downline pumps primed. Enough pressure will not exist to operate downline pumps, even at a partial rate.

(1) Shut off engine. Refer to applicable technical manual.

(2) Shut off waterflow through malfunctioning pump. Close butterfly valves in suction and discharge lines.

(3) Open butterfly valve in bypass line.

(4) Notify operators at other pumping stations of equipment failure.

(5) Operation of lead pump should be decreased (refer to applicable technical manual). Discharge rate from lead pump should only be enough to keep downline pumps primed.

(6) Boost pumps (operating in automatic mode) should decrease to idle automatically. Operators at boost pumping stations should make certain their units have adjusted properly. Operators must also monitor readings on pressure gages. Pumps that fail to remain primed must be shut off immediately. (Refer to applicable technical manual.)

(7) Close gate valves connected to storage assemblies.

(8) Distribute points may continue to operate as long as enough water remains in storage tanks. When water in storage tanks drops to inoperable level, shut down operation of distribution points. Shut down engine on 125 GPM pump (refer to applicable technical manual).

c. Failure of Storage Assembly. If storage assembly fails, TWDS operation is possible ONLY under the following conditions:

(1) Two storage assemblies are in use, and

(2) The unaffected storage assembly is being used with a distribution point.

(3) To temporarily adapt TWDS operation, proceed as follows:

(a) Close gate valve connected to defective storage tank.

(b) If distribution point is being used with defective storage tank, shut down distribution point (para. 2-13). Shutdown engine on 125 GPM pump (refer to applicable technical manual).

(c) Notify operators at other stations of equipment failure. Pumps may require adjustment.

d. Failure of Distribution Point. If a distribution point fails, TWDS operation is possible ONLY if two distribution points are in use. To temporarily adapt TWDS operation, proceed as follows:

(1) Close gate valve connected to storage tank in use with defective distribution point.

(2) Shutdown operation of defective distribution point (para. 2-13). Shutdown engine on 125 GPM pump (refer to the applicable technical manual).

(3) Notify operators at other stations of equipment failure. Pumps may require adjustment.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. **Lubrication Procedures**. There are no general lubrication procedures required for the TWDS. Refer to applicable technical manuals for lubrication procedures for 600 GPM pumping assembly, 125 GPM pumping assembly, and hylpochlorination unit.

Section II. TROUBLESHOOTING PROCEDURES

3-2. **General**. This section contains troubleshooting instructions designed to be useful in diagnosing and correcting unsatisfactory operation or failure of TWDS. Refer to applicable technical manual for troubleshooting procedures for 600 GPM pumping assembly, 125 GPM pumping assembly, hypochlorination unit, and storage tank.

3-3. **Operator Troubleshooting**. Table 3-1 lists common malfunctions which you may find during operation or maintenance of pump unit or its components. You should perform tests/inspections and corrective actions in order listed. Ensure that PMCS has been performed.

a. 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 your supervisor.

b. Any trouble or corrective action beyond the scope of operator maintenance shall be reported to unit maintenance.

SYMPTOM INDEX

Table 3-1. Troubleshooting Procedures

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. 20,000-GALLON PILLOW TANK IS NOT BEING FILLED.

Step 1. Check Cinch gate valve to see if closed or damaged.

a. Open 4-inch gate valve.

b. Notify supervisor if 4-inch gate valve is damaged or Class III leak is present.

Step 2. Check to see if valve on drain assembly is open or damaged.

a. Close valve.

b. Refer to applicable technical manual for 20,000-gallon pillow tank and replace damaged valve.

Step 3. Check to see if tank fabric is punctured, torn, or damaged.

Refer to applicable technical manual and repair damaged 20,000-gallon pillow tank

Step 4. Check hose assembly for leaks.

a. Close 4-inch gate valve, refer to paragraphs 2-8.j. to disconnect and reconnect hose if hose connections have a Class III leak, open 4-inch gate valve.

b. If hose assembly is damaged, notify unit maintenance.

Step 5. Check to see if pressure-reducing valve assembly is damaged.

Notify unit maintenance if pressure-reducing valve assembly is damaged.

2. NO DISCHARGE OF WATER AT MANUAL DISBURSING STATION.

Step 1. Check to see if 125 GPM pumping assembly is working.

Refer to applicable technical manual and troubleshoot 125 GPM pumping assembly.

Step 2. Check to see if 2-inch gate valves are dosed or leaking.

a. Open 2-inch gate valve.

b. Notify supervisor if 2-inch gate valve is damaged or has a Class III leak

Step 3. Check 2-inch and 4-inch hoseline sections for loose connections or leaks.

a. Refer to paragraph 2-8.k. and reconnect loose 2-inch hoseline connection or refer to paragraph 2-8.j. and reconnect loose Cinch hoseline connection.

b. Notify supervisor if 2-inch or Cinch hoseline is damaged or has a Class III leak

Table 3-1. Troubleshooting Procedures-(Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. NO DISCHARGE OF WATER AT MANUAL DISBURSING STATION - Cont

Step 4. Check nozzles and elbow valve assemblies for damage or defective parts.

If damaged or defective parts are found, notify unit maintenance.

Step 5. Check hypochlorination unit adjustment range to ensure that flow is at 14 GPM.

If 14 GPM flow rate cannot be obtained, notify unit maintenance.

3. NO DISCHARGE OF WATER AT PRESSURE-REDUCING VALVE.

Step 1. Check that isolation cock valves are open.

a. If not, fully open isolation cock valves.

b. If no discharge of water, go to step 2.

Step 2. Ensure pressure-reducing valve is correctly installed.

If water still does not flow and pressure-reducing valve is correctly installed, notify unit maintenance.

4. PRESSURE-RELIEF VALVE ACTIVATES.

Step 1. Check for obstructions and closed butterfly valves downline.

a. Check obstructions.

b. Open butterfly valves.

Step 2. Check for proper installation of pressure-reducing valve.

Reposition pressure-reducing valve is required.

Step 3. Check for malfunctioning pressure-reducing valve.

a. Check that isolation check valves are open.

b. If still malfunctioning, notify unit maintenance.

Step 4. Refer to technical manual for 600 GPM pumping assemblies and ensure 600 GPM pumping assemblies are operating properly.

If 600 GPM pumping assemblies are not operating properly, refer to proper technical manual and troubleshoot 600 GPM pumping assemblies.

Step 5. Install new pressure-relief valve.

Table 3-1. Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

5. PUMP SUCTION GAGE SHOWS LOW SUCTION PRESSURE.

Step 1. Check to see if butterfly valve in suction line is fully open.

Open butterfly valve.

Step 2. Check to see if butterfly valve on bypass hose is fully closed.

Close butterfly valve.

NOTE

The following step applies only to lead pumping station.

Step 3. Check to see if wye-connection reducer is clogged with debris.
Clean wye-connection reducer.

6. PUMP DISCHARGE GAGE SHOWS HIGH DISCHARGE PRESSURE

Contact operators at downline pumping stations to see if station has been shut down.

Stop engine (refer to applicable technical manual and notify supervisor).

Section III. MAINTENANCE PROCEDURES

ALPHABETICAL INDEX PARAGRAPH

3-4. **Introduction**. This section contains instructions covering maintenance functions for the operator on the TWDS. Replacement procedures for most TWDS components are contained in the assembly and disassembly procedures (para. 2-8 and 2-15). Personnel required are listed only if the task requires more than one. After completing maintenance procedure, perform operational check to be sure that equipment is operating correctly.

3-5. **MAINTENANCE OF HOSE ASSEMBLIES**.

This task covers: Repair

INITIAL SETUP

Tools

Repair Kit, Hoseline
(Item 107, Appendix C)

Equipment Conditions

Pumping stations are shutdown (refer to applicable technical manual).

a. REPAIR.

(1) Perform mid-section hose repair as follows:

(a) Install hose clamps (1, Figure 3-1) 3 ft (0.9 m) upline and downline from hose section (2) to be removed.

(b) Tighten hose damps (1) until hose (2) is pinched closed.

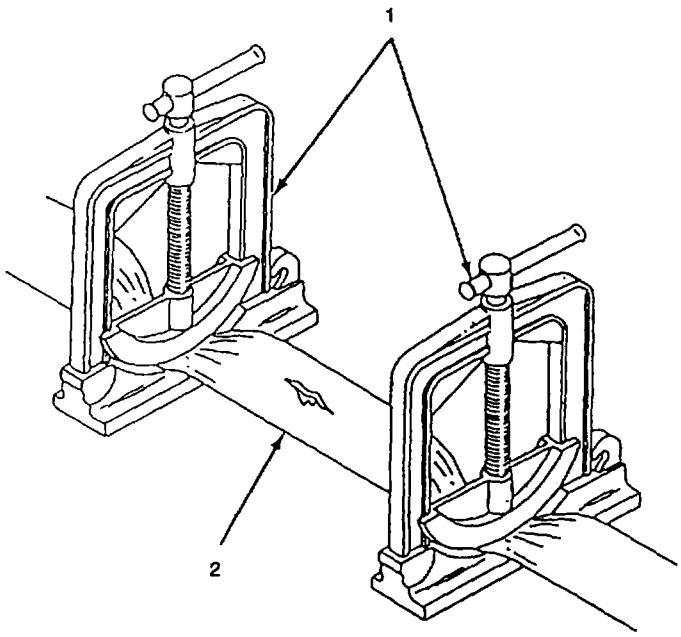


Figure 3-1. Installing Hose Clamps

NOTE
Always mark, score, and cut hose squarely. Do not leave ragged or uneven edges.

(c) Cut both sides of hose (1, Figure 3-2) 6 inches (15.2 cm) from leak Remove damaged section of hose.

3-5. MAINTENANCE OF HOSE ASSEMBLIES. - (Cont)

(d) Inspect inside of hose ends (2) for further damage. Cut hose back again, as required, to reach an undamaged area.

(e) Drain hose ends (2) and wipe dry.

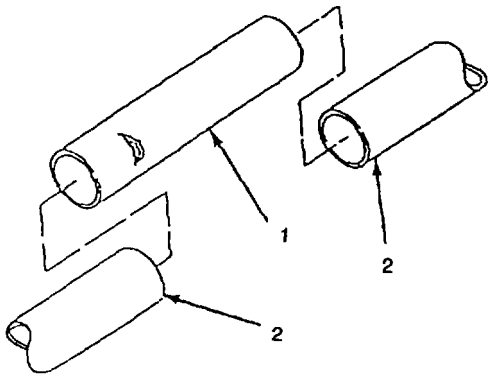


Figure 3-2. Removing Damaged Hose Section

(f) Install mid-section adapter assembly between hose ends as follows (Figure 3-3):

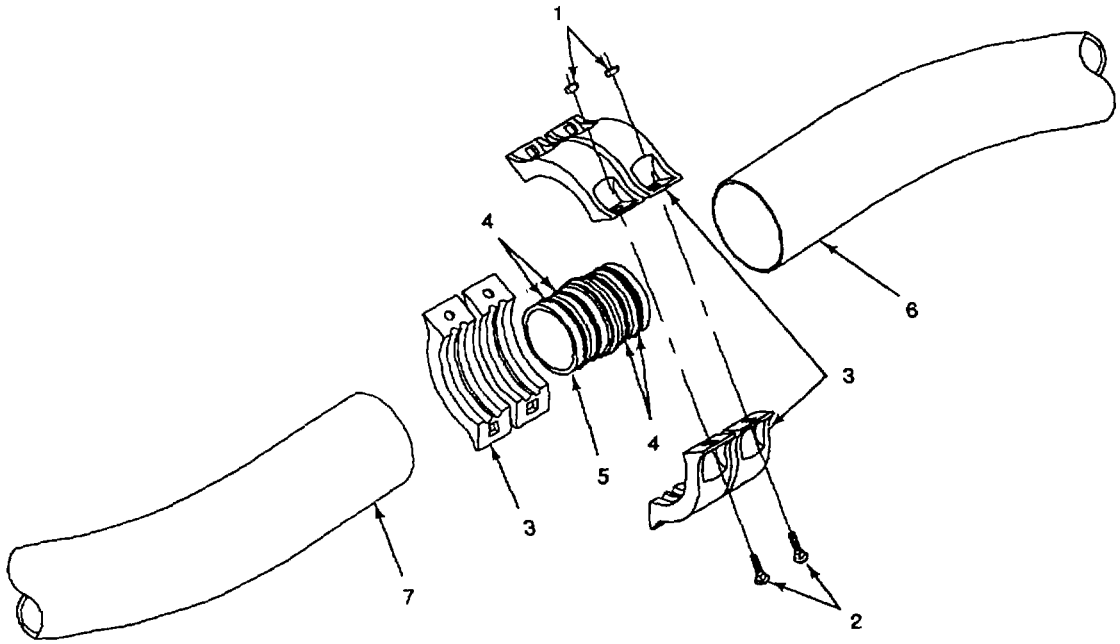


Figure 3-3. Mid-section Hose Adapter Assembly

1 Loosen nuts (1) and bolts (2) fully, between damps (3).

3-5. **MAINTENANCE OF HOSE ASSEMBLIES. - (Cont)**

2 Inspect for missing or damaged O-rings (4) on adapter (5). Replace missing or damaged O-rings (4).

3 Apply anti-seize lubricant to O-rings (4).

4 Insert hose ends (6 and 7) between clamps (3) and onto adapter (5).

CAUTION

Do not overtighten nuts and bolts. Overtightening may damage O-rings and adapter causing leaks.

5 Tighten nuts (1) and bolts (2) alternately and evenly. Do not overtighten.

(2) Install grooved end adapter assembly onto end of collapsible hose assembly as follows (Figure 3-4):

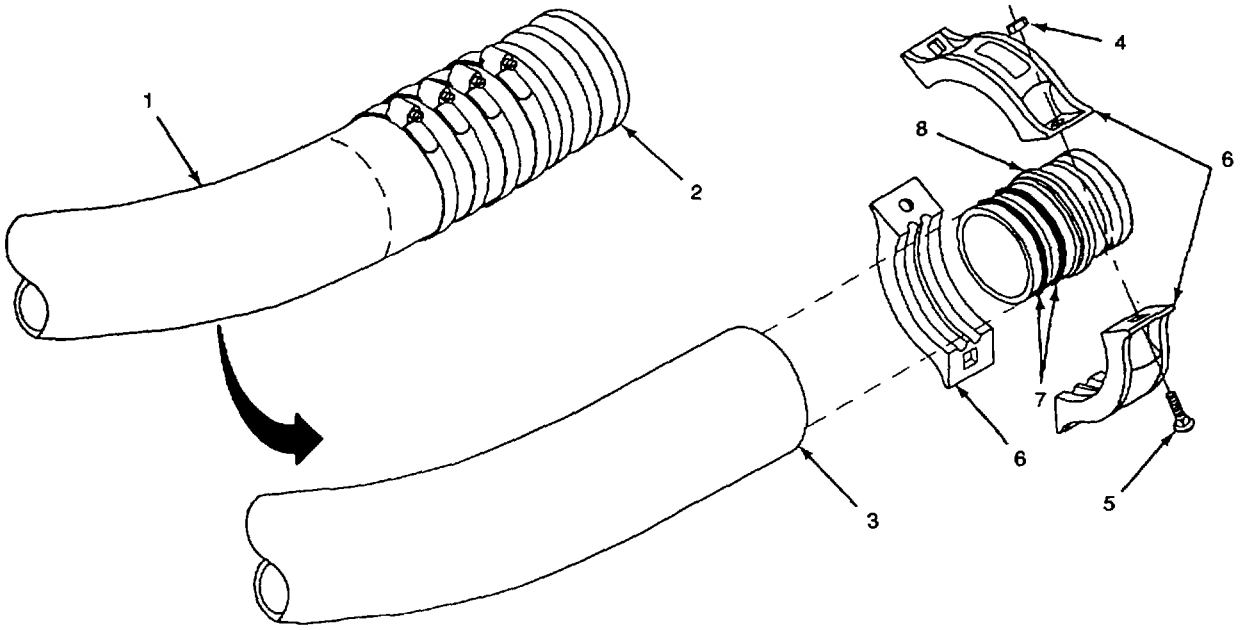


Figure 3-4. Grooved End Hose Adapter Assembly

NOTE

Always mark, score, and cut hose squarely. Do not leave ragged or uneven edges.

(a) Cut end of hose (1) below damaged section. Remove damaged hose end (2).

(b) Inspect inside of hose end (3) for further damage. Cut hose back again, as required, to reach an undamaged area.

(c) Drain hose end (3) and wipe dry.

3-5. MAINTENANCE OF HOSE ASSEMBLIES. - (Cont)

(d) Loosen nuts (4) and bolts (5) fully, between damps (6).

(e) Inspect for missing or damaged O-rings (7) on adapter (8). Replace missing or damaged O-rings (7).

(f) Apply anti-seize lubricant to O-rings (7).

(g) Insert hose end (3) between damps (6) and onto adapter (8).

(h) Tighten nuts (4) and bolts (5) alternately and evenly. Do not overtighten.

CAUTION

Do not overtighten nuts and bolts. Overtightening may damage O-rings and adapter causing leaks.

(3) Install female hose adapter assembly as follows (Figure 3-5):

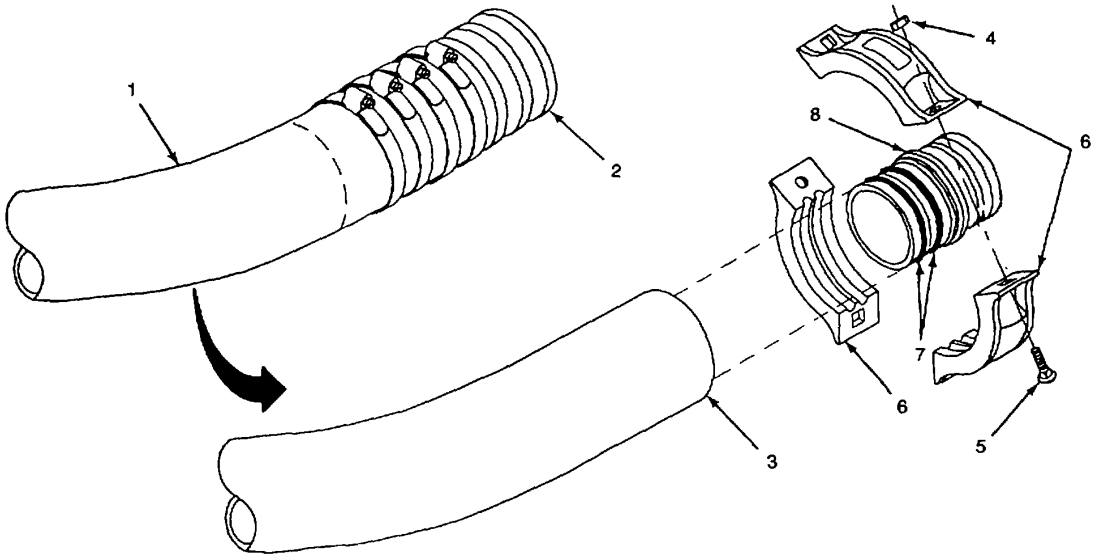


Figure 3-5. Female Hose Adapter Assembly

NOTE

Always mark, score, and cut hose squarely. Do not leave ragged or uneven edges.

(a) Cut end of hose (1) below damaged section. Remove damaged hose end (2).

3-5. MAINTENANCE OF HOSE ASSEMBLIES. - (Cont)

(b) Inspect inside of hose end (3) for further damage. Cut hose back again, as required, to reach an undamaged area.

(c) Drain hose end (3) and wipe dry.

(d) Loosen nuts (4) and bolts (5) fully, between clamps (6).

(e) Inspect for missing or damaged O-rings (7) on adapter (8). Replace missing or damaged O-rings (7).

(f) Apply anti-seize lubricant to O-rings (7).

(g) Insert hose end (3) between damps (6) and onto adapter (8).

CAUTION

Do not overtighten nuts and bolts. Overtightening may damage O-rings and adapter causing leaks.

(h) Tighten nuts (4) and bolts (5) alternately and evenly. Do not overtighten.

3-6. MAINTENANCE OF PRESSURE-RELIEF VALVE.

This task covers:
a. Remove
b. Install

INITIAL SETUP

Tools

Pipe Wrench
(Appendix D)

Equipment Conditions

Pumping stations are shutdown (refer to applicable technical manual).

Materials/Parts

Anti-seizing Tape
(Item 10, Appendix E)

a. REMOVE (Figure 3-6).

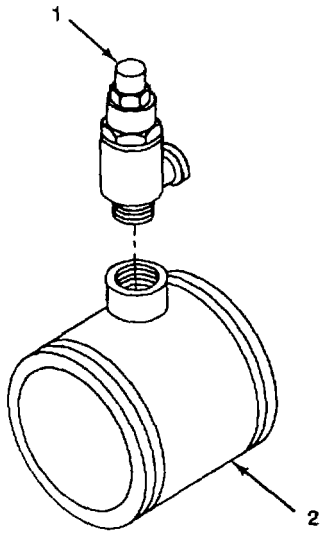


Figure 3-6. Pressure-Relief Valve

Unscrew and remove safety relief valve (1, Figure 3-6) from pipe coupling (2).

b. INSTALL.

NOTE
The anti-seizing tape is to be wrapped in the same direction as the piping threads.

(1) Apply anti-seizing tape to threads of safety relief valve (1).

(2) Install safety relief valve (1) in pipe coupling (2).

3-7. MAINTENANCE OF NOZZLE STAND ASSEMBLY.

