TECHNICAL MANUAL

OPERATOR, UNIT, AND INTERMEDIATE DIRECT SUPPORT

MAINTENANCE MANUAL

[INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST]

TACTICAL PETROLEUM TERMINAL

MODEL WBEI-10002

NSN 3835-01-182-1976

Approved for public release; distribution is unlimited

HEADQUARTERS, DEPARTMENT OF THE ARMY
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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONTINUED)

LIST OF ILLUSTRATIONS (CONTINUED)

ILLUSTRATED PARTS BREAKDOWN

CHAPTER 1 - INTRODUCTION

OVERVIEW

The scope and use of this manual are described in Section I. Section II generally describes the operation of a typical Tactical Petroleum Terminal (TPT). Detailed instructions are covered in subsequent chapters. Important safety precautions are summarized in Section III.

SECTION I SCOPE OF MANUAL

1-1 Description of Coverage

This manual covers the installation, operation, and maintenance of a typical single Tactical Petroleum Terminal. Included are comprehensive parts lists cross-referenced to the NSN and military specifications, when applicable. U.S. Army and manufacturers' technical manuals are referenced when appropriate. The combination of information will permit the installation, operating, and support organizations to perform their functions effectively. It is emphasized that the instructions and data are for a typical terminal rather than a specific terminal for a certain site. Recommended criteria on site selection and layout is included. Modification may be necessary for specific sites as determined by qualified authorities responsible for the actual site selection, installation, and operation. Information to assist in modification decisions is included. The relationship to an associated pipeline system servicing the terminal is covered in general terms. Technical data regarding associated pipeline systems are covered in other technical manuals for those specific systems.

1.2 How to Use the Manual

1-2.1 General. It is recommended that users of the manual first review its entire content. Areas of specific interest can then be studied in detail. The Table of Contents, List of Figures, and List of Tables at the front of the manual clearly describe its structure and content. Most subject descriptions are covered in logical order in the Table of Contents. If a specific subject cannot be located in the Table of Contents, refer to the Alphabetical Index at the back of the manual. It is noted that most drawings and illustrations are included in Chapter 2 and that it is often necessary to refer back to these when concerned with installation, operation and maintenance. Required technical information is either in the manual or reference is made to other identified technical manuals or data published by the Government or the original manufacturer of the equipment. When references are made, it is most important that the reference noted be studied thoroughly.

1-2.2 Equipment Names. There are a number of different names for equipment used in various Government documents and by various Government groups. The names in this manual may not match up exactly to the name normally used by the reader. Table I-1 cross references the name used in this manual to the various Government names observed or heard.

1-2.3 Terminology. If certain abbreviations and terminology used in this manual are not fully understood, refer to the Glossary and List of Abbreviations at the back of the manual.

TABLE 1-1

EQUIPMENT NAME
CROSS REFERENCE

EQUIPMENT NAME IN THIS MANUAL	EQUIVALENT GOVERNMENT EQUIPMENT NAMES
5000 Bbl Fabric Collapsible Tank	5000 Bbl BFTA Tank, Fabric, Collapsible, 5000 Bbl Bulk Fuel Tank, Fabric, Collapsible, 5000 Barrel Petroleum Tank, Fabric, Collapsible, POL 210,000 Gallon
50,000 Gal. Fabric Collapsible Tank	Tank, Fabric, Collapsible, POL, 50,000 Gallon Tank, Fabric Collapsible, 50,000 Gallon Petroleum
600 Gpm Hoseline Pump (Wheel-Mounted)	Pumping Assembly, Diesel Engine Driven, Self-Priming, Centrifugal, 600 gpm at 150 psi Pumping Assembly, Hoseline, Diesel-Engine Driven Centrifugal, 600 gpm at 150 psi. 6-inch Hoseline Pump, Bulk Liquid Distribution System
350 Gpm Transfer Pump (Wheel-Mounted)	Pump Assembly, 350 gpm, 275 ft. head POL, (81349) MIL. P-52144 Pumping Assembly, Diesel Engine Driven, Wheel Mounted, 350 gpm, 275 ft. head, Model 13220E 1070 (97403) (Fuel Use Only) NSN 4320-01-141-3551

TABLE 1-1

EQUIPMENT NAME CROSS REFERENCE (continued)

EQUIPMENT NAME IN THIS MANUAL	EQUIVALENT GOVERNMENT EQUIPMENT NAMES
1250 Gpm Flood and Transfer Pump (Skid-Mounted)	Pumping Assembly, Diesel Engine Driven, Self-Priming Centrifugal, 1250 gpm at 180 feet total head Flood and Transfer Pump, Petroleum Distribution System Pumping Assembly, Flood and Transfer Diesel Engine Driven, Centrifugal, 1250 gpm at 180 feet total head
Filter Separator	Filter-Separator, Liquid Fuel, Frame Mounted, 350 gpm capacity
Fuel Dispensing Assembly	Fuel Dispensing Kit
Optional Tank Configuration	50,000 Gal. Tank TPT Option

SECTION II - GENERAL INFORMATION

1-3 Purpose and Theory of Operation

A Tactical Petroleum Terminal is a facility designed and packaged in such a way that it can be rapidly erected at most any location for the receipt, storage, and dispensing of liquid fuels, specifically diesel, motor gasoline, and aviation jet fuel. Fuels can be received from a pipeline or from tanker trucks. The TPT can dispense fuels directly to user vehicles or to fuel transport vehicles, or return fuel to the pipeline for downstream distribution. The facility can be disassembled and moved to another location or returned to an equipment storage facility.

1-4 Primary Components of a TPT

The primary components of a single typical TPT, arranged in the order of the project's Components List, are:

1-4.1 One (1) Switching Manifold consisting of aluminum pipe, valves, and fittings.

1-4.2 Three (3) Tanker-Truck Receipt Manifolds consisting of hose, valves, and fittings.

1-4.3 Three (3) Fuel Dispensing Assemblies consisting of:

a. Six (6) Filter Separators (two (2) each assembly)

b. Hose, valves, and fittings (one (1) lot each assembly)

1-4.4 Three (3) Transfer Hoseline Assemblies consisting of hose, valves, and fittings (one (1) lot each)

1-4.5 Three (3) Tank Farm Primary Modules consisting of:

a. Six (6) 5000 bbl fabric collapsible tanks (two (2) each module)

b. Six (6) 600 gpm hoseline pumps (two (2) each module)

c. Hose, valves, fittings (one(1) lot each module)

1-4.6 Six (6) Tank Farm Secondary Modules consisting of:

a. Twelve (12) 5000 bbl fabric collapsible tanks (two (2) each module)

b. Six (6) 600 gal hoseline pumps (one (1) each module)

c. Hose, valves, and fittings (one (1) lot each module)

1-4.7 One (1) Sampling Assembly

1-4.8 One (1) Contaminated Fuel Module consisting of:

a. Two (2) 50,000 gal. fabric collapsible tanks

b. One(1) 350 gpm transfer pump

c. Hose, valves and fittings

1-4 Primary Components of a TPT - Cont'd.

1-4.9 Nineteen (19) Fire Suppression Sets including equipment and clothing

1-4.10 Twenty (20) Roadway Crossing Guards

1-4.11 One(1)Testing Kit

1-4.12 Six (6) Flood Light Sets

1-4.13 One (1) Optional Tank Configuration consisting of:

a. Six (6) 50,000 gal. fabric collapsible tanks

b. Hose, valves and fittings

1-4.14 Three (3) 600 Gpm Hoseline Pumps (for tanker-truck receipt manifold or utility use)

1-4.15 Seven (7) Meter Strainer Assemblies (for use in intake system and at fuel dispensing)

1-4.16 Miscellaneous Government supplied ancillary, and utility items not detailed herein and not supplied as part of NSN 3835-01-182-1976 but necessary for effective operations.

1-4.17 Communications facilities are specified and supplied by the Government and are outside the scope of supply under NSN 3835-01-182-1976. Communications procedures an communication facility operation are as specified by the Government and are not covered in this manual.

1-5 General Configuration and Arrangement

The primary components listed in paragraphs 1-4 through 1-4.16 are arranged and installed in such a way as to make up a functional TPT. Fig. 1-1 at the end of this chapter schematically represents a single TPT. The details of design, specification and structure are covered in Chapter 2. The reader may refer forward to the Piping and Instrument Diagram (P&ID), contained in Chapter 2, Fig. 2-1, for a better understanding; however, it will be described and referred to in detail in Chapter 2 and subsequent chapters. The following is a general overview of the TPT;

1-5.1 A standard configuration TPT is composed of eighteen (18) 5000 Bbl fabric collapsible tanks, twelve (12) 600 gpm hoseline pumps, seven (7) meter-strainers, three (3) fuel dispensing sets including six (6) filter- separators, the associated piping, hose, valves, and fittings and support equipment, and ancillary equipment. Optional configurations are outlined under para.'s 1-5.9 and 1-5.10.

1-5.2 Each standard configuration TPT may be arranged into three (3) separate Fuel Units, one for diesel, one for motor gasoline, and one for jet fuel. If desired for certain or some other combinations of service conditions, two or all three Fuel Units may be designated for the same fuels. Each Fuel Unit consists of six (6) 5000 bbl fabric collapsible tanks arranged in three (3) modules; two (2) secondary modules, and one (1) primary module; a fuel dispensing set, and a transfer hoseline set connecting the switching manifold.

1-5.3 A Tank Farm, Secondary Module, consists of two (2) 5000 bbl fabric collapsible tanks, one (1) 600 gpm hoseline pump, and the associated hose, valves, and fittings.

1-5 General Configuration and Arrangement - Cont'd.

1-5.4 A Tank Farm, Primary Module, consists of two (2) 5000 bbl fabric collapsible tanks, two (2) 600 gpm hoseline pumps, and the associated hose, valves, and fittings.

1-5.5 A Fuel Dispensing Assembly, including two (2) filter-separators, is tied in to each Fuel Unit.

1-5.6 Each Fuel Unit is connected to the switching manifold through the Transfer Hoseline Assembly. The switching manifold is tied into the pipeline system and an optional tanker truck receipt manifold when called for. Discharge hoses from the fuel units, part of the transfer hoseline assembly, normally connect to the associated pipeline system. The configuration of the switching manifold may vary with site condition and the specific service requirements. A single switching manifold may connect two or more TPT's under some conditions.

1-5.7 Meter Strainer Assemblies are installed in the intake transfer hoseline and in the hoseline to the fuel dispensing assembly.

1-5.8 A Sampling Assembly is installed in the header from the associated pipeline system feeding the switching manifold. The Testing Kit is used to test samples taken.

1-5.9 When required, three Tanker-Truck Receipt Manifolds, utilizing up to three (3) 600 gpm hoseline pumps available for this purpose can be installed.

1-5.10 An Optional Tank Configuration involving up to six (6)50,000 gallon fabric collapsible tanks can be tied in in lieu of a 5000 Bbl fabric collapsible tank or as supplemental storage capacity as dictated by specific site conditions and service requirements.

1-5.11 A Contaminated Fuel Module consisting of two (2) 50,000 gallon fabric collapsible tanks, a 350 gpm transfer pump, and the associated hose, valves and fittings is normally installed to receive and load out off-specification or slop fuels received from the associated pipeline.

1-5.12 Spare pumps or pumping capacity for special fuel transfers can be obtained by utilizing the 600 gpm hoseline pumps covered in para. 1-5.9 above or by utilizing the 1250 gpm flood and transfer pumps normally supplied with the associated pipeline system.
(NOTE: Six (6) 1250 gpm flood and transfer pumps are supplied for Area 8, NSN 3835-01-182-1977.)

1-5.13 Fire Suppression Set equipment is located throughout the facility.

1-5.14 The Floodlight Sets are set up to supply lighting in the operating areas.

1-5.15 Roadway Crossing Guards are installed wherever necessary to have hose lines cross roadways.

1-5.16 Equipment is normally installed over an expansive area for fire-protection purposes.

A berm or firewall is constructed around each fabric collapsible tank to contain any spills.

1-5 General Configuration and Arrangement - Cont'd.

1-5.17 The design Storage Capacity of a TPT is summarized as follows:

Standard Configuration

Three (3) Fuel Units @ 30,000 Bbl ea.	90,000 Bbl	3,780,000 Gal.
Six (6) Optional Tanks @ 50,000 Gal. ea.	7.143 Bbl	300.000 Gal.
* Total Maximum Capacity	97,143 Bbl	4,080,000 Gal.

* Excludes two 50,000 Gal. Contaminated Fuel Storage Tanks

1-5.18 The maximum design operating pressures for the TPT components and transfer systems are:

Equipment - 150 psig (except fabric collapsible tanks)
Fabric collapsible tanks - liquid level static head plus 0.10 psig
Valves, fittings, and discharge hose - 150 psig (except dispensing assembly)
Suction hose - 100 psig (normally subjected only to static head pressure)
Dispensing assembly - 75 psig (much lower operating pressure recommended, see para. 4-16.5h)

1-6 General Operations

Detailed operating instructions are covered in Chapter 4. The following paragraphs briefly describe what can be done.

1-6.1 Receive fuel from the associated pipeline through the switching manifold directly to any one of the fabric collapsible tanks. Normal practice is to receive fuel into the secondary module tanks.

1-6.2 Receive fuel from tanker-trucks through the optional tanker-truck receipt manifold and the switching manifold directly to any of the fabric collapsible tanks within the applicable fuel unit.

1-6.3 Transfer fuel from any tank within a fuel unit to another tank in the same fuel unit.

1-6.4 Discharge fuel through the dispensing assembly from any tank within the fuel unit. Normal practice for purposes of quality control is to discharge fuel to the dispensing assembly from a primary module tank.

1-6.5 Discharge fuel from any tank in the fuel unit to the associated pipeline.

1-6.6 In the case of systems involving the installation of multiple TPT's at the same location, fuel can be transferred from one TPT to another via the associated pipeline and switching manifolds. See the technical manuals for the specific area involved.

1-6.7 Discharge fuel from any tank within a fuel unit to any tank in another fuel unit within the same TPT. Although this can be done, consideration must be given to contamination due to the dedicated nature of fuel units and the switching manifold. This would normally be considered only in the case of the entire TPT being dedicated to the handling of a single type of fuel, a peculiar storage problem, or an emergency situation.

SECTION III- SAFETY SUMMARY

1-7 General

Safety is such an important part of Tactical Petroleum Terminal operations the subject is summarized here to draw the reader's attention to what are considered to be the most important points. Safety is emphasized further throughout this manual. It is important that, operating personnel be safety conscious and watch for things that might cause injury to themselves, to others, or to the equipment.

1-8 Safety on Specific Equipment

Safety precautions regarding specific equipment and systems will be noted throughout this manual. It is mandatory that personnel associated with the installation, operation or maintenance of specific pieces of equipment also study the safety section of the technical manuals issued by the U.S. Army or the manufacturer of that particular piece of equipment and abide by the safety instructions therein. These technical manuals and literature are listed in the Appendix D.

1-9 Fire Prevention vs. Fire Suppression

All petroleum fuels are flammable and under certain conditions explosive. Fire prevention is eliminating or avoiding conditions that could result in a fire or explosion and is covered in this safety summary. Fire suppression is containing and extinguishing fires once they start.

Fire suppression is covered in Chapter 4, paragraphs 4-6.0 through 4-6.4 and the reader is urged to review that section carefully as well as all other paragraphs concerning safety and fire. Fire prevention warnings will also be noted at various points throughout this manual.

1-10 Specific Safety Hazards

In the following listing of what are considered to be the most important safety hazards, the: heading **WARNING** indicates immediate danger to personnel. **CAUTION** indicates danger of damaging equipment. Damaged equipments can in turn be dangerous to personnel. These warnings and cautions plus others will also be covered in other sections of this manual in an effort to emphasize the importance of safety.

1-10.1

WARNING

NO SMOKING

Allow no smoking within 100 ft. of any facility or device storing or handling petroleum fuels. Erect " No Smoking" signs to this effect.

1-10.2

WARNING

VEHICLE ENGINES OFF
WHEN FILLING VEHICLE WITH FUEL

Vehicle engines must be shut down when filling the vehicle with fuel to minimize the risk of fire or explosion.

1-10 Specific Safety Hazards - Cont'd.

1-10.3

WARNING

GROUNDING

All equipment, devices, machinery, hoses and piping must be grounded to avoid static electricity discharge. When loading or filling vehicles, make sure the fuel dispensing system is grounded. If a grounding strap is present and intact, connect it to the vehicle frame. Touch the fill nozzle against the vehicle's metal prior to opening the filling valve to discharge any static charge before fuel vapor is present, if grounding strap is not there for some reason.

1-10.4

WARNING

DISCONNECT VEHICLE FROM HOSELINES

Make sure hoselines are disconnected from vehicles at loading and unloading stations before vehicle is moved.

1-10.5

WARNING

LIQUID FUEL ACCUMULATION

The accumulation of liquid fuel, or hot lubricating oil is a fire hazard. Wipe and wash down such areas or surfaces promptly. Dispose of any wiping rags in an area removed from the fuel storage or handling areas. Apply no smoking rules within 100 ft. of any fuel accumulation.

1-10.6

WARNING

FUEL SATURATED SOIL

Fuel saturated soil is a fire hazard. Do not allow unnecessary personnel in the area. Do not allow smoking within 100 ft. of the area. Wash down the area thoroughly with water until the evidence of fuel is gone. A detergent in with the water will help disperse the fuel.

1-10.7

WARNING

LIQUID FUEL LEAKS

Promptly correct any fuel leakage that causes an accumulation of fuel on any surface. If it cannot be corrected safely while in operation, shut down and make corrections to stop the leak. Make a list of any minor leaks that cannot be corrected in operation and make repairs at the first shut down opportunity.

1-10.8

WARNING

EYE INJURY

Liquid petroleum fuels will cause severe irritation if in contact with eyes. Always wear safety goggles when doing work that might result in getting fuel in the eyes. This is particularly necessary when drawing samples. If eyes are subjected to the fuel, flush and wash them promptly and thoroughly with fresh water. Warm water is preferable.

1-10.9

WARNING

CHEMICAL BURNS

Liquid petroleum fuels can cause chemical burns or severe skin irritation. Some people are more susceptible than others. Be safe wear approved gloves and long sleeves when the possibility of getting fuels on bare skin exists. This is particularly necessary when drawing samples. When fuels do come in contact with skin wash with soap and water as soon as possible.

1-10.10

WARNING

NOISE - HEARING DAMAGE

Areas near diesel engine-driven pumps have a high noise level. Wear ear protection devices to avoid temporary or possibly permanent hearing damage.

1-10.11

WARNING

HOT ENGINE PARTS

Engine parts, particularly the exhaust system, can be very hot and cause severe burns. Do not touch until engine is shut down and cooled off. Avoid spilling fuel or oil on hot engine parts which could result in a fire.

1-10.12

WARNING

HYDROCARBON FUMES

In addition to being potentially explosive, hydrocarbon fumes are dangerous to a person's respiratory system and can cause illness and potentially death. Certain weather conditions may amplify the accumulation of fumes. Persons who must enter areas suspected of fumes must wear goggles and breathing devices. If not absolutely necessary to enter such an area for overriding safety reasons, it should be cleared of fumes first. Always have other personnel standing by to assist the person who must enter the area.

1-10 Specific Safety Hazards - Cont'd.

1-10.13

WARNING

EXHAUST FUMES

The pumps in this system are operated by diesel engines. Exhaust fumes can cause illness and death. Pump engines must not be operated in an enclosed area unless action has been taken to direct the fumes outside and all exhaust manifold leaks have been eliminated. Good ventilation in such an enclosure is absolutely mandatory.

1-10.14

WARNING

MOVING PARTS

Engines and pumps have fast moving parts that can damage hands, feet etc. Take special care while in operation.

1-10.15

WARNING

HOSE WHIP

Weight down free hose ends and loops with sand bags. Leave hose in fuel dispensing area in a relatively straight stretched-out condition rather than coiled or tangled. Hose may tend to move rapidly or whip when pressure changes and can injure personnel.

1-10.16

WARNING

CLEAN OPERATING AREAS

Keep operating areas cleaned up and picked up. Remove any unnecessary equipment, trash, large rocks etc. Such can be tripped over during the rush of operation and cause personal injury.

1-10.17

WARNING

FUEL AIR MIXTURES

Any mixture of fuel vapor or fuel droplets in air is potentially explosive. Air in contact with a fuel surface is potentially explosive or as a minimum flammable. Treat such conditions as hazardous and eliminate the cause immediately.

1-10.18

WARNING

DISASSEMBLING FLANGES & COUPLINGS

Always be sure that piping or hose systems and the associated equipment are depressured before breaking (disassembling) flanges and couplings for changing configurations or for maintenance. This is to avoid injury to personnel and to avoid causing a fire hazard.

1-10.19

WARNING.

MAJOR TANK SPILLS

If a major spill occurs due to tank overflow or breakage, or hose breakage, do not go inside the tank berm or firewall until the accumulation has been removed and managing supervision approves entry. Special fire protection precautions must be taken under these conditions. Fire suppression equipment should be concentrated in the area.

1-10.20

WARNING

Make sure that the systems from which the TPT is receiving fuel, or to which the TPT is transferring fuel, are incapable of overpressuring the TPT hose and valve system which is rated at 150 psig. Overpressure can result in a serious failure, causing personnel. injury and fire.

1-10.21

WARNING

OVERFILL OF FABRIC COLLAPSIBLE TANKS

The fabric collapsible tanks are designed primarily for static liquid head pressure only. The tank vents are set at 0.10 psig and are incapable of passing large volumes of liquid.

Overfilling will result in a spill through the vent and can, if filling under pressure, result in overpressure and a tank rupture, causing a major and dangerous spill.

1-10.22

WARNING

CLEAR TANK VENTS

Make sure tank vents are always clear and clean. A plugged tank vent can cause damage to the fabric tank. Make sure pressure relief feature is operating.

1-10.23

WARNING

MAJOR SPILLS

Major spills can be caused by tank, line, or hose breaks or by operating error. When a major spill occurs, isolate the area and take action to contain the spill if it is outside a tank berm or firewall. Pump or otherwise get the spilled liquid into an appropriate transportable tank and dispose of it outside the operating area.

1.10.24

CAUTION

VEHICLE DAMAGE TO HOSE AND EQUIPMENT

Install well-covered roadway crossing guards to prevent vehicles from damaging hose.
Ensure adequate traffic control procedures in operational areas so that accidental damage to hoses, berms, tanks and other equipment does not occur.

1-10.25

CAUTION

DAMAGED, PIPE, FITTINGS, VALVES

Damaged pipe, fittings, and valves must be inspected by a qualified person immediately and removed from service if damage is severe enough to justify it. When a pipe, fitting or valve shows a visible crack or substantial leakage stop operations immediately and remove the equipment from service.

1-10.26

CAUTION

CUT OR SCORED HOSE

Consider cut, scored or badly deformed hose to be unsuitable for service. Replace at first possible opportunity. Broken or leaking hose must be depressured and replaced immediately. Failure to do so can result in a failure of operations at an inappropriate time and in the creation of a severe fire hazard.

1-10.27

CAUTION

DAMAGED FABRIC TANKS

Damaged fabric tanks must be removed from service and repaired or replaced promptly. Failure to do so can result in a major spill.

1-10.28

CAUTION

SHARP ROCKS OR OBJECTS

Sharp rocks or objects should be removed from the operating area to prevent damage to hose. They must be removed from the tank pad area within the tank berm to avoid damaging the fabric tank. Damage to hose or tanks can cause severe spills.

1-10.29

CAUTION

TANK BERMS

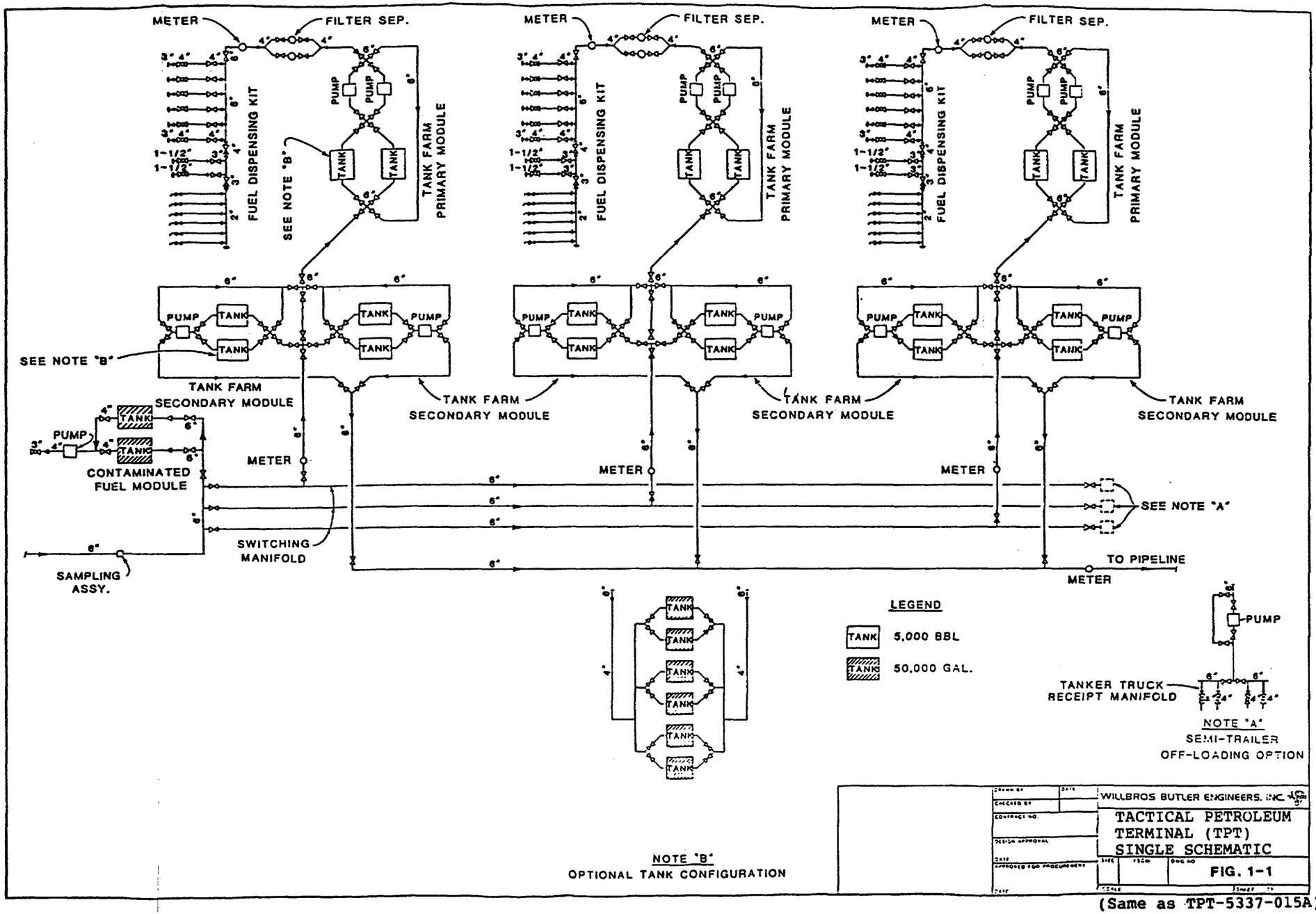
Tank berms must be kept in good repair. Integrity of the berms is necessary to contain a tank spill and isolate the resultant fire hazard to a single, relatively small area.

1-10.30

CAUTION

ELECTROLYTIC CORROSION

At various and numerous locations aluminum pipe and fittings are in contact with ferrous metals such as the malleable iron coupling clamps. The aluminum adjacent to the ferrous metal should be inspected routinely for evidence of electrolytic corrosion. If corrosion is causing leakage or if pitting or metal loss is in excess of 1/16 inch, the aluminum pipe, fitting, or valve should be replaced. Electrolytic corrosion is accelerated in damp salt air atmospheres.



(Same as TPT-5337-015A)

CHAPTER 2 - DESIGN, EQUIPMENT AND SYSTEM DATA

OVERVIEW

Chapter 2 covers the design features and technical data on the equipment and materials used in a typical Tactical Petroleum Terminal. Section I is an overall description of the terminal and includes reference to a Piping and Instrument Diagram (P&ID) and typical plot plans. The requirements for the fabric collapsible tank pads and berms (firewalls) are also covered. Section II defines the equipment used, exclusive of piping, hose, valves, and fittings which are defined in Section III. Section IV describes the assembled systems of equipment, pipe, hose, valves and fittings. Drawings and diagrams required for the installation, operation, and maintenance of the TPT are included in this chapter. Section V covers system hydraulics, i.e., estimated flow rates vs. pressure drop under various conditions. Subsequent chapters on installation, operation and maintenance will refer back to the information in Chapter 2 as necessary.

SECTION I - GENERAL DESIGN DATA

2-1 General Design Information

The theory of operation and a general functional description of a TPT is covered in Chapter 1 Section II. The following information and the associated drawings and illustrations further define a TPT.

2-1.1 Piping and Instrument Diagram Fig 2-1

The Piping and Instrument Diagram is a standard industry tool used to control design and construction and define a system. It is used as an important and primary reference for operations. It should be studied carefully. The P&ID schematically shows all equipment, instruments, piping, hoselines, and valves. Each operable item has an identification number. Refer to para. 2-1.2 below for the equipment identification system. The P&ID shows the basic physical characteristics of size and capacity. On Fig 2-1 the fuel supply to the TPT enters the switching manifold from the associated pipeline or from tanker-trucks. The fuel is transferred from the switching manifold to any module or tank in the appropriate fuel unit (diesel, mogas, or jet fuel). The fuel is discharged through the fuel dispensing assembly or can be returned to the associated pipeline system depending on the needs of the particular operation. Normally, fuel is received into the secondary module tanks and discharged through the dispensing assembly from the primary module tanks. The fuel can be transferred to any tank within the fuel unit. Fuel can also be transferred from one fuel unit to another within the same TPT by removing or bypassing the meter strainer assembly in the receiving line or by field connecting the line normally discharging to the associated pipeline system to the switching manifold. The details of operation are covered in Chapter 4.

2-1-2 Equipment. Valve. & Instrument Identification System

a. The equipment, valve and instrument identification system used on the P&ID and throughout this manual comprises a three-part code. The first part, letter or letters, indicates the type of equipment; the second part is the identification or series number; and the third part, letter or letters, the service.

2-1.2 Equipment, Valve, & Instrument Identification System - Cont'd.

Example:

V5D

V - indicates a valve
5 - identification or series number
D - the service (in this case diesel)

b. The identification or series number used within one fuel unit is the same as within another fuel unit. The variation between fuel units is in the service part of the number only.
The total system in one typical TPT is the same as in another.

c. To avoid large numbers the identification or series number in the fuel dispensing assembly is followed by a lower case letter.

d. The designations assigned for the first part are:

V - Valve
CV - Check Valve
T - Tank
P - Pump
M - Meter
MS - Meter Strainer Assembly
FS - Filter Separator Assembly
S - Strainer
PR - Pressure Control or Regulating Valve
RV - Relief Valve
PG - Pressure Gage
DP - Differential Pressure Gage
SA - Sampling Assembly

e. The series number assigned will, to the extent possible, follow the order of flow.

f. The letter designations for service are:

D - Diesel Fuel Unit
J - Jet Fuel Unit
M - Motor Gas Fuel Unit
HD - Diesel Header (Switching Manifold)
HJ - Jet Fuel Header (Switching Manifold)
HM- Mogas Header (Switching Manifold)
CF - Contaminated Fuel System
OC - Optional Tank Configuration System
TD - Tanker Truck Receipt -Diesel
TJ - Tanker Truck Receipt -Jet Fuel
TM - Tanker Truck Receipt -Mogas
H - Common Header(To/From Switching Manifold)

2-1.3 Major Equipment List

The following listing of major equipment items with descriptions and identification numbers is for the reader's convenience in reference to the P&ID (Fig. 2-1) and subsequent installation, operation, and maintenance instructions. Valves and instruments furnished with the major equipment are noted below. Other valves, hose, piping, and fittings are covered in detail in Section II of this chapter and in the parts lists of Chapter 8.

Number	Description	Service
T1D	5000 Bbl Fabric Collapsible Tank	Diesel Fuel Unit Secondary Module
T2D	5000 Bbl Fabric Collapsible Tank	Diesel Fuel Unit Secondary Module
T3D	5000 Bbl Fabric Collapsible Tank	Diesel Fuel Unit Secondary Module
T4D	5000 Bbl Fabric Collapsible Tank	Diesel Fuel Unit Secondary Module
T5D	5000 Bbl Fabric Collapsible Tank	Diesel Fuel Unit Primary Module
T6D	5000 Bbl Fabric Collapsible Tank	Diesel Fuel Unit Primary Module
T1J	5000 Bbl Fabric Collapsible Tank	Jet Fuel Unit Secondary Module
T2J	5000 Bbl Fabric Collapsible Tank	Jet Fuel Unit Secondary Module
T3J	5000 Bbl Fabric Collapsible Tank	Jet Fuel Unit Secondary Module
T4J	5000 Bbl Fabric Collapsible Tank	Jet Fuel Unit Secondary Module
T5J	5000 Bbl Fabric Collapsible Tank	Jet Fuel Unit Primary Module
T6J	5000 Bbl Fabric Collapsible Tank	Jet Fuel Unit Primary Module
T1M	5000 Bbl Fabric Collapsible Tank	Mogas Fuel Unit Secondary Module
T2M	5000 Bbl Fabric Collapsible Tank	Mogas Fuel Unit Secondary Module

2-1.3 Major Equipment List- Cont'd.

Number	Description	Service
T3M	5000 Bbl Fabric Collapsible Tank	Mogas Fuel Unit Secondary Module
T4M	5000 Bbl Fabric Collapsible Tank	Mogas Fuel Unit Secondary Module
T5M	5000 Bbl Fabric Collapsible Tank	Mogas Fuel Unit Primary Module
T6M	5000 Bbl Fabric Collapsible Tank	Mogas Fuel Unit Primary Module
	Total number 5000 Bbl Fabric Collapsible Tanks- 18	
T1OC	50,000 Gal. Fabric Collapsible Tank	Optional Tank Configuration
T2OC	50,000 Gal. Fabric Collapsible Tank	Optional Tank Configuration
T3OC	50,000 Gal. Fabric Collapsible Tank	Optional Tank Configuration
T4OC	50,000 Gal. Fabric Collapsible Tank	Optional Tank Configuration
T5OC	50,000 Gal. Fabric Collapsible Tank	Optional Tank Configuration
T6OC	50,000 Gal. Fabric Collapsible Tank	Optional Tank Configuration
T1CF	50,000 Gal. Fabric Collapsible	Tank Fuel Module Contaminated
T2CF	50,000 Gal. Fabric Collapsible	Contaminated Fuel Module
	Total Number 50.000 Gal. Fabric Collapsible Tanks - 8	
P1D	600 Gpm Hoseline Pump	Diesel Fuel Unit Secondary Module
P2D	600 Gpm Hoseline Pump	Diesel Fuel Unit Secondary Module
P3D	600 Gpm Hoseline Pump	Diesel Fuel Unit Primary Module
P4D	600 Gpm Hoseline Pump	Diesel Fuel Unit Primary Module

2-1.3 Major Equipment List- Cont'd.

Number	Description	Service
P1J	600 Gpm Hoseline Pump	Jet Fuel Unit Secondary Module
P2J	600 Gpm Hoseline Pump	Jet Fuel Unit Secondary Module
P3J	600 Gpm Hoseline Pump	Jet Fuel Unit Primary Module
P4J	600 Gpm Hoseline Pump	Jet Fuel Unit Primary Module
P1M	600 Gpm Hoseline Pump	Mogas Fuel Unit Secondary Module
P2M	600 Gpm Hoseline Pump	Mogas Fuel Unit Secondary Module
P3M	600 Gpm Hoseline Pump	Mogas Fuel Unit Primary Module
P4M	600 Gpm Hoseline Pump	Mogas Fuel Unit Primary Module
P1TD	600 Gpm Hoseline Pump	Tanker-Truck Receipt or Spare
P1TJ	600 Gpm Hoseline Pump	Tanker-Truck Receipt or Spare
P1TM	600 Gpm Hoseline Pump	Tanker-Truck Receipt or Spare

Total 600 Gpm Hoseline Pumps - Number 15

Number	**Description**	**Service**
P1CF	350 Gpm Transfer Pump	Contaminated Fuel Module

Total 350 Gpm Transfer Pumps - 1

Number	**Description**	**Service**
FS1D	Filter Separator	Diesel Fuel Unit Primary Module
FS2D	Filter Separator	Diesel Fuel Unit Primary Module

2-1.3 Major Equipment List- Cont'd.

Number	Description	Service
FS1J	Filter Separator	Jet Fuel Unit Primary Module
FS2J	Filter Separator	Jet Fuel Unit Primary Module
FS1M	Filter Separator	Mogas Fuel Unit Primary Module
FS2M	Filter Separator	Mogas Fuel Unit Primary Module
	Total Filter Separators - 6	
MS1 D	Meter Strainer Assembly	Intake to Diesel Fuel Unit
MS2D	Meter Strainer Assembly	Discharge to Diesel Fuel Dispensing Assembly
MS1M	Meter Strainer Assembly	Intake to Mogas Fuel Unit
MS2M	Meter Strainer Assembly	Discharge to Mogas Fuel Dispensing Assembly
MS1J	Meter Strainer Assembly	Intake to Jet Fuel Unit
MS2J	Meter Strainer Assembly	Discharge to Jet Fuel Dispensing Assembly
* MS1H	Meter Strainer Assembly	Common Header from TPT

Total Meter Strainer Assemblies - 7

* Location not defined for typical TPT. Location will be defined in specific area technical manuals.

NOTES:

a. Vent and drain fittings, valves, and hose are supplied as part of the fabric collapsible tank packages and are marked V and D on the P&ID, Fig. 2-1.

b. The following valves are supplied as part of the 5000 bbl fabric tank packages and are not absolutely necessary for the operation of the system. They do not appear in the part lists, Chapter 8. These valves may be relocated and used elsewhere in the system at the discretion of the authority operating the system.

2-1.3 Major Equipment List - Cont'd.

V6D	V61	V6M
V69	V9J	V9M
V22D	V22J	V22M
V250D	V25J	V25M
V400	V40J	V40M
V48D	V48J	V48M

c. The following valves are supplied with the 50,000 gal. fabric tanks and do not appear in the parts lists, Chapter 8. V1aOC thru V1fOC are required for the operation of the Optional Tank Configuration. V3CF and V6CF are not absolutely necessary and may be relocated and used elsewhere at the discretion of the authority operating the system.

V1aOC	V1eOC
V1bOC	V1fOC
V1cOC	V3CF
V1dOC	V6CF

d. The following valves and pressure gages are supplied with and are part of the pumps and do not appear in the Chapter 8 parts lists.

WithP1D	With P2D
V 11D	V27D
Check Valve	Check Valve
V12D	V28D
PG1D	PG3D
PG2D	PG4D

With P3D	With P4D
V430	V51D
Check Valve	Check Valve
V44D	V52D
PGSD	PG7D
PG6D	PG8D

2-1.3 Major Equipment List- Cont'd.

With P1J
V11J
Check Valve
V12J
PG1J
PG2J

With P2
V27J
Check Valve
V28J
PG3J
PG4J

With P3J
V43J
Check Valve
V44J
PG5J
PG6J

With P4J
V51J
Check Valve
V52J
PG7J
PG8J

With P1M
V1M
Check Valve
V12M
PG1M
PG2M

With P2M
V27M
Check Valve
V28M
PG3M
PG4M

With P3M
V43M
Check Valve
V44M
PGSM
PG6M

With P4M
V51M
Check Valve
VS2M
PG7M
PG8M

With P1TD
V8TD
Check Valve
V9TD
PG1TD
PG2TD

With P1TJ
V8TJ
Check Valve
V9TJ
PG1TJ
PG2TJ

2-1.3 Major Equipment List- Cont'd.

With P1TM	With P1CF
V8TM	V4CF
Check Valve	V7CF
V9TM	V8CF
PG1TM	V9CF
PG2TM	PG1CF
PG2CF	

e. Differential pressure gages (DP's) and water detector kit adapters (w) are supplied as part of the filter separator assemblies.

2-1.4 General Design Conditions Summary

a. Storage Capacity

	Barrels	Gallons
One (1) Fuel Unit		
Secondary Module A		
Tank T-1 (0, M, or J)	5,000	210,000
Tank T-2 (D, M, or J)	5.000	210.000
Sub-Total	10,000	420,000
Secondary Module B		
Tank T-3 (D, M, or J)	5,000	210,000
Tank T-4 (D, M, or J)	5.000	210.000
Sub-Total	10,000	420,000
Primary Module		
Tank T-5 (D, M, or J)	5,000	210,000
Tank T-6 (D, M, or J)	5.000	210.000
Sub-Total	10,000	420,000
Total per Fuel Unit	30,000	1,260,000
One Standard Configuration TPT		
Three (3) Fuel Units @30,000 Bbls	90,000	3,780,000

2-1.4 General Design Conditions Summary - Cont'd.

Optional Configuration		
Six (6) 50,000 Gal.	7,143	300,000
Sub-Total	97,143	4,080,000
Contaminated Fuel Storage		
Two (2) 50,000 Gal.	2,.381	100,000
Total Available Storage	99,524	4,180,000

b. Design Flow Rates

One TPT

Fuel receiving rate (typical TPT, to single fuel unit)	800 gpm
Internal transfer rate	600 gpm
Discharge to pipeline system (ea. fuel unit w/l1 pump)	600 gpm (1)
Discharge to pipeline system (ea. fuel unit, from 2 tank modules, 2 parallel pumps)	800 gpm (1)
Fuel dispensing rate (ea. fuel unit)	600 gpm (2)

NOTES

(1) Nominal dependent on associated pipeline system pressure requirements may require installation of booster pump (spare 600 gpm hoseline pump). Site and pipeline system governs.

(2) Nominal based on pump capacity flow and pressure to be regulated at pump to maintain safe but adequate rates at dispensing nozzles for particular installation and loading circumstance. Rate with one filter separator in service is restricted to 350 gpm.

c. Design Operating Pressure

Discharge and transfer hose	150 psig max.
Suction hose (normally utilized in pump suction service only at pressures at or below static liquid head)	100 psig max.
Valves and fittings (except dispensing set	150 psig max.
Fuel dispensing set)	75 psig (1)
Equipment incl. 600 gpm hoseline pumps, filter separators, and meter strainer assemblies	150 psig max.
Fabric collapsible tanks	Static liquid head plus 0.10 psig

2-1.4 General Design Conditions Summary - Cont'd.

NOTES

(1) Nominal maximum shut-in pressure should be operated at low pressure for personnel safety. Flow and pressure to be regulated at pump to maintain safe but adequate rates and pressures for the particular installation and loading circumstance. (see para. 4-16.5h)

2-2 General Layout and Plot Plans

The layout of a TPT must necessarily be flexible and fit the particular site selected. This manual, therefore, outlines a number of alternatives and criteria and does not attempt to overly restrict the arrangement. Various potential plot plans are shown in Fig.'s 2-2, 2-3a, 2-3b, 2-4a, 2-4b, 2-5a, 2-5b, 2-6 and 2-7. Other arrangements or modifications of these may be more practical for a particular site. the plot plans include suggested arrangements of equipment. The routing of hoselines is shown but the details of valves, fittings, and assembly are covered in other drawings and illustrations. The objective in any equipment arrangement is to provide for efficiency and safety in operations. As a general rule, it is recommended that the overall TPT and the fuel units be arranged in accordance with the maximum spacing plot plans to the extent the particular operating site will permit. This will provide for the highest level of safety for the equipment and the operating personnel without adversely affecting operating efficiency. The various plot plans presented are described as follows.

2-2.1 Typical TPT Overall Plot Plan

a. A typical TPT overall plot plan is shown in Fig. 2-2. The plot plan is an example of a TPT which has been arranged to make full use of the hoseline provided for wide spacing between fuel modules. In many locations, due to terrain or operational situations, the layout may have to differ substantially from that shown. if possible the dispensing sets should be located generally upwind of the prevailing wind direction. Actual layouts are at the discretion of the installing and operating authority in each case. Important information concerning all TPT layouts is, however, contained in Figure 2-2.

b. Road access should always be considered when planning a TPT site. Ideally, there should be a limited-number of entry points into the TPT, with each entry point having a control or checkpoint to monitor and route traffic in and out of the area. A road capable of supporting two-way tanker-truck traffic should run along the perimeter of the TPT site, giving access to each fuel unit's fuel dispensing assembly. In the area of the fuel dispensing assemblies, the roadway should be widened to a minimum of 40 feet. Traffic control measures should be made to route through traffic away from the fuel dispensing area. Similar fuel handling areas are necessary for the contaminated fuel module and the tanker truck receipt manifold.

c. Although not shown on the plot plan, limited access roads within individual fuel modules must be provided to allow material handling equipment in and out, for pump movement, fire suppression equipment, maintenance, etc. The roadway crossing guards, which allow vehicles to cross over hose without damaging it (see para. 2-4.10), are to be installed as necessary. Access must be provided to the pumps and near each tank berm.

d. Another important item shown on the general plot plan is the location of the fire suppression equipment. A trailer-mounted fire extinguisher capable of producing fire

2-2.1 Typical TPT Overall Plot Plan - Cont'd.

extinguishing foam (see 2-4.13a) should be located next to each tank berm. Small covered shelters for housing the kevlar fire fighting clothing and extra fire fighting supplies should be built at central, easily accessible locations around the TPT. The 20-lb. hand-held fire extinguishers should be distributed and located at each pump, operating and fuel dispensing area. Personnel must be aware of the location of all fire fighting equipment at all times-in order to prevent confusion in an emergency. Easily seen signs flagging the locations of fire extinguishers would be appropriate.

2.2 Fuel Module Plot Plans

a. Due to varying site conditions, material availability and operational situations, a single typical plot plan for the fuel modules in a TPT cannot be stipulated. Several alternative typical plot plans have been prepared for the most likely cases. With modifications by the installation group in the field as necessary, these typical plans should be helpful towards establishing an actual plot plan for most field situations encountered.

b. The most important information to consider when examining the plot plans is the relative spacing between major components in the fuel modules. Distances shown are relative to a common point (i.e., the edge of a 5,000 bbl collapsible tank). By setting the tank locations, the rest of the layout is defined, although some variation will occur due to uneven terrain, obstacles which must be bypassed (such as large rocks or trees) and small differences in the length-of the hose sections caused by specification length tolerances. If layout changes are made, it is most important that the valve logic of the system remain unchanged. If the relationships between valves are changed, the operating instructions provided in this manual must be changed accordingly, and all operating personnel notified.

c. Figures 2-3a and 2-3b concern plot plans where, due to limited site space or a shortage of proper berm material, pairs of 5,000 bbl tanks share a common berm between two tanks.

d. Figures 2-4a, 2-4b, 2-5a and 2-5b concern plot plans for situations where there is enough space and/or enough berm material available for each 5,000 Bbl tank to have an individual berm on all sides. Figures 2-4a and 2-4b are the ideal situation. There is enough area available to spread the tanks and equipment as far apart as the hoseline will allow within the fuel modules. Figures 2-5a and 2-5b show a layout with the minimum recommended spacing between the 5,000 Bbl tanks (i.e., 50 feet). Like Figures 2-3a and 2-3b, this is a situation where the area available for the TPT modules is at a minimum.

e. The location of the 5,000 bbl tanks and their berms are the controlling factors in selecting a TPT site and layout. If pairs of tanks must have a common berm wall, a cleared and leveled area approximately 215 ft. x 115 ft. is required for each pair of tanks. (If sandbags are used to construct the berm, the area is approximately 190 ft. x 100 ft.) If the tanks have individual berms, the area required for the tank/berm measures approximately 115 ft. x 115 ft. (approximately 100 ft. x 100 ft. if sandbags are used). See Section III, paragraphs 3-3 through 3-7.3 for site and berm preparation guidelines.

f. Besides the selection of level ground, if possible, another important factor in choosing tank location is the elevation of the tank relative to the rest of the module. To allow for the possibility of the receipt of extraordinary high vapor pressure fuel, it is preferable to keep the tanks and the pump wheel base at about the same level to maximize the

2-2.2 Fuel Module Plot Plans Cont'd.

suction head available to the pump. If it is necessary to install a module on a sloping terrain, it is best for safety reasons to install the tanks on the lower side of the slope to avoid flooding the pump operating area with fuel in the event of a tank and berm break. If possible, the difference in elevation between the pump pad and the tank should be held to a maximum of 2 feet.

2-2.3 Tanker-Truck Receipt Manifold Plot Plan

a. A tanker-truck receipt manifold detailed plot plan is not shown due to the variability and optional nature of the manifold. The tanker-truck receipt manifold may be located off one side of the switching manifold, as shown on Fig. 2-2, the overall plot plan.

b. Note that 6-inch hoseline from the transfer hoseline assembly, is used to connect the tanker-truck receipt manifold to the switching manifold. The use of the hoseline gives considerable flexibility to the exact location of the receipt manifold in the TPT.

c. The most important factor in choosing the exact site for the tanker truck receipt manifold is road access, since it is probable that much heavy truck traffic will occur in this area of the TPT. A graded area 120 ft. wide x approximately 700 ft. long is recommended.

2-2.4 Fuel Dispensing Assembly Plot Plan

The fuel dispensing assembly plot plan requirements are as shown on Fig.'s 2-2, 2-3a, 2-4a, and 2-5a. The fuel dispensing assembly is approximately 525 ft. long. It is recommended that a section at least 50 ft. wide and 600 ft. long be graded for the fuel dispensing assembly itself. An area alongside 120 ft. wide x approximately 700 ft. long should be graded for vehicle traffic and parking while loading.

2-2.5 Contaminated Fuel Module Plot Plan

a. The contaminated fuel module's plot plan is shown in Figure 2-6. The contaminated fuel module will be located between the associated pipeline and the switching manifold within the TPT (see Fig. 2-2, TPT Overall Plot Plan).

b. The two 50,000 gallon collapsible fabric tanks will each require a level area approximately 60 ft. x 100 ft. (46 ft. x 86 ft. if sand bags are used) for the tank/berm location, if the installation authority chooses to have them with separate berms. If the two tanks are installed within a common berm, an area of approximately 105 ft. x 100 ft. (96 ft. x 87 ft., if sand bags are used) is required.

c. Space must be provided for the 350 gpm transfer pump used with the contaminated fuel module.

d. Road access must be provided to the contaminated fuel module to allow tanker-trucks to load the contents of the 50,000 gallon tanks as required. A graded area 40 ft. wide x approximately 100 ft. long is recommended

2-2.6 50,000 Gallon Tank TPT Optional Configuration Plot Plan

a. Included in a complete TPT are up to six (6) 50,000 gallon fabric collapsible tanks and the necessary valves, hose and fittings to connect them. The bank of tanks can be used

2-2.6 50,000 Gallon Tank TPT Optional Configuration Plot Plan - Cont'd.

to replace or supplement the 5,000 bbl tanks in a fuel module or under some conditions in a completely separate area. Figure 2-7 shows a possible layout utilizing all six fuel tanks.

b. Note that no pump is included with the option, so installation plans will need to include a source of pump power (4-inch to 6-inch adapters are included with the option). For this purpose, one of the 600 gpm hoseline pumps may be used (see para. 2-4.3). Alternatively, one of the 1250 gpm flood and transfer pumps normally supplied with the associated pipeline system may be used (see para. 2-4.5).

c. Each pair of 50,000 gallon tanks will require a leveled area approximately 105 ft. x 100 ft. (96 ft. x 87 ft. if sand bags are used).

d. If less than six tanks are required at a particular location, the layout can be modified as necessary.

2-3 Typical Pad and Berm Design

All tanks are installed on pads inside berms (firewalls) to contain any spills and isolate any fire resulting from such spills. The following are basic design criteria for tank berms. Refer to Fig's. 2-8, 2-9, and 2-10 for additional graphic information.

2-3.1 Sites

Sites for tanks and their berms should be carefully selected,, giving consideration to space, terrain, soil consistency, camouflage and accessibility. Once the site is selected, it should be cleared and graded such that there can be approximately 10 slope in the final tank pad toward the location of the drain assembly that is closest to the tank's pump suction fitting. All sharp objects, rocks, sticks, etc. that might puncture the fabric tank must be removed.

2-3.2 Materials of Construction

a. Berms are normally constructed of earth from the surrounding area. The more impermeable the soil the better. A high clay content is desirable to avoid leakage and keep the berm in shape. Some rock and gravel content will tend to avoid washout.

b. Berms may be constructed of sand bags if site conditions preclude earth construction, however, sand bag berms will not hold a tank spill very well unless action is taken to seal the gaps between bag ends. Heavy clay packing between joints will help. Nevertheless, considerable leakage can take place. An alternative to sandbag construction is the use of sand confinement grids, NSN 5680-01-198-7955, with a construction procedure similar to AFCS Dwg. 14910 KM-KP. Sandbags are supplied with the TPT, NSN 3835-01-182-1976.

c. Tank pads and berms may be lined with a heavy gage plastic sheeting if soil permeability is a problem at a particular site. Construction grade low density polyethylene preferably with a fibre net molded in, is acceptable. Care must be taken to adequately overlap and, if possible, seal the joints and then hold them down with a light earth fill over the liner. Low density polyethylene can be heat sealed at the joints if time and site conditions permit it prior to the advent of fuel to the area. Another acceptable method of

2-3.2 Materials of Construction - Cont'd.

seal is to tape the joint with two to four-inch self-adhering plastic tape. If a drain line penetrating the berm is used (see para. 2-3.5), a section of the liner must be pierced and tied tightly with synthetic cord around the drain pipe or otherwise sealed so as to avoid washout or leakage at this point. Another acceptable sealing method is to use two to four inch wide plastic self-adhering tape, overlapping the liner and the pipe. Sealing tape and plastic sheeting are not supplied with the TPT, NSN 3835-01-182-1976.

2-3.3 5,000 Barrel Tank Berms

The dimensions of a 5,000 bbl. fabric collapsible tank are:

a. Dry: 68 ft. 6 in. x 68 ft. 6 in.
b. Filled: 6 ft. 8 in. x 66 ft. x 66 ft.

The minimum dimensions of berm should be:

c. From toe of berm to tank wall when filled, 4 ft.
d. Berm height, to contain full tank with 1 ft free-board, 5 ft. 6 in.

2-3.4 50,000 Gallon Tank Berms

The dimensions of a 50,000 gallon fabric collapsible tank are:

a. Dry: 26 ft. x 66 ft.
b. Filled: 5ft. 8in. x24ft. x64ft.

The minimum dimensions of berm should be:

c. From toe of berm to tank wall when filled, 3 ft.
d. Berm height, to contain full tank with 1 ft. free-board, 4 ft. 6 in.

2-3.5 Berm Basin Drain

To provide a drain for the basin formed by the berms, a 2-inch or larger pipe with a gate valve (used pipe and valves of any rating are acceptable) on the outboard end may be installed in the bottom of the berm at the lowest end of the tank pad (see Fig. 2-8 and 2-9). The valve must be normally closed and opened only to drain water from the bermed area. If a drain is not installed, the basin inside the berms may have to be pumped from time to time, depending on the permeability of the soils and whether or not a sealing liner is installed. Drain pipe and valves are not supplied with the TPT, NSN 3835-01-182-1976.

2-3.6 Other Information

For additional information, see TM 5-5430-210-12, overpacked with the 50,000 gal. tanks and the technical manual published by ILC Dover and overpacked with the 5,000 bbl tanks. It is noted that the recommendations in paragraph 2-3.1 through 2-3.6 and the associated drawings differ some and are considered an improvement over the information in TM 5-5430-210-12. The tank pad slope recommendations will permit better pump out and drainage of the fabric tanks.

SECTION II - EQUIPMENT DATA

2-4 General Equipment Information

The TPT is made up of both Government and contractor supplied equipment, piping, hose, valves, and fittings. Government furnished equipment is marked with GFE after the NSN. This section covers design data and other information on all equipment except the piping, hose, valves, and fittings which will be covered in detail in Section III. Section IV will describe the systems made up of the equipment and materials described in Section II and III. Data on the equipment is covered in detail; or the equipment is described in more general terms giving essential and primary information with reference being made to other specific technical manuals as required.

2-4.1 5,000 Bbl Fabric Collapsible Tanks (18 units) NSN 5430-01-160-3528 GFE

a. General Description. The 5000 barrel capacity, fabric collapsible, fuel storage tanks are complete with fittings, accessories and emergency repair items. An assembled tank consists of the basic tank structure fabricated of elastomeric-coated nylon fabric with attached handles, filler discharge assemblies with access doors, a vent fitting with pressure relief cap, and two drain fittings. See Fig. 2-11 for dimensional data and the location of tank fittings.

Dimensions and Design Data

Dimensions Dry:	68 ft. 6 in. x 68 ft. 6 in. (collapsed)
Dimensions Full:	66 ft. x 66 ft. x 6 ft. 8 in. (Ht.)
Design Capacity:	5000 Bbl (210,000 gal.)
Design Pressure:	Designed and intended for static liquid head (pressure) only. Relief cap on 2 in. vent set at 3 in. of water (0.1 psig)

b. Accessories. Each tank is provided with the following accessories:

1) One 1-foot length hose assembly conforming to MIL-H-370, type I (without static wire), size 1 (1/2-inch), class 2 fittings with 1/2-inch NPT threads, attached to a 1/2-inch rising stem gate valve conforming to W-V-54, type II, class A.
2) Four 1-foot-length hose assemblies conforming to MIL-H-370, type II, size 10 (6-inch), class 1, style A.
3) A flanged gate valve with two flange gaskets conforming to MIL-V-58039, size 6 inch, type 1, bolted to quick-disconnect couplings MS27023-19 and M52702719. Bolts, nuts and lock-washers and flat washers shall be used conforming to MS90725-63, MS51967-8, MS35338-46 and MS27183-14, respectively. Flat washers are placed under each bolthead and lockwashers under each nut. A cap and plug conforming to MS27028-19 and MS27029-19 are attached to the valve assembly.
4) Two -inch tee aluminum assemblies, with one female quick-disconnect coupling on one of the straight run sections of the tee and male quick disconnect couplings on the opposite end and on the leg of the tee. Two caps and one plug are provided and attached to the assembly.

2-4.1 5,000 Bbl Fabric Collapsible Tanks (18 units) NSN 5430-01-160-3528 GFE - Cont'd.

5) Two reducer, one 6-inch female by 4-inch male, quick-disconnect, per MS49000-21, and one 6-inch male by 4-inch female quick disconnect per MS49000-23.
6) One NATO Adapter, 4-inch female quick-disconnect by 4-inch straight threads per MS70096-7.
7) Three lifting slings and eight deployment straps (see 5.1. 1.5).

c. Emergency Repair Items

The following emergency repair items are furnished with each tank:

Item	Quantity
Repair Kit and Repair Components conforming to MIL-R-22368	1 ea
O-Ring MS9021-383	2 ea
O-Ring MS29513-250	2 ea
Gasket, quick-disconnect coupling MS27030-6	2 ea
Gasket, quick-disconnect coupling MS27030-9	2 ea
Gasket, quick-disconnect coupling MS27030-10	2 ea
Gasket, 6-inch flange	2 ea

d. Function and Location. The 5,000 barrel fabric tanks are used to store fuels in the TPT tank farms.

Tanks Required for Single TPT

	Location	No.	Equipment No. (Ref. para.2-1.3)
1.	Secondary Modules (Diesel)	4	T1 D, T2D, T3D & T4D
	Primary Module (Diesel)	2	T5D & T6D
2.	Secondary Modules (Jet)	4	T1M, T2M, T3M & T4M
	Primary Module (Jet)	2	TSM & T6M
3.	Secondary Modules (Mogas)	4	T1J, T2J, T3J & T4J
	Primary Module (Mogas)	2	T5J, T6J
		Total 18	

e. Detailed information on these tanks is provided in the technical manual published by the manufacturer, ILC Dover. It is mandatory that this technical manual be studied prior to installation, operation or maintenance of the tanks or their accessories.

2-4.2 50.000 Gal. Fabric Collapsible Tanks (8 Units) NSN 5430400-182-8181

a. General Description. The 50,000 gal. capacity, fabric collapsible, fuel storage tanks are furnished complete with fittings, accessories, and emergency repair items. An assembled tank consists of the basic tank structure fabricated of elastomeric-coated nylon

2-4.2 50,000 Gal. Fabric Collapsible Tanks (8 Units) NSN 5430-00-182-8181 - Cont'd.

fabric with attached handles, filler discharge assemblies with access doors, a vent fitting with pressure relief cap, and a drain fitting. See Fig. 2-12 for dimensional data and location of the tank fittings.

Dimensions and Design Data

Dimensions Dry:	26 ft. x 66 ft. (collapsed)
Dimensions Full:	24 ft. x 64 ft. x 5 ft-8 in. (Ht.)
Design Capacity:	50,000 Gal. (1190.5 Bbls)
Design Pressure:	Designed and intended for static liquid head (pressure) only. Relief cap on 2 in. vent set at 0.1 psig (3 in. of water)

b. Accessories include:

One 1/2" x 8' long drain hose assembly with valve
One 4" x 1-0' long filler-discharge hose assembly with valve

For details, see TM 5-5430-210-12.

c. Emergency Repair Items - see TM 5-5430-210-12.

d. Function and Location: The 50,000 gal. fabric tanks are used to store fuels in the TPT. The basic plan is that two (2) are located in the contaminated fuel module and six (6) are located in the optional tank configuration. The six (6) tanks are available for use generally as required but two (2) tanks must be in the contaminated fuel module.

Tanks Required for Single TPT

	Location	No.	Equipment No. (Ref. para. 2-1.3)
1.	Contaminated Fuel Module	2	T1CF, T2CF
2.	Optional Tank Configuration	6	T1OC, T20C, T3OC,T40C, T5OC, T60C

e.. Detailed Information on these tanks is provided in the Department of the Army technical manual, TM-5-5430-210-12. It is important that this manual be studied prior to installation, operation, or maintenance of the tanks or their accessories.

2-4.3 600 Gpm Hoseline Pumps (15 Units) NSN 4320-01-193-3429 GFE

a. Description. The 600 gpm hoseline pumps are Peabody Barnes, Inc., Model US612-ACD-1, wheel-mounted, diesel engine-driven, self-priming centrifugal units. Refer to Figures 2-13 and 2-14. Fig. 2-15 is the performance curve for the pump. The pump is close coupled to a turbo-charged diesel engine which can be operated manually or automatically through an electric governor. Controls regulating either mode of engine operation are contained in the control panel mounted directly over the pump. The pump and engine are mounted on a two-wheel trailer assembly with internal towing bar and leveling supports.

2-4.3 600 Gpm Hoseline Pumps (15 Units) NSN 4320-01-193-3429 GFE -Cont'd.

Pump Data

Capacity	600 Gpm
Discharge Head	150 psi (w/1.0 Sp. Gr.)
Rated @	2400 Rpm
Performance Curve	See Fig. 2-15
Suction Nozzle	6" Double Groove
Discharge Nozzle	6" Double Groove

Engine Data

6 Cylinder, 4 Stroke Diesel, Deutz F6L912	
Displacement	344.84 in.3
Cooling	Air
Crankcase Oil Capacity	15 qts.
Fuel Capacity	20 gal.
Fuel	Diesel (also JP-4, JP-5 or JP-8 with possible power loss up to 15%)

Assembly Data

Length	154"
Width	85"
Height	77"
Weight	3380 lbs.

b. Function and Location. The function of these pumps is to transfer fuel from one tank (or tanks) to another, pump fuel to the dispensing set, pump fuel to the associated pipeline system, or pump fuels from the tanker-truck receipt manifold to the TPT storage tanks.

The locations of the pumps are shown below.

Pump Units Required for Single TPT

Location		No.	Equipment No. (Ref. para. 2-1.3)
1)	Diesel Fuel, Secondary Modules	2	P1D & P2D
	Diesel Fuel, Primary Modules	2	P3D & P4D
2)	Jet Fuel, Secondary Modules	2	P1J & P2J
	Jet Fuel, Primary Modules	2	P3J & P4J
3)	Mogas, Secondary Modules	2	P1M & P2M
	Mogas, Primary Modules	2	P3M & P4M
4)	Diesel Fuel, Tanker-Truck Receipt	1	P1TD
5)	Jet Fuel, Tanker-Truck Receipt	1	P1TJ

2-4.3 600 GO m Hoseline Pumps (15 Units)
NSN 4320-01-193-3429 GFE -Cont'd

6)	Mogas Fuel, Tanker-Truck Receipt	1	P1TM

Total 15

c. Detailed information on these pumps is provided in the technical manual entitled "Installation, Operation and Maintenance Instructions with Parts Breakdown", NSN 4320-01-193-3429, prepared by Peabody Barnes, Inc. It is important that this publication be studied in detail prior to installation, operation, or maintenance and that its stipulations be followed.

2-4.4 350 Gpm Transfer Pump (1 Unit)
NSN 4320-01-092-3551 GFE

a. Description: The 350 gpm pumping assembly is designed specifically to transfer light liquid petroleum fuels. The unit can be field transported by means of a towing vehicle. It consists of an air cooled, three cylinder diesel engine and a self-priming centrifugal pump mounted on a two-wheel frame assembly. The pumping assembly incorporates its own control panel and suction and discharge valves. These components are also mounted on the frame assembly. An internal fuel tank supplies fuel to the diesel engine, thereby making the' unit a complete self-supporting pumping assembly. See Fig. 2-16. Fig. 2-17 is the performance curve for the pump.

Pump Data	
Capacity	350 Gpm
Discharge Head	275 ft.
Rated @	2300 Rpm
Performance Curve	Fig. 2-17
Suction Nozzle Size	4 in. (2 nozzles ea.)
Discharge Nozzle Size	4 in. (2 nozzles ea.)
Engine Data	
3 Cylinder, 4 Stroke Diesel	
Displacement	172.45 in.3
Cooling	Air
Crankcase Capacity	1.98 Gal.
Fuel Capacity	19 Gal.
Fuel	Diesel or JP-4
Assembly Data	
Length	122in.
Width	70in.
Height	68 in.
Weight	2140 1bs.

b. Function and Location: This pump unit is used in the contaminated fuel module with the TPT. The pump can also be easily moved and used as required in other locations and services. The equipment number assigned is P1CF.

2-4.4 350 Gpm Transfer Pump(1 Unit)
NSN 4320-01-092-3551 GFE - Cont'd.

c. Detailed information on these pumps is provided in the Department of the Army technical manual TM-5-4320-226-14, Operator's, Organizational, Direct Support and General Support Maintenance Manual. It is important that this publication be studied in detail prior to installation, operation, or maintenance and that its stipulations be followed.

2-4.5 1250 Gpm Flood and Transfer Pumps (6 Units w/Area 8. See Note.)
NSN 4320-01-194-5601 GFE

NOTE

These pumps are not part of the supply of TPT but are listed here for convenience of the operator only. Available in Area 8 but may differ for other areas.

a. Description: The 1250 gpm pumps are Peabody Barnes, Inc. Model US612ACD, skid-mounted, diesel engine driven, self-priming centrifugal pumps. Refer to Fig. 2-18. Fig.15 is the performance curve for the pump. The pump is close coupled to a turbo-charged diesel engine. Engine speed is controlled manually through a push-pull, locking micrometer throttle. The throttle, engine controls, and indicators are mounted in the control panel, directly over the pump unit. The pump and engine are skid mounted for ease of installation and movement. Except for the skid-mounted feature and the control system, these pumps are the same as the 600 GPM units under 2-4.3.

PUMP DATA

Capacity	1250 Gpm
Discharge Head	180 ft.
Rated @	2000 Rpm
Performance Curve	Fig. 2-15
Suction Nozzle	6" Double Groove
Discharge Nozzle	6" Double Groove

ENGINE DATA

6 Cylinder, 4 Stroke Diesel, Deutz F6L912	
Displacement	344.84 in.3
Cooling	Air
Crankcase Capacity	15 qts.
Fuel Capacity	20 gal.
Fuel	Diesel (also JP-4, JP-5, or JP-8
with possible power loss up to 15%)	

ASSEMBLY DATA

Length	97.5 in.
Width	58.5 in.
Height	69.25 in.
Weight	3000 lbs.

b. Function and Location. As required for the transfer of fuels. See Note above. No TPT equipment number assigned. See technical manuals for specific area involved.

2-4.5 1250 Gpm Flood and Transfer Pumps (6 Units w/Area 8. See Note.)
NSN 4320-01-194-5601 GFE - Cont'd.

c. Detailed information on these pumps is provided in the technical manual entitled "Installation, Operation and Maintenance Instructions with Parts Breakdown", of April 1985, NSN 4320-01-194-5601 prepared by Peabody Barnes, Inc. and overpacked with the pump. It is important that this publication be studied in detail prior to installation, operation, or maintenance and that its stipulations be followed.

2-4.6 Meter-Strainer Assemblies (7 Units)
NSN_____

a. Description:

The meters are Smith Meter, Inc., aluminum single case, positive displacement meter, Model No. SF-6V-NF with 6-inch double grooved connections. Maximum working pressure 150 psig for maximum flow rate 800 gpm. A large numeral reset counter mounted on the meter reads out in U.S. Gallons.

The strainers, one mounted upstream of each meter, are Weamco, Inc., 6-inch cast steel strainer, 40 mesh stainless steel basket, 150 psi working pressure, with 6-inch double grooved connections. A Smith Meter, Inc., Type RB Air Release Head is mounted on the strainer. The meters and strainers are mounted together on a skid for easy handling and a firm setting. See Fig. 2-19.

b. Function and Location:

Meters measure fuel into the fuel units and to the fuel dispensing assemblies. The strainers are to protect the meter.

Meter Locations

	Location	No.	Equipment No. (Ref.para.2-1.3)
1)	Inlet Line to Diesel Fuel Unit	1	MS 1 D
	Inlet Line to Fuel Dispensing Assembly	1	MS 2 D
2)	Inlet Line to Jet Fuel Unit	1	MS 1 J
	Inlet Line to Fuel Dispensing Assembly	1	MS 2 J
3)	Inlet Line to MoGas Fuel Unit	1	MS 1 M
	Inlet Line to Fuel Dispensing Assembly	1	MS 2 M
* 4)	Outlet Line to Associated Pipeline System	1	MS 1H

* Location not defined for typical TPT. Will be defined in specific area technical manuals.

c. Detailed information on the meters and strainers is in the technical documents published by Smith Meter, Inc. and Weamco, Inc., overpacked with the equipment. Additional information is contained in Supplemental Technical Data, Appendix A.

2-4.7 Filter-Separators (6 Units)
NSN 4330-00-177-8485 GFE

a. Description:

1) General. The 350 gpm optimum performance filter-separator is a two stage vertical-type unit designed to remove undissolved water and solid contaminants from fuels. The filter-separator has a water level indicator (sight gage), a manual water drain valve, and a differential pressure indicator. See Fig. 2-20.

2) Filtration, Coalescence and Separation. The first stage consists of fluid pressure filter elements which perform a dual function. Contaminated fuel under pressure enters the filter-separator through the inlet line manifold and into and through the filter elements which filter out all solids and coalesces the finely dispersed water into droplets of sufficient size to be separated. The second stage consists of teflon coated screen lined canisters (18 per unit). The fuel flows through the teflon coated screen where the water droplets are stopped and pulled downward by gravity to the sump for subsequent draining. Clean fuel then flows into the top of the outlet tube and out the outlet connection at bottom rear of the unit.

3) Water Drainage. The level of accumulated water in the sump is indicated by a ball float in the sight gage, water is manually drained through a valve on the bottom of the sump.

4) Water Detection. A water detector kit adapter, NSN 4730-01-013-7590 (not an integral part of the filter-separator) is installed immediately downstream of each filter separator to permit sampling of the exit stream to check fuel quality and the performance of the filter-separator. See Fig. 2-21.

5) Capacity. 350 Gpm

6) Maximum Operating Pressure. 150 psig

b. Function and Location

The filter-separators are installed in the TPT after the fuel storage tanks and before the fuel dispensing assembly. They are part of the fuel dispensing system. This assures that only clean, dry fuel is dispensed. They are located as follows in numbers noted:

Single TPT, Three Units:

Location	No.	Equipment No.
Before Diesel Dispensing Assembly	2	FS1 D & FS2D
Before Jet Fuel Dispensing Assembly	2	FS1J & FS2J
Before MoGas Dispensing Assembly	2	FS1M & FS2M

c. Detailed information on the filter-separator is contained in Department of the Army technical manual TM 5-4330-211-12. It is important that this manual be studied prior to installation, operation or maintenance of the unit.

2-4.8 Sampling Assembly(1 Unit)
NSN

a. A Sampling Assembly is located on the inlet line to the switching manifold for each TPT to permit periodic sampling and quality control. See Fig. 2-1. The exact location will be shown in technical manuals for the specific site.

b. The unit consists of a pipe section with double grooved ends, a 1/2" tap into the line, a 1/2" ball valve, a 1/2" needle valve, a gooseneck spigot, and a catch basin. See Fig. 22 for detail.

2-4.9 Range Poles (36 Units)
NSN 6685-00-514-5575

a. A range pole is made of two sections of steel tubing of nominal 1 1/8-inch outside diameter and of nominal 0.032-inch wall thickness. The assembled length is 6-1/2 feet, including a hardened steel point permanently fastened to the lower end. The steel point is concentric to the centerline of the pole. A spring catch locks the two sections rigidly together. The two sections of the pole are fitted in a two-pocket carrying case made of cotton duck.

b. The range poles are used to roughly gage and estimate the fuel in the collapsible tanks in the TPT. Two poles are supplied for each 5,000 Bbl tank. They are mounted on opposite sides of the tank in the berm and a cord is stretched across the tank. The level of the cord can be set as best suits the operator; however, it is recommended that the level be set at the full height of the tank, i.e., 6'-8" from the pad. It is also recommended that a readily visible ball or other object be mounted on the cord at the center of the tank. See Figure No. 2-23.

2-4.10 Roadway Crossing Guards (20 Units)
NSN 3835-01-187-1556

a. Roadway Crossing Guards are simple metal channels, so constructed as to fit over the hose with no sharp or rough edges to damage the hose walls. See Figure No. 2-24.

b. The guards are located and used principally in road crossings, as shown in Figure No. 2-24, to protect the hose from traffic weight, vibration and other effects which might cause damage. They can also be used in other places, such as protecting the hose from rock, or from ballast and cinders under a railroad spur.

2-4.11 Flood Light Sets (6 Units)
NSN 6230-01-056-5238 GFE

a. A flood light set is a wheel-mounted gasoline engine-driven generator with an integrally mounted telescoping tower carrying three (3) high intensity lamps capable of lighting up to six acres. Essential information on the unit is as follows:

Manufacturer: High Lite Corporation
Model HLT-3K-5K-MIL

Gasoline Engine Generator - 3KV, 12KV, 60 Hz
Fuel Capacity - 12.87 Gal.
3 Lamps - 1000 Watts ea. 3000 Watts total
100,000 Lumens ea. 300,000 Lumens total

2-4.11 Flood Light Sets (6 Units)
NSN 6230-01-056-5238 GFE - Cont'd.

Unit Dimensions:
Width 61 in.
Width w/outriggers 109 in.
Length 145 in.
Height:
Tower down 78 in.
Tower up 37 ft. 9.5 in.
Weight, assembled
and dry 2170 lbs.

b. Details are found in the Department of the Army TM 5-6230-210-13&P. It is mandatory that this manual be studied prior to installation, operation, or maintenance of the unit. Fig. 2-25 is an illustration of the floodlight set.

c. The six (6) units are to be installed as determined by operating management for the particular TPT site. Particular attention should be given to the lighting of fuel dispensing areas, fuel receipt areas, and heavy operating areas around the pumps and the switching manifold. Suggested locations are shown on Fig. 2-2.

2-4.12 Testing Kit (1 Unit)
NSN 6630-01-008-5524

a. One (1) portable petroleum fuel testing kit, manufactured to military specification (81349) MIL-T-52849, is supplied. For details, refer to the manual overpacked with the kit.

b. It is noted that mobile petroleum testing facilities will be specified and supplied to the operating areas by the U.S. Army as required.

2-4.13 Fire Suppression Equipment (19 Sets)
NSN 4210-01-210-8728

a. Each TPT is furnished with nineteen (19) sets of fire suppression equipment. Each set contains the following:

1 Extinguisher, fire, dry chemical and AFFF, self-contained, skid- mounted remote hose car, wheel-mounted. lAW (07464) D-5LTW100N except delete skid mounted and mount fire extinguisher on commercial 2-wheel trailer, IAW MI T46791, Type III, except delete requirements for service brakes, lighting, tailgate side and end racks, tarpaulin and bows. Manually operated hand-brake shall be provided for parking.
NSN 42 01-210-6466
36 Dry chemical, fire, Purple K (50 lb. can) (81349) 0-D-1407 NSN 4210-00-752-9343 (for use with dry chemical/AFFF fire extinguisher or for recharge of portable 20 lb. unit
5 Foam liquid, fire (5 gal.) (81349) MIL-F-24385 NSN 4210-01-056-8343 (for use with dry chemical/AFFF fire extinguisher)

2-4.13 Fire Suppression Equipment (19 Sets)
NSN 4210-01-210-8728 - Cont'd.

3 Hoods, fire, Kevlar
(93934) 566HK
NSN

4 pr. Gloves, fire, Kevlar
(93934)1GL-2-KM
NSN

1 Coat, fire, Kevlar (M)
(93934) 15676MK-M
NSN

1 Coat, fire, Kevlar (L)
(93934) 1576MK-L
NSN

1 Coat, fire, Kevlar (S)
(93934) 1576MK-5
NSN

1 Trouser, fire, Kevlar (L)
(93934) 2576MK-L
NSN

1 Trouser, fire, Kevlar (S)
(93934) 2576MK-S
NSN

1 pr. Boots, fire, ranger, knee (size 8)
(85960) 3124/27-8
NSN

1 pr. Boots, fire, ranger, knee (size 9)
(85960) 3124/27-9
NSN

1 pr. Boots, fire, ranger, knee (size 10)
(85960) 3124/27-10
NSN

1 pr. Boots, fire, ranger, knee (size 7) PR
(85960) 3124/27-7
NSN

1 pr. Boots, fire, ranger, knee (size 6) PR
(85960) 3124/27-6
NSN

1 Harness, shoulder, nylon
NSN

8 N2 cylinder w/Superior valve, 300 cu. ft.
(07464)05053300
NSN 3835-01-210-5594

2-4.13 Fire Suppression Equipment (19 Sets)
NSN 4210-01-210-8728 - Cont'd.

(for use with dry chemical/AFFF wheel-mounted extinguishers or alternately for recharge of the 20 lbs. portable units)

5 Extinguisher, fire, dry chemical, 20 lb. capacity, Type 1, Class 2, size 20 (81348) A-A-393
NSN

b. The location of fire suppression equipment in the TPT is up to the operating management. Plot plan, Fig. 2-2, suggests certain general locations. Whatever locations are selected, they should be readily accessible to the operators and the fire suppression crew and should be clearly flagged with prominent signs. Clothing should be stored in a dry, readily accessible building or container. Storage facilities are not supplied with NSN 3835-01-182-1976.

c. The supply, use and maintenance of the dry chemical/AFFF fire extinguisher is described in detail in the U.S. Marine Corps technical manual TM 07661 B-14/1, NSN-4210-01-205-2246, in Appendix A of this manual. The unit described is the same as the unit supplied (NSN 4210-01-210-6466) except for wheel-mounting.

d. Other equipment and clothing are described in further detail in Chapter 8 and Appendix A.

SECTION III - HOSE, PIPE, FITTINGS AND VALVE ASSEMBLIES

2-5 General Information

For the most part the hose, pipe, fittings and valves that interconnect the equipment described in Section II are preconnected into convenient assemblies that make the task of installation more efficient. This section describes these assemblies. A small number of separate fittings are required that is, they are not preassembled to other items. These are also described in this section.

2-5.1 Hose Assemblies

a. 6-inch Hose Lightweight, Collapsible, Discharge (168 Units)
NS

Figure:	2-30 and 2-31
Specification:	M I L-H-82127A (revised)
OD:	6-3/8 in., plus 1/8 in., minus 1/16 in.
ID:	6 in., plus or minus 1/32 in.
Weight:	2 5/8 lb./ft. (maximum)
Working Pressure:	150 psig
End Adapters:	(2) hose to D.G. adapters per (97403) 13226E8269, aluminum 6061-T6, and (1) swivel hose adapter for each two hose lengths
Cover:	Synthetic rubber, not less than 1/16 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra end reinforcement extending 48" from each end
Hose Tube:	Synthetic rubber, not less than 1116 inch thick
Color:	Sand Matte

Identification:	Manufacturer's name or trade mark, quarter and year of manufacture, the type working pressure and the words "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	Provided in 250 ft. lengths, packed two to a flaking box with the swivel. Flaking box dimensions are 92-1/4 inch x 81-1/2 inch x 18-1/4 inch. The hose is used in the transfer hose assembly.

b. 6-Inch Hose. Collapsible, Discharge (224 Units)
NSN 3835-01-210-5618

Figure:	2-32
Specification:	MIL-H-82127A
OD:	6-5/8 in., plus 1/8 in., minus 1/16in.
ID:	6 in., plus or minus 1/32 in.
Weight:	4-11/16 lb./ft. (maximum)
Working Pressure:	150 psi
End Adapters:	Hose to D.G. adapters per (97403) 13226E8269, aluminum 6061-T6
Cover:	Synthetic rubber, not less than 5/64 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra reinforcement extending 14" from each end
Hose Tube:	Synthetic rubber, not less than 5/64 inch thick
Color:	Sand Matte
Identification:	Manufacturer's name or trade mark, quarter and year of manufacture, the type working, pressure and the words "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	Provided in 50 ft. lengths and used in the tank farm modules, contaminated fuel module, tanker-truck receipt manifold, and the fuel dispensing assembly

c. 6-Inch Hose. Non-Collapsible Suction (228 Units)
NSN 4720-01-210-5596

Figure:	2-33
Specification:	MIL-H-370E, Type II
OD:	6-7/8 in., plus 1/8 in., minus 1/16 in.
ID:	6 in., plus or minus 1/16 in.
Working Pressure:	100 psig
End Adapters:	Hose to D.G. adapters per (97403) 13226E8269, aluminum 6061-T6
Cover:	Synthetic rubber, not less than 5/64 in. thick
Reinforcement:	Cotton or synthetic fiber ply with a helix of wound steel reinforcing wire
Hose Tube:	Synthetic rubber, not less than 5/64 inch thick
Color:	Sand Matte
Identification:	Manufacturer's name or trade mark, quarter and year of manufacture, the type, and the words "MIL-H-370, Type II, Liquid Fuel"

2-5.1 Hose Assemblies - Cont'd.

Use:	Provided in 12 ft. lengths and used in the tank farm modules and the tank-truck receipt manifold

d. 4-Inch Hose, Collapsible, Discharge (7 Units)
NSN 4720-01-210-4560

Figure:	2-34
Specification:	MIL-H-82127A
OD:	4-3/4 in., plus 1/8 in., minus 1/16 in.
ID:	4 in., plus or minus 1/32 in.
Weight:	2-5/8 lb./ft. (maximum)
Working Pressure:	150 psig
End Adapters:	(1) MS 27025-17 and (1) MS 27021-17 made of aluminum alloy 356-T6
Cover:	Synthetic rubber not less than 5/64 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra reinforcement extending 14 in. from each end
Hose Tube:	Synthetic rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	Provided in 12 ft. lengths and is found in the contaminated fuel module and the optional tank configuration.

e. 4-Inch Hose, Collapsible, Dispensing (40 Units - 25 ft., 4 Units - 50 ft.)
NSN 4720-00-083-0047 (25 ft.) and
NSN 4720-00-083-0046 (50 ft.)

Figure:	2-35
Specification:	MIL-H-1 1588D, Type III, Class 1
OD:	4-3/4 in., plus 1/8 in., minus 1/16 in.
ID:	4 in., plus or minus 1/32 in.
Weight:	2-5/8 lb./ft. (maximum)
Working Pressure:	150 psig
End Adapters:	(1) MS 27021-17 and (1) MS 27025-17 made of aluminum alloy 356-T6
Cover:	Synthetic rubber not less than 5/64 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra reinforcement extending 14 in. from each end
Hose Tube:	Synthetic rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"

2-5.1 Hose Assemblies - Cont'd.

Use:	The hose is provided in 25 and 50 ft. lengths. The hose is used in the fuel dispensing assembly and the 50,000 Gal. TPT optional tank configuration.

f. 4-Inch Hose, Non-Collapsible. Suction (96 Units)
NSN 4720-00-727-1339

Figure:	2-36
Specification:	MIL-H-370D, Type II
OD:	4-3/4 in., plus or minus 11/16 in.
ID:	4 in., plus or minus 1/32 in.
Working Pressure:	100 psig
End Adapters:	MS 27021-17 and MS 27025-17, aluminum alloy 356-T6
Cover:	Synthetic rubber not less than 5/64 in. thick
Reinforcement:	Cotton or synthetic fiber ply with a helix of wound steel reinforcing wire
Hose Tube:	Synthetic rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, "MIL-H-370, Type II, Liquid Fuel".
Use:	Provided in 12 ft. lengths. Used in tanker-truck receipt manifold, contaminated fuel module and the 50,000 Gal. TPT optional tank configuration

g. 3-Inch Hose, Collapsible. Dispensing (9 Units)
NSN 4720-00-083-0048

Figure:	2-35
Specification:	11588D, Type III, Class I
OD:	3-5/8 in., plus 1/8 in., minus 1/16 in.
ID:	3 in., plus or minus 1/32 in.
Weight:	1-7/8 lb./ft. (maximum)
Working Pressure:	125 psig
End Adapters:	MS 27021-15 and MS 27025-15, made of aluminum alloy 356-T6
Cover:	Synthetic Rubber not less than 5/64 in. thick
Reinforcement:	Cotton or Synthetic Fiber Plies, extra reinforcement extending 14 inches from each end
Hose Tube:	Synthetic Rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	The hose is provided in 50 ft. lengths for use in the fuel dispensing assembly.

2-5.1 **Hose Assemblies - Cont'd.**

h. 2-Inch Hose, Collapsible, Dispensing (15 Units)
NSN_____

Figure:	2-35
Specification:	11588D, Type III, Class I
OD:	2-9/16 in., plus 1/8 in., minus 1/16 in.
ID:	2 in., plus or minus 1/32 in.
Weight:	1-1/4 lb./ft. (maximum..
Working Pressure:	100 psig
End Adapters:	(1) MS 27021-11 and (1) MS 27025-11, made of aluminum alloy 356-T6
Cover:	Synthetic rubber not less than 5/64 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra reinforcement extending 14 inches from each end
Hose Tube:	Synthetic rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	The hose is provided in 25 ft. lengths for use in the fuel dispensing assembly.

i. 1-1/2-Inch Hose. Collapsible, Dispensing (6 Units)
NSN 4720-00-901-7624

Figure:	2-35
Specification:	11588D, Type III, Class I
OD:	2 in., plus or minus 1/16 in.
ID:	1-1/2 in., plus or minus 1/32 in.
Weight:	1 lb./ft. (maximum)
Working Pressure:	100 psig
End Adapters:	(1) MS 27021-9 and (1) MS 27025-9 made of aluminum alloy 356-T6
Cover:	Synthetic rubber not less than 3/64 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra reinforcement extending 14 inches from each end
Hose Tube:	Synthetic rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, " Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	The hose is provided in 25 ft. lengths for use in the fuel dispensing assembly.

j. 1-Inch Hose, Collapsible, Dispensing (25 Units)
NSN 4720-00-083-0049

Figure:	2-35
Specification:	11588D, Type III, Class I

2-5.1 **Hose Assemblies - Cont'd.**

OD:	1-9/16 in., plus or minus 1/16 in.
ID:	1 in., plus or minus 1/32 in.
Weight:	3/4 lb./ft. (maximum)
Working Pressure:	100 psig
End Adapters:	(1) MS 27021-5 and (1) MS 27025-5-made of aluminum alloy 356-T6
Cover:	Synthetic rubber not less than 3/64 in. thick
Reinforcement:	Cotton or synthetic fiber plies, extra reinforcement extending 14 inches from each end
Hose Tube:	Synthetic rubber, not less than 5/64 in. thick
Color:	Sand Matte
Identification:	Manufacturer's name or trademark, the type, quarter and year of manufacture, working pressure and the words, "Hose, Liquid Petroleum Fuels, Dispensing, Collapsible"
Use:	The hose is provided in 25 ft. lengths for use in the fuel dispensing assembly.

2-5.2 **Aluminum Pipe and Couplings**

a. 6-Inch Aluminum Pipeline Sections, Double Groove Ends (25 Units)
NSN 4710-01-181-3986 GFE

Figure:	2-37A (Groove data)
OD:	6.625 in., plus 0.050 in., minus 0.024,in.
Wall Thickness:	0.188 in.
Length:	19 ft.
Working Pressure:	600 psig
Weight:	87 lbs.

The aluminum pipeline sections are used in the TPT switching manifold, and are connected using the double groove coupling clamps provided (see 2-5.2.b). The aluminum pipeline sections come in a unitized bundle of 25 sections, one bundle to a TPT.

b. 6-Inch Coupling Clamp, Double Grooved (25 Units)
NSN 4730-01-181-4074 GFE

Figure:	2-37B and 2-37C
Working Pressure:	600 psig
Weight:	

The 6-inch double groove malleable iron coupling clamps are used with the aluminum pipeline sections in the switching manifold of the TPT. The coupling clamps come 25.clamps to a crate. Each clamp is enclosed in a heat shrink bag and is accompanied by a synthetic rubber, pre-lubricated gasket in its own plastic bag. Packed with the 25 clamp set are a hammer, a drift pin, and two removable assembly tools.

2-5.3 **Fitting and Valve Assemblies**

a. 6-Inch Cross Assembly, Double Groove Ends (21 Units)
NSN 3835-01-210-5595

Figure:	2-38
Assembly Weight:	390.2 lbs.
Dimensions LxWxH (in.):	48x48x24
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	8	Adapter, flange to double groove end, 6-inch; 150 psig working pressure; aluminum 356-T6; flange in accordance with F.S.C.M. (97403) Drawing 13226E8268
2	4	Cap, 6-inch, double groove; 150 psi working pressure; aluminum 356-T6
3	8	Coupling, clamp, 6-inch, single groove; 150 psi working pressure; malleable cast iron body and handle; connecting pin cold rolled AISI 1212 steel; compatible with double groove fittings
9	4	Valve, gate, flanged, 6-inch; hydrostatic qualified to 150 psig working pressure; valve body aluminum 356.0; valve stem, double gates and seats corrosion resistant steel; rising stem; MIL-V-58039
10	1	Cross, double groove ends, 6-inch; 150 psig working pressure; aluminum 356-T6

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

b. 6-Inch Wye Assembly, Double Grooved Ends (16 Units)
NSN 3835-01-210-5592

Figure:	2-39
Assembly Weight:	210.4 lbs.
Dimensions LxWxH (in.):	48x48x36
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Wye, double groove ends, 6-inch; 150 psig working pressure; fabricated from aluminum alloy 6061-T6 pipe
2	5	Coupling, clamp, 6-inch, single groove ends; 150 psig working pressure; malleable cast iron body and-handle; connecting pin cold rolled AISI 1212 steel; compatible with double groove fittings
3	4	Adapter, flange to double groove end, 6-inch; 150 psig working pressure; aluminum 356-T6; flange in accordance with F.S.C.M. (97403) Drawing 13226E8268
4	2	Valve, gate, flanged, 6-inch; hydrostatic qualified to 150 psig working pressure; valve body aluminum 350.0; valve stem, double gates and seats corrosion resistant steel; rising stem; MIL-V-58039
6	3	Cap, 6-inch double groove; 150 psig working pressure; aluminum 356-T6

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

c. 6-inch Tee Assembly. Double Groove Ends (9 Units)
NSN 4730-01-211-9548

Figure:	2-40
Assembly Weight:	183 lbs.
Dimensions LxWxH (in.):	48x48x36
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	4	Adapter, flange to double groove end,. 6-inch; 150 psig working pressure; aluminum 356-T6; flange in accordance with F.S.C.M. (97403) Drawing 13226E8268

6	2	Valve, gate, flanged, 6-inch; hydrostatic qualified to 150 psig working pressure; valve body aluminum 356.0; valve stem, double gates and seats corrosion resistant steel; rising stem; MIL-V-58039
8	5	Coupling, clamp, 6-inch, single groove; 150 psig working pressure; malleable cast iron body and handle; connecting pin cold rolled AISI 1212 steel; compatible with double groove fittings
9	1	Tee, double groove ends, 6-inch; 150 psig working pressure; aluminum 356-T6
10	3	Cap, 6-inch, double groove; 150 psig working pressure; aluminum 356-T6

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

d. 4-Inch Reducer Valve Assembly, Quick Disconnect (3 Units)
NSN 4820-01-210-5624

Figure:	2-41
Assembly Weight:	34.4 lbs.
Dimensions, LxWxH (in.):	24x12x12
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Valve, gate, 4-inch, flanged; hydrostatic qualified to 150 psig working pressure; valve body cast aluminum 356.0; stem, double gates and seats made of bronze; rising stem type; MIL-V-58039
2	1	Coupling half, reducer, 4-inch flange to 3-inch cam-lock (male); 150 psig working pressure; aluminum 356-T6; flange conforming to MS 27031
4	1	Coupling half, flange to cam-lock (female), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27027-17; flange conforming to MS 27031

10	1	Coupling half, cap, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028- 17
11	1	Coupling half, plug, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-17

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

e. 4-Inch Tee Assembly, Quick Disconnect (1 Male x 2 Female -2 Units, 3 Male - 1 Unit, 3 Female- 1 Unit)
NSN_____

Figure:	2-42,2-43, 2-44
Assembly Weight:	33.2 lbs.
Dimensions, LxWxH (in.):	24x24x12
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Tee, 4-inch, flanged; 150 psig working pressure; cast aluminum 356-T6
*	*	Coupling half, flange to cam-lock (male), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27023-17; flange conforming to MS 27031
*	*	Coupling half, flange to cam-lock (female), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27027-17; flange conforming to MS 27031
*	*	Coupling half, plug, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-17
*	*	Coupling half, cap, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028- 17

* Note: There are three versions of this assembly used in a TPT:

(1) All female adapters, Fig. 2-42
(2) All male adapters, Fig. 2-43
(3) Two female and one male adapters, Fig. 2-44

In the case of mixed male and female adapters, the odd adapter is one of the tee branches.

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

f. 4-Inch Gate Valve Assembly, Quick Disconnect (36 Units)
NSN 4820-01-210-5605

Figure:	2-45
Assembly Weight:	36 lbs.
Dimensions, LxWxH(in.):	18x12x18
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Valve, gate, 4-inch, flanged; hydrostatic qualified to 150 psig working pressure; valve body cast aluminum 356.0; stem, double gates and seats made of bronze; rising stem type; MIL-V-58039
6	1	Coupling half, cap, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028- 17
8	1	Coupling half, flange to cam-lock (male), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27027-17; flange conforming to MS 27031
10	1	Coupling half, plug, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-17
11	1	Coupling half, flange to cam-lock (female), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27027-17; flange conforming to MS 27031

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

g. 4-Inch Wve Connection. Quick Disconnect (6 Units each Type)
NSN 4730-01-210-5626 and NSN 3835-01-210-5630

Figure:	2-46 and 2-47
Assembly Weight:	35.9 lbs.
Dimensions, LxWxH (in.):	48x48x24
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	*	Coupling half, flange to cam-lock (Female), 4 inch; 150 psig working pressure; aluminum 356-T6, MS 27027-17; flange conforming to MS 27031
2	1	Wye, 4-inch, flanged; 150 psig working pressure; aluminum 356-T6
4	*	Coupling half, flange to cam-lock (male), 4 inch, 150 psig working pressure; aluminum 356-T6; MS 27023-17; flange conforming to MS 27031
9	*	Coupling half, cap, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-17
10	*	Coupling half, cap, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-17

* Note: There are two versions of the wye assembly in the TPT:

(1)	Two female and one male adapters. See Fig. 2-46, NSN 4730-01-210-5626.
(2)	Two male and one female adapters. See Fig. 2-47, NSN 3835-01-210-5630.

The odd adapter is always on the leg of the wye.

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

h. 4-Inch Ball Valve Assembly, Quick Disconnect (30 Units)
NSN 4820-01-211-9547

Figure:	2-48
Assembly Weight:	27 lbs.
Dimensions LxWxH(in.):	24x12x12
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Coupling half, external pipe thread to cam-lock (female), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27026-17
2	1	Valve, ball, 4-inch; internal pipe threads; 300 psig working pressure; aluminum S6-70-A-T6; pipe threads in accordance with FED-STD-H28/7
3	1	Coupling half, external pipe thread to cam-lock (male), 4-inch; 150 psig working pressure; aluminum 356-T6; MS 27022-17
4	1	Coupling half, cap, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-17
5	1	Coupling half, plug, dust, 4-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-17

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

i. 3-Inch Reducer Valve Assembly, Quick Disconnect (3 Units)
NSN_____

Figure:	2-49
Assembly Weight:	24.1 lbs.
Dimensions LxWxH(in.):	12x12x18
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Valve, gate, 3-inch, flanged; hydrostatic qualified to 150 psig working pressure; valve body cast aluminum 356.0; valve stem, double gates and seats made of bronze; rising stem type; MIL-V-58039
2	1	Coupling half, reducer, 3-inch flange to 2-inch cam-lock (male); 150 psig working pressure; aluminum 356-T6; flange conforming to MS 27031
4	1	Coupling half, flange to cam-lock (female), 3-inch; 150 psig working pressure; aluminum 356-T6; MS:27027-15; flange conforming to MS 27031
10	1	Coupling half, cap, dust, 2-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-11
11	1	Coupling half, plug, dust, 2-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-15

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

j. 3-Inch Ball Valve Assembly, Quick Disconnect (1 Unit)
NSN_____

Figure:	2-50
Assembly Weight:	17.5 lbs.
Dimensions LxWxH (in.):	24x12x12
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Coupling half, external pipe thread to cam-lock (female), 3-inch; 150 psig working pressure; aluminum 356-T6; MS 27026-15
2	1	Valve, ball, internal pipe thread connections, 3-inch; 300 psig working pressure; aluminum S6-90-A-T6; pipe threads in accordance with FED-STD-H28/7

3	1	Coupling half, external pipe thread to cam-lock (male), 3-inch; 150 psig working pressure; aluminum 356-T6; MS 27022-15
4	1	Coupling half, cap, dust, 3-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-15
5	1	Coupling half, plug, dust, 3-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-15

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

k. 3-Inch Reducer Tee Assembly, Quick Disconnect (6 Units)
NSN 4730-01-209-9209

Figure:	2-51
Assembly Weight:	39.6 lbs.
Dimensions, LxWxH (in.):	24x24x18
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Tee, 3-inch, flanged; 150 psig working pressure; aluminum 356-T6
2	1	Coupling half, flange to cam-lock (male), 3-inch; 150 psig working pressure; aluminum 356-T6; MS 27023-15; flange conforming to MS 27031
3	1	Valve, gate, 3-inch, flanged; hydrostatic qualified to 150 psig working pressure; valve body cast aluminum 356.0; valve stem, double disks and seats made of bronze; rising stem type; MIL-V-58039
5	1	Coupling half, reducer, 3-inch flange to 1-1/2-inch cam-lock (male); 150 psig working pressure; aluminum 356-T6; flange conforming to MS 27031
6	1	Coupling half, flange to cam-lock (female) 3-inch; 150 psig working pressure; aluminum 356-T6; MS 27027-15; flange conforming to MS 27031

12	1	Coupling half, plug, dust, 3-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-15
13	1	Coupling half, cap, dust, 1-1/2-inch cam-lock, 150 psig working pressure; aluminum 356-T6, MS 27028-9
14	1	Coupling half, cap, dust, 3-inch,cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-15

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

l. 2-Inch Reducer Tee Assembly, Quick Disconnect (18 Units)
NSN 4730-01-210-5627

Figure:	2-52
Assembly Weight:	5.4 lbs.
Dimensions, LxWxH (in.):	12x12x12
Assembly Working Pressure:	150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Tee, 2-inch, internal pipe thread; 250 psig working pressure; aluminum 356-T6; threads in accordance with FED-STD-H28/7; MIL-F-52618
2	1	Coupling half, external pipe thread to cam-lock (male), 2-inch; 150 psig working pressure; aluminum 356-T6; MS 27022-11
3	1	Reducer, 2-inch external pipe thread to 1-inch cam-lock (female); 150 psig working pressure; aluminum 356-T6; MS 49002-5
4	1	Nipple, 2-inch external pipe thread by 3 inches long
5	1	Coupling half, internal pipe thread to cam-lock (female) 2-inch; 150 psig working pressure; aluminum 356-T6; MS 27024-11
7	1	Coupling half, plug, dust, 1-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-5

8	1	Coupling half, plug, dust, 2-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-11
9	1	Coupling half, cap, dust, 2-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-11

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

m. 1.5-Inch Ball Valve Assembly, Quick Disconnect (6 Units)
NSN 4820-01-210-5615

Figure:	2-53
Assembly Weight:	6 lbs.
Dimensions LxWxH (in.):	12x12x12
Assembly Working Pressure:	150psig

Major Component Description

Item No.	Quantity	Description
1	1	Coupling half, external pipe thread to cam-lock (female), 1-1/2-inch; 150 psig working pressure; aluminum 356-T6; MS 27026-9
2	1	Valve, ball, 1-1/2 inch internal pipe thread, 300 psig working pressure; aluminum 56-70-A-T6
3	1	Coupling half, external pipe thread to cam-lock (male), 1-1/2-inch; 150 psig working pressure; aluminum 356-T6; MS 27022-9
4	1	Coupling half, cap, dust, 1-1/2-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27028-9
5	1	Coupling half, plug, dust, 1-1/2-inch cam-lock; 150 psig working pressure; aluminum 356-T6; MS 27029-9

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

2-5.3 **Fitting and Valve Assemblies - Cont'd.**

n. 6-inch Gate Valve Assembly (16 Units)
NSN_____

Figure: 2-54
Assembly Working Pressure: 150 psig

Major Component Description

Item No.	Quantity	Description
1	1	Valve, gate, 6-inch, flanged; hydrostatic qualified to 150 psig working pressure; valve body cast aluminum 356.0; stem and gate corrosion resistant steel; rising stem type; MIL-V-58039
2	2	Adapter, flange to double grooved end, 6-inch; 150 psig working pressure; aluminum 356-T6; flange in accordance with F.S.C.M. (97403) Drawing 13226E8268
8	2	Coupling, clamp, 6-inch, single groove; 150 psig working pressure; malleable cast iron body and handle; connecting pin cold rolled AISI 1212 steel; compatible with double groove fittings
9	2	Cap, 6-inch cam-lock; 150 psig working pressure; aluminum 356-T6

Gaskets are provided for all connections.

See Chapter 8 for complete parts list.

2-5.4 **Separately Supplied Fittings**

a. 6-inch Tee Fitting. Double Grooved, (17 Units)
NSN 4730-01-210-5628

Figure: 2-55
Dimensions LxWxH (in.): 15x11x7
Working Pressure: 150 psig

Description:

Tee, double grooved ends, 6-inch; 150 psig working pressure; aluminum 356-T6

b. 6x6x4 Inch Reducing Tee - Double Grooved (30 Units)
NSN 4730-01-210-5625

Figure: 2-56
Dimensions,

LxWxH (in.): 14-3/4x6-7/8x10-7/8
Working Pressure: 150 psig

Description:

Tee, Reducing, 6"x6"x4" - double grooved ends, aluminum 356-T6

c. 6-inch cap, double grooved (1069 Units)
NSN_____

Figure: 2-57
Dimensions,
DxW (in.): 6.63 (dia.) x 1.88
Working Pressure: 150 psig

Description:

Cap, double grooved, 6-inch, aluminum 356-T6

d. Coupling, Adapter, Cam-Lock Male by Double Grooved Pipe, 6-inch Nominal Size (38 units)
NSN_____

Working Pressure: 75 psig

Description:

Coupling half, nipple adapter, male cam-lock by double grooved end pipe, 6 inches nominal size; aluminum 356-T6; MS 70100-3 (with double groove end)

e. Coupling, Adapter, Cam-Lock Female by Double Groove Pipe, 6-inch Nominal Size (21 units)
NSN 4730-01-210-4556

Working Pressure: 75 psig

Description:

Coupling, adapter assembly, female quick disconnect by double groove end pipe, 6 inch nominal size; aluminum 356-T6; per drawing (97403) 13226E8267-1

f. Coupling, Adapter, Cam-Lock Male by Grooved End Pipe, 4-inch Nominal Size (24 units)
NSN 4730-01-222-6704

Dimensions,
DxW (in.): 4.5 (dia.) x 4.5
Working Pressure: 150 psig

Description:

Coupling half, nipple adapter, male by grooved end pipe; aluminum 356-T6; MS 70100-1

2-5.4 **Separately Supplied Fittings - Cont'd.**

g. Coupling, Adapter, Cam-Lock Female by Grooved End Pipe, 4-inch Nominal Size (18 units)
NSN_____

Working Pressure: 150 psig

Description:

Coupling, adapter assembly, female quick disconnect by groove end pipe, 4 inch nominal size; aluminum 356-T6; per drawing (97407) 13226E8267-2

h. Coupling, 1-inch Cam-Locking Male by External Pipe Thread (25 Units)
NSN 4730-00-084-7435

Working Pressure: 150 psig

Description:

Coupling half, cam-locking male by external pipe thread, 1-inch nominal size; aluminum 356-T6; MS 27022-5. May be assembled with Item 2-5.4i when received.

i. Nozzle, 1-inch (18 Units)
NSN 4930-00-902-4642

Weight: 2.5 lbs.
Test Pressure: 250 psig (nominal operating pressure 15 psig)
Capacity: 12 Gpm

Description:

Nozzle, fuel and oil servicing, non-automatic shutoff, 1 inch; aluminum 356-T6; MIL-N-521 10, Type I, Size 1, Class 8, Style 2

NOTE
The nozzle is intended for use with unleaded gasoline.

j. Reducer, Cam-Locking. 4-inch Female by 6-inch Male (3 units)
NSN_____

Working Pressure: 150 psig

Description:

Reducer, cam-locking type, 4-inch female by 6-inch male; aluminum 356-T6; MS 49000-23

k. Reducer, Cam-Locking, 6-inch Female x 4-inch Male (20 units)
NSN_____

Working Pressure: 150 psig

2-5.4 **Separately Supplied Fittings - Cont'd.**

Description:

Reducer, cam-locking type, 6-inch female by 4-inch male; aluminum 356-T6; MS 49000-21

l. Reducer, Cam-Locking, 4-inch Female x 3-inch Male (19 units)
NSN 4730-00-951-3293

Working Pressure: 150 psig

Description:

Reducer, cam-locking type, 4-inch female by 3-inch male; aluminum 356-T6; MS 49000-1

m. Reducer, Cam-Locking, 3-inch Female by 4-inch Male (12 units)
NSN 4730-00-951-3296

Working Pressure: 150 psig

Description:

Reducer, cam-locking type, 3-inch female by 4-inch male; aluminum 356-T6; MS 49000-9

2-5.5 **Miscellaneous Information**

a. Flanges and Gaskets. Various valves and fittings in the TPT are flanged as shown in the preceding illustrations. The standard dimensions of aluminum flanges used in the system and shown on Fig. 2-58A. Standard gasket dimensions are shown on Fig. 2-58B. Flange gasket material is a cork and rubber composition per MIL C-6183, Type OPTL, CL 1, Gr.B. It is important to note that with aluminum flanges a full-faced gasket must be used.

b. Single Grooved Coupling Clamps. Single grooved malleable iron coupling clamps are used throughout the TPT as noted except on the aluminum pipe system in the switching manifold (see para. 2-5.2b). The single grooved clamps are compatible with double grooving. They fit into only the first groove of the coupled components. The gasket is similar to that in the double grooved coupling, i.e., prelubricated, synthetic rubber, and a c-shaped cross-section. The gasket is compressed when the clamp is closed. The single grooved coupling is shown on Fig. 2-59.

6" single grooved coupling, NSN 4730-01-109-4413 (1522 units)
4" single grooved coupling, NSN_____ (42 units)

c. Ground Rod Sets (54 units)
NSN

Ground rods are provided for each fuel loading point in the tanker-truck receipt manifold and fuel dispensing set. The sets conform to MIL-W-R-550A.

Description:

Ground Rod, Brass, Self-Driving, Type III, Class B, 9 ft. long with 12 ft. cable, MIL-W-R-550A.

SECTION IV - STORAGE AND TRANSFER SYSTEMS

2-6 General. The equipment described in Section II, paragraphs 2-4.1 through 2-4.8 and the hose, pipe, fitting and valve assemblies described in Section III are installed in such a way as to make up the storage and transfer systems described below. Specific drawings are referenced for each section. Reference to the P&ID Fig. 2-1 will clarify the relationship of the systems. Actual installation of the system elements is described in more detail and in appropriate sequence in Chapter 3.

2-6.1 Typical Primary Modules (3 Units) NSN 3835-01-210-5611

a. The primary tank farm module is the holding area for fuel dispensing activities within the TPT. Fuel is pumped directly to the fuel dispensing assembly from the storage tanks of the primary module. Should the need arise, it is possible to pump product from the primary module back to a secondary module, or to the pipeline system.
b. A primary module consists of three 6-inch aluminum cross assemblies (see Fig.2-38), two 5000 Bbl collapsible fabric tanks (see Fig. 2-11 and para. 2-4.1), two 600 GPM hoseline pumps (see Fig. 2-13 and para. 2-4.3), and enough 6-inch hose assemblies, suction and discharge, to connect the components (see Fig. 2-32 and Fig. 2-33). Range poles (see Fig. 2-23) are provided to assist in determination of the amount of product present in the fuel tanks.
c. For typical site layouts and installation plans of a primary module, refer to Fig.'s 2-60A, 2-60B and 2-60C, and the plot plans for a primary module (see 2-3A, 2-4A. and 2-5A). Note the relative locations of major equipment components and the maximum and minimum dimensions, particularly the fuel tank spacing. The maximum distances are dictated by the available hoseline and the minimum distances by safety considerations. The hoseline arrangements shown are example layouts. Other arrangements may be more suitable for certain situations.

2-6.2 Typical Secondary Modules (6 Units) NSN 3835-01-210-5612

a. The secondary tank farm modules are the main bulk storage facility within the TPT. Product stored in a secondary module can be pumped to the primary tank farm module or to the pipeline system. The valve arrangement of the secondary module and the transfer hoseline set make it possible to transfer product from one tank to another within a secondary module or to transfer product from one secondary module to the other within the fuel unit.
b. A secondary module consists of one 6-inch aluminum cross assembly (Fig. 2-38), two 6-inch aluminum wye assemblies (Fig. 2-39), a double grooved aluminum tee (Fig. 2-55), two 5000 Bbl fabric collapsible tanks (Fig. 2-11 and para. 2-41), one 600 GP;., hoseline pump (Fig. 2-13 and para. 2-4.3) and enough 6-inch hose assemblies, suction and discharge, to connect the components (Fig.'s 2-32 and 2-33). Range poles (Fig. 2-23) are provided to assist in the determination of the amount of product present in the fuel tanks.
c. For a typical site layout and installation plans of a secondary module, refer to Fig.'s 2-61A, 2-61B and 2-61C. The secondary module plot plans (Fig.'s 2-38, 2-4B and 2-SB) show two secondary modules connected by the transfer hoseline set. Note the relative locations of major equipment components and maximum and minimum dimensions, particularly fuel tank spacing and the distance between the two secondary modules. The maximum distances are dictated by the available hoseline and the minimum distances by safety and space

2-6.2 **Typical Secondary Modules (6 Units)**
NSN 3835-01-210-5612 -Cont'd.

considerations. The hoseline arrangements shown are example layouts. Other arrangements may be more suitable for certain situations.

2-6.3 **Switching Manifolds (1 Set)**
NSN 3835-01-210-5593

a. The switching manifold provides the means of controlling flow between the fuel modules, the contaminated fuel module and the associated pipeline. Valving in the switching manifold allows cuts between batches of different fuels arriving at the TPT from the associated pipeline, with the product interface going into the contaminated fuel module.
b. The switching manifold consists of one 25-piece bundle (475 ft.) of aluminum pipeline sections (Fig. 2-36 and para. 2-5.2), one crate (25 ea.) of double groove coupling clamps (Fig.'s 2-37A, and 2-378), nine 6-inch aluminum gate valve assemblies (Fig. 2-54), nine 6-inch aluminum double groove tees (Fig. 2-55), and one sampling assembly. The sampling assembly is covered as a specific item in paragraph 2-4.8 and Fig. 2-22.
c. Ideally, the switching manifold should be as compact as possible, however, certain situations may require extra length.
d. The meter strainer, MS1H, is located in specific site technical manuals or by field instruction.

2-6.4 **Transfer Hoseline Assemblies (3 Sets)**
NSN 3835-01-210-5613

a. The transfer hoseline assembly provides the connection between the switching manifold, the secondary tank farm modules, the primary tank farm modules and the return manifold to the pipeline system. Valve assemblies in the transfer hoseline allow the switching of product between the fuel modules.
b. The transfer hoseline assembly consists of approximately 2.75 miles of 6-inch lightweight collapsible hoseline (Fig. 2-30), one 6-inch aluminum wye assembly (Fig. 2-39) and two 6-inch aluminum cross assemblies (Fig. 2-38).
c. The hoseline is provided in flaking boxes, with two 250 ft. lengths connected by a swivel coupling, per box. Three flaking boxes can be stacked on the bed of a truck (may vary according to truck type and terrain) and flaked out continuously.
d. Note the location of the cross and wye assemblies relative to the secondary tank farm modules (Fig's. 2-63A and 2-63B) and the plot plan of secondary tank farm modules (Fig's. 2-38, 2-48, and 2-58). The proper placement of these assemblies is very important to insure the layout of the secondary tank farm modules can be done properly.

2-6.5 **Fuel Dispensing Assemblies (3 Sets)**
NSN 3835-01-211-6835

a. The fuel dispensing assembly is the means of issuing petroleum products from a TPT. There is one fuel dispensing assembly for each of the three fuel units. Using a primary tank farm module as its pumping source and bulk holding point, the fuel dispensing assembly allows fuel distribution to many users simultaneously.

2-6.5 **Fuel Dispensing Assemblies (3 Sets)**
NSN 3835-01-211-6835 - Cont'd.

b. The major components of the fuel dispensing assembly include two 350-gpm filter separators (Fig. 2-20 and para 2-4.7), two probe adapters for the water detection kit, six bottom loading points for loading tank trucks, two 500 gallon collapsible drum loading points and six refilling points for filling vehicle fuel tanks, 5-gallon cans and 55-gallon drums. About 1,000 feet of hoseline and valves of various sizes (Fig. 2-64) are used to connect the components of the dispensing assembly.
c. For a layout of the fuel dispensing assembly, refer to Fig.'s 2-3A, 2-4A and 2-5A. These primary tank farm module plot plans show the layout of the fuel dispensing assembly relative to the primary module. This minimum distance indicated should be maintained for safety concerns.

2-6.6 **Contaminated Fuel Module (1 Unit)**
NSN 3835-01-210-4556

a. The contaminated fuel module provides a holding area for products which become mixed or otherwise contaminated during transport to the TPT. This includes the interface which occurs in pipeline batching. A pump and connections for loading a tanker- truck are provided to allow the contaminated product to be transported as necessary for blending or disposal.
b. The contaminated fuel module consists of a 6-inch aluminum wye assembly (Fig. 2-39), two (2) 50,000-gallon fabric collapsible tanks (see para. 2-4.2 and Fig. 2-12), a 350 gpm pump (see para. 2-4.3 and Fig. 2-16), a 3-inch ball valve assembly (Fig. 2-50) for loading tanker-trucks and hoses and fittings to connect the components.
c. The capacity of the contaminated fuel module may be supplemented with 50,000 gal. tanks designated for the optional tank configuration described in para. 2-6.7, if necessary.
d. A typical layout of a contaminated fuel module is shown in Fig. 2-65. Road access is required to allow the unloading of the 50,000-gallon tanks by tanker-trucks.

2.6.7 **Optional Tank Configuration (1 Unit 0-6 Tanks)**
NSN

a. The optional tank configuration can be used to replace or supplement the normal 5,000 barrel fabric tanks in a fuel module. There is one optional tank configuration supplied with each TPT.
b. The optional tank configuration consists of up to six 50,000 gallon fabric collapsible tanks, six 4-inch aluminum wye assemblies (Fig.'s 2-46 and 2-47), twelve 4-inch aluminum gate valve assemblies (Fig. 2-45), four 4-inch aluminum tee assemblies (Fig.'s 2-42, 2-43, and 2-44). Connections between components are made with 4-inch hoseline assemblies, both suction and discharge (Fig.'s 2-34 and 2-36). Note that each 50,000 gallon tank comes with one ten foot section of 4-inch suction hose and a 4-inch aluminum gate valve which are incorporated into the hoseline layout. Each tank is also supplied with a 4 to 6-inch adapter (para. 2-5.4k) and a 6-inch cam lock to double groove adapter (para. 2-5.4d) to allow the tank to be used separately. Two 6-inch tees (Fig. 2-55) are provided to be used as required.

2.6.7 **Optional Tank Configuration (1 Unit 0-6 Tanks) -Cont'd.**
NSN

c. 50,000 gallon fabric tanks above may be used to supplement the capacity of the contaminated fuel module if necessary.

d. 50,000 gallon fabric collapsible tanks are fully described in Department of the Army TM 5-5430-210-12.

2-6.8 **Tanker-Truck Receipt Option (3 Sets)**
NSN 3835-01-210-5617

a. The three tanker-truck receipt manifolds provide the TPT with the pumps, valves and manifolding necessary to allow the off-loading of petroleum products from tank-trucks if required. A bypass line around the pump is provided, allowing the manifold to be used to load tank-trucks to supplement the fuel dispensing set, if required. The partial or full installation of this facility is optional, depending on site needs.

b. A tanker-truck receipt manifold (Fig. 2-67) has four tanker-truck unloading stations using 4-inch ball valves with 3-inch quick disconnect couplings. The 600 GPM hoseline pump (see para. 2-4.3) provides the means to deliver the product to the TPT. The truck unloading valves are connected to 4-inch suction hose (Fig. 2-36) which are connected to 6-inch suction hose (Fig. 2-33) leading to the pump. The bypass around the pump is made up of 6-inch discharge hose (Fig. 2-32). Three 6-inch aluminum tee assemblies (Fig. 2-40) and four 6x6x4-inch aluminum tees (Fig. 2-56) provide the necessary connections in the manifold.

c. To connect the receipt manifold to the TPT and maintain a safe separation between the components (see General Plot Plan, Fig. 2-2) 250 ft. long 6-inch hoseline sections from the transfer hoseline kit can be utilized as necessary (Fig. 2-30).

2-6.9 **Multiple TPT Installations**

Multiple TPT's can be installed in one general location if required by operations in a particular Petroleum Distribution System Inland Portion Area. The details of multiple installations are beyond the scope of this manual which is for a single typical TPT only. The primary change for a multiple TPT is in the switching manifold. Technical manuals for specific areas are to be referred to for this information.

SECTION V - SYSTEM HYDRAUUCS

2-7 **General**

The TPT hoseline, pipe, valve, and fitting system are designed to operate at pressures not exceeding 150 psig. This maximum pressure exists only at the inlet to the TPT or at the discharge of the hoseline pumps under flowing conditions due to elevation differences and line pressure drop (friction loss). Operating conditions may vary from site to site due to the terrain, the specific service of the TPT, or the available feed pressure to the TPT. These peculiar conditions may cause the installation and operating authority, or the specific site designer, to deviate from the typical or standard conditions described in this manual. There may be substantial differences in elevation between the switching manifold and the tank farm modules or differences in elevation between one tank module and another. Hoseline lengths may have to be shorter or longer than described herein. It may be necessary to extend the length of the switching manifold or

2-7 **General - Cont'd.**

the intake line to the switching manifold. Differences in lengths will cause a variation in the pressure drop from the intake to the end point. The available intake pressure may deviate downward from 150 psig. The information in this section is intended as a guide to assist the responsible parties to make a proper judgment as to the effect on pressure drop and flow rates of the potential deviations outlined above.

2-7.1 **Elevation Head**

If the elevation at the inlet is greater than the elevation at the end point, there will be additional pressure available due to the elevation head. There will be less pressure available if the end point is higher than the inlet. At 60°F. the pressure in psi for each foot of elevation difference is as follows:

On Diesel (.85 Specific Gravity) - .369 psi per foot
On Jet Fuel JP-4 (.78 Specific Gravity) - .338 psi per foot
On MoGas (.72 Specific Gravity) - .312 psi per foot

The following table will permit quick estimating of the pressure effect of elevation differences.

Table 2-1

PRESSURE EFFECT OF ELEVATION DIFFERENTIALS
PRESSURE DIFFERENTIALS PSI

Required Pressure			
Elev. Diff.	**Diesel**	**JP-4**	**MoGas**
Feet			
5	1.9	1.7	1.6
10	3.7	3.4	3.1
15	5.5	5.1	4.7
20	7.4	6.8	6.2
25	9.2	8.5	7.8
30	11.1	10.1	9.4
35	12.9	11.8	10.9
40	14.8	13.5	12.5
45	16.6	15.2	14.0
50	18.5	16.9	15.6
100	36.9	33.83	31.2

2-7.2 **Line Loss**

a. The following tables compare approximate hoseline lengths with flow rates and the required pressure to flow through that length.

Table 2-2

SIX (6) INCH HOSELINE LENGTHS IN FEET, DIESEL (D-2) VERSUS RATE OF FLOW

Required Pressure, psig						
Flow Rate, Gpm	**25**	**50**	**75**	**100**	**125**	**150**
200	15,500	--	--	--	--	--
300	7,500	15,000	--	--	--	--
400	4,500	9,000	13,500	--	--	--
500	3,000	6,000	9,000	12,000	--	--
600	2,200	4,400	6,600	8,800	11,000	--
700	1,600	3,200	4,800	6,400	8,000	9,600
800	1,300	2,600	3,900	5,200	6,500	7,800
900	1,000	2,000	3,000	4,000	5,000	6,000
1000	800	1,600	2,400	3,200	4,000	4,800

Table 2-3

SIX (6) INCH HOSELINE LENGTHS IN FEET, JET FUEL (JP-4) VERSUS RATE OF FLOW

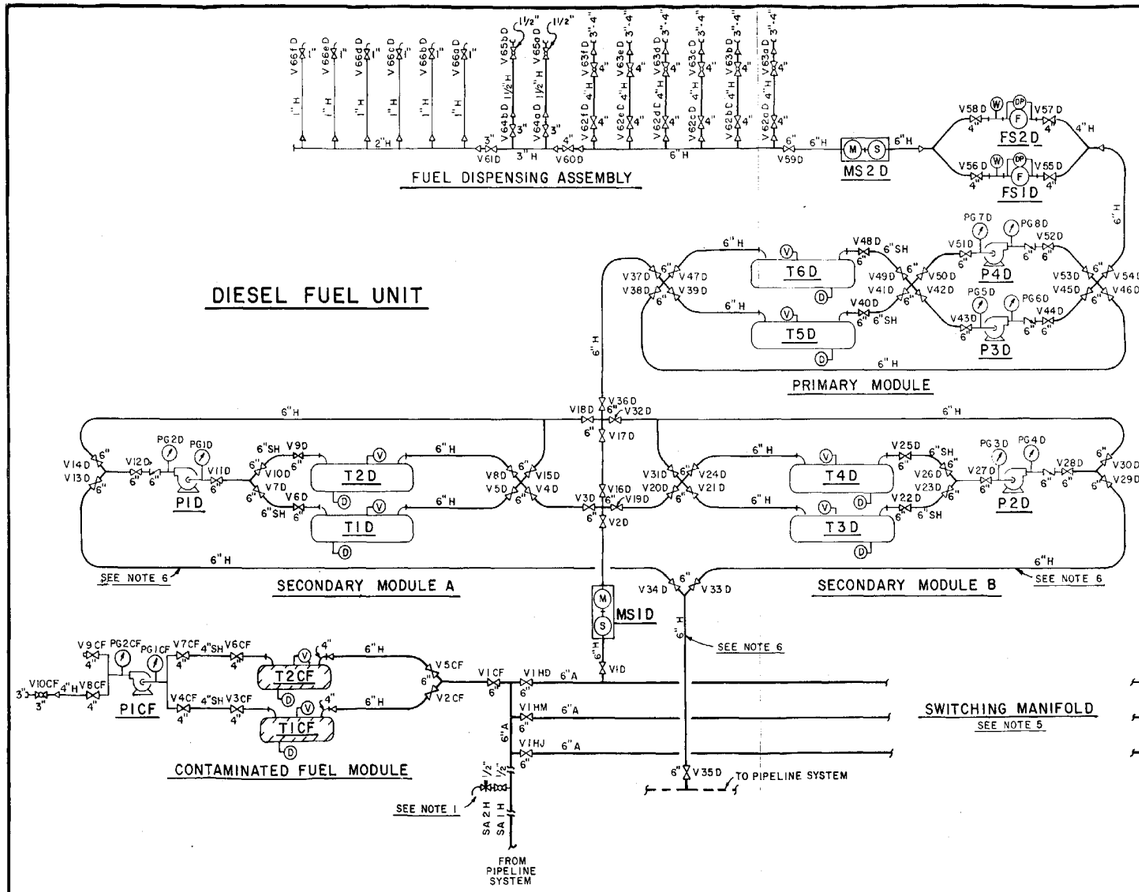
Required Pressure, psig						
Flow Rate, Gpm	**25**	**50**	**75**	**100**	**125**	**150**
200	17,300	--	--	--	--	--
300	8,400	16,800	--	--	--	--
400	5,000	10,000	15,500	--	--	--
500	3,400	6,800	10,200	13,600	--	--
600	2,400	4,800	7,200	9,600	12,000	--
700	1,800	3,600	5,400	7,200	9,000	10,800
800	1,400	2,800	4,200	5,600	7,500	8,400
900	1,100	2,200	3,300	4,400	5,500	6,600
1000	900	1,800	2,700	3,600	4,500	5,400

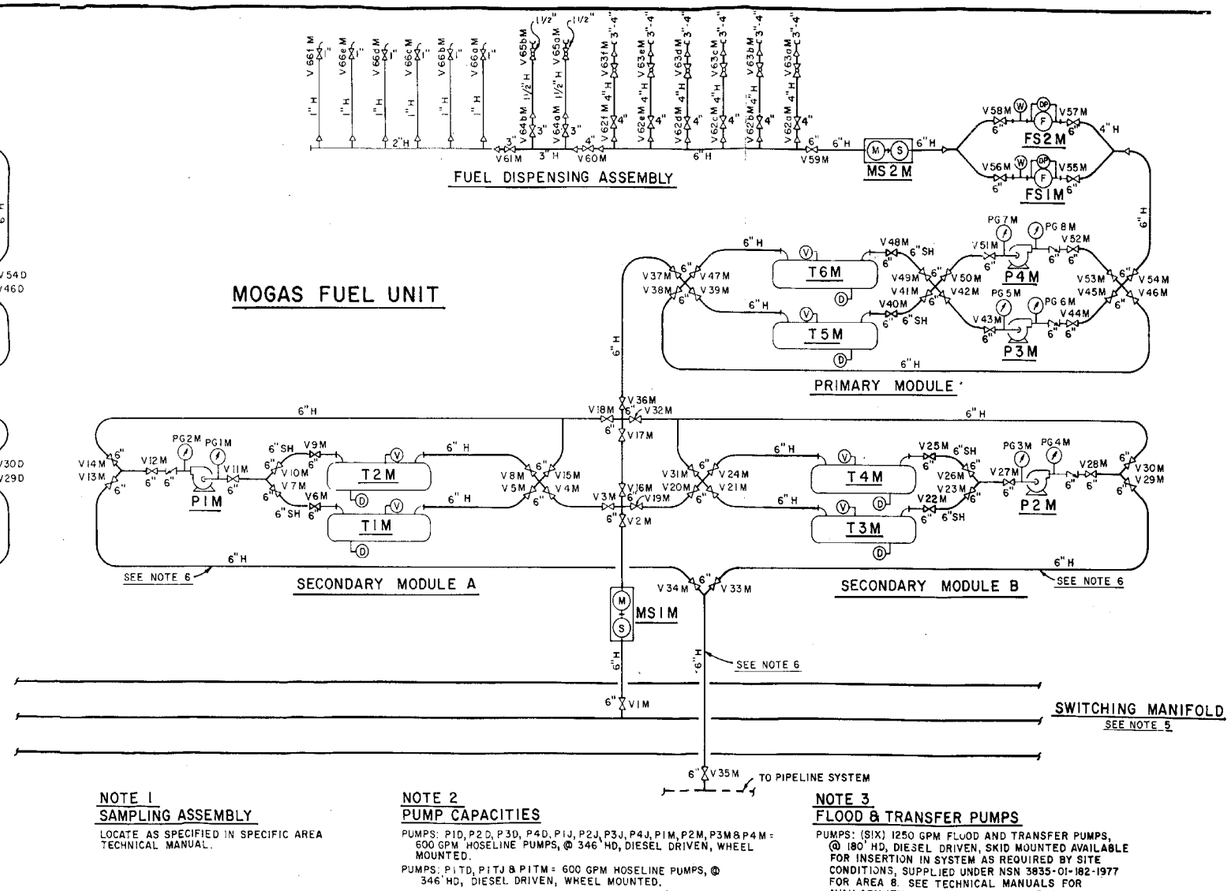
Table 2-4

SIX (6) INCH HOSELINE LENGTHS IN FEET, MOGAS VERSUS FLOW RATE

Required Pressure, psig						
Flow Rate, Gpm	**25**	**50**	**75**	**100**	**125**	**150**
200	25,200	--	--	--	--	--
300	12,000	24,000	--	--	--	--
400	7,200	14,400	21,600	--	--	--
500	4,800	9,600	14,400	19,200	--	--
600	3,400	6,800	10,200	13,600	17,000	--
700	2,600	5,200	7,800	10,400	13,000	15,600
800	2,000	4,000	6,000	8,000	10,000	12,000
900	1,600	3,200	4,800	6,400	8,000	9,600
1000	1,300	2,600	3,900	5,200	6,500	7,800

b. The lengths shown in Tables 2-2, 2-3 and 2-4 can be utilized for 6-inch aluminum pipelines as well by multiplying the lengths shown by 1.42.





NOTE 1
SAMPLING ASSEMBLY

LOCATE AS SPECIFIED IN SPECIFIC AREA TECHNICAL MANUAL.

NOTE 2
PUMP CAPACITIES

PUMPS: P1D, P2D, P3D, P4D, P1J, P2J, P3J, P4J, P1M, P2M, P3M & P4M = 600 GPM HOSELINE PUMPS, @ 346' HD, DIESEL DRIVEN, WHEEL MOUNTED.

PUMPS: P1TD, P1TJ & P1TM = 600 GPM HOSELINE PUMPS, @ 346' HD, DIESEL DRIVEN, WHEEL MOUNTED.

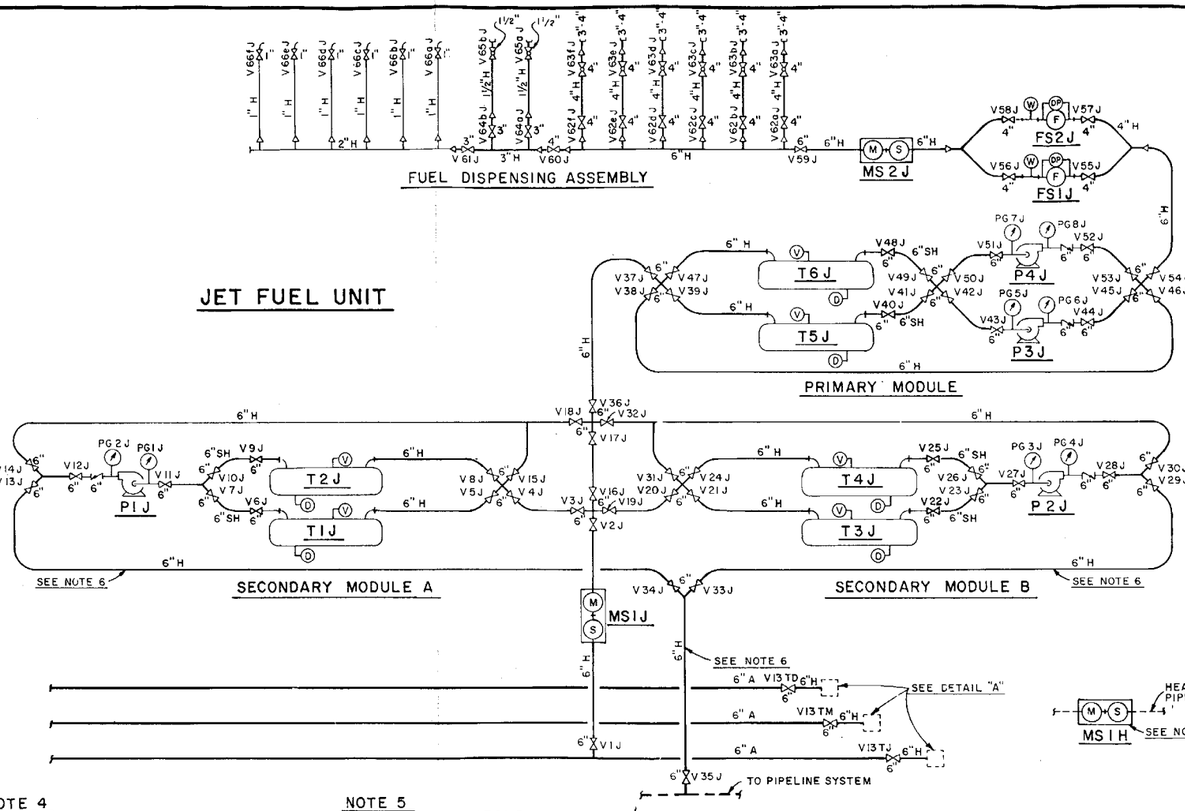
PUMP: P1CF = 350 GPM TRANSFER PUMP, @ 275' HD, DIESEL DRIVEN, WHEEL MOUNTED.

NOTE 3
FLOOD & TRANSFER PUMPS

PUMPS: (SIX) 1250 GPM FLOOD AND TRANSFER PUMPS, @ 180' HD, DIESEL DRIVEN, SKID MOUNTED AVAILABLE FOR INSERTION IN SYSTEM AS REQUIRED BY SITE CONDITIONS, SUPPLIED UNDER NSN 3835-01-182-1977 FOR AREA 8. SEE TECHNICAL MANUALS FOR AVAILABILITY IN OTHER SPECIFIC AREAS.

2-55/(2-56 blank)

2-55/(2-56 blank)



NOTE 4

FOR INFORMATION ON VALVES AND INSTRUMENTS SUPPLIED AS PART OF MAJOR EQUIPMENT SEE MAJOR EQUIPMENT LIST 2-1.2.

NOTE 5
SWITCHING MANIFOLD

SWITCHING MANIFOLD SHOWN IS FOR A TYPICAL SINGLE TPT INSTALLATION. MODIFICATIONS MAY BE NECESSARY FOR SPECIFIC TPT SITES OR SERVICE. SCHEMATIC LENGTH DOSE NOT INDICATE ACTUAL RELATIVE LENGTH. SHORT MANIFOLD IS DESIRABLE. SEE TECHNICAL MANUALS FOR SPECIFIC AREAS FOR DETAILS.

NOTE 6
ALTERNATE FOR RECEIVING ONLY TPT

AT RECEIVING ONLY TPT'S THESE HOSELINES MAY BE LEFT OUT.

NOTE 7

SEE TECHNICAL MANUAL FOR TPT BY WILLBROS BUTLER ENGINEERS INC., CHAPTER 2, FOR DETAILS ON EQUIPMENT IDENTIFICATION NUMBERS, EQUIPMENT SPECIFICATIONS, DESIGN OPERATING PRESSURES AND DESIGN FLOWS.

NOTE 8

MS1H SUPPLIED WITH TPT INSTALLED IN COMMON HEADER TO PIPELINE SYSTEM POSITIONED IN ACCORDANCE WITH SPECIFIC SITE TECHNICAL MANUAL.

DWN	DATE
CHKD	DATE
ENGR	DATE
APPROVED	

WILLBROS BUTLER ENGINEERS, INC.

TYPICAL TACTICAL PETROLEUM TERMINAL PIPING & INSTRUMENT DIAGRAM

NSN 3835-01-182-1976

SCALE	PROJECT NO	DRAWING NO	REV.
		FIGURE 2-1	8

2-56.1/(2-56.2 blank)

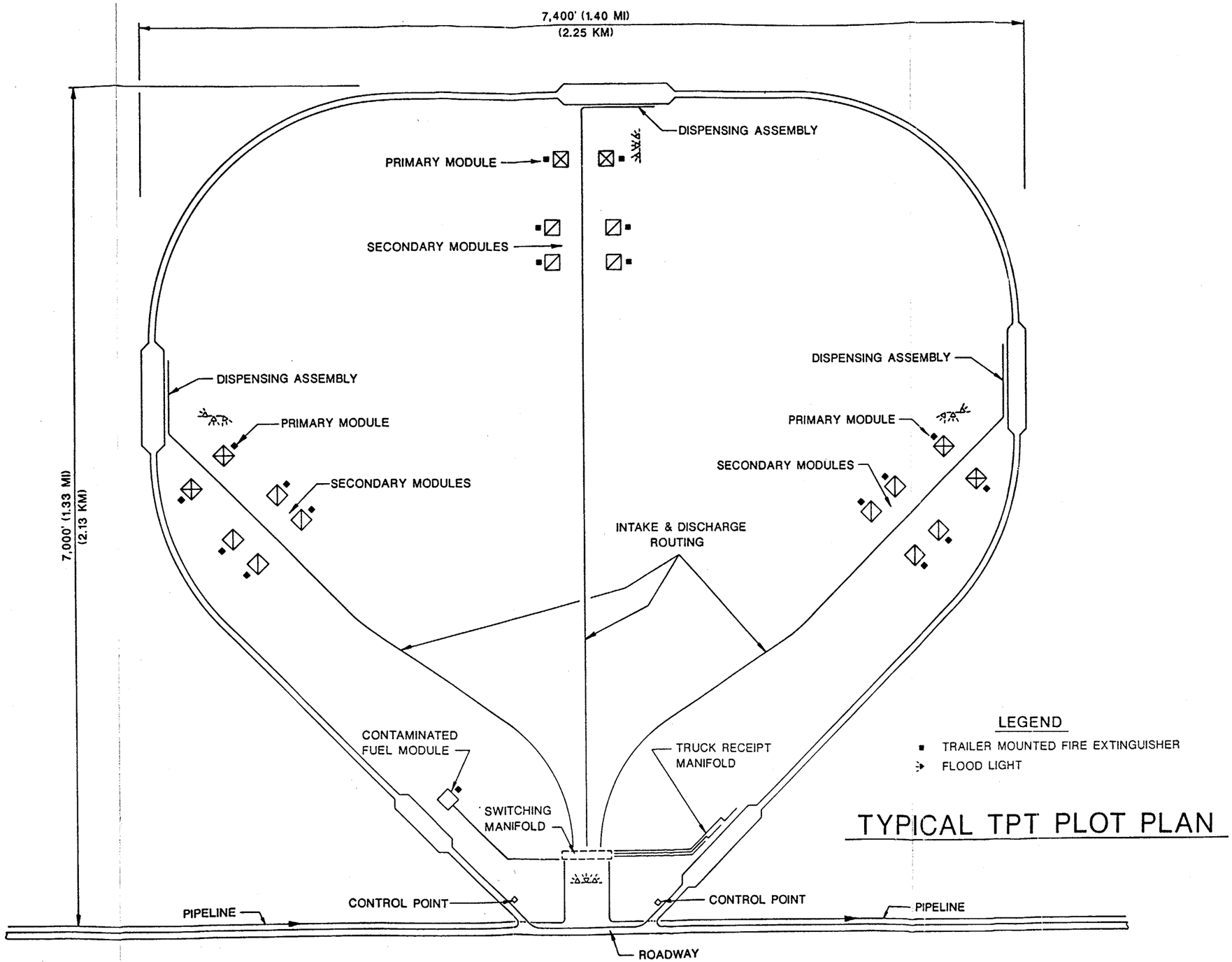
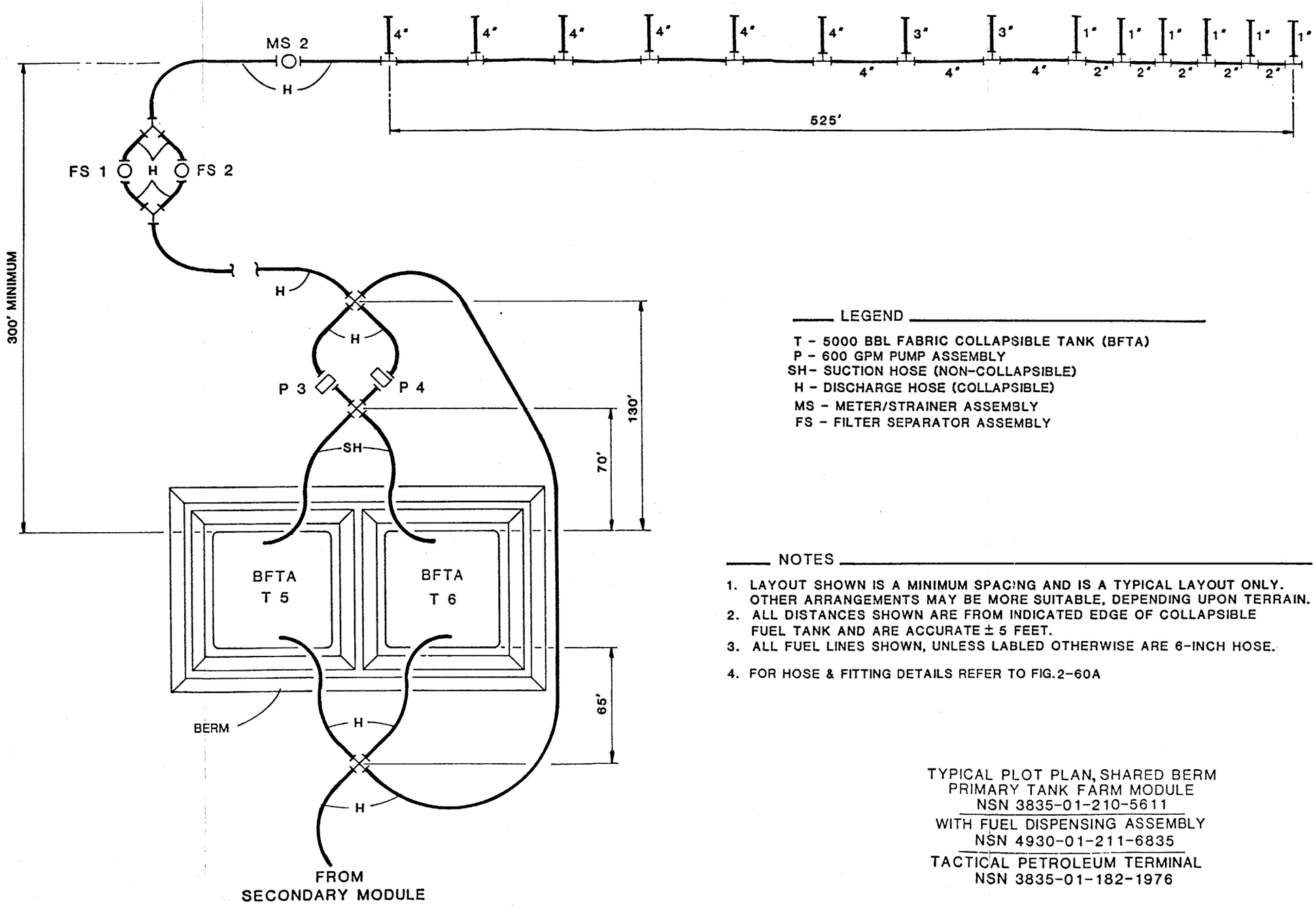

7,400' (1.40 MI)
(2.25 KM)
7,000' (1.33 MI)
(2.13 KM)
PRIMARY MODULE
SECONDARY MODULES
DISPENSING ASSEMBLY
DISPENSING ASSEMBLY
PRIMARY MODULE
SECONDARY MODULES
DISPENSING ASSEMBLY
PRIMARY MODULE
SECONDARY MODULES
INTAKE & DISCHARGE
ROUTING
CONTAMINATED
FUEL MODULE
TRUCK RECEIPT
MANIFOLD
SWITCHING
MANIFOLD
CONTROL POINT
CONTROL POINT
PIPELINE
PIPELINE
ROADWAY
LEGEND
TRAILER MOUNTED FIRE EXTINGUISHER
FLOOD LIGHT
TYPICAL TPT PLOT PLAN

FIG. 2-2



LEGEND

T - 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA)
P - 600 GPM PUMP ASSEMBLY
SH- SUCTION HOSE (NON-COLLAPSIBLE)
H - DISCHARGE HOSE (COLLAPSIBLE)
MS - METER/STRAINER ASSEMBLY
FS - FILTER SEPARATOR ASSEMBLY

NOTES

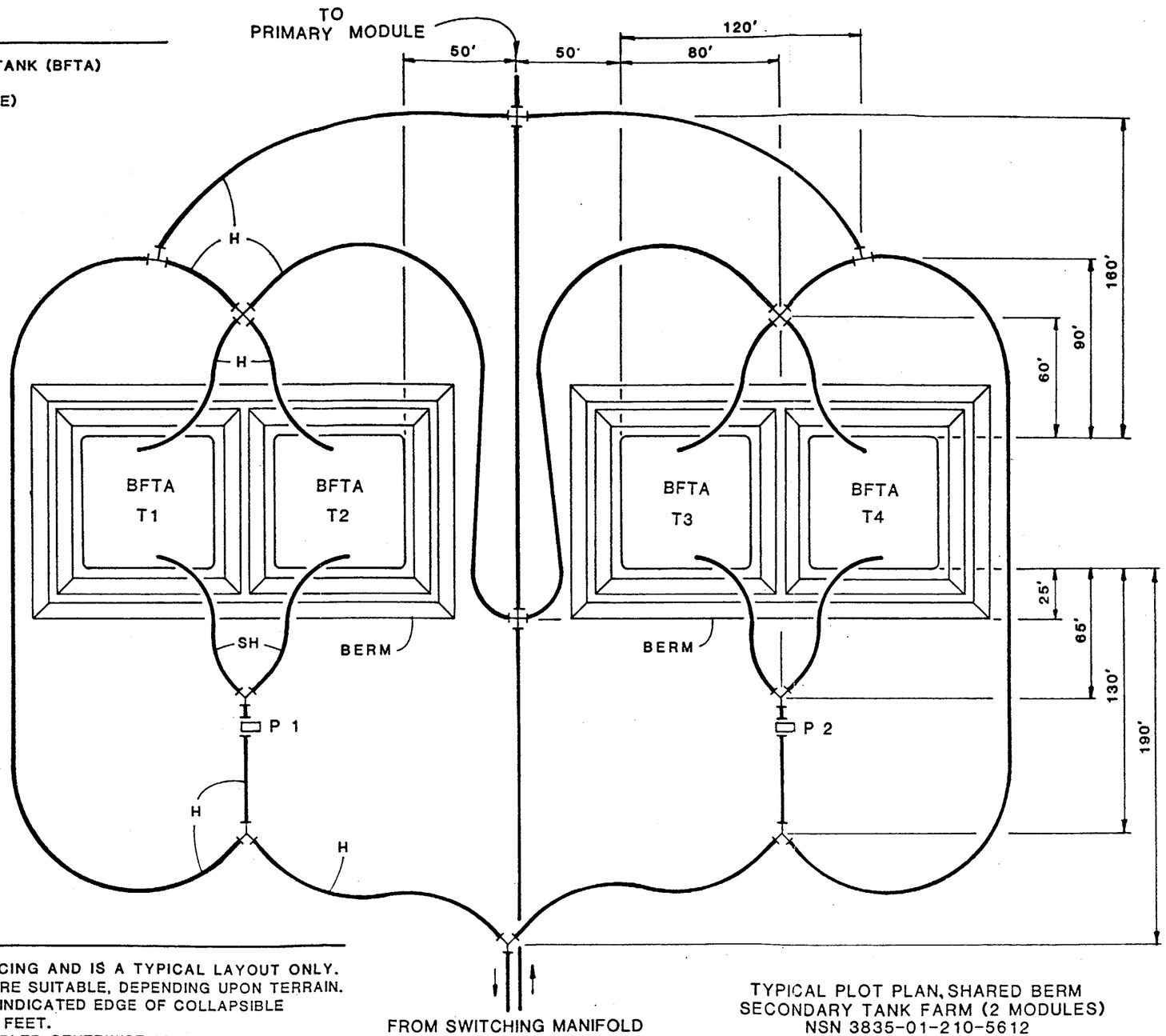
1. LAYOUT SHOWN IS A MINIMUM SPACING AND IS A TYPICAL LAYOUT ONLY. OTHER ARRANGEMENTS MAY BE MORE SUITABLE, DEPENDING UPON TERRAIN.
2. ALL DISTANCES SHOWN ARE FROM INDICATED EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES SHOWN, UNLESS LABLED OTHERWISE ARE 6-INCH HOSE.
4. FOR HOSE & FITTING DETAILS REFER TO FIG.2-60A

TYPICAL PLOT PLAN, SHARED BERM
PRIMARY TANK FARM MODULE
NSN 3835-01-210-5611
WITH FUEL DISPENSING ASSEMBLY
NSN 4930-01-211-6835
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-3A

LEGEND

T - 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA)
P - 600 GPM PUMP ASSEMBLY
SH - SUCTION HOSE (NON-COLLAPSIBLE)
H - DISCHARGE HOSE (COLLAPSIBLE)



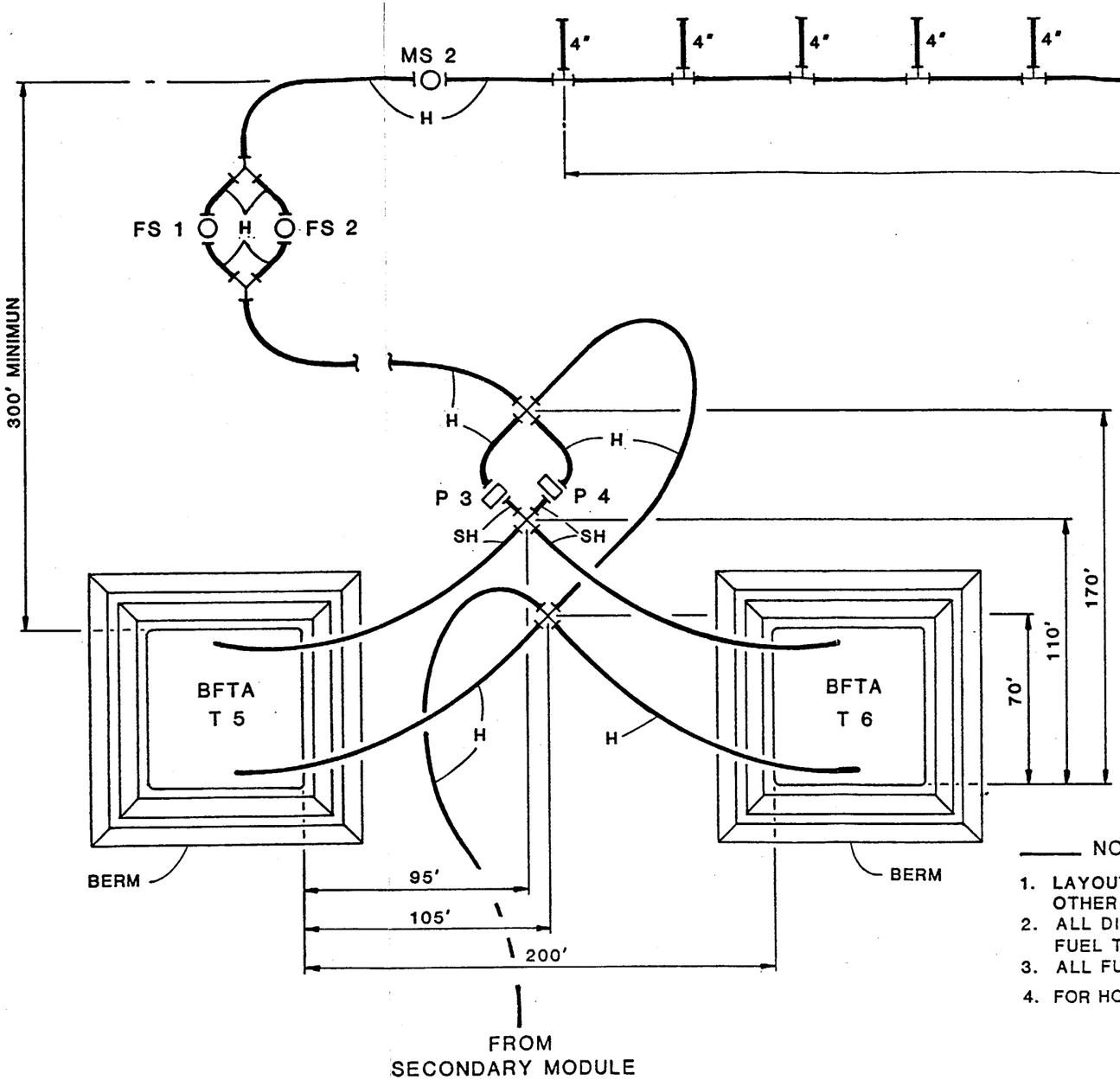
FROM SWITCHING MANIFOLD TO PIPELINE SYSTEM

TYPICAL PLOT PLAN, SHARED BERM SECONDARY TANK FARM (2 MODULES)
NSN 3835-01-210-5612
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

NOTES

1. LAYOUT SHOWN IS A MINIMUM SPACING AND IS A TYPICAL LAYOUT ONLY. OTHER ARRANGEMENTS MAY BE MORE SUITABLE, DEPENDING UPON TERRAIN.
2. ALL DISTANCES SHOWN ARE FROM INDICATED EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES SHOWN, UNLESS LABLED OTHERWISE ARE 6-INCH HOSE.
4. FOR HOSE & FITTING DETAILS REFER TO FIG. 2-61A

FIG. 2-3B



LEGEND

T – 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA).
P – 600 GPM PUMP ASSEMBLY
SH – SUCTION HOSE (NON-COLLAPSIBLE)
H – DISCHARGE HOSE (COLLAPSIBLE)
MS – METER/STRAINER ASSEMBLY
FS – FILTER SEPARATOR ASSEMBLY