This task covers:
a. Disassemble
b. Inspect
c. Repair
d. Assembly

INITIAL SETUP

Tools

Pliers (Item 136, Appendix C)

a. DISASSEMBLE (Figure 3-7).

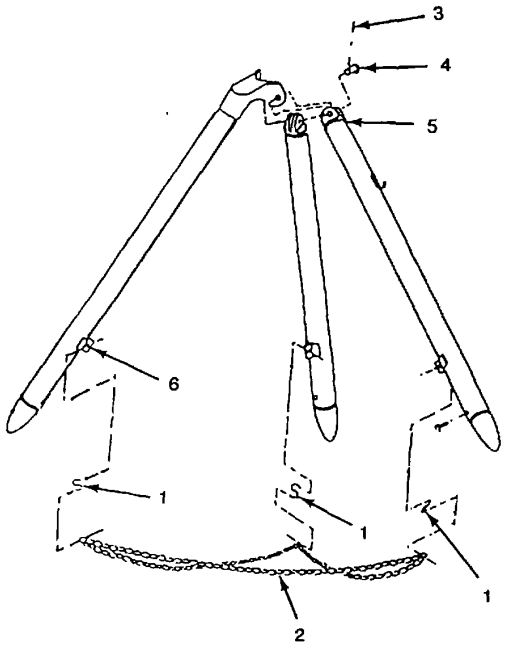


Figure 3-7. Nozzle Stand Assembly

(1) Remove three S-hooks (1) from clips (6).

(2) Remove three chains (2) from three S-hooks (1).

(3) Remove cotter pin (3) from each straight pin (4).

(4) Remove straight pin (4) from each clevis (5).

b. INSPECT.

Inspect stand assembly for cracked or separated welds. If damaged, replace nozzle stand assembly.

3-7. **MAINTENANCE OF NOZZLE STAND ASSEMBLY. - (Cont)**

c. REPAIR.

Repair is accomplished by replacement of parts.

d. ASSEMBLE.

(1) Install straight pin (4) into each clevis (5) and secure with cotter pins (3).

(2) Install three S-hooks (1) onto chains (2).

(3) Attach three S-hooks (1) to clips (6).

3-8. **Maintenance of Displacement and Evacuation Kit**. Repair of displacement and evacuation kit consists of replacement of damaged or missing individual kit items.

3-9. **Maintenance of Repair Kit.** Repair of repair kit consists of replacement of damaged or missing individual kit items.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

4-1. **Common Tools and Equipment**. Appendix B, Section III contains the authorized common tools. For authorized equipment, refer to Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-2. **Special Tools, TMDE and Support Equipment**. No special tools, TMDE, or support equipment are required for the repair of the TWDS at the unit level of maintenance.

4-3. **Repair Parts**. Repair parts for the TWDS are listed and illustrated in the Repair Parts and Special Tools List (RPSTL) TM 10-4320-317-23P.

Section II. SERVICE UPON RECEIPT

4-4. **General**. When new, used, or reconditioned equipment is first received, it is the responsibility of the person in charge to determine whether the equipment has been properly prepared for service by the supplying organization and to be sure it is in condition to perform its function. For this purpose, inspect all assemblies, subassemblies, and accessories to be sure they are properly assembled, secure, clean, and correctly adjusted and/or lubricated. Check all tools and equipment to be sure every item is present, in good condition, clean and properly mounted or stowed.

4-5. **Site Requirements**. Select a site that provides ample space to maneuver vehicles that may be used to move and position TWDS equipment.

4-6. **Service Upon Receipt of Equipment**.

a. Packing Groups. TWDS consists of four equipment groups divided into eight packing groups. The packing groups contain a total of 47 crates. The crates are plywood-sheathed, skidded, and equipped with headers for using a forklift. The crates are marked with names of equipment and packing group to which they belong. To unpack the TWDS, perform unpacking procedures that apply to each equipment group. The equipment used will depend on the specific mission of TWDS. Unpack only those components needed to complete the mission.

b. Pumping Stations. The six trailer-mounted pump assemblies are protected by their individual sound enclosure. All other components necessary to complete the assembly of the six pumping stations are in a crate marked PUMPING STATIONS.

(1) Load this crate on the back of the truck used to tow the first trailer-mounted pump assembly to the lead pumping station installation site.

(2) Tow crate and pump to installation site for lead pumping station. Transport remaining trailer-mounted pump assemblies (boost pumping stations) to their respective installation sites.

c. Storage Assemblies. Components for the storage assemblies are packed in three crates. Two crates are marked TANK, FABRIC, COLLAPSIBLE, 20 K GALLON. Each of these two crates contains one 20,000-gallon collapsible storage tank along with valves and fittings required for tank installation. The third crate contains all other components for two storage assemblies. This crate is marked STORAGE ASSEMBLY. Transport these three crates to the first storage assembly site.

d. Distribution Points. Components for distribution points are packed in three crates. Two of these crates contain a 125 GPM pump and are marked PUMP, CENTRIFUGAL, 125 GPM. The third crate contains all other components needed to complete assembly of two distribution points. This crate is marked DISTRIBUTION POINT. Transport the three distribution point crates to the first storage assembly site.

e. 10-Mile Hoseline Segment. Components of the 10-mile hoseline segment are packed in 34 crates. Thirty-three crates contain hoseline and are marked HOSE ASSEMBLY, 6 INCH, 500 FEET. The remaining crate is marked 10-MILE SEGMENT. It contains all other components needed for installation of the 10-mile hoseline segment. Begin unpacking the 1 O0-mile hoseline segment by transporting these crates to the area of the lead pumping station.

f. General Unpacking Instructions.

(1) Be careful during unpacking not to damage container contents or packing materials.

(2) Remove lid from crate. As required, remove blocking, bracing, and anchoring securing contents within crate.

(3) Save all packing materials and store them in their opened containers after removal of contents.

(4) Return unused components to crates.

(5) Return all fiberboard and plywood boxes to original crates.

(6) Retain all packing materials at installation site. This will speed repacking when moving to a new site or returning to storage.

g. Inspection of Unpacked Components. Inspect TWDS components as follows:

(1) 10-mile hoseline segment per Table 4-1.
(2) Pumping stations per Table 4-2.
(3) Storage assemblies per Table 4-3.
(4) Distribution points per Table 4-4.

Table 4-1. 10-Mile Hoseline Segment

ITEM	Qty	Size	Inspection
Coupling half, quick disconnect, female -	1	6-inch	Check for stripped or worn threads. Make sure cam arms move freely. Check for damaged or missing gasket.
Tool, clamp coupling	1		Inspect for serviceability.
Pressure-reducing valve	1		Inspect skids for broken welds. Inspect valve for bent or broken tubing, missing parts, or other damage. Make sure valve is properly attached to skid
Pressure-relief valve	1	6-inch	Inspect relief valve and nipple for cracked or broken parts Make sure valve is firmly seated in nipple
Repair kit	1		Inspect kit chest for broken handles, latches, and hinges. Open chest and check inner partitions for broken seam welds. Check contents in each kit (listed in Appendix C) for damaged or missing items
Grooved pipe coupling	15	6*-inch	Check for damaged or missing gasket. Check for damaged or missing components
Road crossing guards	24	6-inch	Inspect guards for cracks, dents, or other damage
Socket wrench	4	1 1/4-inch	Inspect for serviceability.
Socket wrench	2	1 1/16 inch	Inspect for serviceability.
Socket wrench handle	4		Inspect for serviceability
Suction hose assembly, 6 in. X 10ft	12	6 in. X 10 ft	Inspect hose for punctures, cuts, or scrapes. Make sure cam arms move freely. Check for damaged or missing gasket.
Suspension kit	5		Inspect kit chest for broken handles, latches, and hinges. Open chest and check inner partitions for broken seam welds. Check contents in each kit (listed in Appendix C) for damaged or missing items
Swivel joint assembly	65	6-inch	Check for smooth swivel operation. Check for damaged or missing gasket. Check for damaged or missing bolts and nuts.
Wye-connection reducer	1	6 in. X 4in. X 4in.	Inspect reducer assembly for missing parts. Make sure in. coupling pipe fitting is tightly screwed into male quick-disconnect coupling half. Inspect grooved pipe couplings for tightness Make sure female quick-disconnect couplings are tightly screwed onto reducer pipe fittings. Make sure cam arms move freely. Check for damaged or missing gaskets on quick-disconnect and grooved pipe couplings

Table 4-1. 10-Mlle Hoseline Segment - (Cont)

Hose assembly, collapsible, 6 in. X 500 ft	128	6 in. X 500 ft	Inspect hose for punctures, cuts, or scrapes. Make sure bands that secure adapters are tight
Pipe fitting, coupling	1	6-inch	Check for stripped or worn threads.
Displacement and evacuation kit, 6-inch hoseline	1		Inspect kit chest for broken handles, latches, and hinges. Open chest and check inner partitions for broken seam welds. Check kit contents (listed in Appendix C) for damaged or missing items.
Endcap	1	6-inch	Check for damage to sealing surfaces.

Table 4-2. Pumping Stations

Item	Qty	Size	Inspection
Butterfly valve	18	6-inch	Check gear-actuated handle for smooth operation. Make sure disc operates freely
Check valve	6	6-inch	Make sure assembly is tight. Check for loose, missing, or damaged nuts
Suction hose assembly	6	6 in. X 10 ft	Inspect hose for punctures, cuts, or scrapes. Make sure bands that secure adapters are tight
Discharge hose assembly	6	6 in. X 20 ft	Inspect hose for punctures, cuts, or scrapes. Make sure bands that secure adapters are tight
Bypass hose assembly	6	6 in. X 75 ft	Inspect hose for punctures, cuts, or scrapes. Make sure bands that secure adapters are tight
Coupling, boltless	66	6-inch	Check for damaged or missing gasket. Check for damaged or missing components
450 Lateral pipe fitting	12	6-inch	Check for damage to sealing surfaces.
Pumping assembly	6	600 GPM	Refer to applicable technical manual.
Pressure-relief valve and nipple	6	6-inch	Check for cracked or broken parts. Make sure relief valves firmly seated in nipple
Tool, damp coupling	10		Inspect for serviceability.

Table 4-3. Storage Assemblies

Item	Oty	Size	Inspection
Capscrew	32	0.375 UNC	Check for worn, stripped, or damaged threads.
		2A X 3.25 in	
Coupling half, female, quick disconnect	2	4-inch	Make sure cam arms move freely. Check for damaged or missing gasket
Coupling half, male, quick- disconnect	2	4-inch	Check for stripped or worn threads.
Coupling pipe fitting	2	4-inch	Check for stripped or worn threads.
Discharge hose assembly,	8	4 in. X 10 ft	Inspect hose for punctures, cuts, or scrapes. Make sure adapter to coupling quick-cam arms move freely. Check for damaged or missing disconnect threads
Flange adapter	2	4-inch	Check for damage to sealing surfaces
Flat washer	64	0.046 ID X	
		0.812 OD	
Gasket	4	4-in., Class	Check for tears, punctures, or other damage
		150	
Gate valve, flanged	2	4-inch	Make sure assembly is tight. Check for loose, damaged, or missing nuts and bolts. Make sure handwheel is firmly secured to valve stem
Coupling, boltless	2	4-inch	Check for damaged or missing gasket. Check for damaged or missing components.
Coupling, boltless	2	6-inch	Check for damaged or missing components.
Hex nut	32	0.375 16	Check for stripped or worn threads.
		UNC-2B	
Lockwasher	32	0.375-inch	
Reducing tee	2	6 in. X 6 in.	Check for damage to sealing surfaces.
		X 4 in.	
Gate valve	2	4-inch	Make sure handwheel is firmly secured to valve stem and operates smoothly
Tank, pillow	2	20,000-gal.	Refer to applicable technical manual.

Table 4-4. Distribution Points

Item	Qty	Size	Inspection
Color comparator kit	2		Check kit for damaged or missing contents. Check shelf life of chemicals. Make sure lock securely fastens lid on kit.
Coupling half, quick	8	2-inch	Check for stripped or worn threads. Make sure cam arms disconnect, female move freely. Check for damaged or missing gasket.
Coupling half, quick	8	2-inch	Check for stripped or worn threads. Check for damage to disconnect, male sealing surface
Hose assembly	2	2 in. X 10 ft	Inspect hose for punctures, cuts, or scrapes. Make sure cam arms move freely. Check for damaged or missing gasket.
Hose assembly	16	2 in. X 20 ft	Inspect hose for punctures, cuts, or scrapes. Make sure cam arms move freely. Check for damaged or missing gasket.
Drinking water storage bag	4	36-gal.	Inspect bag for punctures, tears, and worn areas. Check for broken or missing faucets. Make sure faucets operate smoothly.
Dust plug, quick-disconnect	4	2-inch	Ensure dust plug is not cracked or damaged. coupling half
Elbow valve	4	2 in. X 2 in.	Make sure cam arms move freely. Check for damaged or missing gasket. Make sure handwheel is firmly secured to valve stem and operates operates smoothly.
Gate Valve	4	2-inch	Check for stripped or worn threads. Make sure handwheel is firmly secured to valve stem and operates smoothly
Hypochlorination unit	2	100 GPM	Refer to applicable technical manual.
Nozzle	4		Check for stripped or worn threads. Make sure trigger mechanism operates smoothly.
Nozzle stand assembly	4		Inspect assembly for bent or damaged legs. Check for missing, broken, or unconnected chains. Inspect chain attachment and hook welds for cracks or separation.
Reducer, quick-disconnect, threaded	4	2 in. X 1.5 in.	Make sure cam arms move freely. Check for damaged or missing gasket. Check reducers for stripped or worn threads
Reducer, quick-disconnect	4	2 in. X 1.5 in.	Make sure cam arms move freely. Check for damaged or missing gasket. Check reducers for stripped or worn threads
Reducer, quick-disconnect	2	2 in. X 3 in.	Make sure cam arms move freely. Check for damaged or missing gasket. Check reducers for stripped or worn threads
.			
Reducer, quick-disconnect	2	2 in. X 4 in.	Make sure cam arms move freely. Check for damaged or missing gasket. Check reducers for stripped or worn threads.

Table 4-4. Distribution Points - (Cont)

Item	Qty	Size	Inspection
Reducer, quick-disconnect	2	4 in. X 2 in.	Make sure cam arms move freely. Check for damaged or missing gasket. Check reducers for stripped or worn threads.
Wye-connection, quick-	6	2 in. X 2 in. X 2 in.	Make sure cam arms move freely. Check for damaged or disconnect missing gasket.
Centrifugal Pump Unit	2	125 GPM	Refer to applicable technical manual.
Swivel, hose	4	2-inch	Check for cracks or breaks

h. Deprocessing Unpacked Equipment.

(1) Remove all tape and packing film, if any, from equipment.

(2) Remove all plastic tie-wraps, if any, necessary to place the equipment in operation.

(3) Remove all shipping tags from components and retain for future reference.

(4) Refer to DA Form 2258, Depreservation Guide for Vehicles and Equipment, packed with the equipment. The depreservation guide explains what was done to the

i. Report damage or discrepancies in accordance with DA PAM 750 -8 for Product Deficiency Report (SF368).

Section III. PREPARATION FOR STORAGE AND SHIPMENT

4-7. **Administrative Storage**. This paragraph contains information on administrative storage procedures.
.

a. Storage Length and Readiness. Placement of equipment in administrative storage should be for short periods of time (1- 45 days) when a storage of maintenance efforts exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period, appropriate maintenance records will be kept.

b. Prior to Placing Unit in Storage. Before placing equipment in administrative storage, current maintenance services and Preventive Maintenance Checks and Services (PMCS) should be completed, shortcomings and deficiencies should be corrected, and all Modification Work Orders (MWOs) should be applied.

c. Storage Site Selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, the sites selected should provide required protection from the elements and allow access for visual inspection when applicable.

4-8. **Preparation of TWDS for Storage**. Perform storage procedures for the 600 GPM pumping assembly, 125 GPM pump, hypochlorination unit, and storage assembly. Refer to applicable technical manuals.

4-9. **Preparation of TWDS for Shipment** The TWDS is in a shippable form once the four equipment groups have been disassembled and prepared for movement. Tricons are skidded and equipped with headers for using a forklift.

Section IV. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-10. **General**. To ensure that the TWDS is ready for operation at all times, it must be inspected within designated intervals so that defects may be discovered and corrected before they result in serious damage or failure. Table 4-6 contains a tabulated listing of Preventive Maintenance Checks and Services to be performed by unit maintenance personnel. All deficiencies and shortcomings will be recorded as well as the corrective action taken on DA Form 2404 at the earliest possible opportunity.

4-11. **Explanation of Table Entries**.

a. Item No. Column. Numbers in this column are for reference. When completing DA Form 2404 (Equipment Inspection and Maintenance Worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.

b. Interval Column. This column tells you when you must do the procedure in the procedure column. BEFORE procedures must be done before you operate or use the equipment for its intended mission. DURING procedures must be done during the time you are operating or using the equipment for its intended mission. AFTER procedures must be done immediately after you have operated the equipment.

c. Location and Item to Check/Service Column. This column provides the location and the item to be checked or serviced. The item location is underlined.

d. Procedure Column. This column gives the procedure you must do to check or service the item listed in the Check W Service column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.

e. Not Fully Mission Capable If: Column. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

f. Reporting and Correcting Deficiencies. If you equipment does not perform as required, refer to Section V under Troubleshooting for possible problems. Report any malfunctions or failures on the proper DA Form 2404, or refer to DA Pam 750-8.

Table 4-5. Unit Maintenance Preventive Maintenance Checks and Services

Item No	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable If:
1	Annually	Butterfly Valves	Inspect and lubricate butterfly valve as per paragraph 4-15.	

Section V. UNIT TROUBLESHOOTING PROCEDURES

4-12. **Unit Troubleshooting Procedures**. Unit troubleshooting procedures listed in Table 4-6 cover the most common malfunctions that may be repaired at the unit level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the unit troubleshooting procedures. This manual cannot list all the possible malfunctions or every possible test/inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

Table 4-6. Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. PUMP SUCTION GAGE SHOWS LOW SUCTION PRESSURE.

Check to see if pressure gage is damaged.

Replace gage (refer to applicable pumping assembly technical manual).

2. PUMP DISCHARGE GAGE SHOWS HIGH DISCHARGE PRESSURE.

Step 1. Check to see if pressure gage is damaged.

Replace gage (refer to applicable pumping assembly technical manual).

Step 2. Check to see if check valve is installed correctly.

Remove valve and correctly install (para. 2-8.h.).

Step 3. Check to see if check valve is damaged.

Replace valve (para. 2-8.h.).

Table 4-6. Troubleshooting Procedures - (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. STORAGE TANK IS NOT BEING FILLED.

Step 1. Check to see if end cap is on last hoseline segment.

Install end cap (para. 2-8.d.).

Step 2. Check to see if gate valve is damaged.

Replace gate valve (para. 2-8.j.).

Step 3. Check to see if pressure-reducing valve is damaged.

Replace pressure-reducing valve (para. 2-8.g.).

4. PRESSURE-REDUCING VALVE WON'T OPEN OR WON'T CLOSE DRIP-TIGHT.

Step 1. Pressurize valve and close cocks to pressure-reducing control. Loosen fitting on valve cover.

Check to see if water continues to flow.

If water continues to flow through opening, go to step Step 3. If water does not continue to flow through opening, go to step Step 2.

Step 2. Remove cover plug. Install threaded end of T-shaped bar in threaded hole in top of valve stem. Use bar to move diaphragm assembly up and down. Check to see if diaphragm assembly moves freely.

If diaphragm assembly moves freely, go to step Step 4. If diaphragm assembly does not move freely, notify direct support maintenance.

Step 3. Check to see if diaphragm assembly is loose on valve stem.

If loose, tighten diaphragm assembly. If not loose, replace diaphragm.

Step 4. Connect a line from the inlet to cover. Apply pressure to the valve inlet. Set pressure to 10 psi (69 kPa). Check to see if valve seal is drip-tight.

Notify direct support maintenance.

5. 20,000-GALLON PILLOW TANK IS NOT BEING FILLED.

Step 1. Check to see if pressure-reducing valve assembly is damaged.

Refer to paragraph 2-8.g. and replace pressure-reducing valve assembly.

Step 2. Troubleshoot 20,000-gallon pillow tank. Refer to applicable technical manual.

Table 4-6. Troubleshooting Procedures - (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. PRESSURE-REDUCING VALVE ASSEMBLY WILL NOT ALLOW WATER TO FLOW.

WARNING

Assembly may be pressurized. Personal injury may result if pressure is not reduced before performing maintenance or pressure-reducing valve assembly.

Step 1. Check isolation tubing for obstructions.

If found, remove obstructions.

Step 2. Close inlet isolation cock valve.

a. If valve opens, replace regulator control.

b. If valve remains closed, notify direct support maintenance.

7. PRESSURE-REDUCING VALVE IS NOT REDUCING PRESSURE.

WARNING

Assembly may be pressurized. Personal injury may result if pressure is not reduced before performing maintenance or pressure-reducing valve assembly.

Step 1. Check isolation tubing for obstructions.

If found, remove obstructions.

Step 2. Ensure that inlet and cover isolation cock valves are open, then dose outlet isolation cock valve.

a. If main valve closes, replace pressure-reducing control valve.
b. If main valve opens, notify direct support for diaphragm and spring maintenance.