NOTES

1. LAYOUT SHOWN IS A MAXIMUM SPACING AND IS A TYPICAL LAYOUT ONLY. OTHER ARRANGEMENTS MAY BE MORE SUITABLE, DEPENDING UPON TERRAIN.
2. ALL DISTANCES SHOWN ARE FROM INDICATED EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES SHOWN, UNLESS LABLED OTHERWISE ARE 6-INCH HOSE.
4. FOR HOSE & FITTING DETAILS REFER TO FIG. 2-60B

TYPICAL PLOT PLAN, MAXIMUM SPACING
PRIMARY TANK FARM
NSN 3835-01-210-5611
WITH FUEL DISPENSING ASSEMBLY
NSN 4930-01-211-6835
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

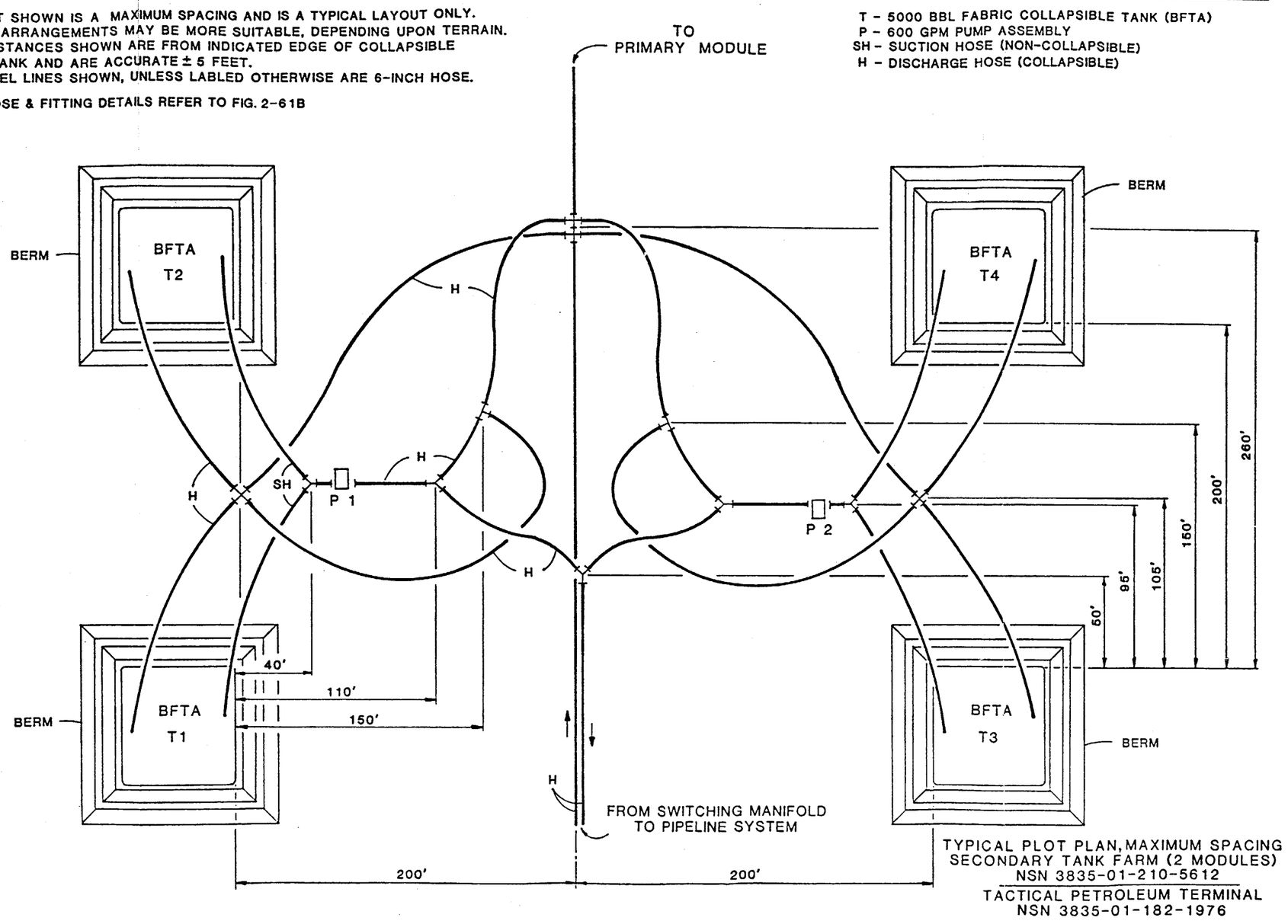
FIG. 2-4A

NOTES

1. LAYOUT SHOWN IS A MAXIMUM SPACING AND IS A TYPICAL LAYOUT ONLY. OTHER ARRANGEMENTS MAY BE MORE SUITABLE, DEPENDING UPON TERRAIN.
2. ALL DISTANCES SHOWN ARE FROM INDICATED EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES SHOWN, UNLESS LABLED OTHERWISE ARE 6-INCH HOSE.
4. FOR HOSE & FITTING DETAILS REFER TO FIG. 2-61B

LEGEND

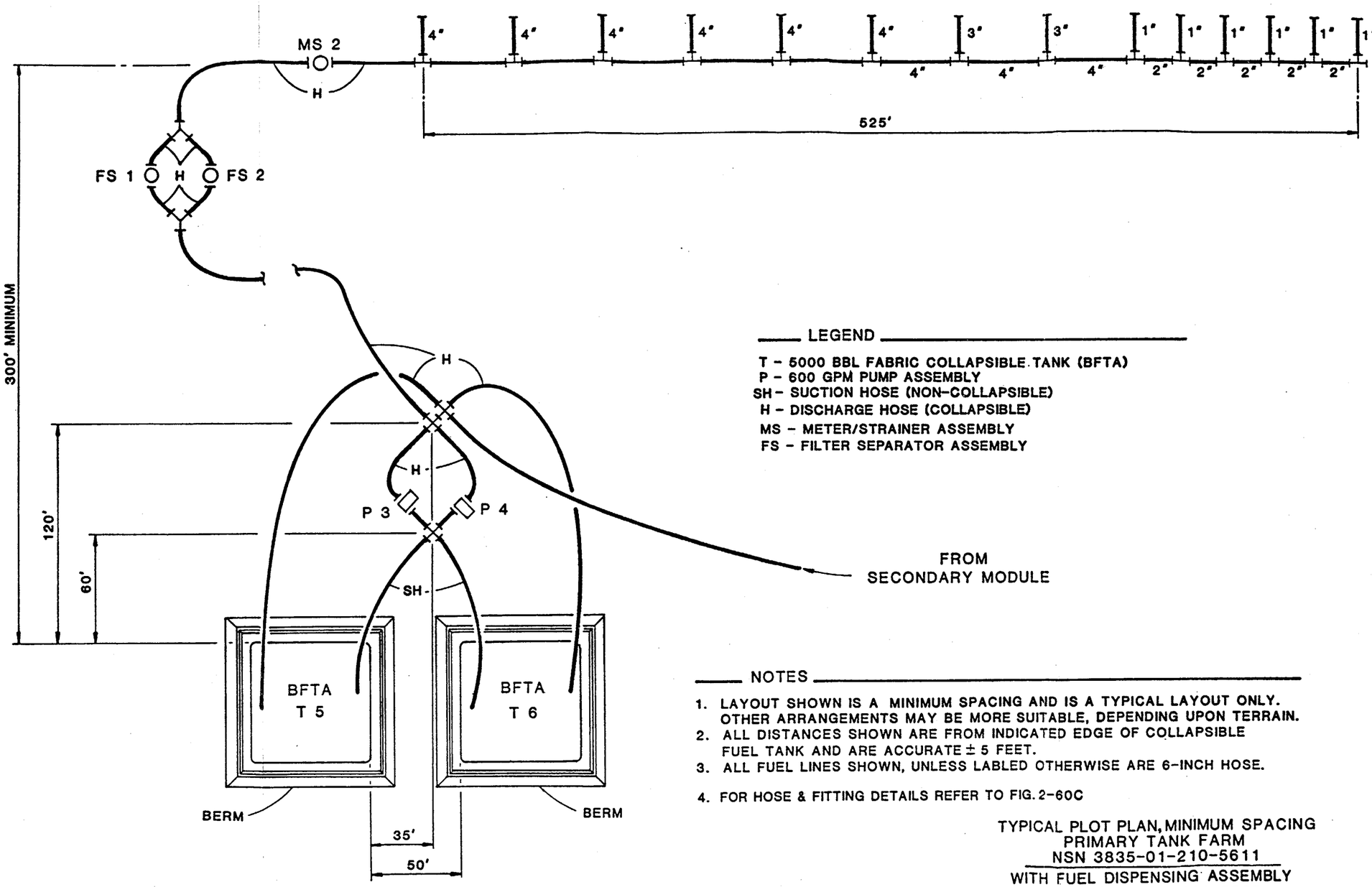
T - 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA)
P - 600 GPM PUMP ASSEMBLY
SH - SUCTION HOSE (NON-COLLAPSIBLE)
H - DISCHARGE HOSE (COLLAPSIBLE)



TYPICAL PLOT PLAN, MAXIMUM SPACING
SECONDARY TANK FARM (2 MODULES)
NSN 3835-01-210-5612

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-4B



LEGEND

T – 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA)
P – 600 GPM PUMP ASSEMBLY
SH – SUCTION HOSE (NON-COLLAPSIBLE)
H – DISCHARGE HOSE (COLLAPSIBLE)
MS – METER/STRAINER ASSEMBLY
FS – FILTER SEPARATOR ASSEMBLY

NOTES

1. LAYOUT SHOWN IS A MINIMUM SPACING AND IS A TYPICAL LAYOUT ONLY. OTHER ARRANGEMENTS MAY BE MORE SUITABLE, DEPENDING UPON TERRAIN.
2. ALL DISTANCES SHOWN ARE FROM INDICATED EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES SHOWN, UNLESS LABLED OTHERWISE ARE 6-INCH HOSE.
4. FOR HOSE & FITTING DETAILS REFER TO FIG. 2-60C

TYPICAL PLOT PLAN, MINIMUM SPACING
PRIMARY TANK FARM
NSN 3835-01-210-5611
WITH FUEL DISPENSING ASSEMBLY
NSN 4930-01-211-6835
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

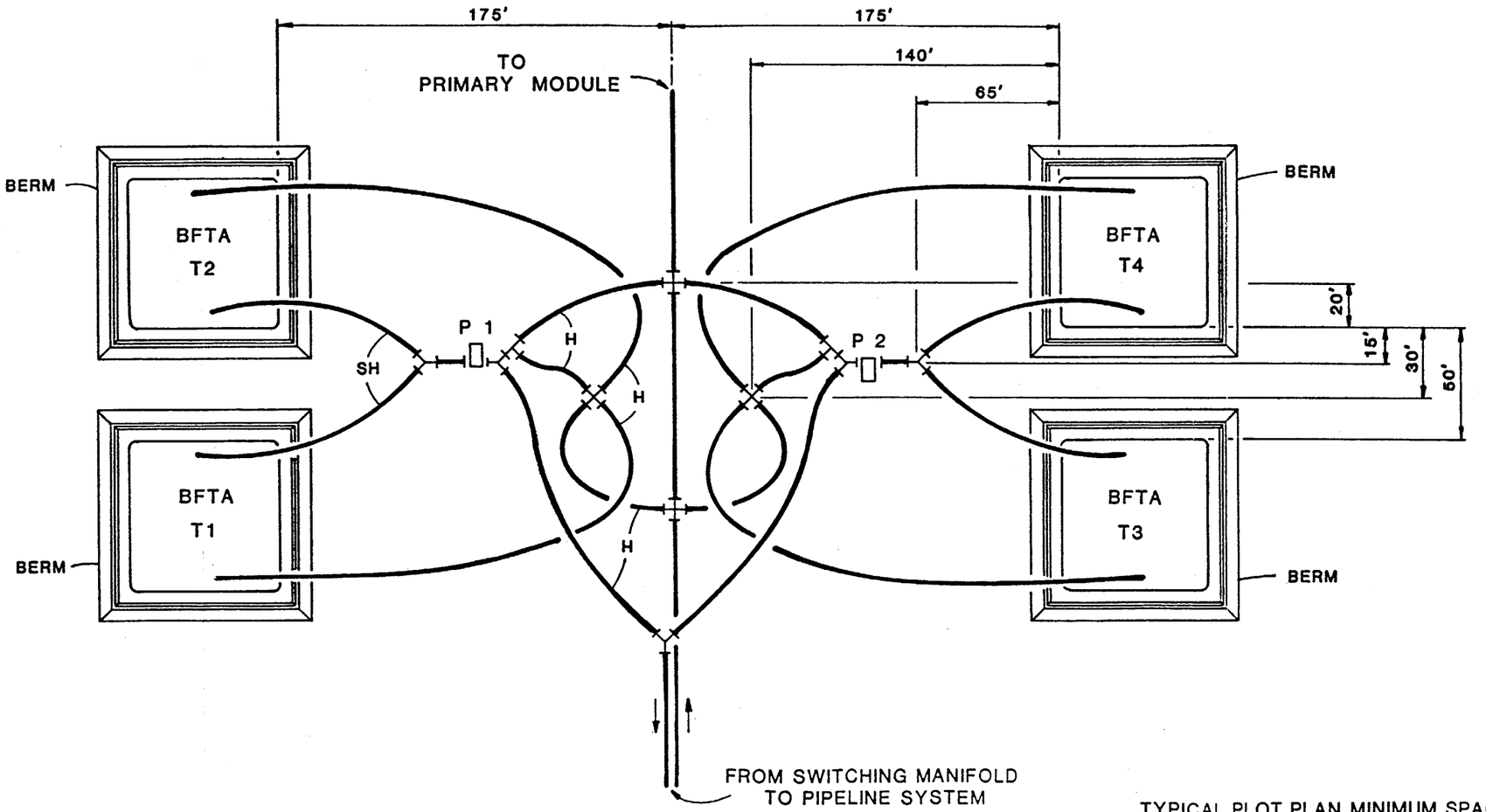
FIG. 2-5A
2-67/(2-68 Blank)

NOTES

1. LAYOUT SHOWN IS A MINIMUM SPACING AND IS A TYPICAL LAYOUT ONLY. OTHER ARRANGEMENTS MAY BE MORE SUITABLE, DEPENDING UPON TERRAIN.
2. ALL DISTANCES SHOWN ARE FROM INDICATED EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES SHOWN, UNLESS LABLED OTHERWISE ARE 6-INCH HOSE.
4. FOR HOSE & FITTING DETAILS REFER TO FIG. 2-61C

LEGEND

T - 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA)
P - 600 GPM PUMP ASSEMBLY
SH - SUCTION HOSE (NON-COLLAPSIBLE)
H - DISCHARGE HOSE (COLLAPSIBLE)



TYPICAL PLOT PLAN, MINIMUM SPACING
SECONDARY TANK FARM (2 MODULES)
NSN 3835-01-210-5612

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

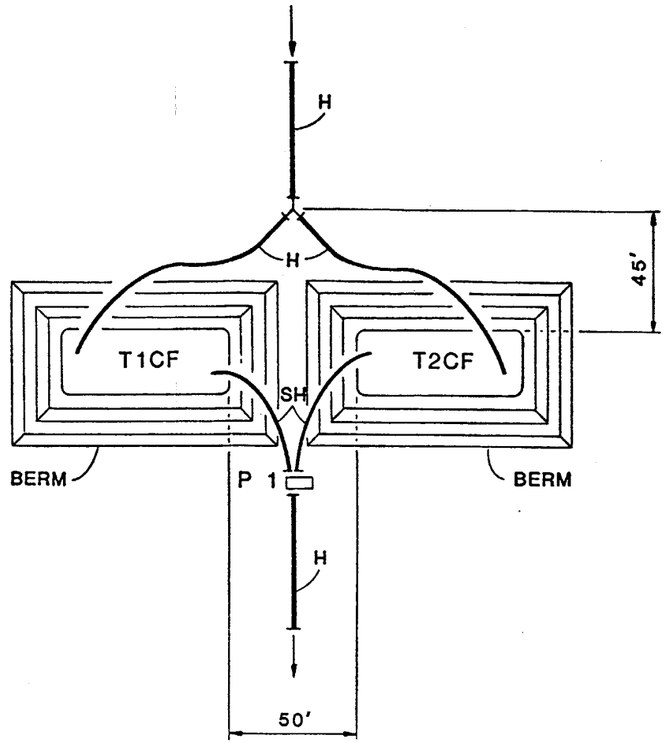
FIG. 2-5B

LEGEND

T – 50,000 GALLON FABRIC COLLAPSIBLE TANK
H – DISCHARGE HOSE (COLLAPSIBLE)
SH – SUCTION HOSE (NON-COLLAPSIBLE)
P – 350 GPM PUMP ASSEMBLY

NOTES

1. LAYOUT SHOWN UTILIZES ALL COMPONENTS IN A CONTAMINATED FUEL MODULE, AND IS A TYPICAL LAYOUT ONLY.
2. ALL DISTANCES SHOWN ARE FROM THE EDGE OF COLLAPSIBLE FUEL TANK AND ARE ACCURATE ± 5 FEET.
3. ALL FUEL LINES ARE 6-INCH ON FILL SIDE AND 4-INCH ON SUCTION SIDE OF LAYOUT.
4. FOR HOSE & FITTING DETAILS REFER TO FIG. 2-65



PLOT PLAN
CONTAMINATED FUEL MODULE
NSN 3836-01-210-4556

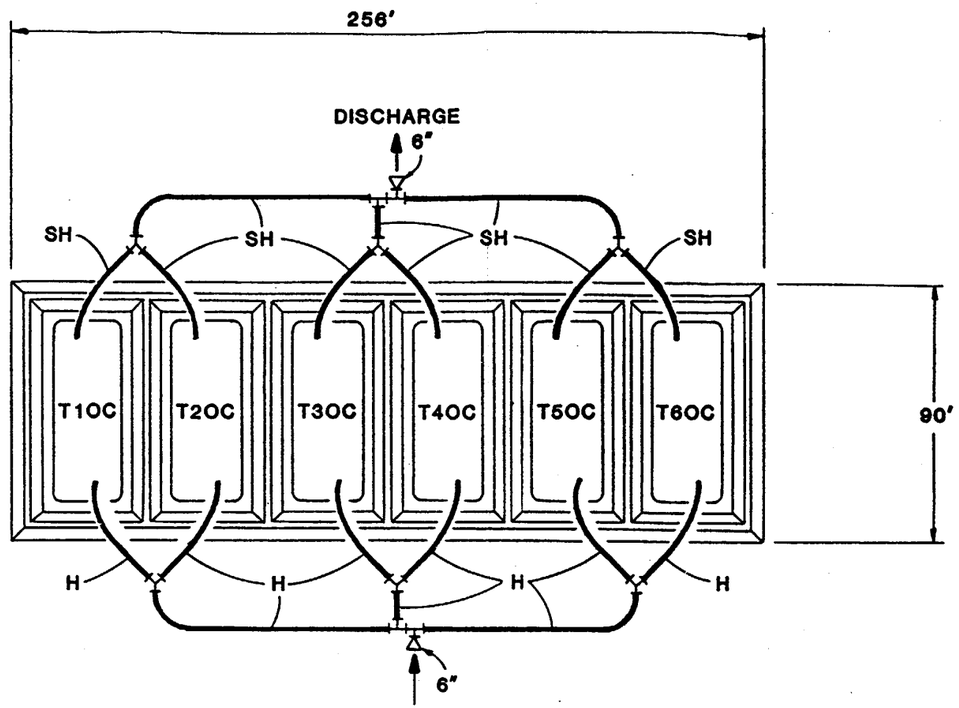
FIG. 2-6
2-71/(2-72 Blank)

LEGEND

T – 50,000 GALLON FABRIC COLLAPSIBLE TANK ASSEMBLY
H – DISCHARGE HOSE (COLLAPSIBLE)
SH – SUCTION HOSE (NON-COLLAPSIBLE)

NOTES

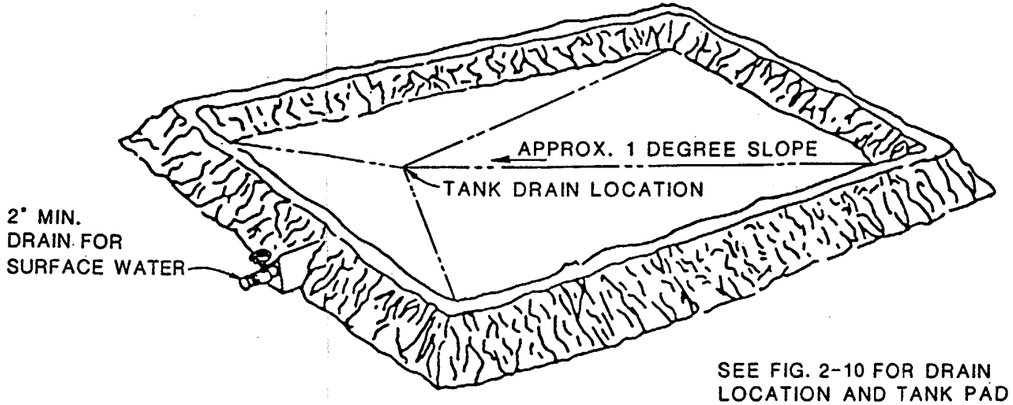
1. LAYOUT SHOWN IS A TYPICAL LAYOUT ONLY. TWO 6-INCH TEE ASSEMBLIES TO BE USED TO CONNECT OPTION TO REST OF TPT NOT SHOWN. REDUCERS ARE PROVIDED TO EACH TANK TO CONNECT EACH TANK SEPARATELY IF REQUIRED.
2. ALL DISTANCES SHOWN ARE ± 5 FEET.
3. ALL FUEL LINES ARE 4-INCH HOSE.
4. PUMPS MUST BE OBTAINED FROM ANOTHER SOURCE.
5. ASSUMES SOIL BERMS USED.



PLOT PLAN
50,000 GAL. TPT OPTIONAL TANK CONFIGURATION

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-7

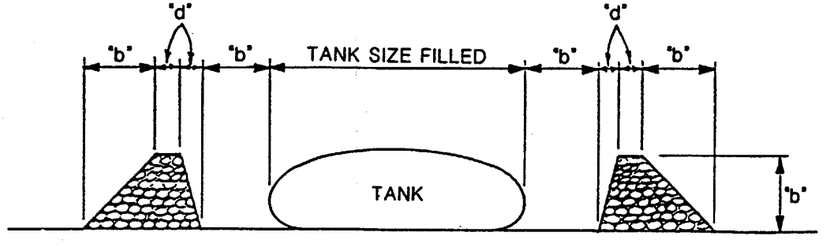


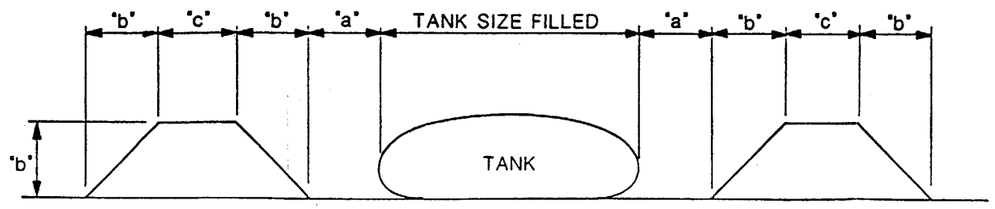
SEE FIG. 2-10 FOR DRAIN LOCATION AND TANK PAD INSTALLATION.

PLAN

SCHEDULE

TANK SIZE FILLED	"a"	"b"	"c"	"d"
5,000 BBL 66'-0"(20.12M)x66'-0"(20.12M)	4'-0" (1.22M)	5'-6" (1.68M)	5'-0" (1.52M)	1'-0" (.31M)
50,000 GAL. 24'-0"(7.32M)x64'-0"(19.51M)	3'-0" (.92M)	4'-6" (1.37M)	5'-0" (1.52M)	1'-0" (.31M)
3,000 GAL. 4'-0"(1.22M)x12'-6"(3.81M)	2'-6" (.76M)	3'-0" (.92M)	3'-0" (.92M)	1'-0" (.31M)





TYPICAL BERM CROSS SECTION
SOIL

TYPICAL BERM CROSS SECTION
SAND BAGS

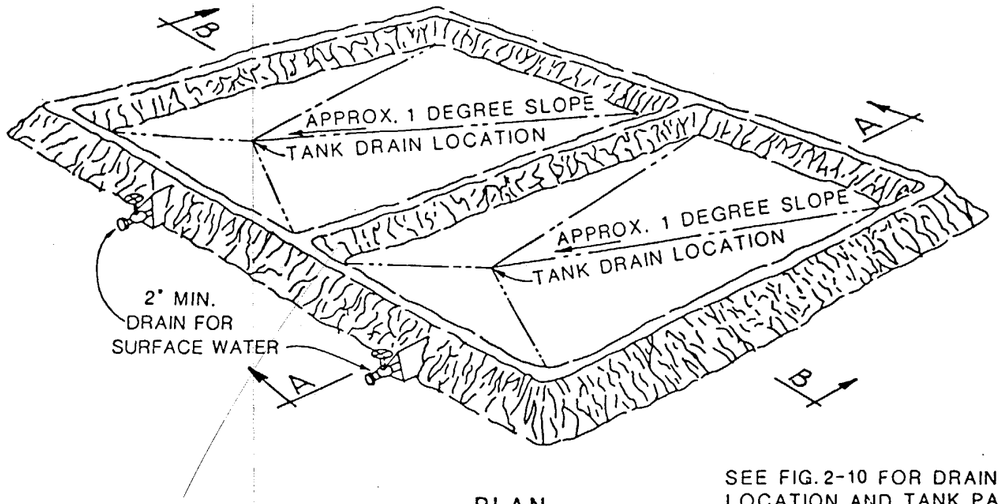
ALTERNATIVE TO SAND BAGS

USE SAND GRID REVETMENT CONSTRUCTION, SIMILAR TO AFCS DWG. 14910 KM-KP.

MATERIAL: SAND CONFINEMENT GRID
NSN 5680-01-198-7955

TANK BERM CONSTRUCTION

FIGURE 2-8

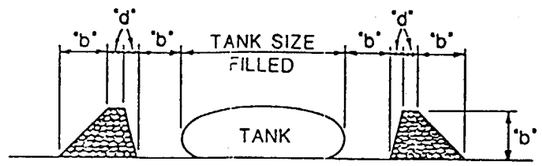


PLAN

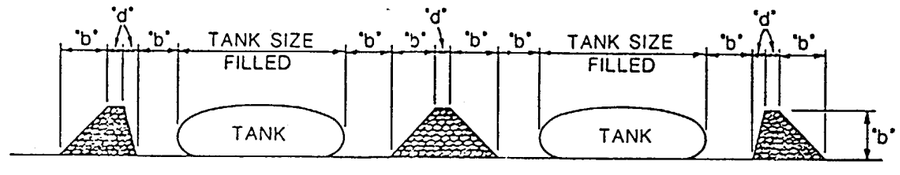
SEE FIG. 2-10 FOR DRAIN LOCATION AND TANK PAD INSTALLATION.

SCHEDULE

TANK SIZE FILLED	"a"	"b"	"c"	"d"
5,000 BBL 66'-0"(20.12M)x66'-0"(20.12M)	4'-0" (1.22M)	5'-6" (1.68M)	5'-0" (1.52M)	1'-0" (.31M)
50,000 GAL. 24'-0"(7.32M)x64'-0"(19.51M)	3'-0" (.92M)	4'-6" (1.37M)	1'-0" (.31M)	1'-0" (.31M)
3,000 GAL. 4'-0"(1.22M)x12'-6"(3.81M)	2'-6" (.76M)	3'-0" (.92M)	1'-0" (.31M)	1'-0" (.31M)



SECTION A-A



SECTION B-B

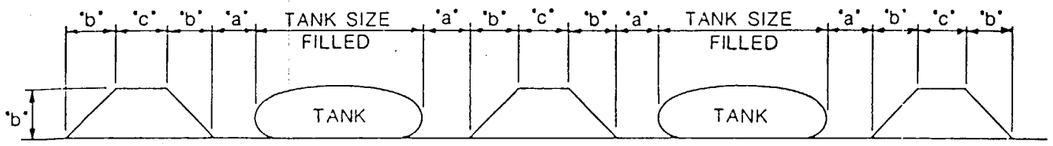
TYPICAL BERM CROSS SECTION
SAND BAGS

ALTERNATIVE TO SAND BAGS

USE SAND GRID REVETMENT CONSTRUCTION, SIMILAR TO AFCS DWG. 14910 KM-KP.

MATERIAL: SAND CONFINEMENT GRID
NSN 5630-01-198-7955

SECTION A-A



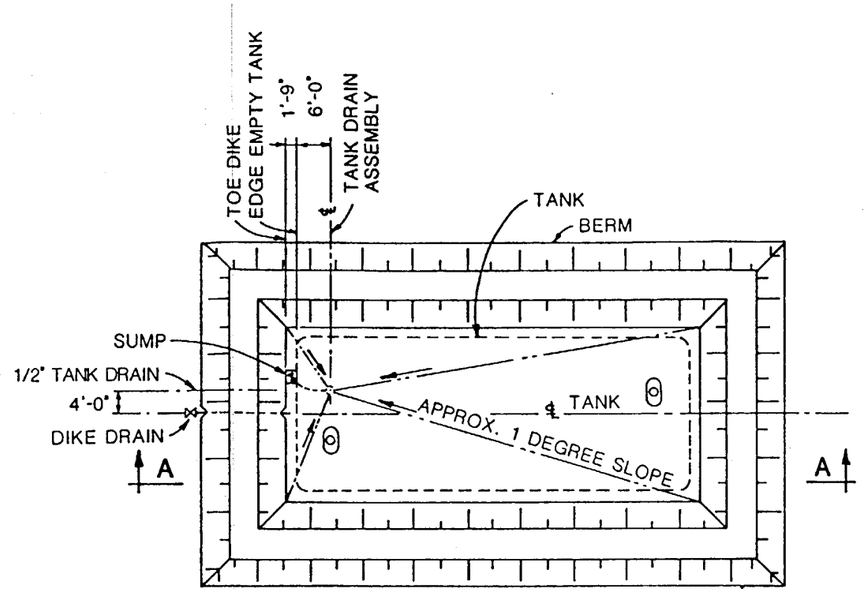
SECTION B-B

TYPICAL BERM CROSS SECTION
SOIL

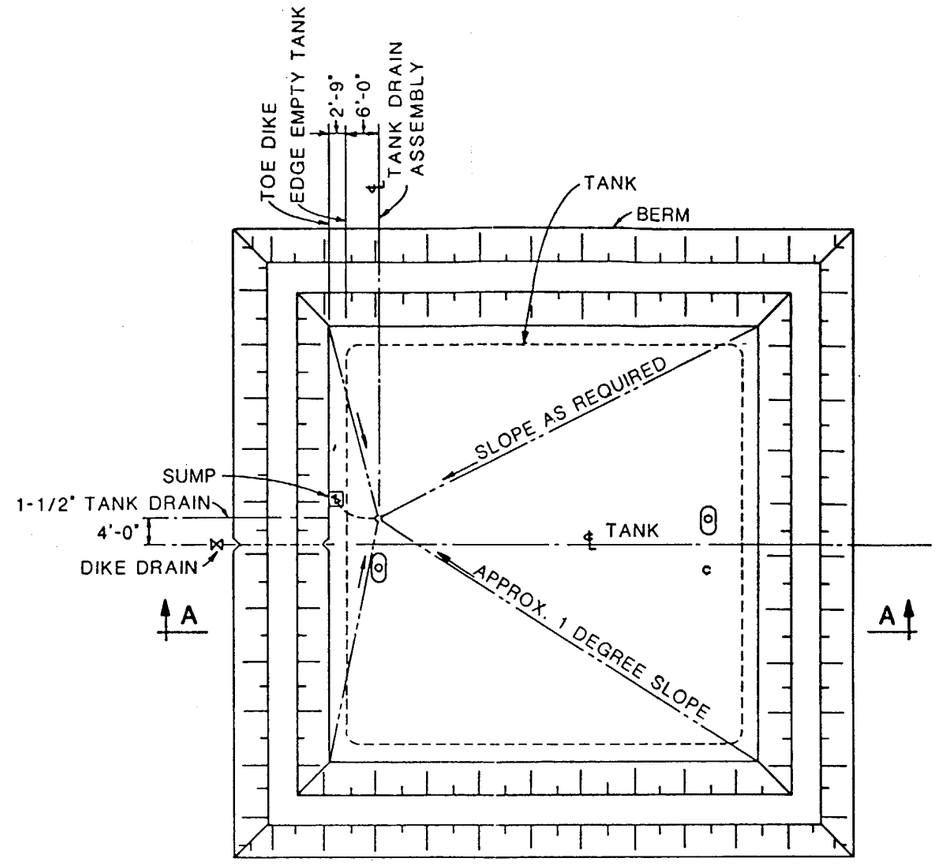
SHARED TANK BERM CONSTRUCTION

FIGURE 2-9
2-77/(2-78 Blank)

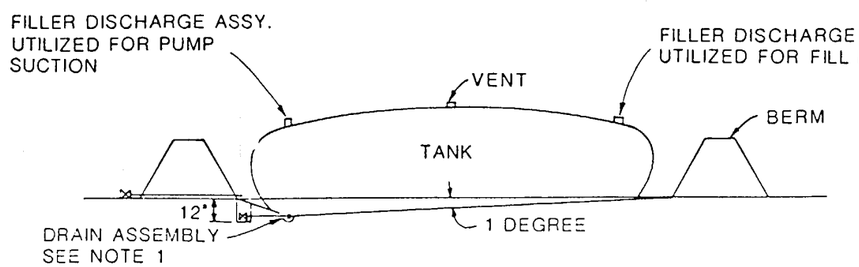
FIGURE 2-9
2-77/(2-78 Blank)



PLAN
FOR 50,000 GAL FABRIC
COLLAPSIBLE TANK



PLAN
FOR 5,000 BBL FABRIC
COLLAPSIBLE TANK



SECTION A-A

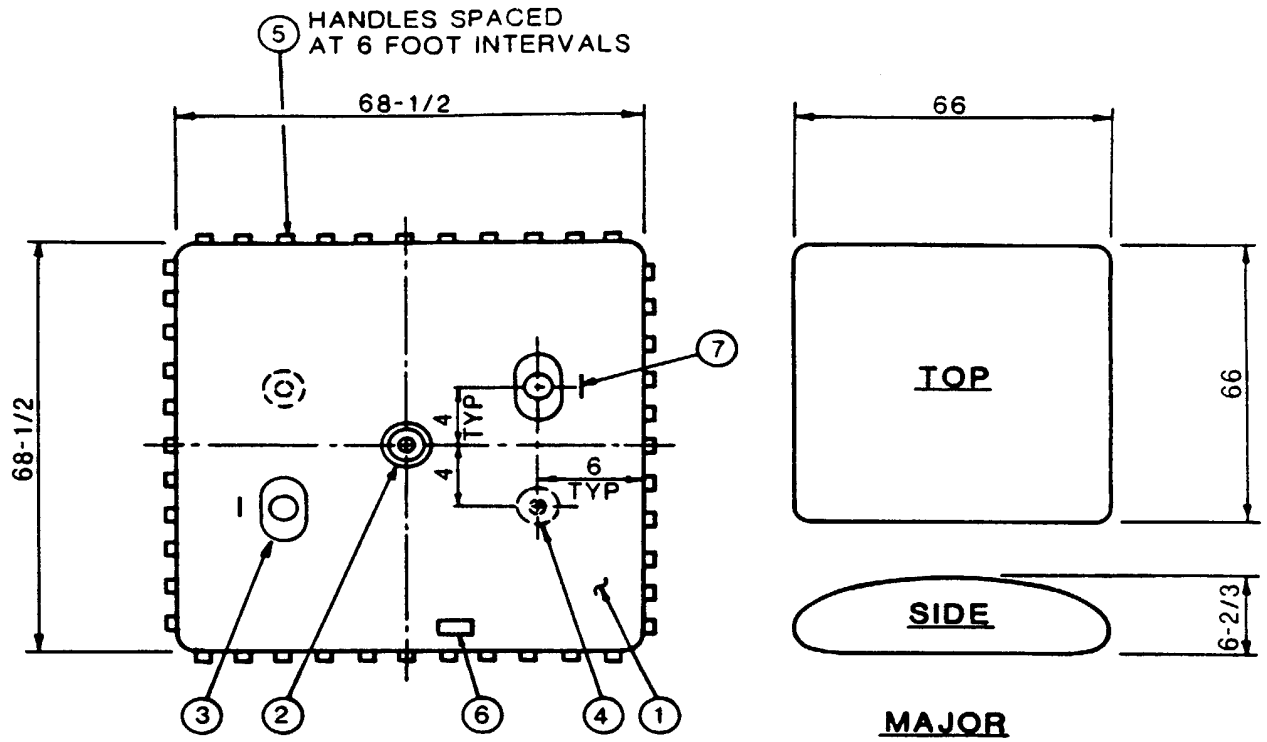
NOTE 1

REMOVE ENOUGH SOIL AT DRAIN FITTING LOCATION AND ON THE ROUTE OF TANK DRAIN HOSE TO AVOID DEFORMATION OF TANK BOTTOM. A 18"x18"x12" SUMP WILL BE NECESSARY FOR DRAIN VALVE ACCESS.

TANK PAD AND TANK INSTALLATION CRITERIA

FIGURE 2-10
2-79/(2-80 Blank)

FIGURE 2-10
2-79/(2-80 Blank)



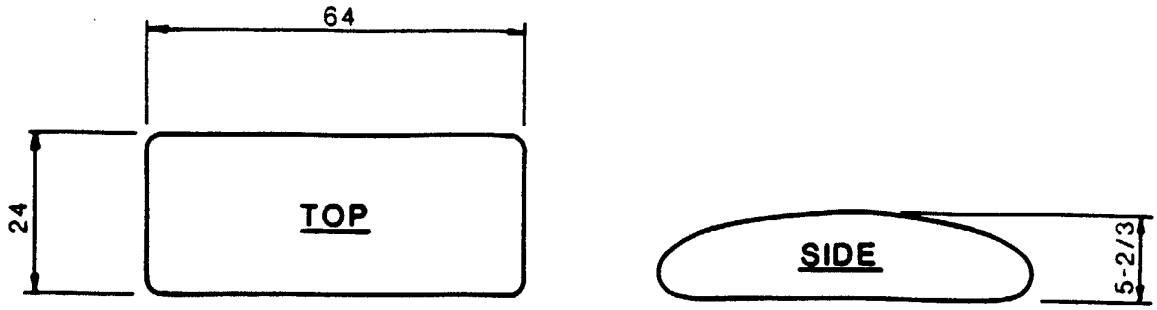
NOTES

1. ALL DIMENSIONS IN FEET.
2. TOLERANCES: FITTINGS LOCATION ±2 FEET. OTHER ±1 FOOT.

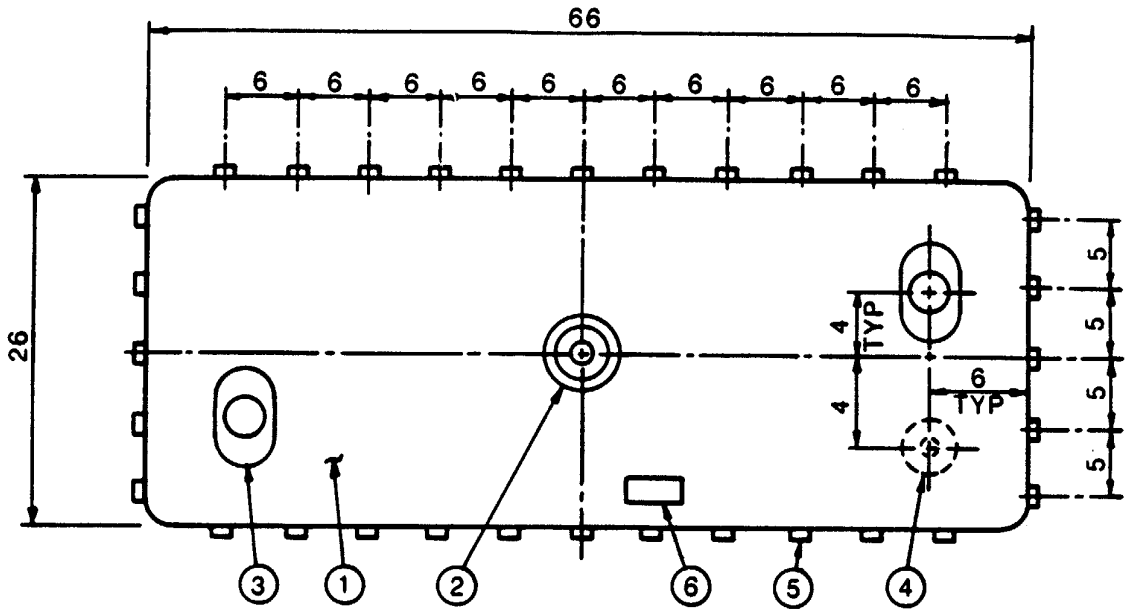
ITEM	QTY.	DESCRIPTION
1	1	TANK 5000 BARREL
2	1	VENT ASSY
3	2	FILLER-DISCHARGE ASSY
4	2	DRAIN ASSY
5	44	HANDLES (11 PER SIDE)
6	1	LABEL
7	2	WARNING NOTICE

FIG. 2-11

5000 BBL FABRIC
COLLAPSIBLE TANK
NSN 5430-01-160-3528



MAJOR DIMENSIONS OF FULL TANK



DIMENSIONS OF EMPTY TANK

NOTES:

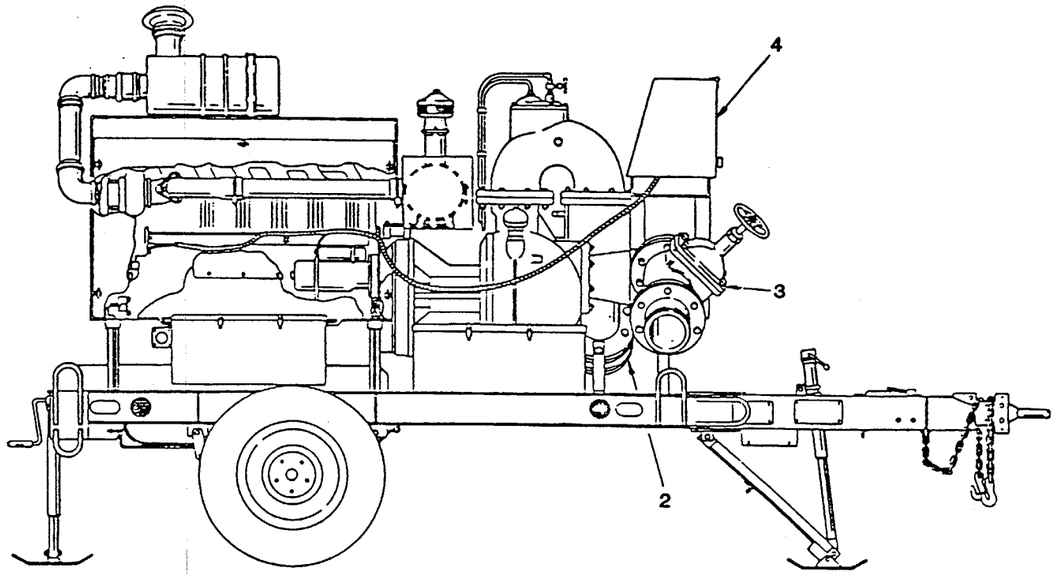
1. ALL DIMENSIONS IN FEET.
2. ALL TOLERANCES ±1 FOOT UNLESS OTHERWISE NOTED.

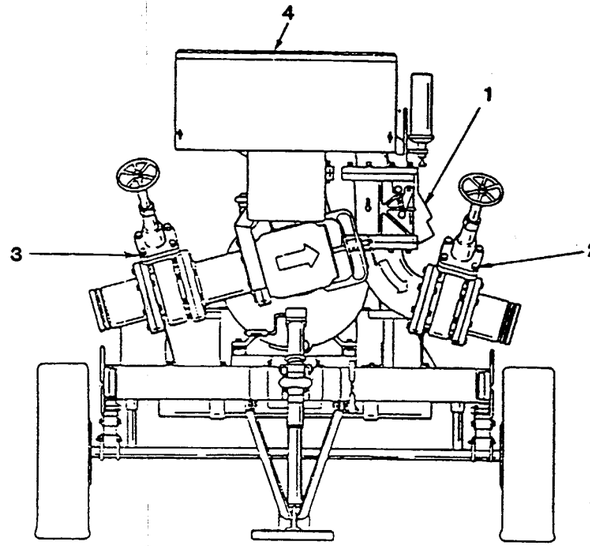
ITEM	QTY.	DESCRIPTION
①	1	TANK 50,000 GAL.
②	1	VENT ASSY.
③	2	FILLER-DISCHARGE ASSY.
④	1	DRAIN ASSY.
⑤	32	HANDLE
⑥	1	LABEL

FIG. 2-12

5000 BBL FABRIC
COLLAPSIBLE TANK
NSN 5430-01-160-3528

1. DISCHARGE CHECK VALVE
2. DISCHARGE GATE VALVE
3. SUCTION GATE VALVE
4. INSTRUMENT PANEL



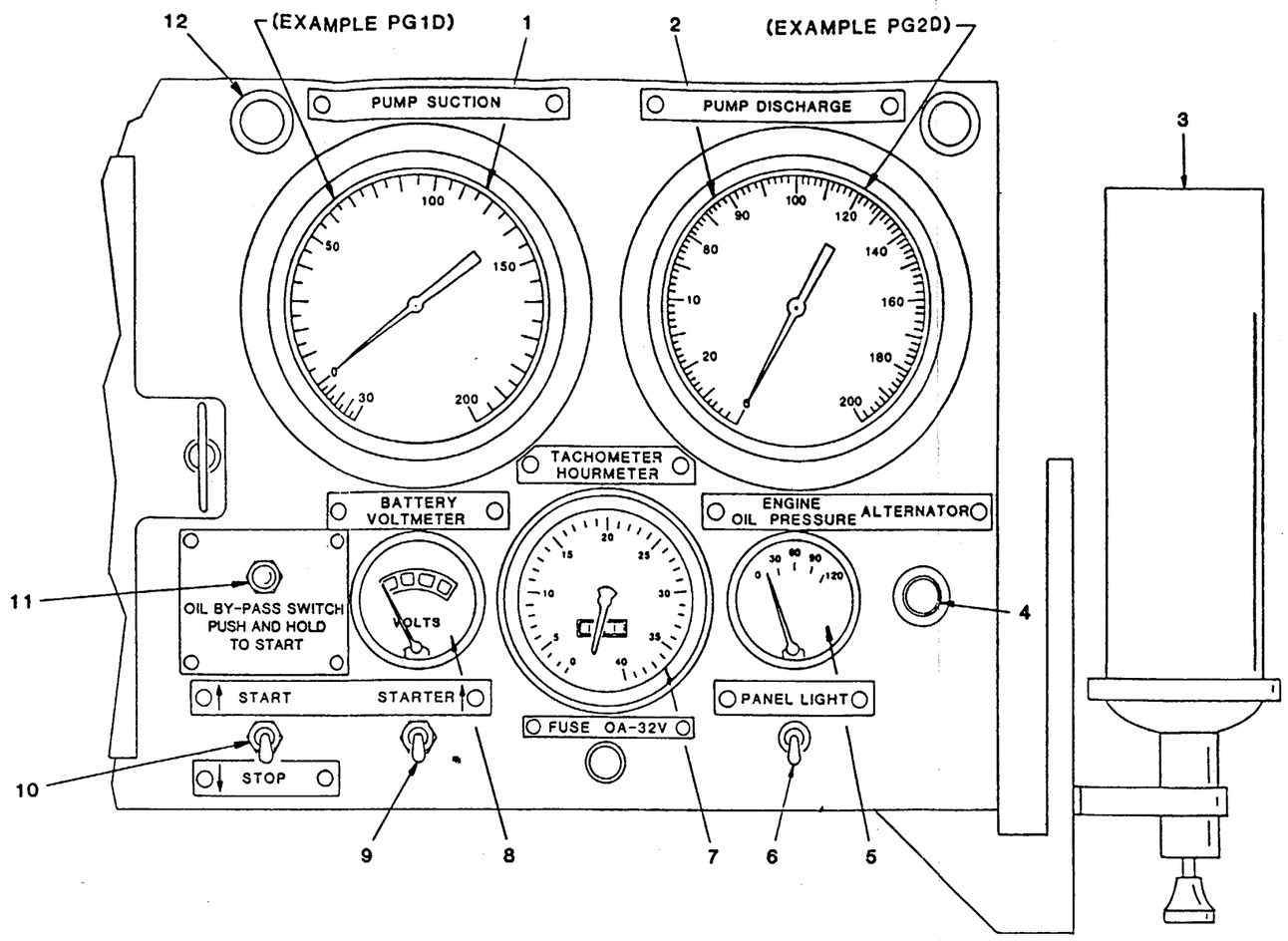


LENGTH	154 INCH (391.16 cm)
WIDTH	85 INCH (215.90 cm)
HEIGTH	77 INCH (195.58 cm)
WEIGHT	3380 lb. (1533 kg)

600 GPM HOSELINE PUMP
NSN 4320-01-193-3429

FIG. 2-13

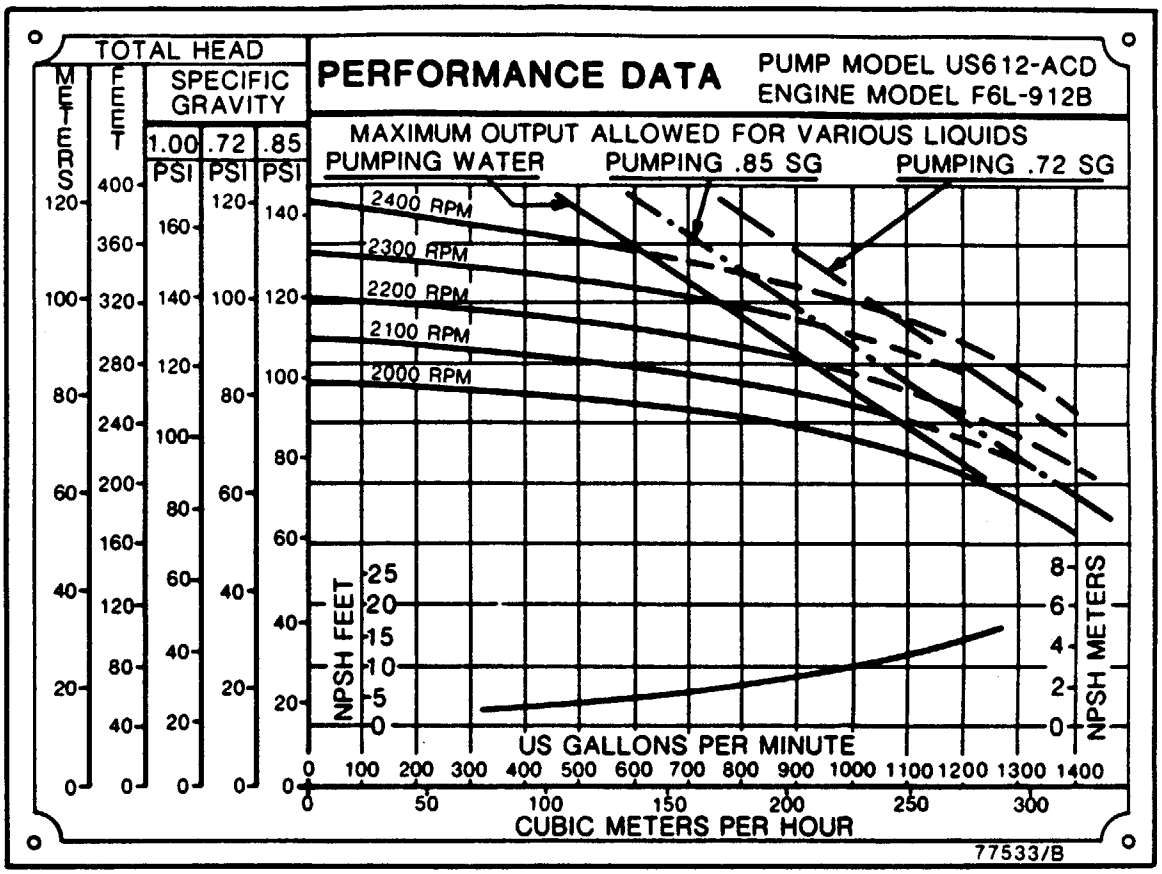
1. PUMP SUCTION GAGE
2. PUMP DISCHARGE GAGE
3. STARTING AID
4. ALTERNATOR LIGHT
5. ENGINE OIL PRESSURE GAGE
6. PANEL LIGHTS SWITCH
7. TACHOMETER/HOURMETER GAGE
8. BATTERY VOLTMETER GAGE
9. STARTER SWITCH
10. START/STOP SWITCH
11. OIL BY-PASS PUSHBUTTON
12. PANEL LIGHTS



THE INSTRUMENT PANEL IS LOCATED IN THE CONTROL PANEL CABINET MOUNTED ABOVE THE SUCTION MANIFOLD.
THE INSTRUMENTS MOUNTED ON THIS PANEL MONITOR PUMP AND ENGINE FUNCTIONS DURING OPERATIONS.
THE SWITCHES MOUNTED ON THIS PANEL ARE USED WHEN STARTING OR STOPPING THE PUMP.

600 GPM HOSELINE PUMP
CONTROL PANEL
NSN 4320-01-193-3429

FIG. 2-14



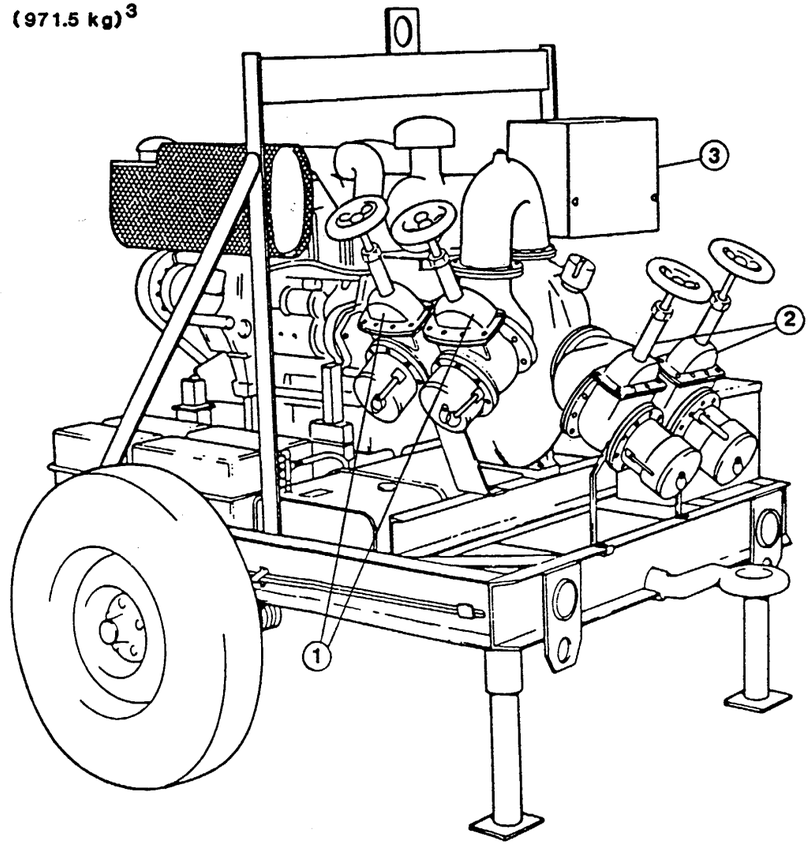
600 GPM HOSELINE PUMP
PEABODY BARNES MODEL US612-ACD-1
NSN 4320-01-193-3429

1250 GPM FLOOD AND TRANSFER PUMP
PEABODY BARNES MODEL US612-ACD
NSN 4320-01-194-5601

FIG. 2-15
PERFORMANCE CURVE

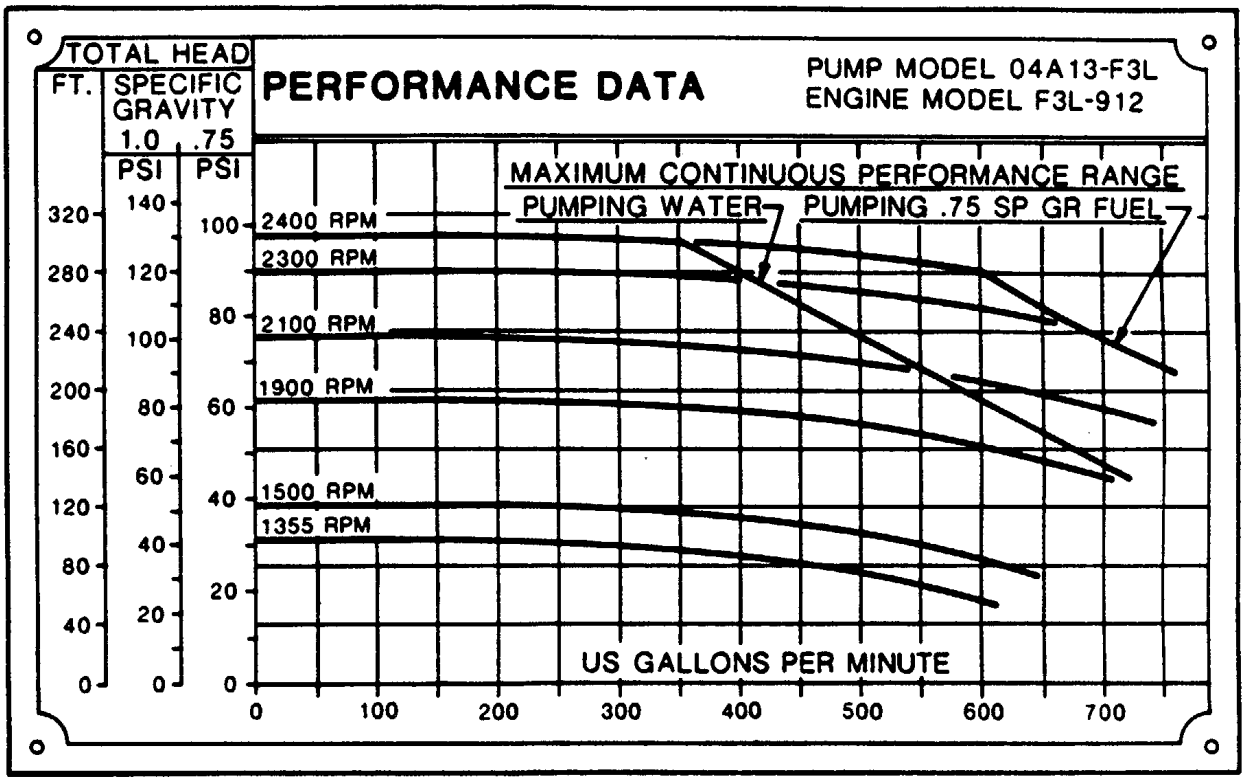
1. DISCHARGE GATE VALVE
2. SUCTION GATE VALVE
3. INSTRUMENT PANEL

LENGTH	122 INCH	(3098 cm)
WIDTH	70 INCH	(1778 cm)
HEIGTH	68 INCH	(1727 cm)
WEIGHT	2140 lb.	(971.5 kg)[3]



350 GPM TRANSFER PUMP
NSN 4320-01-092-3551

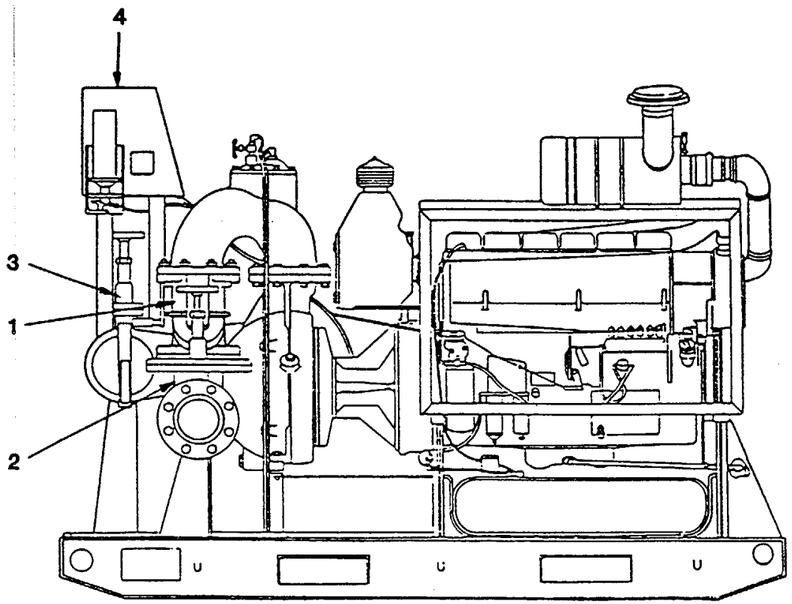
FIG. 2-16

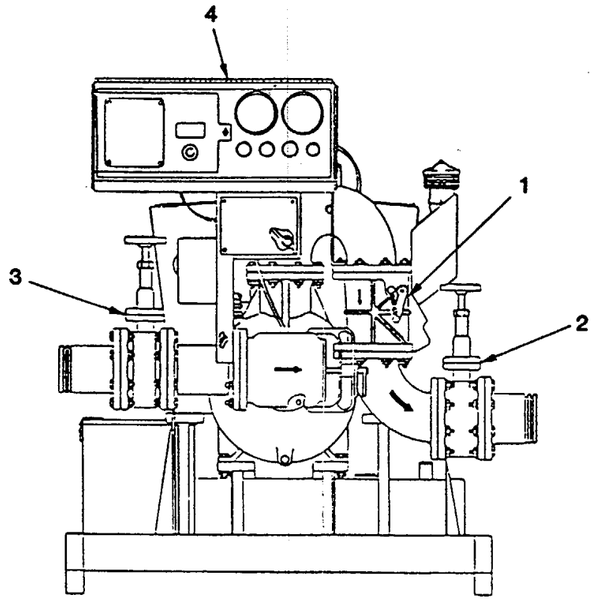


350 GPM TRANSFER PUMP
NSN 4320-01-092-3551

FIG. 2-17

1. DISCHARGE CHECK VALVE
2. DISCHARGE GATE VALVE
3. SUCTION GATE VALVE
4. INSTRUMENT PANEL

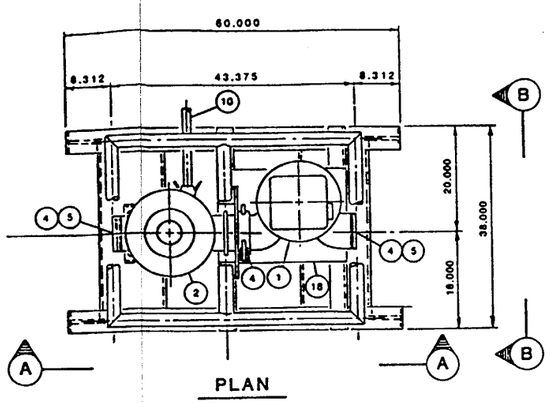




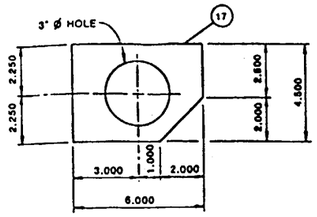
LENGTH	97.50 INCH	(247.65 cm)
WIDTH	58.50 INCH	(148.59 cm)
HEIGTH	69.25 INCH	(175.90 cm)
WEIGHT	3000 lb.	(1360 kg)

1250 GPM FLOOD & TRANSFER PUMP
NSN 4320-01-194-5601

FIG. 2-18



PLAN

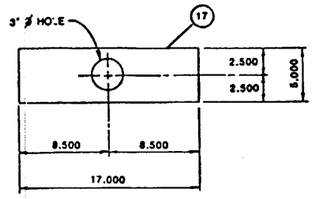


LIFTING LUG DETAIL

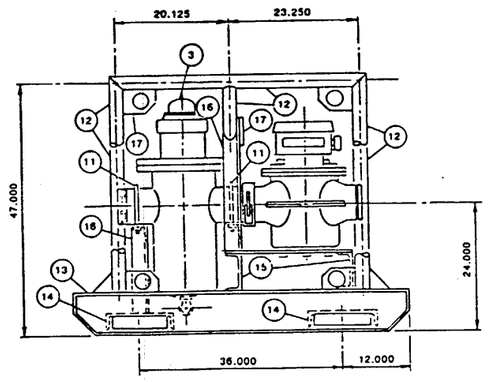
NOTES:

1. DRAWING IS FOR ASSEMBLY REFERENCE ONLY. FOR DETAIL INFORMATION, SEE COMPONENTS LIST CPL. CPL-20088.

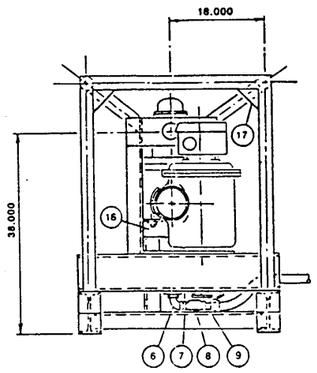
2. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OF DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED STD 595.



LIFTING EYE DETAIL



ELEVATION "A-A"



ELEVATION "B-B"

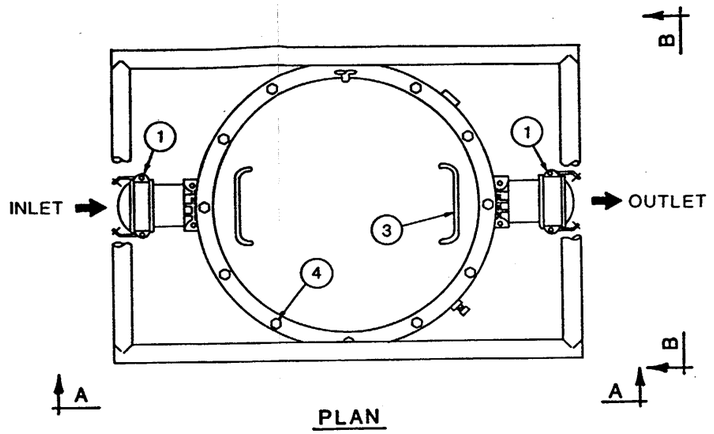
FIND NO	FSCM	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL
18				1	PLATE, STEEL, 3/8" THK.		
17				1	PLATE, STEEL, 1/2" THK.		
16				1	ANGLE, 3"X3"X1/4"		
15				1	CHANNEL, C8 X 11.5#		
14				1	CHANNEL, C12 X 20.7#		
13				1	WIDE FLG. W8 X 13#		
12				1	PIPE, 2.375"O.D. X 0.276" W.T.		
11				1	U-BOLT, 1/2"Ø FOR 6" PIPE W/ 2-H NUTS		
10				1	HOSE ASSY., 1" CAM-LOCK 25 FT. LG.		
9				1	ADAPTER, 1"NPT. X CAM-LOCK		
8				1	VALVE, BALL, 1"M X F. NPT		
7				1	BUSHING, 1-1/4"X1" NPT		
6				1	STREET ELL, 1-1/4" NPT.		
5				1	CAP END, 6" DBL GRV.		
4				2	CLAMP, 6" SNAP JOINT, DBL GRV.		
3				1	AIR RELEASE		
2				1	STRAINER 6" STL. 40 MESH GROOVE END		
1				1	FLO METER, 6" ALUM., 800 GPM GROOVE END		

PARTS LIST

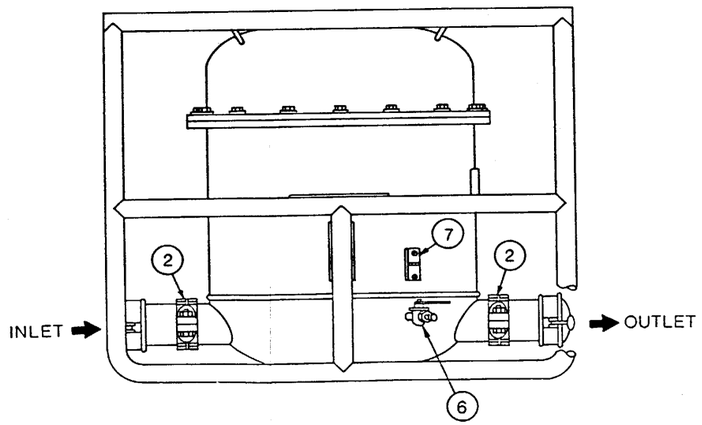
DRAWN BY	DATE	WILLBROS BUTLER ENGINEERS, INC.
CHECKED BY		
CONTRACT NO.		METER STRAINER ASSEMBLY (METER SKID ASSEMBLY)
DESIGN APPROVAL		
DATE		SIZE / FSCM / DWG NO. FIG. 2-19
APPROVED FOR PROCUREMENT		
DATE		SCALE / SHEET OF

2-95/(2-96 Blank)

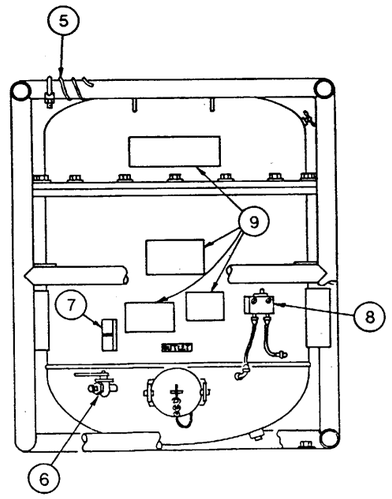
FIG. 2-19



PLAN



ELEVATION "A-A"



ELEVATION "B-B"

LEGEND

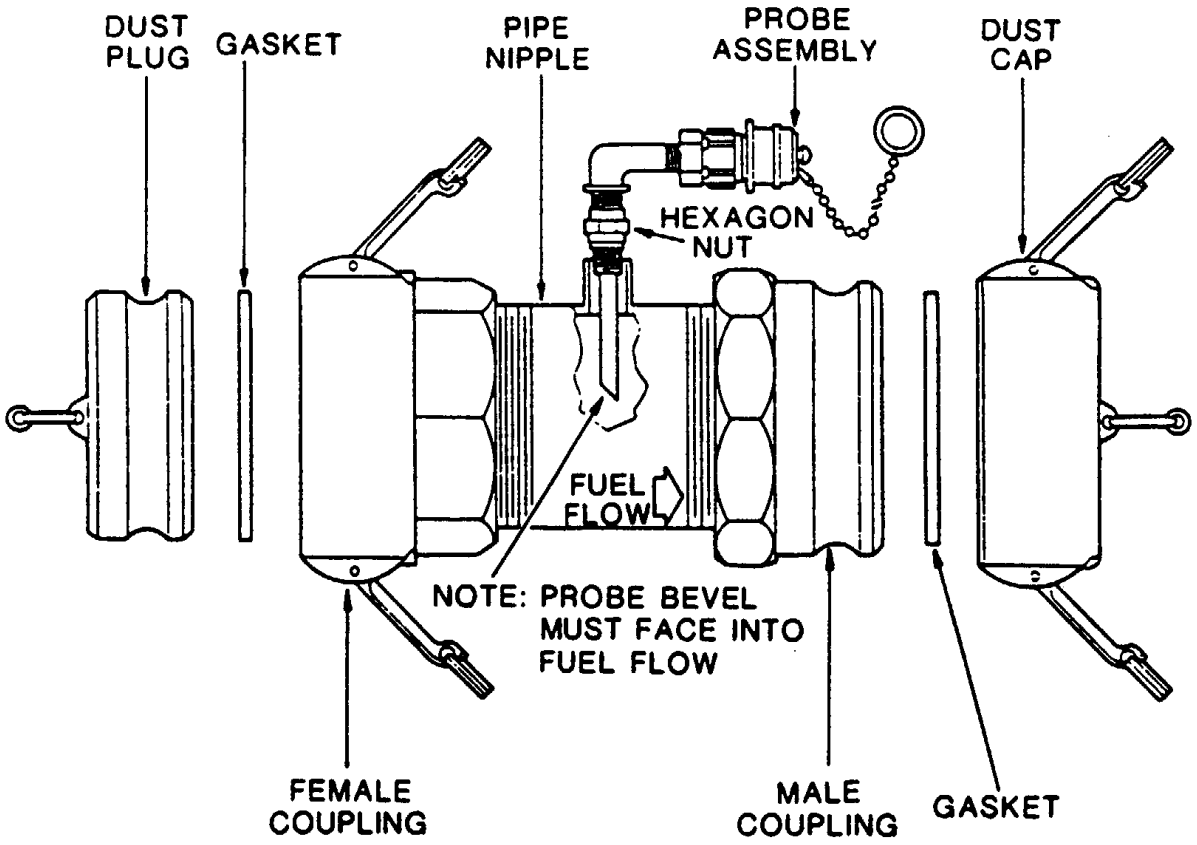
1. QUICK DISCONNECT COUPLING WITH CAP OR PLUG.
2. COUPLING CLAMP.
3. HEAD LIFTING HANDLE.
4. HEAD BOLTS.
5. GROUND CABLE.
6. WATER DRAIN VALVE.
7. SIGHT GAGE.
8. DIFFERENTIAL PRESSURE INDICATOR WITH SIGNAL BUTTON.
9. INSTRUCTION PLATES.

NOTES

LENGTH 47 INCHES
WIDTH 33 INCHES
HEIGHT 40 INCHES
WEIGHT 375 POUNDS
NSN: 4330-00-177-8485

FILTER SEPARATOR
NSN 4330-00-177-8485

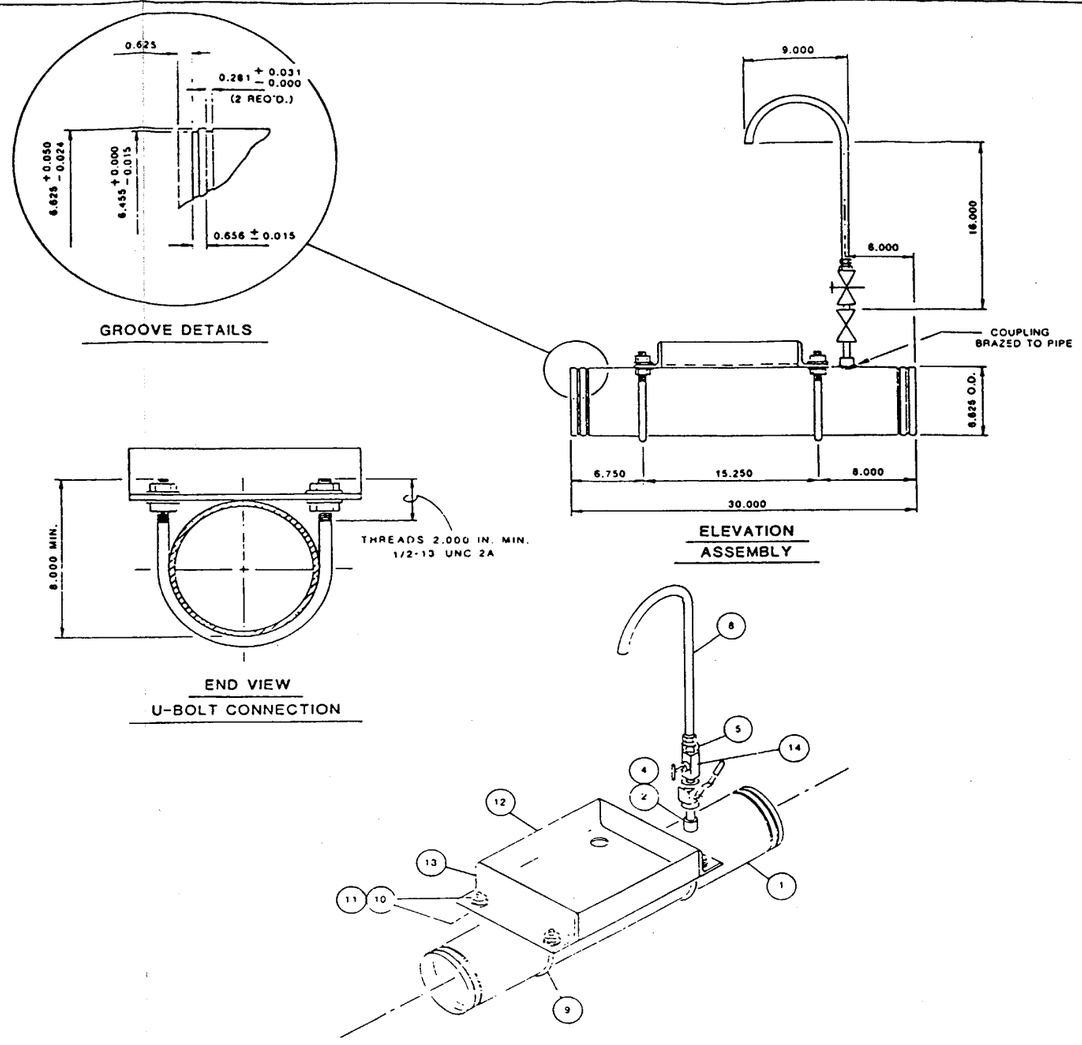
FIG. 2-20



WATER DETECTOR KIT ADAPTER

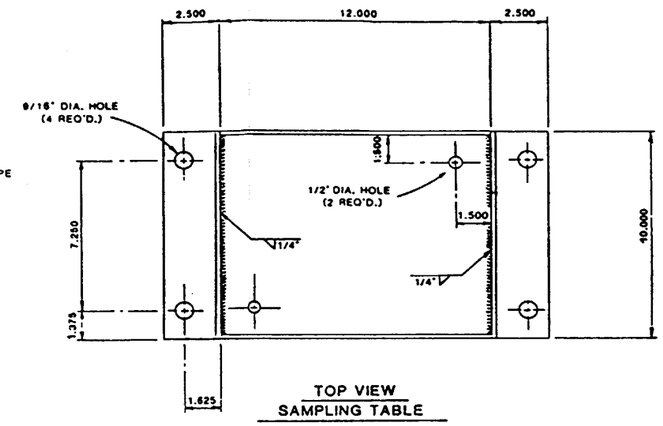
NSN 4730-01-013-7590

FIG. 2-21



NOTES:

1. DRAWING IS FOR ASSEMBLY REFERENCE ONLY. FOR DETAIL INFORMATION, SEE COMPONENTS LIST CPL. CPL-20072.
2. TUBING TO BE REMOVED AND WIRED TO PIPE FOR SHIPPING PURPOSES.