Section VI. UNIT MAINTENANCE PROCEDURES

4-13. **Introduction**. This section contains instructions covering maintenance functions to the Unit Level maintenance personnel on the pumping assembly.

4-14. MAINTENANCE OF PRESSURE-RELIEF VALVE.

This task covers:
a. Disassemble
b. Inspect
c. Assemble

INITIAL SETUP

Tools

General Mechanic's Automotive Tool Kit, Item 1, Appendix B

Equipment Conditions

TWDS system shutdown.

Materials/Parts

Anti-seizing Tape (Item 10, Appendix E)

a. DISASSEMBLE (Figure 4-1).

Unscrew relief valve (1) from grooved coupling (2).

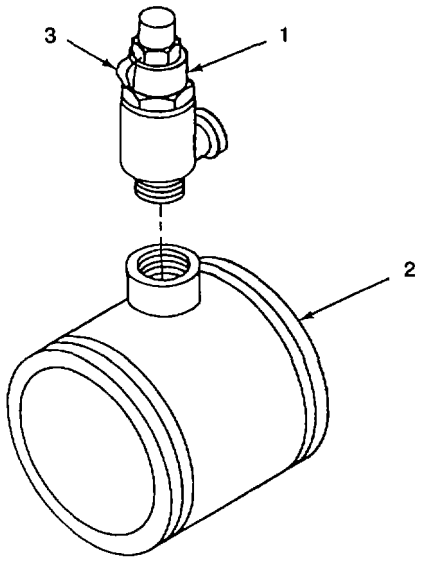


Figure 4-1. Pressure-Relief Valve

b. INSPECT.

(1) Check wire seal (3) on relief valve. If broken, replace relief valve (1).

(2) Inspect threaded parts for damaged threads and pitting. If damaged threads or pitted, replace the damaged part.

(3) Inspect all sealing surface parts for uneven wear or pitting. If worn or pitted, replace sealing surface parts.

4-14. MAINTENANCE OF PRESSURE-RELIEF VALVE. - (Cont)

c. ASSEMBLE.

NOTE

The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(1) Apply anti-seizing tape to threads of relief valve (1).

(2) Screw relief valve into coupling (2).

4-15. MAINTENANCE OF BUTTERFLY VALVE.

This task covers: a. Disassemble b. Repair c. Assemble

INITIAL SETUP

Tools

General Mechanic's Automotive Tool Kit, Item 1, Appendix B

Equipment Conditions

Butterfly valve is removed (para. 2-8.h.).

Materials/Parts
O-rings (TM 10-4320-317-23P)
Potable Water Gasket Lubricant (Item 6, Appendix E)

a. DISASSEMBLE (Figure 4-2).

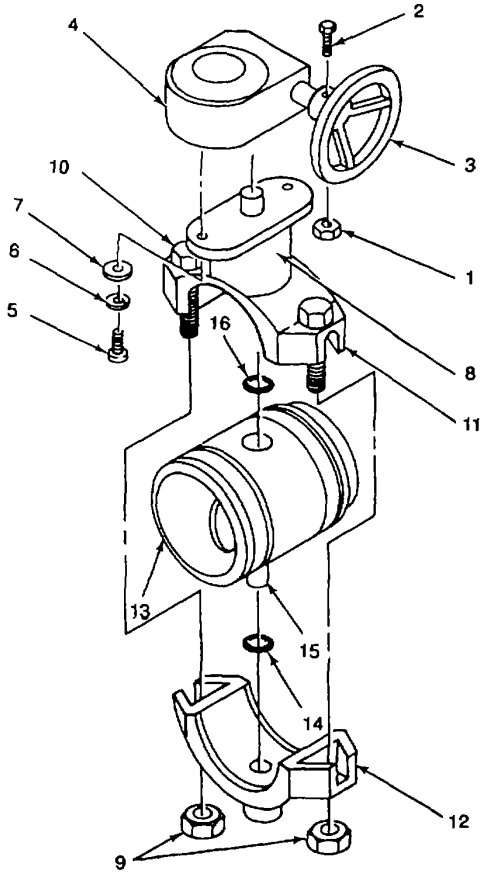


Figure 4-2. Butterfly Valve

4-15. MAINTENANCE OF BUTTERFLY VALVE - (Cont)

NOTE
This is a general procedure for butterfly valves throughout the system.

(1) Remove locknut (1), bolt (2), and handle (3) from stem of handle assembly (4).

(2) Remove capscrews (5), lockwashers (6), flat washers (7), and handle assembly (4) from flange on valve neck (8).

(3) Loosen nuts (9) that secure upper and lower housings (11 and 12) together. Remove nuts (9) and bolts (10).

(4) Carefully separate upper and lower housings (11 and 12) from valve body (13).

(5) Remove O-ring (14) from lower stem (15).

(6) Remove O-ring (16) from upper housing (11).

b. REPAIR.

Repair is accomplished by replacement of parts.

c. ASSEMBLE.

(1) Apply potable water gasket lubricant to lower stem (15) and O-rings (14 and 16).

(2) Install shaft into upper housing (11).

(3) Install O-ring (16) onto upper housing (11).

(4) Install O-ring (14) over lower stem (15).

NOTE

Wider slot on upper housing fits into the inner groove of valve body.

(5) Align upper and lower housings (11 and 12) and install valve body (13).

(6) Install two bolts (10) and nuts (9).

(7) Install handle assembly (4) onto flange of valve neck (8) with flat washers (7), lockwashers (6), and capscrews (5).

(8) Install handle (3) onto stem with bolt (2) and locknut (1).

4-16. MAINTENANCE OF 4-INCH GATE VALVE.

This task covers: a. Disassemble c., Repair
b. Inspect d. Assemble

INITIAL SETUP

Tools

General Mechanic's Automotive Tool Kit (Item 1, Appendix B)

Material /Parts

Packing (TM 10-4320-317-23P)

Equipment Conditions

4-inch gate valve is removed (para. 2-15.h.).

a. DISASSEMBLE (Figure 4-3).

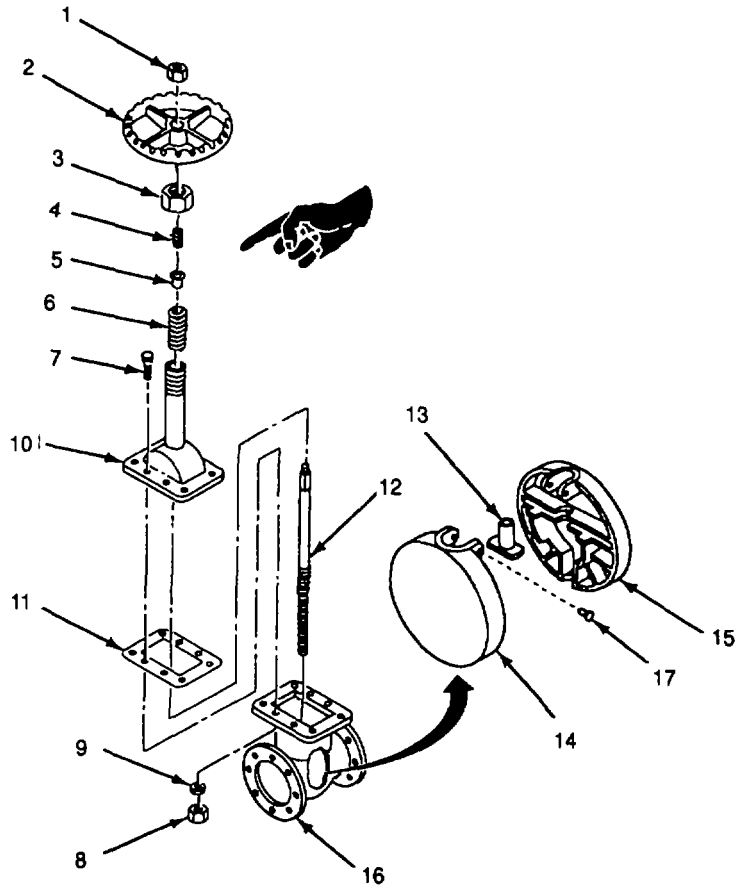


Figure 4-3. 4-Inch Gate Valve

(1) Remove handwheel nut (1).

4-16. MAINTENANCE OF 4-INCH GATE VALVE - (Cont)

(2) Remove handwheel (2).

(3) Turn packing nut (3) CWW and remove.

(4) Remove packing gland spring (4) and packing gland (5).

(5) Remove packing (6).

(6) Remove bolts (7), nuts (8), and lockwashers (9).

(7) Remove bonnet (10) and gasket (11) from valve body (16).

(8) Remove valve stem (12) from valve bonnet (10).

(9) Remove pull-nut (13) and discs (14 and 15) from valve body (16).

(10) Remove setscrews (17), and discs (14 and 15) from pull-nut (13).

b. INSPECT.

(1) Inspect parts for pitting and defects. Replace defective parts.

(2) Inspect discs and seat rings in body for pitting. Replace both items if either are pitted.

c. REPAIR.

Repair is accomplished by replacement of parts.

d. ASSEMBLE.

(1) Clean gasket and mating surfaces.

(2) Position discs (14 and 15) onto pull-nut (13).

(3) Install setscrews (17) in discs (14 and 15).

(4) Install assembled discs (14 and 15) into valve body (16) making sure guides on discs are in grooves in valve body.

(5) Install valve stem (12) into pull-nut (13).

(6) Screw valve stem (12) into valve bonnet (10).

(7) Align and install gasket (11) and valve bonnet (10) onto valve body (16).

(8) Install bolts (7), lockwashers (9), and nuts (8).

(9) Install packing (6).

(10) Install packing gland (5).

(11) Install gland spring (4).

(12) Install packing nut (3).

(13) Install handwheel (2) and handwheel nut (1) onto bonnet stem (12).

(14) Check handwheel (2) for smooth operation.

4-17. MAINTENANCE OF 2-INCH GATE VALVE.

This task covers: a. Disassemble
b. Repair
c. Assembly

INITIAL SETUP

Tools

General Mechanic's Automotive Tool Kit (Item 1, Appendix B)

Materials/Parts

Packing (TM 10-4320-317-23P)

Equipment Conditions

2-inch gate valve removed (para. 2-15.i).

a. DISASSEMBLE (Figure 4-4).

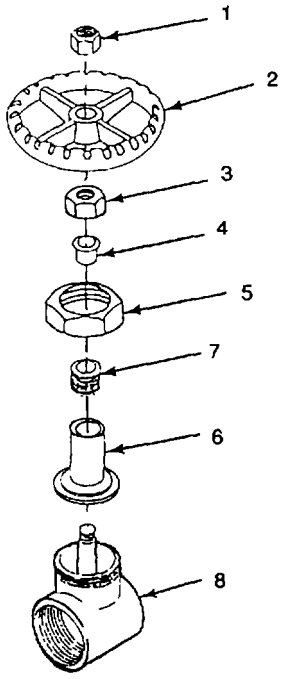


Figure 4-4. 2-Inch Gate Valve

(1) Remove handwheel nut (1) and handwheel (2).

(2) Remove packing nut (3) and packing gland (4).

(3) Remove bonnet ring (5) and bonnet (6).

(4) Remove packing (7).

4-17. MAINTENANCE OF 2-INCH GATE VALVE - (Cont)

b. REPAIR.

Repair is accomplished by replacement of packing.

c. ASSEMBLE.

(1) Install bonnet (6) onto valve body (8).

(2) Install bonnet ring (5) on valve body (8).

(3) Install packing (7) and packing gland (4) into bonnet (6).

(4) Install packing nut (3) on bonnet (6).

(5) Install handwheel (2) and handwheel nut (1).

(6) Check handwheel (2) for smooth operation.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

5-1. **Common Tools and Equipment**. Appendix B, Section III contains the authorized common tools. For authorized equipment, refer to Modified Table of Organization and Equipment (MTOE) applicable to your unit.

5-2. **Special Tools; Test, Measurement, and Diagnostic Equipment; and Support Equipment**. No special tools; test, measurement, and diagnostic equipment; or support equipment are required for the repair of the pump unit.

5-3. **Repair Parts**. Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 10-4320-317-23P.

Section II. MAINTENANCE PROCEDURES

5-4. **Introduction**. This section contains instructions covering maintenance functions for the direct support level on the TWDS.

NOTE

Personnel required are listed only if the task requires more than one. After completing each maintenance procedure, perform an operational check to ensure that equipment is properly functioning.

5-5. MAINTENANCE OF PRESSURE-REDUCING CONTROL

This task covers:
a. Disassemble
b. Inspect
c. Repair
d. Assemble

INITIAL SETUP

Tools

General Mechanic's Automotive Tool Kit (Item 1, Appendix B)

Equipment Conditions

Pressure-reducing valve assembly is removed (para. 2-15.d).

Material/Parts

Anti-seizing Tape (Item 10, Appendix E)

a. DISASSEMBLE (Figure 5-1).

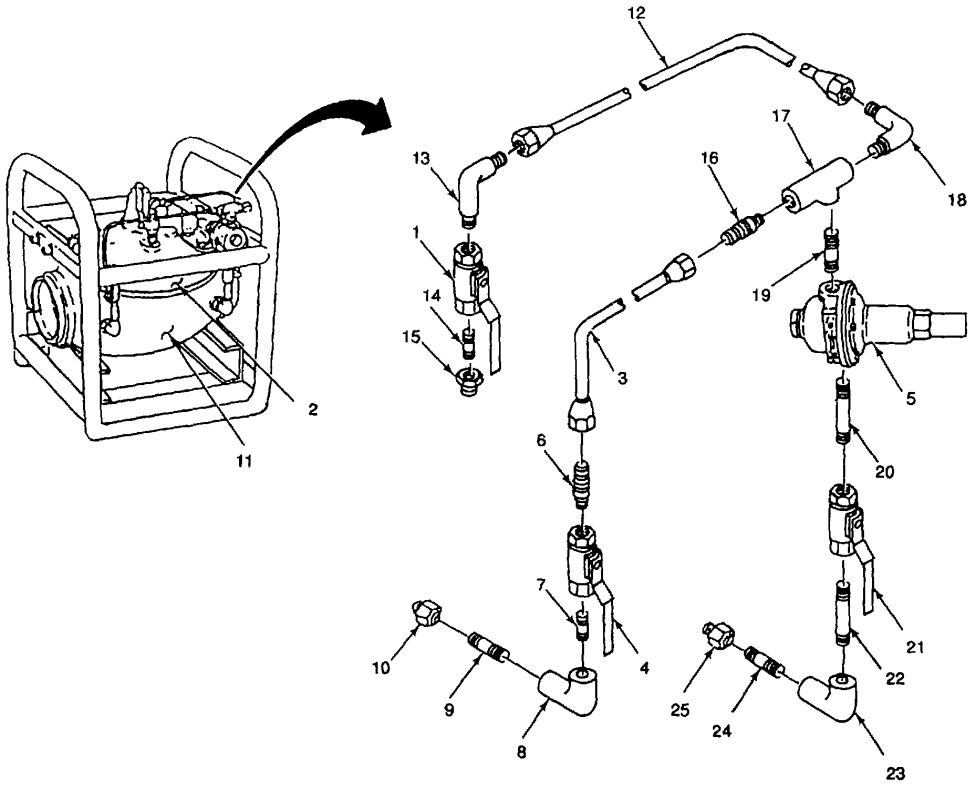


Figure 5-1. Pressure-Reducing Control

5-5. MAINTENANCE OF PRESSURE-REDUCING CONTROL - (Cont)

(1) Open cover isolation cock valve (1) to release pressure inside valve (2).

(2) Remove tubing (3) between isolation cock valve (4) and pressure-reducing control valve (5).

(3) Remove male connector tubing fitting (6) from isolation cock valve (4).

(4) Remove isolation cock valve (4) from pipe nipple (7).

(5) Remove pipe nipple (7) from elbow (8).

(6) Remove elbow (8) from pipe nipple (9).

(7) Remove pipe nipple (9) from reducer (10).

(8) Remove reducer (10) from valve body (11).

(9) Remove tubing (12) between pressure-reducing control valve (5) and isolation cock valve (1) on cover of valve (2).

(10) Remove male elbow tubing fitting (13) from isolation cock valve (1).

(11) Remove isolation cock valve (1) from pipe nipple (14).

(12) Remove pipe nipple (14) from reducer (15).

(13) Remove reducer (15) from cover of valve (2).

(14) Remove male connector tubing fitting (16) from pipe tee (17).

(15) Remove male elbow tubing fitting (18) from pipe tee (17).

(16) Remove pipe tee (17) from pipe nipple (19).

(17) Remove pipe nipple (19) from pressure-reducing control valve (5).

(18) Remove pressure-reducing control valve (5) from pipe nipple (20).

(19) Remove pipe nipple (20) from isolation cock valve (21).

(20) Remove isolation cock valve (21) from pipe nipple (22).

(21) Remove pipe nipple (22) from elbow (23).

(22) Remove elbow (23) from pipe nipple (24).

(23) Remove pipe nipple (24) from reducer (25).

(24) Remove reducer (25) from valve body (11).

5-5. MAINTENANCE OF PRESSURE-REDUCING CONTROL - (Cont)

b. INSPECT.

(1) Inspect threaded parts for damaged threads. Replace parts if damaged.

(2) Inspect tubing for kinks or damage. Replace tubing if damaged.

c. REPAIR.

Repair is accomplished by replacement of parts.

d. ASSEMBLE.

NOTE
The anti-seizing tape is to be wrapped in the same direction as the pipe threads.

(1) Wrap anti-seize tape on pipe threads of components.

(2) Install reducer (25) on valve body (11).

(3) Install pipe nipple (24) into reducer (25).

(4) Install elbow (23) onto pipe nipple (24).

(5) Install pipe nipple (22) into elbow (23).

(6) Install isolation cock valve (21) on pipe nipple (22).

(7) Install pipe nipple (20) into isolation cock valve (21).

(8) Install pressure-reducing control (5) onto pipe nipple (20).

(9) Install pipe nipple (19) onto pressure-reducing control valve (5).

(10) Install pipe tee (17) onto pipe nipple (19).

(11) Install male elbow tubing fitting (18) into pipe tee (17).

(12) Install male connection tubing fitting (16) into pipe tee (17).

(13) Install reducer (15) into cover of valve (2).

(14) Install pipe nipple (14) into reducer (15).

(15) Install isolation cock valve (1) onto pipe nipple (14).

(16) Install male elbow tubing fitting (13) into isolation cock valve (1).

(17) Connect tubing (12) to male elbow tubing fittings (13 and 18).

5-5. MAINTENANCE OF PRESSURE-REDUCING CONTROL - (Cont)

(18) Install reducer (10) into valve body (11).

(19) Install pipe tee (9) into reducer (10).

(20) Install elbow (8) onto pipe nipple (9).

(21) Install pipe nipple (7) into elbow (8).

(22) Install isolation cock valve (4) on pipe nipple (7).

(23) Install male connection tubing fitting (6) into isolation cock valve (4).

(24) Connect tubing (3) to male connection tubing fittings (6 and 16).

(25) Place all isolation cock valves (1, 4, and 21) to the open position.

5-6. MAINTENANCE OF MAIN VALVE ASSEMBLY.

This task covers:
a. Remove
b. Disassemble
c. Inspect
d. Repair
e. Assemble
f. Install

INITIAL SETUP

Tools

1 1/4-inch socket with ratchet
(Item 2, Appendix B)

Materials/Parts

Cloth, Abrasive
(Item 4, Appendix E)

WARNING

Because of the weight and bulk of the main valve pump assembly, a minimum of two people are required to remove/install this equipment. Failure to comply with this warning could result in serious injury to personnel and damage to equipment.

Personnel Required

Two

a. REMOVE (Figure 5-2).

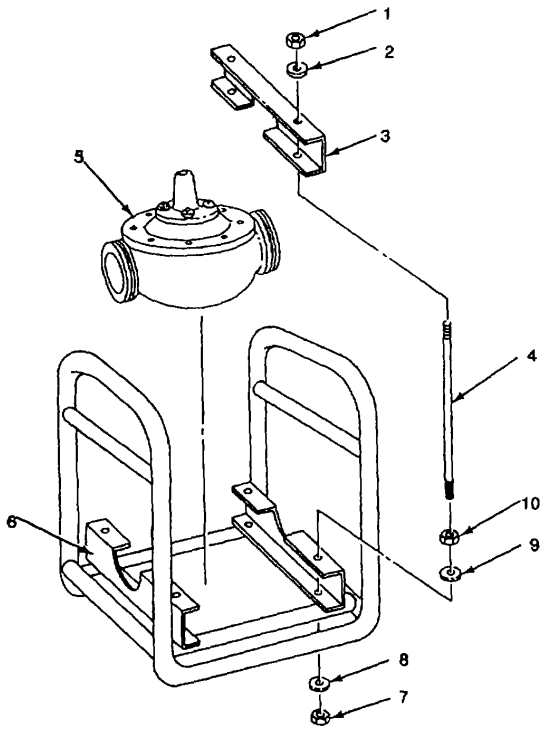


Figure 5-2. Main Valve

5-6. MAINTENANCE OF MAIN VALVE ASSEMBLY - (Cont)

NOTE

If main valve assembly is to be disassembled, loosen the nuts securing valve cover prior to removing brackets.

(1) Remove nuts (1) and flat washers (3).

(2) Lift brackets (3) from studs (4).

WARNING

Because of the weight and bulk of the main valve assembly, a minimum of two people are required to remove/install this equipment. Failure to comply with this warning could result in serious injury to personnel and damage to equipment.