FIND NO	FSCM	DWG SIZE	PART OR IDENTIFYING NO	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL
14					VALVE, NEEDLE, 1/2"-3000 PSI, M x F, SCRD		
13					ANGLE 2-1/2"X2-1/2"X 1/4" ALUM.		
12					10 CHANNEL 5.43# X 12" LONG, ALUM.		
11					WASHER, PLAIN, STEEL, 9/16" I.D.		
10					NUT, HEX, STEEL, 1/2"		
9					U-BOLTS STEEL, 1-2" DIA		
8					TUBE, S.S., 1/2" O.D x 0.035 W.T., 32" LG.		
7							
6							
5					MALE CONNECTOR 1/2", COMPR. TUBE FIT, S.S		
4					VALVE, BALL, 1/2" M x F, 2000 PSI, F.S.		
3							
2					COUPLING, ALUM., 1/2" NOM		
1					PIPE, ALUM., 6" STD. WT.		

PARTS LIST

DRAWN BY K	DATE 4-25-85
CHECKED BY	
CONTRACT NO.	
DESIGN APPROVAL	
DATE	
APPROVED FOR PROCUREMENT	
DATE	

WILLBROS BUTLER ENGINEERS, INC.

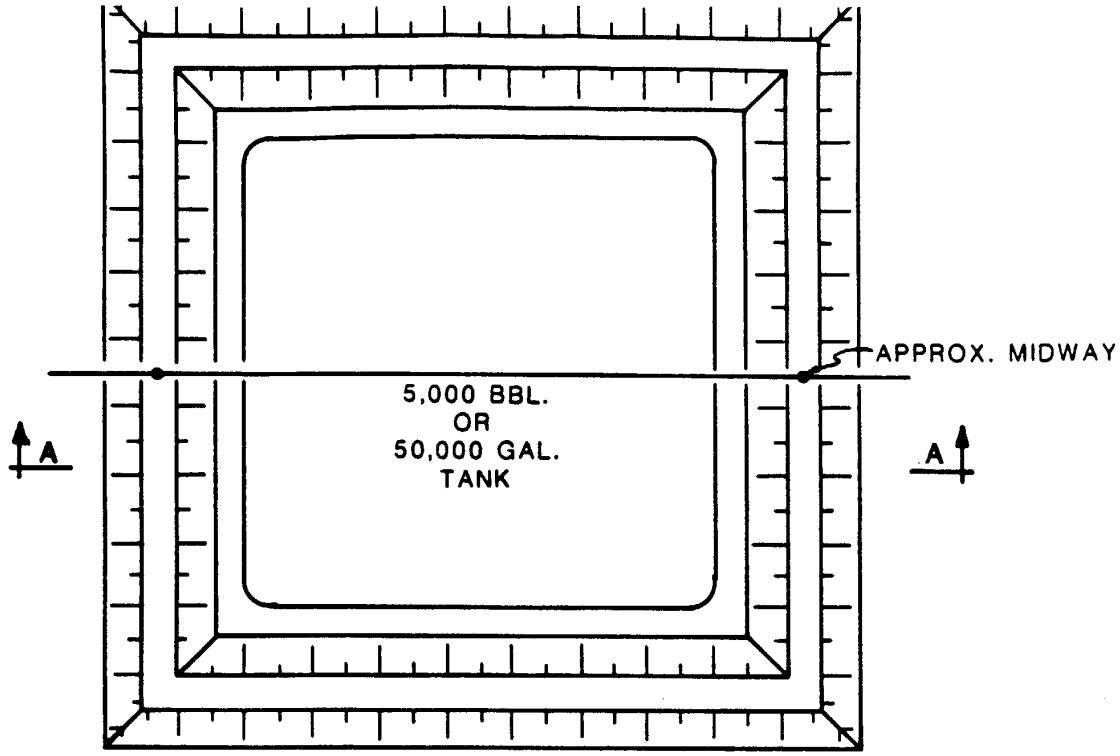
FUEL SAMPLING ASSEMBLY

SIZE | FSCM | DWG NO. | FIG. 2-22

SCALE

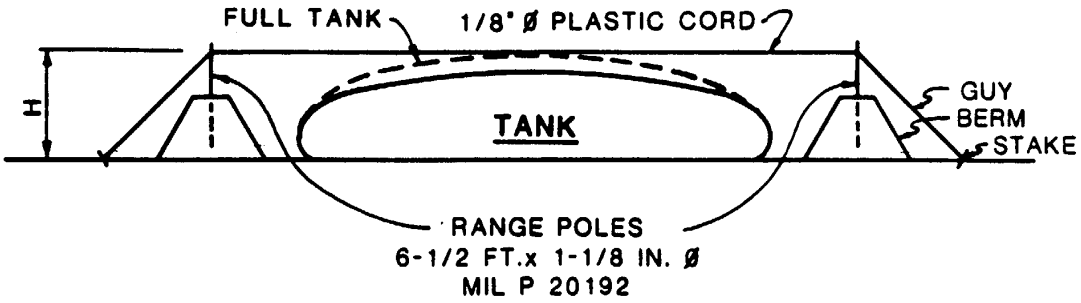
2-101/(2-102 Blank).

FIG. 2-22



PLAN

H = 6'-8" - 5000 BBL TANK
H = 5'-8" - 50,000 GAL. TANK



SECTION "A-A"

USE OF RANGE POLES FOR APPROXIMATE TANK GAGING

NSN 6685-00-514-5575

FIG. 2-23

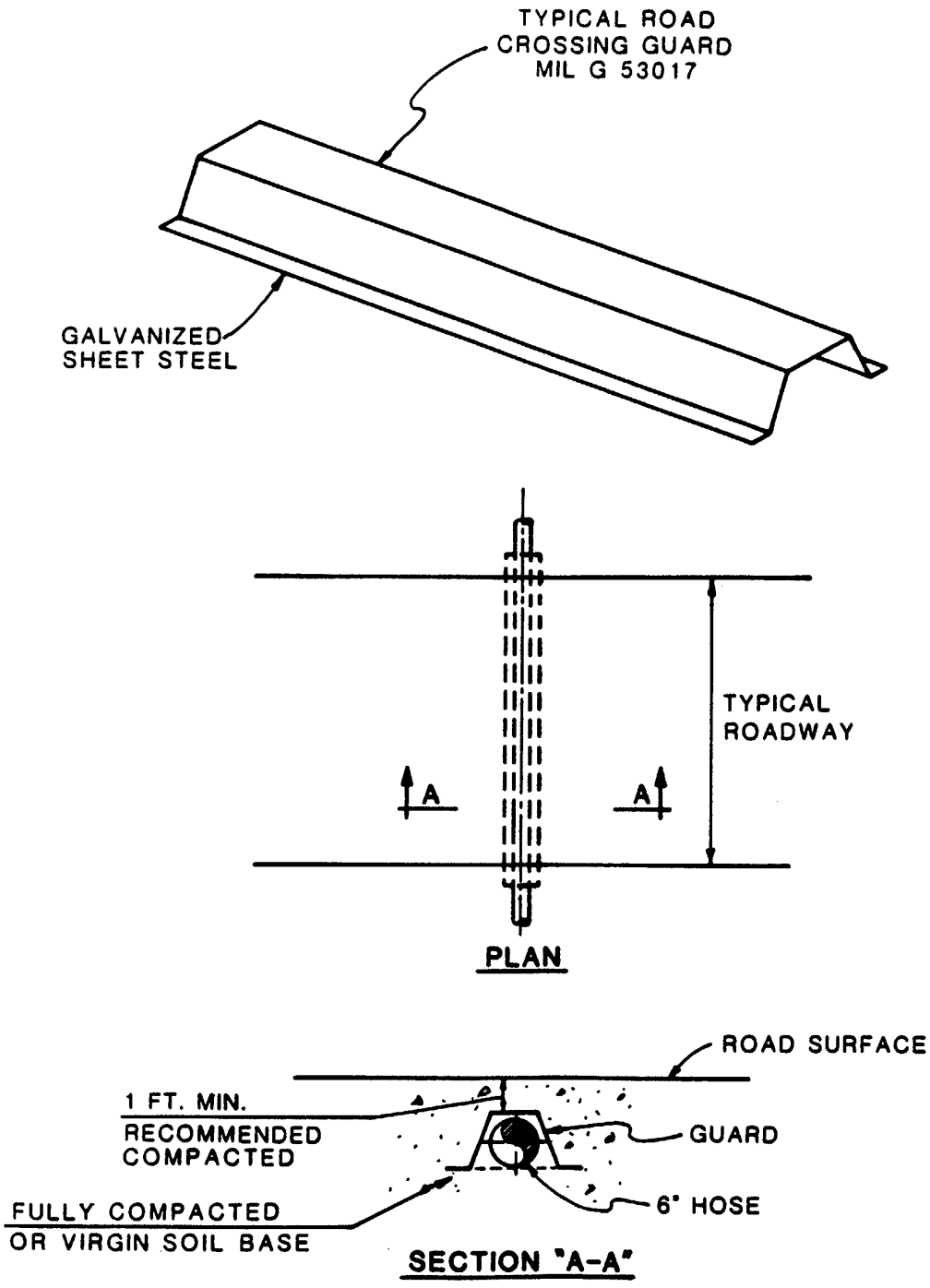
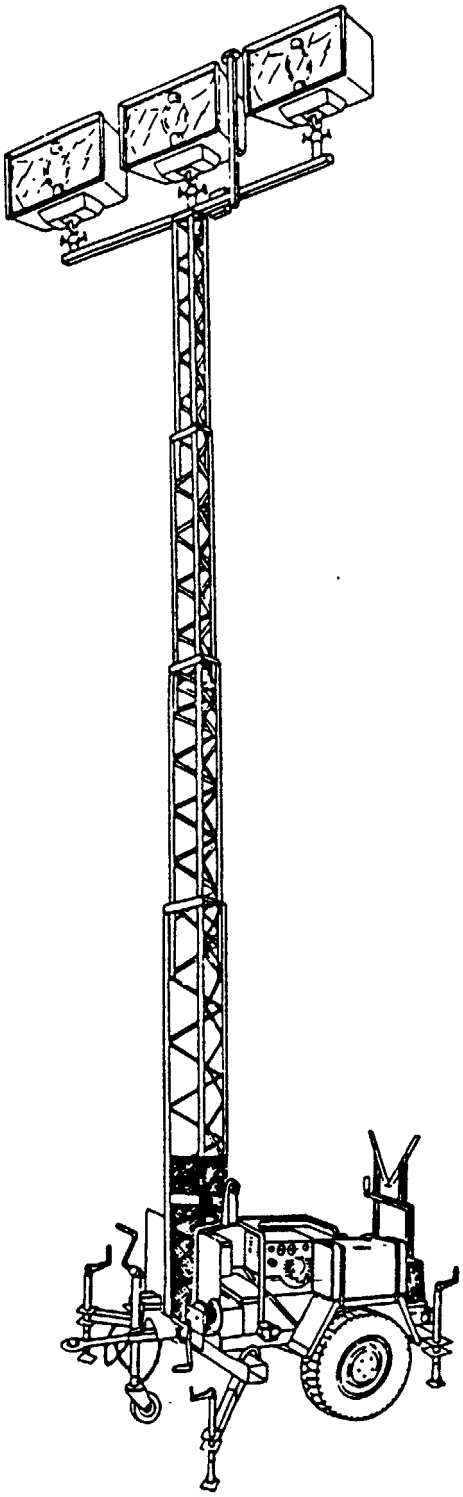


FIG. 2-24
USE OF ROADWAY
CROSSING GUARDS
NSN 3835-01-187-1556



FLOOD LIGHT SET
WITH TOWER EXTENDED
NSN 6230-01-056-5238

FIG. 2-25

PARTS LIST	
ITEM	DESCRIPTION
1	ADAPTER, 6 IN.
2	CLAMP, 7 IN., TYPE H
3	HOSE, RUBBER 6 IN., 250 FT.
4	COUPLING, CLAMP 6 IN. W/ GASKET
5	CAP, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE TRANSFER HOSE ASSEMBLY.

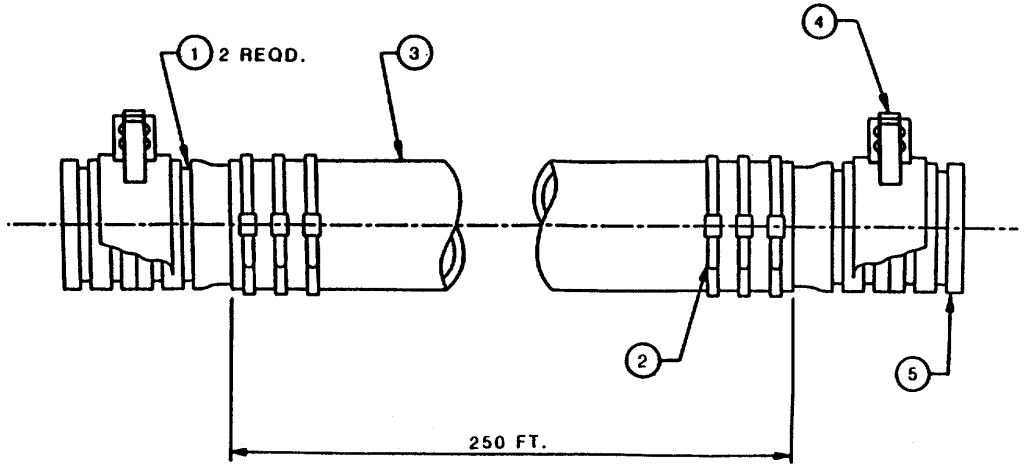


FIG. 2-30
6 INCH HOSE, LIGHTWEIGHT DISCHARGE 250 FT.
NSN

PARTS LIST	
ITEM	DESCRIPTION
1	CASE
2	SEAL
3	SEAL
4	INSERT
5	BACK THRUST RING
6	BEARING CAGE
7	FT. THRUST RING
8	RETAINING RING
9	1/4" BALL BEARING
10	SET SCREW

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE TRANSFER HOSE ASSEMBLY.

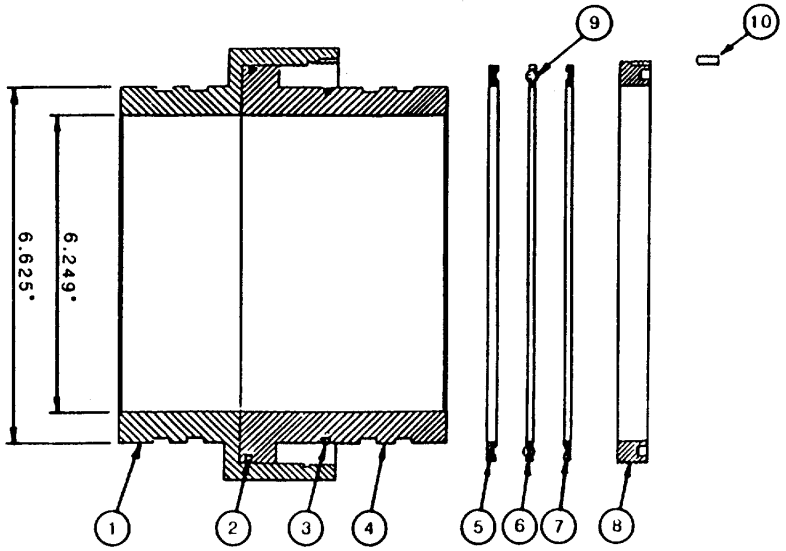


FIG. 2-31
6 INCH HOSE SWIVEL
NSN

PARTS LIST	
ITEM	DESCRIPTION
1	HOSE TO GROOVED ADAPTER, 6 IN.
2	CLAMP, HOSE
3	HOSE, 6 IN., DISCHARGE
4	COUPLING, 6 IN.
5	CAP, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE PRIMARY MODULE, SECONDARY MODULE, CONTAMINATED FUEL MODULE, FUEL DISPENSING ASSEMBLY AND THE TANKER-TRUCK RECEIPT MANIFOLD.

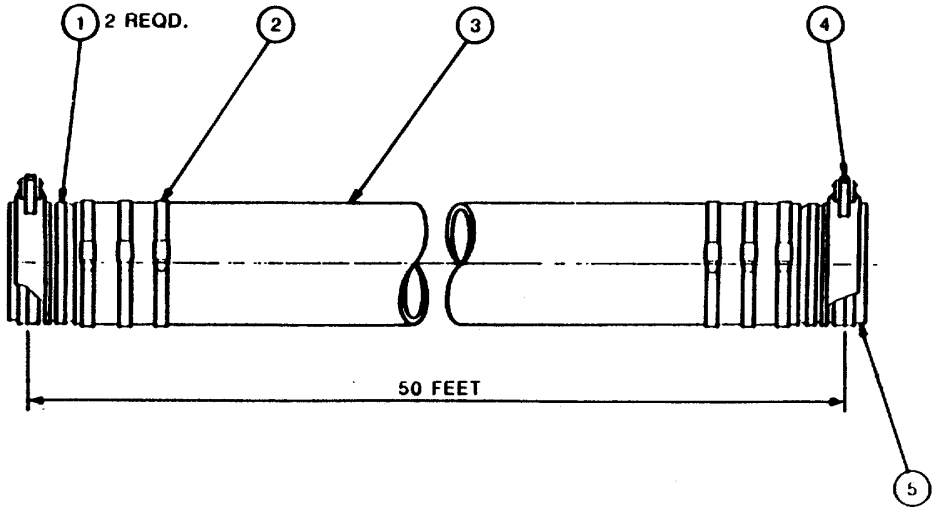


FIG. 2-32
6 INCH HOSE ASSEMBLY, DISCHARGE, 50 FT.
Ref: U.S. ARMY DRAWING (97403) 13226E8270
NSN: 3835-01-210-5618

PARTS LIST	
ITEM	DESCRIPTION
1	ADAPTER, HOSE TO GROOVED, 6 IN.
2	CLAMP, HOSE
3	HOSE, 6 IN., SUCTION
4	COUPLING, 6 IN.
5	CAP, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE PRIMARY MODULE, SECONDARY MODULE AND THE TANKER-TRUCK RECEIPT MANIFOLD.

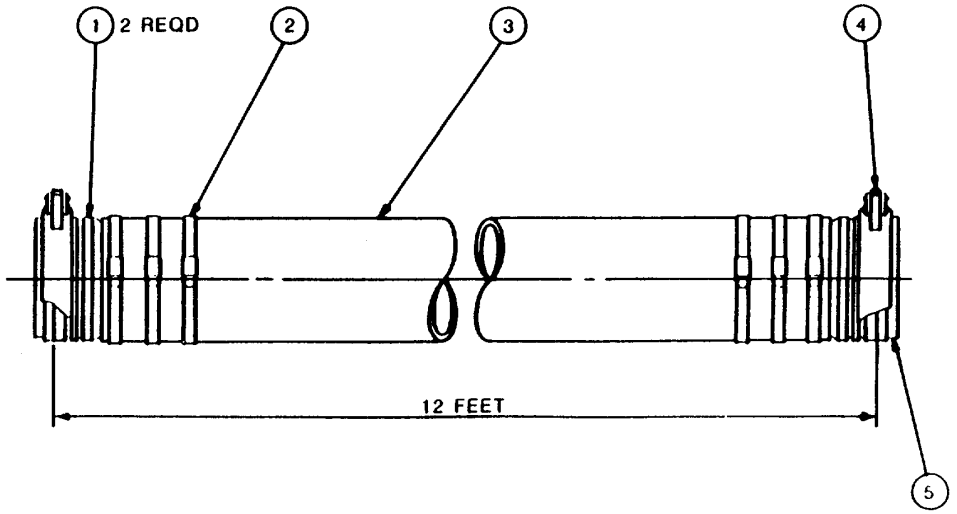


FIG. 2-33
6 INCH HOSE ASSEMBLY, SUCTION, 12 FT.
Ref: U.S. ARMY DRAWING (97403) 13226E8271
NSN: 4720-01-210-5596

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, 4 IN., FEMALE
2	CLAMP, HOSE
3	HOSE, 4 IN., DISCHARGE
4	COUPLING HALF, 4 IN. MALE
5	CAP, 4 IN. CAM-LOCKING TYPE
6	PLUG, 4 IN. MALE, CAM-LOCKING
7	GASKET, CAM-LOCKING TYPE, 4 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE CONTAMINATED FUEL MODULE AND THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.

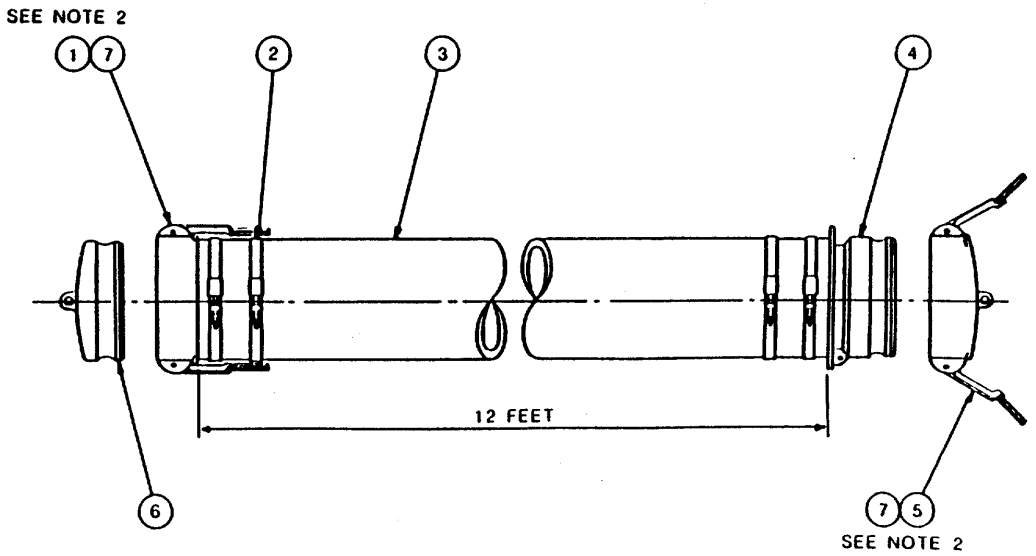


FIG. 2-34
4 INCH HOSE ASSEMBLY, DISCHARGE, 12 FT.
Ref: U.S. ARMY DRAWING (97403) 13226E8285
NSN: 4720-01-210-4560

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, FEMALE
2	CLAMP, HOSE
3	HOSE, DISCHARGE
4	COUPLING HALF, MALE
5	CAP, CAM-LOCKING TYPE
6	PLUG, MALE, CAM-LOCKING
7	GASKET, CAM-LOCKING TYPE

SIZE SCHEDULE		
DIA.	LENGTH "A"	NSN
4 IN.	50 FT.	4720-00-083-0046
4 IN.	25 FT.	4720-00-083-0047
3 IN.	50 FT.	4720-00-083-0048
2 IN.	25 FT.	
1 1/2 IN.	25 FT.	4720-00-901-7624
1 IN.	25 FT.	4720-00-083-0049

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBL (EXCEPT 4"x50 FT.) 4 INCH ARE ALSO IN 50,000 GAL. TPT OPTIONAL TANK CONFIGURATION.

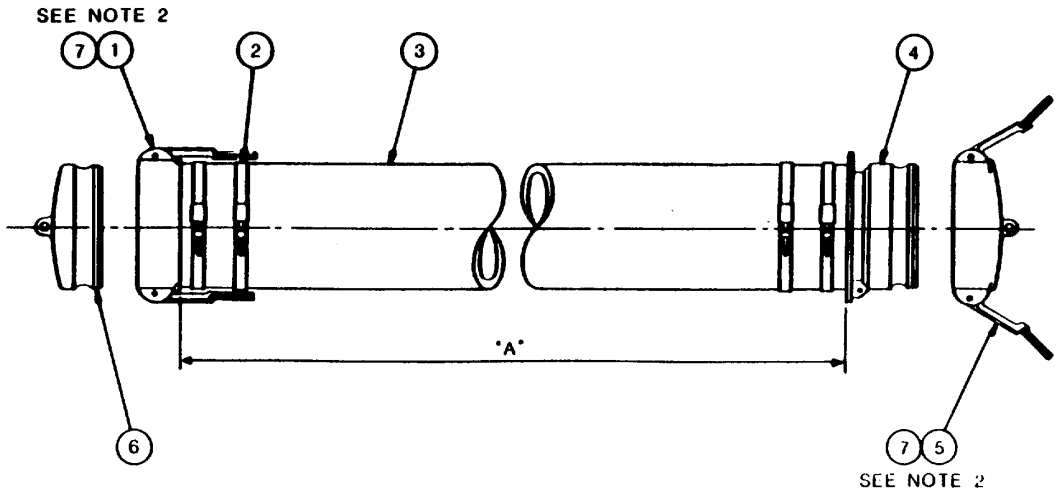


FIG. 2-35
HOSE ASSEMBLY, DISPENSING
NSN: SEE SIZE SCHEDULE FOR NSN

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, 4 IN., FEMALE
2	CLAMP, HOSE
3	HOSE, 4 IN., SUCTION
4	COUPLING HALF, 4 IN. MALE
5	CAP, 4 IN. CAM-LOCKING TYPE
6	PLUG, 4 IN. MALE, CAM-LOCKING
7	GASKET, CAM-LOCKING TYPE, 4 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE CONTAMINATED FUEL MODULE, TANKER-TRUCK RECEIPT MANIFOLD AND THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.

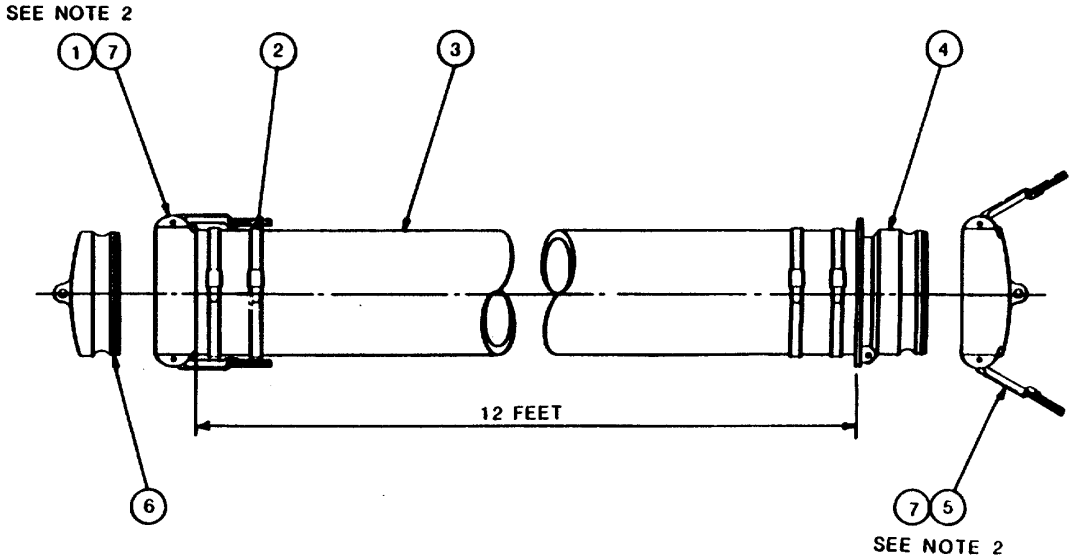
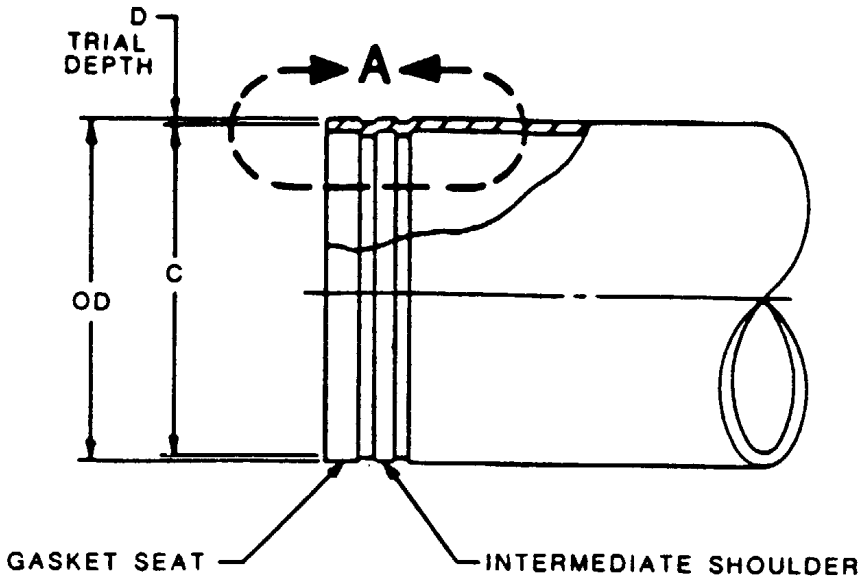
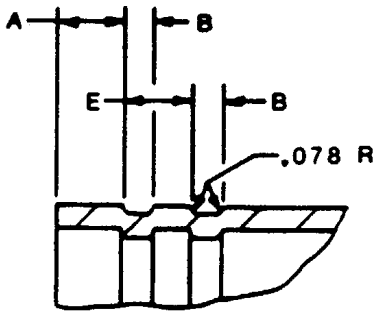


FIG. 2-36
4 INCH HOSE ASSEMBLY, SUCTION, 12 FT.
Ref: U.S. ARMY DRAWING (97403) 13226E8283
NSN: 4720-00-727-1339



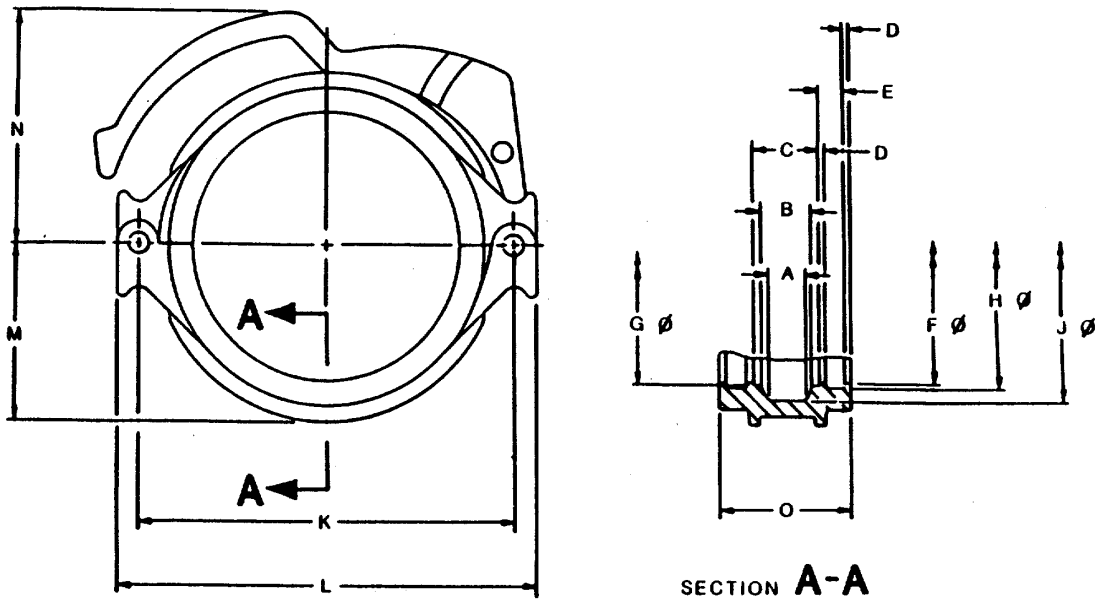


VIEW **A**
SCALE 1/1

NOMINAL PIPE SIZE	OD	DIM A	DIM B	DIM C	DIM D	DIM E
6	6.625 + .050 − .024	.625 ±.030	.281 +.031 −.000	6.455 + .000 − .030	.085	.656 ± .005

NOTE: PIPE SECTION LENGTH 19 FEET
DOUBLE GROOVES BOTH ENDS.

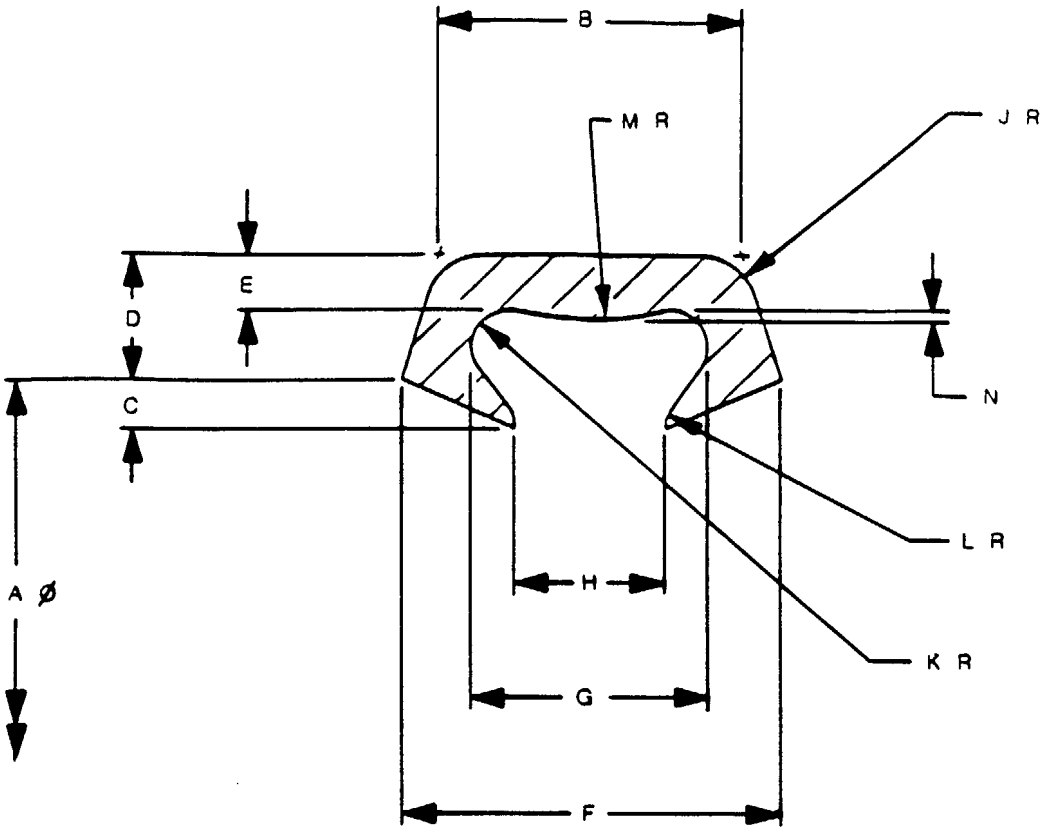
FIG. 2-37A
6 INCH PIPE, ROLL-GROOVE, DOUBLE



NOM SIZE		DIM A	DIM B	DIM C	DIM D	DIM E	DIM F	DIM G	DIA H	DIA J	DIM K .062	DIM L .062	DIM M .062	DIM N .125	DIM O .031
6	MAX	1.062	1.281	1.531	.202	.666	6.475	6.703	6.765	7.406	9.125	10.250	4.250	5.687	3.250
	MIN	1.000	1.218	1.468	.172	.646	6.455	6.641	6.703	7.344					

NOTE: DIMENSIONS SHOWN ARE FOR INFORMATION ONLY. THE DIMENSIONS OF THE COUPLING SHALL BE SUCH THAT WHEN INSTALLED AS SPECIFIED IN 3.4, THE COUPLING MEETS ALL OF THE PERFORMANCE REQUIREMENTS OF THIS PURCHASE DESCRIPTION.

FIG. 2-37B
6 INCH COUPLING CLAMP, DOUBLE GROOVE
NSN 4730-01-181-4074



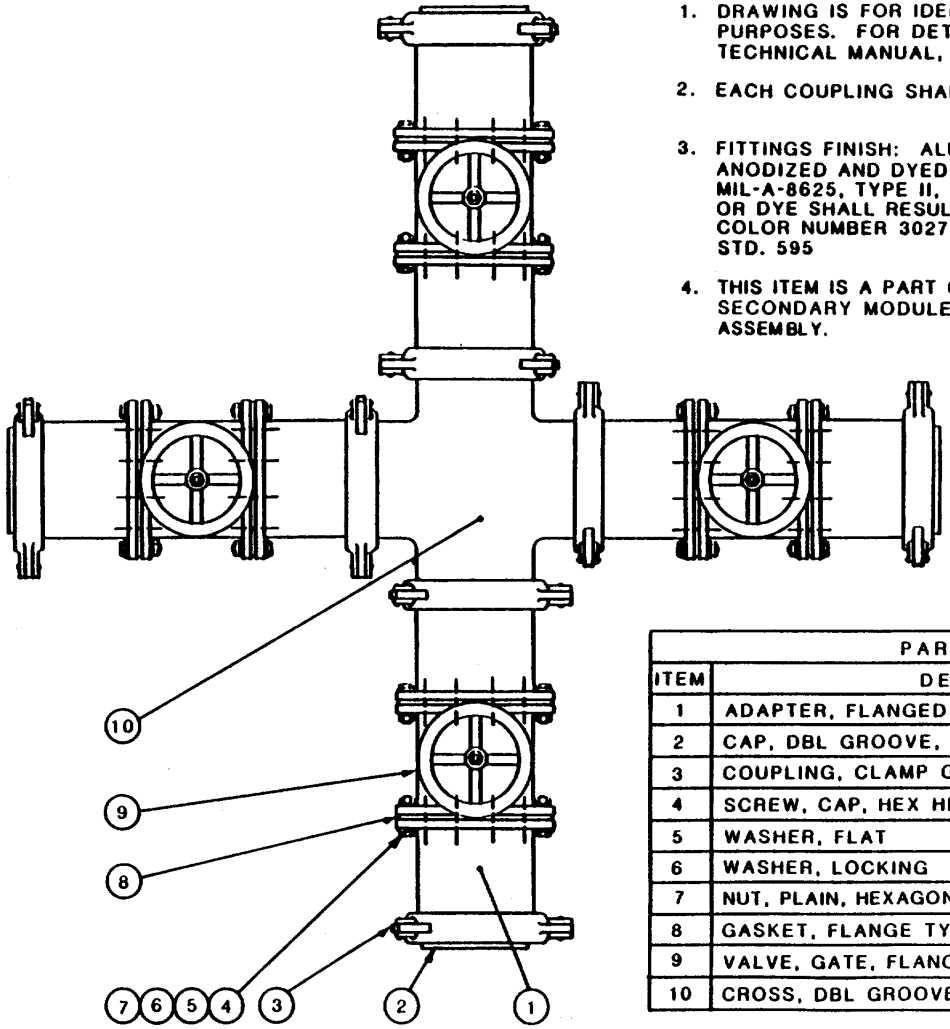
DIMENSIONAL NOTE: TOLERANCES, UNLESS OTHERWISE SPECIFIED, SHALL BE ±.030

PIPE SIZE	DIA A	DIM B	DIM C	DIM D	DIM E	DIM F	DIM G	DIM H	J ±.062	K	L	M ±.062	N
6	6.492	.980	.153	.429	.184	1.225	.765	.490	.188	.125	.093	1.000	.030

FIG. 2-37C
GASKET, COUPLING CLAMP
NSN 4730-01-181-4074

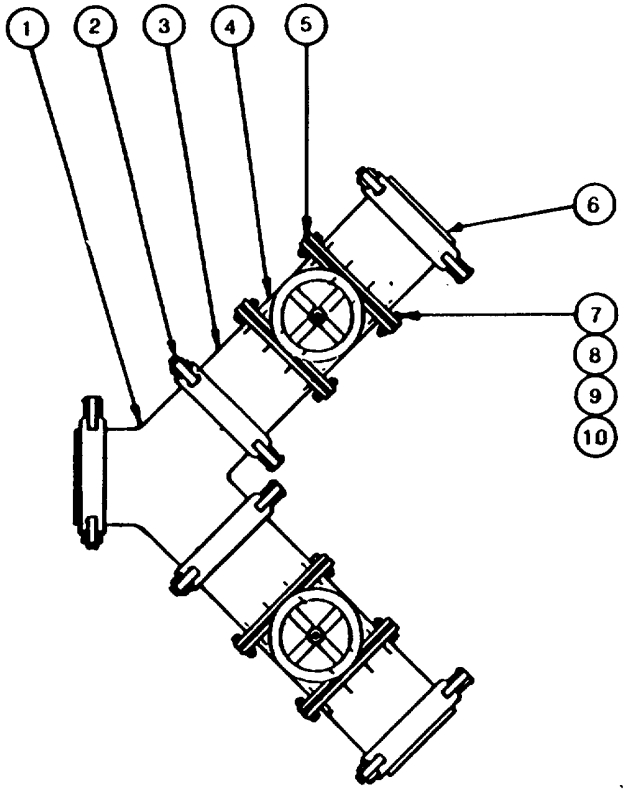
NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE PRIMARY MODULE, SECONDARY MODULE AND TRANSFER HOSE LINE ASSEMBLY.



PARTS LIST	
ITEM	DESCRIPTION
1	ADAPTER, FLANGED TO DBL GROOVE, 6 IN.
2	CAP, DBL GROOVE, 6 IN.
3	COUPLING, CLAMP GROOVED-END, 6 IN.
4	SCREW, CAP, HEX HEAD
5	WASHER, FLAT
6	WASHER, LOCKING
7	NUT, PLAIN, HEXAGON
8	GASKET, FLANGE TYPE, 6 IN. APERATURE
9	VALVE, GATE, FLANGE, 6 IN.
10	CROSS, DBL GROOVED, 6 IN.

FIG. 2-38
6 INCH CROSS ASSEMBLY, DOUBLE GROOVED ENDS
REF: U.S. ARMY DRAWING (97403) 13226E8266
NSN 4730-01-181-4074

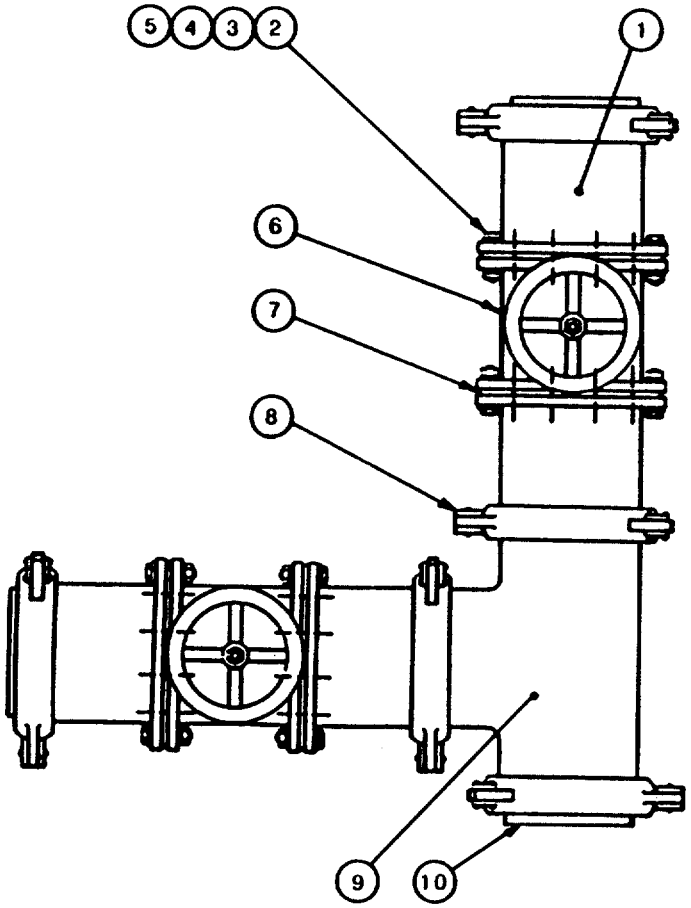


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE SECONDARY MODULE, CONTAMINATED FUEL MODULE AND THE HOSE LINE TRANSFER ASSEMBLY.

PARTS LIST	
ITEM	DESCRIPTION
1	Y FITTING, 90°, DBL GROOVED, 6 IN.
2	COUPLING, CLAMP GROOVED-END, 6 IN.
3	ADAPTER, FLANGED TO DBL GROOVE, 6 IN.
4	VALVE, GATE, FLANGE, 6 IN.
5	GASKET, FLANGE TYPE, 6 IN. APERATURE
6	CAP, DBL GROOVE, 6 IN.
7	SCREW, CAP, HEX HEAD
8	WASHER, FLAT
9	WASHER, LOCKING
10	NUT, PLAIN, HEXAGON

FIG. 2-39
6 INCH WYE ASSEMBLY
REF: U.S. ARMY DRAWING (97403) 13226E8265
NSN 3835-01-210-5592

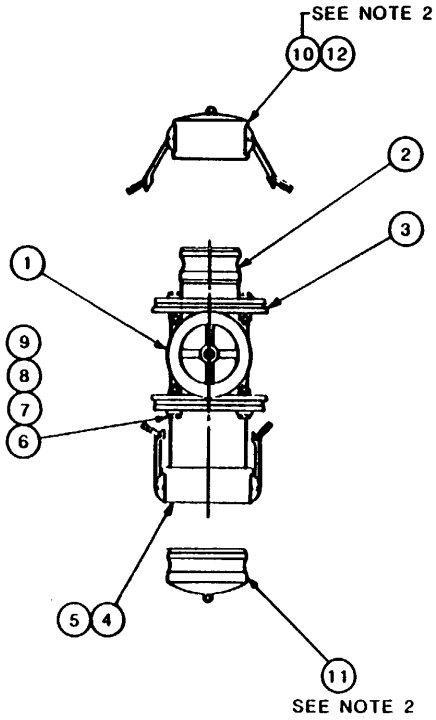


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE TANKER-TRUCK RECEIPT MANIFOLD.

PARTS LIST	
ITEM	DESCRIPTION
1	ADAPTER, FLANGED TO DBL GROOVE, 6 IN.
2	SCREW, CAP, HEX HEAD
3	WASHER, FLAT
4	WASHER, LOCKING
5	NUT, PLAIN, HEXAGON
6	VALVE, GATE, FLANGE, 6 IN.
7	GASKET, FLANGE TYPE, 6 IN. APERATURE
8	COUPLING, CLAMP GROOVED-END, 6 IN.
9	TEE, DBL GROOVE, 6 IN.
10	CAP, DBL GROOVE, 6 IN.

FIG. 2-40
6 INCH TEE ASSEMBLY, DOUBLE GROOVED ENDS
REF: U.S. ARMY DRAWING (97403) 13226E8272
NSN 4730-01-211-9548



NOTES:

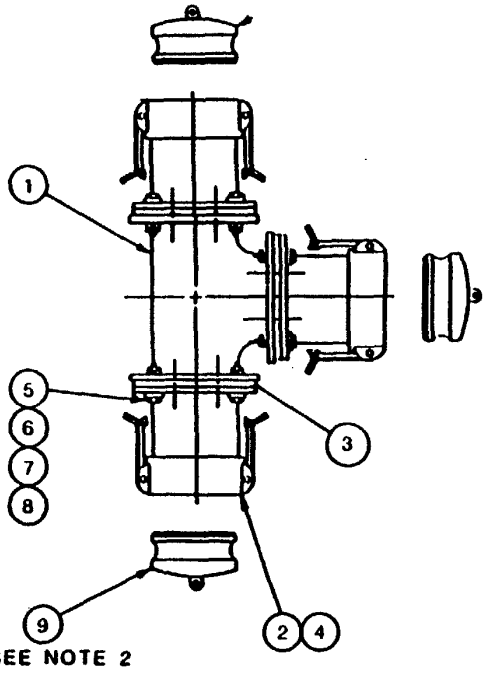
1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY.

PARTS LIST	
ITEM	DESCRIPTION
1	VALVE, GATE, FLANGED, 4 IN.
2	REDUCER, 4 IN. FLANGED TO 3 IN. MALE CAM-LOCKING
3	GASKET, FLANGE TYPE, 4 IN. APERATURE
4	COUPLING HALF, CAM-LOCKING, FEMALE TO
	FLANGED, 4 IN.
5	GASKET, CAM-LOCKING TYPE, 4 IN.
6	SCREW, CAP, HEX HEAD
7	WASHER, FLAT
8	WASHER, LOCKING
9	NUT, PLAIN, HEXAGON
10	CAP, CAM-LOCKING, 4 IN.
11	PLUG, CAM-LOCKING, 4 IN.
12	GASKET, CAM LOCKING TYPE, 3 IN.

FIG. 2-41 4 INCH REDUCER VALVE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8263
NSN: 4820-01-210-5624

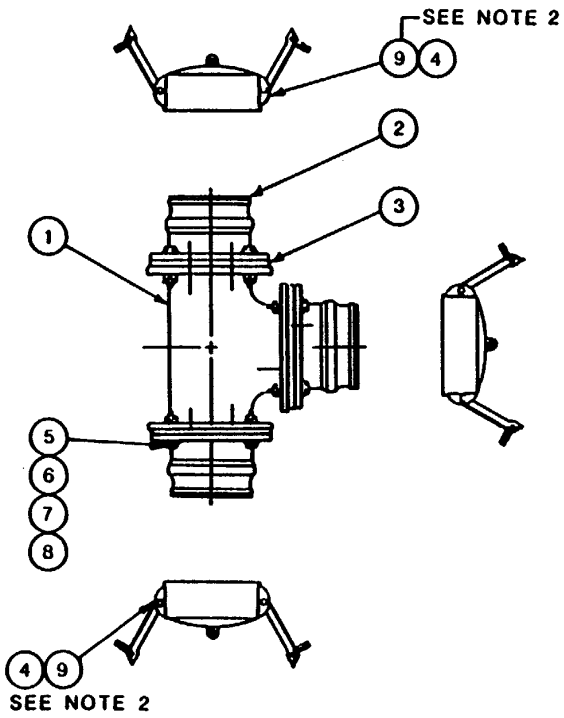
NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.



PARTS LIST	
ITEM	DESCRIPTION
1	TEE, FLANGED ALUMINUM, 4 X 4 X 4
2	COUPLING HALF, CAM-LOCKING, FEMALE TO
	FLANGED, 4 IN.
3	GASKET, FLANGE TYPE, 4 IN. APERATURE
4	GASKET, CAM-LOCKING TYPE, 4 IN.
5	SCREW, CAP, HEX HEAD
6	WASHER, FLAT
7	WASHER, LOCKING
8	NUT, PLAIN, HEXAGON
9	PLUG, CAM-LOCKING, 4 IN.

FIG. 2-42 4 INCH TEE ASSEMBLY, FEMALE, QUICK DISCONNECT

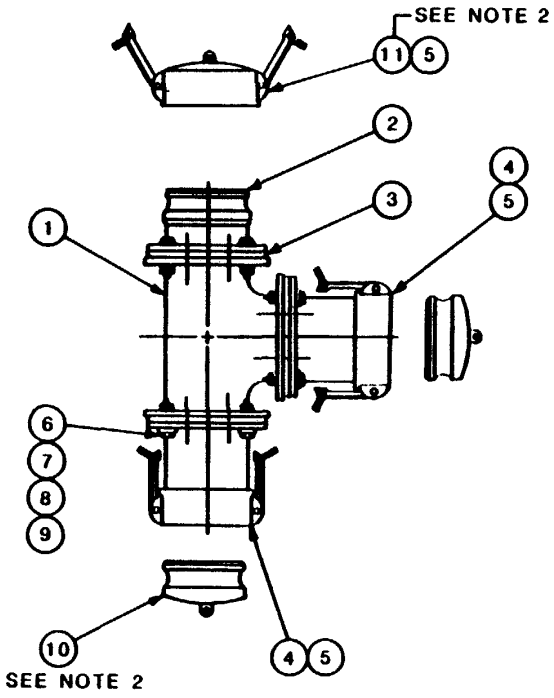


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.

PARTS LIST	
ITEM	DESCRIPTION
1	TEE, FLANGED ALUMINUM, 4 X 4 X 4
2	COUPLING HALF, CAM-LOCKING, MALE TO
	FLANGED, 4 IN.
3	GASKET, FLANGE TYPE, 4 IN. APERATURE
4	GASKET, CAM-LOCKING TYPE, 4 IN.
5	SCREW, CAP, HEX HEAD
6	WASHER, FLAT
7	WASHER, LOCKING
8	NUT, PLAIN, HEXAGON
9	CAP, CAM-LOCKING, 4 IN.

FIG. 2-43 4 IN. TEE ASSEMBLY, MALE, QUICK DISCONNECT

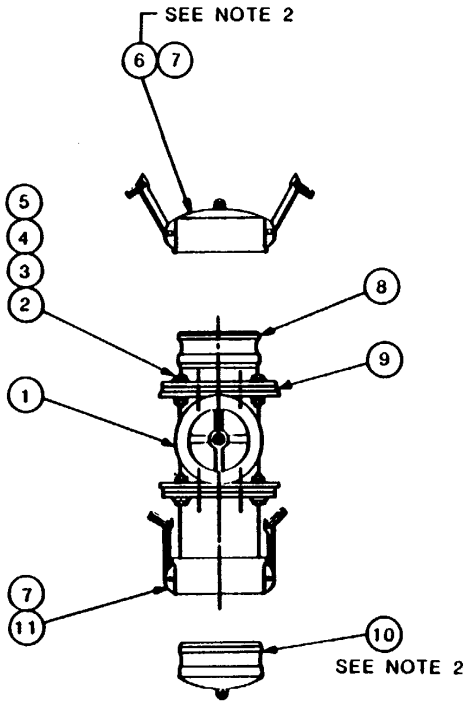


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.

PARTS LIST	
ITEM	DESCRIPTION
1	TEE, FLANGED ALUMINUM, 4 X 4 X 4
2	COUPLING HALF, CAM-LOCKING, MALE TO
	FLANGED, 4 IN.
3	GASKET, FLANGE TYPE, 4 IN. APERATURE
4	COUPLING HALF, CAM-LOCKING, FEMALE TO
	FLANGED, 4 IN.
5	GASKET, CAM-LOCKING TYPE, 4 IN.
6	SCREW, CAP, HEX HEAD
7	WASHER, FLAT
8	WASHER, LOCKING
9	NUT, PLAIN, HEXAGON
10	PLUG, CAM-LOCKING, 4 IN.
11	CAP, CAM-LOCKING, 4 IN.

FIG. 2-44 4 INCH TEE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8275
NSN:

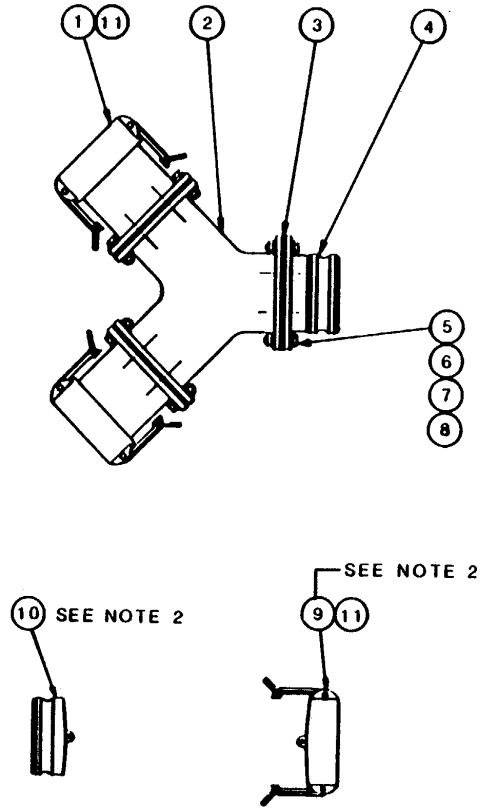


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBL AND THE 50,000 GAL. TPT OPTIONAL TANK CONFIGURATIO

PARTS LIST	
ITEM	DESCRIPTION
1	VALVE, GATE, FLANGED, 4 IN.
2	SCREW, CAP, HEX HEAD
3	WASHER, FLAT
4	WASHER, LOCKING
5	NUT, PLAIN, HEXAGON
6	CAP, CAM-LOCKING, 4 IN.
7	GASKET, CAM-LOCKING TYPE, 4 IN.
8	COUPLING HALF, CAM-LOCKING, MALE TO FLANGED,
	4 IN.
9	GASKET, FLANGE TYPE, 4 IN. APERATURE
10	PLUG, CAM-LOCKING, 4 IN.
11	COUPLING HALF, CAM-LOCKING, FEMALE TO
	FLANGED, 4 IN.

FIG. 2-45 4 INCH VALVE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8282
NSN: 4820-01-210-5605

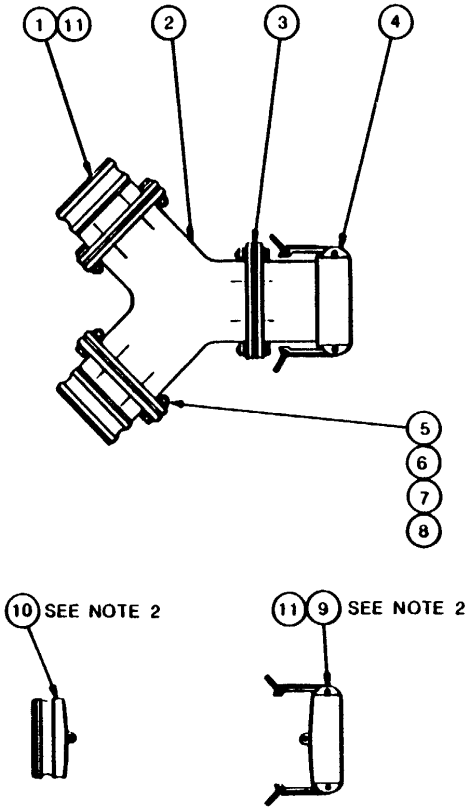


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY AND THE 50,000 GAL. TPT OPTIONAL TANK CONFIGURATION.

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, CAM-LOCKING, FEMALE TO
	FLANGED, 4 IN.
2	Y-CONNECTION, FLANGED, 4 IN.
3	GASKET, FLANGE TYPE, 4 IN. APERATURE
4	COUPLING HALF, CAM-LOCKING, MALE TO FLANGED,
	4 IN.
5	SCREW, CAP HEX HEAD
6	WASHER, FLAT
7	WASHER, LOCKING
8	NUT, PLAIN, HEXAGON
9	CAP, CAM-LOCKING, 4 IN.
10	PLUG, CAM-LOCKING, 4 IN.
11	GASKET, CAM-LOCKING TYPE, 4 IN.

FIG. 2-46 4 INCH WYE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8258
NSN: 4730-01-210-5626



NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMB AND THE 50,000 GAL. TPT OPTIONAL TANK CONFIGURATIOI

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, CAM-LOCKING, FEMALE TO
	FLANGED, 4 IN.
2	Y-CONNECTION, FLANGED, 4 IN.
3	GASKET, FLANGE TYPE, 4 IN. APERATURE
4	COUPLING HALF, CAM-LOCKING, MALE TO
	FLANGED, 4 IN.
5	SCREW, CAP HEX HEAD
6	WASHER, FLAT
7	WASHER, LOCKING
8	NUT, PLAIN, HEXAGON
9	CAP, CAM-LOCKING, 4 IN.
10	PLUG, CAM-LOCKING, 4 IN.
11	GASKET, CAM LOCKING, 4 IN.

FIG. 2-47 4 INCH WYE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8274
NSN: 3835-01-210-5630

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, CAM-LOCKING, FEMALE TO
	EXTERNAL THREAD, 4 IN.
2	VALVE, BALL, 4 IN. INTERNAL THREAD
3	COUPLING HALF, CAM-LOCKING, MALE TO
	EXTERNAL THREAD, 4 IN.
4	CAP, CAM-LOCKING, 4 IN.
5	PLUG, CAM-LOCKING, 4 IN.
6	GASKET, CAM-LOCKING TYPE, 4 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY AND THE TANKER-TRUCK RECEIPT MANIFOLD.

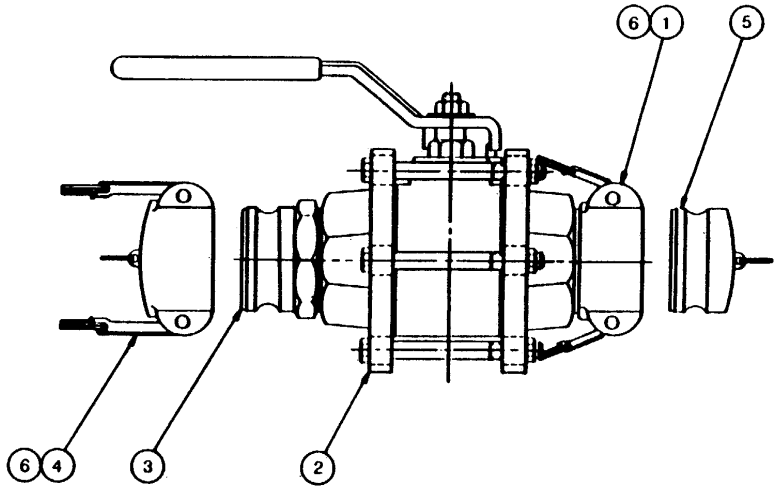
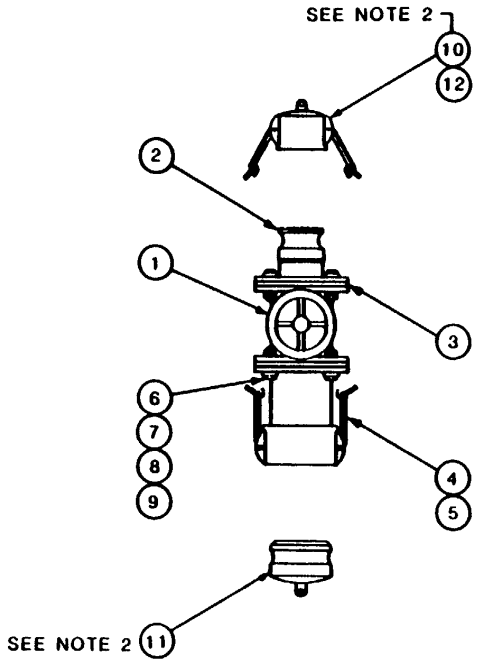


FIG. 2-48 4 INCH BALL VALVE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8279
NSN: 4820-01-211-9547



NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY

PARTS LIST	
ITEM	DESCRIPTION
1	VALVE, GATE, FLANGED 3 IN.
2	REDUCER, 3 IN. FLANGED, TO 2 IN. MALE, CAM-LOCKING
3	GASKET, FLANGE TYPE, 3 IN. APERATURE
4	COUPLING HALF, CAM-LOCKING, FEMALE TO FLANGE,
	3 IN.
5	GASKET, CAM LOCKING TYPE, 3 IN.
6	SCREW, CAP, HEX HEAD
7	WASHER, FLAT
8	WASHER, LOCKING
9	NUT, PLAIN, HEXAGON
10	CAP, 2 IN. FEMALE, CAM LOCKING
11	PLUG, 3 IN. MALE, CAM LOCKING
12	GASKET, CAM LOCKING, 2 IN.

FIG. 2-49 3 INCH VALVE ASSEMBLY, REDUCER, QUICK DISCONNECT
REF: U.S. DRAWING (97403) 13226E8264
NSN:

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, CAM-LOCKING, FEMALE TO
	EXTERNAL THREAD, 3 IN.
2	VALVE, BALL, 3 IN. INTERNAL THREAD
3	COUPLING HALF, CAM-LOCKING, MALE TO
	EXTERNAL THREAD, 3 IN.
4	CAP, CAM-LOCKING, 3 IN.
5	PLUG, CAM-LOCKING, 3 IN.
6	GASKET, CAM-LOCKING TYPE, 3 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE CONTAMINATED FUEL MODULE.

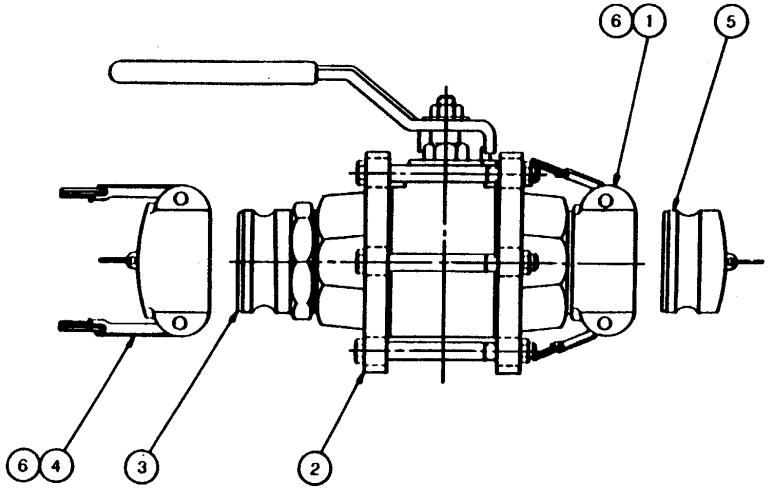
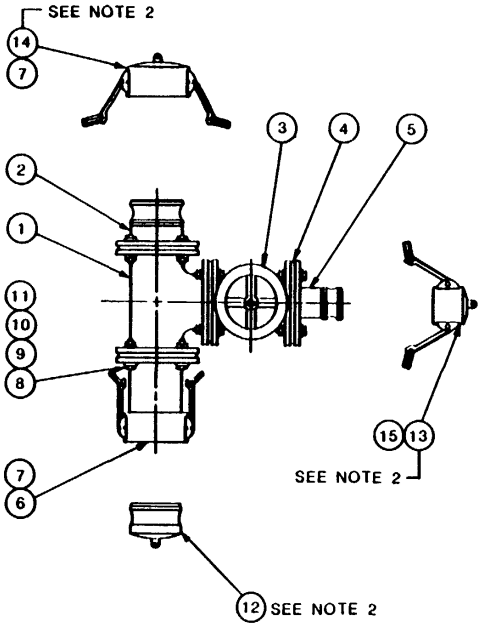


FIG. 2-50. 3 INCH BALL VALVE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8273
NSN:

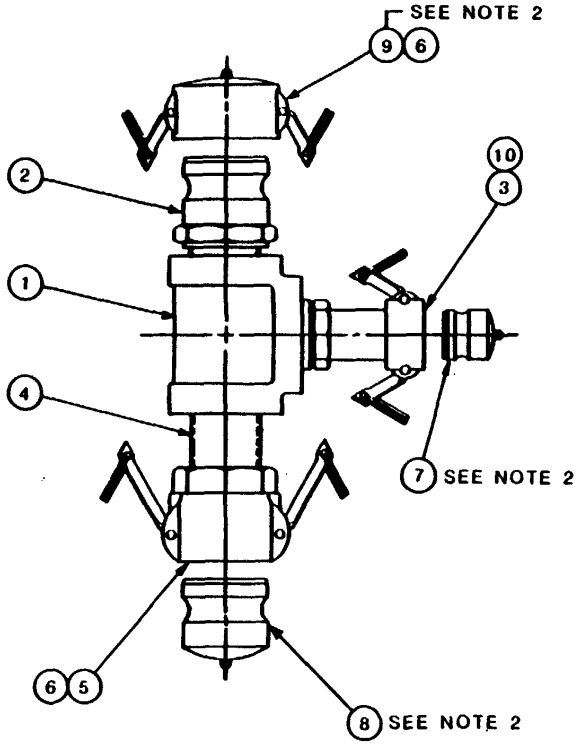


NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY.

PARTS LIST	
ITEM	DESCRIPTION
1	TEE, FLANGED TYPE, 3 X 3 X 3
2	COUPLING HALF, CAM-LOCKING, MALE TO FLANGE,
	3 IN.
3	VALVE, GATE, FLANGE, 3 IN.
4	GASKET, FLANGED TYPE, 3 IN. APERATURE
5	REDUCER, 3 IN. FLANGED TO 1.50 IN. MALE CAM-
	LOCKING
6	COUPLING HALF, CAM-LOCKING, FEMALE TO FLANGE,
	3 IN.
7	GASKET, CAM LOCKING TYPE, 3 IN.
8	SCREW, CAP HEX HEAD
9	WASHER, FLAT
10	WASHER, LOCKING
11	NUT, PLAIN, HEXAGON
12	PLUG, CAM-LOCKING, 3 IN.
13	CAP, CAM-LOCKING, 1.50 IN.
14	CAP, CAM-LOCKING, 3 IN.
15	GASKET, CAM LOCKING TYPE, 1.50 IN.

FIG. 2-51 3 INCH TEE ASSEMBLY, REDUCER, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8260
NSN: 4730-01-209-9209



NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY.

PARTS LIST	
ITEM	DESCRIPTION
1	TEE, INTERNAL THD, 2 X 2 X 2
2	COUPLING HALF, CAM-LOCKING, MALE TO EXTERNAL
	THREAD, 2 IN.
3	REDUCER, 2 IN. MALE EXTERNAL THD TO 1 IN.
	FEMALE CAM-LOCKING
4	NIPPLE, 2 IN. X 3 IN. LONG
5	COUPLING HALF, CAM-LOCKING FEMALE TO
	INTERNAL THREAD, 2 IN.
6	GASKET, CAM-LOCKING TYPE, 2 IN.
7	PLUG, CAM-LOCKING, 1 IN.
8	PLUG, CAM-LOCKING, 2 IN.
9	CAP, CAM-LOCKING, 2 IN.
10	GASKET, CAM-LOCKING TYPE, 1 IN.

FIG. 2-52 2 INCH TEE ASSEMBLY, REDUCER, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8262
NSN: 4730-01-210-5627

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, CAM-LOCKING, FEMALE TO
	EXTERNAL THREAD,1.50 IN.
2	VALVE, BALL, 1.50 IN. INTERNAL THREAD
3	COUPLING HALF, CAM-LOCKING, MALE TO
	EXTERNAL THREAD, 1.50 IN.
4	CAP, CAM-LOCKING, 1.50 IN.
5	PLUG, CAM-LOCKING, 1.50 IN.
6	GASKET, CAM-LOCKING TYPE, 1.50 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY.

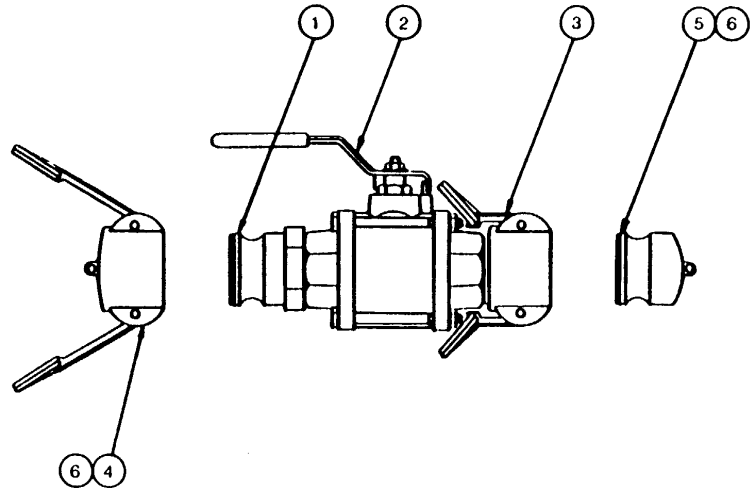


FIG. 2-53 1.50 INCH BALL VALVE ASSEMBLY, QUICK DISCONNECT
REF: U.S. ARMY DRAWING (97403) 13226E8276
NSN:

PARTS LIST	
ITEM	DESCRIPTION
1	VALVE, GATE, 6 INCH FLANGED ENDS
2	ADAPTER, FLANGE TO DBL GROOVE, 6 IN.
3	GASKET, FLANGE
4	SCREW, CAP, HEXAGON HEAD
5	WASHER, FLAT-ROUND
6	WASHER, LOCK-SPRING, HELICAL
7	NUT, PLAIN, HEXAGON
8	COUPLING, CLAMP, GROOVED END PIPE
9	CAP, DBL GROOVE, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE SWITCHING MANIFOLD AND THE FUEL DISPENSING ASSEMBLY.

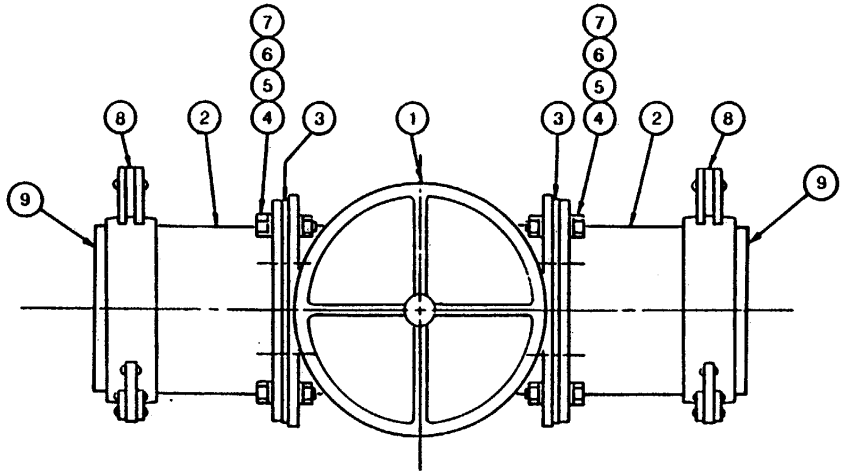


FIG. 2-54 6 INCH GATE VALVE ASSY., ALUMINUM WITH FLANGE TO DOUBLE GROOVE NSN

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
3. THIS ITEM IS A PART OF THE SECONDARY MODULE, SWITCHING MANIFOLD AND THE 50,000 GAL. TPT OPTIONAL TANK CONFIGURATION.

PARTS LIST	
ITEM	DESCRIPTION
1	TEE, DBL GROOVE, 6 IN.

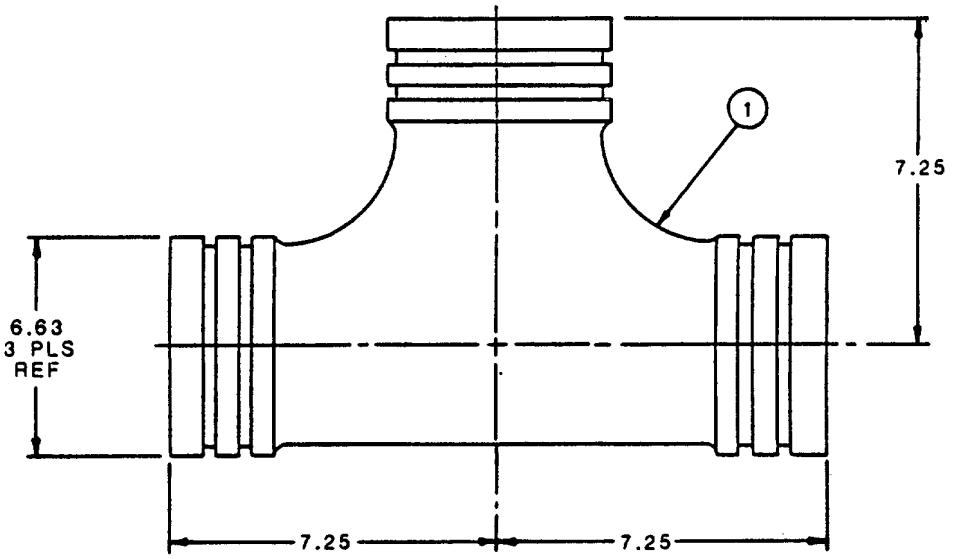


FIG. 2-55 6 INCH TEE, DOUBLE GROOVED
NSN 4730-01-210-5628

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
3. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMBLY AND THE TANKER-TRUCK RECEIPT MANIFOLD.