(3) Lift main valve assembly (5) from the skid (6).

(4) Remove nuts (7), flat washers (8), and studs (4).

(5) Remove flat washers (9) and nuts (10) from studs (4).

b. DISASSEMBLE (Figure 5-3).

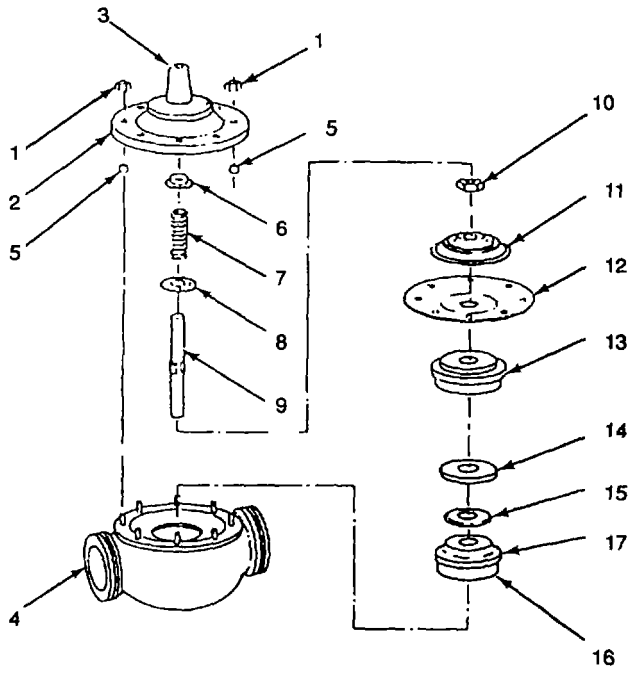


Figure 5-3. Main Valve Assembly

5-6. MAINTENANCE OF MAIN VALVE ASSEMBLY - (Cont)

WARNING

To prevent injury to personnel, be sure to vent internal pressure from pressure-reducing valve before disassembling valve. Water released under pressure may cause injury to personnel.

(1) Remove nuts (1) from cover (3).

(2) Using dull cold chisel, drive upward around edge of cover (2) to loosen.

WARNING

Remove cover slowly to release tension on spring. Sudden release of spring tension may cause injury to personnel.

CAUTION

Pull cover straight up, to avoid damaging cover bearing or valve stem.

(3) Slowly lift cover (3) from valve body (4). Remove stud spacers (5).

(4) Remove spring guide (6), spring (7), and spacer (8) from valve stem (9).

(5) Lift assembled diaphragm (12) and disc (14) components from seat (16). Remove spacers (15).

CAUTION

To prevent damage to stem, be sure to use vise that has soft brass jaws.

(6) Secure lower end of valve stem (9) (on diaphragm and disc assembly) in vice with soft jaws.

(7) Examine threads above stem nut (10) for signs of corrosion or mineral deposits. If needed, clean threads with wire brush before removing nut.

(8) Remove stem nut (10).

(9) Remove diaphragm washer (11), diaphragm (12), disc retainer (13), and disc (14) from valve stem (9).

(10) Pry disc (14) from disc retainer (13). Remove disc (14).

c. INSPECT (Figure 5-3).

(1) Inspect threads for damage. If threads are damaged, replace main valve body (4).

(2) Inspect seating surface on valve body. If worn, replace valve body (4).

(3) Inspect valve stem (9) for corrosion and scale. If needed, use crocus cloth moistened with water to clean valve stem.

5-6. MAINTENANCE OF MAIN VALVE ASSEMBLY - (Cont)

NOTE

If new disc is unavailable, turn old disc over.

(4) Inspect diaphragm (12), disc (14), and spacers (15) for signs of wear, corrosion, and damage. Replace worn or damaged parts.

(5) Inspect seat (16) and disc guide (17) for signs of wear, corrosion, and damage. Replace worn or damaged parts.

d. REPAIR.

Repair is accomplished by replacement of parts.

e. ASSEMBLE (Figure 5-3).

(1) Install disc (14) into disc retainer (13).

(2) Install disc (14), disc retainer (13), diaphragm (12), and diaphragm washer (11) onto valve stem (9).

NOTE

If new disc is installed, a different number of spacers may be required to obtain right amount of grip on disc.

(3) Install spacers (15) onto valve stem (9).

(4) Carefully lower stem (9) (on diaphragm and disc assembly) through valve body (4).

CAUTION

· When installing stem nut, tighten nut until diaphragm cannot be twisted. If nut is loose, diaphragm could pull loose and tear under pressure.

· When tightened, make sure disc is not compressed too much. Disc should be compressed only very slightly by disc guide. If needed, remove enough spacers to obtain proper disc compression.

(5) Install stem nut (10).

(6) Align holes in diaphragm (12) with studs in valve body (4). Stretch diaphragm over studs.

(7) Install spacer (8), spring (7), and spring guide (6) over valve stem (9).

(8) Install stud spacers (5) over studs on valve body (4).

5-6. MAINTENANCE OF MAIN VALVE ASSEMBLY - (Cont)

CAUTION

When installing cover, make sure diaphragm is lying smooth under cover. If diaphragm is not smooth, valve will not work properly.

(9) Align holes in cover (3) with studs in valve body (4). Carefully install cover (3) over studs.

(10) Install nuts (1) on studs. Do not tighten.

f. INSTALL (Figure 5-2).

(1) Install nuts (10) onto studs (4).

(2) Install flat washers (9) onto studs and install studs (4) into skid (6).

(3) Secure studs (4) to skid (6) with flat washers (8) and nuts (7).

WARNING

Because of the weight and bulk of the main valve assembly, a minimum of two people are required to remove/install this equipment. Failure to comply with this warning could result in death or serious injury to personnel and damage to equipment.

(4) Install main valve assembly onto the skid (6).

(5) Install brackets (3), flat washers (2), and nuts (1).

5-7. MAINTENANCE OF PRESSURE-REDUCING VALVE ASSEMBLY SKID.

This task covers: Repair

INITIAL SETUP

Equipment Conditions

Main Valve Assembly removed (para. 5-6).

WARNING

· Do not work on equipment that is not securely stabilized to prevent sliding.

· Do not work on equipment without following standard shop safety precautions.

REPAIR.

WARNING

· Do not work on equipment that is not securely stabilized to prevent sliding.

· Do not work on equipment without following standard shop safety precautions.

Repair of skid consists of welding cracked seams and frame member in accordance with T B 420-25.

APPENDIX A

REFERENCES

A-1. SCOPE. This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced
in this manual.

A-2. FORMS.

Recommended Changes to Publications and Blank Forms ..... DA Form 2028
Product Quality Deficiency Report SF-368
Equipment Inspection and Maintenance Worksheet ..... DA Form 2404

A-3. FIELD MANUALS.

NBC Contamination Avoidance ..... FM 3-11.3
NBC Protection ..... FM 3-11.4
Fixed Site Protection ..... FM 3-11.34
NBC Decontamination ..... FM 3-11.5
Field Behavior of NBC Agents ..... FM 3-6
Chemical Reference Handbook ..... FM 3-7
First Aid Procedures ..... FM 4-25.11

A-4. TECHNICAL MANUALS.

Procedures for Destruction of Equipment to Prevent
Enemy Use (Mobility Equipment Command) ..... TM 750-244-3
Repair Parts and Special Tools List ..... TM 10-4320-317-23P

A-5. MISCELLANEOUS PUBLICATIONS.

The Army Maintenance Management System (TAMMS) ..... DA Pam 750-8
Joint Regulation Governing the Use and Application
of Uniform Source Maintenance and Recoverability (SMR) Codes ..... AR 700-82
Occupational and Environmental Health TB-MED-577

APPENDIX B

MAINTENANCE ALLOCATION CHART (MAC)

Section I. INTRODUCTION

B-1. The Army Maintenance System MAC

a. This introduction (Section I) provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.

b. The MAC (immediately following, Section II) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Field – includes two sub columns, Unit (C (operator/crew) and O (unit)) and Direct Support (F) maintenance.

Sustainment – includes two sub columns, General Support (H) and Depot (D).

c. Section III, Tools and Test Equipment, lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

d. Section IV, Remarks, contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. Maintenance Functions

Maintenance functions are limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination (e.g., by sight, sound or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

c. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint or to replenish fuel, lubricants, chemical fluids or gases. The following are examples of service functions:

(1) Unpack. To remove from packing box for service or when required for the performance of maintenance operations.

(2) Repack. To return item to packing box after service and other maintenance operations.

(3) Clean. To rid the item of contamination.

(4) Touch up. To spot paint scratched or blistered surfaces.

(5) Mark. To restore obliterated identification.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating or fixing into position a spare, repair part or module (component or assembly) in a manner to allow the proper functioning of equipment or a system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and the assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

i. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, faults, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

(1) Services. Inspect, test, service, adjust, align, calibrate and/or replace.

(2) Fault location/troubleshooting. The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

(3) Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

(4) Actions. Welding, grinding, riveting, straightening, facing, machining and/or resurfacing.

j. Overhaul. The maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

B-3. Explanation of Columns in the MAC, Section II

a. Column (1) Group Number. Column (1) lists Functional Group Code (FGC) numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the Next Higher Assembly (NHA).

b. Column (2) Component/Assembly. Column (2) contains the item names of components, assemblies, subassemblies and modules for which maintenance is authorized.

c. Column (3) Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions refer to "Maintenance Functions" previously defined).

d. Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as man-hours in whole hours or decimals) in the appropriate sub column. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field:

C Operator or Crew maintenance
O Unit maintenance
F Direct Support maintenance

Sustainment:

H General Support maintenance
D Depot maintenance

e. Column (5) Tools and Test Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE) and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table in Section III.

f. Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries in Section IV.

B-4. Explanation of Columns in the Tools and Test Equipment Requirements, Section III

a. Column (1) Tool or Test Equipment Reference Code. The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

b. Column (2) Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column (3) Nomenclature. Name or identification of the tool or test equipment.

d. Column (4) National Stock Number (NSN). The NSN of the tool or test equipment.

e. Column (5) Tool Number. The manufacturer's part number.

B-5. Explanation of Columns in the Remarks, Section IV

a. Column (1) Remarks Code. The code recorded in column (6) of the MAC.

b. Column (2) Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

SECTION II. MAINTENANCE ALLOCATION CHART
FOR
TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM 10 MILE SEGMENT

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Test Equipment Ref Code	(6) Remarks Code
			Field			Sustainment			
			Unit		DS	GS	Depot		
			C	O	F	H	D		
00	Tactical Water Distribution Equipment System, 10-Mile Segment								
01	10-Mile Hoseline Segments/ Components								
0101	Hose Assy, Suction 6 in. x 10 ft.	Inspect Repair	0.1 2.0						A
0102	Hose Assy, Collapsible	Inspect Repair	0.1 2.0						A
0103	Suspension Kit, 6-inch Hoseline	Inspect Replace	0.5 1.0						
0104	Valve Assy, Pressure-relief	Inspect Replace Repair	0.1 0.3	 0.5				 1	
0105	Valve Assy, Pressure Reducing								
010501	Skid, Valve Assy, Pressure Reducing	Inspect Replace Repair	0.1	 1.0 0.5	 0.5 1.0			 1	 C
010502	Control, Pressure Reducing	Inspect Replace Repair		0.2 0.5 1.0	 0.5 1.0			 1 1	
010503	Valve Assy, Main	Inspect Replace Repair		0.3 0.5 1.0	 0.5 1.0			 1 1,2	
0106	Displacement and Evacuation Kit, 6-inch Hoseline	Inspect Repair	0.2 0.5						D
0107	Repair Kit, Hoseline, 6-inch	Inspect Repair	0.2 0.5						D

SECTION II. MAINTENANCE ALLOCATION CHART – cont'd
FOR
TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM 10 MILE SEGMENT

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Test Equipment Ref Code	(6) Remarks Code
			Field			Sustainment			
			Unit		DS	GS	Depot		
			C	O	F	H	D		
02	Pumping Station								
0201	Valve, Butterfly 6-inch Gear Actuated	Inspect Repair	0.1	 1.5				 1	
0202	Pumping Assy, 600 GPM								B
03	Storage Assembly								
0301	Valve, 4-inch Gate, Flanged	Inspect Repair	0.1	 1.5				 1	
0302	Tank, Pillow, 20,000 gal MIL-T-83029)								D
04	Distribution Point								
0401	Stand Assy, Nozzle, Plug	Inspect Repair	0.1 0.5						
0402	Valve, Gate, 2-inch	Inspect Repair	0.1	 0.5				 1	
0403	Hypochlorination Unit								B
0404	Pump, Centrifugal, 125 GPM								B
05	Chest, Water Tank – 50K								B
06	Tricon								B

SECTION III. TOOLS AND TEST EQUIPMENT FOR TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM 10 MILE SEGMENT

Tool or Test Equipment Ref. Code	Maintenance Level	Nomenclature	National Stock Number (NSN)	Tool Number
1	O	Tool Kit, General Mechanics	5180-00-177-7033	SC 5180-90-CL-N26
2	O	Shop Set, Automotive Vehicle Maintenance and Repair: Organizational Maintenance Common No. 1	4910-00-754-0654	SC 4910-95-CL-A74
3	C	Punch, Drive Pin, 1/4 inch GGG-P-831 (81348)	5120-00-240-6083	

SECTION IV. REMARKS FOR TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM 10 MILE SEGMENT

Remarks Code	Remarks
A	Repair Kit, Hose line, Item 107, of Appendix C is used for repair/replacement of hoses of the Tactical Water Distribution Equipment System (TWDS), 10-Mile Segment.
B	Refer to applicable technical manual for maintenance for TWDS components.
C	Repair by welding. Refer to TB 420-25.
D	Repair of this kit is limited to the replacement of damaged, missing, or expended items.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. SCOPE. This appendix lists components of end item and basic issue items for the TWDS to help you inventory items required for safe and efficient operation.

C-2. GENERAL. The Components of End Item and Basic Issue Items lists 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. 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 TWDS in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the TWDS during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This listing is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS. The following provides an explanation of columns found in the tabular listings:

a. Column (1) Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

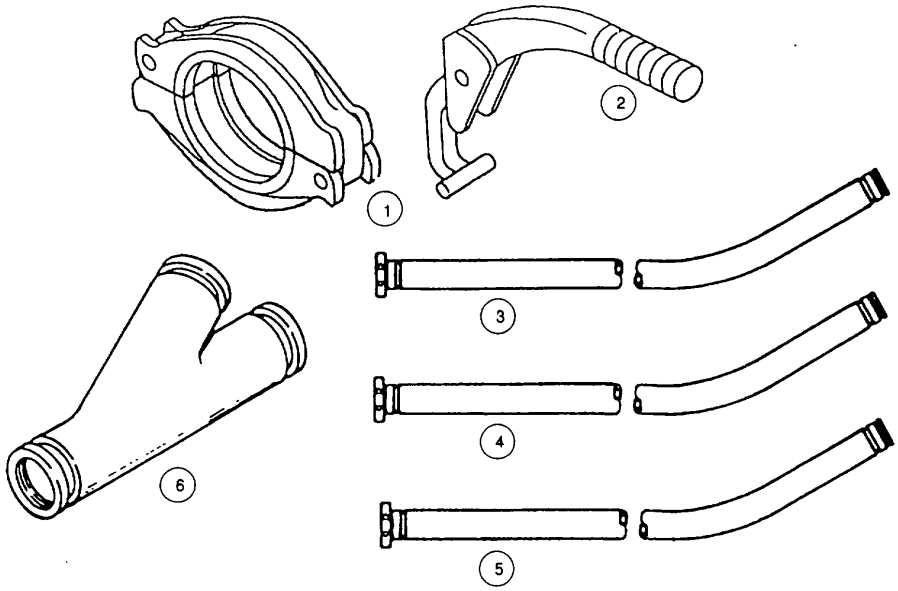
b. Column (2) National Stock Number Indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) Description. Indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGEC (in parentheses) followed by the part number.

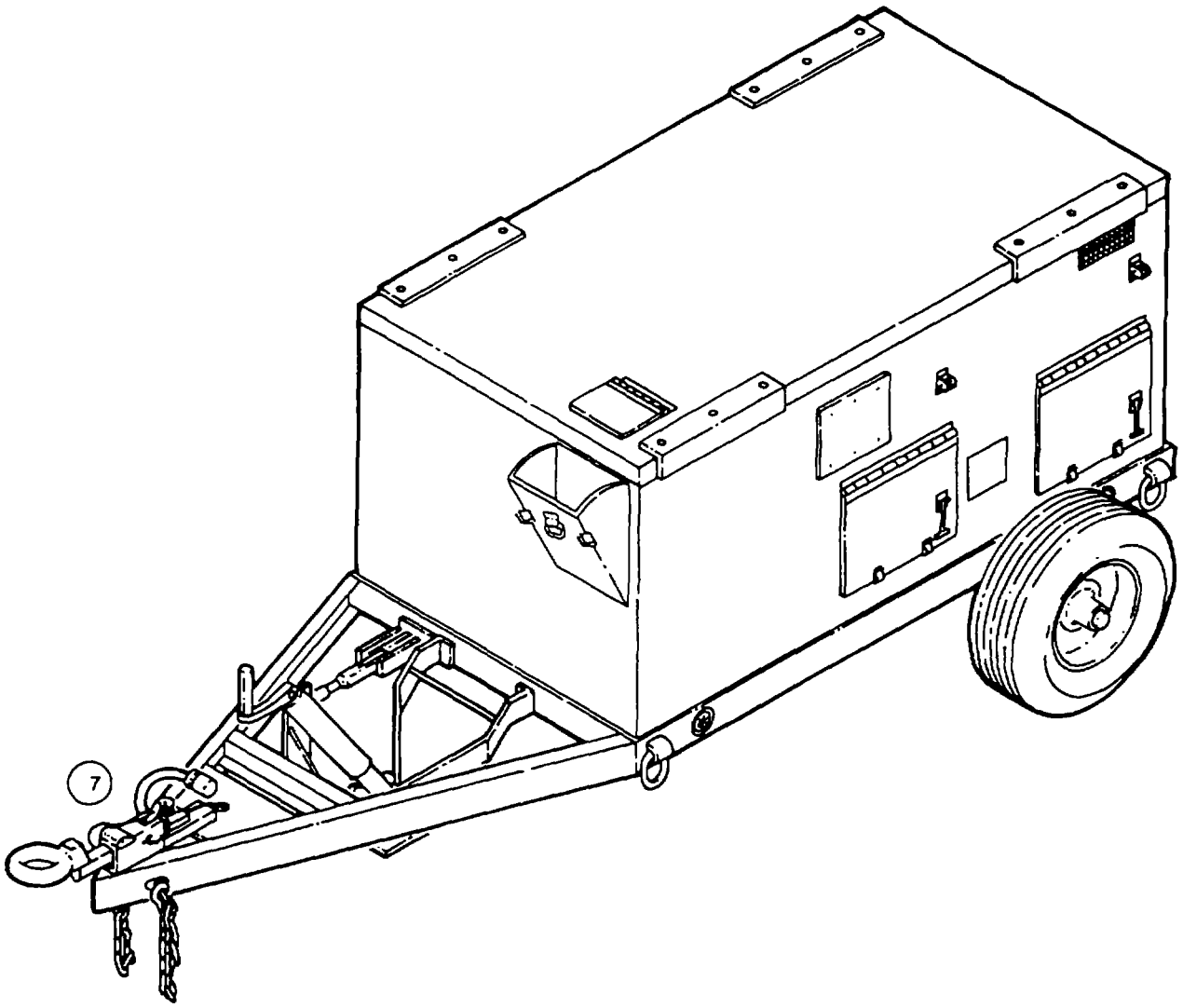
d. Column (4) Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (. e. g, EA, IN, PR).

e. Column (5) Quantity Required (Qty. rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