PARTS LIST	
ITEM	DESCRIPTION
1	TEE, DBL GROOVE, 6"x6"x4"

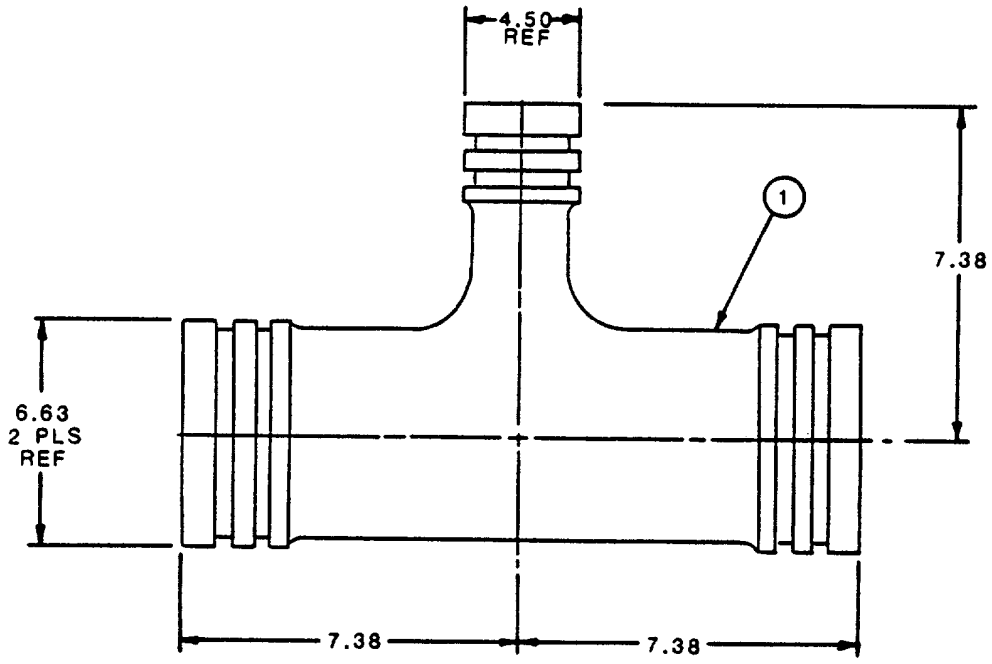


FIG. 2-56 TEE, REDUCING, 6x6x4
NSN 4730-01-210-5625

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
3. THIS ITEM IS A PART OF VARIOUS SETS.

PARTS LIST	
ITEM	DESCRIPTION
1	CAP, DBL GROOVE, 6 IN.

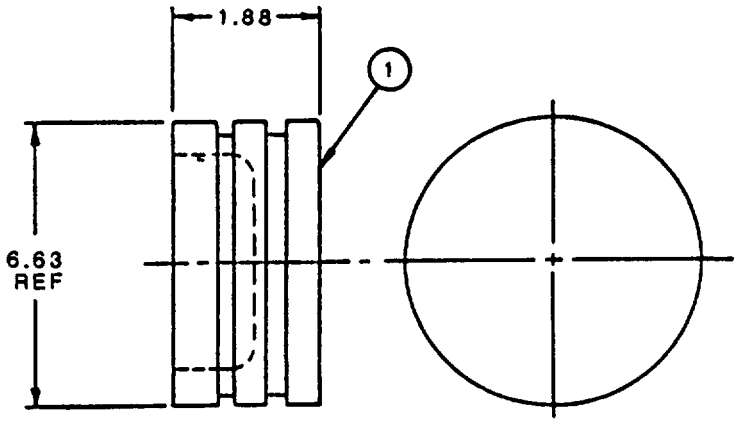
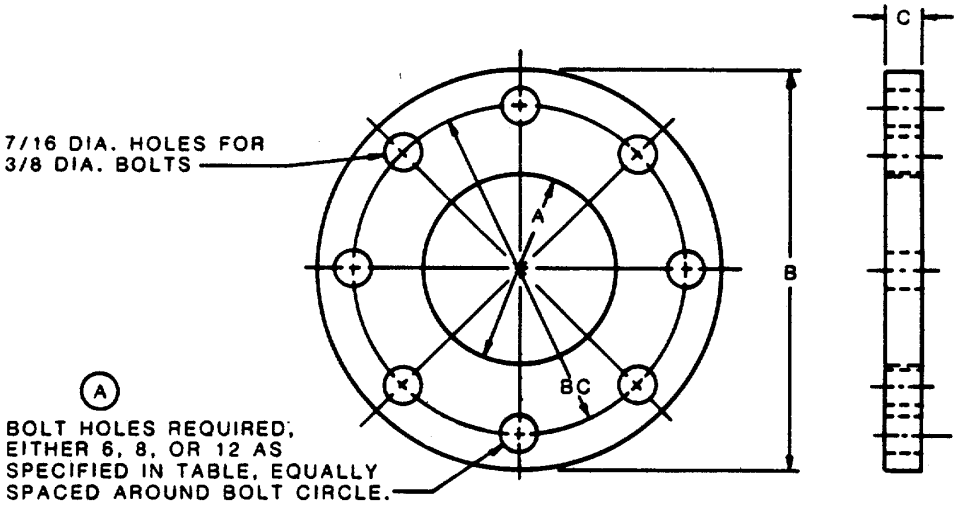


FIG. 2-57 6 INCH CAP, END

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
3. THIS ITEM IS A PART OF VARIOUS SETS.



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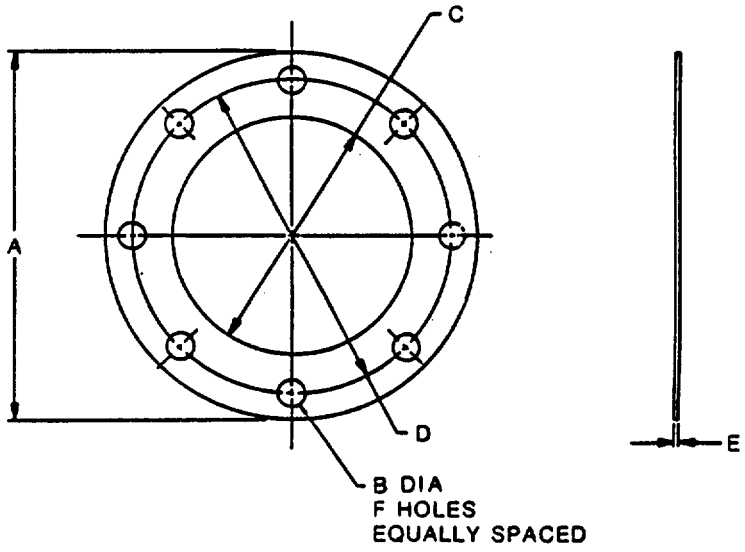
SIZE	A NOM	B	BC	C	BOLT HOLES
2	2-1/4	4-1/2	3-3/4	3/8	6
2-1/2	2-5/8	5	4-1/4	3/8	6
3	3	5-5/8	4-7/8	3/8	8
4	4	6-5/8	5-7/8	3/8	8
6	6	8-7/8	8-1/8	3/8	12

TOLERANCE ±1/64

FIG. 2-58A ALUMINUM FLANGE DIMENSIONS

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. MATERIAL: CORK AND RUBBER COMPOSITION PER MIL-C-6183 TYPE OPTIONAL, CLASS 1, GR. B
3. THIS ITEM IS A PART OF VARIOUS SETS.

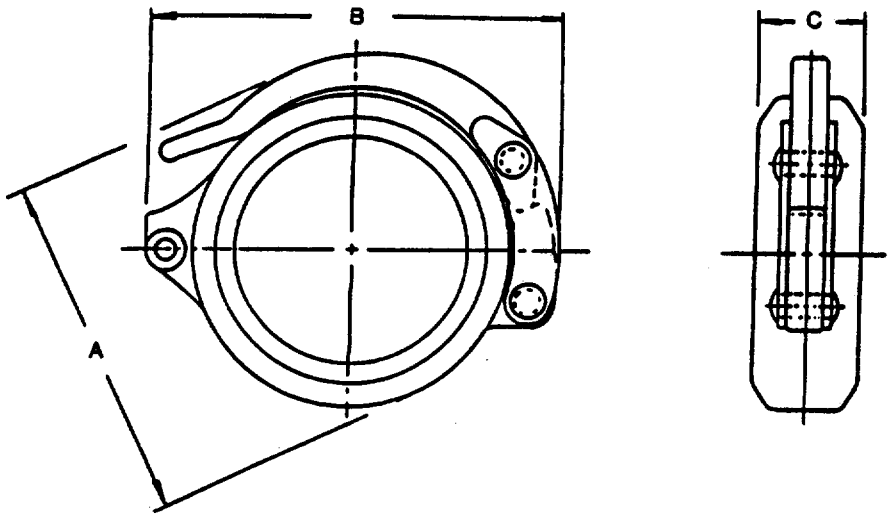


SIZE	DIA A	DIA B	DIA C	DIA D	DIA E	HOLE QTY F
3	5.75	.450 / .435	3.00	4.875	.062 ±.015	8
4	6.75	.450 / .435	4.12	5.875	.062 ±.015	8
6	9.00	.450 / .435	6.00	8.125	.062 ±.015	12

FIG. 2-58B FLANGE GASKET DIMENSIONS

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. THIS ITEM IS A PART OF VARIOUS SETS.



SCHEDULE

NOMINAL SIZE INCHES	COUPLING DIMENSIONS			NSN
	A	B	C	
4	6-7/8	7-3/4	2	
6	8-7/8	10-1/2	2	4730-10-209-4413

FIG. 2-59 4 INCH & 6 INCH COUPLING, SINGLE GROOVE, GENERAL DIMENSIONS
NSN: SEE SCHEDULE

PARTS LIST

1. 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA) SEE FIG. 2-11 & PAR. 2-4.1
   NSN 5430-01-160-3528 SEE ILC DOVER TECHNICAL MANUAL.

2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG.
   NSN 3835-01-210-5618 FIG. 2-32, PAR. 2-5.1b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595
   FIG. 2-38, PAR. 2-5.3a

4. COUPLING, ADAPTER, CAM-LOCK MALE BY DOUBLE GROOVED PIPE,
   6-INCH NOMINAL SIZE. PAR. 2-5.4d

5. COUPLING, ADAPTER, CAM-LOCK FEMALE BY DOUBLE GROOVED PIPE
   6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

6. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12-FT. LONG.
   NSN 3835-01-210-5596 FIG. 2-33, PAR. 2-5.1c

7. 600 GPM HOSELINE PUMP SEE PAR. 2-4.3 & FIG. 2-13
   ALSO SEE PEABODY BARNES TECHNICAL MANUAL.
   NSN 4320-01-193-3429

8. 6-INCH HOSE ASSEMBLY, NON-COLLAPSIBLE, 10-FT. LONG,
   CAM-LOCK END CONNECTION. OVER PACKED WITH 5000 BBL TANK.

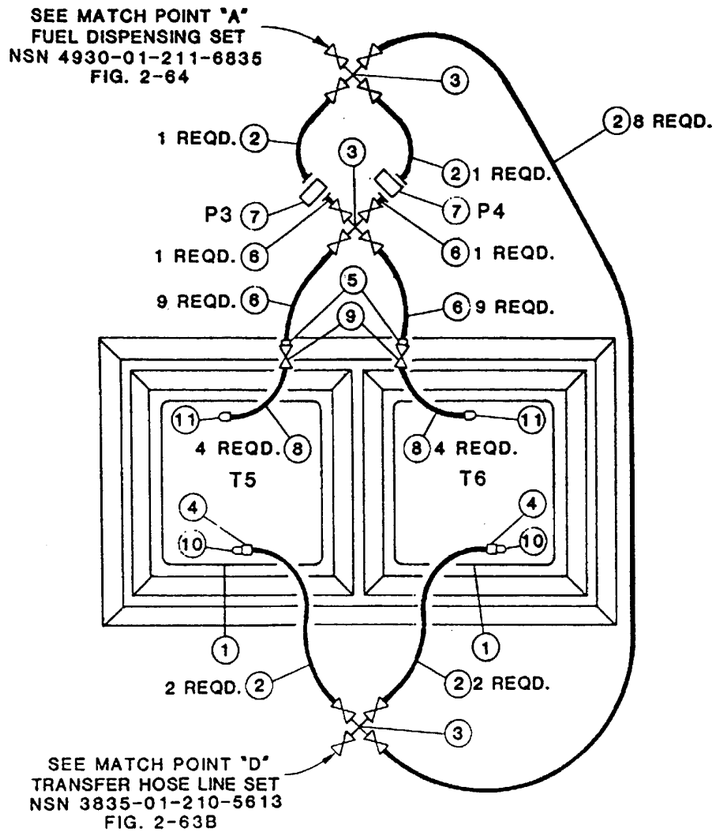
9. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, CAM-LOCK CONNECTION,
   OVER PACKED WITH 5000 BBL TANK.

10. ELBOW, FEMALE TO FEMALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

11. ELBOW, FEMALE TO MALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-3A

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2



SHARED BERM ALTERNATE
HOSE, VALVE, AND FITTING INSTALLATION
PRIMARY MODULE
NSN 3835-01-210-5611

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-60A

PARTS LIST

1. 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA) SEE FIG. 2-11 & PAR. 2-4.1 NSN 5430-01-160-3528 SEE ILC DOVER TECHNICAL MANUAL.

2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG. NSN 3835-01-210-5618 FIG. 2-32, PAR. 2-5.1b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595 FIG. 2-38, PAR. 2-5.3a

4. COUPLING, ADAPTER, CAM-LOCK MALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. PAR. 2-5.4d

5. COUPLING, ADAPTER, CAM-LOCK FEMALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

6. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12-FT. LONG. NSN 3835-01-210-5596 FIG. 2-33, PAR. 2-5.1c

7. 600 GPM HOSELINE PUMP SEE PAR. 2-4.3 & FIG. 2-13 ALSO SEE PEABODY BARNES TECHNICAL MANUAL. NSN 4320-01-193-3429

8. 6-INCH HOSE ASSEMBLY, NON-COLLAPSIBLE, 10-FT. LONG, CAM-LOCK END CONNECTION. OVER PACKED WITH 5000 BBL TANK.

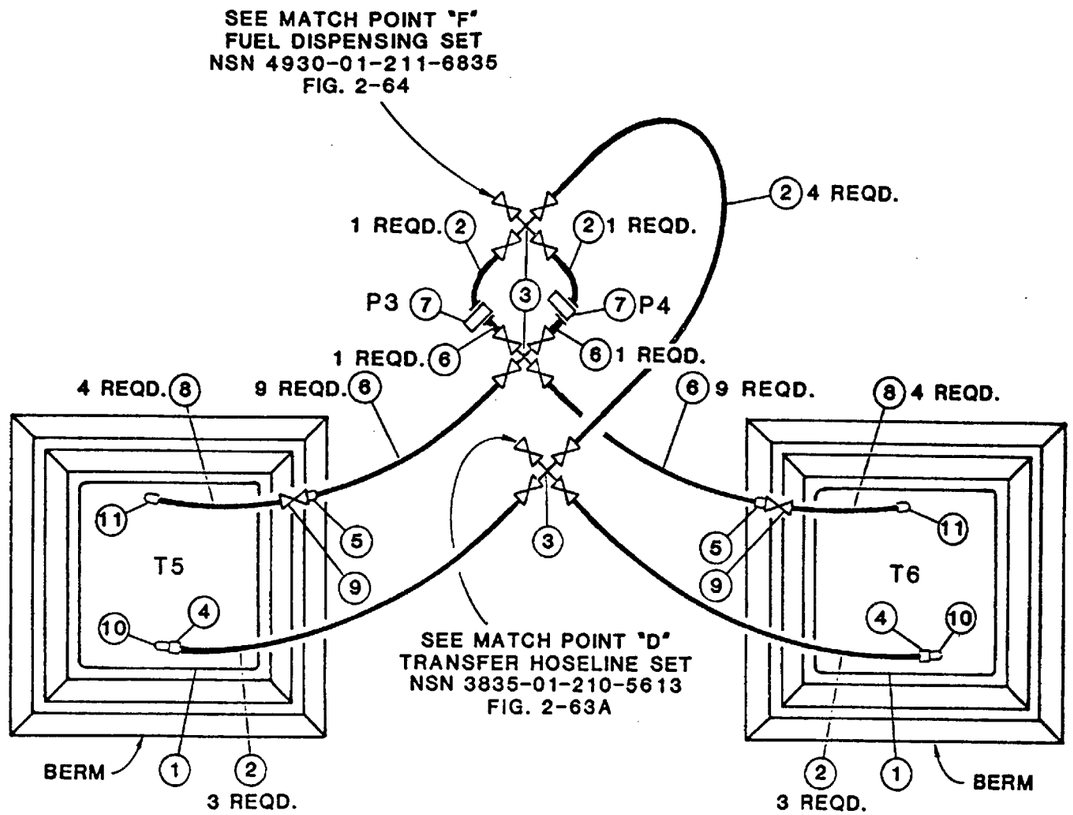
9. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, CAM-LOCK CONNECTION, OVER PACKED WITH 5000 BBL TANK.

10. ELBOW, FEMALE TO FEMALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

11. ELBOW, FEMALE TO MALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-4A

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2



MAXIMUM SPACING ALTERNATE
HOSE, VALVE, AND FITTING INSTALLATION
PRIMARY MODULE
NSN 3835-01-210-5611

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-60B

PARTS LIST

1. 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA) SEE FIG. 2-11 & PAR. 2-4.1
   NSN 5430-01-160-3528 SEE ILC DOVER TECHNICAL MANUAL.

2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG.
   NSN 3835-01-210-5618 FIG. 2-32, PAR. 2-5.1b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595
   FIG. 2-38, PAR. 2-5.3a

4. COUPLING, ADAPTER, CAM-LOCK MALE BY DOUBLE GROOVED PIPE,
   6-INCH NOMINAL SIZE. PAR. 2-5.4d

5. COUPLING, ADAPTER, CAM-LOCK FEMALE BY DOUBLE GROOVED PIPE,
   6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

6. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12-FT. LONG.
   NSN 3835-01-210-5596 FIG. 2-33, PAR. 2-5.1c

7. 600 GPM HOSELINE PUMP SEE PAR. 2-4.3 & FIG. 2-13
   ALSO SEE PEABODY BARNES TECHNICAL MANUAL.
   NSN 4320-01-193-3429

8. 6-INCH HOSE ASSEMBLY, NON-COLLAPSIBLE, 10-FT. LONG,
   CAM-LOCK END CONNECTION. OVER PACKED WITH 5000 BBL TANK.

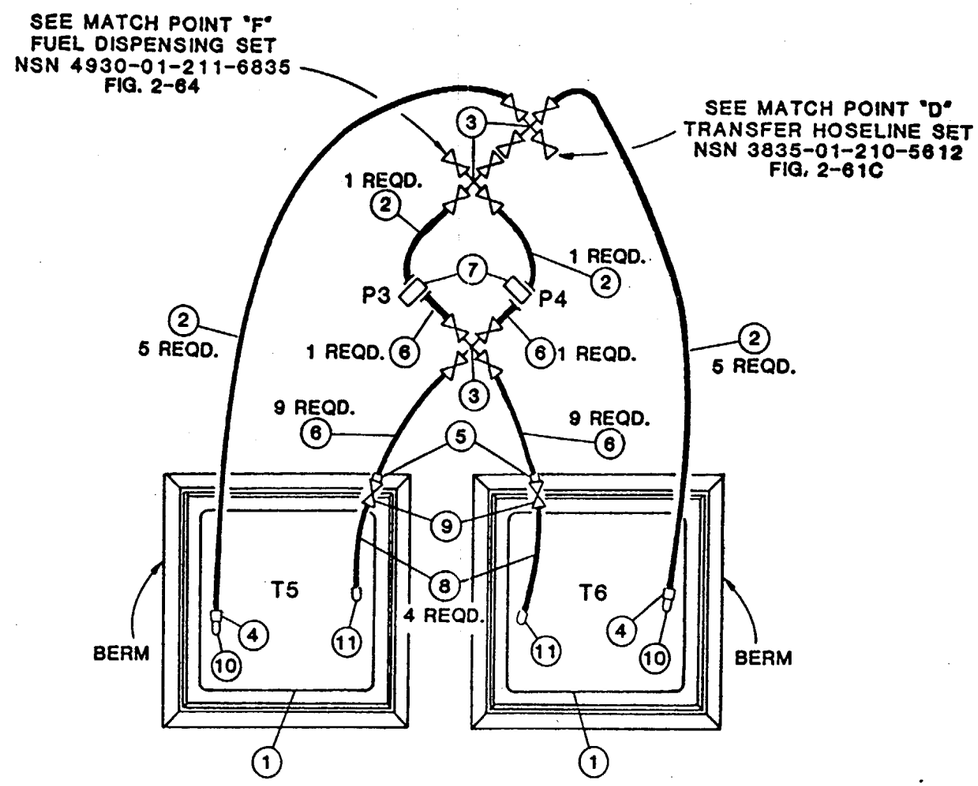
9. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, CAM-LOCK CONNECTION,
   OVER PACKED WITH 5000 BBL TANK.

10. ELBOW, FEMALE TO FEMALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

11. ELBOW, FEMALE TO MALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-5A

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2



MINIMUM SPACING ALTERNATE
HOSE, VALVE, AND FITTING INSTALLATION
PRIMARY MODULE
NSN 3835-01-210-5611

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-60C

PARTS LIST

1. 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA) SEE FIG. 2-11 & PAR. 2-4.1
   NSN 5430-01-160-3528 SEE ILC DOVER TECHNICAL MANUAL.

2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG.
   NSN 3835-01-210-5618 FIG. 2-32. PAR. 2-5.1b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595
   FIG. 2-38, PAR. 2-5.3a

4. COUPLING, ADAPTER, CAM-LOCK MALE BY DOUBLE GROOVED PIPE,
   6-INCH NOMINAL SIZE. PAR. 2-5.4d

5. COUPLING, ADAPTER, CAM-LOCK FEMALE BY DOUBLE GROOVED PIPE,
   6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

6. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12-FT. LONG.
   NSN 3835-01-210-5596 FIG. 2-33, PAR. 2-5.1c

7. 600 GPM HOSELINE PUMP SEE PAR. 2-4.3 & FIG. 2-13
   ALSO SEE PEABODY BARNES TECHNICAL MANUAL.
   NSN 4320-01-193-3429

8. 6-INCH ALUMINUM WYE ASSEMBLY. NSN 3835-01-210-5592
   FIG. 2-39, PAR. 2-5.3b

9. 6-INCH ALUMINUM TEE. NSN 4730-01-210-5628. FIG. 2-55, PAR. 2-5.4a

10. 6-INCH HOSE ASSEMBLY, NON-COLLAPSIBLE, 10-FT. LONG,
    CAM-LOCK END CONNECTION. OVER PACKED WITH 5000 BBL TANK.

11. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, CAM-LOCK CONNECTION,
    OVER PACKED WITH 5000 BBL TANK.

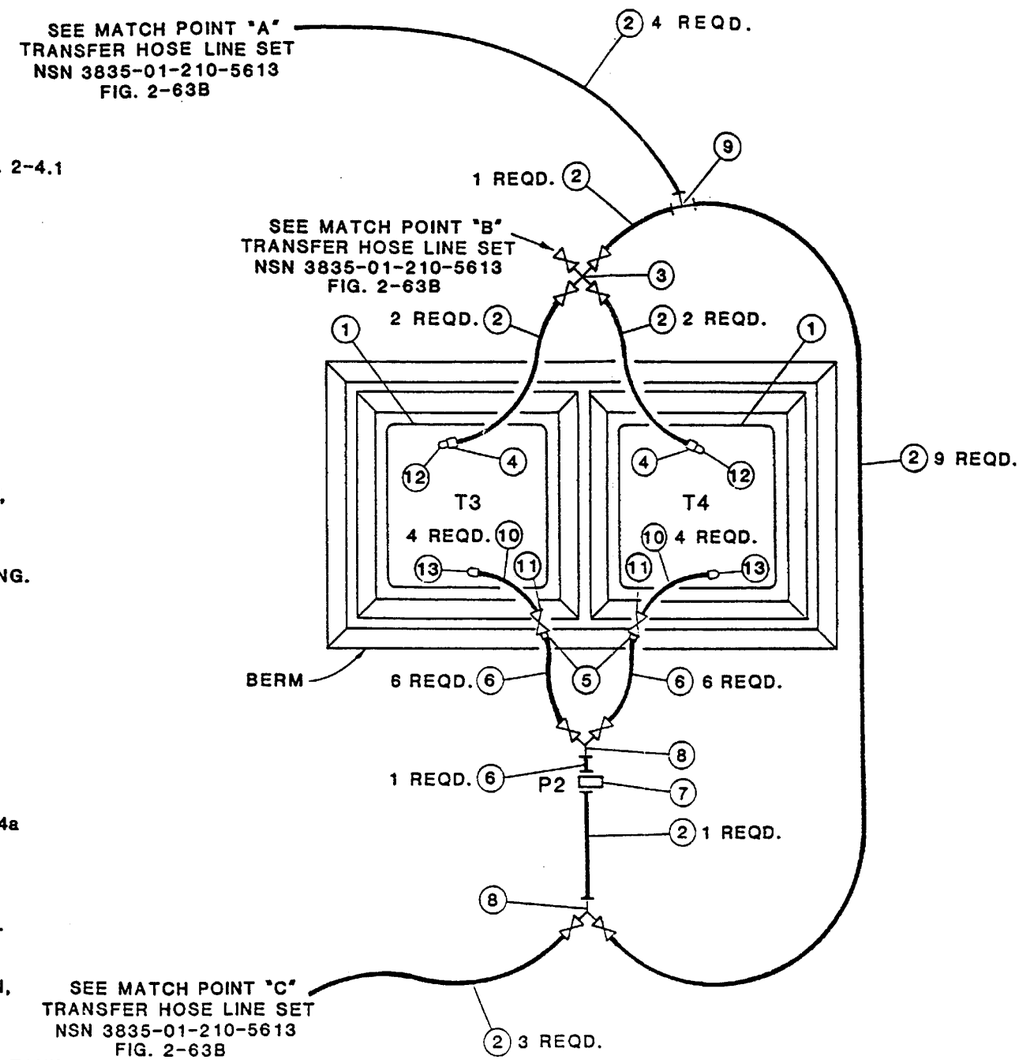
12. ELBOW, FEMALE TO FEMALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

13. ELBOW, FEMALE TO MALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-3B

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2

3. INSTALLATION OF T1, T2 AND P1 WILL BE
   THE SAME BUT OPPOSITE HAND.



SHARED BERM ALTERNATE
HOSE, VALVE, AND FITTING INSTALLATION
SECONDARY MODULE
NSN 3835-01-210-5612
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-61A

PARTS LIST

1. 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA) SEE FIG. 2-11 & PAR. 2-4.1 NSN 5430-01-160-3528 SEE ILC DOVER TECHNICAL MANUAL.

2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG. NSN 3835-01-210-5618 FIG. 2-32. PAR. 2-5.1b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595 FIG. 2-38, PAR. 2-5.3a

4. COUPLING, ADAPTER, CAM-LOCK MALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. PAR. 2-5.4d

5. COUPLING, ADAPTER, CAM-LOCK FEMALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

6. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12-FT. LONG. NSN 3835-01-210-5596 FIG. 2-33, PAR. 2-5.1c

7. 600 GPM HOSELINE PUMP SEE PAR. 2-4.3 & FIG. 2-13 ALSO SEE PEABODY BARNES TECHNICAL MANUAL. NSN 4320-01-193-3429

8. 6-INCH ALUMINUM WYE ASSEMBLY. NSN 3835-01-210-5592 FIG. 2-39, PAR. 2-5.3b

9. 6-INCH ALUMINUM TEE. NSN 4730-01-210-5628. FIG. 2-55, PAR. 2-5.4a

10. 6-INCH HOSE ASSEMBLY, NON-COLLAPSIBLE, 10-FT. LONG, CAM-LOCK END CONNECTION. OVER PACKED WITH 5000 BBL TANK.

11. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, CAM-LOCK CONNECTION, OVER PACKED WITH 5000 BBL TANK.

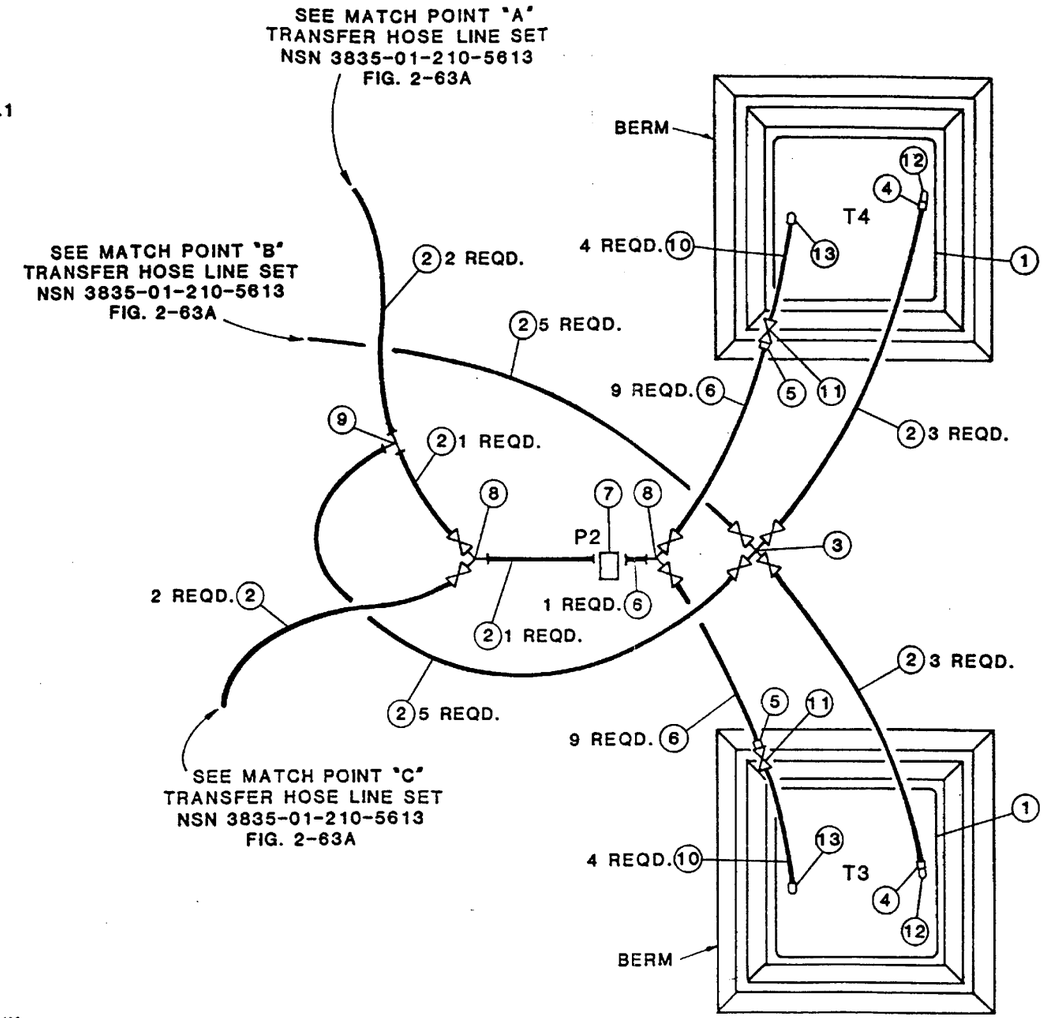
12. ELBOW, FEMALE TO FEMALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

13. ELBOW, FEMALE TO MALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-4B

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2

3. INSTALLATION OF T1, T2 AND P1 WILL BE THE SAME BUT OPPOSITE HAND.



MAXIMUM SPACING ALTERNATE
HOSE, VALVE, AND FITTING INSTALLATION
SECONDARY MODULE
NSN 3835-01-210-5612
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-61B

PARTS LIST

1. 5000 BBL FABRIC COLLAPSIBLE TANK (BFTA) SEE FIG. 2-11 & PAR. 2-4.1 NSN 5430-01-160-3528 SEE ILC DOVER TECHNICAL MANUAL.

2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG. NSN 3835-01-210-5618 FIG. 2-32. PAR. 2-5.1b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595 FIG. 2-38, PAR. 2-5.3a

4. COUPLING, ADAPTER, CAM-LOCK MALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. PAR. 2-5.4d

5. COUPLING, ADAPTER, CAM-LOCK FEMALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

6. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12-FT. LONG. NSN 3835-01-210-5596 FIG. 2-33, PAR. 2-5.1c

7. 600 GPM HOSELINE PUMP SEE PAR. 2-4.3 & FIG. 2-13 ALSO SEE PEABODY BARNES TECHNICAL MANUAL. NSN 4320-01-193-3429

8. 6-INCH ALUMINUM WYE ASSEMBLY. NSN 3835-01-210-5592 FIG. 2-39, PAR. 2-5.3b

9. 6-INCH ALUMINUM TEE. NSN 4730-01-210-5628. FIG. 2-55, PAR. 2-5.4a

10. 6-INCH HOSE ASSEMBLY, NON-COLLAPSIBLE, 10-FT. LONG, CAM-LOCK END CONNECTION. OVER PACKED WITH 5000 BBL TANK.

11. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, CAM-LOCK CONNECTION, OVER PACKED WITH 5000 BBL TANK.

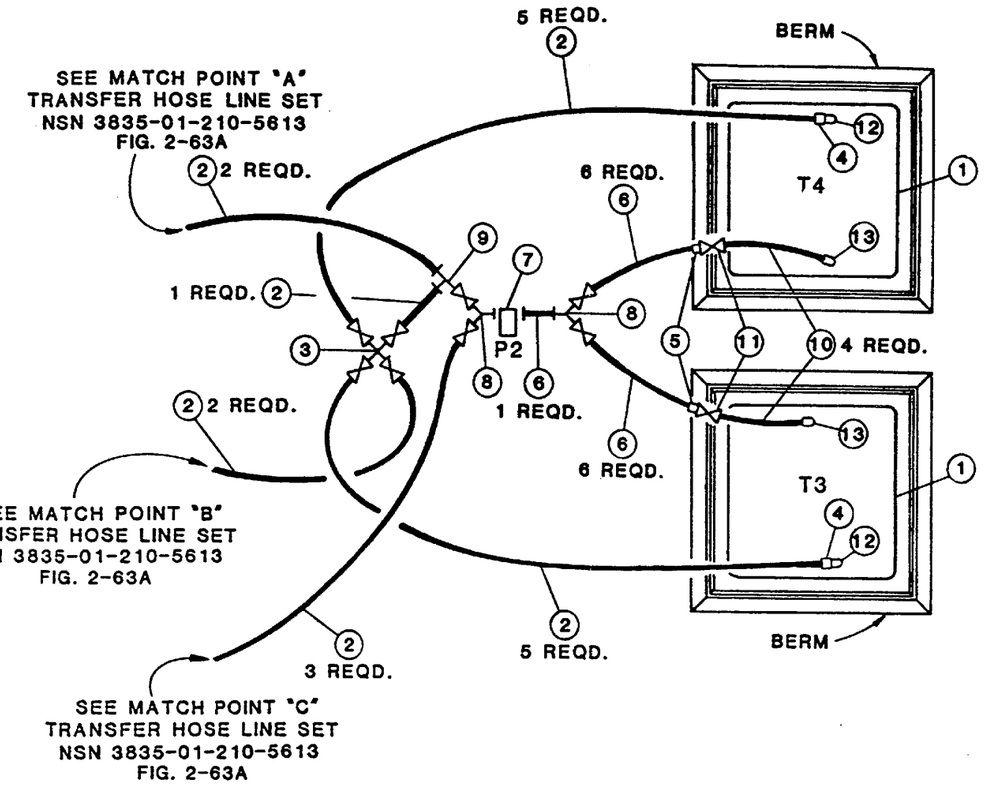
12. ELBOW, FEMALE TO FEMALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

13. ELBOW, FEMALE TO MALE, 6"X 90° SIZE. OVER PACKED WITH 5000 BBL TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-5B

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2

3. INSTALLATION OF T1, T2 AND P1 WILL BE THE SAME BUT OPPOSITE HAND.



MINIMUM SPACING ALTERNATE
HOSE, VALVE, AND FITTING INSTALLATION
SECONDARY MODULE
NSN 3835-01-210-5612
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-61C

PARTS LIST

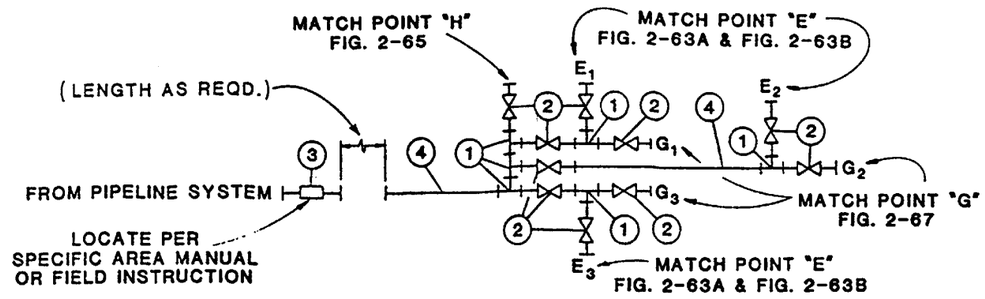
1. 6-INCH ALUMINUM TEE NSN 4730-01-210-5628 FIG. 2-55, PAR. 2-5.4a
2. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, GROOVED END. FIG. 2-54 PAR. 2-5.3n
3. 6-INCH ALUMINUM SAMPLING ASSEMBLY. FIG. 2-22 PAR. 2-4.8
4. 6-INCH ALUMINUM PIPELINE SET. SEE PAR. 2-5.2a&b
5. METER STRAINER ASSEMBLY, 800 GPM, DOUBLE GROOVE CONNECTIONS. FIG. 2-19, PAR. 2-4.6

MATCH POINT LEGEND

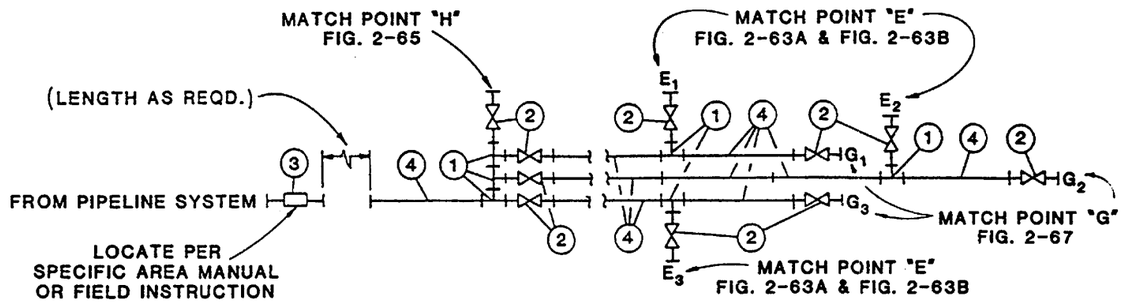
E_1 ,G_1 ,J_1 – DIESEL FUEL

E_2 ,G_2 ,J_2 – MOGAS

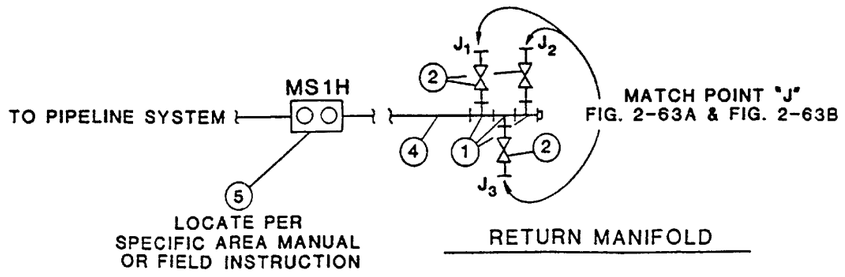
E_3 ,G_3 ,J_3 – JET FUEL



STANDARD RECEIPT MANIFOLD



OPTIONAL RECEIPT MANIFOLD



RETURN MANIFOLD

SWITCHING MANIFOLD
NSN 3835-01-210-5593

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-62

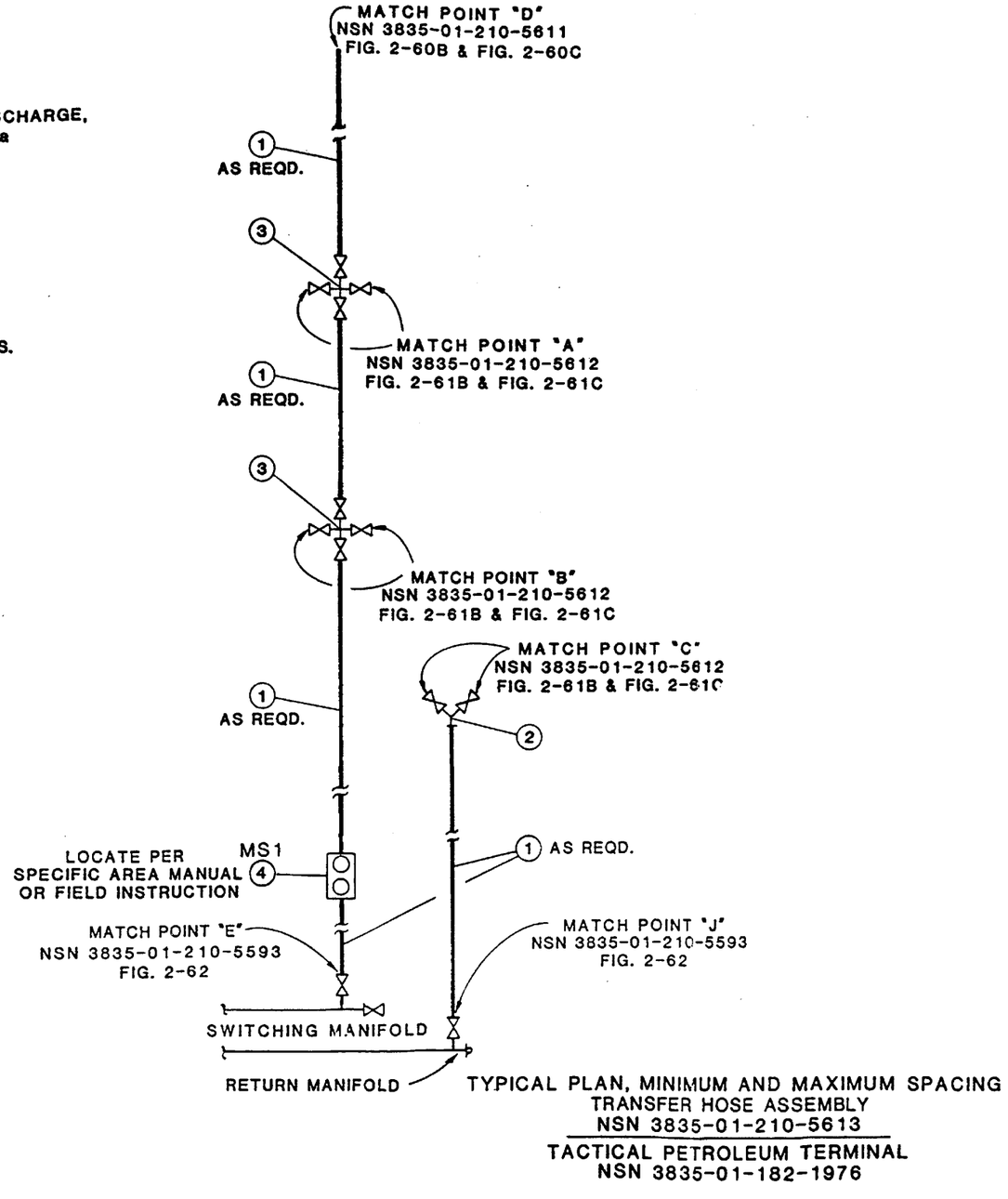
PARTS LIST

1. 6-INCH LIGHT WEIGHT, HOSE LINE ASSEMBLY, WITH SWIVEL, DISCHARGE, COLLAPSIBLE, 250 FT. LONG. FIG. 2-30 & FIG. 2-31, PAR. 2-5.1a

2. 6-INCH ALUMINUM WYE ASSEMBLY. NSN 3835-01-210-5592 FIG. 2-39, PAR. 2-5.3b

3. 6-INCH ALUMINUM CROSS ASSEMBLY. NSN 3835-01-210-5595 FIG. 2-38, PAR. 2-5.3a

4. METER STRAINER ASSEMBLY, 800 GPM, DOUBLE GROOVE CONNECTIONS. FIG. 2-19, PAR. 2-4.6



TYPICAL PLAN, MINIMUM AND MAXIMUM SPACING
TRANSFER HOSE ASSEMBLY
NSN 3835-01-210-5613

TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-63A

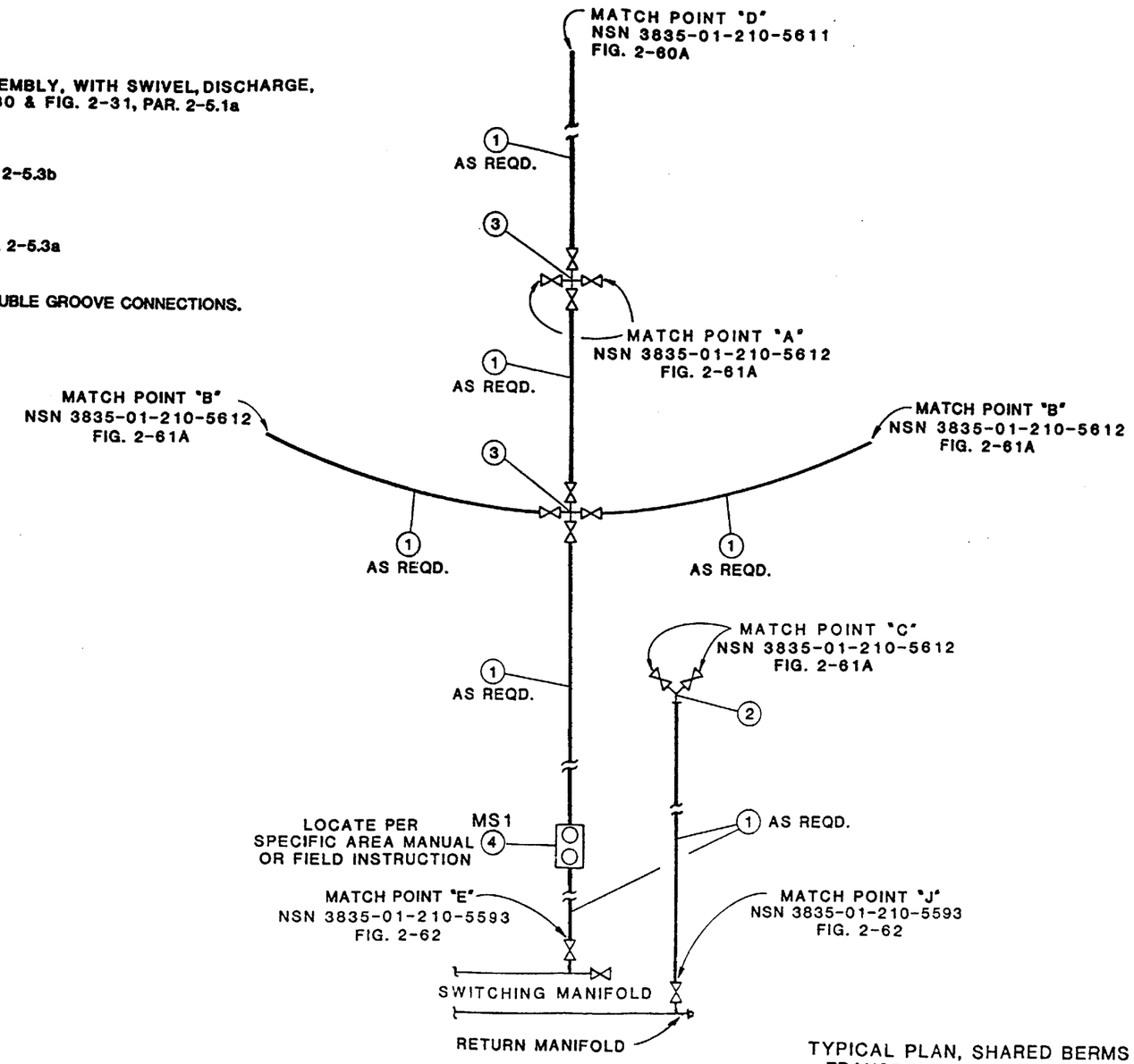
PARTS LIST

1. 6-INCH LIGHT WEIGHT, HOSE LINE ASSEMBLY, WITH SWIVEL, DISCHARGE, COLLAPSIBLE, 250 FT. LONG. FIG. 2-30 & FIG. 2-31, PAR. 2-5.1a

2. 6-INCH ALUMINUM WYE ASSEMBLY.
   NSN 3835-01-210-5592 FIG. 2-39, PAR. 2-5.3b

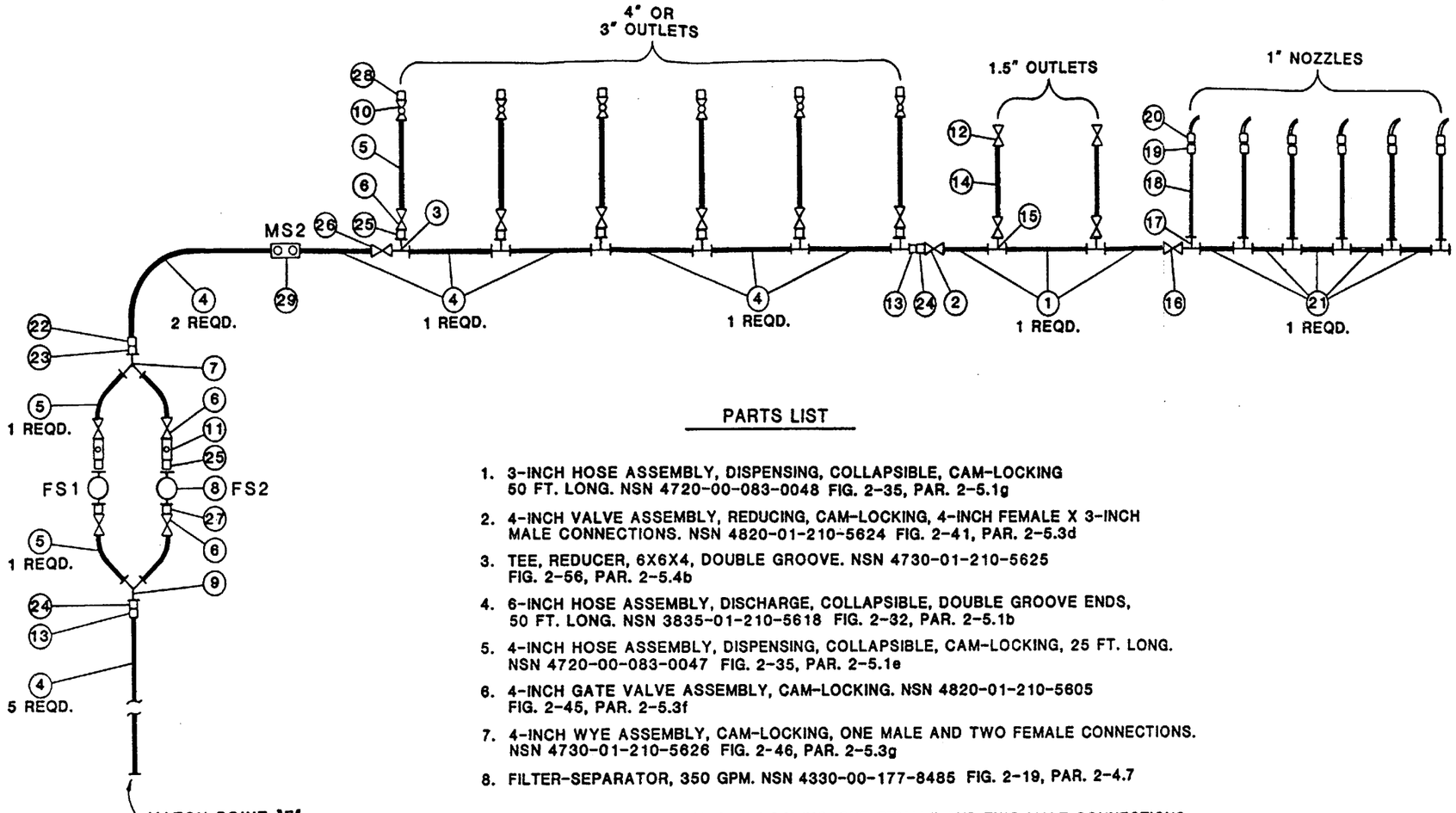
3. 6-INCH ALUMINUM CROSS ASSEMBLY.
   NSN 3835-01-210-5595 FIG. 2-38, PAR. 2-5.3a

4. METER STRAINER ASSEMBLY, 800 GPM, DOUBLE GROOVE CONNECTIONS.
   FIG. 2-19, PAR. 2-4.6



TYPICAL PLAN, SHARED BERMS
TRANSFER HOSE ASSEMBLY
NSN 3835-01-210-5613
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

FIG. 2-63B



PARTS LIST

1. 3-INCH HOSE ASSEMBLY, DISPENSING, COLLAPSIBLE, CAM-LOCKING 50 FT. LONG. NSN 4720-00-083-0048 FIG. 2-35, PAR. 2-5.1g
2. 4-INCH VALVE ASSEMBLY, REDUCING, CAM-LOCKING, 4-INCH FEMALE X 3-INCH MALE CONNECTIONS. NSN 4820-01-210-5624 FIG. 2-41, PAR. 2-5.3d
3. TEE, REDUCER, 6X6X4, DOUBLE GROOVE. NSN 4730-01-210-5625 FIG. 2-56, PAR. 2-5.4b
4. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, DOUBLE GROOVE ENDS, 50 FT. LONG. NSN 3835-01-210-5618 FIG. 2-32, PAR. 2-5.1b
5. 4-INCH HOSE ASSEMBLY, DISPENSING, COLLAPSIBLE, CAM-LOCKING, 25 FT. LONG. NSN 4720-00-083-0047 FIG. 2-35, PAR. 2-5.1e
6. 4-INCH GATE VALVE ASSEMBLY, CAM-LOCKING. NSN 4820-01-210-5605 FIG. 2-45, PAR. 2-5.3f
7. 4-INCH WYE ASSEMBLY, CAM-LOCKING, ONE MALE AND TWO FEMALE CONNECTIONS. NSN 4730-01-210-5626 FIG. 2-46, PAR. 2-5.3g
8. FILTER-SEPARATOR, 350 GPM. NSN 4330-00-177-8485 FIG. 2-19, PAR. 2-4.7
9. 4-INCH WYE ASSEMBLY, CAM-LOCKING, ONE FEMALE AND TWO MALE CONNECTIONS. NSN 3835-01-210-5630 FIG. 2-47, PAR. 2-5.3g
10. 4-INCH BALL VALVE, CAM-LOCKING. NSN 4820-01-210-9547 FIG. 2-48, PAR. 2-5.3h
11. ADAPTER, FOR WATER DETECTION KIT. NSN 4730-01-013-7590 FIG. 2-21, PAR. 2-4.7a4
12. 1.5-INCH BALL VALVE, CAM-LOCKING NSN 4820-01-210-5615 FIG. 2-53, PAR. 2-5.3m

CONTINUED ON SHT. 2 OF 2

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-3A,4A&5A

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2

HOSE, VALVE, AND FITTING INSTALLATION
FUEL DISPENSING ASSEMBLY
NSN 4930-01-211-6835
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

PARTS LIST

13. COUPLING, ADAPTER, CAM LOCKING MALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. PAR. 2-5.4d

14. 1.5-INCH HOSE ASSEMBLY, DISPENSING, COLLAPSIBLE, 25 FT. LONG. NSN 4720-00-901-7624 FIG. 2-35, PAR. 2-5.1i

15. TEE ASSEMBLY, REDUCER, CAM-LOCKING, 1.5" MALE X 3" MALE X 3" FEMALE CONNECTIONS. NSN 4730-01-209-9209 FIG. 2-51, PAR. 2-5.3k

16. 3-INCH VALVE ASSEMBLY, REDUCER CAM-LOCKING, 3-INCH FEMALE X 2-INCH MALE. FIG. 2-49, PAR. 2-5.3j

17. TEE, ASSEMBLY, REDUCER, CAM-LOCKING, 1" FEMALE X 2" MALE CONNECTIONS. NSN 4730-01-210-5627 FIG. 2-52, PAR. 2-5.3l

18. 1-INCH HOSE ASSEMBLY, DISPENSING, COLLAPSIBLE, CAM-LOCKING, 25 FT. LONG. FIG. 2-35, PAR. 2-5.1j

19. COUPLING, 1" CAM-LOCKING MALE X EXTERNAL PIPE THREAD. NSN 4730-00-084-7435 PAR. 2-5.4h

20. NOZZLE, 1-INCH. NSN 4930-00-902-4642 PAR. 2-5.4j

21. 2-INCH HOSE ASSEMBLY, DISPENSING, COLLAPSIBLE, CAM-LOCKING, 25 FT. LONG. FIG. 2-35, PAR. 2-5.1h

22. COUPLING, ADAPTER, CAM-LOCKING FEMALE BY DOUBLE GROOVED PIPE, 6-INCH NOMINAL SIZE. NSN 4730-01-210-4559 PAR. 2-5.4e

23. REDUCER, CAM-LOCKING, 4-INCH FEMALE X 6-INCH MALE. PAR. 2-5.4j

24. REDUCER, CAM-LOCKING, 6-INCH FEMALE X 4-INCH MALE. NSN 4730-01-079-8234 PAR. 2-5.4k

25. COUPLING, ADAPTER, 4-INCH, CAM-LOCKING MALE BY GROOVED END PIPE. PAR. 2-5.4f

26. 6-INCH ALUMINUM GATE VALVE ASSEMBLY, DOUBLE GROOVE ENDS. FIG. 2-54, PAR. 2-5.3n

27. COUPLING, ADAPTER, 4-INCH, CAM-LOCKING FEMALE BY GROOVED END PIPE. PAR. 2-5.4g

28. REDUCER, CAM-LOCKING, 4-INCH FEMALE X 3-INCH MALE. NSN 4730-00-951-3293 PAR. 2-5.4l

29. METER STRAINER ASSEMBLY, 800 GPM, DOUBLE GROOVE CONNECTIONS. FIG. 2-19, PAR. 2-4.6

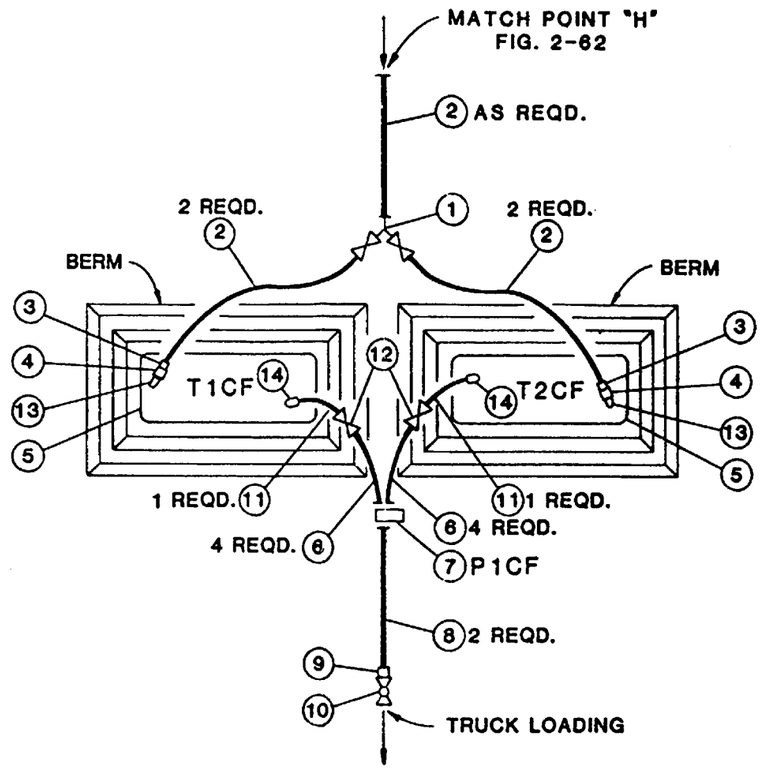
HOSE, VALVE, AND FITTING INSTALLATION
FUEL DISPENSING ASSEMBLY
NSN 4930-01-211-6835
TACTICAL PETROLEUM TERMINAL
NSN 3835-01-182-1976

PARTS LIST

1. 6-INCH ALUMINUM WYE ASSEMBLY. NSN 3835-01-210-5592
   FIG. 2-39, PAR. 2-5.3b
2. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG. NSN 3835-01-210-5618
   FIG. 2-32, PAR. 2-5.1b
3. COUPLING ADAPTER, CAM-LOCK, MALE BY EXTERNAL DBL. GROOVED PIPE, 6-INCH NOMINAL SIZE.
   PAR. 2-5.4d
4. REDUCER, CAM-LOCK, 6-INCH FEMALE BY 4-INCH MALE NSN 4730-01-079-8234
   PAR. 2-5.4k
5. 50,000 GALLON FABRIC, COLLAPSIBLE TANK. NSN 5430-00-182-8181
   FIG. 2-12 & PAR. 2-4.2
6. 4-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12 FT. LONG. NSN 4720-00-727-1339
   FIG. 2-36, PAR. 2-5.1f
7. 350 GPM TRANSFER PUMP, NSN 4320-01- 092-3551 FIG. 2-16, PAR. 2-4.4
8. 4-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 12 FT. LONG. NSN4720-01-210-4560
   FIG. 2-34, PAR. 2-5.1d
9. REDUCER, CAM-LOCK, 4-INCH FEMALE BY 3-INCH MALE NSN 4730-00-951-3293 PAR. 2-5.4l
10. 3-INCH BALL VALVE ASSEMBLY. FIG. 2-50, PAR. 2-5.3j
11. 4-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 10-FT. LONG,
    OVER PACKED WITH 50,000 GALLON TANK.
12. 4-INCH GATE VALVE ASSEMBLY, OVER PACKED WITH 50,000 GALLON TANK
13. ELBOW, FEMALE TO FEMALE, 4"X90° SIZE. OVER PACKED WITH 50,000 GALLON TANK
14. ELBOW, FEMALE TO MALE, 4"X90° SIZE. OVER PACKED WITH 50,000 GALLON TANK

NOTES: 1. FOR DIMENSIONAL LAYOUT SEE FIG. 2-6

2. FOR OVERALL TPT PLOT PLAN SEE FIG. 2-2

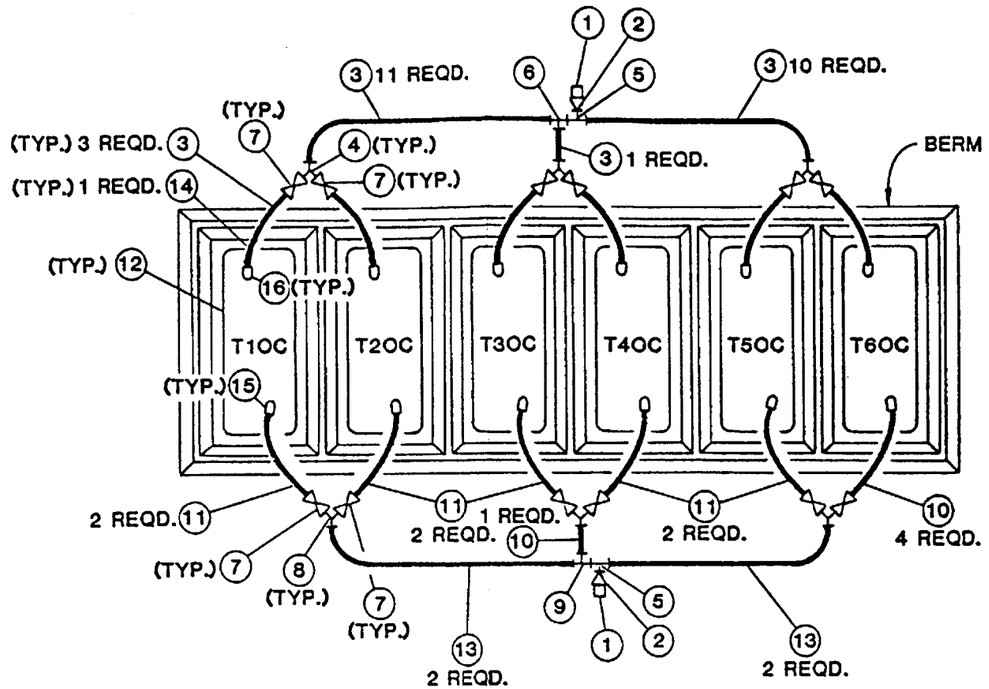


HOSE, VALVE, AND FITTING INSTALLATION
CONTAMINATED FUEL MODULE
NSN 3836-01-210-4556

FIG. 2-65

PARTS LIST

1. COUPLING, ADAPTER, CAM-LOCKING MALE BY DOUBLE GROOVE PIPE, 6-INCH NOMINAL SIZE. PAR. 2-5.4d
2. REDUCER, CAM-LOCKING, 6-INCH FEMALE BY 4-INCH MALE. PAR. 2-5.4k
3. 4-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12 FT. LONG. NSN 4720-00-727-1339 FIG. 2-36 PAR. 2-5.1f
4. 4-INCH WYE ASSEMBLY, CAM-LOCKING, ONE MALE AND TWO FEMALE CONNECTIONS. NSN 4730-01-210-5626 FIG. 2-46 PAR. 2-5.3g
5. 4-INCH TEE ASSEMBLY, CAM-LOCKING, ONE MALE AND TWO FEMALE CONNECTIONS. FIG. 2-44 PAR. 2-5.3e
6. 4-INCH TEE ASSEMBLY, CAM-LOCKING 3 FEMALE CONNECTIONS. FIG. 2-42 PAR. 2-5.3e
7. 4-INCH VALVE ASSEMBLY, CAM-LOCKING CONNECTIONS NSN 4820-01-210-5605 (EIGHT OVER PACKED WITH 50,000 GALLON TANK ASSEMBLY.)FIG. 2-45 PAR. 2-5.3f
8. 4-INCH WYE ASSEMBLY, CAM-LOCKING, TWO MALE AND ONE FEMALE CONNECTIONS. NSN 3835-01-210-5630 FIG. 2-47 PAR. 2-5.3g
9. 4-INCH TEE ASSEMBLY, CAM-LOCKING, THREE MALE CONNECTIONS. FIG. 2-43 PAR. 2-5.3e
10. 4-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 12 FT. LONG. NSN 4720-01-210-4560 FIG. 2-34 PAR. 2-5.3d
11. 4-INCH HOSE ASSEMBLY, DISPENSING, COLLAPSIBLE, 25 FT. LONG. NSN 4720-00-082-0047 FIG. 2-35 PAR. 2-5.3e
12. 50,000 GALLON FABRIC TANK. NSN 5430-00-182-8181 FIG. 2-12 PAR. 2-4.2
13. 4-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG. NSN 4720-00-083-0046 FIG. 2-35 PAR. 2-5.3e
14. 4-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 10 FT. LONG. OVER PACKED WITH 50,000 GALLON TANK.
15. ELBOW , FEMALE TO FEMALE, 4"X90° SIZE. OVER PACKED WITH 50,000 GALLON TANK.
16. ELBOW , FEMALE TO MALE, 4"X90° SIZE. OVER PACKED WITH 50,000 GALLON TANK.



NOTES

1. ITEMS 1 AND 2 ARE PROVIDED IN SUFFICENT QUANITY (12EA.) TO CONNECT EACH TANK INDIVIVUALLY.
2. 2 SIX-INCH DOUBLE GROOVE ALUMINUM TEES, NSN-4730-01-210-5628, ARE INCLUDED FOR CONNECTIONS AS NECESSARY IN THE FIELD.

HOSE, VALVE, AND FITTING INSTALLATION
OPTIONAL TANK CONFIGURATION

FIG. 2-66

PARTS LIST

1. 6-INCH ALUMINUM TEE ASSEMBLY. NSN 4730-01-211-9548 FIG. 2-40, PAR. 2-5.3c

2. 6-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12 FT. LONG. NSN 4720-01-210-5596 FIG. 2-33, PAR. 2-5.1c

3. ALUMINUM TEE FITTING, 6X6X4 NSN 4730-01-210-5625 FIG. 2-56, PAR. 2-5.4b

4. COUPLING, ADAPTER, 4-INCH, CAM-LOCKING FEMALE BY GROOVED END PIPE, PAR. 2-5.4g

5. 4-INCH HOSE ASSEMBLY, SUCTION, NON-COLLAPSIBLE, 12 FT. LONG. NSN 4720-00-727-1339 FIG. 2-36, PAR. 2-5.1f

6. 4-INCH BALL VALVE ASSEMBLY, CAM-LOCK CONNECTIONS NSN 4820-01-211-9547 FIG. 2-48, PAR. 2-5.3h

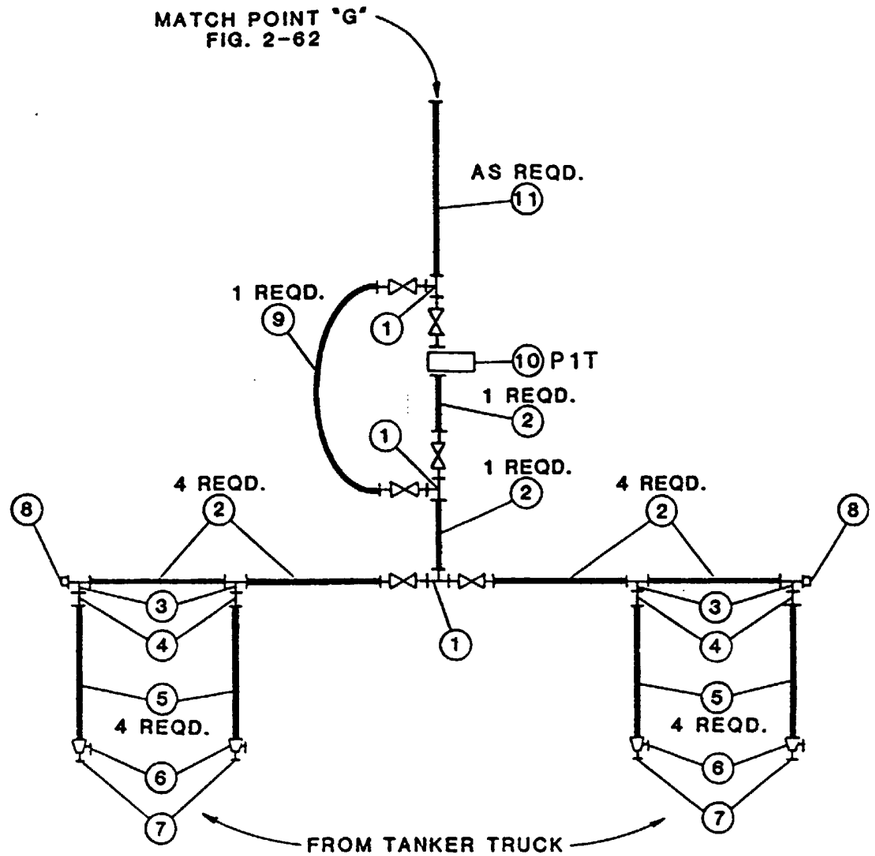
7. REDUCER CAM-LOCK, 3-INCH FEMALE BY 4-INCH MALE NSN 4730-00-951-3296 PAR. 2-5.4m

8. 6-INCH ALUMINUM CAP, GROOVED END. FIG. 2-57, PAR. 2-5.4c

9. 6-INCH HOSE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 50 FT. LONG. NSN 3835-01-210-5618 FIG. 2-32, PAR. 2-5.1b

10. 600 GPM HOSELINE PUMP, SEE PEABODY BARNES TECHNICAL MANUAL. NSN 4320-01-193-3429 FIG. 2-13 EQUIPMENT NUMBER P1T

11. 6-INCH HOSE LINE ASSEMBLY, DISCHARGE, COLLAPSIBLE, 250 FT. LONG. FIG. 2-30, PAR. 2-5.1a



TANKER TRUCK RECEIPT MANIFOLD OPTION
NSN 3835-00-210-5617

FIG. 2-67

CHAPTER 3 - INSTALLATION

OVERVIEW

This chapter provides instructions on the assembly and erection of a single typical TPT. The information on design, equipment and systems data in Chapter 2 is referred to as necessary.
The recommended or most desirable sequence of installation is as described, however, it is recognized that this can be varied in the field in relation to actual site conditions and the status of materials receipt. This manual does not recommend or specify tools or construction equipment required, transportation equipment required, or the manpower and skills required. Section I covers site selection and planning. Section II describes site preparation and earthwork. Section III covers the receipt and handling of TPT equipment and materials.

The installation of the equipment and materials is covered in Section IV. When appropriate, the reader is referred to other technical manuals published by the U.S. Army or the manufacturer for further detailed instruction.

SECTION I SITE SELECTION AND PLANNING

3-1 Site Selection

It is assumed that the U.S. Army will pre-select a specific site or at least a generally desired area for a site prior to the deployment of the TPT. There is probably no such thing as a completely ideal site. In most cases, a compromise must be made. It is recommended that the following factors be considered in site selection.

3-1.1 Distribution and Traffic Plan. The need for the terminal in a general area can be decided only by reference to the U.S. Army's distribution and traffic plan.

3-1.2 Relation to the Area System. The ability to supply the terminal must be considered, i.e., the relationship to the primary source of supply and the hydraulics of the pipeline to the terminal. This, however, is a two-way street and, in most cases, the distribution plan will be the governing factor and cause the associated pipeline system design to be such that it can deliver to the TPT site selected.

3-1.3 TPT Area Size. The size of the area selected must be such that it can contain the equipment and roadways required. Guidance on this is contained in para.'s 2-2 through 2-2.6 and the referenced plot plans, Fig.'s 2-2, 2-3A, 2-3B, 2-4A, 2-48, 2-5A and 2-5B. Compromise and rearrangement of equipment will often be necessary.

3-1.4 Suitability of Terrain. The site selected should be reasonably level and well drained at least in the areas in which the individual storage and loading and unloading modules are planned. Consideration should be given to the amount of earth moving work required. The less, the better. Low and swampy areas should be avoided. It should be as free as possible from heavy obstructions such as large rocks and trees.

3-1.5 Road Access. If possible, the site should be located relatively near existing road systems capable of carrying the traffic involved. There must be access to that road system or it must be feasible to construct a new road connecting the existing road system.

3-1.6 Water Availability. If possible, there should be water available at the site or making it available at the site must be feasible. The operation must have water available for safety reasons even if it must be hauled in. Water must be available for the charging of the dry chemical/AFFF wheel mounted fire extinguisher. Its availability is also desirable for general fire protection inspite of the availability of dry chemical fire extinguishers.

3-1.7 Local Population The site should be well away from local population concentrations.

3-2 Scheduling Logic

Without knowledge of a specific site, manpower and construction equipment allocations, shipping schedules, and U.S. Army intent and priority for a specific area, it is not possible to propose a schedule. An installation logic diagram without a time scale is, however, provided in Fig. 3-1 as a guide for the preparation of a schedule. The logic is in the sequence of the instructions. Dependencies and appropriate activity overlap are shown.

3-3 Plot Plan

With the equipment data and installation instructions provided in this manual, it is believed that the facility can be erected with only a firmed-up plot plan and the field prepared grading plan recommended in Section II. The following procedure for plot plan preparation is recommended.

3-3.1 After the site has been selected, a preliminary plot plan should be made that shows all the major equipment and system locations, including tanks, pumps, floodlight sets, fuel dispensing areas, tanker-truck receipt areas, and the access roads. Chapter 2 para.'s 2-2 through 2-3.6 and the associated Fig.'s 2-2, 2-3A, 2-38, 2-4A, 2-48, 2-SA and 2-58 should be referred to for guidance.

3-3.2 After the primary cuts and fills have been made so that firm knowledge of the characteristics of the site is available, and before the earthwork on tank sites, berms, and roadways is started, the preliminary plot plan should be reviewed, corrected as necessary, and finalized into a final plot plan on which equipment locations are firm. Final roadwork, tank pad and berm construction must be based on this final plot plan.

SECTION II SITE PREPARATION AND EARTHWORK

3-4 General Site Preparation

Final site selection and subsequently site preparation and earthwork must be based on the plot plan prepared as in para.'s 3-3 through 3-3.2. Because the site will probably not be ideal, there must be some give and take between the plot plan and site preparation results. The following procedures are recommended.

3-4. The first step is to cut an access road to the site unless one already exists.

3-4.2 Site preparation work should be based on a grading plan that minimizes cut and fill operations even if the plan is roughly prepared in the field. The plan should be based on actual on-site elevations and survey, observation of obstructions, and knowledge of the types of soils that appear to be present.

3-4.3 Stake out the area that must be cleared, marking where the major components will be located. Cut, grub out, doze, or if necessary, blast out major obstructions, i.e., trees, bush, large rocks and boulders, buildings, etc.

3-4.4 While it may be desirable to clear and finally grade the entire area required for a TPT, it is only necessary to clear and grade the areas where a fuel unit will be located, transfer systems installed, roadways built, and loading and unloading facilities installed. There must be good drainage regardless of the amount of clearing and grading undertaken.

3-4.5 To the extent possible, cuts and fills should be planned and executed such that the volume of cut soils roughly equals the required fill for low spots, tank berms, and roadways.
If the area to be utilized is fairly flat and requires only minimal grading, the materials for roadways and tank berms can come from a borrow pit near the site which can, if desired, be converted to a reserve water storage basin.

3-4.6 In preparing the grading plan and executing the cut and fill, it should be kept in mind that the major equipment, most particularly the 5000 Bbl tanks, should be set on virgin or cut soils, if possible, rather than on fill.

3-4.7 If it is required that tankage be located on a filled area, the fill must be compacted as it is placed. Compaction after a deep fill has little effect.

3-4.8 When extensive fill is required, the slopes must be such as to prevent slides and minimize erosion. As a general rule, there should be no slopes greater than 2:1 (approx. 250) in sandy or loamy soils.

3-5 Roadways

Roadways must be fully compacted, have good drainage, and to the extent possible, have at least a surface of gravel or crushed rock. Each side of the road should have an adequate swale or ditch to provide good drainage. Drainage culverts should be placed as required. The road, swale, ditch, and drain culvert requirements will vary with site conditions and anticipated rainfall. Fig. 2-2 shows a desirable road layout. Roadways must be constructed to permit ready access to all areas for installation, operation, fuel loading and unloading, and fire fighting.

3-6 Tank Pad and Berm Construction

Proper tank pad and berm construction is most important to provide for tank operation and protection from spill or a fire resulting from the spill. The reader is referred to para.'s 2-3 through 2-3.6 and Fig.'s 2-8, 2-9 and 2-10.

3-6.1 Tank pads are preferably constructed of a loamy or clay soil containing some sand so that a smooth area can be graded and its shape hold up. Fig.'s 2-8, 2-9 and 2-10 show what is needed in tank pad shape and slope. The longest slope should be approximately 10 (degree) from horizontal. Other shorter slopes will be greater. The low point should be where the tank drain will end up when the tank is unrolled. A small ditch and a basin for the drain line and the drain valve can be excavated by hand at the time the tank is unrolled. The low point described is to permit maximum pump out of the tank and drainage through the drain line.
The base of the tank pad area must be virgin soil, cut soil, or highly compacted. To avoid damage to the tank bottom, sticks, stones, or sharp objects must be removed prior to installing the tank.

3-6.2 Tank berms are constructed as shown on Fig.'s 2-8 and 2-9. They may be constructed before, after, or simultaneously with tank pad construction, depending on job conditions. In any case, it is necessary that the tank pad be cleared of any rocks, clumps, etc., that roll on during berm construction. It is recommended that tank pad rough grading be completed before berm construction and that it be finished up after berm construction. The preferred materials are soils containing a fairly high clay content to hold shape and provide sealing.
The berm should be compacted as it is constructed. Alternate materials are sand bags or the sand grids as described in para. 2-3.2b.

3-6.3 If a berm drain is installed, as recommended, it should be laid in a hand-cut trough after the first layer of berm is placed and before the second layer is placed. Care must be taken, of course, to avoid damage by the equipment constructing the berm. This can best be handled by not installing the valve until after the berm is completed and giving the pipe ends plenty of cover. When the drain valve is installed, it should be left closed, and preferably locked closed, or the integrity of the berm has been compromised.

3-6.4 If the installing authority decides to install construction grade polyethylene sealing sheets, they should be installed after the pad and berm are completed. After the joints of the sheeting are sealed, a light layer of soil (without rocks) may be spread to protect the sheeting and hold it in place. See para.'s 2-3.2a and 2-3.2c.

CAUTION

Tank pads must be free of rocks, sticks, and sharp objects to prevent tank damage.

CAUTION

Berm drain valve must be installed in the closed position and opened only to drain the berm when necessary,

CAUTION

If fabric collapsible tanks are installed on a general slope in excess of 30, they may tend to creep in the direction of the slope. Install as shown on Fig. 2-10.

3-7 Pads for Other Equipment

3-7.1 To the extent possible, all operating equipment should be set on virgin or cut soils rather than fill. If a filled area cannot be avoided, it must be well compacted. This is particularly important for the pumps.

3-7.2 If available, it is recommended that the areas on which equipment is placed be covered with a 4-6 inch layer of coarse gravel or crushed rock. The gravel or crushed rock should extend out and around the equipment for several feet. This will provide a high and dry area from which to operate and maintain the equipment.

3-7.3 The same practice of placing coarse gravel or crushed rock area at and around often operated valve stations is recommended as well.

SECTION III EQUIPMENT RECEIPT

3-8 General

All equipment and materials are shipped to the receiving port or staging area in accordance with the U.S. Army's transportation plan. All items are boxed or crated in accordance with a plan that provides for the full identification of what is in the box or crate. Each container contains overpacked documents which further confirm the identity and gives instructions as to treatment arid,/in the case of hose, pipe, fittings and valve assemblies, where in the TPT the items go. Because of the care given in packaging and identification, it is generally recommended that the containers be transported directly from the receiving port or staging area to the actual erection site prior to opening. The materials are then removed from the containers, further identified, inspected, and moved to the specific location at the site where they are installed. If installation is delayed for some reason, the materials should remain in

the container or they should be provided with temporary protection from the elements and construction damage. The empty containers, along with any items to be stored for future repacking use, are then moved to a designated storage area.

3-8.1 Identification. Containers are identified externally by the markings on the crate as well as by packing lists in a waterproof container attached to the outside. Packing lists and other documentation are also inside the container but the external identification system is such that the container need not be opened until needed in the erection program. Appendix 8 contains a complete set of identification data for the containers intended for TPT use and it is recommended that the reader refer to this information to aid in his understanding of this section. Fig. 3-2 in this section is a sample of typical container markings. The following describes the purpose and meaning of this marking.

a. Identification markings as shown in Fig.3-2 are located in the upper left section of the two long sides of the container and on one end.

b. All containers for material used in a Tactical Petroleum Terminal are marked with an 18-inch high x 18-inch wide heavy black bordered triangle as shown. This triangle may have a number inside which is placed there only as identification of a particular TPT number on its initial shipment to the depot for storage prior to any deployment to an operating area or other temporary storage preceding deployment. The triangle may have a color code within it designating the deployment or operating area which is beyond the scope of this manual to define. It will always be a black bordered triangle.

c. The name of the system, the subsystem if applicable, and the applicable NSN are shown directly below the geometric shape. In this case it is a Tactical Petroleum Terminal NSN 3835-01-182-1976.

d. The project code is shown on the immediate upper left on the geometric shape. (For IPDS Area 8, it is PLP, shown as an example)

e. Further to the left of the shape is a series of identification, shipping, and original source information complying with U.S. Army standards which is described as follows:

1. The first identification group indicates the content is a part of a particular NSN for a particular module of the TPT. The number following another number at the top of the group indicates that it is container number "X' of "XX' numbers of containers in the module. If the COSIS program is applicable, it is so marked after the numbers.

2. The second identification group is the NSN of the specific content and its name.

3. The third identification group is quantity of those items in the second group.

NOTE

On containers containing a number of different assemblies or individual items, the items will be listed consecutively one over the other; the NSN first and then the name. The quantity of each will be noted after the description in parentheses, such as (1 ea.), (2 ea.), etc.

4. The fourth identification group indicates the quality of packing and the type of preservation followed by the date of packing. The classifications of packing and preservation are in accordance with the U.S. Army's standard system. A/A designates Level A packing and Level A preservation.

3-8.1 Identification- Cont'd.

5. The fifth group shows the weight in pounds followed by the volume in cubic feet.

6. The sixth group states that the contents are components of a particular petroleum distribution system area or a TPT.

7 The last group is the name and address of the manufacturing contractor packing the goods or for which the contents are packed. Such as:

Engineered Air Systems, Inc.

1270N. Price Road

St. Louis, Missouri 63132

U.S.A.

d. If on receipt at the staging area or at the erection site a discrepancy is found which deviates substantially from the description above, it must be discussed with transportation or installation management before the crate is further transported and, in any case, before it is opened.

e. If crates are badly damaged on receipt, the damage should be reported to transportation and/or installation management before the crate is transported further or opened.

3-8.2 Transport to Site. Unloading, reloading, transport to the site, and unloading at the site are handled by vehicles and equipment specified and selected by the U.S. Army. The containers must be handled with care regardless of the content. Any special directions on the container designating which side is up and caution in handling must be respected. It is recommended that the containers remain closed until they are set down in the final areas designated for erection. The containers should be set down as near as possible to the final erection point to minimize possible damage and double handling. The point of set down should be as designated on a field prepared plan that takes into account the plot plan determined in Section I, para. 3-2 of this chapter.

3-8.3 Unpack and Inspect. Upon arrival at the laydown area near the erection site, the container should be opened so that the contents can be visually inspected for damage and compared to the packing lists for completeness. Any damage or missing items should be reported immediately. If planning and scheduling are proper, the contents are to be removed from the container and set down at or near the final location of the equipment.

The parties handling the equipment must read any overpacked instructions carefully and abide by the instructions therein. It is recommended that servicing procedures on major equipment take place at or near the erection location to avoid double handling and unpacking area clutter. Again note any damage. Leave all protective caps and plugs in place.

Any items shipped in separate boxes within the main container should be clearly marked and set down adjacent to the major piece of equipment. If practical, such separately boxed goods should be wired or otherwise attached to the main assembly to avoid loss or misuse. If there is going to be a substantial delay between arrival at the job site and installation, it is recommended that the materials remain in the container until installation is imminent. If for some reason the material has been or must be removed from the container and a substantial delay in installation is going to occur, the equipment should be protected from weather and

3-8.3 Unpack and Inspect - Cont'd.

dirt by covering it with polyethylene or some other protective material. Empty containers should be moved to a storage area for future use.

SECTION IV INSTALLATION AND ASSEMBLY OF EQUIPMENT.

3-9 General

3-9.1 In the following installation instructions, reference is made to the drawings and illustrations contained in Chapter 2. It is recommended that the reader first become well acquainted with these instructional drawings and illustrations and then refer back to them as necessary and as called for in the installation instructions for a full understanding of the installation procedure.

3-9.2 The recommended order of installation is as described. In general, it is recommended that major equipment be installed first, followed by major fittings and valve assemblies, and then by the interconnecting hoselines.

3-9.3 Internal cleanliness in the installation of all equipment, valves, fittings and hoses cannot be over-emphasized. Sand, rocks, rags, tools, clothing, etc., left inside will end up blocking flow or damaging equipment. Positive action must be taken to avoid the entry of dirt and contaminants. Leave protective caps and plugs in place until actually ready to make a connection. Just prior to closing a joint, inspect the parts being assembled and remove any foreign material.

CAUTION
INTERNAL CLEANLINESS

Do not remove protective caps or plugs until actually ready to assemble and install parts and equipment. Take special care to avoid getting dirt, rags, tools or other foreign materials inside hoses, piping, valves, fittings, or equipment. Thoroughly inspect all parts internally immediately before assembly. Remove any foreign materials observed. To assure cleanliness, flush or swab out hoselines and piping that cannot be readily observed if there has been any possibility for of the entry of dirt or other materials. Foreign materials in the system will plug flow or damage equipment which can result in a serious safety hazard as well as interrupted operations.

NOTE
COUPLING CLAMPS AND GASKETS

Coupling clamps are normally shipped loose with the gaskets packaged separately or on assemblies. They are clamped in place without the gasket installed. Gaskets must be slipped over the pipe or fitting ends and the coupling clamp placed over them. See paragraph 3-13.10 and U.S. Army technical manual TM-5-343 for acceptable procedures.

3-9 General - Cont'd.

NOTE
VALVE PACKING

Stem packing on valves is normally shipped with the gland nuts not taken up tightly. It is necessary that the gland be tightened before the valve is put under pressure in test or operation.

3-9.4 These instructions assume that the equipment and materials have arrived at the site and are spotted in the manner described in Section III. As a general rule, installation can proceed on the basis of individual single fuel units at a time or the total TPT at one time.

3-10 Install Floodlight Sets

Two (2) per fuel unit/six (6) per TPT.

3-10.1 Service, install, and prepare the floodlight sets for operation in accordance with Department of the Army technical manual TM 5-6230-210-13&P.

3-10.2 Refer to para. 2-4. 11 and Fig. 2-25 in this manual for general information on these sets. Locate as directed in field.

3-10.3 Approximate erection weight 2170 lbs. ea.

WARNING
Observe all safety warnings and cautions noted in TM 5-6230-210-13&P.

WARNING
Ground equipment at time of installation.

NOTE
Installation early in the erection program is necessary to permit safe installation work at night.

3-11 Install 5000 Bbl Fabric Collapsible Tanks

Six (6) per fuel unit/eighteen (18) per TPT.

3-11.1 Service, install on assigned pad, and assemble appurtenances in accordance with the instructions in the technical manual published by ILC Dover and overpacked with the tanks.

3-11.2 For general information, on these tanks, refer to para.'s 2-3.3, 2-3.5,2-4.1 and the associated illustrations, Fig.'s 2-10 and 2-11 in this manual. See field plot plan for location.

3-11 Install 5000 Bbl Fabric Collapsible Tanks - Cont'd .

3-11.3 Approximate erection weight - 6000 lbs. ea.

WARNING

Observe and abide by all warnings and cautions noted in the ILC Dover technical manual.

CAUTION

Make sure tank pad is free of sharp objects and smooth prior to rolling out tank.

CAUTION

Make sure one drain on the tank is located over the low spot in the pad and that tank orientation is such that the top fitting intended for pump suction is the one closest to this same drain.

CAUTION

Cut a small trench for the drain hose prior to unrolling that end of tank under which the drain hose will pass.

3-12 Install 50.000 Gallon Fabric Collapsible Tanks

Up to six (6) per optional tank configuration
Two (2) per contaminated fuel module

3-12.1 Service, install on assigned pad, and assemble appurtenances in accordance with the instructions in the Department of the Army technical manual TM 5-5430-21012.

3-12.2 For general information on these tanks, refer to para.'s 2-3.4, 2-3.5 and 2-4.2 and Fig.'s 2-10 and 2-12 in this manual. See final field plot plan for location.

3-12.3 Approximate erection weight 744 lbs. ca.

WARNING

Observe and abide by all safety warnings and cautions in TM 5-5430-210-12.

CAUTION

Make sure tank pad is free of sharp objects and smooth prior to rolling out tank.

CAUTION

Make sure drain on the tank is located over the low spot in the pad and that tank orientation is such that the top fitting intended for pump suction is the one closest to this same drain.

CAUTION

Trench out for the drain hose prior to unrolling that end of tank under which the drain hose will pass.

3-13 Install 600 Gpm Hoseline Pumps

Four (4) per fuel unit/twelve (12) per TPT
One (1) per tanker-truck receipt manifold/three (3) per TPT

3-13.1 Install, service, and prepare for operation in accordance with the instruction in the technical manual published by Peabody Barnes, Inc. for their Model US612-ACD-1 and overpacked with each pump.

3-13.2 For general information, refer to para.'s 2-4.3, 3-7.1,3-7.2 and Fig. 2-13.

3-13.3 Approximate erection weight 3380 lbs. ea.

WARNING
Ground the pumps at time of installation.

WARNING NOTE
Observe all warnings and cautions noted in the Peabody Barnes, Inc. technical manual.

CAUTION
Install pumps as far away from the tanks as possible without deforming tank top or causing long unsupported lengths of suction hose. The suction hose should lay on the ground without strain on the tank or pump. Pump engines and exhaust fumes are hot and distance from the tank will enhance safety.

3-14 Install 350 Gpm Transfer Pump

One (1) per contaminated fuel module/one per TPT 3-14.1 Install, service, and prepare for operation in accordance with Department of the Army technical manual TM 5-4320-226-14.

3-14.2 General information on this pump is in para. 2-4.4 and fig. 2-16 in this manual. See final field plot plan for location.

3-14.3 Erection weight is 21401bs.

WARNING NOTE
Observe all warnings and cautions stated in TM 5-4320-226-14.

WARNING
Ground pumps at time of installation.

CAUTION
Install pump as far away from the tanks it serves as possible without bridging the suction hose or deforming the tank top. Pump engine and exhaust fumes are hot and distance from tanks enhances safety.

3-15 Install 1250 Gpm Flood and Transfer Pump (Reference Only)

Number and usage varies with specific area.

3-15.1 If called for on specific site TPT operation plan, install, service and prepare for operation in accordance with the technical manual published by Peabody Barnes, Inc. for their Model US612-ACD.

3-15.2 For general information, see para. 2-4.5 in this manual. Locate as instructed in the field. Note para.'s 3-7.1 and 3-7.2

3-15.3 Approximate erection weight 3000 lbs.

WARNING

Observe all warnings and cautions noted in the Peabody Barnes Inc. technical manual for this pump.

Ground equipment at time of installation.

3-16 Install Meter Strainer Assemblies

Three (3) per fuel unit supply line
Three (3) per fuel dispensing set
One (1) per common header to associated pipeline system
Seven (7) per TPT

3-16.1 Install at locations shown on Fig.'s 2-62, 2-63A and 2-638. Note para.'s 3-7.1 and 3-7.2. General information on unit is in para. 2-4.6 and Fig. 2-19.

3-16.2 Service and prepare for operation in accordance with the manufacturer's manuals overpacked with the equipment.

3-16.3 Approximateweight500 lbs.

CAUTION
Ground equipment at time of installation.

3-17 Install Filter-Separators

Two (2) per fuel dispensing assembly/six (6) per 1TPT

3-17.1 Install, service, and prepare for operation in accordance with Department of the Army Technical Manual TM 5-4330-211-12.

3-17.2 For general information and location, refer to para.'s 2-4.7 and Fig. 2-20. Note para.'s 3-7.1 and 3-7.2.

3-17 Install Filter-Separators - Cont'd.

3-17.3 Approximate weight - 375 Ibs. ea.

CAUTION
Ground equipment at time of installation.

3-18 Assemble and Install Primary Module Hoselines, Valves and Fittings .

One (1) system per fuel unit/three (3) per TPT.

Assemblies of the primary module are crated in a partially assembled condition to facilitate packaging and shipping. Some assembly is required to place the units in operating condition prior to installation. The following assembly and installation procedures are used on the shared berm alternate shown in figure 2-60A. Procedures for the layout shown in figure 260B or 2-60C will be the same..

3-18.1 Assembly. Refer to figure 2-38.

a. Position crates containing cross assemblies near their respective installation sites as indicated in figure 2-60A.

b. Remove 6-inch aluminum cross assembles, coupling clamps, caps, and coupling gaskets from crate.

c. Inspect all items for damage, cleanliness, and quantities required.

d. Remove four coupling clamps (3, figure 2-38) securing gate valves (9) and flanged adapters (1) to cross (10).

e. Slide one coupling gasket over each cross (10) grooved end.

f. Align mating surfaces of adapter (1) and cross (10). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces. Position coupling clamp (3) over gasket.

g. While maintaining alignment of mating parts; lock coupling clamp securely.

h. Repeat steps e, thru g. for remaining adapters(1).

3-18.2 Installation. Refer to figure 2-60A.

CAUTION
INTERNAL CLEANLINESS Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

a. Check the position of 600 gpm hoseline pump installed per paragraph 3-13.

3-18.2 **Installation. - Cont'd**. Refer to figure 2-60A.

b. Place crates containing hose and fittings in their respective installation position.

c. Uncrate 6-inch discharge hose assemblies (2 and 6) and position as shown.

NOTE

6-inch suction hoses (8), 6-inch gate valves (9) and elbows (10 and 11) are overpacked with the 5,000 BBL tank.

d. Remove protective caps and connect 6-inch suction hoses (8) to tank elbows (11) and gate valves (9) with coupling gaskets and clamps.

e. Connect coupling adapters (5) to gate valves (9).

f. Connect 6-inch suction hoses (6) between gate valves (9) and cross assembly (3).

g. Connect 6-inch suction hoses (6) to cross assembly (6) and inlet side of pump assemblies (7).

h. Connect 6-inch discharge hoses (2) between outlet side of pump assemblies (7) and cross assembly (3).

i. Connect coupling adapters (4) to tank elbows (10).

j. Connect 6-inch discharge hoses (2) between coupling adapters (4) and cross assembly (3).

k. Connect 6-inch discharge hoses (2) between cross assemblies (3) as shown.

I. Inspect all connections to verify correct installation of coupling clamps, coupling gaskets and security of cam-lock devices.

3-19 Assemble and Install Secondary Module Hoselines, Valves and Fittings .

Two (2) systems per fuel unit/six (6) per TPT.

Assemblies of the secondary module are crated in a partially, assembled condition to facilitate packaging and shipping. Some assembly is required to place the units in operating condition prior to installation.

a. Position crates containing 6-inch cross and Y assemblies near their respective installation sites as indicated in figure 2-61 A.

b. Remove 6-inch aluminum cross assembly (3), 6-inch aluminum Y assemblies (8), and coupling gaskets from crates.

c. Inspect all items for damage, cleanliness, and quantities required.

d. Remove coupling clamps (3, figure 2-38) connecting flanged adapter (1) to cross (10).

3-19.1 **Assembly. - Cont'd**. Refer to figure 2-38.

e. Slide one coupling gasket over each cross (10) grooved end.

f. Align mating surfaces of adapter (1) and cross (10). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces. Position coupling clamp (3) over gasket.

g. While maintaining alignment of mating parts, lock coupling clamp securely.

h. Repeat steps e. thru g. for remaining adapters (1).

i. Remove coupling clamps (2, figure 2-39) connecting flanged adapters (3) and gate valves (4) to Y fitting (1).

j. Slide one 6-inch coupling gasket over each Y (1) grooved end.

k. Align mating surfaces of adapter (3) and Y fitting (1). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces. Position coupling clamp (2) over gasket.

I. While maintaining alignment of mating parts, lock coupling clamp securely.

m. Repeat steps j. thru I. for other branch of Y fitting (1).

3-19.2 **Installation**. Refer to figure 2-61A.

CAUTION
INTERNAL CLEANLINESS

Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

NOTE

6-inch hose assembly (10), 6-inch gates valves (11) and elbows (12 and 13) are overpacked with the 5,000 BBL tanks (1).

a. Check the position 600 gpm pump installed per paragraph 3-13.

b. Uncrate 6-inch hose assemblies (2 and 6) and position as shown.

c. Connect coupling adapters (4) to elbows (12).

d. Remove protective caps and connect 6-inch discharge hoses (2) to cross assembly (3).

e. Connect discharge hose (2) between cross assembly (3) and tee (9).

f. Connect discharge hoses (2) to tee (9). (Hoses connect to transfer hose line set.) g. Connect suction hoses (10) to fuel tank elbows (13) and gate valves (11).

3-19.2 Installation.- Cont'd. Refer to figure 2-61A.

h. Install coupling adapters (5) on ends of suction hoses (10).

i. Connect suction hoses (6) between coupling adapters (5) and gate valves on Y assembly (8).

j. Connect suction hoses (6) between Y assembly (8) and suction side of fuel pump (7).

k. Connect discharge hose (2) between discharge side of fuel pump (7) and inlet of Y assembly (8).

i. Connect discharge hoses (2) to gate valve of Y assembly (8). (Hoses connect to transfer hose line set.) m. Connect discharge hoses between Y assembly (8), and tee (9).

n. Inspect all connections to verify correct installation of flanges, coupling clamps, coupling gaskets, and security of cam-lock devices.

3-20 Assemble and Install Switching Manifold .

One (1) system per TPT.

3-20.1 Assembly. No assembly of the switching manifold is required prior to installation.

3-20.2 Installation. Refer to figure 2-62.

CAUTION
INTERNAL CLEANLINESS
Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

a. Position crates containing 6-inch aluminum tees, 6-inch aluminum gate valves, 6inch sampling assembly and 6-inch aluminum pipeline set near their respective installation sites as indicated.

b. Remove tees, valves, pipeline, sampling assembly, coupling clamps, and coupling gaskets from crate.

c. Inspect all items for damage, cleanliness, and quantities required.

d. Connect 6-inch tees (1) together to form the configuration shown.

e. Connect gate valve assemblies (2) to tees (1).

f. Connect aluminum pipe (4) between gate valves (2).

g. Connect aluminum pipeline kit between tee (1) and sampling assembly (3).

3-20.2 Installation. - Cont'd. Refer to figure 2-62.

h. Inspect all connections to verify correct installation of flanges coupling gaskets, and clamps and security of cam-lock devices.

3-21 Assemble and Install Transfer Hose Assembly, Valves and Fittings .

One (1) system par fuel unit/three (3) per TPT.

Assemblies of the transfer hose set are crated in a partially assembled condition to facilitate packaging and shipping. Some assembly is required to place the cross and Y units in -operating condition prior to installation.

3-21.1 Assembly. Refer to figure 2-38.

a. Position crates containing 6-inch cross and Y assemblies near their respective installation sites as indicated in figure 2-63A.

b. Remove 6-inch aluminum cross assembly (3) 6-inch aluminum Y assemblies (2) and coupling gaskets from crates.

c. Inspect all items for damage, cleanliness, and quantities required.

d. Remove coupling clamps(3, figure 2-38)connecting flanged adapter(l)to cross (10).

e. Slide one coupling gasket over each cross (10) flange.

f. Align mating surfaces of adapter (1) and cross (10). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces. Position coupling clamp (3) over gasket.

g. While maintaining alignment of mating parts, lock coupling clamp securely.

h. Repeat steps e. thru g. for remaining adapters(1).

i. Remove coupling clamps (2, figure 2-39) connecting flanged adapters (3) to Y fitting (l).

j. Slide one 6-inch coupling gasket over each Y (1) flange.

k. Align mating surfaces of adapter (3) and Y fitting (1). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces Position coupling clamp (2) over gasket

I. While maintaining alignment of mating parts, lock coupling damp securely.

m. Repeat steps j. thru I. for other branch of Y fitting.

3-21.2 Installation. Refer to figure 2-638.

CAUTION
INTERNAL CLEANLINESS
Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

a. Position meter strainer (4), cross assemblies (3), and Y assembly near their respective installation points as indicated.

b. Connect discharge hose (1) between 6-inch gate valve of switching manifold and inlet side of meter strainer (4).

c. Connect discharge hose (1) (quantity as required) between outlet port of meter strainer (4) and cross assembly (3).

d. Connect discharge hose (1) (quantity as required) between two cross assemblies (3).

e. Connect discharge hose (1) between cross assembly (3) and primary module cross assembly.

f. Connect discharge hose (10) between gate valve of return manifold and Y assembly (2).

g. Inspect all connections to verify correct installation flange, coupling gaskets, and clamps and security of cam-lock devices.

3-22 Assembly and Install Fuel Dispensing Assemblies.

One (1) system per fuel unit/three (3) per TPT.

3-22.1 Assembly. No assembly of the fuel dispensing set is required prior to installation.

3-22.2 Installation. Refer to figure 2-64.

CAUTION
INTERNAL CLEANLINESS
Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

a. Check position of 350 gpm filter separators (8) and 800 gpm meter strainer (29), installed per paragraphs 3-16 and 3-17.

b. Connect 4-inch coupling adapters (27) and 4-inch gate valves (6) to inlet side of filter separators (8).

c. Connect 4-inch coupling adapters (25), water detection kit adapters (11) and 4inch gate valves (6) to outlet side of filter separators (8).

3-22.**2** **Installation. - Cont'd. Refer to figure 2-64.**

d. Connect coupling reducer (24) and coupling adapter (3) to 4-inch Y assembly (9).

e. Connect 6-inch discharge hose (40) between primary module cross assembly and Y assembly (9).

f. Connect 4-inch coupling reducer (23) and 6-inch coupling adapter (22) to 4-inch Y assembly (7).

g. Install 4-inch dispensing hose (5) between gate valves (6), mounted on filter separators (8), and 4-inch Y assembly (7).

h. Connect 6-inch discharge hose (4) between Y assembly (7) and inlet side of meter strainer (29).

i. Connect coupling reducers (25) and 4-inch gate valves (6) to reducer tees (3). Position assembly units as shown.

j. Connect 6-inch gate valve (26) to reducer tee (3).

k. Install 6-inch discharge hose from outlet port of meter strainer (29) to 6-inch gate valve (26).

l. Connect 4-inch ball valves (10) and reducer couplings (28) to ends of 4-inch dispensing hoses (5). Connect other ends of hoses to 4-inch gate valves (6).

m. Connect 6-inch coupling adapter (13), 6-inch coupling reducer (24), and 4-inch reducing valve assembly (2) to reducer tee (3).

n. Connect 1.5-inch dispensing hoses (14) to reducer tee assemblies (15S). Connect 1.5-inch ball valves (12) to hoses.

o. Connect 6-inch discharge hoses (4) between reducer tees (3).

p. Connect 3-inch reducer valve assembly (16) to reducer tee (17).

q. Connect 1-inch coupling adapters (19) to 1-inch dispensing hose assemblies (18). Install 2-inch nozzles (20) on coupling adapters.

r. Connect 3-inch dispensing hose (1) between 4-inch valve assembly (2) and reducer tee assemblies (15).

s. Connect 3-inch reducer valve assembly (16) to reducer tee (17) and 3-inch dispensing hose (1).

t. Install 2-inch dispensing hoses (21) between reducer tees(17).

u. Inspect all connections to verify correct installation of flanges, coupling gaskets and clamps, and security of cam lock devices.

3-23 Assemble and Install Contaminated Fuel Module Hoselines, Valves, and Fittings .

One (1) system per TPT.

The 6-inch aluminum Y assembly used in the contaminated fuel module is crated in a partially assembled condition to facilitate packaging and shipping. Some assembly is required to place the units in operating condition prior to installation.

3-23.1 Assembly. Refer to figure 2-39.

a. Remove coupling clamps (2) connecting flanged adapters (3) to Y fitting (l).

b. Slide one 6-inch coupling gasket over each Y fitting (1) flange.

c. Align mating surfaces of adapter (3) and Y fitting (1). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces. Position coupling clamp (2) over gasket.

d. While maintaining alignment of mating parts, lock coupling clamp securely.

e. Repeat steps j. thru I. for other branch of Y fitting (1).

3-23.2 Installation. Refer to figure 2-65.

CAUTION
INTERNAL CLEANLINESS
Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

NOTE
Elbows (13 and 14), 4-inch suction hoses (11), and 4-inch gate valves (12) are overpacked with the 50,000 gallon tanks.

a. Connect elbows (13) to outlet ports of 50,000 gallon tanks. Connect 6-inch reducers (4) to elbows.

b. Connect coupling adapters (3) to 6-inch reducers (4).

c. Install 6-inch discharge hoses (2) between coupling adapters (3) and gate valves of Y assembly (1).

d. Connect 6-inch discharge hose (2) between Y assembly (1) and switching manifold gate valve.

e. Connect elbows (14) to inlet ports of 50,000 gallon tanks.

f. Connect 4-inch suction hoses (11) to tank elbows (14) and 4-inch gate valves(12) to suction hoses.

3-23.2 Installation.- Cont'd. Refer to figure 2-65.

g. Connect 4-inch suction hoses (6) to suction side of 350 GPM transfer pump (7) and 4-inch gate valves (12).

h. Connect 4-inch discharge hoses (8) to discharge side of transfer pump (7).

i. Connect 4-inch reducer (9) and 3 in gate valve (10) to discharge hose (8).

j. Inspect all connections to verify correct installation of flanges, coupling gaskets, and clamps and security of cam-lock fasteners.

3-24 Assemble and Install Optional Tank Configuration Hoselines, Valves and Fittings .

One (1) system per TPT.

NOTE

The optional tank configuration should be installed only if required by operations management.

3-24.1 Assembly. No assembly of the optional tank configuration is required prior to installation.

3-24.2 Installation. Refer to figure 2-66.

CAUTION

INTERNAL CLEANLINESS

Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

NOTE

Elbows (15 and 16) and 4-inch valve assembly (7) are overpacked with the 50,000 gallon tanks (12).

a. Connect elbows (15) to inlet ports of 50,000 gallon tanks (12).

b. Connect 4-inch valve assemblies (7) to Y assemblies (4).

c. Connect 4-inch discharge hoses (11 and 13) between 4-inch valve assemblies (7) and tank elbows (15). Ensure the correct hose lengths are installed in the positions shown. Make sure the correct bend radii are maintained.

d. Connect 4-inch discharge hoses(10 and 11) to 4-inch tee assembly (9), then to Y assemblies (4).

e. Connect 4-inch hoses (from hoseline outfit) from 4-inch tee assemblies (9) to 4-inch tee assembly (6).

f. Connect reducer (2) and coupling adapter (1) to tee assembly (6).

3-24.2 Installation. - Cont'd.

g. Connect elbows (16) to tanks (12).

h. Connect 4-inch valve assemblies (7) to 4-inch Y assemblies (4).

i. Install 4-inch suction hose (3) between elbows(16) and 4-inch Y assemblies (4).

j. Connect reducers (2) to 4-inch tee assemblies (6). Connect coupling adapters (1) to reducers.

k. Install remaining 4-inch discharge hoses (11 and 17) as shown.

I. Inspect all connections for correct installation of flanges, coupling gaskets, and clamps and security of all cam-lock devices.

3-25 Assemble and Install Tanker Truck Receipt Manifold Hoselines, Valves and Fittings .

There (3) manifolds per TPT.

The tee assembly utilized in the tanker truck receipt manifold is crated in a partially assembled condition to facilitate packaging and shipping. Some assembly is required to place the unit in operating condition prior to installation.

NOTE

The tanker truck receipt manifolds should be installed only under the direction of operations management.

3-25.1 Assembly. Refer to figure 2-40**.**

a. Position crates containing 6-inch tee assemblies near their respective installation sites as indicated in figure 2-67.

b. Remove 6-inch tee assemblies from crates.

c. Remove coupling clamps (8, figure 2-40) connecting flanged adapters (1) to tee fitting (9).

d. Slide one 6-inch coupling gasket over each tee fitting (9) flange.

e. Align mating surfaces of adapter (8) and tee fitting (9). Pull coupling gasket over sealing surfaces of both pieces. Ensure gasket is correctly positioned over full circumference of sealing surfaces. Position coupling clamp (8) over gasket.

f. While maintaining alignment of mating parts, lock coupling clamp securely.

g. Repeat steps b. thru d. for other branch of tee fitting (9).

3-25.2 Installation. Refer to figure 2-67.

CAUTION
INTERNAL CLEANLINESS
Make sure all hoselines, fittings and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

a. Position crates containing tanker truck receipt manifold components in their respective installation positions as shown.

b. Remove components from crates as required.

c. Check position 600 Gpm hoseline pump (10) installed under paragraph 3-14.

d. Connect 6-inch tee assembly (1) to discharge side of pump (10). Connect 6-inch suction hose (2) to suction side of pump.

e. Position and connect three remaining tee assemblies(1). Install connecting 6-inch suction hoses (2) and 6-inch discharge hose (9) from pump (10).

f. Connect coupling adapters (4) to tee fittings (3).

g. Connect tee assembly (1) to tees (3) with 6-inch suction hoses (2).

h. Connect 4-inch suction hoses (5) to coupling adapters (4).

i. Connect 4-inch ball valves (6) and reducers (7) to 4-inch suction hoses (5).

j. Install 6-inch caps (8) on tee fittings(3).

k. Connect 6-inch discharge hose (11) from tee assembly (1) to switching manifold.

3-26 Install Sampling Assembly

One (1) per TPT

3-26.1 Install sampling assembly in the location specified in the technical manuals for specific sites or as directed by operations management.

3-26.2 For information on the sampling assembly, see para. 2-4.8 and Fig. 2-22. Nose para.'s 3-7.1 and 3-7.2.

CAUTION
Ground assembly at time of installation.

3-27 Install Fire Suppression Equipment

3-27.1 Check out, service, install the fire suppression equipment in accordance with overpacked instructional manuals and specific instruction of operating management. The

3-27 Install Fire Suppression Equipment - Cont'd.

location and storage of fire suppression equipment is at the discretion of operating management. See U.S. Marine Corps TM 076618-14/1 in Appendix A for instructions on the dry chemical/AFFFunit.

3-27.2 General information on fire suppression equipment is in para. 2-4.13.

CAUTION

Thoroughly check out all fire suppression equipment at the time of locating in the unit. Extinguishing equipment must be charged and in working order. Clothing must be clean and in good condition.

CAUTION

Clearly mark storage areas for fire suppression equipment and educate all personnel on its location and use prior to bringing flammable fuels to any part of the system.

3-28 Install Safety and No Smoking Signs

Prepare and install appropriate safety and no smoking signs at locations designated by operating management for the specific site. The following criteria is recommended: 3-28.1 No smoking within 100 ft. of any system or equipment containing flammable fuels.
Set up "No Smoking" signs.

3-28.2 Set up special and numerous "No Smoking" signs around fuel dispensing and fuel receipt area.

3-28.3 To minimize the threat of smokers, create a well-marked "Smoking Permitted" area well away from the facilities and make that the only area in which smoking is permitted.

3-28.4 Set up "Shut Engine Off" signs at fuel dispensing and receiving areas.

3-28.5 Set up "Disconnect Hose Before Moving Vehicle" signs at dispensing and receiving areas.

3-28.6 Place the following safety signs at appropriate locations:

a. "Danger Hot Surfaces" at pump engines
b. "Danger Moving Parts" at pump and engines
c. "Danger Wear Goggles and Gloves" at sampling position.
d. "Watch Your Step" in congested areas

3-29 Pressure Test System

It is recommended that the entire TPT system be pressure tested before it is placed in operation. The purpose of the test is to prove the integrity of the system, by locating leaks, blockages, and installation faults. The purpose is not to prove the strength of materials; therefore, test pressures are limited to the maximum design operating pressures. The test

procedures below allow for three different test medias, air, water or fuel. The media used is dependent on the conditions at the specific site and installation/operations management decision. From a safety standpoint, a water test is preferred; however, it has certain disadvantages. Although a fuel test is inherently more risky, it can be handled safely if extreme care is taken and the method will save time. If a fuel pressure test is conducted, it can be handled in conjunction with the purge and commissioning programs outlined in Chapter 4. A complete test is recommended; however, it is understood that some deviation at the discretion of qualified operating management may be required due to specific site conditions and immediate operating needs.

3-29.1 Test Media. Testing may be done with water, compressed air or fuel. The decision as to which test medium to be used must be based on site conditions and operating need.
There are advantages and disadvantages to the use of each:

a. Water. Testing with water is safer, and leaks are easier to find, but there are some disadvantages.

1) Water may not be available for packing the system in some areas.

2) Water expands as it freezes. It should not be used if the ambient temperature is expected to drop below freezing during the test. A glycol or alcohol antifreeze, if available, may be added to lower the freezing temperature.

3) All water must be removed and system dried out prior to its being packed with fuel. It is not recommended that the fabric collapsible tanks be tested with water due to the difficulty of removing the water.

b. Compressed Air. If testing with water or fuel is impossible, the test may be made with compressed air. Test pressures with air must be lower. Se 3-29.2 below. It is not considered safe practice to attempt to test fabric collapsible tanks with air.

WARNING

Air can b used to test clean, vapor free lines only. Never put air in line after fuel use, unless they have been thoroughly cleaned and purged. Air mixed with fuel vapor is a dangerous fire hazard.

c. Fuel. Since there are some problems when testing with water or air, testing can be done with fuel. Several conditions should be met when testing with fuel.

1) All fire suppression equipment should be in place and in operating condition.

2) Buildings near the section under test should be vacated and well ventilated.

3) The test section should be under constant surveillance during test.

3-29.2 Maximum Test Pressures

a. General. Testing is for locating leaks, loose connections, blockage in system and flaws in construction. Testing will prove the integrity of the facility prior to regular operation.

3-29.2 Maximum Test Pressures - Cont'd.

b. Fabric Collapsible Tanks. No pressure is allowed other than static liquid head. Make sure tank vent is open and clear. The tanks may be filled to approximately 85 percent design capacity, with fuel. All inlet and outlet valves must be closed and blanked off. Hold for 8 hours. If any leaks develop, the tank must be emptied and repaired, tank refilled and held for another 8 hours test.

c. Pump Suction Hose. If a section connecting a suction hose is being tested to higher pressure, this hose must be blanked off and tested separately.

Test pressure:	
With water	100 psig
With fuel	100 psig
With air	50 psig

d. Four (4) inch and smaller discharge hose, valves and fittings.

Test pressure:	
With water	150 psig
With fuel	150 psig
With air	50 psig

e. Six (6) inch pump discharge and transfer hose, valves and fittings.

Test pressure:	
With water	150 psig
With fuel	150 psig
With air	50 psig

3-29.3 Test Pressure Source. Test pressure can be supplied from any source capable of holding the specified test pressures. The 600 gpm hoseline pump is suitable for testing with water or fuel if a special test pump is not available. Although compressed air is an adequate test medium, the TPT, NSN 3835-01 182-1976, does not supply an air compressor.

3-29.4 Preparations for Testing. Before the test is begun, actions should be taken to insure that the test runs smoothly.

a. Test all communications equipment. Good communications are required during testing operation.

b. Check the accuracy of all pressure gages.

c. Be certain that there are sufficient gaskets, repair clamps, etc. available.

d. Locate fire suppression equipment near the testing area, and be sure that it is in operating condition (when testing with fuel).

e. Make sure to have a tank vehicle and drums available, in case a section has to be drained (when testing with fuel).

f. See that shovels and materials to dig and line a pit are at the test site in case there is a break and spill (when testing with fuel).

3-29.4 Preparations for Testing Cont'd.

g. Have caps, plugs and blinds available to blank off section under test.

h. After all the TPT equipment, hose, valves, and fittings are physically connected, there should be a meeting of all responsible personnel connected with the testing program. Each phase of the test plan including a detailed communication plan shall be discussed and reviewed. Prior to filling a section for test, a final check should be made to verify the following:

1) All valves are in proper position for filling.
2) All hoses, valves and fittings connections are tight. Valve packing glands tight.
3) Pumps are in good working condition.
4) Test gages are installed and ready for use.

3-29.5 Test Procedure. Test procedure will vary with test medium used.

a. Water. Valves are to be adjusted so that water can be pumped through the section under test, exhausting air and air water mix. Slowly pump water into the system. When all air is evacuated, discharge valves should be closed, section filled with water and pump stopped. Check all connections for leaks, if no leaks are found, start pump and raise pressure to 25 psi, stop pumps, check for leaks, and check gages. If no leaks are found and gages are okay start pump and raise pressure to selected test pressure. Stop pump, check for leaks, check gages, and record time, pressure and ambient temperature on test report. Test should be held for 8 hours, or an other time as determined by on site conditions. Pressure will vary with temperature change. If a major change occurs, it might become necessary to add to or drain water from the test section. Water added or removed must be measured and noted on test report. The pressure and temperature must be checked and noted on test report at one-half hour intervals. Any leaks found and size and type of leak must be noted on test report, this information is required to approve the system for operation.

b. Fuel. In general, the procedure for testing with fuel is the same as with water, except for the following:

1) See Paragraphs 3-29.4d, e, and f above.
2) Arrangements have to be made to catch and dispose of fuel used in purging air from system.
3) No smoking rules and regulation must be established and enforced.

c. Air. Only a clean, vapor free system can be tested with air. Test pressure should be no more than 50 psig, to reduce the danger of whip if a hose comes loose. When testing with air no purge is necessary. The test section should be blanked-off and an air compressor connected to it. Disconnect both fill and suction hoses from any fabric tank in the system. Before starting the compressor, check all connections for tightness, all valves for position and the gages for accuracy. Start compressor and raise pressure to 10 psig, stop compressor and check all fittings for leaks. If no leaks are found, start compressor and raise pressure to 50 psig, or other as selected. Record time, pressure and ambient temperature on test report. After 30 minutes, if all appears okay, check all connections with soap suds to assure there are no leaks. Then continue test for 8 hours, or an other time as determined by site conditions.

3-29.5 Test Procedure - Cont'd.

The pressure and temperature must be checked and noted on the test report at 30 minute intervals. Soap suds are effective in locating leaks. Any leaks found, and size and type of leak must be noted on test report, this information is required to approve the system for operation.

CAUTION

Under no conditions are the fabric collapsible tanks to be subject to air tests. Remove all connecting hoses to tanks to prevent this. Entry of air to the fabric tanks can exceed the tanks venting capacity, inflate, and possibly rupture the tank.

CAUTION

All test media, water or fuel, if incompatible with the particular fuel service designated for the system tested, must be thoroughly drained from the system before it is placed in service.

3-30 Install Road Crossing Guards
Twenty (20) units per TPT

Install the road crossing guards described in para. 2-4.10 in the manner shown on Fig. 2-24 at all points where hoselines cross an area where vehicle traffic is planned. Erect signs advising drivers that there is a crossing at that point. "Danger, Hoseline Crossing" would be an acceptable notice.

WARNING

Hoselines can be easily damaged by vehicles crossing them. Be sure well covered hose guards are installed where traffic is expected. Permit no vehicles to cross unguarded hose.

3-31 Install Range Poles
Two (2) per 5000 bbl tank/thirty-six (36) per TPT

Install range poles and cords at all 5000 bbl tanks as described in paragraph 2-4.9 and shown on Fig. 2-23.

3-32 Paint System

Paint all metal parts that have not been previously painted or anodized to acceptable standards or that have deteriorated in shipment and storage. Prepare surfaces and apply primer in accordance with MIL T-704, Type A and finish coat per MIL-E-52798, Type I, sand color.

3-33 Equipment and Line Identification Marking

3-33.1 It is recommended that all major equipment (tanks, pumps, meter strainers, filter separators, and operating valves, and pump pressure gages be marked with the equipment identification numbers shown on the P&ID, Fig. 2-1, for efficiency and safety in operation.
Equipment that has large enough surfaces should be stencil painted using color that contrasts well with the background. Small valves, etc., can be marked with metal strips bearing the equipment number and wired to the valve. This should be done after installation to make sure numbering is correct.

3-33 Equipment and Line Identification Marking - Cont'd .

3-33.2 It is also recommended that consideration be given to marking hoselines and pipelines with color-coded bands and direction of flow arrows as described in MIL STD 161 F.
Care must be taken to correct the marking if the service of a marked section of hose is changed.

3-34 Testing Kit
One (1) per TPT

Check out and store in location designated by operating management.

3-35 Area Clean-up

The area must be cleaned up by the installation crew prior to commencing operations.
Remove all construction dregs, obstructions, boxes, etc. Unused materials, hose, fittings, etc., should be stored in a specific area for future use. All caps, plugs, etc., should be boxed and marked for use in the event the system is disassembled for shipment.

3-36 Final Inspection

3-36.1 It is important to make a final inspection utilizing a check-off list arranged essentially in the order of this installation procedure. This should be done by supervisory and management personnel from both the installation and operating groups.

3-36.2 The points of inspection to be emphasized include but are not limited to:

a. Integrity and height of tank berms closed berm drain.

b. Floodlights Location and operability. Grounding.

c. Proper laydown of fabric collapsible tanks proper connection of appurtenances.

d. Pumps Serviced, location, operability. Grounded.

e. Meter-strainers Flow direction. Grounding.

f. Filter-separators Flow direction, test adapter installed, grounded.

g. Hoselines, Valves, Fittings. All couplings closed, flanges tight, valve packing glands tight, valves in operable position and closed. No sharp bends, proper lay on tank tops, sandbags on ends and bend subject to whip adequate walkways over hose, evidence of damage.

h. Sampling assembly Operable location and joints tight. Valves closed. Grounded.

i. Fire suppression equipment Proof of check out, location, marking.

j. Safety and no smoking signs Readable and in place.

k. Review pressure test results and proof of corrective action.

3-36 Final Inspection - Cont'd.

l. Road crossing guards in place where needed and marked.

m. Range pole installation and location proper - Cross cord at proper height.

n. Corrective painting complete.

o. Equipment identification marking correct.

p. Testing kit intact.

q. Clean up of area adequate.

3-36.3 Make correction of faults found in inspection - reinspect. Do not proceed with operations until all points affecting the integrity and safety of the system are corrected.

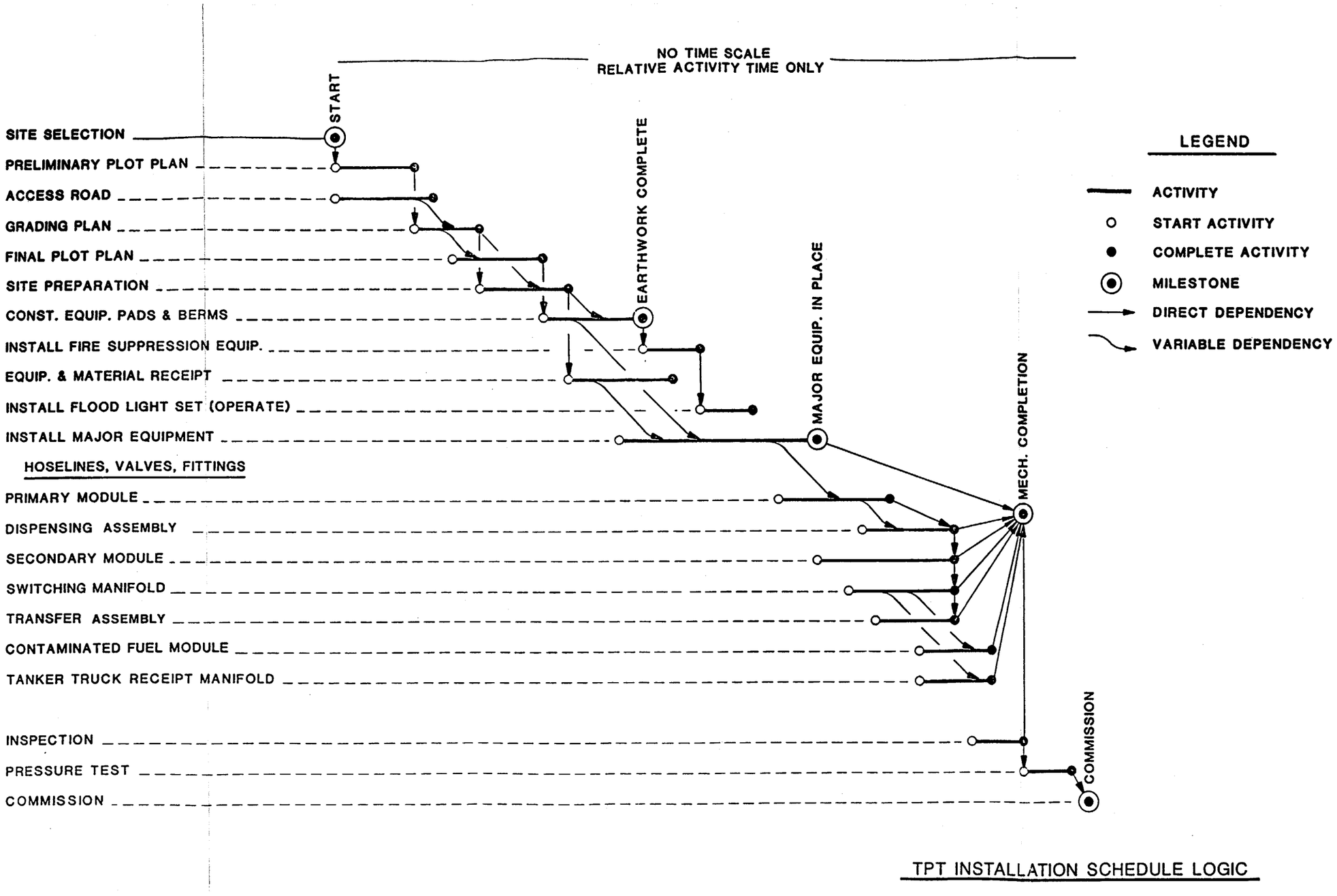
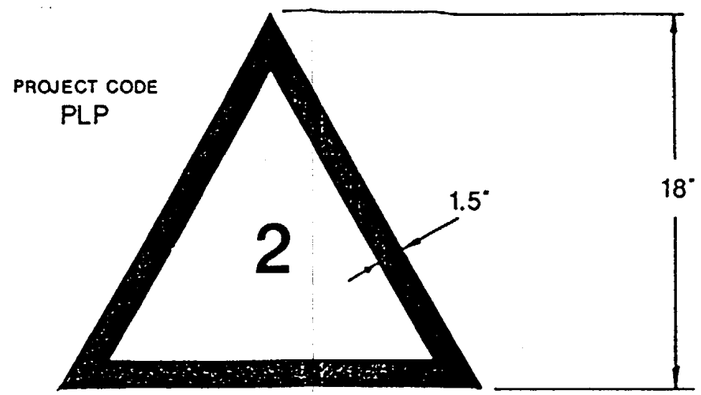

NO TIME SCALE
RELATIVE ACTIVITY TIME ONLY
START
SITE SELECTION
PRELIMINARY PLOT PLAN
ACCESS ROAD
GRADING PLAN
FINAL PLOT PLAN
SITE PREPARATION
CONST. EQUIP. PADS & BERMS
INSTALL FIRE SUPPRESSION EQUIP.
EQUIP. & MATERIAL RECEIPT
INSTALL FLOOD LIGHT SET (OPERATE)
INSTALL MAJOR EQUIPMENT
HOSELINES, VALVES, FITTINGS
PRIMARY MODULE
DISPENSING ASSEMBLY
SECONDARY MODULE
SWITCHING MANIFOLD
TRANSFER ASSEMBLY
CONTAMINATED FUEL MODULE
TANKER TRUCK RECEIPT MANIFOLD
INSPECTION
PRESSURE TEST
COMMISSION
EARTHWORK COMPLETE
MAJOR EQUIP. IN PLACE
MECH. COMPLETION
COMMISSION
LEGEND
ACTIVITY
START ACTIVITY
COMPLETE ACTIVITY
MILESTONE
DIRECT DEPENDENCY
VARIABLE DEPENDENCY
TPT INSTALLATION SCHEDULE LOGIC

FIG. 3-1

1" LETTERS

	*
2-10 COSIS	
P/O 3835-01-210-5612	(1)
TANK FARM, SECONDARY MODULE, NO.1	
3835-01-210-5592 Y ASSY. 6 IN.	(2)
2 EA.	(3)
A/A (2/8/85)	(4)
2000 LBS. 80 CU. FT.	(5)
3835-01-182-1976 COMPONENT OF TPT	(6)
ENGINEERED AIR SYSTEMS INC. 1270 N. PRICE RD. ST. LOUIS, MISSOURI USA 63132	(7)



TACTICAL PETROLEUM TERMINAL
3835-01-182-1976

NOTE: NUMERALS UNDER * INDICATE THE GROUP NUMBER DESCRIBED IN PARA. 2-5.5

SAMPLE
CONTAINER MARKING
HYPOTHETICAL ONLY

FIG. 3-2

CHAPTER 4 - OPERATION

OVERVIEW

Chapter 4 contains general and detailed instructions on how to operate the facility. Section I covers general subjects including fuel quality control, measurement, and record keeping.

More emphasis on safety in operations is included. Section II gives basic operation instructions for the major equipment. Section III covers commissioning and specific fuel movement and storage operations. Section IV covers some of the special problems that may be encountered under adverse and unusual weather and site conditions. On Government furnished equipment for which a specific technical manual has been published by the U.S. Army or by the manufacturer, this manual will cover only the most important points of operation and will refer the reader to the specific technical manual for further detail. It is beyond the scope of this manual to recommend or specify the numbers and qualifications of operating personnel.

SECTION I - GENERAL

4-1 General Information

The TPT is designed to receive, store, and dispense any of three types of fuel; diesel, jet fuel, or motor gasoline. Fuels are received from an associated pipeline system or from tanker trucks, or both, depending on specific site operating criteria. Fuels can be dispensed to transport vehicles or directly to user vehicles. When the mission of the particular terminal calls for it, fuels can be discharged from storage to an associated pipeline. For a thorough understanding of the physical features of the TPT, it is necessary that the reader refer to the Chapter 2, Design, Equipment and System Data. For applicable supporting information and U.S. Army practice the reader is referred to the Department of the Army manuals listed in Appendix D.

4-1.1 Flow Diagram (P&ID)

For the convenience of the reader, the same P&ID as included in Chapter 2 has been altered to show normal flow directions and is included in this chapter as Fig. 4-1. It is important that the reader fully understand the flow diagram (P&ID with flow arrows). It should be noted that the P&ID flow diagram is strictly schematic and does not indicate relative line and hoseline length nor does it necessarily represent the types of fittings at line junctions. The switching manifold, for example, shows up schematically as quite long whereas in actual practice it is recommended that it be kept as short as possible. Referring to Fig. 4-1, it is noted that fuel from the associated pipeline systems enters the switching manifold near the left hand side of the diagram. The fuel, if contaminated with the previously received fuel of a different specification (interface), or if otherwise contaminated, can be diverted to the contaminated fuel module. When sampling assures the operators of clean specification fuel, the appropriate valves are opened to route the fuel to the tank farm module desired and the valves to contaminated fuel module are closed. When called for by the specific operation at the TPT site, fuel can also be received from the tanker-truck receipt manifold shown near the right-hand side of the diagram. Incoming fuel quantities are measured by the meters in the intake hoselines to the fuel units. By proper positioning of valves, the fuel can be routed to any module. Normally, fuel is received into the secondary modules for storage and then transferred to the primary module for dispensing. Fuel can be transferred between modules with the hoseline pumps. Fuel is sent to the dispensing assembly via the primary module hoseline pump(s) through filter separators to remove traces of water. The fuel can be

4-1.1 Flow Diagram (P&ID) - Cont'd.

sampled at the discharge of the filter separators to assure quality. The meter in the hoseline to the dispensing assembly records quantities dispensed. The dispensing assembly is designed to load fuels into transport or user vehicles. If called for in the mission of the specific TPT, the hoseline system can be connected such that the TPT can discharge fuel to an associated pipeline system. A meter is provided to measure this flow. If desired in a multiple TPT system, which may include an extended common switching manifold, the discharge hose system from each fuel unit can be tied back into the appropriate dedicated header so that fuel can be transferred to another TPT on the same switching manifold. The P&ID flow diagram also shows an optional tank configuration which can be used to supplement the 5,000 bbl tanks as desired by the operating authority. Specific operating and valve positioning instructions for most all potential operations are covered in Section III.

4-1.2 System Hydraulics

Installation and operating authorities should be aware of the fact that if hoseline lengths, or pipeline lengths, or elevation differentials between modules deviate from the concepts of the layouts shown in this manual, flow rates and pressure drops will vary from one TPT to another. This is not considered to be a potential problem except in the case where the delivery pressure to the TPT is substantially below the design pressure of 150 psig or if it is necessary to have longer lengths of transfer hoseline than considered in this typical TPT manual. In the event that these deviate conditions are encountered, the responsible installation and operating managements are referred to the system hydraulic data contained in Chapter 2, Section V, for guidance.

4-2 Fuel Quality Assurance

Quality assurance is of utmost importance to the operation of the TPT. Firm quality checking procedures must be established to assure that the TPT receives and dispenses only fuels which meet U.S. Army standards. It is not within the scope of this manual to detail the fuel quality assurance program. U.S. Army standard procedures should be utilized. The reader should refer to the U.S. Army and other applicable military standards which include:
MIL-HDBK-200F
Military Standardization Handbook
Quality Surveillance Handbook for Fuels, Lubricants and Related Products

FM-18
Petroleum Terminal and Pipeline Operations

FM 10-70
Inspecting and Testing Petroleum Products

FM 10-72
Petroleum Testing Facilities: Laboratories and Kits

This manual offers guidance and recommendations on sampling, sample points, frequency of sampling, on-site testing, and criteria for requesting laboratory service.

4-2.1 Sample Points

Normally, the quality of product shipped to the TPT has been proven at the source and again upon arrival at the point where it is pumped to the associated pipeline feeding the TPT. Facilities at the TPT permit sample taking as follows:

a. A sampling assembly (Fig. 2-22 and para. 2-4.8) is installed in the header feeding the TPT switching manifold from the associated pipeline or other delivery system. The primary use of the sampling assembly is to check incoming fuel and establish the arrival of the interface between batches of different specification fuel. It can also be used to spot sample and check the quality of incoming fuel during the receiving period as desired by the operating authority.

b. A sample point is located in the discharge line of each filter separator (Fig. 2-21 and para. 2-4.7a.4). The primary purpose of this sample point is to check the quality and make sure no water is carried over to the dispensing assembly.

c. There are no facilities to safely take composite samples from the fabric collapsible tanks. A bottom sample may be taken from the drain connection to check the accumulation of BS&W (bottom sediment and water). A top sample may be taken when the hoseline pumps connected to the tanks are in operation through the vent petcock and hose connection on the pump discharge elbow if handled carefully.

4-2.2 Sampling

a. Extreme care must be taken when drawing samples. This is particularly true when drawing a sample from a flowing line under pressure. The following warnings and cautions apply to all sampling under a, b, c, and d, below.

WARNING

Wear safety goggles, long sleeves, and approved gloves when drawing samples. If fuel comes in contact with skin, wash off with water immediately. Warm water is most effective.

WARNING

When drawing samples, station a fire extinguisher near at hand.

WARNING

If fuel is spilled and accumulated, wash down the area to remove the fire hazard caused.

WARNING

No smoking within 100 ft. of any sampling operation.

CAUTION

Have an assistant or helper stand by to assist with any trouble when drawing a sample.

b. The sampling assembly (Fig. 2-22) should be operated as follows:

1. Place containers under the drain holes of the sampling table to catch any spilled fuel.

4-2.2 Sampling - Cont'd.

2. Place the sample bottle (or other container) under the gooseneck of the sampler.

3. Open the ball valve (Item 4, Fig. 2-22) first.

4. Take sample by throttling through the needle valve (Item 14, Fig. 2-22).

5. When sample has been taken, close the needle valve and then the ball valve.

6. Clean up any spilled fuel.

c. To take a sample from the water detector kit adapter downstream of the filter separators, remove the cap on the probe assembly and install the connector furnished with the test kit. Draw the sample in accordance with the instructions furnished with the test kit.

d. To draw a sample from the discharge vent of a hoseline pump, use extreme caution.

1. Reduce the discharge pressure to a minimum and still maintain flow from the tank.

2. Place a container under the vent hose and open the petcock to remove any air accumulated.

3. When flow without air is obtained, close the petcock and insert vent hose in neck of sample bottle.

4. Open the petcock and fill bottle.

5. Close petcock, clean up, and dispose of fuel in the container used in step 2.

WARNING

Use extreme care when taking a sample from the hoseline pump discharge vent. Avoid contact with hot engine parts. Avoid getting any fuel on hot engine parts. Have a fire extinguisher handy.

e. When taking a sample from a tank bottom drain, it is necessary to get inside the tank berm.

1. Place a container under the tank bottom drain valve. Open valve and draw off sufficient fuel to make sure the drain hose has been flushed.

2. Close valve.

3. Place sample container under the valve and open the valve partially to fill the sample container slowly. When filled, close drain valve.

4. Dispose of the fuel drawn off under step 1.

4-2.3 Test Equipment

a. Each TPT is furnished with a testing kit having a description as follows:

Testing Kit, Petroleum, Aviation
Fuel Contamination, Portable
NSN 6630-01-008-5524

Instructions for using the kit are on a placard attached inside the storage chest. The kit is capable of testing for:

Particulate contaminants
API gravity
Free water content

b. Laboratory facilities are not furnished specifically for a single TPT NSN 3835-01-182-1976. The Government normally furnishes the following laboratories to the operating area:

Mobile Petroleum Laboratory
NSN 6640-00-902-4940
Airmobile Petroleum Laboratory
NSN 6640-00-902-9711
Petroleum Base Laboratory
NSN 6640-00-303-4940

Describing the make-up and use of these facilities is beyond the scope of this manual.

4-2.4 Sampling and Test Frequency

Sampling and test frequency are determined by the service mission and specific operations of the particular TPT. The reader is referred to the U.S. Army publications listed in para. 4-2. It is recommended that a specific sampling and test program be set up for each particular TPT. The following are guidelines to assist in determining the sampling and testing requirements.

a. Sampling and Testing to Determine Cut. The associated pipeline feeding the TPT may be in multiple fuel service. Segregated storage of quality fuel in the TPT is desired. When a new batch of fuel is shipped up the pipeline, the dispatcher will advise the operating supervision at the TPT of its estimated time of arrival. The fuel ahead of the new batch may be taken into one fuel unit while it is intended to take the new batch into a different fuel unit. Between these batches is a section of commingling called the "interface". Upon arrival of the interface, it is desired to cut the fuel to the contaminated fuel storage module. When the interface has passed, the new batch is cut and sent to the specified fuel unit. Both these operations are handled by manipulation of the switching manifold which will be discussed further on in this chapter. The determination of when the interface has arrived and when it has passed is by sampling, visual observation and comparison of the samples, and by gravity measurement, all of which can be handled by the portable testing kit (para. 4-2.3a). Samples are drawn from the sampling assembly, Fig. 2-22, para. 4-2.1 la. The frequency of sampling will be determined by the rate of flow for the particular installation. Actual experience with the particular installation will be the final determining factor. Generally speaking, samples will be taken 30 minutes before the interface is scheduled to arrive and then at ever decreasing intervals starting at 5 minutes down to 30 seconds until the change in characteristics indicate the arrival of the interface. Flow is then immediately routed to the contaminated fuel module. When sampling indicates the interface has passed, that is, two

4-2.4 Sampling and Test Frequency - Cont'd.

or more samples have the same visual and gravity characteristics, the flow is cut to the appropriate fuel unit and flow to the contaminated fuel unit is stopped.

b. Sampling to Assure Quality to the Dispensing Assembly. Samples from the water detector kit adapter (Fig. 2-21, para. 4-2.1 b) downstream of each filter separator are taken to assure that the filter separators are performing properly. The testing kit (para. 4-2.3a) is utilized for this purpose. It is recommended that samples be drawn and tested as follows:

1. Once each four (4) hours of operation of dispensing assembly

2. Three checks at 15 minute intervals after filter separator is first put in operation or whenever there has been a filter change or an upset in operations.

c. Sampling from Tank Too via Pumps. It is recommended that samples be drawn and checked as follows.

1. Once per day

2. Whenever there is suspicion of contamination

3. Whenever that particular tank or module is to be transferred to another module in same TPT

4. Whenever that particular tank or module is to be transferred to the associated pipeline system, another TPT, or any other major bulk movement.

d. Sampling from Tank Bottom Drain. It is recommended that samples be drawn and checked as follows:

1. Once per week

2. Whenever there is suspicion of contamination by water or other contaminates

3. Prior to transferring tank contents elsewhere

CAUTION

Contaminated tank bottoms should be drawn off and disposed of prior to transferring all of a tank to another tank, to fuel dispensing, or to the associated pipeline. Under no conditions should tank bottoms be dispensed to user vehicles.

4-2.5 Utilization of Laboratory Facilities

It is recommended that the laboratory facilities noted in para. 4-2.3b be utilized under the following circumstances:

a. When the quality of a fuel is questioned.

b. When a fuel cannot be classified.

c. To assist in determining action to be taken as regards the content of the contaminated fuel module.

4-2.5 Utilization of Laboratory Facilities - Cont'd.

. When anew batch of fuel is received from the associated pipeline.

e. When a major transfer is planned between different TPT's or into the associated pipeline.

f. When jet fuel has been in storage for 30 days or more without addition of fresh stock.

g. All fuels in storage prior to any major drawdown on which vehicles or aircraft are dependent on the quality.

h. Routine, once per week, check of a cross section of samples analyzed with the portable testing kit to assure proper use and accuracy of the testing kit.

4-3 Metering and Gaging

The combination of meter strainer assemblies and the range poles are used to determine the quantity of fuel movement to and from the TPT and inventory within the TPT. Metering and gaging systems are intended for operating control and are not intended for accounting purposes.

4-3.1 Meter-Strainer Assemblies

a. There are 7 meter-strainer assemblies as described in para. 2-4.6 and Fig. 2-19.

Three are used to measure fuel into each fuel unit, three are used to measure fuel output at each dispensing assembly, and one is available to install in a common header returning fuel to the associated pipeline. For location of these units, see Fig.'s 4-1, 2-63A, 2-63B and Fig. 2-64. For further information, refer to the technical data over packed with the equipment and Appendix A. To operate the meter for recording a fuel transfer: 1. Set the meter at zero (or alternately record the reading) prior to the transfer.

2. Read and record the reading at the completion of the transfer.

3. The difference between the initial reading "1" and the final reading "2" is the amount of fuel transferred in U.S. gallons.

b. The strainer is installed to protect the meter. A plugged strainer will cause excessive pressure drop. The strainer must be cleaned on a routine basis as described in Chapter 6.

c. The meter is designed and intended for an accuracy of 0.1%. If accuracy in transfer measurement is desired, the meter should be checked for accuracy every 2,000,000 gallons. U.S. Army publication FM 10-18, Petroleum Terminal and Pipeline Operation, Appendix D, describes a satisfactory method of determining accuracy. The questioned meter can also be checked against a meter of proven accuracy by installing them in series.

4-3.1 Meter-Strainer Assemblies - Contd.

CAUTION

PURGING AIR THROUGH METER STRAINER ASSEMBLY

The positive displacement meter cannot be subjected to any substantial airflow without running the risk of overspeeding and ruining the water. Special care must be taken during purge and fill operations.

4-3.2 Range Poles

a. Range poles are installed at each 5000 Bbl fabric collapsible tank as described in Fig. 2-23 and para. 2-4.9. While this is far from an accurate measurement, it is useful and will help prevent overfilling if observed. They can be used as a check and backup for metered movements and in the resolution of inventory problems. The tanks have not been strapped as would be the case with a standard metal tank. The height of the tank does not vary in a direct linear way with its content. However, when the tank is full, it will always be at the same height unless it has been damaged or distorted for some reason. When it is half full, it will be approximately one half (1/2) its full height. If the range poles are installed as suggested in this manual, the following procedures apply.

1. The height of a 5,000 bbl tank is specified to be 6 ft. 8 in. when it contains 5,000 bbl. The tank top should be touching the cord between the two range poles.

2. If the tank top is 3 ft. 4 in. below the cord, the tank contains approximately 2,500 bbl.

3. If the tank is 3 ft. 4 in. high at the beginning of a transfer and 2 ft. 4 in. high at the end of a transfer, approximately 750 bbl have been moved out, i.e., approximately 750 bbl per ft. of height change.

b. The accuracy of the above guideline can be checked and modified in the field by metering a known amount into the tank and checking against the actual change in elevation.

c. The position of and the tightness of the cord between the range poles should be checked routinely to assure that it is located 6 ft. 8 in. above the tank bottom (or some other fixed height specified by operating management).

4-4 Operating Records

4-4.1 General

It is not within the scope of this manual to detail the extent or form of operating records desired by the U.S. Army. The reader should refer to U.S. Army instructional manuals which include:

FM 10-69
Petroleum Supply Point
Equipment and Operations

FM 10-18
Petroleum Terminal and Pipeline Operation

4-4.2 Recommended Records

The following records are recommended:

a. Fuel Movement

1. In and out each fuel unit

a) Type of fuel
b) Quantity
c) Date and time
d) Source
e) Destination
f) Ending inventory

2. Each dispensing assembly

a) Type of fuel
b) Quantity per 24 hours
c) Date
d) Receipts file

3. Total TPT - Summary

a) Type of fuel
b) Quantity
c) Date
d) Inventor

b. Fuel Quality

a) Date and time of sample
b) Accepted/rejected
c) Analyses record
Serial No. Date/Time

c. Operating Log

1. Chronological record of activity in each fuel unit. Date/time
2. Chronological record of activity in total TPT. Date/time
3. Listing of operating problems encountered.
4. Listing maintenance problems encountered. Time and date of equipment removal or replacement
5. Listing of pending or deferred maintenance.
6. Record of any accidents.

e. Pumps and Engines. Specific records should be kept on pumps and engines including

4-4.2 Recommended Records - Cont'd.

1. Time and dates in operation
2. Fuel records
3. Oil changes
4. Complete maintenance records

f. Accidents. Specific record of and action on any accidents, equipment, or personnel.

g. Work orders. Copies of all maintenance work orders written and record of completion.

h. Materials receipts. Copies of receipts issued for any materials or equipment received for which responsibility was passed.

4-5 Pre-operating Inspection

Prior to operating any of the TPT facility, it should be subjected to a very thorough inspection by operating management. If this is done in conjunction with the completion of erection, Chapter 3, it can be one in the same with the final construction inspection. At any time, however, that the unit has been shut down for any extended period, a very thorough pre operating inspection should take place. It is recommended that this inspection be guided by a check list that includes but is not limited to the following: a. All flanges and couplings closed and secure.

b. All valves in closed position.

c. Hose lay proper, no kinks, hose guards in place.

d. Free end hoses weighted down with sand bags.

e. All equipment grounded.

f. Evidence that filter-separators have been checked out and ready for operation.

g. Evidence that pumps have been checked out and ready for operation.

h. Hose lay on tank tops.

i. Tank berms okay. Drain shut.

j. Floodlights in place and operable.

k. Water supply secure.

l. Meters reset.

m. Range poles properly in place.

n. Fire suppression equipment in place and evidence of check out.

o. First aid equipment intact.

4-5 Pre-operating Inspection Cont'd.

p. No smoking and other safety signs in place.

q. Record keeping facility intact.

r. Area free of trash and hazards.

s. Roadways open.

t. Operating personnel know their individual function.

u. Communications system and back-up functional.

4-6 Fire Protection and Suppression

It is not in the scope of this manual to supply the sole instruction on fire prevention and fire suppression. Management and supervision are, or should become, thoroughly acquainted with U.S. Army instructional manuals on this subject. Some guidelines specifically related to the problem of handling flammable fuels are outlined below. Chapter 2, para. 2-4.13 lists the fire suppression equipment supplied with the TPT. Appendix A includes specific instructions on the use and maintenance of the fire suppression equipment supplied.

4-6.1 Causes and Prevention of Fires and Explosions

Volatile petroleum fuels vaporize at normal atmospheric temperatures, and the vapors burn readily when ignited. For fuel vapors to burn or explode, three elements must be present fuel, air or oxygen, and a source of ignition. All three must be present at the same time and place to produce a fire. If any one of these elements is missing, a fire will not occur. Personnel must remember that in any of the operations they perform, two of the elements, air and fuel, are present. The only other element is heat; and if the fire or sparks occur under such conditions, an explosion or fire will result.

a. TPT personnel have little control over the air present in most of their operations. With the exception of preventing spills, they have little control over the generation of flammable vapors. Therefore, primary attention in preventing fires must be given to eliminating possible sources of ignition. There are many potential ignition sources, some of which are as follows:

1. Sparks generated by static electricity.

2. Operating internal combustion engines.

3. Arcing of electrical circuits.

4. Open flame.

b. Static electricity has been the source of ignition for many petroleum fires. Static electricity may be generated by agitation or flow of petroleum liquid, moving machinery, moving vehicles, and by personnel. Protection against these ignition sources is obtained by dissipating static charges through proper connections to the ground before they build up sufficiently to be dangerous or by discharging the static charges before vapors are released into the air. To illustrate, a fuel dispensing system is grounded and the fill valve or nozzle is touched to the metal vehicle before the nozzle or valve is opened.

c. The operation of internal combustion engines can provide sources of ignition. Ignition of vapors may occur through the arcing of distributor points, arcing at spark plugs,

hot engines exhaust piping, burning or glowing carbon particles in the exhaust piping, backfiring, and others.

d. Sparks caused by electrical currents is another common source of ignition in fuel handling operations. The heat in this case is a spark, such as may occur when battery terminals are connected or when an electrical switch is operated. Other examples of sparks from electrical currents are: arcing of generator brushes, arcing of welding machine brushes, arcing of brushes in electric motors and tools, and the sparks that occur in short circuits.

e. Electrical storms can cause a passage of current or a residual static charge in equipment and result in sparks or arcing.

f. Open flames and lights are obvious ignition sources. Similar to this is the hazard of standard electric light bulbs, and photo-flash bulbs. Should any of these bulbs break, the filament would be hot enough to ignite a vapor air mixture and cause a fire or explosion.

g. Other precautions against fires and explosions are given below:

WARNINGS

1. Personnel should wear nonstatic-producing clothing such as cotton. Nylon, wool, silk and certain plastics should not be worn.

2. Keep all grounding connections clean, unpainted and in good condition.

3. Never begin any fuel handling operation until all equipment is properly grounded and bonded.

4. Do not use a chamois filter for filtering fuels. Chamois filters increase the danger of static electricity.

5. Allow no smoking within 100 feet of any refueling operation.

6. Do not permit or use open fires, matches, cigarette lighters, oil lanterns, or similar open flames within 100 feet of fuel handling operations.

7. Never perform any repair work during fuel handling operations or while in a hazardous area.

8. Do not use any flashlights, drop lights, and extension cords, except those approved for use in hazardous locations.

9. Do not carry any matches or cigarette lighters in pockets.

10. Discontinue fuel handling operations at approach of electrical storms.

11. Be certain that no heaters, welding torches, or blowtorches are being used within 100 feet of fuel handling operations.

12. Be certain that no internal combustion engines are being operated within 100 feet of fuel handling operations. The only exception to this is engines necessary to the operations, which are specially equipped with spark arresters, flame arresters, and other safety equipment.

13. Vehicle engines must be shut down while taking on or discharging fuel.

14. Promptly clean up or wash down all spills and fuel accumulations.

15. Keep all equipment and work areas neat, clean, orderly, and in good mechanical condition. This is very important.

16. Keep fire suppression equipment in good condition and readily available.

17. Move fire suppression equipment to be near areas of spills, liquid fuel accumulation, sampling operations, etc. until the fire hazard is corrected.

18. Never use gasoline for cleaning parts, clothing, rags, or other items.

19. Do not wash hands in fuels.

20. After using, place all oily waste and rags in self-closing metal containers. Empty containers at an assigned disposal point frequently.

21. Immediately remove any articles of clothing or shoes that have become soaked with fuels. This should be done in an area free from ignition sources.

4.6.2 Summary of Fire Suppression Methods

If a fire starts in a TPT unit, there are a number of ways to extinguish it. It is essential that instructions are prepared and all personnel be familiar with them. Fire suppression equipment furnished with the TPT is covered in detail in para. 2-4.13 and Appendix A. The following general outline of fire suppression methods includes the use of dry chemical and foam extinguishers which are furnished with the TPT as well as other methods so that the reader will have a broad knowledge of fire suppression practice.

a. Water and Water Fog. Water alone can extinguish a petroleum fire only when applied under favorable circumstances. Solid water streams, water sprays, and water fog all have their proper use. The decision of when, where, and how to apply water should be made by the person assigned as fire chief.

b. Blankets. Blankets are mainly used to put out fires in a person's clothing. Wet blankets can sometimes be used to help smother a fire at a vapor leak or at a vent.

c. Foam. Foam used on petroleum fires is a continuous mass of very small bubbles filled with inert gas or air and held together by surface tension. There are two types of foam: chemical (carbon dioxide) and mechanical (air or inert gas foam).