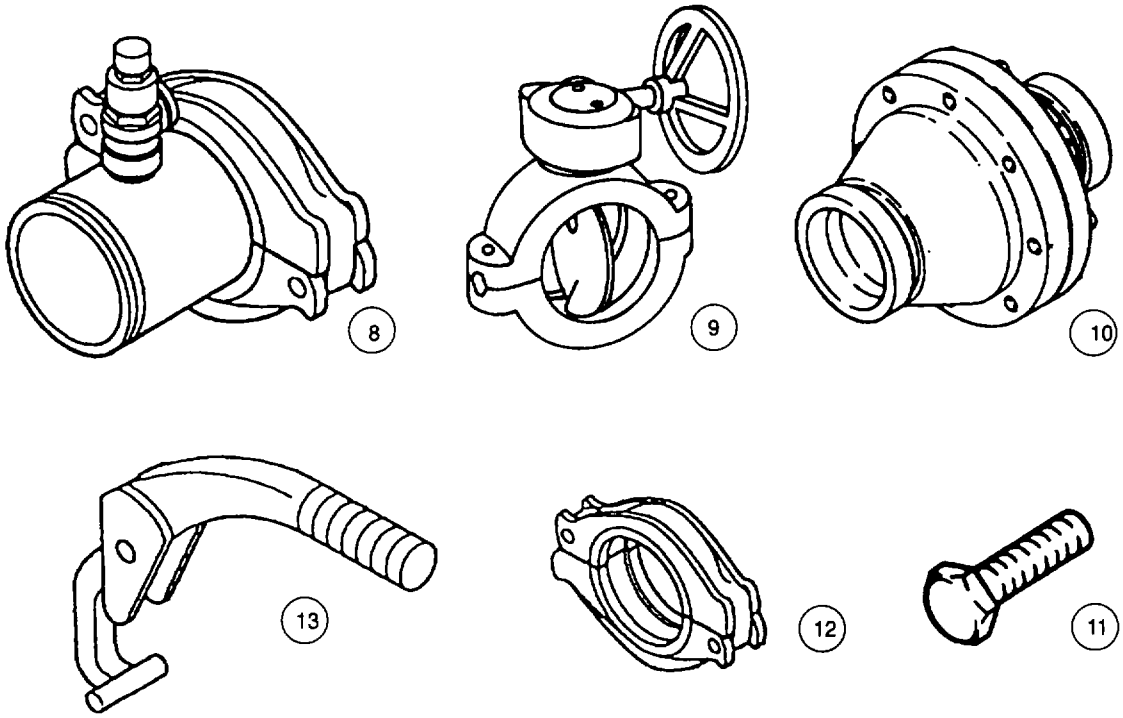
Section II. COMPONENTS OF END ITEM



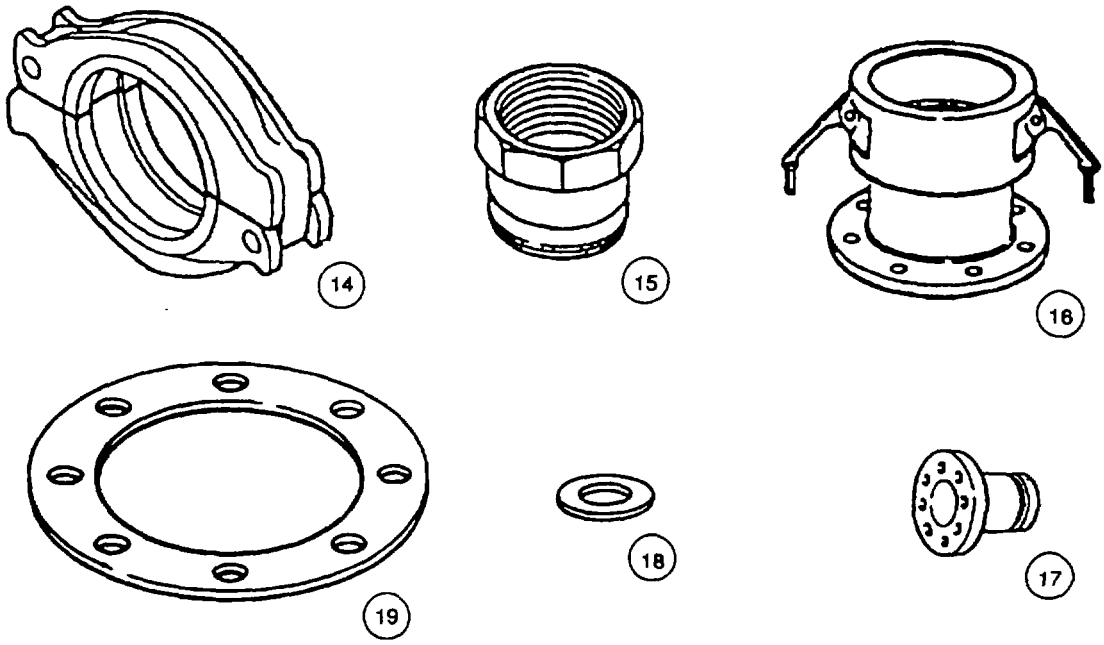
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
0	4320-01-128-4244	PUMPING STATION (97403)13225E9088		EA	6
1	4730-01-384-9332	Coupling, Clamp, 6-inch (79154) C-060-791 -A-EB		EA	8
2	5120-01-270-7428	Wrench, Spanner (79154) 792		EA	1
3	4720-01-279-7772	Hose Assembly, Discharge, 6 inch X 10 feet (97403)13225E9088-7		EA	1
4	4720-01-365-9098	Hose Assembly, Discharge, 6 inch X 20 feet (97403)13225E9088-5		EA	1
5	4720-01-276-5952	Hose Assembly, 6 inch X 75 feet (97403)13225E9088-6		EA	1
6	4730-01-182-3449	Pipe Fitting, Lateral Grooved, 45, 6-inch (81349) M10388-A18AK1C		EA	2
		NOTE Item 0 consists of items 1 thru 10.			



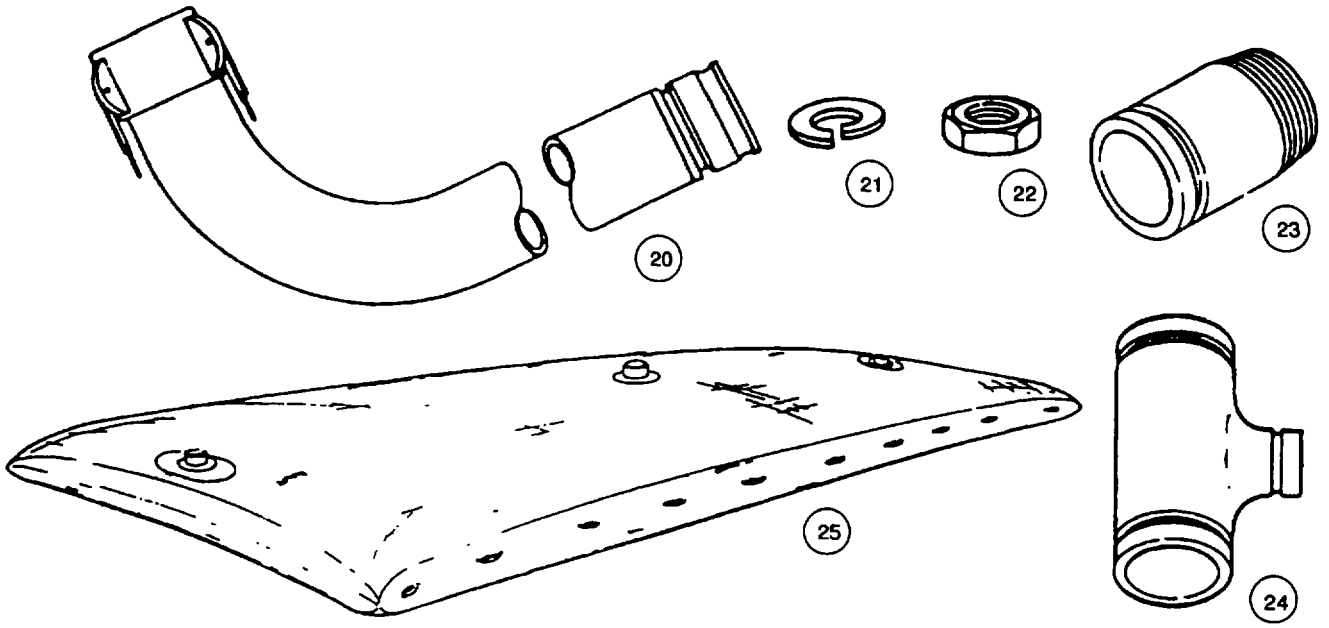
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
7		Pumping Assembly, Water, 600 GPM, Trailer Mounted		EA	1



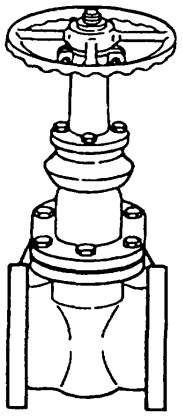
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
8	4820-01-201-7138	Valve Assembly, Pressure-Relief, 6-inch (97403)13225E9196		EA	1
9	4820-01-186-0744	Valve, Butterfly, 6-inch, Gear Actuated (79154) 700E61N		EA	3
10	4820-01-186-0738	Valve, Check, EDPM, 6-inch (79154) V-060-71 0-P-E3		EA	1
10A	4320-01-128-4245	STORAGE ASSEMBLIES (97403)13225E9089		EA	2
11	5305-00-724-7236	Bolt, 0.375 16 UNC-2A X 3.25 inches (80204) B1821 BH063C325N		EA	32
12	4730-01-270-6554	Coupling, Clamp, 4-inch (79154) 4-791-A		EA	2
13	5120-01-270-7428	Wrench, Spanner (79154) 792		EA	2
		NOTE Item 1OA consists of items 11 thru 26.			



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
14	4730-01-384-9332	Coupling, Clamp, 6-inch (79154) C-060-791 -A-EB		EA	2
15	4730-00-840-0796	Coupling Half, Quick-Disconnect Male, 4-inch (96906) MS27020-17		EA	2
16	4730-00-088-9286	Coupling Half, Quick-Disconnect Flanged, Female, 4-inch (96906) MS27027-17		EA	2
17	4730-00-840-5347	Coupling Half, Quick-Disconnect, 4-inch, Male (96906) MS27023-17		EA	2
18	5310-00-823-8803	Flat Washer, 0.046 ID X 0.812 OD (96906) MS271 83-21		EA	64
19	5330-01-141-1864	Gasket, Class 150, 4-inch Nominal (97403)13220E1069-1		EA	4



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
20	4720-01-138-8986	Hose Assembly, 4 inch X 10 feet (97403)13225E9136-3		EA	8
21	5310-00-004-5034	Washer, Lock 0.375-inch (26916) 004-003005-059		EA	32
22	5310-00-763-8920	Nut, Plain, Hexagon, 0.375 16 UNC-2B (96906) MS51967-20		EA	32
23		Pipe, Fitting, Coupling, 4-inch (81349) M1 0388-A02A11 C6A		EA	2
24	4730-01-180-4057	Tee, Pipe, 6 X 6 X 4-inch (81349) M1 0388-A-30-EB-1-A-6C		EA	2
25	5430-01-106-9678	Tank, Storage, 20,000-Gallon (81349) M53029-20		EA	2



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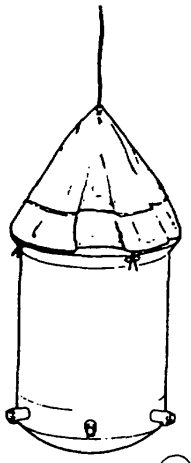

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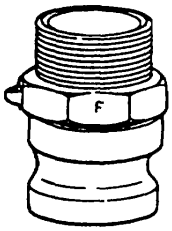

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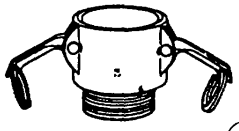
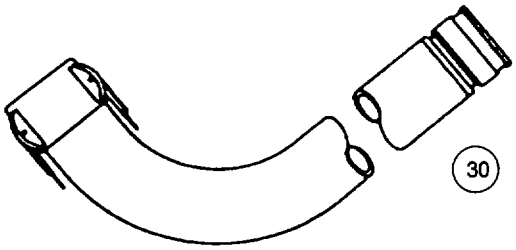
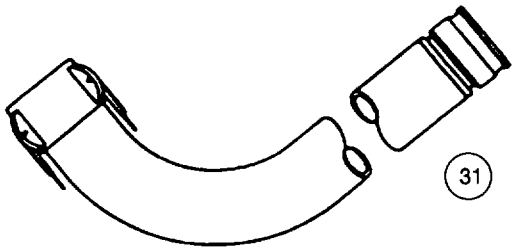
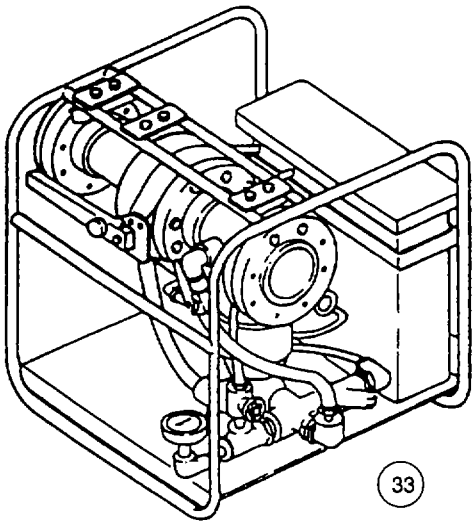


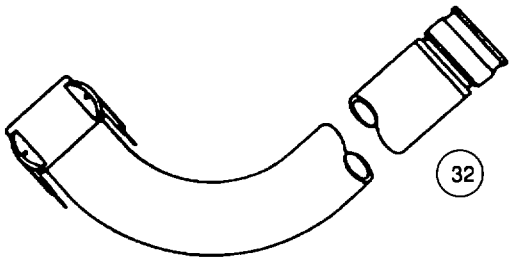
28

(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
26	4820-01-159-0439	Valve, Gate, 4-inch, Flanged (81718) OPW-676-FR41N		EA	2
26A	4320-01-128-4246	DISTRIBUTION POINTS (97403) 13225E9091		EA	2
27	4610-01-117-8271	Bag, Drinking Water Storage, 36-Gallon (81349) MIL-B-273		EA	4
28	4730-00-088-9285	Coupling Half, Quick-Disconnect (96906) MS27026-11		EA	6
29	4730-00-938-7997	Coupling Half, Quick-Disconnect (96906) MS27022-11		EA	6
		NOTE **Item 26A consists of items 27 thru 59.**			

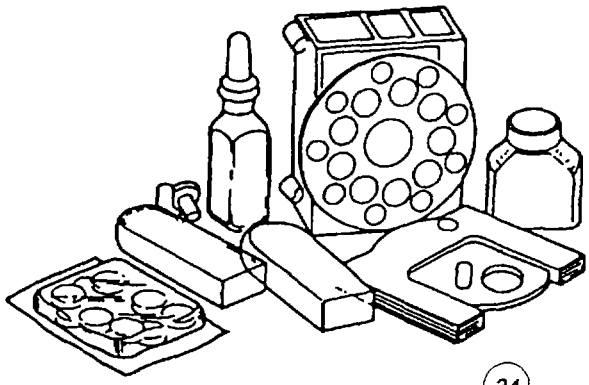




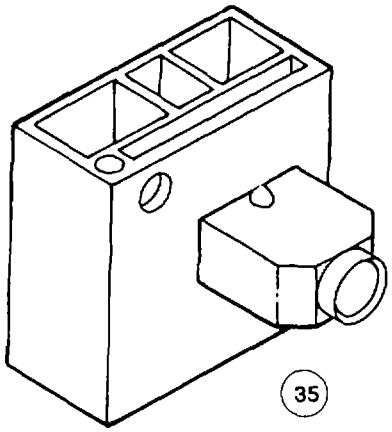




(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
30		Hose Assembly, 2 inch X 10 feet (97403)13225E9136-1		EA	2
31	4720-01-138-8986	Hose Assembly, 2 inch X 20 feet (97403)1 3225E9136-2		EA	14
32	4720-01-163-4684	Hose Assembly, 2 inch X 20 feet (97403)13225E9135-2		EA	2
33		Hypochlorination Unit		EA	2



34



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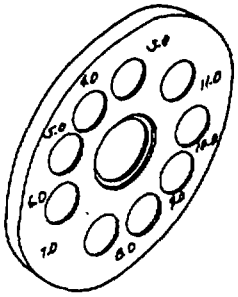

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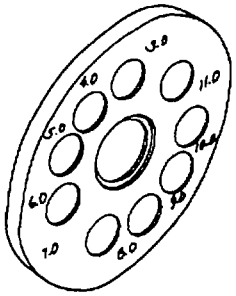

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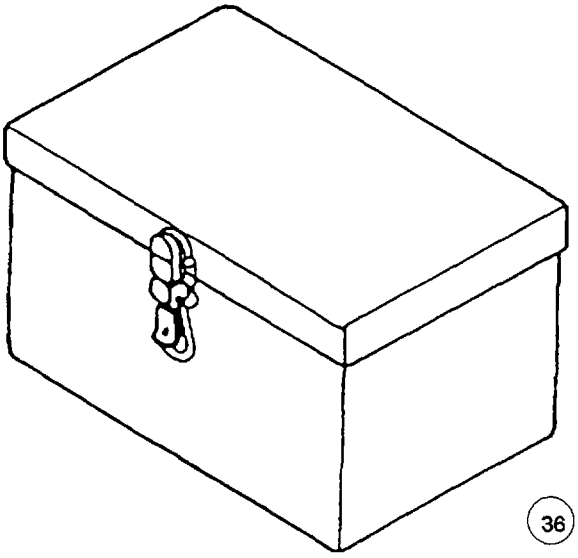
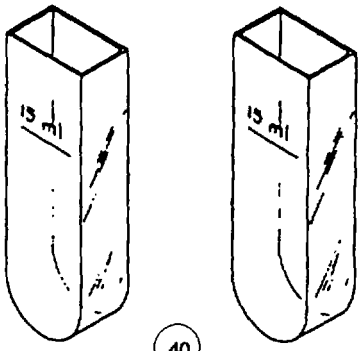


36

(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
34	6630-01-044-0334	Kit, Comparator, Color (12308) U25337		EA	2
35	6630-01-336-9215	Color Comparator (97403)13200E7400		EA	2
36		Container, Kit (97403)13216E901 6		EA	2
37		Disc, Chlorine		EA	2
38		Disc, pH		EA	2

39



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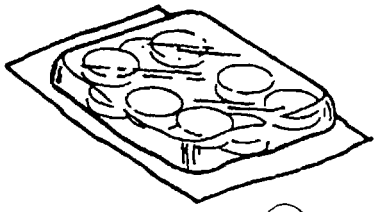

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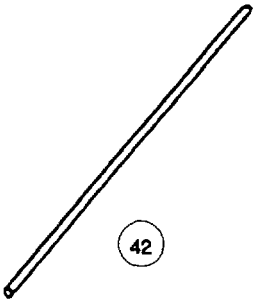
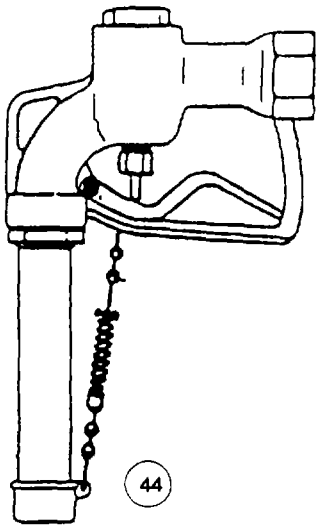
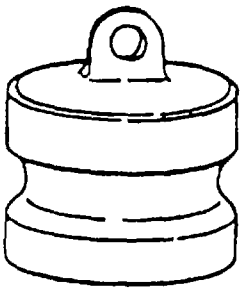


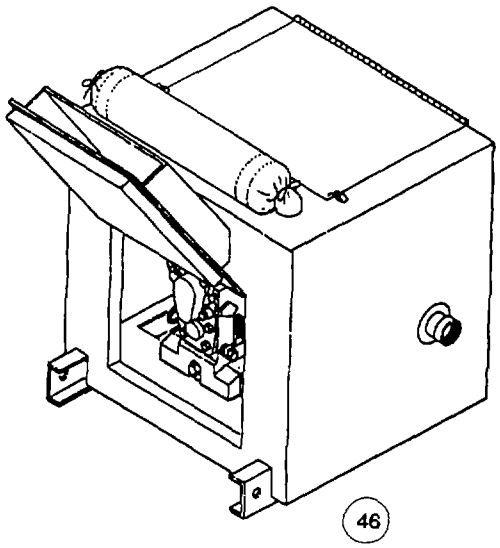
42

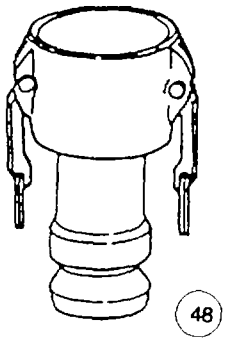
41

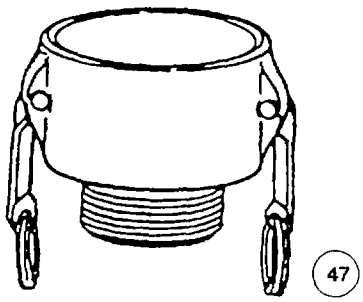
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
39		Instructions		EA	2
40		Sample Cells		EA	4
41		Solution, pH, 4 Ounce		OZ	2
42		Stirring Rod		EA	2
43		Tablets, DPD		BX	2



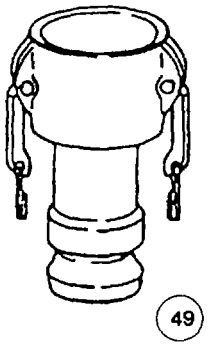


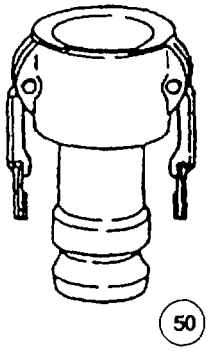


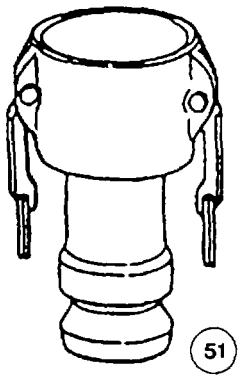


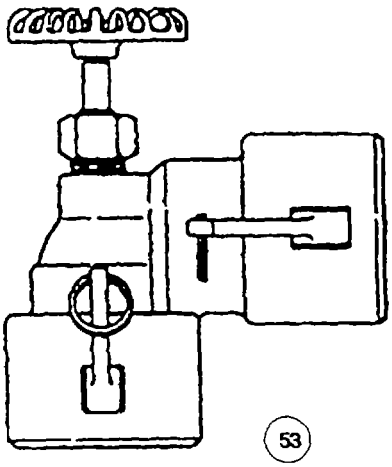


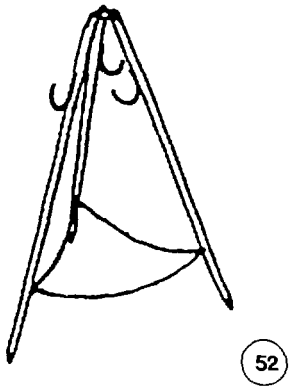
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
44	2910-01-188-8198	Nozzle, 1 1/4-inch (81718) 190-GW		EA	4
45	4730-00-915-5127	Plug, Dust, Quick-Disconnect, 200-DP (96906) MS27029-11		EA	4
		125GPM Pumping Assembly		EA	2
47	4730-01-192-1624	Coupling Half, MS49002-9 Quick-Disconnect (96906)		EA	4
48	4730-00-951-3297	Reducer, Quick-Disconnect (96906) MS49002-5		EA	4



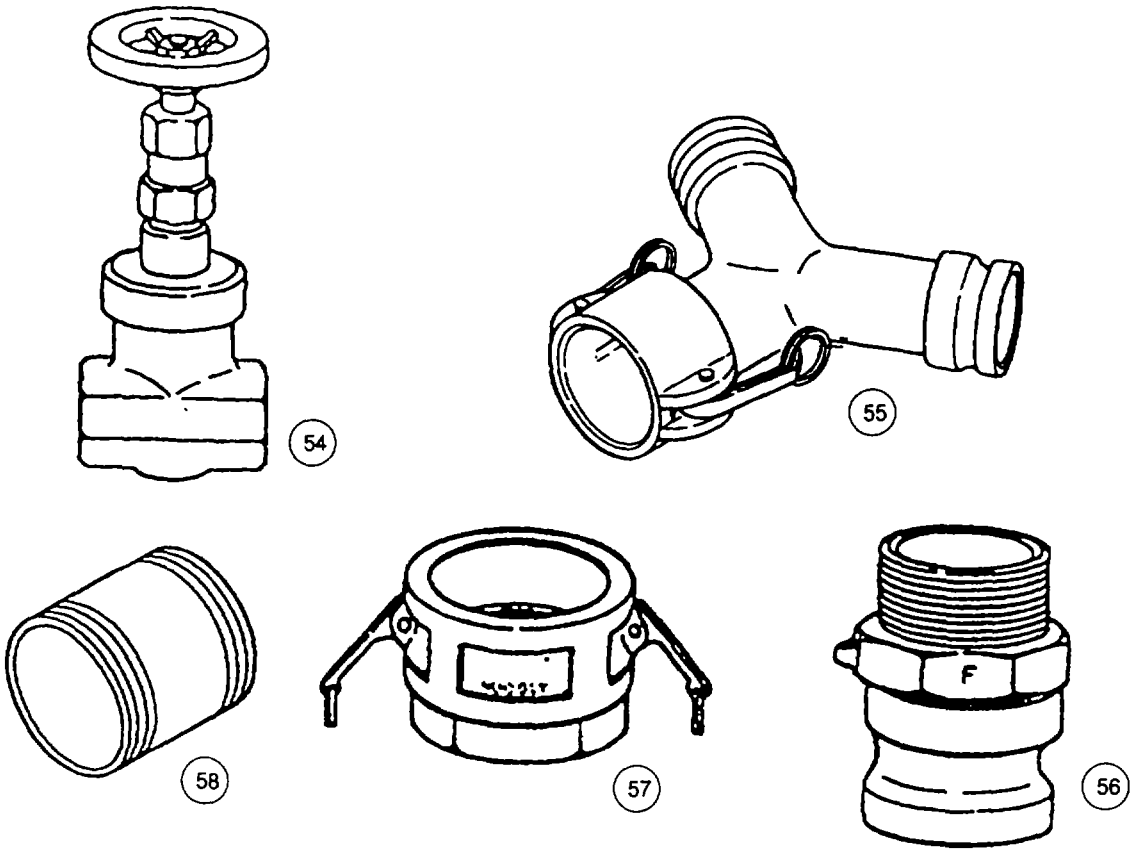




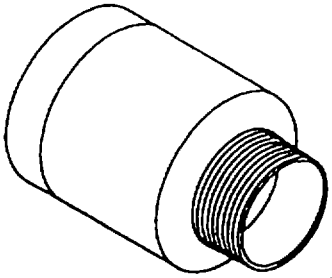




(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
49	4730-00-951-3297	Reducer, Quick-Disconnect (96906) MS49000-11		EA	2
50	4730-01-186-0821	Reducer, Quick-Disconnect (96906) MS49000-19		EA	4
51	4730-01-064-0560	Reducer, Quick-Disconnect (96906) MS49000-17		EA	4
52	4930-01-120-7426	Stand Assembly, Nozzle (97403)1 3225E91 40		EA	4
53	4820-01-167-6550	Valve, Elbow Coupler, 2 inch X 2 inch (97403)13219E0491		EA	4



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
54	4820-00-810-4250	Valve, Gate, 2-inch (82666) B120-2"		EA	4
55	4730-01-068-5070	Wye, Connection, Quick-Disconnect (81718) 319K-21N		EA	6
56	4730-00-840-0797	Coupling Half, Quick-Disconnect, Male (96906) MS27022-17		EA	2
57	4730-00-088-9286	Coupling Half, Quick-Disconnect, Female (96906) MS27024-17		EA	2
58		Nipple, 4-inch Diameter, 6-inches long (81348) WW-N-351		EA	2



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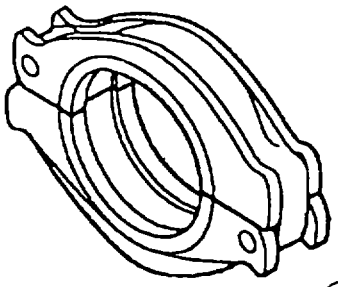

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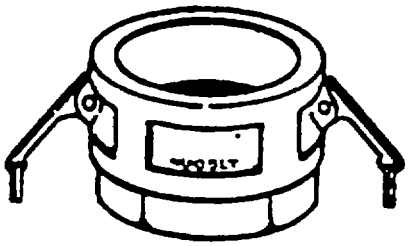

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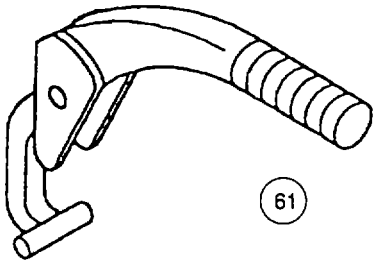
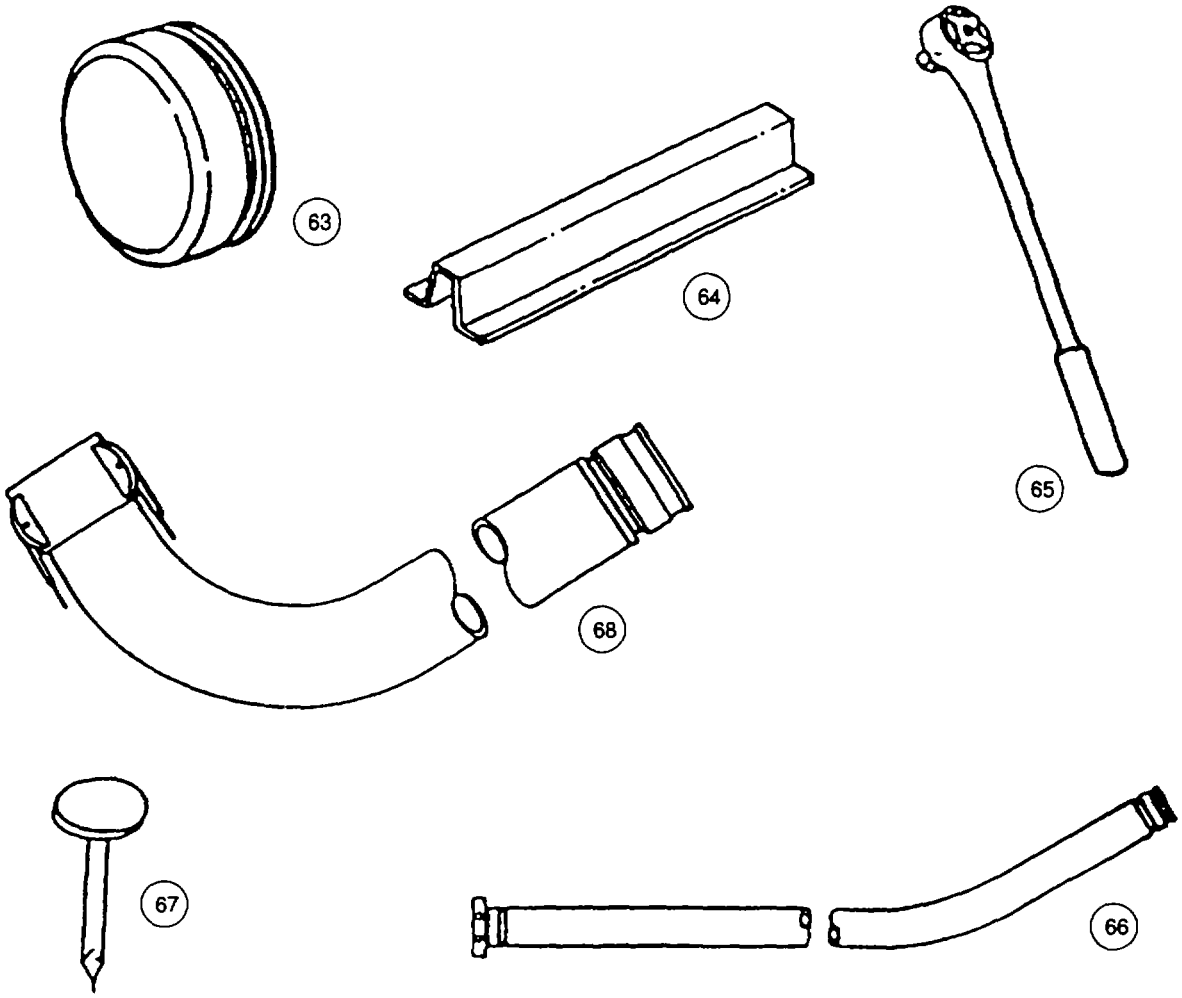
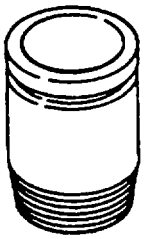


61

(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
59	4730-01-109-0790	Swivel, Hose (97403)13225E9139-3 10-MiLE HOSELINE SEGMENT		EA	4
60	4730-01-384-9332	Coupling, Clamp, 6-inch (79154) C-060-791 -A-EB		EA	15
61	5120-01-270-7428	Wrench, Spanner (79154) 792		EA	4
62	4730-01-186-0817	Coupling Half, Quick-Disconnect, Female, 6-inch (96906) MS27024-19		EA	1



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
63		End Cap, Grooved Pipe, 6-inch (81349) M 10388-A05AK1 A		EA	1
64	3835-01-187-1556	Guard, Road Crossing, 6-inch (97403)13226E1576		EA	24
65	5120-00-249-1076	Handle, Socket Wrench (77053) 9649		EA	4
66	4720-01-346-7216	Hose Assembly, Collapsible, 6 inch X 500 feet (81349) M53027-5000		EA	128
67		Nails, Steel Roofing, 1 1/2-inch (96906) MS9071 4-8B		EA	240
68	4720-01-163-4686	Hose Assembly, Suction, 6-inch X 10 feet (97403)13225E9135-6		EA	12



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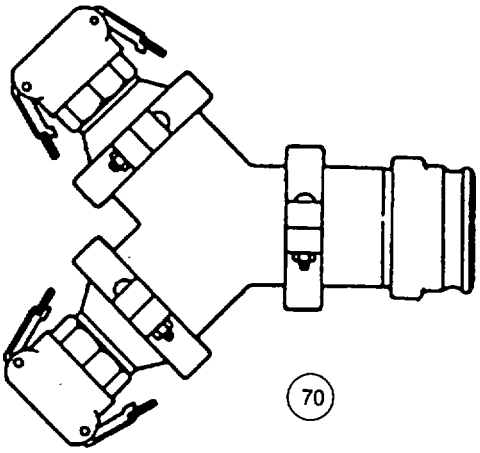

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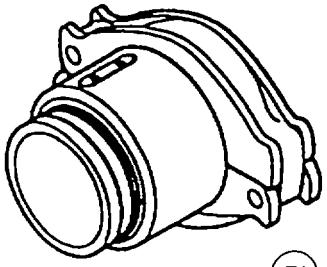
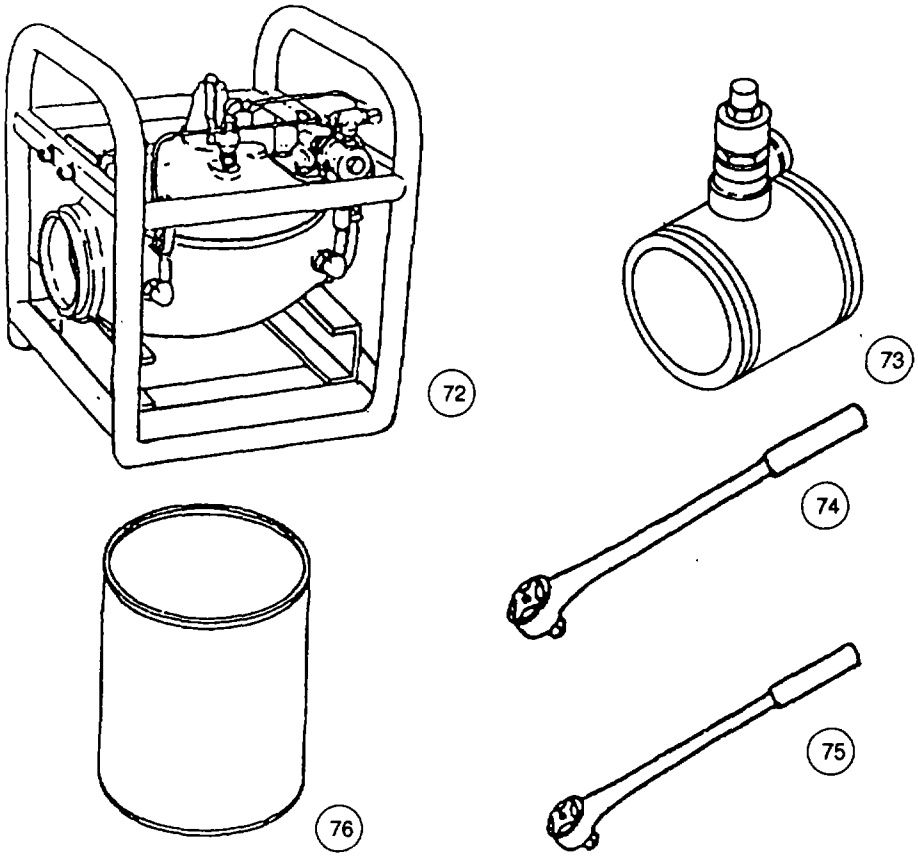
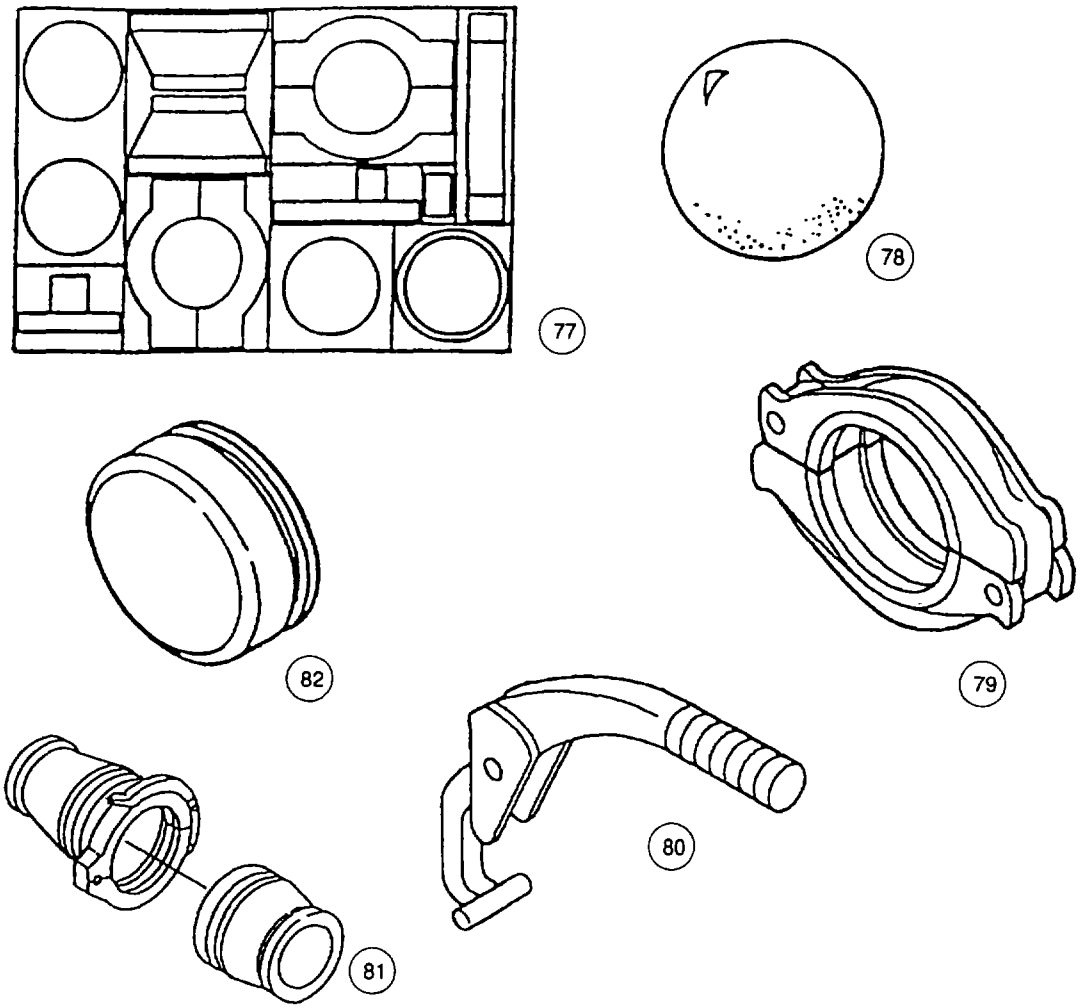


71

(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
69		Pipe Fitting, Coupling, 6-inch (81349) M10388-A-07-AK-1 -A-6A		EA	1
70		Reducer, Wye-Connection, 6 x 4 X 4-inch (97403)1 3225E9190		EA	1
71		Swivel JointAssy, 6-inch (97403)13225E9195		EA	65

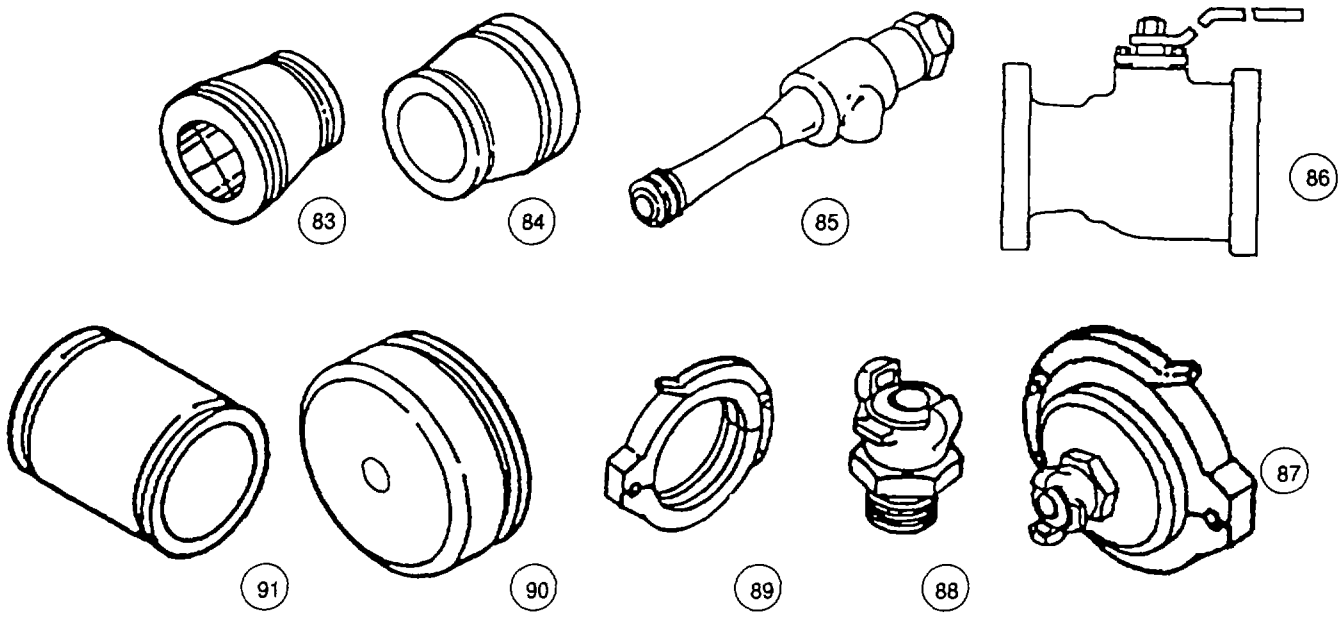


(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
72	4820-01-264-6203	Valve Assembly, Pressure-Reducing (97403)13225E9090-13		EA	1
73	4820-01-201-7138	Valve Assembly, Pressure-Relief (97403)13225E9196		EA	1
74		Wrench, Socket, 1 1/4-inch (81348) GGG-W-641, Type II, Class 2		EA	2
75		Wrench, Socket, 1 1/16-inch (81348) GGG-W-641, Type I, Class 2		EA	4
76		Lubricant, Gasket, 1-Quart Can (97403)13225E9192		EA	2