1. The foam must be applied to the fire so that it acts as a blanket on the surface of the product. The foam must be spread over the burning surface faster than the fire can destroy it. The rate of application varies with the type of foam, discharging outlet, and product. About 1 gallon of water-in-foam for each 10 square feet of liquid surface (or about a 1-1/4 inch thickness of chemical or low expansion air foam per minute over the surface) is usually enough to fight a gasoline fire.

2. When a high volume flow of foam is available, it should be fully used by applying several streams of foam from different points at the same time. However, each foam stream should be large enough to be effective by itself. It should be so directed that it slides smoothly on to the surface of the burning liquid. Prompt, ample, gentle applications of foam are most effective.

4.6.2 Summary of Fire Suppression Methods - Cont'd .

d. Carbon Dioxide. The carbon dioxide extinguisher holds liquid carbon dioxide under high pressure. Extinguishers are made with both disk valves and seat valves. The disk valve type releases the entire contents of the cylinder when it is opened. The seat valve type, which has a control valve, permits only the desired amount of gas to be discharged. The stream should be directed at the base of the flames. The carbon dioxide extinguisher may be used on electrical fires.

e. Soda acid. The soda acid extinguisher contains a solution of water and sodium bicarbonate and, in a separate bottle, an amount of sulfuric acid. When the extinguisher is turned upside down, the chemicals are mixed and expelled under pressure through the hose. This extinguisher must not be used on electrical fires.

f. Dry Chemical. The dry chemical extinguisher contains chemically processed bicarbonate of soda in a powder form. Air or gas pressure contained either inside or outside of the extinguisher shell, is used to discharge the bicarbonate of soda. In applying powder to flammable liquid fires, the stream should be so directed that the section of fire closest to the operator is extinguished first. The operator should then gradually move forward, shifting the discharge nozzle from side to side. Equipment should be cleaned after fire extinguishment because of the corrosive nature of dry powder extinguishing agents. This extinguisher may be used on electrical fires.

g. Inert Gas. An inert gas, such as nitrogen, can be used in a confined space to extinguish the fire by displacing the oxygen. Personnel cannot be in the same space. Nitrogen may also be used to blanket a flammable liquid in a confined space to prevent ignition due to the displacement of air (oxygen).

4-6.3 Fire Extinguishers Supplied with TPT

Each TPT is furnished with the fire suppression equipment defined in para. 2-4.13. It is noted that there are two types of fire extinguishers:

a. Nineteen (19) wheel-mounted combination dry chemical and foam extinguisher. The mixing and motive force of the extinguisher is supplied from compressed nitrogen bottles carried on the equipment. The foam used in this extinguisher is called aqueous film forming foam (AFFF). In general terms, the practice is to extinguish the fire with dry chemicals and then prevent reignition with the AFFF which forms a film over the extinguished area. Details on the operation of this equipment are contained in the U.S. Marine Corps technical manual in Appendix A.

b. Ninety-five (95) 20 lb. capacity dry chemical, hand carried, fire extinguishers. These are intended for use in extinguishing more minor fires.

4-6.4 Types of Fires and Suppression Action

a. Electrical Fires. When an electrical fire occurs, the first action is to shut off the current at a point away from the immediate switch controlling the equipment on fire. If wires must be cut, only qualified personnel, with proper equipment, should be allowed to cut them. If the current cannot be shut off immediately, a carbon dioxide or dry chemical extinguisher should be used to put out the fire. For large fires, water fog can be used provided care is taken to not cause a solid stream of water under any conditions.

4-6.4 Types of Fires and Suppression Action - Cont'd .

CAUTION
Never use a solid stream of water on electrical fires.

b. Vent Fires. The fabric collapsible tanks have little or no vapor or air space above the liquid if operated properly; however, under some conditions, a vapor and air space may exist. Any vent fires of the tanks must be recognized and extinguished promptly to prevent the flame from entering the tank. This action should be taken even if the flame arrester is believed to be in place.

WARNING
Never draw fuel from a tank burning at the vent. This could pull the fire into the tank.

1. Vapor-rich Atmosphere. If the vent fire is a yellow-orange color and is giving off black smoke, it indicates a vapor-rich tank atmosphere. In this case, there is little danger of the flame entering the tank. The flame should be extinguished with water fog, carbon dioxide or dry chemical.

2. Flammable Atmosphere. A vent fire with a snapping, blue-red, almost smokeless flame indicates that the atmosphere in the tank is near the flammable range and, because of this, flame may soon enter the tank. In this case, personnel must be kept away from the tank and outside the berm. The atmosphere in the tank can be made vapor-rich by pumping products into the tank. When the flames show a vapor-rich atmosphere in the tank, the fire can be extinguished with water fog, carbon dioxide, or dry chemical.

c. Liquid Fires. Fires on the surface of liquid fuel accumulations from spills or leaks can be extinguished with foam or dry chemical extinguishers. On large fires, water fog or solid streams are effective, but the action should be directed by an experienced fire fighting expert. The wheel-mounted combination dry chemical and aqueous film forming foam extinguishers furnished with the TPT are intended for use in extinguishing liquid fuel fires by first extinguishing the fire with dry chemical and then preventing reignition with the film forming foam. Detailed operating instructions are in Appendix A.

4-6.5 Organization and Training

The key to effective fire prevention and fire suppression is organization and training. All personnel associated with TPT operations should be trained first in the elimination of fire hazards and, secondly, in the use of the fire suppression equipment. It is recommended that a specific fire fighting organization be established to handle the suppression of fires that do occur. If a fire does occur, all personnel not involved in the critical operation of the unit or in the fire fighting organization should be evacuated.

4-7 Health and Safety Precautions

Not all personnel health and safety hazards can be covered. The secret of safe operations is to cause people to "Think Safety". It is recommended that in addition to an initial formal safety training program, a system of regular safety meetings be set up where personnel can recite their safety problems and supervision can take action. Specific safety topics can be covered in such open discussions. The following outlines some of the more obvious potential health and safety problems and actions to be taken.

4-7.1 Health Hazards

a. Hydrocarbons, and in particular the fuels intended for handling in the TPT, can be dangerous to health and sometimes fatal if care and precautions are not taken.

WARNING

HYDROCARBON FUMES

Hydrocarbon fuel fumes are dangerous to respiratory health if inhaled. Avoid breathing fumes. If necessary due to fumes in an area that must be entered, wear an approved breathing device.

WARNING

INGESTION OF HYDROCARBONS

Liquid hydrocarbons are dangerous if ingested. Do not induce vomiting. Call a physician at once.

WARNING

CHEMICAL BURNS

Liquid hydrocarbons can cause severe chemical burns if in contact with the skin. Wash off thoroughly if exposed. Wear approved gloves if likely to be in contact with hydrocarbon liquids.

WARNING

EYE INJURY

Liquid hydrocarbons can cause eye damage. If eyes are exposed, wash out immediately with large volumes of water. Wear safety goggles if there is any chance of contact with the eyes.

The following is a summary of health hazards and recommended action to be taken for the specific fuels involved in the TPT. The operating authority should consult the appropriate U.S. Army authorities for confirmation and amplification of these recommendations.

1. Gasoline (Mogas) a) Personnel must avoid repeated or prolonged breathing of gasoline fumes. Use in well ventilated area. When necessary, first aid consists of allowing victim to breathe fresh air.

b Do not ingest gasoline. If gasoline is ingested, do not induce vomiting. Call a physician at once.

c Avoid prolonged contact with skin. First aid consists of washing skin and changing contaminated clothing.

4-7.1 Health Hazards - Cont'd.

2. Diesel Fuel a) Users should avoid breathing of exhaust fumes produced by fuel pumps. Use in well ventilated area. First aid consists of allowing the victim to breathe fresh air.

b Do not ingest diesel fuel. If diesel fuel is ingested, do not induce vomiting. Call a physician at once.

3. Jet Fuel (JP-4, JP-5, JP-8)

a) Personnel must avoid prolonged or repeated breathing of jet fuel fumes. Use in well ventilated area. First aid consists of allowing the victim to breathe fresh air.

b Do not ingest jet fuel. If jet fuel is ingested, do not induce vomiting. Call a physician at once.

c Avoid prolonged or repeated contact with skin. First aid consists of washing skin and changing contaminated clothing.

b. Exhaust fumes from the diesel engine-driven pumps and the lighting generators are dangerous to health. Steps must be taken to avoid exposure to exhaust fume concentrations.

WARNING

EXHAUST FUMES

The pumps in this system are operated by diesel engines. Exhaust fumes can cause illness and death. Pump engines must not be operated in an enclosed area unless action has been taken to direct the fumes outside and all exhaust manifold leaks have been eliminated. Good ventilation in such an enclosure is absolutely mandatory.

c. Hearing damage from engine noise is possible.

WARNING

NOISE HEARING DAMAGE

Areas near diesel engine-driven pumps have a high noise level. Wear ear protection devices to avoid temporary or possibly permanent hearing damage.

4-7.2 General Safety

The following is a summary of some of the general safe work practices that should be followed to avoid personnel injury and equipment damage. There are other warnings and conditions connected with specific equipment and systems that must be observed. These are covered under the operations of these items.

WARNING

NO SMOKING

Allow no smoking within 100 ft. of any facility or device storing or handling petroleum fuels. Erect "No Smoking" signs to this effect.

WARNING

MOVING PARTS

Engines and pumps have fast moving parts that can damage hands, feet etc. Take special care while in operation.

WARNING

HOT ENGINE PARTS

Engine parts, particularly the exhaust system can be very hot and cause severe burns. Do not touch until engine is shut down and cooled off. Avoid spilling fuel or oil on hot engine parts which could result in a fire.

WARNING

HOSE WHIP

Weight down free hose ends and loops with sand bags. Leave hose in fuel dispensing area in a relatively straight stretched-out condition rather than coiled or tangled. Hose may tend to move rapidly or whip when pressure changes and can injure personnel.

WARNING

VEHICLE ENGINES OFF WHEN
FILLING VEHICLE WITH FUEL

Vehicle engines must be shut down when filling the vehicle with fuel to minimize the risk of fire or explosion.

CAUTION

VEHICLE DAMAGE TO HOSE

Install well-covered roadway crossing guards to prevent vehicles from damaging hose.

WARNING

FUEL AIR MIXTURES

Any mixture of fuel vapor or fuel droplets in air is potentially explosive. Air in contact with a fuel surface is potentially explosive or as a minimum flammable. Treat such conditions as hazardous and eliminate the cause immediately.

4-7.2 General Safety - Cont'd.

WARNING

BREAKING FLANGES & COUPLINGS

Always be sure that piping or hose systems and the associated equipment are depressured before breaking (disassembling) flanges and couplings for changing configurations or for maintenance. This is to avoid injury to personnel and to avoid causing a fire hazard. Refer to paragraphs 4-17 thru 4-17.5 for depressurizing procedures.

WARNING

LIQUID FUEL LEAKS

Promptly correct any fuel leakage that causes an accumulation of fuel on any surface. If it cannot be corrected safely while in operation, shut down and make corrections to stop the leak. Make a list of any minor leaks that cannot be corrected in operation and make repairs at the first shut down opportunity.

WARNING

LIQUID FUEL ACCUMULATION

The accumulation of liquid fuel, or hot lubricating oil is a fire hazard. Wipe and wash down such areas or surfaces promptly. Dispose of any wiping rags in an area removed from the fuel storage or handling areas. Apply no smoking rules within 100 ft. of any fuel accumulation.

WARNING

FUME ACCUMULATION

When leaks or spills occur, there will possibly be an accumulation of fumes that may be a fire hazard. This is particularly the case if the facility is located in a low lying area or during certain atmospheric conditions. Make sure fire suppression equipment is ready. Clear personnel from the area until the fumes have been dispersed.

WARNING

FUEL SATURATED SOIL

Fuel saturated soil is a fire hazard. Do not allow unnecessary personnel in the area. Do not allow smoking within 100 ft. of the area. Wash down the area thoroughly with water until the evidence of fuel is gone. A detergent in with the water will help disperse the fuel.

WARNING

MAJOR TANK SPILLS

If a major spill occurs due to tank overflow or breakage, or hose breakage, do not go inside the tank berm or firewall until the accumulation has been removed and managing supervision approves entry. Special fire protection precautions must be taken under these conditions. Fire suppression equipment should be concentrated in the area.

4-7.2 General Safety - Cont'd.

CAUTION

DAMAGED, PIPE, FITTINGS, VALVES

Damaged pipe, fittings, and valves must be inspected by a qualified person immediately and removed from service if damage is severe enough to justify it. Pipe, fittings, and valves that show a visible crack or substantial leakage should be removed from service immediately.

CAUTION

CUT OR SCORED HOSE

Consider cut, scored or badly deformed hose to be unsuitable for service. Replace at first possible opportunity. Broken or leaking hose must be depressured and replaced immediately. Failure to do so can result in a failure of operations at an inappropriate time and in the creation of a severe fire hazard. Refer to paragraphs 4-17 thru 4-17.5 for depressurizing procedures.

WARNING

GROUNDING

All equipment, devices, machinery, hoses and piping must be grounded to avoid static electricity discharge. When loading or filling vehicles, make sure the fuel dispensing system is grounded. If a grounding strap is present and intact, connect it to the vehicle frame. Touch the fill nozzle against the vehicle's metal prior to opening the filling valve to discharge any static charge before fuel vapor is present, if grounding strap is not there for some reason..

WARNING

SYSTEM OVERPRESSURE

Make sure that the systems from which the TPT is receiving fuel or to which the TPT is transferring fuel are incapable of overpressuring the TPT hose and valve system which is rated at 150 psi. Overpressure can result in a serious failure, causing personnel injury and fire.

WARNING

CLEAN OPERATING AREAS

Keep operating areas cleaned up and picked up. Remove any unnecessary equipment, trash, large rocks etc. Such can be tripped over during the rush of operation and cause personal injury.

SECTION II - MAJOR EQUIPMENT OPERATION

4-8 General

Major equipment is considered to be the 5,000 bbl fabric collapsible tanks, 50,000 gallon fabric collapsible tanks, 600 gpm hoseline pumps, 350 gpm transfer pump, filter separators,

4-8 General Cont'd.

meter strainer assemblies and floodlight sets. The use and operation of the meter strainer assemblies along with the range poles are already covered in para. 4-3. The other major equipment noted above all have specific technical manuals published by the manufacturer or the U.S. Army and it is most important that the reader refer to these technical manuals for detailed operating instructions. This section will primarily reference these technical manuals with special comment when considered appropriate. All of the major equipment with the exception of the floodlight sets function in and for the system's operations covered in Section III.

4-9 5,000 Bbl Fabric Collapsible Tank Operation

4-9.1 Information on the 5,000 bbl fabric collapsible tanks is found in para. 2-4.1 and Fig. 2-11. Detailed instructions are in the ILC Dover technical manual supplied with the tanks.

These instructions must be studied in detail before operating the tanks.

4-9.2 The tanks are filled by opening the appropriate valves at the cross assemblies. For example, note valve V21J on the cross assembly (assuming cross assembly is under pressure, that is, V20J or V31J open to a hoseline under pressure) is opened to fill tank T3J as shown on the flow diagram, Fig. 4-1.

4-9.3 The tanks are drawn down by suction from the hoseline pumps after opening the appropriate valves. For example, valves V22J, V23J and V27J, along with valving on the discharge and downstream of P2J, must be open to draw down tank T3J with the pump P2J on Fig. 4-1.

4-9.4 The tanks can be drained through the drain connection D supplied with the tank.

4-9.5 It is important to note the following warnings and cautions in operating the 5,000 bbl fabric collapsible tanks.

WARNING

OVERFILL OF FABRIC COLLAPSIBLE TANKS

The fabric collapsible tanks are designed primarily for static liquid head pressure only. The tank vents are set at 0.10 psig and are incapable of passing large volumes of liquid. Overfilling will result in a spill through the vent and can, if filling under pressure, result in overpressure and a tank rupture, causing a major and dangerous spill.

WARNING

CLEAR TANK VENTS

Prior to filling tank, inspect and make sure tank vents are always clear and clean. A plugged tank vent can cause damage to the fabric tank or cause a loss of pump suction. Make sure pressure relief feature is operating.

4-9 5,000 Bbl Fabric Collapsible Tank Operation - Cont'd.

CAUTION

DAMAGED FABRIC TANKS

Prior to filling tanks, inspect for fabric flaws or breaks. Damaged fabric tanks must be removed from service and repaired or replaced promptly. Failure to do so can result in a major spill.

CAUTION

TANK DRAIN

Prior to filling tank, make sure the bottom drain valve is closed.

CAUTION

BERM DRAIN

Prior to filling tank, make sure the berm drain valve (if any) is closed.

CAUTION

TANK BERMS

Tank berms must be kept in good repair. The integrity of the berms is necessary to contain a tank spill and isolate the resultant fire hazard to a single, relatively small area.

CAUTION

TANK HOSE CONNECTIONS

Prior to operation, make sure the connections to the tank are tight and that the lay of hose is such as to not cause the stiff fill/discharge connection to cock and cause an air/vapor space. A cocked connection can cause a loss of suction to the associated pump or a trapped air/vapor space not wanted in the fabric collapsible tank. The tank is designed to operate without air or vapor above the liquid surface.

4-10 50,000 Gallon Fabric Collapsible Tank Operation

4-10.1 Information on the 50,000 gallon fabric collapsible tanks is found in para. 2-4.2 and Fig. 2-12. Detailed instructions are in Department of the Army technical manual TM 5430-210-12. These instructions must be studied in detail before operating the tanks.

4-10.2 The tanks are filled by opening the appropriate valves. For example, note valves V 1 CF and V2CF are opened to fill the contaminated fuel tank T1CF as shown on the flow diagram, Fig. 4-1.

4-10 50,000 Gallon Fabric Collapsible Tank Operation - Cont'd.

4-10.3 The tank T1CF is drawn down by suction from the operating transfer pump P1CF after opening the appropriate valves, V3CF, V4CF, V8C, and V1 OCF.

4-10.4 The tanks can be drained through the drain connection D supplied with the tank.

4-10.5 It is important to note the following warnings and cautions in operating the 50,000 gallon fabric collapsible tanks.

WARNING

OVERFILL OF FABRIC COLLAPSIBLE TANKS

The fabric collapsible tanks are designed primarily for static liquid head pressure only. The tank vents are set at 0.10 psig and are incapable of passing large volumes of liquid. Overfilling will result in a spill through the vent and can, if filling under pressure, result in overpressure and a tank rupture, causing a major and dangerous spill.

WARNING

CLEAR TANK VENTS

Prior to filling tank, inspect and make sure tank vents are always clear and clean. A plugged tank vent can cause damage to the fabric tank or cause a loss of pump suction. Make sure pressure relief feature is operating.

CAUTION

DAMAGED FABRIC TANKS

Prior to filling tanks, inspect for fabric flaws or breaks. Damaged fabric tanks must be removed from service and repaired or replaced promptly. Failure to do so can result in a major spill.

CAUTION

TANK DRAIN

Prior to filling tank, make sure the bottom drain valve is closed.

CAUTION

BERM DRAIN

Prior to filling tank, make sure the berm drain valve (if any) is closed.

CAUTION

TANK BERMS

Tank berms must be kept in good repair. The integrity of the berms is necessary to contain a tank spill and isolate the resultant fire hazard to a single, relatively small area.

4-10 50,000 Gallon Fabric Collapsible Tank Operation - Cont'd.

CAUTION

TANK HOSE CONNECTIONS

Prior to operation, make sure the connections to the tank are tight and that the lay of hose is such as to not cause the stiff fill/discharge connection to cock and cause an air/vapor space. A cocked connection can cause a loss of suction to the associated pump or a trapped air/vapor space not wanted in the fabric collapsible tank. The tank is designed to operate without air or vapor above the liquid surface.

4-11 600 Gpm Hoseline Pump Operation

Information on the 600 gpm hoseline pumps is found in para. 2-4.3 and Fig.'s 2-13 and 2-14. Fig. 2-15 is the performance curve for the pump. Detailed instructions are in the technical manual prepared by Peabody Barnes and supplied with the pumps. These instructions must be studied in detail before operating the pumps. The pump is started, operated, and shut down in accordance with Peabody Barnes instructions.

WARNING

HOSELINE PUMP OPERATION

Observe all Warnings and Cautions contained in the technical manual published by Peabody Barnes, Inc. for Model 612 ACD-1 pump and supplied with the equipment.

WARNING

FABRIC TANK OVERFILL

Do not leave the pump operating and unattended at any time, if possible, but particularly not when filling a fabric collapsible tank that is nearing full capacity. An overfilled tank can result in a rupture and the resultant major spill.

WARNING

DRY SUCTION

Do not leave a pump operating and unattended at anytime, if possible, but particularly not when a fabric collapsible tank is nearing its empty point. Continued operation with a dry suction can result in pump failure.

WARNING

OVERPRESSURE

Do not operate the pump at discharge pressures in excess of 150 psig. Equipment including the pump is not designed for pressures above 150 psig.

4-11 600 Gpm Hoseline Pump Operation -Cont'd.

CAUTION

PRESSURE GAGES

Check the pressure gages on the pumps routinely to assure that they are accurate. These are the only operating pressure gages in the TPT system. Misoperation causing equipment failure and personnel injury could be the result of a lack of accurate pressure indication.

4-12 350 Gpm Transfer Pump

Information on the 350 GPM transfer pump is found in para. 2-4.4 and Fig. 2-16. Fig. 2-17 is the performance curve for the pump. Detailed instructions are in the Department of the Army technical manual TM-5-4320-226-14 supplied with the pump. The pump must be operated in accordance with the U.S. Army manual and study of it is recommended.

WARNING

TRANSFER PUMP OPERATION

Observe all Warnings and Cautions contained in TM 5-4320-226-14.

WARNING

DRY SUCTION

Do not leave pump operating and unattended at anytime, if possible, but particularly not when a fabric collapsible tank is nearing its empty point. Continued operation with a dry suction can result in pump failure.

WARNING

OVERPRESSURE

Do not operate the pump at discharge pressures in excess of 150 psig. Equipment including the pump is not designed for pressures above 150 psig.

CAUTION

BACK FLOW

It is noted that this pump does not have a built-in check valve and thus back flow is possible. Judicious operation of the discharge gate valve is required to prevent back flow if the hydraulic conditions are such that back flow can occur.

4-13 Filter Separator Operation

Information on the filter separators is found in para. 2-4.7 and Fig. 2-20. Detailed operating instructions are in Department of the Army technical manual TM 5-4330-211-12 supplied with the equipment. Operation must be in accordance with that manual and study of it is recommended. Note that the filter separators are rated at 350 gpm and that if loading rates at the dispensing set are in excess of this, it will be necessary to operate two (2) filter

4-13 Filter Separator Operation - Cont'd.

separators in parallel. The performance of the filter separator should be checked routinely. MIL HDBK 200 defines military practice and fuel quality criteria.

WARNING

FILTER SEPARATOR OPERATIONS

Observe all Warnings and Cautions contained in TM 5-4330-21 1-12.

WARNING

FILTER SEPARATOR FAILURE

The performance of military aircraft and vehicles is dependent on the performance of the filter separators. If there is any question about satisfactory performance, remove the unit from service and take the action called for in TM 5-4330-211-12.

WARNING

OPENING FILTER SEPARATOR

Make sure unit is depressurized and drained before opening for element inspection or replacement. Refer to paras. 4-17 thru 4-17.5 for depressurizing procedures.

CAUTION

Protect filter/separator elements. When testing any system with water, care must be taken to ensure that water is not introduced into the filter/separator assemblies that contain filter elements. Contact with water will make the elements unusable and they must be discarded. To ensure inadvertent destruction of filter elements, remove them from the filter/separator assembly before testing any system with water.

4-14 Floodlight Sets

Information on the floodlight sets is found in para. 2-4.11 and Fig. 2-25. Detailed operating instructions are in the Department of the Army technical manual TM 5-6230-210-13&P. It is recommended that this manual be studied and its instructions followed.

WARNING

FLOODLIGHT SETS OPERATION

Observe all Warnings and Cautions contained in TM 5-6230-210-13&P.

WARNING

FLOODLIGHT SET FAILURE

The floodlight sets can be as essential to operations as the pumping and fuel handling equipment. Failure of the floodlight sets can result in unsafe operating conditions.

SECTION III - SYSTEM OPERATIONS

4-15 Commissioning

When all the equipment and systems have been installed, serviced, and inspected as described in Chapter 3, the TPT is ready for commissioning. The term commissioning is meant to include purging and initial line fill. Commissioning is not intended to include a complete fill of the storage tanks. The procedures described below, if handled properly, are an excellent training exercise for routine operations which will be conducted at higher rates and pressures. The recommended steps to be taken are as follows.

4-15.1 If the facility has just been completed and given a thorough inspection, it is not necessary to reinspect it. If, however, the unit has been in standby for a period of time, a very thorough pre-operating inspection, as called for in para. 4-5, is recommended before commencing commissioning operations.

4-15.2 If the unit has been previously pressure tested, as described in para.'s 3-29 through 3-29.5, an additional pressure test is not required. If this prior pressure test has been made with water, any remaining water which has not been satisfactorily removed in the dry out procedures described will be driven to the 5,000 bbl secondary module tanks in the procedures described below. It will then be necessary to drain off the accumulated water from the tank bottoms.

4-15.3 If the unit has not been previously pressure tested, and operating management chooses to test with fuel, this can be accomplished after the line fill in the procedures outlined below. All of the procedures and cautionary measures described in para. 3-29 through 3-29.5 are recommended.

4-15.4 The source of fuel and entrance pressure for purging the systems can be from the pipeline system via the switching manifold or from tanker trucks feeding the switching manifold through the tanker-truck receipt manifold. The latter is recommended, if available, because of the relatively low and variable feed rates desired.

4-15.5 The primary function of the purging operation is first to remove air from the system and secondly to flush contaminants from the system. The process of removing air from the system will cause a relatively high venting rate from the tank vents. The vent gas is likely to be flammable due to mixing with fuel vapors and droplets. Special precautions must be taken due to this condition.

WARNING

VENT GASES DURING PURGE

The vent gases during purging operations may be a flammable mixture of fuel vapors and air. Special precautions to eliminate ignition sources in the area must be taken. All "No Smoking" and other rules outlined in para. 4-7 must be strictly enforced. Fire suppression equipment must be stationed near the tank modules.

4-15.6 These procedures are written on the basis that extreme care has been taken to assure internal cleanliness as described in the installation procedures in Chapter 3. If, however, a certain section of the system is known to contain, or suspected of containing, contaminants such as dirt, construction waste, or water, it is recommended that this section be disconnected, flushed out with water, drained, and dried before purging operations commence.

WARNING

INTERNAL DIRT AND WASTE

Dirt, rocks, construction waste, etc. can ruin operating equipment and cause operating failures. Operating management must assure themselves of the elimination of such contaminants before commencing operations.

4-15.7 It is recommended that purging and initial line-fill operations take place at relatively low flow rates and pressures. Flow rates should be restricted to a range of 50-150 gpm. Pressures should not exceed that required to attain these flow rates.

CAUTION

LOW FLOW IN PURGING

Restrict flow rates to 150 gpm maximum during purging and line fill operations. High and turbulent rates will mix air with the fuel and extend the purging procedure.

4-15.8 The purge and initial line fill must be conducted with the fuel intended for storage and distribution from that particular fuel unit. If the TPT's designated service is for more than one fuel, it is recommended that only one fuel unit be purged and filled at one time to avoid mistakes and the resultant contamination in this first operation of the facility. If, 4-15 however, it is urgent to get the entire TPT into operation, all three fuel units can be purged and the lines filled simultaneously due to the dedicated nature of the switching manifold headers. Special care must be taken to avoid errors that cause cross contamination.

4-15.9 The following procedures relate to one fuel unit. For clarity, the reference is made to the jet fuel unit. All valve and equipment designations are related to the jet fuel unit. The purge and line fill of the other fuel units will be the same except that the service designation of the equipment and valve numbers change from J to M or D. For example, the opening of valve V33J in this description becomes the opening of V33M in the mogas fuel unit and V33D in the diesel fuel unit. All the procedures refer to the P&ID Flow Diagram, Fig. 4-1. Although this is written as a continuous process, it may be shut down at any point by stopping the pumps and closing the valves.

a. Make ready a source of fuel and fuel pressure to the switching manifold, either through the tanker-truck receipt manifold or from the associated pipeline. The following procedures assume the supply is from tanker-trucks via the tanker-truck receipt manifold. Minor and obvious modifications are required if the source is from the associated pipeline.

b. After connecting to tanker-truck with the connector followed by valve V1TJ, open V1TJ, V5TJ, V7TJ, V8TJ, V9TJ, VIOTJ, V13TJ.

c. Block in the line from the associated pipeline with the first valve upstream on the header or disconnect and blind off the switching manifold with an aluminum plug.

d. Purge and fill supply hoselines to the contaminated fuel module:

4-15 Commissioning - Cont'd.

1. Open V1HJ and V1CF.

2. Start P1TJ and open V2CF slowly.

3. Air will flow into tank T1CF and through its vent.

4. When a steady flow of liquid can be heard and the venting rate has dropped, open V5CF slowly and purge into tank T2CF. Close V2CF.

5. When a steady flow of liquid into T2CF can be heard and the venting rate has dropped close V1CF and V1 HJ.

6. Stop the pump P1TJ.

7. Close valve V5CF.

8. It is not recommended that the discharge system from T1CF and T2CF be purged or filled at this time. This can be done at the first opportunity when disposing of the contents of the contaminated fuel tanks.

e. Purge and fill supply lines.

1. Open valves V2J, V3J, V4J, and V5J.

2. Start pump P1TJ.

3. Crack open V 1J at the switching manifold very slowly. Observe "Caution" below. After meter strainer is flooded the valve should be opened fully.

CAUTION
PURGING OF METER STRAINER ASSEMBLY

Very low flow rates (approximately 10 gpm maximum) must be maintained during the purge and fill operation until air has been fully purged from the meter strainer assembly and the upstream hose line. The switching manifold up to V J, V 1 D, or V 1M must be fully flooded and air free. High airflow thru the meter strainer assembly may overspeed and ruin the meter. See detailed instructions in Appendix A (Smith Meter Inc. , Bulletin 1-8. 4. 1)

4. Air will flow to tank T1J and through its vent.

5. When a steady flow of liquid can be heard entering the tank T1J and the venting rate has dropped, allow approximately one (1) to two (2) feet of liquid to accumulate for upstream purging, thru pump P11J. Then open valve V8J and close valve V5J.

6. When a steady flow of liquid can be heard and the vent rate has dropped, allow approximately two (2) feet of fuel to accumulate in tank T2J. Open V20J and V21J in preparation for the initial purge of the secondary module 8.

7. Open V19J slowly and close valves V3J, V4J and V8J. Air will flow into tank T3J and through its vent.

8. When a steady flow of liquid is heard and the vent rate has dropped, allow about two (2) feet of liquid to accumulate in tank T3J.

9. Open V24J and then close V21J. When a steady flow of liquid can be heard and the vent rate has dropped, allow about two (2) feet of liquid to accumulate in tank T4J.

10. Open valves V17J, V36J, V37J and V39J. Slowly open V16J and purge into tank T5J. Close valve V24J, V20J and V19J.

11. When a steady stream of liquid can be heard and the vent rate has dropped, allow about two (2) feet to accumulate in T5J.

12. Open V47J slowly and close V39J.

13. When a steady stream of liquid can be heard and the vent rate has dropped, allow about two (2) feet to accumulate in T6J.

14. Open valves V21J and V31J. Slowly open V32J. Close V36J.

15. Allow a brief purge and liquid flow into tank T3J, say 3-5 minutes.

16. Open Vl5J and V5J. Slowly open V18J. Close V21J, V31J and V32J.

17. Allow a brief purge and liquid flow into tank T1J, say 3-5 minutes.

18. Shut down pump P1TJ.

19. Close valves V15J, V5J and V18J.

f. Purge and fill discharge lines from secondary modules. This procedure assumes that valve V35J is connected to the associated pipeline as shown on Figure 4-1 and that the associated pipeline is able to receive fuel at least in small quantities as well as vent off the purged air. An alternate is to temporarily connect it into the switching manifold and return fuel to the storage tanks via the supply line, i. e. , V J, etc. Another alternate is to discharge into a 50,000 gallon storage tank erected for this purpose or into a tanker-truck.

1. Open valves V6J, V7J, V 11J, V12J, V13J, V34J.

2. Start pump P3J and operate at rates below 150 gpm. Slowly open V35J.

3. When evidence of air venting has dropped off and a steady stream of liquid is flowing, open valves V9J and V1OJ.

4. When suction has been obtained from tank T2J, open valves V5J, Vl5J and V14J.

Close valve V35, V34J and Vl3J.

5. When flow can be heard into tank T1J and evidence of venting has dropped off, shut down pump P1J and close valves V9J, V 10J, V 11J, V12J, V14J, Vl5J and VSJ.

6. Open valves V22J, V23J, V27J, V28J, V29J and V33J. Start pump P2J and operate at rates below 150 gpm. Slowly open V35J. Continue pumping until sure that the air from

the line between V29J and V33J has passed valve V35J. This time will vary with the length of transfer hose installed for the specific TPT.

7. Open V30J, V31J, and V24J. Close V35J, V33J and V29J.

8. When liquid flow to tank T4J can be heard and vent rates have dropped off, open V25J and V26J. Close V22J and V23J.

9. When suction has been obtained from T4J, open valve V21J and close V24J.

10. When liquid flow to tank T3J can be heard and vent rates have dropped off, shut down pump P2J and close V25J, V26J, V27J, V28J, V30J, V31J and V21J.

g. Purge and fill primary module discharge system.

1. Open valves V40J, V41J, V42J, V43J, V44J, V45J, V46J, V38J and V47J.

2. Start pump P3J and operate at less than 150 gpm rates.

3. When liquid can be heard entering tank T6J and vent rates have dropped off, shut down pump P3J and close valves V40J, V41J, V42J, V43J, V44J, V45J, V46J, V38J and V47J.

h. Purge and fill dispensing assembly.

Tank trucks or other containers are needed on hand for this operation.

1. Connect a tank truck at the first (a) 3"-4" inch dispensing connection.

2. Open valves V48J, V49J, V50J, V51J, V52J, V53J, V54J, V55J, V56J, V59J, V62aJ and V63aJ.

3. Start pump P3J or P4J and operate at low rates, say 50 gpm, and pump thru to the tank truck. Hold discharge pressures on the pump to the minimum required to safely but adequately pump thru the dispensing set. It is recommended that pressures of no more than 35 psig at the pump be maintained. Under no conditions, should the pump discharge pressure exceed 75 psig to avoid overpressure of dispensing set fittings.

4. Connect another tanker-truck to the second (b) 3"-4" dispensing connection.

Alternatively connect the second dispensing hose to another inlet to the same truck.

5. When the first dispensing connection is passing a solid stream of liquid with no air entertainment, open valves V62bJ and 63bJ. Close V62a and 63aJ.

6. Move the first tanker-truck to the third dispensing connection and repeat the above procedures for all six 3"-4" dispensing connections. If the alternate noted in (4) above is in use merely connect the third dispensing hose to the truck after the first dispensing hose is disconnected ect...or until all six 4dispensing hoses have been purged and filled.

7. Open V57J and V58J. Close V56J and V55J.

8. Open valve V60J and discharge to the tanker-truck or some other safe container thru the 1-1/2" hoselines by operating V64aJ and V65aJ first and V64bJ and V65bJ next in similar manner to the procedures for the 4" lines.

9. Repeat these procedures for the six (6) 1 " hose and nozzle sets moving downstream. The last hose is the last to be purged and filled.

10. Dispose of the fuel collected in the tanker truck as instructed by operating management.

11. The performance of the filter separator should be checked during this operation.

WARNING

DISPENSING ASSEMBLY GROUNDING

Be sure each of the nozzles and dispensing system is grounded in each operation above.

WARNING

FUELSPLASH

Particularly during this first commissioning operation, watch out for splashback due to air bubbles and excessive pressure fluctuations. Wear goggles and approved gloves.

WARNING

HOSE WHIP

Particularly during this first commissioning operation, watch for hose whip caused by pressure fluctuations and air passage.

CAUTION

PRESSURE BLOCKING IN

When a transfer of fuel is completed in the commissioning procedure it is generally recommended that the valve in the applicable line of flow that is furthest upstream (closest to the source of pressure) be closed first and sequentially followed by the valves downstream. This will avoid the block in of fuel under pressure and thus enhance the safety of the system.

i. Completion of Commissioning

1. Make sure all valves in the system are closed after completion of the commissioning process. This will help avoid operating error in routine operations to follow.

2. Take a sample of all tank drains for accumulation of water and contaminant (BS&W). Draw off any accumulation prior to routine operation.

3. Reinspect the facility for any evidence of leakage or damage. Repair any faults noted.

4-15 Commissioning - Cont'd.

4. Transfer fuels to the modules selected by operating management if desired. Use procedures in para. 4-16 through 4-16.5p.

5. Record the inventory.

4-16 Fuel Transfers

4-16.1 The operating instructions below are referenced to the equipment and valve identification numbers shown on the P&ID flow diagram, Fig. 4-1. The instructions are based on the jet fuel unit but apply to the mogas and diesel fuel units as well. The valve and equipment numbers are the same in each fuel unit except for the service designation J, D, or M. Valve V1J, for example, has the same function as V1D or V1M.

4-16.2 These instructions assume that the commissioning procedures outlined in para. 4-15 through 4-15i. 5 have been undertaken and that excessive air and thus excessive venting at the tanks will not take place.

4-16.3 Feed rates to the fuel unit are assumed to be not in excess of 800 gpm. Entry pressure, that is, pressure at the switching manifold is assumed to be not in excess of 150 psig as specified. Pump discharge pressures to the dispensing sets must not exceed 75 psig.

4-16.4 It is recommended that all the safe working and operating practices noted in prior sections, and particularly in para. 's 4-7 through 4-7. 2, be reviewed again. It is also recommended that the instructions on the operation of major equipment described in the applicable specific technical manuals be reviewed again and considered part of these instructions.

WARNING

OVERFILLING FABRIC TANKS

Do not overfill the fabric collapsible tanks. A spill through the vent or possibly a rupture and major spill could result.

CAUTION

CLOSE VALVES AFTER TRANSFER

To avoid future operating error, close all valves after each transfer operation.

4-16.5 Specific fuel transfer instructions are as follows:

CAUTION

PRESSURE BLOCKING IN

When a fuel transfer is completed it is generally recommended that the valve in the applicable line of flow that is furthest upstream (closest to the source of pressure) be closed first and sequentially followed by the closure of the valves next downstream. This will avoid the blocking in of fuel under pressure an thus enhance the safety of the system.

4-16 Fuel Transfers -Cont'd.

a. Direct Feed from Associated Pipeline to the Contaminated Fuel Module

When fuel coming from the associated pipeline is off specification, normally during the passage of the interface as determined by the sampling procedures outlined in para. 42. 4a, feed is cut to the contaminated fuel module as follows:

1. Prior to the anticipated arrival of the interface, open valves V2CF and VSCF.
2. When the sample results indicate action is required, promptly open valve V 1CF.
3. Promptly dose the valves V1JM (HD or HM) to the switching manifold as may be in service at the time.
4. Feed is cutback to the switching manifold when and as described in para. 14-16.5b.
5. At an appropriate time, usually after a transfer to the contaminated fuel tanks is completed, the contents of off specification fuel can be pumped out of the contaminated fuel tanks as follows:
    a) Open valvesV3CF and V4CF to pump out tank T1CF or valves V6CF and V7CF to pump out tank T2CF.
    b) Connect the 3inch coupling to the tanker-truck.
    c) Open V8CF.
    d) Start the pump PICF and pull suction from the tank while opening V1OCF.
    e) When pump out is complete, dose V 10CF and immediately shut down P1 CF.
    f) Close valves V3CF and V4CF or V6CF and V7CF as the case may be.

b. Cut Feed to the Switching Manifold

Prior to this step, the valving in the route to the appropriate storage tank must be opened in accordance with the appropriate procedure described in para. 4-16.d or e.

1. Open valve VIHJ and promptly dose VICF. The switching manifold will now be pressurized and fuel will be flowing in the route selected.
2. Close valves V2CF and VSCF.

c. Feed Switching Manifold from the Tanker-Truck Receipt Manifold

As with feed from the associated pipeline in 416. 5b, the valving in the route to the appropriate storage tank must be opened in accordance with the applicable procedure described in para. 16. 5Sd or e.

4-16 Fuel Transfers - Cont'd.

1. Connect the supply tanker-truck (or trucks) to the couplings outboard of VI TJ (or V2TJ, V3TJ, V4TJ).

2. Open V5TJ (or V6TJ), V7TJ, V8TJ, V 1OTJ and V13TJ.

3. Start pump P1 TJ and open V9TJ. Pressurize and feed the switching manifold.

4. When the transfer is complete, shut down the pump PITJ and close all valves opened above. Disconnect the tanker-truck(s).

WARNING
TANKER TRUCK MOVEMENT

Do not allow truck to move away without disconnecting the hoseline. A spill could result.

d. Transfer Fuel from Switching Manifold to Secondary Module Tanks

Fuel is transferred from the switching manifold to secondary module tanks as follows:

1. Reset meter MS1J to zero or record the reading.

2. Open valves in the hoseline route to tank.

   a) ToT1J. OpenV1J,V2J,V3J,V4J andV5J.

   b) To T2J. Open V1J, V2J, V3J, V4J and V8J.

   c) To T3J. Open V1J, V2J, V19J, V20J and V21J.

   d) To T4J. Open v1j, V2J,V19J, V2OJ and V24J.

3. Transfers may be made to two to four tanks simultaneously if desired, however, the quantity to a specific tank will not be recorded by meter.

4. If transferring to more than one tank, the flow to each tank will not necessarily be equal. Close the valves to a particular tank when the tank top touches the range pole cord.

5. If transferring to a single tank and a continuing transfer to another tank is desired, first open the valves in the route to the next tank and then close the valve in the route to the full tank. Record the meter reading at the time of shift and this can be used to determine the quantity transferred to the first tank.

6. When the transfer is complete to all tanks, close valve V1J and record the meter reading.

7. Close all valves opened in the transfer process.

4-16 Fuel Transfers-Cont'd.

e. Transfer Fuel from Switching Manifold to Primary Module Tanks

This can readily be done if a full tank inventory is desired in the fuel unit. Normal practice is to transfer to the secondary module tanks first to allow BS&W to settle out before dispensing.

1. Reset meter ms1j to zero or record reading.
2. Open valves in the hose line route to tank.

   a) To TSJ. Open VIJ, V2J, V16J. V17J, V36J, V37J, and V39J.

   b) ToT6J. Open VJ, VJ, V16J, V17J, V36J, V37J, andV47J.

3. Transfers may be made to both primary tanks simultaneously if desired, however, the quantity to a specific tank will not be recorded by meter.

4. If transferring to two tanks simultaneously, the flow to each tank will not necessarily be equal. Close the valves to a particular tank when the tank top touched the range pole cord.

5. If transferring to a single tank and a continuing transfer to the other tank is desired, first open the valves in the route to the second tank and then dose the valve in the route to the full tank. Record the meter reading at the time of the shift. This can be used to determine the quantity transferred to the first tank.

6. When the transfer is complete to all tanks, close valve V1J and record the meter reading.
7. Close all valves opened in the transfer process

f. Transfer Fuel from a Secondary Module Tank to a Primary Module Tank

This operating instruction specifically covers the transfer of fuel from secondary module tank T1J to primary module tank T5J. Procedures used to transfer from any secondary module tank to either primary module tank are the same except through a different route and different valves which can readily be determined by study of the P&ID flow diagram, Fig. 4-1.

1. Observe and record range pole reading of tanks TIJ and TSJ.
2. Open valves V6J, V7J, V 1J, Vt2J, V 4J, V18J, V36J, V37J. and V39J.
3. Start and operate pump P3J taking suction on T J and discharging to tank TSJ.
4. Observe closely the process of transfer and the positions of the tank tops in relation to the range pole cord.
5. Shut down pump PIJ when either one of the following occurs
   a) Top of tank T5J touches the range pole cord.

   b) Tank T1J goes near flat (say 6 inches) and is obviously nearly empty.

c) If a completely empty tank is desired, pump down until the pump suction or discharge pressure gage starts to flutter and then immediately shut down the pump. Any remaining fuel and BS&W can be drained off through the bottom drain.

CAUTION

DRY PUMP SUCTION

Do not continue pumping from a tank when the top goes nearly flat. It is best to leave some fuel in the supplying tank unless the requirement is to completely evacuate the tank. Operating a pump with a dry suction can ruin the pump.

g. Transfer Fuel from a Primary Module Tank to a Secondary Module Tank

This operating instruction specifically covers the transfer of fuel from primary module tank T5J to secondary module tank T1J using pump P3J. Procedures used to transfer from the other primary module tank to any secondary module tank are the same except through a different route and different valves which can be readily determined by study of the P&ID flow diagram, Fig. 4-1. Either pump P3J or P4J may be used.

1. Observe and record the range pole reading of tanks TSJ and T1J.
2. Open valves V40J, V41J, V42J, V43J, V44J, V45J, V46J, V38J, V37J, V36J, V18J, VI 5J, and V5J.
3. Start and operate pump P3J taking suction on tank T5J and discharging to tank T1J.
4. Observe closely the process of transfer and the positions of the tank tops in relation to the range pole cord.
5. Shut down pump P3J when either of the following occurs.

   a) Top of tank T1J touches the range pole cord

   b) Tank T5J goes nearly flat (say 6 inches) and is obviously nearly empty.

   c) If a completely empty tank is desired, pump down until the pump suction or discharge pressure gage starts to flutter and then immediately shut down the pump. Any remaining fuel can be drained off though the bottom drain.

CAUTION

DRY PUMP SUCTION

Do not continue pumping from a tank when the top goes nearly flat. It is best to leave some fuel in the supplying tank unless the requirement is to completely evacuate the tank. Operating pump with a dry suction can ruin the pump.

h. <u>Discharge Fuel from a Primary Module Tank Through the Dispensing Assembly</u>

4-16 Fuel Transfers - Cont'd.

The rate of discharge through the dispensing assembly is variable depending on the number and type of vehicles or containers being filled. Pump discharge rates and pressures are therefore variable. It is recommended that pressures be kept as low as possible and yet maintain desired loading rates This is a matter of safety to reduce the potential of hose whip, splash back and spills Experience will be the most reliable guide for dispensing set and feed pump operations. There must be good communications between the dispensing set operating supervisor and the pump operator. The situation at the dispensing set must govern pump operation. Due to the pressure rating of certain dispensing set fittings, the feed pump discharge pressure should not exceed 75 psig. For safety reasons, the pressure at the 1-inch dispensing nozzles must be kept low-in the order of 10-20 psig. When loading tanker-trucks only, it is recommended that the feed pump be operated initially at less than 35 psig. Pressures can then be raised or lowered in increments of 5 psi until a desired loading rate is established. Flow rates can be determined by observation of the meter readings over a known period of time. When using only the 1 -inch and 11/2-inch nozzles, it is recommended that the pump be operated in the manual mode beginning at idle and increasing speed in increments of 50 RPM until a desired loading rate is achieved but not exceeding 1000 RPM. If it is necessary to dispense through the 1-inch and 1112-inch nozzles while loading tanker-trucks, this can be done if handled with care. The valves V60J and V61J can be partially dosed as necessary to cause additional pressure drop before the 1-inch and 1-1/2-inch loading spots. When no fuel is being dispensed, the feed pump must be shut down immediately. To supply fuel to the dispensing assembly from tanks TSJ or T6J, either pump P3J or P4J may be used. This operating instruction describes the use of pump P3J to discharge fuel from tank T5J through the dispensing set.

1. Open valves V40J, V41J, V42J, V43J, V44J, V45J, V54J, V55J, V56J, V59J. Open V60J and V61J only if the 1-inch or 1-1/2-inch loading nozzles downstream are to be used.

2. Connect the dispensing coupling (or couplings) to the tanker truck being loaded.

3. Start pump P3J and hold at a very low discharge pressure or in the idle position.

Note the recommendations in the opening paragraph.

4. Open the valves leading to the appropriate dispensing hose coupling or couplings in use.

5. Raise P3J discharge pressure to that required for the dispensing assembly loading rate desired. Adjust pressure to compensate for major changes in the dispensing assembly loading rate.

6. If filling user vehicles the dispensing nozzles V66a-fJ are used at the will of the refueling operator after opening V60J and V61J.

7. When loading is complete, close the valve nearest the coupling. Disconnect the coupling.

8. When any particular dispensing line is not going to be in service for any extended period that the block valves V62a-fJ and V64a,bJ be left closed.

9. The above instructions pass fuel through the filter separator FS1 1J. If FS2J is to be in service in lieu of FS1J, open valves V57J and V58J. Close V55J and V561. If for some reason it is desired to have both filter separators in service, leave V55J, V56J, VS7J and V58J open. If loading rates are to exceed 350 gpm, both filter separators should be in service.

10. When no fuel is being drawn from the dispensing assembly, shut down the pump in service.
11. When fueling operations are complete or are to be secured for an extended period, close all valves.

WARNING

DISPENSING ASSEMBLY OPERATING PRESSURE

Keep dispensing assembly pressure as low as possible and still maintain the required rates of dispensing. High pressures can result in hose whip, splash back, and spills.

WARNING

GROUNDING

Make sure grounding system at dispensing assembly is in good condition and utilized. Stop loading if any static electricity discharge takes place until the cause is found and corrected.

WARNING

NO SMOKING

Enforce no smoking rules on all personnel, including drivers from outside the TPT.

WARNING

VEHICLE DISCONNECT

Make sure vehicles are disconnected from the dispensing assembly before moving.

WARNING

STOP VEHICLE ENGINES

Stop all vehicle engines while loading.

CAUTION

DISPENSING ASSEMBLY PRESSURE RATING

Certain dispensing set fittings are rated at 75 psig. To protect these fittings, the feed pump discharge pressure should not exceed 75 psig to protect the system if blocked in against pump discharge.

i. Discharge Fuel from a Secondary Module Tank to the Dispensing Assembly

While this operation can be done, it is not recommended unless there is some emergency or special need. The pumps P1J and P2J are normally far removed from the dispensing assembly and good visual communication with the pump operator is considered important. The

operations below are based on pumping tank T1J to the dispensing assembly. The route from other tanks can readily be understood by study of the P&ID flow diagram, Fig. 41.

1. Open valves V6J. V7J, VI 11, V12J VV14J, V18, V36J. V37J, V38J, V461. V54J. V55J.

V56J V59J. Open V60J and V61J if the 1-inch and -n1/2-inch loading spots are to be used.

2. Connect the dispensing coupling (or couplings) to the tanker truck(s) being loaded.

3. Start pump P J and hold at a very low discharge pressure or in the idle position.

4. Open valves leading to the appropriate dispensing coupling or couplings in use.

5. Raise P1J discharge rate to that required for the dispensing assembly load. Adjust rates to follow changes in the dispensing set load.

6. If filling user vehicles the dispensing nozzles V66a-fJ are used at the will of the refueling operator.

7. When loading is complete, dose the valve nearest the coupling. Disconnect the coupling.

8. When any particular dispensing line is not going to be in service for any extended period that the block valves V62a-fJ and V64a, bJ should be left closed.

9. The above instructions pass fuel through the filter separator FS1J. If FS2J is to be in service in lieu of FS 1J, open valves V57J and V5sJ. Close VSSJ and V56J. If for some reason it is desired to have both filter separators in service, leave VSSJ, V56J, V57J and V58J open.

10. When no fuel is being drawn from the dispensing assembly, shut down the pump in service.

11. When fueling operations are complete or are to be secured for an extended period, close all valves.

WARNING

DISPENSING SET PRESSURE

Keep dispensing assembly pressure as low as possible and still maintain the required rates of dispensing. High pressures can result in hose whip, splash back, and spills.

WARNING

GROUNDING

Make sure grounding system at dispensing assembly is in good condition and utilized. Stop loading if any static electricity discharge takes place until the cause is found and corrected.

WARNING

NO SMOKING

Enforce no smoking rules on all personnel, including drivers from outside the TPT.

WARNING

VEHICLE DISCONNECT

Make sure vehicles are disconnected from the dispensing assembly before moving.

WARNING

STOP VEHICLE ENGINES

Stop all vehicle engines while loading.

j. Transfer Fuel from a Primary Module Tank to the Associated Pipeline System.

To transfer fuel from the TPT to the associated pipeline, there must be no back pressure in the pipeline system that exceeds the 600 gpm hoseline pump's discharge head capability. This relative pressure situation will vary with the specific system and cannot be fully described here for a typical installation. The 600 gpm hoseline pumps are restricted to a discharge pressure of 150 psig. The hoseline system is restricted to 150 psig maximum pressure. Assuming the specific installation and its associated pipeline system are set up such that this can be done, the operating instruction for transferring fuel from tank TSJ via pump P3J to the associated pipeline system is as outlined below. The routing and procedures to transfer from T6J or through P4J would be the same except for the valve positions between the tank and pump and the cross assembly. See P&ID flow diagram, Fig. 4-1.

1. Open valves V40J, V41J, V42J, V43J, V44J, V451, V46J, V38J, V37J, V36J, V32J, V30J, V29J, and V33J.
2. Record reading or reset meter MS1H.
3. Start and operate pump P3J at low discharge pressure.
4. Open V35J while increasing the discharge rate on pump P3J.

CAUTION

BACK FLOW

Make sure there is no flow from pipeline system into the TPT when the intent is to transfer from the TPT to the pipeline system.

5. When transfer is complete, close valve V3SJ and promptly shut down pump P3J.
6. Record meterMS1H reading.
7. Close all other valves.

WARNING

DRY PUMP SUCTION

Do not continue pumping after tank is empty. A dry suction can ruin the pump.

k. Transfer Fuel from a Secondary Module Tank to the Associated System

To transfer fuel from the TPT to the associated pipeline, there must be no back pressure in the pipeline system that exceeds the 600 gpm hoseline pump's ability to supply. The relative pressure situation will vary with the specific system and cannot be fully described here for a typical installation. The 600 gpm hoseline pumps are restricted to a discharge pressure of 150 psig. The hoseline system is restricted to 150 psig maximum pressure. Assuming the specific installation and its associated pipeline system are set up such that this can be done, the operating instruction for transferring fuel from tank T1J via pump PIJ to the associated pipeline system is as outlined below. The routing from other secondary module tanks. T2J, T3J, or T41, is similar except for valve positions and can be readily determined from P&ID flow diagram, Fig. 4-1.

1. Open valves V61. V7J, V11J. V12J, V13J, and V34J.
2. Record reading or reset meter MS1H.
3. Start and operate pump P1J at low discharge pressure.
4. Open V35J while increasing the discharge rate on pump P1J.
5. When transfer is complete, close valve V35J and promptly shut down pump P1J.
6. Record reading on meter MS1 H.
7. Close all other valve

CAUTION

BACK FLOW

Make sure there is no flow from pipeline system into the TPT when the intent is to transfer fuel from the TPT to the pipeline system.

WARNING

DRY PUMP SUCTION

Do not continue pumping after tank is empty. A dry suction can ruin the pump.

l. Transfer Fuel from any Tank to the Switching Manifold

When called for, the fuel from any tank can be transferred to the switching manifold by connecting the discharge transfer hose into the switching manifold and following the routing and transfer procedures outlined under "j" and "k" above. The tie-in to the switching manifold can be made at most any point in the manifold desired (see Fig. 2-62) by disconnecting the tee and valve (items 1 and 2 in the return manifold shown on Fig. 2-62) and connecting it in the aluminum pipe and fitting train shown in either the standard or optional receipt manifold. The meter MS1 H can be inserted into the hoseline if needed to register the quantity transferred. In this way, as determined by the operating management, the fuel can be transferred to another fuel unit in the TPT or to the optional tanker-truck receipt manifold for outloading tanker-trucks. In a multiple TPT installation connected to the same switching manifold, the fuel can be transferred to another TPT. In planning these transfers to another fuel unit in the same TPT or to another TPT on the same expanded switching manifold, consideration must be given to the possibility of cross contamination of different specification fuels. Obviously, this should not take place in such a way as to cause cross contamination except in emergencies or special situations.

WARNING

PRESSURIZED SYSTEM

Do not break any flanges or open any couplings until the system is depressurized at that location. Injury and fuel spills can result. Refer to paras. 4-17 thru 4-17. 5 for depressurizing procedures.

WARNING

CAP OPEN FITTINGS OR PIPE

Cap off open fittings or pipe in return manifold to minimize the risk of unintended flow from another fuel unit causing a spill to the return manifold.

m. Load Out Tanker-Trucks at Tanker-Truck Receipt Manifold

Fuel from any tank can be loaded out at the tanker-truck receipt manifold by disconnecting valve V35J from the return manifold to the associated pipeline (Fig. 2-62) and coupling it to the hoseline from the tanker-truck receipt manifold that normally connects at valve V 13TJ (or V13TM, or V13TD, depending on the service). Although the procedure outlined above appears to be the most practical, the procedure described under "n" of tying V35J back into the switching manifold will accomplish the same thing and permit discharge to the tanker truck receipt manifold. In either case, the meter MS1 H can be installed in the transfer hoseline if desired. Assuming the first flow path noted above is selected, the load out procedure is as follows:

1. Connect the tanker-truck or trucks to the tanker-truck receipt manifold.

2. Open the appropriate valve or valves such as V TJ and valves V 5TJ, V 1 TI, and VI2TJ. (Note: PITJ is used in this outloading operation.)

3. Proceed with the routing, valve opening, and pump operation as outlined under -jo or 'k", depending on what tank content is being outloaded, and pump into the tanker truck(s).

4. Watch the loading carefully and as soon as full, close valve V1TJ (or other ball valves in service).

5. Promptly shut down the pump that is in service as soon as loading is complete.

6. Close all other valves opened in the transfer.

WARNING

PRESSURIZED SYSTEM

Do not break any flanges or open any couplings until the system is depressurized at that location. Injury and fuel spills can result. Refer to paras. 41 7 thru 4-17. 5 for depressurizing procedures.

WARNING

CAP OPEN FITTINGS OR PIPE

Cap off open fittings or pipe in return manifold to minimize the risk of unintended flow from another fuel unit to the return manifold causing a spill.

WARNING

TRUCK OVERFILL

Overfilling a tanker-truck will result in a spill and the dangers connected with it. Control flow to the tanker-truck by the valving near the truck, preferably the ball valve because of its rapid dosing feature.

WARNING

COMMUNICATIONS

Rapid and reliable communications between the tanker-truck loading operation point and the pump operator, who may be far removed, is required.

WARNING

DISCONNECT TANKER-TRUCK

Be sure to disconnect tanker-trucks before they are allowed to move.

4-16 Fuel Transfers - Cont'd.

n. Transfer Fuel from a Primary Module Tank to the Other Tank in the Same Module

To transfer fuel from primary module tank T5J to primary module tank T6J via P3J, proceed as described below. For a similar transfer from T6J to T5J, the routing can readily be followed on P&ID, Fig. 4-1.

1. Open valves V40J, V41J, V42J, V43J, V44J, V45J, V46J, V38J, and V47J.
2. Start and operate pump P3J.
3. When transfer is complete, shut down P3J and close all valves.

CAUTION

DRY PUMP SUCTION

Do not continue pumping from a tank when the top goes nearly flat. It is best to leave some fuel in the supplying tank unless the requirement is to completely evacuate the tank. Operating pump with a dry suction can ruin the pump.

o. Transfer Fuel from a Secondary Module Tank to the Other Tank in Same Module

To transfer fuel from a secondary module tank to the other tank in the same module, proceed as outlined below for a transfer from tank T1J to tank T2J. Transfers from T2J to T1J, T3J to T4J, or T4J can readily be understood by studying the P&ID flow diagram, Fig. 4-1.

1. Open valves V6J, V7J, V 11J, V12J, V14J, V15J and V8J.
2. Start and operate pump P1J.
3. When transfer is complete, shut down P1J and close all valves.

CAUTION

DRY PUMP SUCTION

Do not continue pumping from a tank when the top goes nearly flat. It is best to leave some fuel in the supplying tank unless the requirement is to completely evacuate the tank. Operating pump with a dry suction can ruin the pump.

p. Transfer Fuel from a Tank in One Secondary Module to a Tank in the Other Secondary Module

To transfer fuel from a tank in one secondary module to a tank in the other secondary module (Module A to Module B), a transfer from tank T1 J to T3J will be used as the example. The routing between other combinations of tanks can readily be determined by study of the P&ID, Fig. 4-1.

4-16 Fuel Transfers- Cont'd.

1. Open valves V6J, V71, VI J, V121, V14J, V18J, V321, V31) and V21J.

2. Although the drawings and the P&ID in this manual show one possible hook-up, numerous combinations can be made, depending on hoseline availability and the service required.

4-17 Depressurizing and Draining System

After the TPT is commissioned and placed in operation it will be necessary from time to time to depressurize and drain various parts of the system for maintenance or disassembly. Throughout the operating and maintenance instructions of the manual the reader is warned to depressurize the system before breaking (opening) flanges, couplings, and other closures. This is to avoid spills or sprays of fuel that can injure personnel or cause a fire hazard. The following describes procedures recommended for depressurization and draining.

4-17.1 A system is generally depressurized by opening the valves in the line of flow leading to a fabric collapsible tank. The valves upstream of the section to be depressurized are, of course, left dosed. For example; (referring to P&ID Fig. 2-1) if it is necessary to depressurize the hose system leading from the switching manifold to tank T1I in the secondary module of the jet fuel unit to work on or replace valve V2D, the procedure is to leave the following valves closed: VJ, VI51, V116, V81, V 19J. The following valves are opened: V2J, V31, V4J, V5J. The system will then depressurize into tank T1J.

4-17.2 Individual pieces of equipment such as the strainer in the meter strainer assembly, the filter separators, and the hose line pumps have individual vents and drains. After the system has been depressurized, or that piece of equipment blocked in, the vents and drains on the equipment should be opened before that particular item is worked on. This will assure depressurizing of the particular item.

4-17.3 The fuel dispensing assembly or the optional tanker-truck unloading system can be depressurized by opening the valves in the flow path to the vehicle after the associated pump has been shut down an blocked in.

4-17.4 As a standard practice it is recommended that when a fuel transfer has been completed that the valve in the applicable flow line that is furthest upstream (closest to the source of fuel under pressure) be closed first and sequentially followed by the closing of the valves downstream. This will avoid the block in of fuel under pressure and thus enhance the safety of the system. A line closed off in this manner will be depressurized.

4-17.5 When a system, or a portion of a system, must be drained for maintenance the system must be depressurized first. Arrangements should be made for containers to hold the drained fuel for subsequent disposal. The closure(s) (flanges or couplings) at the lowest point(s) should then be opened first and the hose drained into the container(s). A closure at the highest point should then be opened to allow complete drainage.

SECTION IV - OPERATIONS UNDER UNUSUAL CONDITIONS

4-18 General

Operating under severe environmental conditions such as unusually cold weather, unusually hot weather, or in blowing sand and dust requires special precautions. These precautions are outlined below.

4-19 Special Precautions on Major Equipment

All major equipment items have specific technical manuals that must be referred to for the special precautions recommended for that equipment. This section supplements that information but does not replace it. The following manuals are to be referred to:

5,000 Bbl. Fabric Collapsible Tanks -
ILC Dover, Inc. technical manual

50,000 Gal. Fabric Collapsible Tanks -
Department of the Army technical manual, TM 5-5430-210-12

600 Gpm Hoseline Pumps -
Peabody Barnes, Inc. technical manual

350 Gpm Transfer Pump -
Department of the Army technical manual, TM 5-4320-226-14

Filter Separators -
Department of the Army technical manual, TM 5-4330-211-12

Meter Strainer Assemblies -
Smith Meter, Inc. and Weamco, Inc. technical data overpacked with equipment

Floodlight Sets -
Department of the Army technical manual, TM 5-6230-210-13&P

Fire Suppression Equipment -
U.S. Marine Corps technical manual, TM 07661 13-14/1 included in
Appendix A

4-20 Operations in Extreme Cold

The following extraordinary steps and precautions should be taken to prevent problems that can disrupt operations, damage equipment, or possibly cause personnel injury.

4-20.1 If equipment is shut down for any period of time, drain water off prior to freezing. Special attention should be given to:

a. Pump casings
b. Filter separators
c. Meter strainer assemblies
d. Tank bottoms

4-20. Routinely remove snow and ice from:

a. Tank vents
b. Tank tops
c. Meter strainers
d. Filter separator assemblies
e. Pumps and engines
f. Floodlight sets

4-20.3 Engine Crankcases

install block heaters in engine crankcases. These can be operated off the floodlight set generators. If block heaters cannot be utilized, run the engines routinely.

4-20.4 Hoselines

if extremely cold, the hoselines may become stiff and more brittle. Special care should be taken not to bend too sharply or drive over them in this condition.

4-20.5 To help prevent snow accumulations in operating areas and on equipment under blowing snow conditions, it is recommended that snow fences be erected at appropriate locations.

4-20.6 Gasket material will be stiffer and more brittle. Take care not to install gaskets that have been damaged on this account.

4-20.7 When not in use, it will be of help to spread tarpolines over the equipment to keep snow off. The tarps must be removed before commencing operations.

4-20.8 Remove snow accumulations in areas of operation and vehicle traffic.

4-20.9 Spread sand and salt in icy areas, particularly around operating equipment and in the fuel dispensing areas.

4-20.10 if operations in extreme cold are necessary, provide heated enclosures where personnel can get warm before returning to the job. Obviously, key operating positions cannot be vacated without prior relief by another qualified person.

4-21 Operations in Extreme Heat

The following precautions should be taken under conditions of extreme heat.

4-21.1 Fuels, particularly motor gasoline, will vaporize more readily. This can result in more venting at the tank vents and thus special care must be taken to avoid vent fires.

4-21.2 In extreme heat, fuels that are in storage for a long time will gas off a lot of vapor and possibly go off specification. The gravity should be checked before dispensing for use.

4-21.3 Engine operating temperatures must be watched closely. Make sure cooling systems are clean and operating efficiently.

4-21.4 When appropriate, provide sun shelters for personnel.

4-22 Operations in Blowing Sand and Dust

The following precautions should be taken under conditions of blowing sand or dust.

4-22.1 Regularly remove accumulations of sand and dust from equipment and within tank berms.

4-22 Operations in Blowing Sand and Dust - Cont'd.

4-22.2 Make sure dust caps on tank vents are closed unless tank is actually venting.

4-22.3 Special care must be taken to avoid accumulations in engine cooling systems. Clean out routinely.

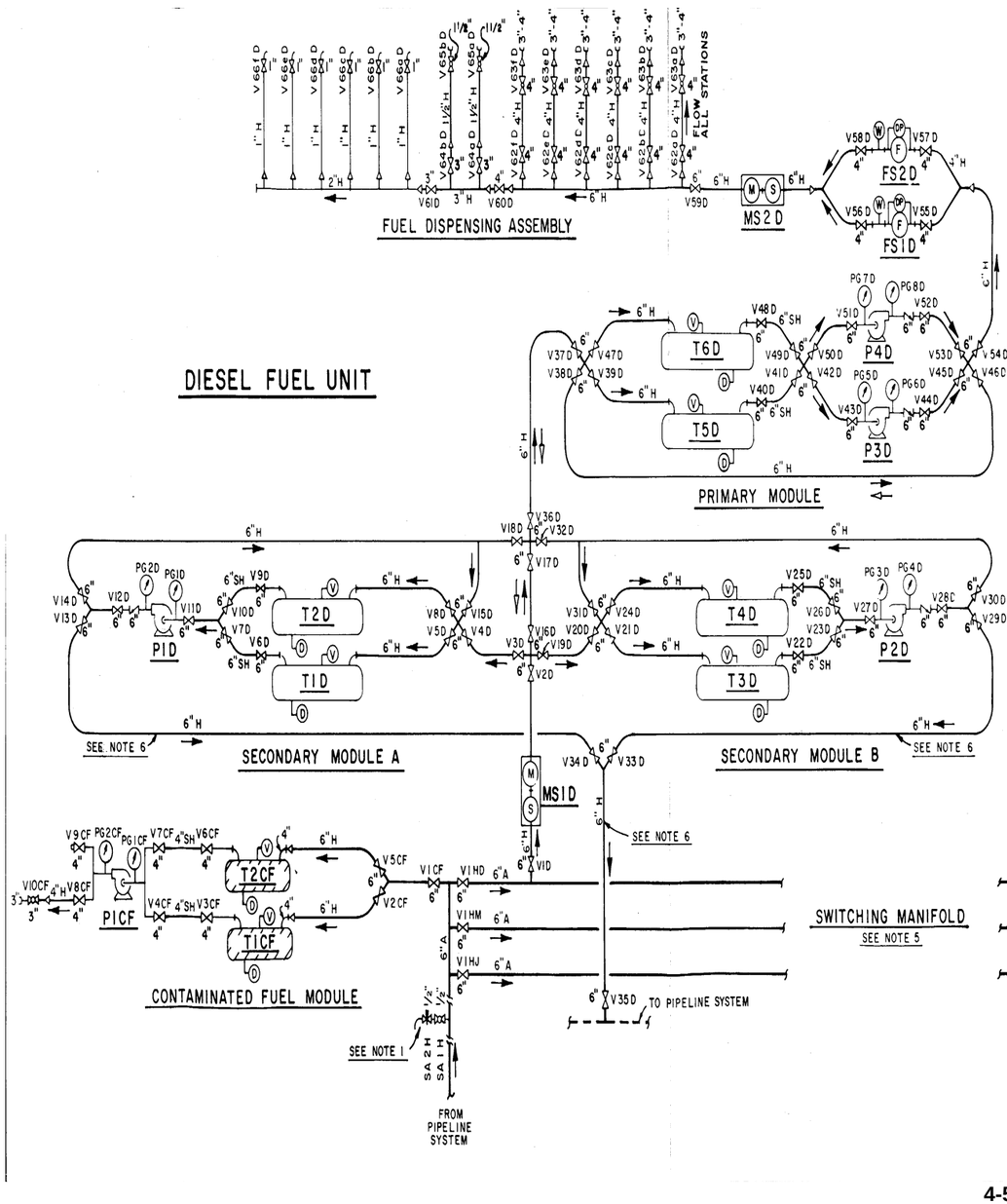
4-22.4 When fueling tanker-trucks or user vehicles, make sure no sand or dust enters the tank.

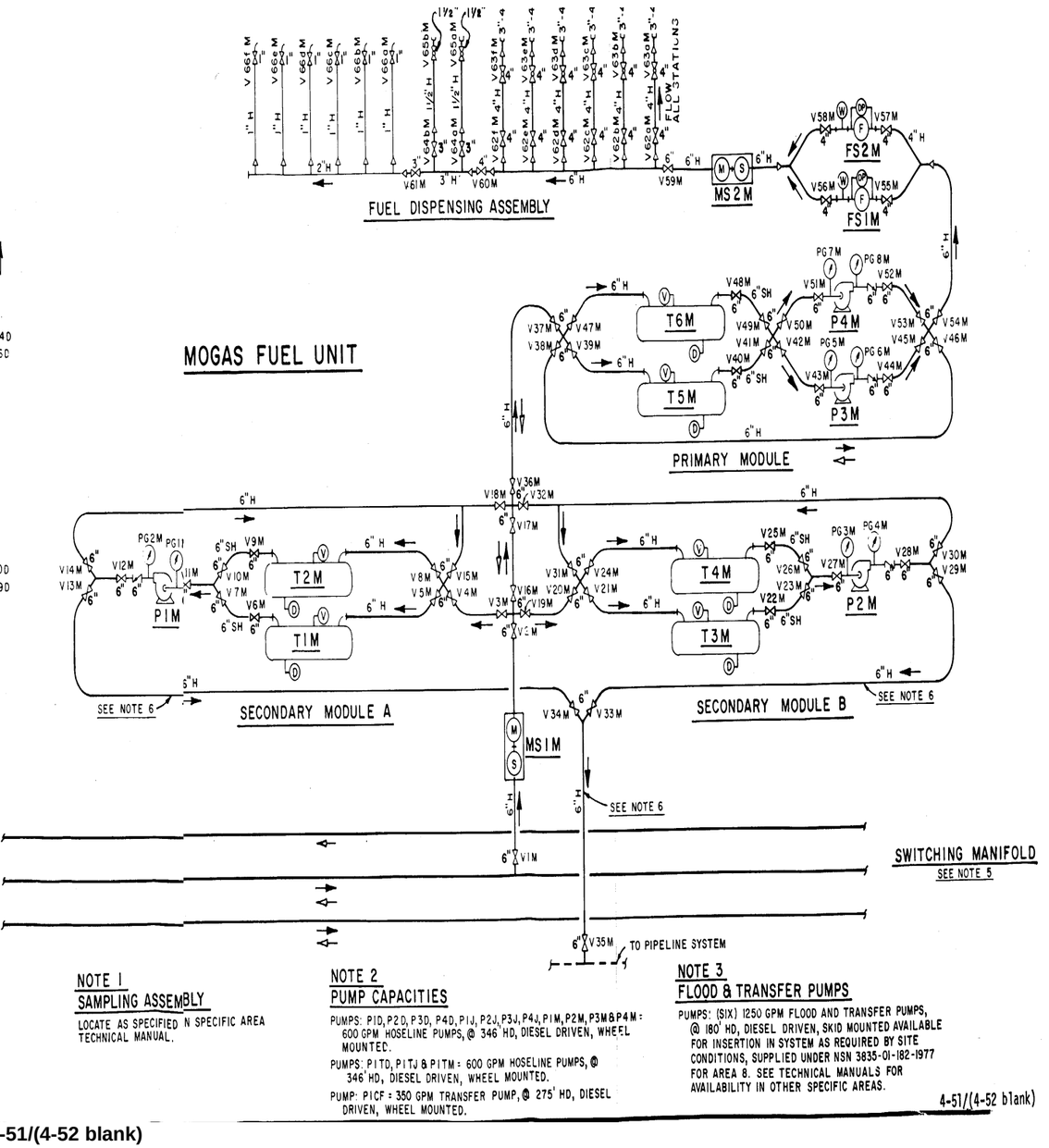
4-22.5 Take special care to avoid accumulations on moving parts.

4-22.6 Special care must be taken when opening any equipment for maintenance. Do not allow dust or sand to enter it. If it does, clean it out carefully. Do not leave equipment standing open.

4-22.8 The erection of snow fences in appropriate locations will help avoid dust or sand accumulations on equipment.

4-22.9 If conditions are very extreme, issue goggles and dust respirators to personnel .





NOTE 1
SAMPLING ASSEMBLY

LOCATE AS SPECIFIED N SPECIFIC AREA TECHNICAL MANUAL.

NOTE 2
PUMP CAPACITIES

PUMPS: P1D, P2D, P3D, P4D, P1J, P2J, P3J, P4J, P1M, P2M, P3M & P4M: 600 GPM HOSELINE PUMPS, @ 346' HD, DIESEL DRIVEN, WHEEL MOUNTED.

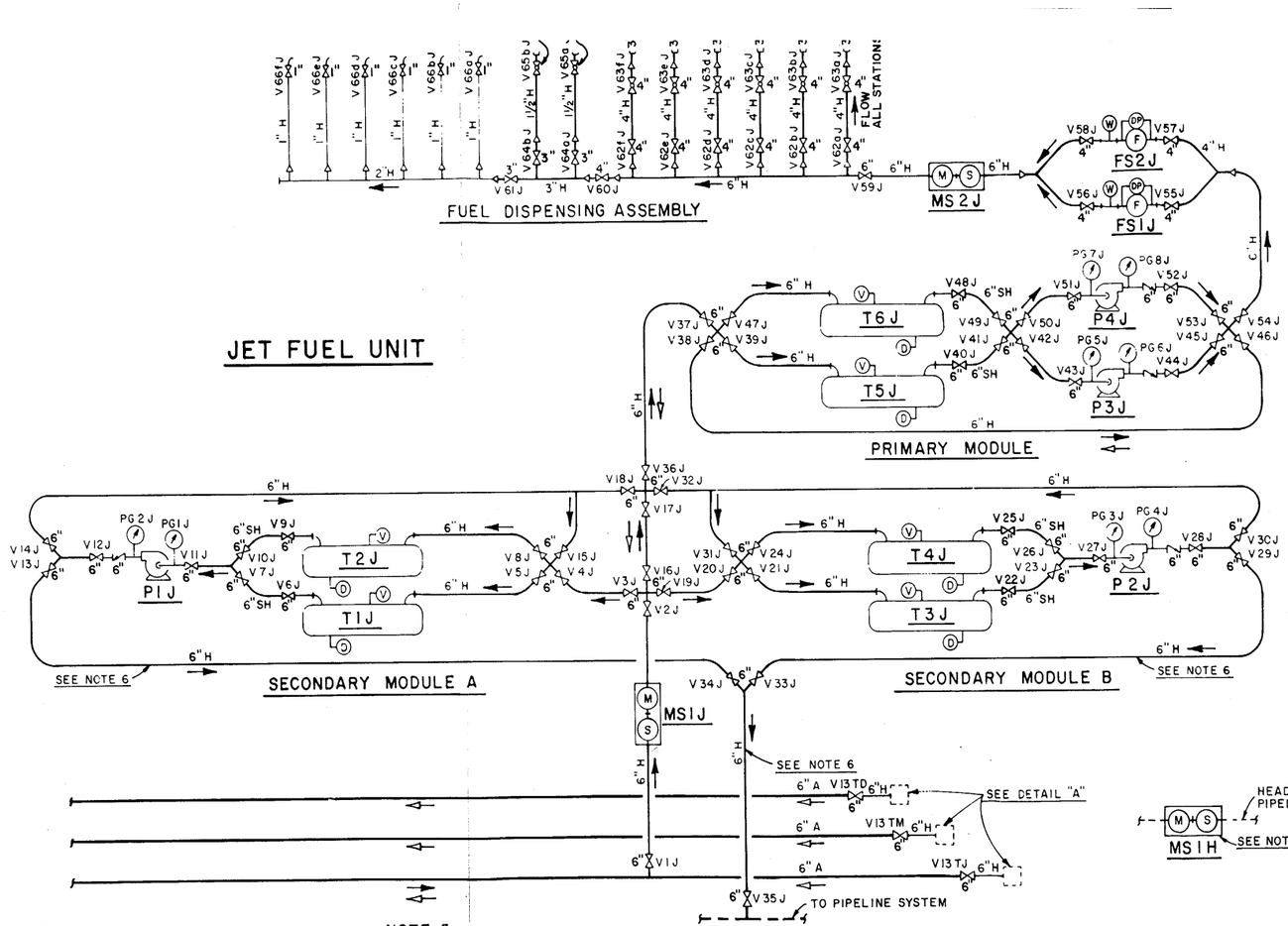
PUMPS: P1TD, P1TJ & P1TM: 600 GPM HOSELINE PUMPS, @ 346' HD, DIESEL DRIVEN, WHEEL MOUNTED.