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
77	3835-01-199-4019	Displacement and Evacuation Kit (97403)13226E1 577		EA	2
78	3835-01-382-9134	Ball, Displacement,Hoseline (97403)1 3228E9872		EA	2
79	4730-01-384-9332	Coupling, Clamp, 6-inch (79154) C-060-791 -A-EB		EA	8
80	5120-01-270-7428	Wrench, Spanner (79154) 792		EA	1
81	3835-01-361-5682	Ball Receiver Assembly (97403) 13226E 1579		EA	1
82	4730-01-178-0317	Cap, Pipe, 6-inch (79154) M1 0388-A05AK1 C		EA	24

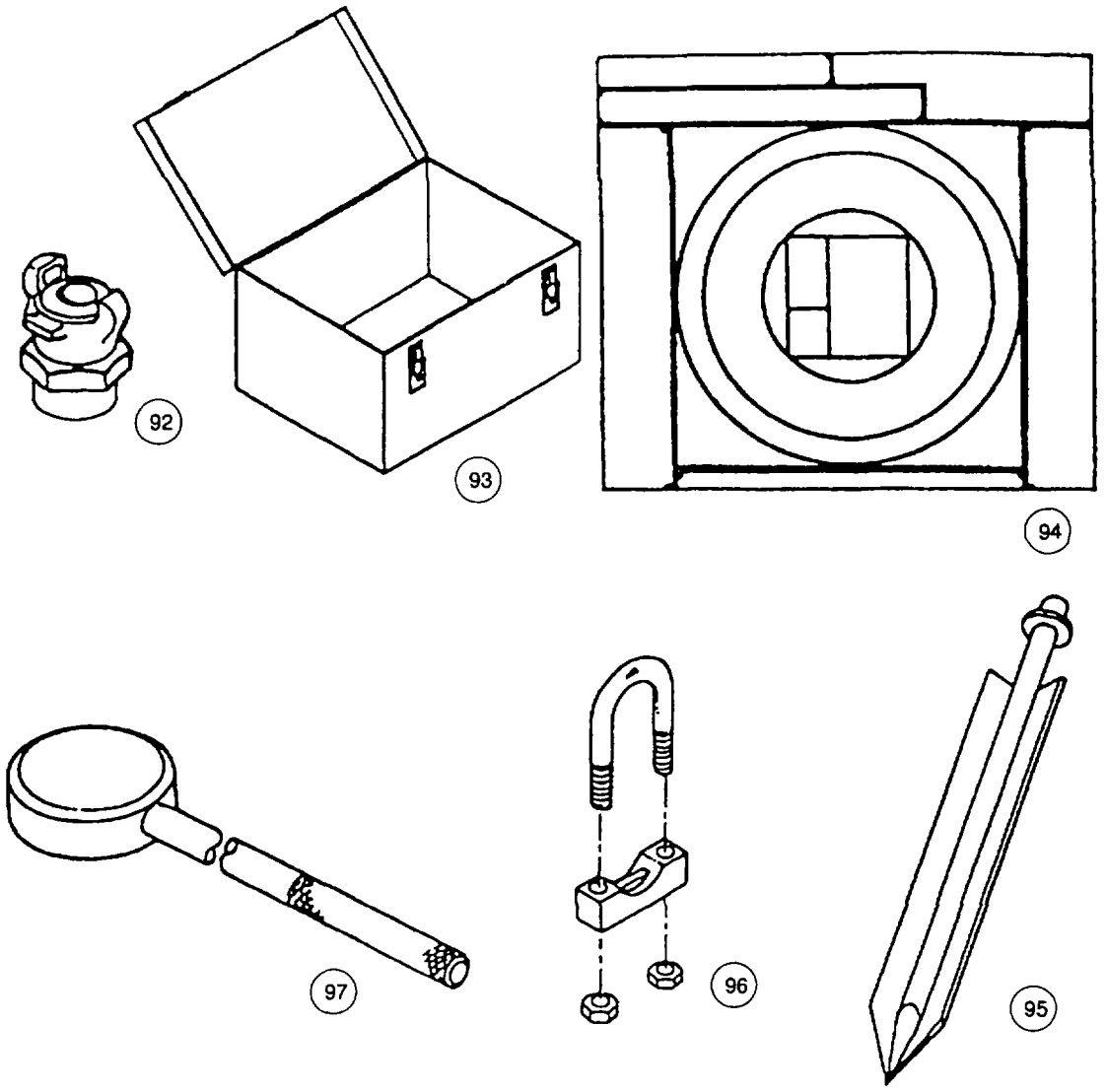
NOTE
Item 77 consists of items 78 thru 93.
Item 81 consists of items 83, 84, and 84A.



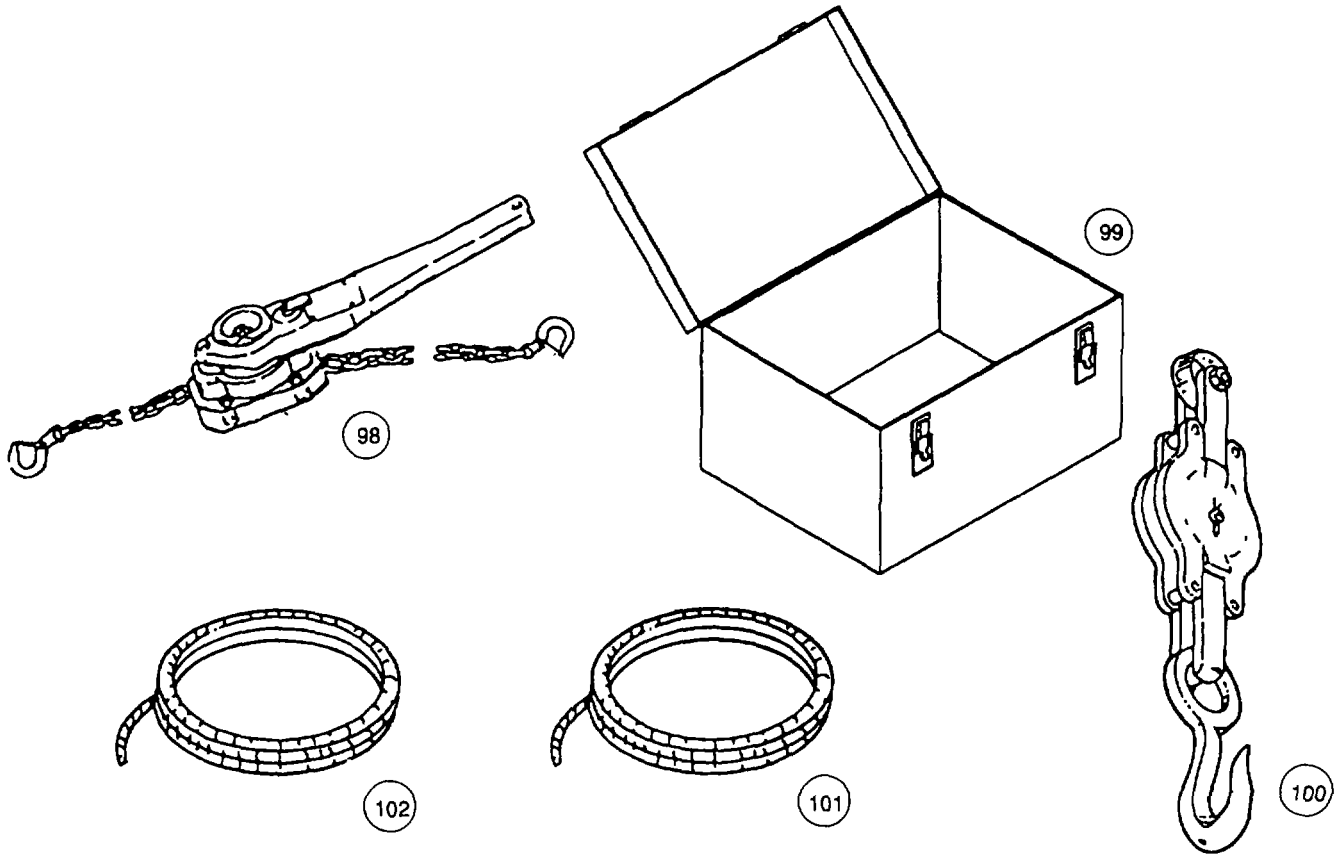
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
83		Reducer, Grooved Pipe, 8 inch x 6-inch, modified as (90598) 25116-100		EA	1
84	4730-01-350-3773	Reducer, Grooved Pipe, 8 inch x 6-inch(79154) 50A8X6		EA	2
84A	4730-01-393-9858	Coupler, Snapjoint, Pipe, 8-inch (79154) 78AX8		EA	1
85	4320-01-212-9621	Ejector Assembly(89117) GL-1		EA	2
86		Valve, Ball, 1-inch NPT (81348) WW-V-35, Type II, Comp Bz, ST3		EA	2
87	3855-01-362-2377	Ball Inlet Assembly (97403) 13225E9198		EA	1
88	4730-00-844-9014	Coupling Half, Quick-Disconnect, Pneumatic, Male, (08557) 263-931		EA	1
89	4730-01-209-4413	Coupler, Snapjoint, Pipe, 6-inch (79154) 78AX6		EA	1
90	4730-01-355-8403	Cap, Pipe, 6-inch (97403)13226E1580		EA	1
91	4730-01-322-0293	Coupling, Pipe Fitting, Grooved both ends (81349) M1 0388-A08AK1 66A		EA	1

NOTE

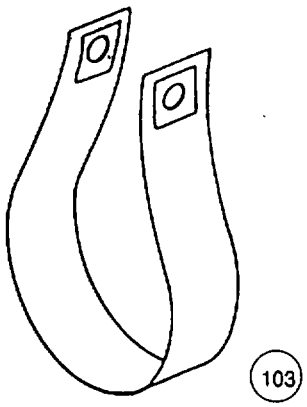
Item 87 consists of items 88, 89, and 90.

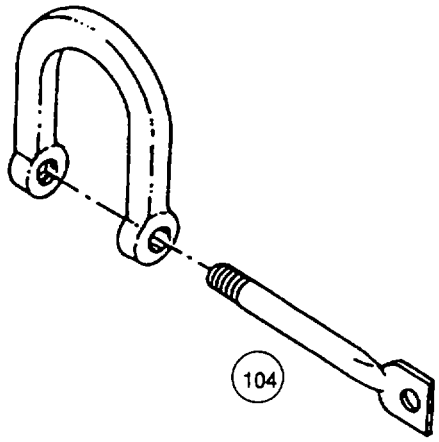


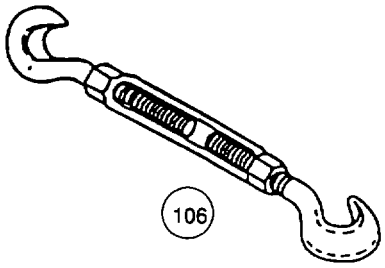
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
92		Coupling Half, Quick-Disconnect, Pneumatic Female, (08557) 302-589		EA	2
93		Kit, Chest, Metal (63317)100-04-011		EA	1
94	3835-01-195-1901	Suspension Kit, Hoseline, 6-inch (97403) PD-82099		EA	5
95	4030-01-206-5035	Stake, Guy (97403)13225E9188		EA	14
96	4030-00-243-4440	Clamp, Wire Rope (96906) MS16842-7 TY1 CL2		EA	25
97	3820-01-359-0869	Stake, Driving Head (97403)13225E9189		EA	1
		NOTE **Item 94 consists of items 95 thru 106.**			

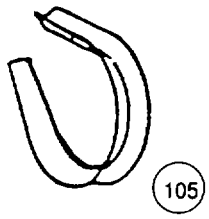


(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
98	3820-01-359-0869	Hoist (5V588) CM637		EA	1
99		Kit Chest, Metal (81348) PPP-B-636		EA	1
100		Snatch Block (81348) GGG-B-490 Type II, Single Sheave		EA	4
101	4020-00-763-5599	Rope, Manila, 1/2 inch X 300 feet (81349) T-R-605, Type M, Class 2		EA	1
102	4010-00-542-2257	Rope, Wire (81349) RR-W-410, Type 1, Class 2		EA	1

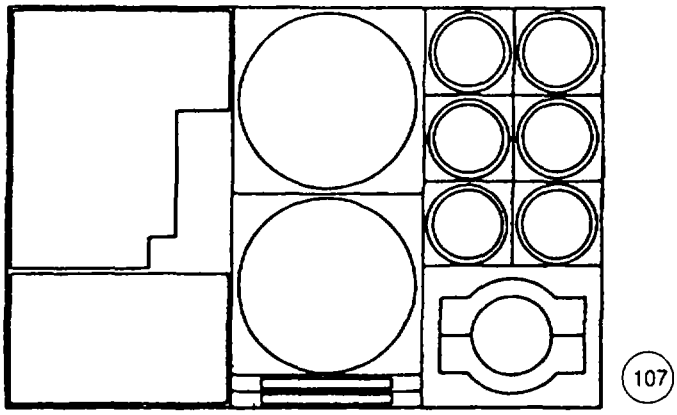


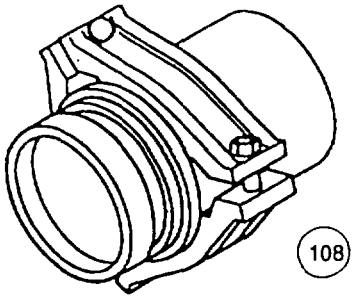


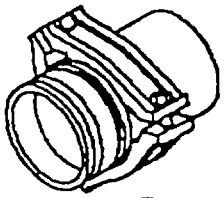


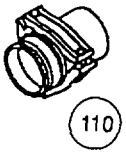


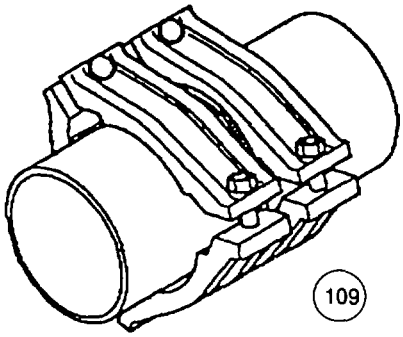
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
103	4730-01-333-1899	Saddle, 6-inch (97403)13226E1570		EA	60
104		Shackle, 1/2-inch (81349) RR-C-271, Type IV, Class 2		EA	60
105		Thimble, Wire Rope, 1/2-inch (81349) FF-T-276, Type II		EA	4
106		Turnbuckle, 1/2 inch X 12 inches (81349) FF-T-791, Type 1, Form 1, Class 5		EA	4





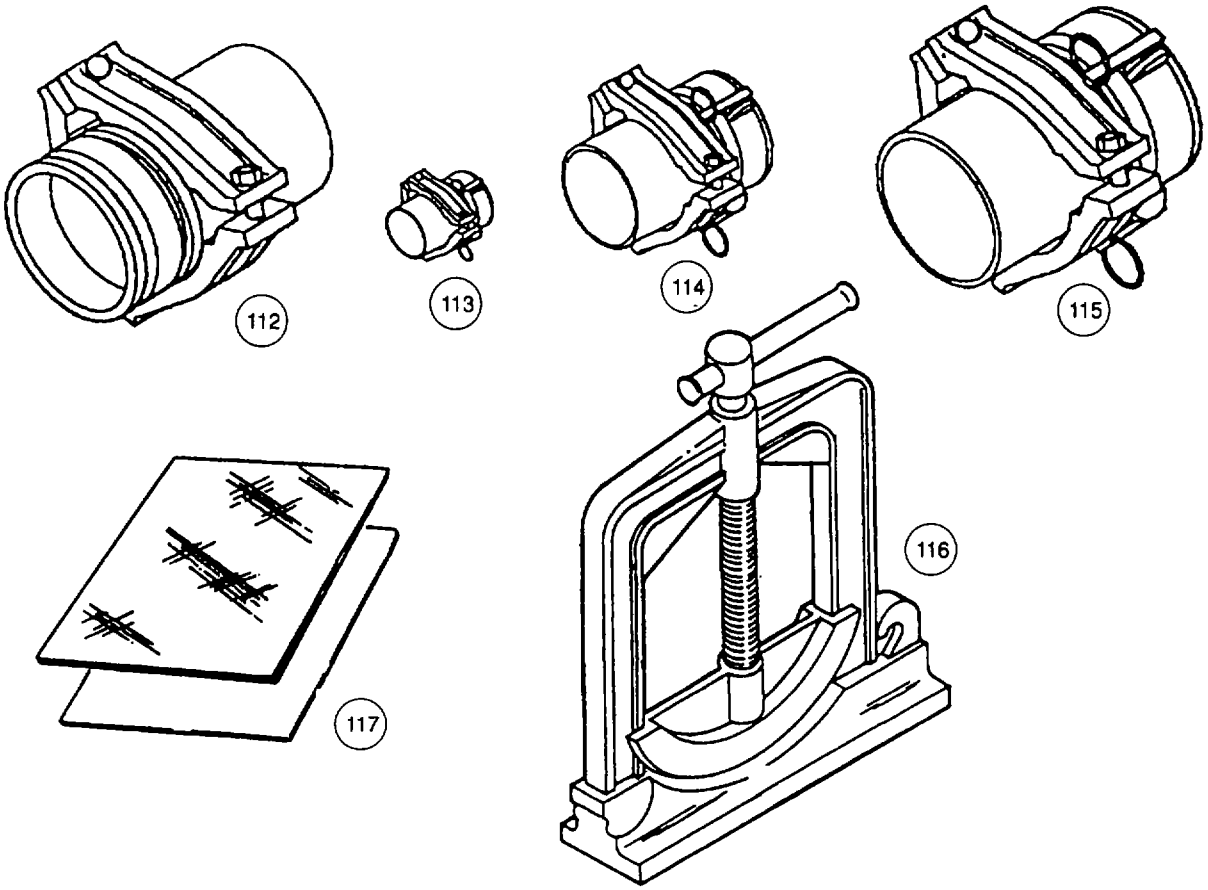




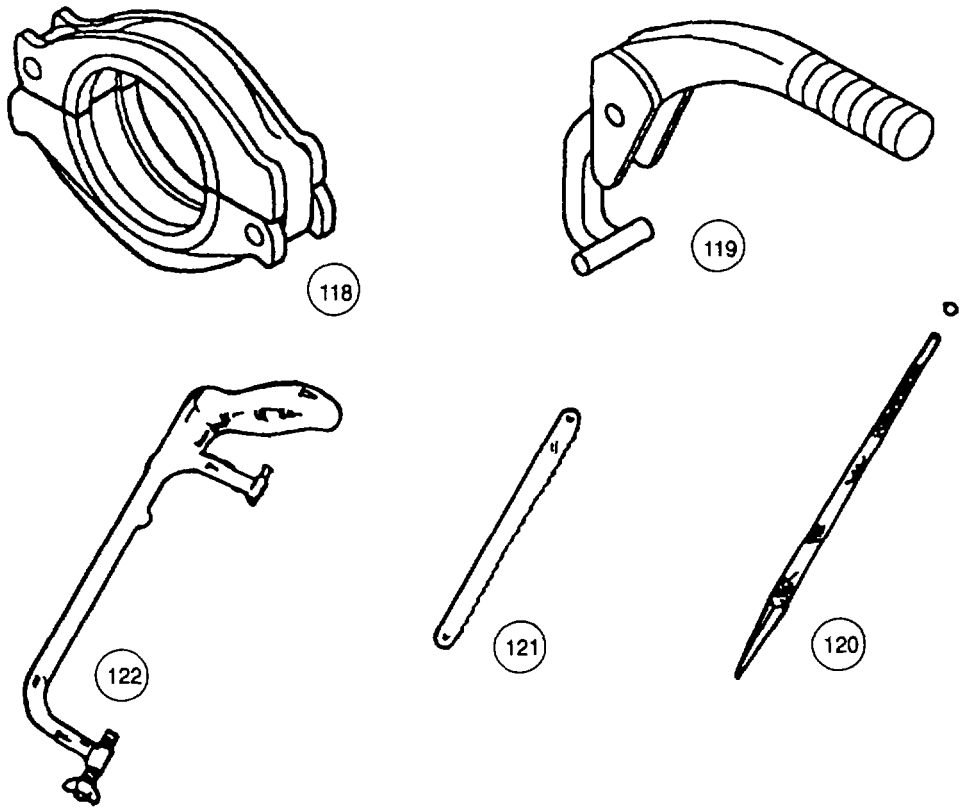


(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
107	4730-01-199-4016	Repair Kit, Hoseline (97403)13226E1581		EA	1
108		Hose Adapter Assembly, Grooved End, 6-inch (79154) C060480AEO		EA	30
109		Hose Mender Assembly, Grooved End, 6-inch (79154) C060482AEO		EA	6
110		Adapter Assembly, Hose, Male, 2-inch (79154) C020483AEO		EA	2
111		Adapter Assembly, Hose, Male, 4-inch (79154) C040483AEO		EA	2

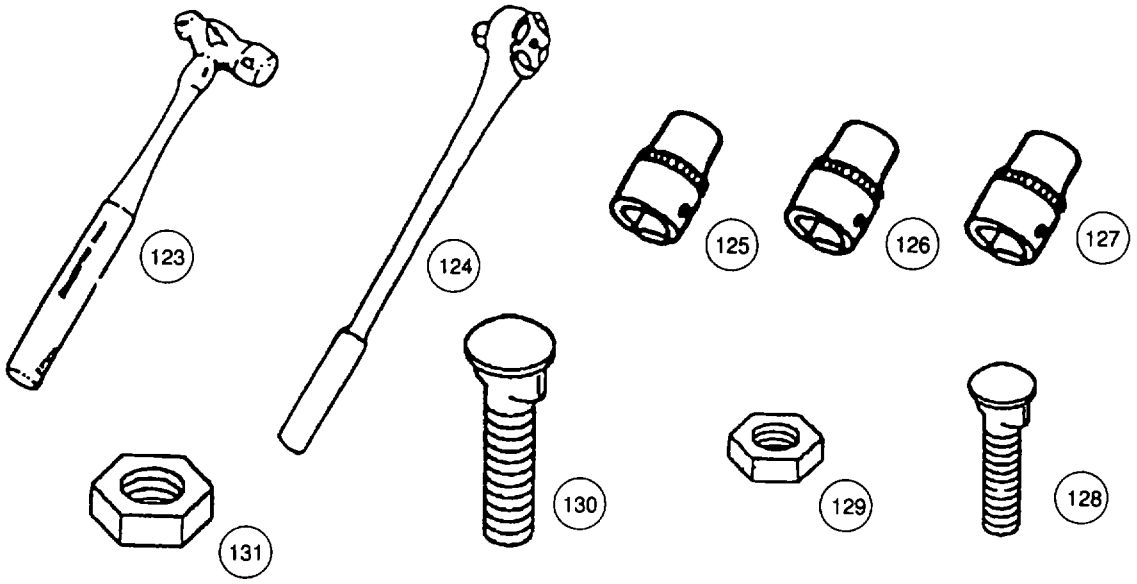
NOTE
Item 107 consists of items 108 thru 138.



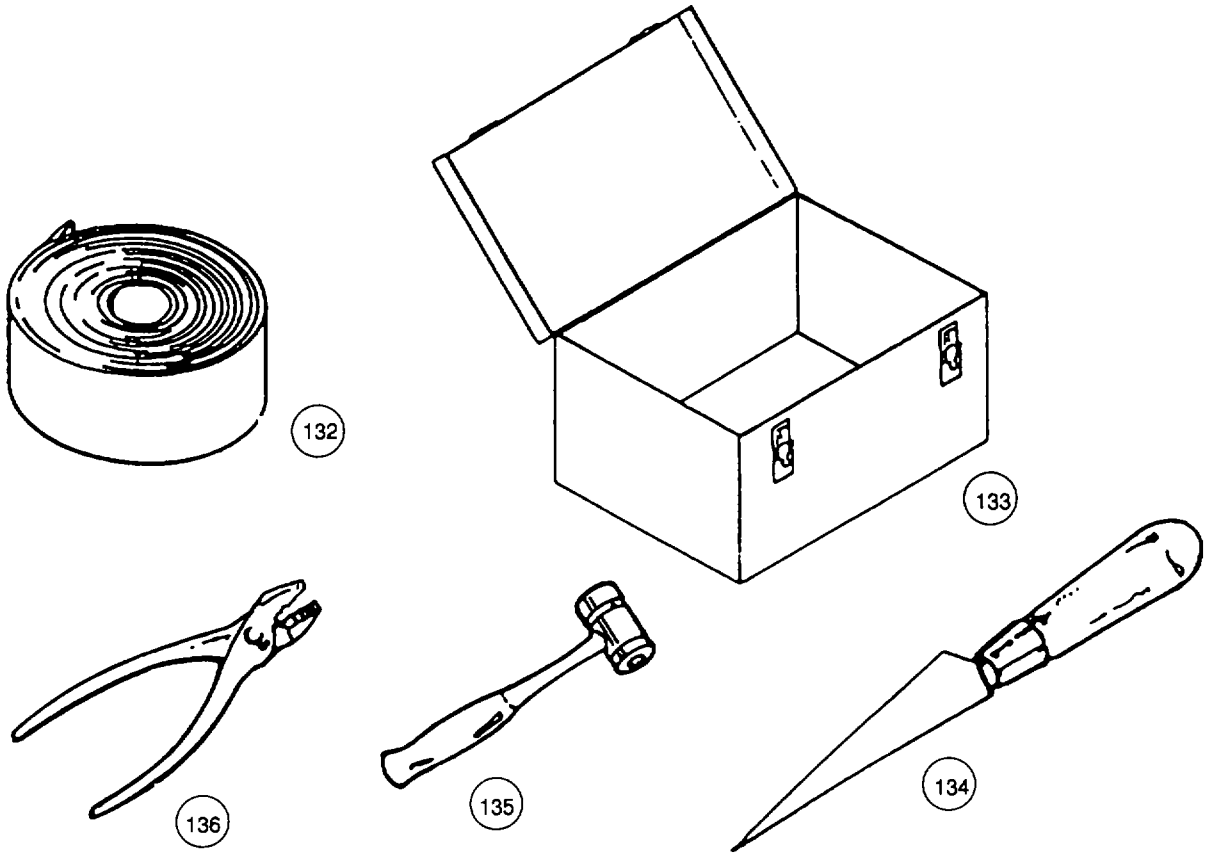
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
112		Adapter Assembly, Hose, Male, 6-inch (79154) C060483AEO		EA	2
113		Adapter Assembly, Hose, Female, 2-inch (79154) C020484AEO		EA	2
114		Adapter Assembly, Hose, Female, 4-inch		EA	2
115		Adapter Assembly, Hose, Female, 6-inch (79154) C060484AEO		EA	2
116	4730-01-359-7166	Clamp, Hose 6-inch (97403) 13226E1581-15		EA	2
117	5350-00-584-4654	Cloth, Abrasive (06565) EMERYCLOSEKOTE		EA	3



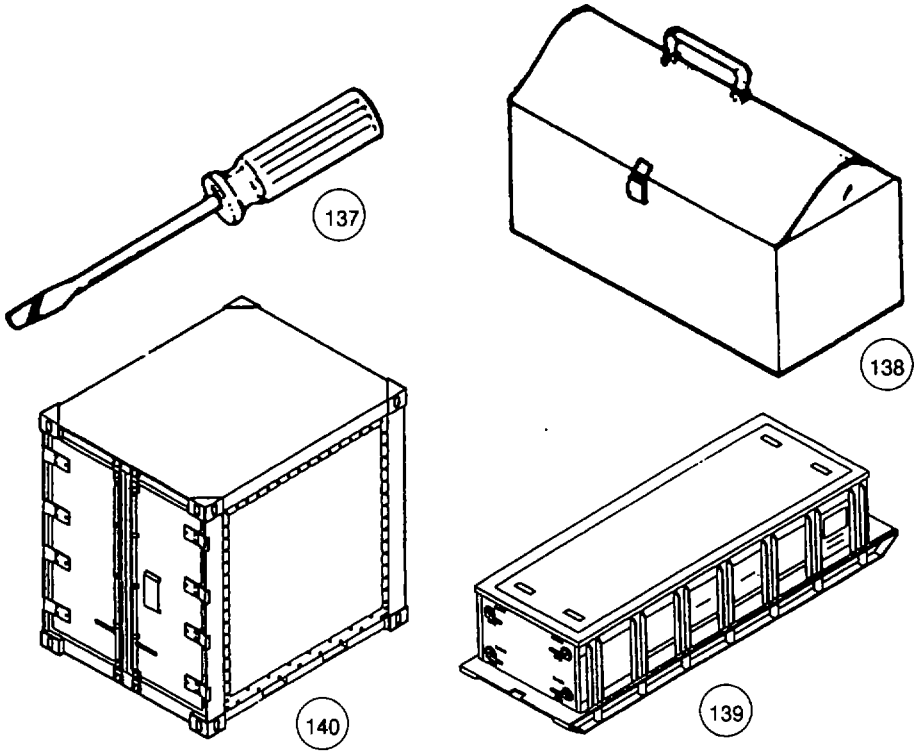
(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
118	4730-01-384-9332	Coupling, Clamp, 6-inch (79154) C-060-791-A-EB		EA	3
119	5120-01-270-7428	Wrench, Spanner (79154) 792		EA	1
120	5110-01-390-6334	File, 1/2 round, 8-inch (43786) 00136		EA	1
121		Hacksaw Blade, 1 O0-inch (78735) 00-106		EA	10
122		Hacksaw Frame, Adjustable (03914) 70-865		EA	1



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
123		Hammer, Ball-Peen, 6-inch (39428) 5855A15		EA	1
124	5120-00-287-4152	Handle, Socket Wrench 3/4-inch Drive (39485) 547A51		EA	1
125		Wrench, Socket, 3/4 drive, 12 point, 1.25 opening (81348) GGG-W-641, TY II, CL 2, STY A		EA	1
126		Wrench, Socket, 9/16,12 point, 3/4 drive (81348) GGG-W-641, TY II, CL 2, STY A		EA	5
127		Wrench, Socket, 11/16,12 point, 3/4 drive (81348) GGG-W-641, TY II, CL 2, STY A		EA	5
128		Bolt, Track Head, 9/16-inch (81346) ASTM A-449		EA	5
129		Nut, Hex, 9/16-inch (81346) ASTM A-1449		EA	5
130		Bolt, Track Head, 11/16-inch (81346) ASTM A-449		EA	20
131		Nut, Hex, 11/16-inch (81346) ASTM A-449		EA	20



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
132		Hose, Rubber, 6 inch x 15 feet (19099) 53027-15AR		EA	2
133		Kit, Chest, Metal (63317)100-04-011		EA	1
134	5110-01-390-1772	Knife, Rubber Cutting, 8 x 1 inch (29891) 60870		EA	1
135		Mallet, Rubber, 32 ounce (03914) 69-490		EA	1
136		Pliers, Linesmans (81348) GGG-P-00471 D-1		EA	1



(1) Illus NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
137		Screwdriver, 6 1/2-inch (63317)100-10-003		EA	1
138	5140-01-248-2692	Tool Box, Metal (75206) K-20/20		EA	1
139	5430-01-352-1397	Tank, Water Chest (90598) 22000-601		EA	1
140		Tricon		EA	

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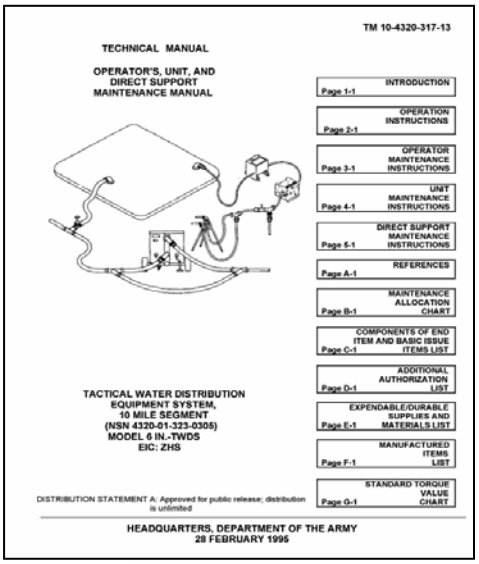
Section III. BASIC ISSUE ITEMS

1



2

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DISCRIPTION CAGEC AND PART NUMBER USABLE ON CODE	(4) U/M	(5) QTY RQR
1		OPERATOR'S, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL FOR TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM, 10 MILE SEGMENT, TM-10-4320-317-13	EA	1
2		UNIT AND DIRECT SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST FOR TACTICAL WATER DISTRIBUTION EQUIPMENT SYSTEM,10 MILE SEGMENT, TM 10-4320-317-23P	EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. **SCOPE**. This appendix lists additional items you are authorized for the support of the TWDS.

D-2. **GENERAL**. This list identifies items that do not have to accompany the pumping assembly and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. **EXPLANATION OF LISTING**. National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name.

Section II. ADDITIONAL AUTHORIZATION LIST

(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER USABLE ON CODE	(4) U/M	(5) QTY RQR
7240-00-827-5694	Pail, Utility, 1-Gallon (45044) 300-100	EA	2
5120-00-277-1481	Wrench, Pipe, Handle Length Large (81348) GGG-W-651	EA	2
4310-01-158-3262	Compressor, Rotary, Air, DED, 250 cfm, 100 psi, Trailer Mounted, (33968) P/N P250W-D-M-H268	EA	1

APPENDIX E

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. **SCOPE**. This appendix list expendable supplies and materials you will need to operate and maintain the TWDS. This listing is for informational purposes 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.

E-2. **EXPLANATION OF COLUMNS**.

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., faceshield, Item 4, Appendix E).

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item.

C - Operator or 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 item.

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 Commercial and Government Entry Code (CAGEC) in parentheses followed by the part number.

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, GL, PR). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE/DURABLES SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	8415-01-333-4158	Apron, Chemical (63531) 96-074	PG
2	C	6810-00-255-0472	Calcium Hypochlorite Powder (81348) O-C-114	DR
3	C	6550-01-285-0796	Chlorine Test, Reagent (4E712) R-0001C	BT
4	F	5350-00-221-0872	Cloth, Abrasive (81348) P-C-458	PK
5	C	8415-01-112-1885	Gloves, Chemical (79371) 36-124	EA
6	C		Lubricant, Gasket, Potable Water System (19853)13225E9192	CN
7	C	6810-00-664-1622	pH Indicator Solution (81349) MIL-T-17412	OZ
8	C	7920-00-205-1711	Rags, Wiping (58536) A-A-2522	BE
9	C	6850-00-285-8011	Solvent, Dry Cleaning, Type 2 (81348) P-D-680	DR
10	C	8030-00-889-3535	Tape, Anti-seizing (81349) MIL-T-27730	EA (SPOOL)

APPENDIX F

MANUFACTURED ITEMS LIST

None authorized.

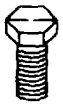
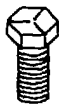
APPENDIX G

STANDARD TORQUE VALUE CHART

FASTENER	TYPE	MIN. TENSILE STRNGN.	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER OF FASTENER													
				2	3	4	5	6	8	10	1/4	1/10	1/8	1/16	1/2	5/16	3/8	3/4
	SAE 0-1-2	74,000 PSI	LOW CARBON STEEL								6	12	20	32	47	69	96	155
	SAE 3	100,000 PSI	MEDIUM CARBON STEEL								9	17	30	47	69	103	145	234
	SAE 5	120,000 PSI	MEDIUM CARBON HEAT TREAT STEEL								10	19	33	54	78	114	154	257
	SAE 6	133,000 PSI	MEDIUM CARBON STEEL QUENCHED TEMPERED								12.5	24	43	69	106	150	209	350
	SAE 7	133,000 PSI	MEDIUM CARBON ALLOY STEEL								13	25	44	71	110	154	215	360
	SAE 8	150,000 PSI	MEDIUM CARBON ALLOY STEEL								14	29	47	78	119	169	230	380
	SOCKET HEAD CAP SCREW	160,000 PSI	HIGH CARBON CASE HARDENED STEEL	TORQUE VALUES: All figures are foot-pounds except those marked with an asterisk (*), which are inch-pounds.							16	33	54	84	125	180	250	400
	SOCKET SET SCREW	212,000 PSI	HIGH CARBON CASE HARDENED STEEL					9*	16*	30*	70*	140*	18	29	43	63	100	146
	MACHINE SCREW YELLOW BRASS	60,000 PSI	COPPER (CU) 63% ZINC (ZU) 37%	2*	3.3*	4.4*	6.4*	8*	16*	20*	65*	110*	17	27	37	49	78	104
	SILICONE BRONZE TYPE "B"	70,000 PSI	COPPER (CU) 96% ZINC (ZNI) 2% SILICON (51) 2%	2.3*	37*	49*	7.2*	10*	19*	22*	70*	125*	20	30	41	53	88	117

There is no difference in the above chart between the torque figures for fine or coarse threads. The torque figures for a finely-threaded fastener as compared to a coarsely-threaded fastener of the same diameter may be slightly higher but hardly worth mentioning.

STANDARD TORQUE VALUE CHART - (Cont)

FASTENER	TYPE	MIN. TENSILE STRNGN.	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER OF FASTENER												
				7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3
	SAE 0-1-2	74,000 PSI	LOW CARBON STEEL	206	310	480	675	900	1100	1470	1900	2360	2750	3450	4400	7350	9500
	SAE 3	100,000 PSI	MEDIUM CARBON STEEL	372	551	872	1211	1624	1943	2660	3463	4695	5427	7226	8049	13450	17548
	SAE 5	120,000 PSI	MEDIUM CARBON HEAT TREAT STEEL	382	587	794	1105	1500	1775	2425	3150	4200	4550	6550	7175	13000	16000
	SAE 6	133,000 PSI	MEDIUM CARBON STEEL QUENCHED TEMPERED	550	825	1304	1815	2434	2913	3985	5189	6980	7491	10825	14983	20151	26286
	SAE 7	133,000 PSI	MEDIUM CARBON ALLOY STEEL	570	840	1325	1825	2500	3000	4000	5300	7000	7500	11000	15500	21000	27000
	SAE 8	150,000 PSI	MEDIUM CARBON ALLOY STEEL	600	900	1430	1975	2650	3200	4400	5650	7600	8200	12000	17000	23000	29000
	SOCKET HEAD CAP SCREW	160,000 PSI	HIGH CARBON CASE HARDENED STEEL	640	970	1520	2130	2850	3450	4700	6100	8200	8800	13000	18000	24000	31000
	SOCKET SET SCREW	212,000 PSI	HIGH CARBON CASE HARDENED STEEL														
	MACHINE SCREW YELLOW BRASS	60,000 PSI	COPPER (CU) 63% ZINC (ZU) 37%	160	215	325	400		595								
	SILICONE BRONZE TYPE "B"	70,000 PSI	COPPER (CU) 96% ZINC (ZNI) 2% SILICON (SI) 2%	180	250	365	450		655								

There is no difference in the above chart between the torque figures for fine or coarse threads. The torque figures for a finely-threaded fastener as compared to a coarsely-threaded fastener of the same diameter may be slightly higher but hardly worth mentioning.

GLOSSARY

Section I. ABBREVIATIONS

AAL	Additional Authorization List
BII	Basic Issue Item
cm	Centimeters
COEI	Components of End Item
CPC	Corrosion Prevention Control
DA	Department of the Army
EIR	Equipment Improvement Recommendation
fpt	Female Pipe Thread
GPM	Gallons Per Minute
IAW	In Accordance With
in	Inches
kg	kilogram
kPa	kilopascals
l	liters
lb	pounds
LO	Lubrication Order
m	meter
mm	millimeter
MTOE	Modified Table of Organization and Equipment
N•m	Newton meter
NSN	National Stock Number
Pam	pamphlet
ppm	parts per million
psi	pound-force per square inch
psig	pound-force per square inch gage
para	paragraph
RPSTL	Repair Parts and Special Tools List
SMR	Source, Maintenance, and Recoverability
TAMMS	The Army Maintenance Management System
TM	Technical Manual
TMDE	Test, Measurement, and Diagnostic Equipment
TOE	Table of Organization and Equipment
TWDS	Tactical Water Distribution Equipment System Set 10-Mile Segment
UOC	Usable on Code
°C	degrees Celsius
°F	degrees Fahrenheit

Section II. DEFINITION OF UNUSUAL TERMS

Hoseline Packing	-	filling of hoseline with water.
Hypochlorination	-	injection of large concentrations of chlorine into water for purification purposes.
Hypochlorination Unit	-	a mechanical assembly used to inject large concentrations of chlorine into potable water.
Pumping Assembly	-	Pumping Assembly, Water, 600 GPM, Trailer Mounted
125 GPM Pump	-	Centrifugal Pump Unit, Water, 125 GPM

ALPHABETICAL INDEX

Subject, Para

Subject, Para

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GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
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5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub no:*** 10-4320-345-13
9. ***Pub Title:*** TM
10. ***Publication Date:*** 11-APR-88
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19. ***Paragraph:*** 3
20. ***Line:*** 4
21. ***NSN:*** 5
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23. ***Figure:*** 7
24. ***Table:*** 8
25. ***Item:*** 9
26. ***Total:*** 123
27. ***Text:***
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PUBLICATION/FORM NUMBER	DATE	TITLE
TM 10-4320-317-13	28 February 1995	Tactical Water Distribution Equipment System, 10 Mile Segment, Model 6IN-TWDS

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*

**Reference to line numbers within the paragraph or subparagraph.*

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PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER TM 10-4320-317-13	DATE 28 February 1995	TITLE Tactical Water Distribution Equipment System, 10 Mile Segment, Model 6IN-TWDS

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

USAPPC V3.00

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)* AMSTA-LC-LPIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	FROM: *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*

**Reference to line numbers within the paragraph or subparagraph.*

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DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPPC V3.00

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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

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

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 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

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 acres
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 feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
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	metric tons	short tons	1.102
pound-feet	newton-meters	1.356	kilograms	pounds	2.205
pound-inches	newton-meters	.11296			

Temperature (Exact)

ºF Fahrenheit temperature 5/9 (after subtracting 32) ºC Celsius temperature

PIN: 073634-000