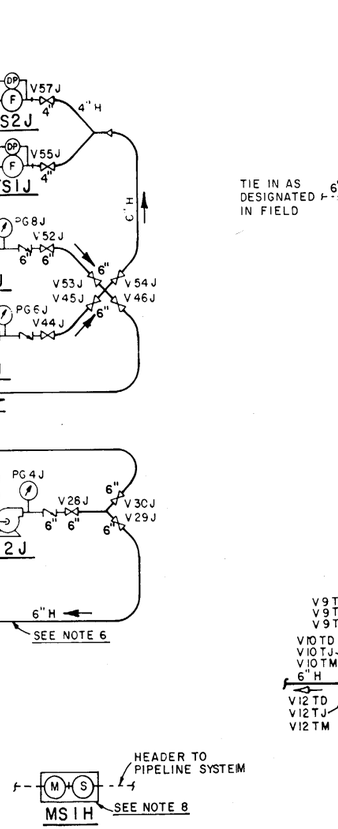
PUMP: P1CF: 350 GPM TRANSFER PUMP, @ 275' HD, DIESEL DRIVEN, WHEEL MOUNTED.

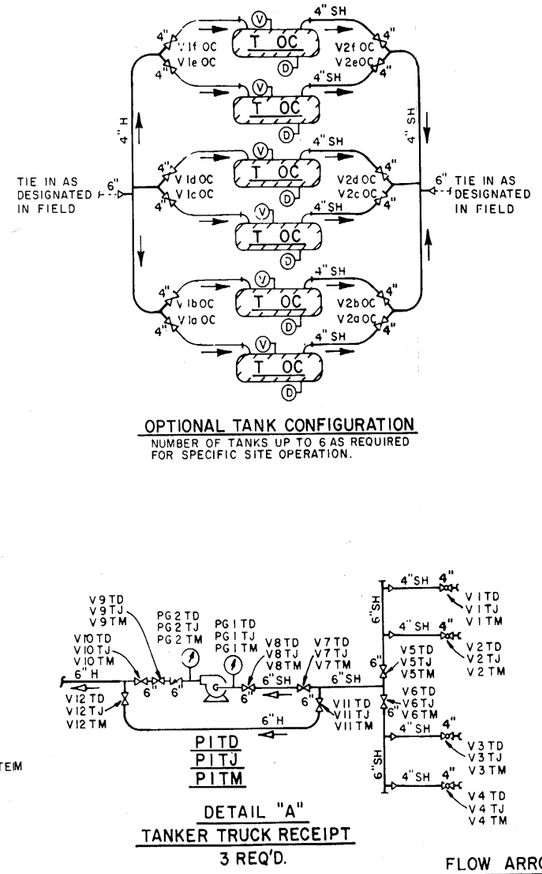
NOTE 3
FLOOD & TRANSFER PUMPS

PUMPS: (SIX) 1250 GPM FLOOD AND TRANSFER PUMPS, @ 180' HD, DIESEL DRIVEN, SKID MOUNTED AVAILABLE FOR INSERTION IN SYSTEM AS REQUIRED BY SITE CONDITIONS, SUPPLIED UNDER NSN 3835-01-182-1977 FOR AREA 8. SEE TECHNICAL MANUALS FOR AVAILABILITY IN OTHER SPECIFIC AREAS.

4-51/(4-52 blank)







OPTIONAL TANK CONFIGURATION

NUMBER OF TANKS UP TO 6 AS REQUIRED FOR SPECIFIC SITE OPERATION.

DETAIL "A"

TANKER TRUCK RECEIPT

3 REQ'D.

LEGEND

- 6"A — ALUMINUM PIPING
- SH or H — SH - SUCTION HOSE; H - DISCHARGE & TRANSFER HOSE
- 5000 BBL FABRIC COLLAPSIBLE TANK
- 50000 GAL. FABRIC COLLAPSIBLE TANK
- METER/STRAINER ASSEMBLY
- FILTER/SEPARATOR WITH DIFF. PRESS. IND.
- PUMP WITH INTEGRAL VALVES & PRESS. GAGES
- QUICK DISCONNECT COUPLING
- REDUCER
- BALL VALVE
- CHECK VALVE
- GATE VALVE
- NEEDLE VALVE
- HOSE NOZZLE
- SAMPLING ASSEMBLY
- (D) DRAIN
- (V) VENT
- (W) WATER DETECTION ADAPTER

NOTE 4

FOR INFORMATION ON VALVES AND INSTRUMENTS SUPPLIED AS PART OF MAJOR EQUIPMENT SEE MAJOR EQUIPMENT LIST 2-1.2.

NOTE 5
SWITCHING MANIFOLD

SWITCHING MANIFOLD SHOWN IS FOR A TYPICAL SINGLE TPT INSTALLATION. MODIFICATIONS MAY BE NECESSARY FOR SPECIFIC TPT SITES OR SERVICE. SCHEMATIC LENGTH DOSE NOT INDICATE ACTUAL RELATIVE LENGTH. SHORT MANIFOLD IS DESIRABLE. SEE TECHNICAL MANUALS FOR SPECIFIC AREAS FOR DETAILS.

NOTE 6
ALTERNATE FOR RECEIVING ONLY TPT

AT RECEIVING ONLY TPT'S THESE HOSELINES MAY BE LEFT OUT.

NOTE 7

SEE TECHNICAL MANUAL FOR TPT BY WILLBROS BUTLER ENGINEERS INC., CHAPTER 2, FOR DETAILS ON EQUIPMENT IDENTIFICATION NUMBERS, EQUIPMENT SPECIFICATIONS, DESIGN OPERATING PRESSURES AND DESIGN FLOWS.

NOTE 8

MS1H SUPPLIED WITH TPT. INSTALLED IN COMMON HEADER TO PIPELINE SYSTEM POSITIONED IN ACCORDANCE WITH SPECIFIC SITE TECHNICAL MANUAL.

FLOW ARROW CODE

- NORMAL FLOW
- ALTERNATIVE FLOW

WILLBROS BUTLER ENGINEERS, INC.

TYPICAL TACTICAL PETROLEUM TERMINAL PIPING & INSTRUMENT DIAGRAM WITH FLOW INDICATION

NSN 3835-01-182-1976

DWN	DATE				
CHKD	DATE				
ENGR	DATE	SCALE	PROJECT NO	DRAWING NO	REV
APPROVED				FIGURE 4-1	5

CHAPTER 5 - GENERAL OPERATIONS TROUBLESHOOTING GUIDE

OVERVIEW

This chapter outlines some of the potential operating problems that may occur, their probable cause, and the corrective actions that can be taken. Reference to the technical data contained in Chapter 2 is recommended. On equipment for which specific technical manuals published by the manufacturer or by the Department of the Army are available, it is recommended that these manuals be reviewed for troubleshooting instructions.

5-1 Troubleshooting

The best way to avoid operating and maintenance problems is to closely follow operating and preventative maintenance instruction. Even so, problems may occur. Some of the possible problems and solutions to them are as follows:

5-1.1 Flow Not Entering Tank

a. Check tank inlet valve. If closed, open it.

b. Check other valves between source and tank. If any are closed, open them.

c. If a valve fails to open, have it replaced and sent out for repairs.

d. Check all hose for kinks, leaks, or other problems. Remove kinks, isolate and repair leaks, or remove the obstruction.

5-1.2 Flow Not Leaving Tank

a. Check tank outlet valve. If closed, open it.

b. Check pump valves, inlet and discharge. If closed, open.

c. If a valve fails to open, have it replaced and sent out for repairs.

d. Check hose between tank and destination for leaks, kinks or other problems.

e. Isolate tank discharge valve and check for obstruction.

f. Check pump operation. Refer to manufacturer's technical manual.

5-1.3 Flow To or From Wrong Tank

a. Check valve positions and correct as required.

b. Check for correct hoseline routing and hookup.

5-1.4 Unexpected Tank Volume Chance

a. Check tank and surrounding area for evidence of leaks.

b. Check other tanks for change of equal volume.

5-1.4 **Unexpected Tank Volume Change - Cont'd.**

c. Check valves and hose between tank and other equipment for open valves or leaks.

5-1.5 **Leaks, Collapsible Tanks**

a. Immediately pump out the tank. Take appropriate fire protection action.

b. Inspect the tank for punctures or cuts.

c. Repair the tank in accordance with the manufacturer's technical manual.

5-1.6 **Low Pump Discharge Pressure**

a. Check pump speed. If not running at rated speed, adjust control.

b. Check suction and discharge valves. If not fully open, open them.

c. Check hose for leaks. Replace if necessary.

d. Check for obstruction in suction hose system.

e. Refer to Peabody Barnes technical manual on the 600 gpm hoseline pumps or TM 5-4320-226-14 on the 350 GPM transfer pump.

5-1.7 **High Pump Discharge Pressure**

a. Check pump speed. If too fast, adjust control.

b. Check valves from pump to destination. If not fully open, open them.

c. Check hoses for kinks or other obstruction.

d. Refer to Peabody Barnes technical manual on the 600 gpm hoseline pumps or TM 5-4320-226-14 on the 350 gpm transfer pump.

5-1.8 **Pump will not operate properly** .

a. Refer to Peabody Barnes technical manual on the 600 gpm hoseline pumps or TM 5-4320-226-14 on the 350 gpm transfer pump.

5-1.9 **Apparent Excessive Fuel Usage in Pump Engine**

a. Inspect fuel tank, fuel line and storage tank for leaks.

b. If no external cause is apparent, refer to the Peabody Barnes technical manual on the 600 GPM hoseline pump or TM 5-4320-226-14 on the 350 gpm transfer pump.

5-1.10 **Excessive Exhaust Fumes from Pump Engine**

a. Check quality of fuel being used.

b. Refer to Peabody Barnes technical manual on the 600 gpm hoseline pumps or TM 5-4320-226-14 on the 350 gpm transfer pump.

5-1.11 **High Pressure Drop Through Filter-Separator**

a. Pump operating too fast. Reduce speed.

b. Discharge line obstructed. Straighten or replace hose.

c. Filter elements require changing. Change elements. See manufacturer's technical manual for instructions.

5-1.12 **Inadequate Performance of Filter-Separator**

a. Pump not discharging smoothly. Check and adjust if required.

b. Canister screen coated or clogged. Remove and clean screen.

c. Filter elements dirty. Replace elements. See TM 5-4330-211-12.

5-1.13 **Low Pressure at Fuel Dispensing Assembly**

a. Partially closed valve on inlet. Check all valves and open fully.

b. Leak, kink or other obstruction in hose. Check all hose. Straighten, repair or replace hose.

c. Dispensing more fuel than being received. Increase pump speed or reduce deliveries.

5-1.14 **Spark (Static Discharge) at Fuel Dispensing**

a. When sparks are seen, stop dispensing operation immediately.

b. Check all bonding and grounding connections. Make certain that all connections are making bare metal-to-metal contact.

5-1.15 **Fuel Accumulation on Ground**

a. Stop operation.

b. Cover with fire-retarding foam.

c. Wash down the area thoroughly with water until all evidence of fuel is gone.

d. Cover small areas of spill with dirt.

e. Repair leak or eliminate other source.

5-1.16 **Strong Fuel Fumes**

a. When an area of strong fumes is found, get fire suppression equipment into the immediate area. Locate source and eliminate it.

b. Strong fumes may be explosive and possibly dangerous to the eyes and respiratory system. Warn personnel that must be in the area. Get unnecessary personnel out of the area.

c. Do not operate equipment in the area until the source has been located, the cause corrected, and fumes have been dissipated.

5-1.17 **Meter Not Registering**

a. Check dial and connector to meter.

b. Refer to manufacturer's technical manual.

5-1.18 **Meter Registered Flow Does Not Check with Range Pole Reading**

a. Check meter reading for accuracy.

b. Check for correct range pole installation.

c. Recheck range pole readings.

d. If meter is malfunctioning, refer to the manufacturer's manual for corrective action.

5-1.19 **Unable to Draw Fuel Sample**

a. Remove 1/2-inch tube and check for restriction. Eliminate restriction, if any.

b. When line is depressured, remove 1/2-inch needle valve and check for restriction. Eliminate restriction, if any.

c. When line is empty and depressured, remove 1/2-inch globe valve, check fitting and valve for restrictions or malfunction. Eliminate restriction or replace valve if necessary.

5-1.20 **Unreasonable Fuel Test Results**

a. Take a second sample, being careful to use a clean sample container and purging the sampling assembly well before taking sample.

b. Take a third sample very carefully and check results with different test equipment.

5-1.21 **Unexpected Back Flow**

a. Inspect associated check valve for proper installation.

b. With system depressured, remove top of check valve and check for foreign object under disk to prevent its closing.

5-1.21 **Unexpected Back Flow- Cont'd**.

c. Check disk, seat and disk hinge. Replace if damaged and send faulty valve out for repairs.

d. Check all block valves to assure that they are closed.

CHAPTER 6 - MAINTENANCE

OVERVIEW

This chapter covers lubrication, preventative maintenance, and corrective maintenance of the materials and equipment in a typical TPT. On certain major Government furnished equipment, the reader is referred to the technical manuals produced by the Government or the manufacturer. The essence of the more pertinent instructions on Government furnished equipment is covered in this manual for the convenience of the user. Section I lists the reference manuals for the Government furnished equipment. This manual will cover the maintenance of generic equipment. It is important that the reader become acquainted with the data in Chapter 2 on each piece of individual equipment. Section II covers lubrication, Section III preventative maintenance, and Section IV corrective maintenance. Appropriate illustrations are included to supplement those in Chapter 2. When appropriate, the reader is referred to more detailed data in Appendix A. This manual does not cover maintenance tools or equipment nor does it recommend the level of maintenance or the numbers and qualifications of personnel required. The intent is to cover maintenance action that would normally be assigned to operators, organizational, or direct support maintenance; however, it may in certain cases specify action that the U.S. Army chooses to assign to levels higher than the direct support level.

SECTION I-GFE EQUIPMENT REFERENCES

6-1. General

Much of the major equipment in the TPT is Government furnished and has a specific technical manual published by the Government or the manufacturer. Detailed maintenance instructions for this equipment are covered in the following referenced manuals. Other information contained in other chapters in this manual is also referenced.

6-1.1 600 Gpm Hoseline Pumps (GFE)

a. The reference technical manual is:

Installation Operation and Maintenance Instructions with Parts Breakdown

Pump Unit, Centrifugal, Hoseline, 600 Gpm, Diesel Engine Driven

Model US612ACD-1

NSN 4301-181-3429

Peabody Barn, Inc.

b. Information in this manual is in para. 2-4.3. Illustrations are Fig. 2-13 and 2-14. The performance curve is on Fig. 2-15.

6-1.2 350 Gpm Transfer Pump (GFE)

a. The reference technical manual is:

Operator's Organizational, Direct Support and General Support Maintenance Manual for Pumping Assembly, Diesel Engine-Driven, Wheel Mtd., 350 Gpm, 275 ft. Head

6-1.2 **350 Gpm Transfer Pump (GFE)- Cont'd**

NSN 4320-01-092-3551

TM 5-4320-226-14

Department of the Army

b. Information on this manual is in para. 2-4.4. The pump is illustrated on Fig. 2-16. The performance curve is Fig. 2-17.

6-1.3 **5,000 Bbl. Gal. Fabric Collapsible Tank (GFE)**

a. The reference technical manual is:

Installation, Operation, and Maintenance Manual with Parts Breakdown

NSN 5430-01-160-3528

ILC Dover, Inc.

b. Information in this manual is in para. 2-4.1. Dimensional data is on Fig. 2-11.

6-1.4 **50,000 Gal. Fabric Collapsible Tank**

a. The reference technical manual is:

Operation and Organizational Maintenance Manual

Tank, Fabric, Collapsible, POL, 50,000 Gal. (189,250 liter)

NSN 5430-00-182-8181

TM 5-5430-210-12

Department of the Army

b. Information in this manual is in para. 2-4.2. Dimensional data is on Fig. 2-12.

6-1.5 **Filter Separator (GFE)**

a. The reference technical manual is:

Operator and Organizational Maintenance Manual including RPSTL.

Filter Separator, 350 Gpm Optimum Performance

NSN 4330-00-177-8485

TM 5-4330-211-12

Department of the Army

b. Information in this manual is in para. 2-4.7 and the unit is illustrated on Fig. 2-20.

6-1.6 **Floodlight Set (GFE)**

a. The reference technical manual is:

Installation, Operation, and Maintenance Manual Including RPSTL

Floodlight Set
High-Lite Corp.
HLT-3-5K-MIL
Serial No.'s 6301A thru 6909A

NSN 6230-01-056-5238
TM 5-6320-210-13&P
Department of the Army

b. Information in this manual is in para. 2-4.11 and on Fig. 2-25.

SECTION II - LUBRICATION

6-2 Lubrication Practices

Mechanical equipment requires lubrication to overcome friction, minimize wear and damage, and to minimize corrosion. A firm lubrication procedure and schedule should be established. The main items that require lubrication are the pumps, engines and generators. Valves require some lubrication to assure their smooth operation. Pivot points on various pieces of equipment should be lubricated regularly. Closure surfaces are to be lubricated to prevent corrosion. Various unpainted surfaces should be coated with lubricant to prevent corrosion. Specific action items are coded in the left-hand column with the recommended frequency during operations as follows:

"D" -daily

"W" -weekly

"M" -monthly

"V" - variable depending on conditions

6-2.1 Pumps and Engines (GFE)

a. Detailed instructions on the lubrication of pumps and engines are contained in the technical manuals referenced in para. 6-1.1 and 6-1.2.

b. Essential lubrication practice is:

"D" 1. Before operation and each day thereafter, the engine crankcase oil levels should be checked. Add oil as necessary. If dirty, change the oil.

"D" 2. Lubricate the ether starting aid mechanism routinely after first cleaning.

"D" 3. Lubricate the tachometer drive system daily after cleaning.

"M" 4. Put light coating of grease on battery terminals routinely after cleaning.

"W" 5. Lubricate engine control pivot points routinely.

"W" 6. Lubricate valve stems, particularly the suction and discharge valves regularly.

6-2.2 **Fabric Collapsible Tanks and Appurtenances (GFE)**

a. Instructions on tank appurtenance maintenance including lubrication are in the technical manuals referenced in para.'s 6-1.3 and 6-1.4.

b. The tanks proper require no lubrication. The attachments and appurtenances that should be lubricated regularly are:

"W" 1. Valve stems

"W" 2. Pivot points on vent fittings

"W" 3. Pivot points on quick disconnect couplings

See general information on generic valves and couplings for further information.

6-2.3 **Filter Separators**

a. Detailed lubrication instructions are in the technical manuals referenced in para. 6-1.5.

b. Essential lubrication practice is:

"W" 1. Lubricate valve stems and pivot points routinely.

“V” 2. Lubricate the closure whenever it is opened up.

6-2.4 **Floodlight Set (GFE)**

a. Detailed lubrication instructions are in the technical manual referenced in para. 6-1.6.

b. Essential lubrication practice is:

"D" 1. Check engine oil daily.

"W" 2. Lubricate pivot points on the lift structure and engine controls routinely.

6-2.5 **Wheel Mounted Dry Chemical/AFFF Fire Extinguishers**

a. Detailed instructions on these units are in Appendix A, TM 07661B-14/1 (U.S. Marine Corps). Information on the trailer on which the unit is mounted is also in Appendix A immediately following TM 07661 B8-14/1. Lubrication requi rements on the fire extinguisher are minimal. The trailer should be lubricated as follows.

b. Trailer

"W" 1. Lubricate hitch with medium weight oil.

"V" 2. Check and repack wheel bearings. Normally every six months except immediately after being in water.

6-2.6 **Hose Lines and Appurtenances**

a. Hoselines proper do not require any lubrication.

b. Attached appurtenances should be lubricated as follows on a routine basis.

"W" 1. Lubricate pivot points on quick disconnect camlock couplings with a light oil routinely. See Fig. 6-1.

"V" 2. Repack 6-inch hose swivels with lubricant when evidence of too much tightness (resistance to rotation) exists. See Fig. 6-9.

"W" 3. Lubricate pivot points on grooved coupling clamps with a light oil. See Fig. 6-11 and 6-12.

6-2.7 **Aluminum Pipe and Fittings**

a. No lubrication of aluminum pipe per se is required.

"W" b. Single groove and double grooved coupling clamp pivot points should be lubricated with a light oil routinely. See Fig. 6-11 and Fig. 6-12.

6-2.8 **Valves**

"W" a. Aluminum Gate Valves.

Clean and lubricate the valve stems. Do this when the valve is open. Use a film of light oil which will not harden and will lubricate the packing as valve is operated. Never use grease. It will harden and collect dirt. See Fig. 6-19.

"W" b. Ball and Needle Valves.

No lubrication other than that provided by the stem packing is required. The packing should be replaced when it is too compressed to lubricate the valve adequately and when tightening the packing nut no longer stops a leak around the valve stem. See Fig. 6-20 and 6-21.

"D" c. Fueling Nozzles.

Lubricate pivot points and sliding surfaces lightly once per day to minimize wear. See Fig. 6-18.

6-2.9 **Meter Strainer Assemblies**

a. No routine lubrication is required for either the meter or the strainer

"V" b. When a strainer is opened, it is recommended that the closure (head) face be lubricated lightly, after cleaning, before it is replaced. See Fig. 6-23.

6-2.10 **Bare Metal Surfaces**

"V" It is recommended that any bare ferrous metal surface be lubricated by brushing or spraying on a medium grade oil to minimize corrosion. If the surface is not a sliding surface, it is preferrable that it be cleaned and painted.

6.2.11 **Standby Equipment**

Equipment that is in standby (not in regular operation) should be kept lubricated to prevent corrosion and keep it ready for start up or use. The frequency is dependent on site conditions and is a matter of judgement by operating management.

SECTION III - PREVENTATIVE MAINTENANCE

6-3 Preventative Maintenance Practices

Preventative maintenance is regularly scheduled work intended to prevent wear and tear and discover faults or problems before they become serious. The lubrication discussed in Section II is a form of preventative maintenance and is often handled in conjunction with the preventative maintenance program. Inspection is a major and most important part of preventative maintenance. Keeping equipment clean is a form of preventative maintenance. Specific actions described below are coded in the left-hand column with the recommended frequency during operations as follows:

"D" - daily (during operation)

"W" - weekly

"M" - monthly

"V" - variable depending on conditions

CAUTION

When faults in equipment are found that are beyond the scope of preventative maintenance personnel, be sure to report such faults immediately so that corrective action can be taken.

6-3.1 **Pumps and Engines (GFE)**

a. Detailed manufacturer's preventative maintenance instructions are in the technical manuals referenced in para. 6-1.1 and 6-1.2.

b. Essential preventative maintenance action is:

"D" 1. Clean up the equipment routinely. Make sure air passages are clear.

"D" 2. Check fuel filter routinely. Clean if necessary.

"W" 3. Check oil filter routinely. Replace when oil is changed.

"W" 4. Check air intake filter. Clean or replace as necessary.

"W" 5. Check belt drives.

"W" 6. Check operability and tightness of all valves and stem packing.

"W" 7. Check battery electrolyte level.

"W" 8. Clean corrosion off electrical terminals and connectors.

"D" 9. Check that grounding is in place and clean connections as necessary.

6-3.1 **Pumps and Engines (GFE) - Cont'd**

"W" 10. Check exhaust manifolding for tightness. Tighten if necessary.

"D" 11. Check vibration levels. Report changes.

"D" 12. Initiate and schedule repairs if faults are found.

"W" 13. If pump assembly is not in operation, it should be jacked over (rotated) at least once per week or briefly started.

6-3.2 **Fabric Collapsible Tanks and Appurtenances (GFE)**

a. Detailed manufacturer's preventative maintenance instructions are in the technical manuals referenced in para.'s 6-1.3 and 6-1.4.

b. Essential preventative maintenance is:

"D" 1. Clean dirt off system.

"D" 2. Check tank for flaws, scratches, tears and leaks. Repair and/or report any found.

"W" 3. Inspect berms for faults.

"W" 4. Check that berm drain is closed.

"D" 5. Check that the hose line lay is not cocking the filler/discharge connection.

"D" 6. Observe that vent valve is operable and clean.

"D" 7. Check that range poles are properly in place.

"D" 8. Check tightness of all hose connections.

"D" 9. Check for valve stem packing leaks. Tighten packing gland if necessary.

"D" 10. Check inside of berm to make sure no sharp objects that could damage tank are present.

"D" 11. Initiate and schedule repairs if faults are found.

6-3.3 **Filter Separators (GFE)**

a. Detailed preventative maintenance practice is covered in the technical manual referenced in par. 6-1.5.

b. Essential preventative maintenance is:

"D" 1. Check differential pressure. Change filter elements if necessary.

"D" 2. Check for damaged gage lines, gages, etc.

"D" 3. Clean any dirt off system.

6-3.3 **Filter Separators (GFE) - Cont'd**

"D" 4. Check for leakage.

"D" 5. Initiate and schedule repairs if faults are found.

"V" 6. Clean filter if differential pressure indicator so indicates the need.

"D" 7. Check the water detector adapter immediately downstream of the filter separator for condition and leakage. If leaking, schedule corrective maintenance. See Fig. 2-21.

6-3.4 **Floodlight Set**

a. Detailed preventative maintenance instructions are in the technical manual referenced in par. 6-1.6.

b. Essential preventative maintenance is:

"D" 1. Check engine crankcase oil. Add or change as necessary.

"D" 2. Check belts for tightness.

"D" 3. Clean the unit up.

"W" 4. Clean off electrical terminals and connections.

"D" 5. Check battery electrolyte level.

"D" 6. Check that grounding is in place and connectors clean.

" D" 7. Test unit daily before nightfall. Correct faults.

"W" 8. If unit is not in active service, the engine and generator should be jacked over (rotated) or started briefly at least once per week.

6-3.5 **Hoselines**

a. Information on hoselines can be found in Chapter 2, para. 2-5.1 through 2-5. 1J and in Fig.s 2-30, 2-31, 2-32, 2-33, 2-34, 2-35 and 2-36.

b. Preventative maintenance practice includes:

"D" 1. Check routinely, preferably while the hose is under pressure, for leaks and damage. Initiate and schedule corrective maintenance if necessary. Check that the banding on hose is in place and tight. If a serious leak is found, cause the hoseline to be depressured and schedule for immediate corrective maintenance.

"D" 2. Check that the swivels in the transfer hoselines are functioning and that hose is not twisted. Report faults for corrective maintenance.

"D" 3. Check that sandbags are in place over any section of hose subject to hose whip.

"D" 4. Check that hose roadway crossing guards are in place and not crushed or damaged. Initiate correct maintenance if necessary. See para. 2-4.10 and Fig. 2-24.

6-3.6 **Quick Disconnect Camlock Couplings**

a. Quick disconnect couplings are found throughout the system and are part of all hoselines under 6-inch diameter. A generic quick disconnect coupling is shown in Fig. 6-10.

b. Preventative maintenance practice includes:

"D" 1. Check all quick disconnect couplings for leakage. Check that cam arms are in closed position. If cam arms are not closed, close them. If leakage is evident, initiate and schedule corrective maintenance.

"W" 2. Clean dirt off unit.

6-3.7 **Grooved Couplings**

a. Grooved couplings are used in numerous positions throughout the facility as described in Chapter 2. Pipe, fittings and the adapters on 6-inch hose are double grooved. The grooving matches the grooving shown on Fig. 6-14. The coupling clamps used within the TPT are single grooved but fit the first groove from the end of the double grooved pipe and fittings. The coupling clamps used in the switching manifold are double grooved. Double grooved coupling clamps are used in the aluminum piping system only and are Government furnished equipment. While double grooved clamps and single grooved clamps are dimensionally interchangeable within the TPT, it is preferred that single groove clamps be used to reduce weight and enhance operating and maintenance convenience. Information on grooved couplings is found in Fig.s 2-37A, 2-37B, 2-37C and 2-59 in Chapter 2. Illustrations for the convenience of maintenance are shown in Fig. 6-11 and 6-12.

b. Preventative maintenance practice includes:

"D" 1. Check all grooved couplings for leakage. If leakage exists, initiate and schedule corrective maintenance unless such leakage is corrected in "2" below.

"D" 2. Check that coupling clamp handles are fully closed. If not, close them.

"W" 3. Clean off coupling assembly routinely.

6-3.8 **Aluminum Pipe**

a. The switching manifold contains 6-inch aluminum pipe with double grooved ends. The pipe is described technically in para. 2-5.2 and Fig. 2-37A. For the convenience of maintenance, Fig. 6-14 showing the double grooved end is included.

b. Preventative maintenance practice includes:

"W" 1. Inspect each section of pipe routinely. Observe the following:

a. Any deformation or dents.

b. Corrosion pitting, particularly near the couplings or other ferrous metal. Report any faults found and initiate corrective maintenance.

6-3.8 **Aluminum Pipe - Cont'd**.

"W" 2. Check switching manifold support system. Piping should be supported continuously on the ground or at minimum 6 ft. intervals. Correct faults found or initiate maintenance.

"W" 3. Clean dirt off system.

6-3.9 **Flanged Connections**

a. There are numerous flanged connections throughout the facility. The bulk of the connections are in 6-inch valve assemblies. Aluminum flange and gasket dimensions are shown in Fig. 2-58A and 2-58B. Fig. 6-17 shows how a flanged connection is made up.

b. Preventative maintenance practice is:

W"/"V" 1. Inspect all flanges routinely or when leakage is noted. Check that all bolts are in place and tight. If not tight, tighten them. Observe any indication of cracks in flange or in the weld. Note any warpage. Report same for corrective maintenance action.

"W" 2. Clean off system.

6-3.10 **Aluminum Gate Valves**

a. There are numerous 150 psig rating flanged aluminum gate valves in the system as fully described in Chapter 2, para.'s 2-5.3a, b, c, d, f, and n. Additional information is furnished in Appendix A. Maintenance practice is the same regardless of size. A cross sectional view identifying the parts and nomenclature is shown in Fig. 6-19.

b. Preventative maintenance practice is:

"D" 1. Inspect all valves routinely or when leakage is noted. Take the following action:

a. If stem packing gland is leaking, take up on the gland nut.

b. If this does not stop leakage, initiate and schedule corrective maintenance.

WARNING

Do not attempt to repack or add packing to a valve under pressure. Depressure unit and repack in the line or depressure unit, remove, and replace it. Repack out of the line.

b. Observe any cracks or warpage and initiate removal from the system.

c. If leakage shows at flanges tighten flange bolts. If this doesn't stop leakage, initiate corrective maintenance.

d. If leakage shows at bonnet flange, initiate corrective maintenance if tightening bonnet bolt does not stop it.

e. Check the operability of the valve. If faulty, initiate corrective maintenance.

"W" 2. Clean up valve.

6-3.11 **Ball Valves**

a. Ball valves are utilized at the fuel dispensing assembly and at the tanker-truck unloading spot. See para.'s 2-5.3h, j, and m and Fig.s 2-48, 2-50 and 2-53 for technical description. Complete detail is found in Appendix A (Pittsburg Brass Mfg. Co.). A typical ball valve cross section and nomenclature is in Fig. 6-20.

b. Preventative maintenance is limited to:

"D" 1. Inspect all valves and check operability routinely. Note leakage or faults. Report findings for corrective maintenance action. The packing gland nut can be tightened up to stop stem leakage. If repacking is required, it should be handled with the valve out of the system. Follow the instructions for valve adjustments found in Appendix A (Pittsburgh Brass).

"W" 2. Clean up the valve.

6-3.12 **Needle Valves**

a. A needle valve is utilized on the sampling assembly Fig. 2-22, para. 2-4.8. Detailed information is in Appendix A (Anderson, Greenwood & Co.). A cross section and nomenclature are shown on Fig. 6-21 for maintenance convenience.

b. Preventative maintenance action is:

"D" 1. Inspect valves and check operability routinely. Note leakage or faults and report findings for corrective maintenance. The packing gland nut can be tightened to stop stem leaks. If repacking is required, it should be handled with the valve out of the system.

"W" 2. Cleanup valve.

6-3.13 **Sampling Assemblies**

a. Technical information on sampling assemblies is in para. 2-4.8 and Fig. 2-22.

b. Preventative maintenance is:

"D" 1. Check the units daily to assure that they are safe and operable. Treat valves as noted in para. 6-2.11 and 6-2.12. If inoperable in any way, initiate corrective maintenance.

"W" 2. Clean up the unit.

6-3.14 **Meter Strainer Assemblies**

a. Technical information on the meter strainer assemblies is covered in para. 2-4.6 and the assembly is shown on Fig. 2-19. Detailed information on the meter is in Appendix A (Smith Meter Co.) and also on the strainer under (Weamco). The air release head attached to the strainer is in Appendix A also (Smith Meter Co.). The detailed information in Appendix A is important and should be reviewed carefully. A cross section of the strainer is shown in Fig. 6-23 for the convenience of maintenance.

b. Preventative maintenance actions recommended on the meters are:

6-3.14 **Meter Strainer Assemblies - Cont'd**

"D"/"V" 1. Check operations records daily or whenever transfers are made for any indication that meter is malfunctioning. Initiate corrective maintenance procedures if necessary.

"W" 2. Drain meter to remove any water or sediment routinely.

"W" 3. Clean unit up.

"D" 4. Check for leakage. Initiate corrective maintenance if leakage cannot be stopped by tightening bolts.

c. Preventative maintenance on the strainer and air release head is:

"D"/"V" 1. Blowdown strainer routinely to remove any accumulation of water or dirt in the body. Only a short 10-15 sec. blowdown is necessary after initial commissioning. This should be done daily if the meter is in continuous service and after every transfer if in intermittent service.

"W"/"V" 2. Remove and clean strainer routinely. Weekly check and cleaning is recommended if unit is in continuous service and after every fuel transfer if in intermittent service.

"W" 3. Clean up unit.

"D" 4. Check for leakage. Initiate corrective maintenance if leakage cannot be stopped by tightening bolts or couplings.

6-3.15 **Wheel Mounted Dry Chemical/AFFF Fire Extinguishers**

"D" Detailed instructions on the units are in Appendix A TM 07661 B- 14/1 (U.S. Marine Corps). Information on the trailer on which the unit is mounted is also in Appendix A immediately following TM 07661B-14/1. Refer solely to this information for preventative maintenance instruction. The unit should be checked for operability and condition routinely.

6-3.16 **20 lb. Dry Chemical Fire Extinguishers**

a. Detailed instructions on these extinguishers is in Appendix A (Ansul).

b. Preventative maintenance is:

"W" 1. Check that extinguishers are fully charged routinely. Recharge if necessary.

"W" 2. Check for leakage.

"W" 3. Clean and lightly lubricate the working parts of nozzle.

"W" 4. If faults are found, get a replacement unit and send faulty unit to support organization for disposition.

6-3.17 **Nitrogen Cylinders**

a. The description of the N2 cylinders is in para. 2-4.13 and TM 07661B-14/1 (U.S. Marine Corps) manual in Appendix A.

b. Preventative maintenance is:

"W" 1. Check routinely for full charge. If not fully charged, send to maintenance support organization for charging or disposition after replacing with a fully charged cylinder.

"W" 2. Clean and lightly lubricate the valve assembly.

6-3.18 **Fire Fighting clothing**

a. A description of the fire fighting clothing is in para. 2-4.13 and an illustration is in the Parts List, Chapter 8.

b. Preventative maintenance is:

"W" 1. Check routinely that clothing is stored in a clean and neat, usable condition and not damaged. Check that the full allotment is there. If short of stock or damaged, order replacements.

"M" 2. Check storage facility to assure that clothing will not be damaged by weather or dirt.

6-3.19 **General**

a. Roadways and drainage.

"V" 1. Check and repair any roadway washout or damage.

"V" 2. Unplug or reform any drainage swales or ditches that are not functioning properly.

b. Safety signs:

"D" 1. Check that all safety signs are in place as intended.

"M" 2. Inspect and touch up or repaint signs as necessary.

c. Corrosion and painting:

"M" 1. Generally clean up all corroded surfaces routinely before pitting and metal loss occurs. Monthly inspection and action is recommended.

"V" 2. Spot paint or repaint all metal surfaces that are not anodized, and not rotating or sliding surfaces subject to lubrication. Touch up scratches. The painting specification is in para. 3-32.

"D" d. Miscellaneous problems. Check with TPT operators daily and review logbook to note any maintenance related problems. Initiate action.

SECTION IV - CORRECTIVE MAINTENANCE

6-4 Corrective Maintenance Practices

Corrective maintenance is that work required to correct the faults found in the preventative maintenance program, other inspections, and that result from equipment failure. The corrective action may be replacement or it may be repair. This manual includes corrective maintenance work, as recommended by WBEI or by the manufacturer, up through the level of work that the direct support maintenance serving the facility could reasonably provide. The U.S. Army may choose to do certain work at a higher support level at their option. This manual does not cover corrective maintenance on Government furnished equipment except for the contribution of certain recommendations where believed appropriate. The reader will be referred to the specially published technical manuals for this Government furnished equipment.

WARNING
DEPRESSURE AND DRAIN

Before disconnecting or opening any equipment or system, be sure to depressure and drain it first. Serious personnel injury and fire hazards can result if you do not.

6-4.1 Pumps and Engines (GFE)

a. Refer to the technical manuals listed in para. 6-1.1 and 6-1.2.

b. It is recommended that the equipment be shut down, action be taken to determine the cause, and corrective maintenance action be taken in accordance with the technical manuals referenced above whenever the following occur:

1. Failure to pump
2. Reduced pumping capacity
3. Control failure
4. Hot running engine
5. Excessive engine noise
6. Increase from normal vibration levels
7. Fuel leakage

6-4.2 5000 Bbl Fabric Collapsible Tanks and Appurtenances

a. Refer to the technical manuals noted in para. 6-1.3.

b. It is recommended that the tank(s) be removed from service, action be taken to determine the cause, and corrective maintenance action be taken in accordance with the technical manual referenced above whenever the following occur:

1. Fuel inside the berm.
2. Tank top not laying essentially flat at the fuel level.
3. Serious scratch or scoring on the tank surface
4. Pump cannot take suction off the tank
5. Fuel not entering the tank as intended
6. Leaking tank valves
7. Leaking hoselines to or from the tank

6-4.3 **50,000 Gal. Fabric Collapsible Tanks and Appurtenances**

a. Refer to the technical manuals noted in para. 6-1.4.

b. It is recommended that the tank(s) be removed from service, action be taken to determine the cause, and corrective maintenance action be taken in accordance with the technical manual referenced above whenever the following occur:

1. Fuel inside the berm.
2. Tank top not laying essentially flat at the fuel level.
3. Serious scratch or scoring on the tank surface
4. Pump cannot take suction off the tank
5. Fuel not entering the tank as intended
6. Leaking tank valves
7. Leaking hoselines to or from the tank

6-4.4 **Filter-Separator (GFE)**

a. Refer to the technical manual noted in para. 6-1.5.

b. It is recommended that a filter-separator be removed from service, action be taken to determine the cause, and corrective maintenance action be taken in accordance with the technical manual referenced above whenever the following occur:

1. Excessive or premature pressure drop
2. Leaking head flange joint
3. Leakage of any kind
4. Excessive or premature water carryover as evidenced by sample from the water detector kit adaptor
5. Rattling nozzle when flowing

6-4.5 **Flood Light Set (GFE)**

a. Refer to the technical manuals noted in para. 6-1.6.

b. It is recommended that the tank(s) be removed from service, action be taken to determine the cause, and corrective maintenance action be taken in accordance with the technical manual referenced above whenever the following occur:

1. No power generated to lighting unit
2. Lighting tower swaying or offset
3. Excessive engine noise or vibration
4. Electrical shock when touching
5. Electrical arcing anywhere
6. Fuel leakage

6-4.6 **Wheel-Mounted Dry Chemical/AFFF Fire Extinguishers**

a. Detailed instructions on the maintenance of the wheel-mounted dry chemical/AFFF fire extinguishers are in the Marine Corps technical manual TM 076618-14/1 contained in this manual under Appendix A.

6-4.6 **Wheel-Mounted Dry Chemical/AFFF Fire Extinguisher Cont'd**

b. It is recommended that the equipment be removed from service as soon as possible (dependent on immediate safety conditions) whenever the following occur and that corrective maintenance action be taken:

1. Application hose leaks
2. Leaking tanks
3. Plugged lines
4. Malfunctioning valves

6-4.7 **Hoselines**

a. The various hoselines provided for the TPT are described in para.'s 2-5.1 through 2-5.lj and in Fig.'s 6-1,6-2, 6-3, 6-4, 6-5,6-6, and 6-7.

b. A hose repair kit is not currently part of the supply of NSN 3835-01-182-1976. The U.S. Army will, as understood by WBEI, cause the supply of a repair kit similar and expanded from that described in para. 9-23 of the Department of the Army technical manual TM 5-343 and in the Department of the Army technical manual TM 10-3835-219-13&P. The kit will cover the requirements of the six (6) inch hose predominant in the TPT as well as smaller hoses.

c. In addition to a supply similar to that described in TM 10-3835-219-13&P, a three (3) part proprietary hose clamp is under consideration and test. The principles of the clamp are shown graphic all in Fig. 6-8. The adapter portion that fits into the hose is smaller in diameter than the normal end adapter shown in Fig. 6-7 and thus easy to insert. The pressure of the-part clamp and the O-ring seal the hose to the adapter. The 3-part clamp is merely bolted in place. A key fits into a groove on the adapter to assure that the clamp is properly placed. Installation is thus simple and quick. Tests thus far indicate the repair clamp will be very useful.

d. The banded end fitting supplied with the hoselines is shown in Fig. 6-7. The adapter and hose have an interference fit and thus the adapter must be mechanically pressed in place. The .044 inch x 3/4-inch stainless steel bands are tensioned tightly around the hose sealing the hose and adapter surfaces. For reference, the tension applied to the bands on assembly was approximately 15,000 psi and caused the 0.75 inch wide band to narrow to 0.0735 inches. Tension was controlled by band width measurement.

e. In general, the repair procedures for ruptured hose described in TM 10-3835-219-13&P, para. 3-15, adapted to hose up to 6 inch are considered satisfactory and should be followed with the following qualifications.

1. It is not generally recommended that the pressure sensitive tape method of repair be used for discharge hoselines due to the pressures involved in the TPT. The procedure may be used on suction hose lines from the fabric tanks to the first block valve at a pump. The procedure may be used on discharge hoselines between the last block valve and the tank fill nozzle.

2. It is generally recommended that the 3-part repair clamp currently under consideration be used for the bulk of field repairs.

3. A badly distorted suction hose should be replaced if the distortion is such as to extensively restrict flow.

6-4.7 **Hoselines - Cont'd**

4. Cutting out the damaged section of hose and rejoining with banded adapters and couplings or with the 3-part repair clamp assemblies is preferable to any taping procedure. When cutting hose, it is recommended that the cut be made at least 3 inches back from the visible rupture or tear to assure that any torn or overstressed fabric and rubber is removed.

5. The repaired hose should be tested before submitting it to routine service.

6. When possible, repairs should be made away from the operating site in a qualified shop.

6-4.8 **Quick Disconnect Camlock Couplings**

a. Quick disconnect couplings with adaptation to various types of fittings are used throughout the TPT. A generic quick disconnect coupling is shown in Fig. 6-10. The various types of fittings are described in para.'s 2-5.4d, e, f, g and h, all manufactured to the referenced military standards.

b. If the coupling is leaking when fully closed and is not otherwise damaged, it should be opened to inspect the gasket. A mere gasket replacement will most often solve the problem.

c. If replacing a gasket does not solve the problem, it is recommended that the entire coupling (M&F) be replaced.

d. Reconditioning the coupling can be handled in a qualified, properly equipped shop. The following is a listing of possible problems and solutions.

1. Cam pins worn. Replace pins.
2. Cams worn. Replace cam arm.
3. Cam arm broken or bent. Replace cam arm.
4. Pull rings can be replaced in the field or shop as necessary.
5. If seating surfaces are scored preventing a good gasket seat, they may be reconditioned with a light machine cut and/or grinding. It is not recommended that any attempt be made to repair scored seats that require removal of more than 0.015 inches of metal and then only once.
6. Distorted coupling halves must be replaced.

6-4.9 **Grooved Coupling Clamps**

a. Information on grooved coupling clamps is on Fig.'s 6-11,6-12, and 6-13. Double grooved coupling clamps are Government furnished and are used in the switching manifold joining aluminum pipe valves and fittings. Single grooved coupling clamps are used within the TPT. Single grooved clamps fit the first groove of double grooved items. Both types of clamps are manufacturer's proprietary items and thus dimensional information is limited. The key dimensions shown are as specified in the Government issued purchase description for double grooved clamps. The double grooved clamps are manufactured by La Barge Products. The single grooved clamps are manufactured by Victaulic.

b. Recommended corrective maintenance procedures are as follows:

6-4.9 **Grooved Coupling Clamps - Cont'd**

1. If a coupling is leaking and the clamp is fully closed, it should be opened and inspected. Generally, if the clamp is not damaged, an adjustment to or replacement of the gasket will correct the problem.
2. If the clamp is damaged or worn and thus not functioning, it should be replaced.
3. The damaged or worn clamp can be repaired in a qualified and properly equipped shop as follows:

a) If a key (the projection that fits into the grooves) has a burr that prevents the clamp from closing in the groove, it may be filed or ground off.

b) If the pins are worn, they should be replaced.

c) If the handle is bent or distorted, it should be replaced.

d) If a key is broken or the clamp body is distorted, the clamp should be passed thru established maintenance channels for disposition.

6-4.10 **Hoseline Swivels**

a. Swivels are provided with the transfer hoselines to minimize twisting action on the hose. Information on the swivels is found on Fig. 2-31 and 6-9. The swivels are not designed to rotate easily, particularly in the unpressurized condition. They must, however, rotate if hose twisting is to be avoided.

b. If the swivels are not turning, they require corrective maintenance. The swivel is dissassembled as shown in Fig. 6-9. Possible causes and corrective actions are as follows:

1. Dry bearing- Clean, inspect, and repack with light grease.
2. Interference and galling - Inspect and note any galled surfaces. Dress with emery cloth, clean, lubricate and reassemble.
3. Missing or worn ball bearings - Inspect, replace all ball bearings, lubricate and reassemble.
4. Swivel leaking - Inspect and replace O-rings.
5. Leakage at couplings - Inspect and handle as in para. 6-4.9.

6-4.11 **Aluminum Pipe**

a. Six (6) inch aluminum pipe is Government furnished. The pipe is described in para. 2-5.2 and on Fig. 2-37A. For the convenience of maintenance, appropriate information is shown on Fig. 6-14.

b. Recommended corrective maintenance actions are:

6-4.11 **Aluminum Pipe-Cont'd**

1. If the pipe is scored or corroded with cuts or pits in the run of the pipe, replacement is recommended.

2. If the pipe is dented with a distortion of more than 1/4-inch from the original cylindrical shape, replacement is recommended.

3. If the grooves are broken over or any crack shows, replacement is recommended.

4. Replaced pipe may be made usuable in shorter sections by cutting off the damaged section and rerolling the grooves.

5. It is noted that a proprietary repair clamp is under consideration and test and will possibly be supplied by Army direction for primary use on the associated pipeline system. These clamps may be used to repair leaks or breaks of limited size in the run of the pipe without removal of the pipe from the system.

6-4.12 **Flanged Connections**

The pipe must be round and not badly deformed for the effective use of the repair clamp. Pipe repair clamps are not supplied with the TPT proper.

a. Flanged adapters are generally used on flanged valves to adapt to quick disconnect camlock couplings or to grooved couplings in the hose system. Standard flange and gasket dimensions are shown in Fig.'s 6-15 and 6-16. Typical flange make-up criteria is shown in Fig. 6-17.

b. It is noted that aluminum flanges and the mating flanges, whether aluminum or steel, must be flat-full faced. That is, no raised faces. The gasket must be full faced. This is due to the strength characteristics of aluminum and to avoid warpage and overstress of the. flange and its welds. In assembly make-up, it is recommended that the flange bolts and nuts be torqued to 30 ft. lbs. + 3 lbs. In any case, the flange bolts must be tightened evenly by tightening a nut approximately opposite the other until all bolts and nuts are tightened evenly.

c. Recommended corrective maintenance actions are:

1. If flange leaks slightly, first try to stop the leak by tightening the flange bolts.

2. If this does not stop the leak, disassemble the flanged connection, inspect and repair or replace as follows:

a) If the gasket is broken, bent, or crushed, replace it.

b) If the flange face is scored to a depth of less than 1/64 inch, it can be faced off (one time) in a qualified and properly equipped shop. If such facilities are not available, the flange and any integral equipment (such as a valve) should be replaced. The faulty items should be passed up thru maintenance channels for disposition.

c) If the flange is scored to a depth deeper than 1/64 inch or the flange is warped, it should be replaced. The faulty equipment item should be passed up thru maintenance channels for disposition..

6-4.13 **Aluminum Gate Valves**

a. Aluminum gate valves are used thru out the TPT system. See para.'s under 2-5.3 for technical descriptions. See Appendix A for manufacturer's data on the valves furnished (Milwaukee Valve Co. and Morrison Bros. Co.). Fig. 6-19 shows a cross section of a typical aluminum gate valve for maintenance instructional purposes.

b. Recommended corrective maintenance actions are as follows.

1. Packing gland leakage that is not stopped by tightening the packing nut indicates that repacking is necessary. To repack (after making sure the valve is depressured or alternatively removed from system), unscrew the packing nut completely. Remove the old packing. Clean out the gland and insert new packing rings. These are split rings and they can be installed without removing the hand wheel. The hand wheel may be removed first if desired. This will permit the packing nut to be removed and the packing rings may be slipped over the stem without spreading the rings. When repacked, replace and tighten the packing nut. Replace the hand wheel and return the valve to service.

2. When repacking, inspect the stem for scoring or wear. If either is present, this could be the cause of packing wear and leakage. In this case, the stem should be replaced. It is recommended that this be done in a qualified shop. See 4 below.

3. If the bonnet joint leaks and the leakage cannot be stopped by tightening the bonnet bolts, the valve must be partially disassembled to replace the bonnet gasket. To do so, remove the bonnet bolts and turn the hand wheel counterclockwise until the upper stem disengages from the lower stem. Lift off the bonnet together with the upper stem and hand wheel. Clean the bonnet seating surfaces and replace the bonnet gasket. Replace the bonnet and engage the upper stem to the lower stem threading (worm) turning the hand wheel clockwise until fully engaged. Replace and tighten the bonnet bolts.

4. If the valve will not close tightly, open fully, leaks past the valve seat, or leaks at the gland in spite of repacking, it must be removed from service, disassembled and repaired. It is recommended that valves in this condition be replaced and that the faulty valve be passed up thru maintenance channels for internal inspection, overhaul, or other disposition.

5. If valve leaks at the flanges, treat it as in para. 6-4.12.

6-4.14 **Ball Valves**

a. The ball valves supplied with the system are specified in para.'s 2-5.3h, j and m. Complete maintenance instructions are contained in Appendix A (Pittsburgh Brass Mfg. Co.) and will not be repeated in detail here. For maintenance convenience, a cross section of a typical ball valve is shown in Fig. 6-20.

b. Other than repacking or tightening the body tie bolts, maintenance of ball valves in the field is not recommended. Fortunately, the service life of ball valves is good.

1. To repack, remove the valve from service and proceed as described in the Pittsburgh Brass Co. literature in Appendix A.

6-4.14 **Ball Valves - Cont'd**

2. If the valve leaks around the body/end fitting joints, attempt to stop the leak by tightening the body tie bolts. If the leak is not stopped, proceed as in (3) below.

3. For any other malfunction, it is recommended that the valve be replaced and the faulty valve be passed up thru maintenance channels for repair or disposition. If emergency field repairs are absolutely necessary, proceed as described in the Pittsburgh Brass literature in Appendix A.

6-4.15 **Needle Valves**

a. A needle valve is utilized on the sampling assembly described in para. 2-4.8 and is shown in Fig. 2-22. Detailed information is in Appendix A (Anderson, Greenwood Co.). A cross section for maintenance convenience is shown in Fig. 6-21.

b. When a needle valve malfunctions, it is recommended that it be replaced. The malfunctioning item should be repaired, if repairable in a qualified shop. Recommended corrective maintenance procedures are as follows:

1. If the valve is leaking at the stem, the teflon packing can be replaced by removing the operating handle and the packing nut, extracting the old packing, inserting the new packing assembly, replacing and tightening the packing nut and replacing the operating handle.

2. If the valve will not hold pressure, it is recommended that it be replaced and the old unit passed up thru maintenance channels for repair or disposition.

6-4.16 **Dispensing Nozzle**

a. The 1-inch dispensing nozzles used in the fuel dispensing assembly are supplied in accordance with MIL-N-521 10, Type I, Size 1, Class B, Style 2.

b. No field maintenance other than cleaning and lubrication is recommended for safety reasons. If the unit malfunctions, it should be replaced and the old unit passed thru maintenance channels for repair or disposition. See Fig. 6-18.

6-4.17 **Sampling Assemblies**

a. The sampling assembly is fully described in para. 2-4.8 and Fig. 2-22.

b. The sampling assembly is a combination of items on which maintenance has been described. Treat the pipe as in para. 6-4.10, the ball valve as in para. 6-4.13, and the needle valve as in para. 6-4.14. The goose neck pipe should give no trouble unless bent out of shape. If bent, replace it. If plugged, unplug it. If welds are cracked or broken, replace the unit and pass up thru maintenance channels for repair of replacement.

6-4.18 **Meter Strainer Assemblies**

a. Information on the meter strainer assemblies is in para. 2-4.6 and Fig. 2-19. Detailed information on the meter and the meter register (Smith Meter Co. and Veeder Root,

6-4.18 **Meter Strainer Assemblies - Cont'd**

respectively) are in Appendix A. Detailed information on the strainer (Weamco) and the attached air eliminator head (Smith Meter Co.) is also in Appendix A. Fig. 6-23 showing the strainer and air eliminator head and Fig. 6-22 showing the nomenclature and dimensions of the meter and the register are included in this chapter for maintenance convenience.

b. Recommended corrective maintenance procedures on the meter and register are as follows.

1. Refer to the detailed information in Appendix A before proceeding with any corrective maintenance work.

2. If the meter malfunctions, the entire unit should be removed and replaced with a spare unit or with a temporary pipe spool cut to the proper length. All meter maintenance work should be done in a qualified and properly equipped shop.

3. It is not recommended that any extensive work be done under field conditions. A field shop should, however, be capable of handling the following.

a) Replace the meter register when malfunctioning.

b) Clean and flush debris from the meter body using a very light lube oil.

4. Malfunctioning meters or registers should be passed up through maintenance channels for repairs or disposition.

c. Recommended corrective maintenance procedures on the strainer are as follows:

1. Refer to the detailed information on the Weamco strainer and the air eliminator head before attempting any maintenance.

2. The most repetitive maintenance work is the removal and cleaning of the basket. To do so, remove the head bolts and lift the entire head with the air eliminator off and set it down such that the seating surfaces do not get dirty. Pull the basket up and out, empty any debris in the basket and flush the basket clean. Remove any debris present in the body. Make sure the drain is open. Replace the basket. Check the head gasket. Replace if necessary. Replace and bolt up the head.

3. If during the procedure in (2) above it is noted that the basket is broken or badly deformed, it should be replaced. The damaged basket should be passed up thru maintenance channels for disposition.

4. The air eliminator head should be inspected routinely. This can be done during the basket cleaning procedure. The air eliminator must be functional and adjusted properly to avoid having a flow of air upset the meter reading or possibly damage the meter. Refer to the detailed information and instructions in Appendix A.

5. If for some reason the strainer body or the grooves on the inlet and outlet nozzles are damaged such that safety is compromised, the entire unit should be replaced and the damaged unit passed thru maintenance channels for disposition.

6-4.19 **General Maintenance Work**

a. Pipe Threads

A number of fittings and equipment items have small diameter threaded pipe connections. All pipe threads are subject to damage from galling or mishandling. If a thread, male or female, is damaged only lightly, it can be repaired by merely chasing the thread with the proper size pipe thread die or tap. Badly damaged threaded nipples or fittings should be replaced.

b. Grounding Systems

Grounding systems are used extensively on all equipment. If the ground connection is broken, it must be promptly replaced. If the ground rod has been broken, it should be promptly replaced with one of the proper length. Broken ground cables must be promptly replaced.

c. Roadway, Berms, and Drainage

Under some conditions, corrective maintenance may be required to handle repairs to damaged roadways, tank berms, and drainage systems. Such work should be handled expeditiously due to the fact that these facilities are also required for safe and efficient operations.

d. Table 6-1, entitled Maintenance Troubleshooting, Piping, Hose, Valves and Fittings, will aid maintenance personnel in relating problems in this area to the cause and the recommended action. Most maintenance work other than on the major equipment such as the pumps will involve piping, hose, valves and fittings.

TABLE 6-1

MAINTENANCE TROUBLESHOOTING
PIPING, HOSE, VALVE AND FITTINGS

Item	Problem	Cause	Action
Discharge hose	Leak	Cut or break	1. Replace. 2. Repair removed section. Use hose repair kit. Test and reissue.
Suction hose	Leak	Cut or break	1. Replace. 2. Repair removed section. Test and reissue.
	Pinched or restricted	Crushed or distorted	1. Replace. 2. Repair removed section if possible. Test and reissue.
Hose or pipe couplings (grooved double or single)	Leak at adapter/ hose joint	Broken or loose bands	1. Replace section. 2. Repair. Replace bands. Test and reissue.
	Leak at adapter adapter	Scored or broken	1. Replace section. 2. Replace adapter off-site. Test and reissue.
	Leak at coupling	Coupling not closed	Close coupling.
		Gasket failure	Replace gasket
		Coupling clamp broken	Replace clamp and gasket.
		Coupling clamp cracked	Replace clamp and gasket.

TABLE 6-1
(Cont'd)

Item	Problem	Cause	Action
Hose or pipe couplings(grooved double or single (Cont'd)	Leak at coupling(Cont'd)	Coupling clamp distorted	Replace clamp and gasket.
		Coupling clamp pin broken	Replace pin.
		Dirt or particles under gasket	Clean and replace after inspecting gasket.
Hose coupling(cam lock)	Leak at coupling	Not closed	Close.
		Gasket failure	Replace gasket.
		Scored seating face	1. Replace hose section. * 2. Replace coupling or reface if only lightly scored. Reissue.
		Scored or broken coupling	1. Replace hose section. 2. Replace broken coupling. Reissue.
		Broken or loose bands	1. Replace hose Section. 2. Replace bands. Test and reissue.
Pipe or adapter grooves	Coupling will not close	Scored or distorted grooves	1. Replace section or piece. 2. File out or reroll groove. Reissure.
Aluminum fittings	Leak	Faulty coupling or grooves	(See pipe couplings and pipe grooves above.)

TABLE 6-1
(Cont'd)

Item	Problem	Cause	Action
Aluminum fittings (Cont'd)	Leak (Cont'd)	Porous casting	Replace
		Broken or cracked	Replace.
	Leak at flange	Failed gasket	Replace.
		Loose flange bolts	Tighten bolts.
		Scored flange face	1. Replace. 2. Replace gasket Face or build up and reface. Reissue.
	Leak at flange	Distorted flange	Replace.
	Leak at coupling	Faulty coupling, gasket	(See pipe couplings above.)
		Not closed	Close.
Aluminum gate valves	Leak at gland	Loose packing	Tighten gland nut.
		Slightly worn packing	Tighten gland nut.
		Worn packing	Add packing and tighten gland nut. (Depressure first.)
		Badly worn packing	Replace packing and tighten gland nut. (Depressure first.)

TABLE 6-1
(Cont'd)

Item	Problem	Cause	Action
Aluminum gate valves (Cont'd)	Leak at gland(Cont'd)	Scored stem	1. Replace valve. * 2. Replace stem and inspect entire valve. Test and reissue.
	Valve will not hold pressure	Scored or cracked seats	1. Replace valve. * 2. Replace seats and inspect entire valve. Test and reissue.
		Scored or broken disc	1. Replace valve. * 2. Replace gate and inspect entire valve. Test and reissue.
		Broken upper stem or lower stem threading	1. Replace valve. * 2. Overhaul valve completely replacing stems. Test and reissue.
	Valve will not hold pressure	Distorted body	Replace valve.
	Valve body leaks	Cracked or broken body	Replace valve.
Ball valves	Leak at gland	Loose packing	Tighten gland nut.
		Worn packing	Repack.
		Badly worn packing	Depressure and repack.
	Valve will not hold pressure	Worn or damaged ball or seats	1. Replace. * 2. Overhaul, replacing ball and seats. Test and reissue.

TABLE 6-1
(Cont'd)

Item	Problem	Cause	Action
Needle valves	Leak at gland	Loose packing	Tighten gland nut.
		Worn packing	Repack
		Scored seating surface	1. Replace. * 2. Overhaul, replacing parts as necessary. Test and reissue.
Piping threads All valves, fittings and pipe	Leak	Cross threaded(not badly damaged)	Disconnect, chase threads to remove burrs. Dope and reconnect.
		Badly damaged threads	Replace, or if feasible, cut short, cut off or ream and rethread.
All aluminum pipe, fittings, valves in contact with ferrous metals	Corrosion adjacent to ferrous contact -	Electrolytic corrosion	Replace if leaking. Replace if pitting beyond 1/16 inch.

NOTES: 1. Qualified and properly equipped shops required on items marked *

2. Items that are not repairable in field, or that are of questionable serviceability, should be passed up through maintenance channels for disposition.

PARTS LIST	
ITEM	DESCRIPTION
1	ADAPTER, 6 IN.
2	CLAMP, 7 IN., TYPE H
3	HOSE, RUBBER 6 IN., 250 FT.
4	COUPLING, CLAMP 6 IN. W/ GASKET
5	CAP, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT TECHNICAL MANUAL, BY WBEI, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE TRANSFER HOSE ASSEMBLY.

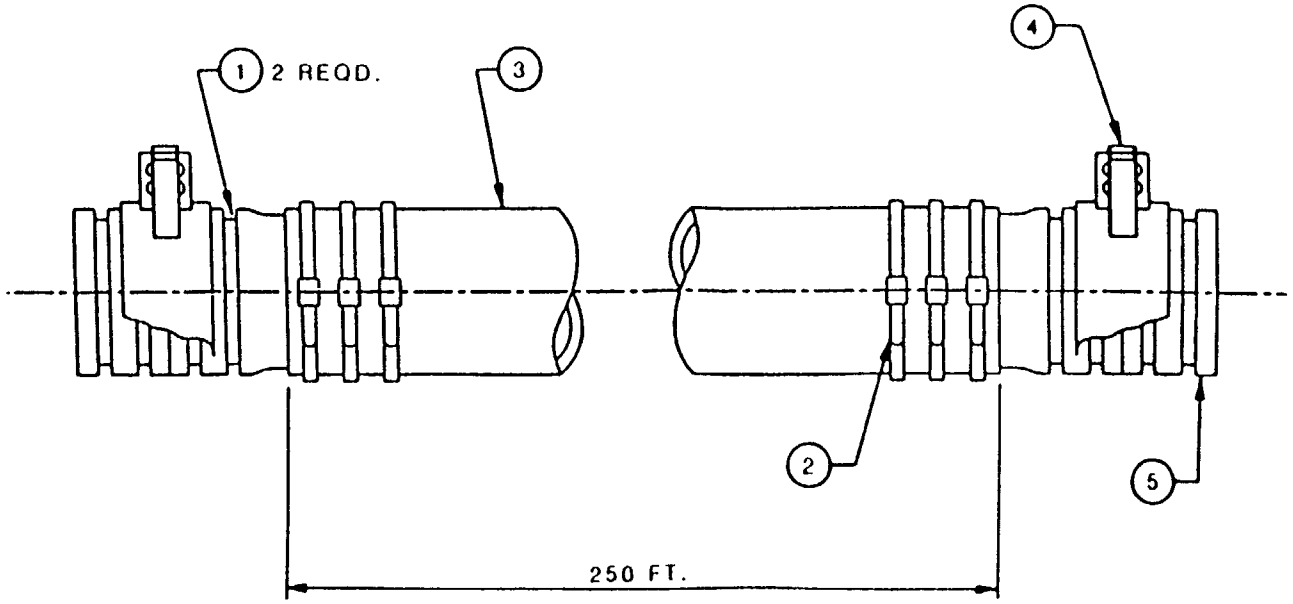


FIG. 6-1
6 INCH HOSE, LIGHTWEIGHT
DISCHARGE 250 FT.

PARTS LIST	
ITEM	DESCRIPTION
1	HOSE TO GROOVED ADAPTER, 6 IN.
2	CLAMP, HOSE
3	HOSE, 6 IN., DISCHARGE
4	COUPLING, 6 IN.
5	CAP, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE PRIMARY MODULE, SECONDARY MODULE, CONTAMINATED FUEL MODULE, FUEL DISPENSING ASSEMBLY AND THE TANKER-TRUCK RECEIPT MANIFOLD.

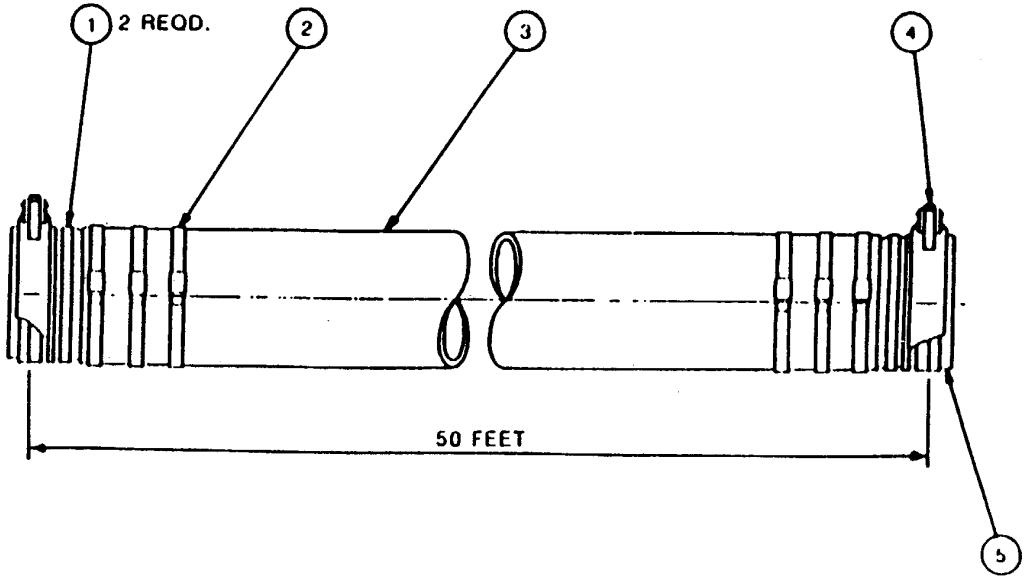


FIG. 6-2
6 INCH HOSE ASSEMBLY, DISCHARGE 50 FT.
REF: U.S. ARMY DRAWING (97403) 13226E8270
NSN: 3835-01-210-5618

PARTS LIST	
ITEM	DESCRIPTION
1	ADAPTER, HOSE TO GROOVED, 6 IN.
2	CLAMP, HOSE
3	HOSE, 6 IN., SUCTION
4	COUPLING, 6 IN.
5	CAP, 6 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE PRIMARY MODULE, SECONDARY MODULE AND THE TANKER-TRUCK RECEIPT MANIFOLD.

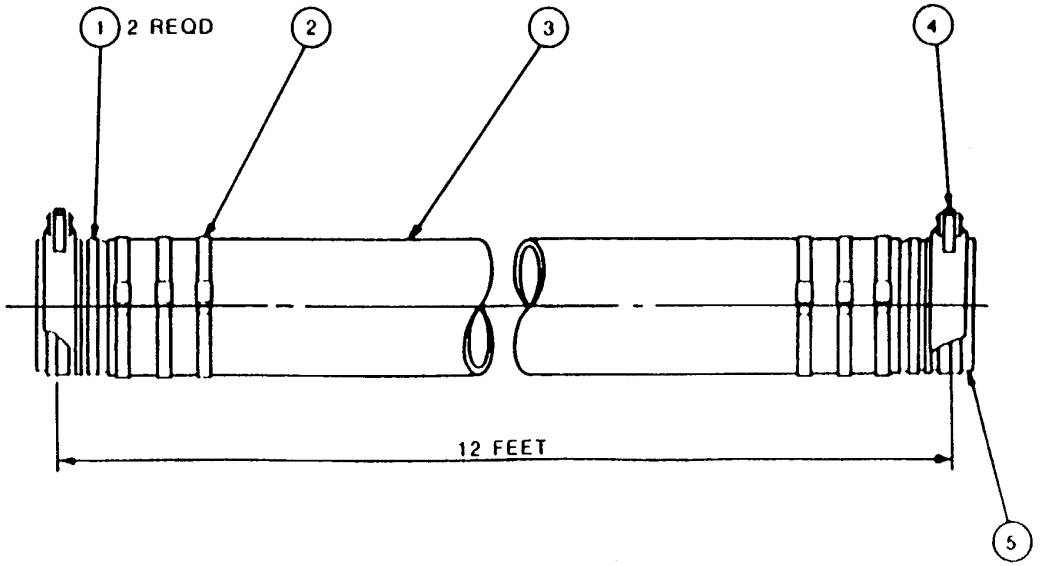


FIG. 6-3
6 INCH HOSE ASSEMBLY, SUCTION, 12 FT.
REF: U.S. ARMY DRAWING (97403) 13226E8271
NSN: 4720-01-210-5596

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, 4 IN., FEMALE
2	CLAMP, HOSE
3	HOSE, 4 IN., DISCHARGE
4	COUPLING HALF, 4 IN. MALE
5	CAP, 4 IN. CAM-LOCKING TYPE
6	PLUG, 4 IN. MALE, CAM-LOCKING
7	GASKET, CAM-LOCKING TYPE, 4 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE CONTAMINATED FUEL MODULE AND THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.

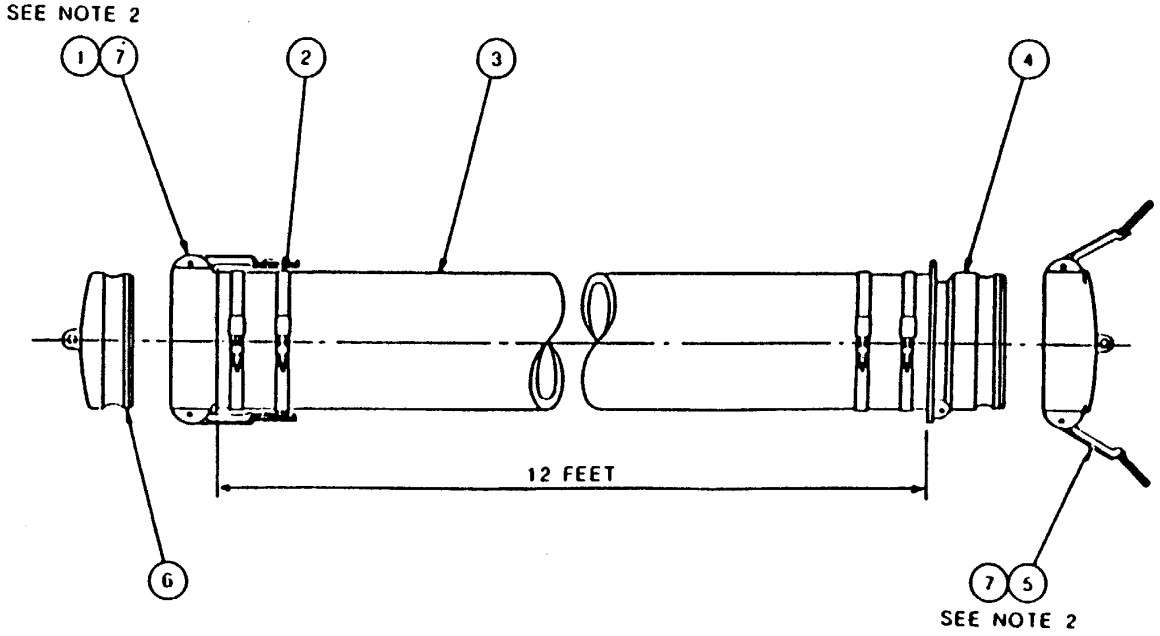


FIG. 6-4
4 INCH HOSE ASSEMBLY, DISCHARGE 12 FT.
REF: U.S. ARMY DRAWING (97403) 13226E8285
NSN: 4720-01-210-4560

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, FEMALE
2	CLAMP, HOSE
3	HOSE, DISCHARGE
4	COUPLING HALF, MALE
5	CAP, CAM-LOCKING TYPE
6	PLUG, MALE, CAM-LOCKING
7	GASKET, CAM-LOCKING TYPE

SIZE SCHEDULE		
DIA.	LENGTH "A"	NSN
4 IN.	50 FT.	4720-00-083-0046
4 IN.	25 FT.	4720-00-083-0047
3 IN.	50 FT.	4720-00-083-0048
2 IN.	25 FT.	
1 1/2 IN.	25 FT.	4720-00-901-7624
1 IN.	25 FT.	4720-00-083-0049

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE FUEL DISPENSING ASSEMB (EXCEPT 4"x50 FT.) 4 INCH ARE ALSO IN 50,000 GAL. TPT OPTIONAL TANK CONFIGURATION.

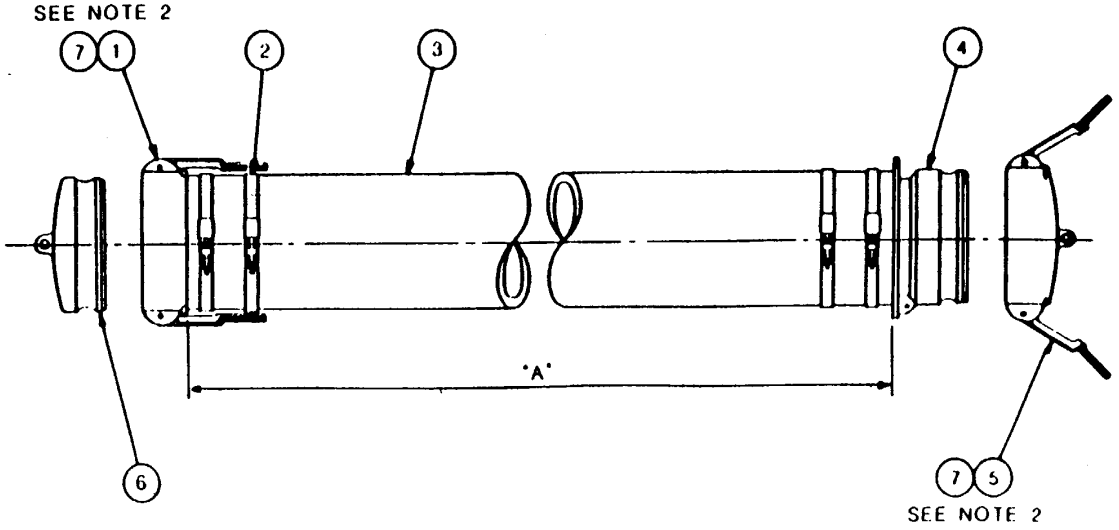


FIG. 6-5
HOSE ASSEMBLY, DISPENSING
NSN: SEE SIZE SCHEDULE FOR NSN

PARTS LIST	
ITEM	DESCRIPTION
1	COUPLING HALF, 4 IN., FEMALE
2	CLAMP, HOSE
3	HOSE, 4 IN., SUCTION
4	COUPLING HALF, 4 IN. MALE
5	CAP, 4 IN. CAM-LOCKING TYPE
6	PLUG, 4 IN. MALE, CAM-LOCKING
7	GASKET, CAM-LOCKING TYPE, 4 IN.

NOTES:

1. DRAWING IS FOR IDENTIFICATION AND ASSEMBLY PURPOSES. FOR DETAIL INFORMATION SEE TPT COMMERCIAL MANUAL, CHAPTER 8.
2. EACH COUPLING SHALL HAVE A CAP WITH GASKET OR PLUG.
3. FITTINGS FINISH: ALUMINUM FITTINGS SHALL BE ANODIZED AND DYED IN ACCORDANCE WITH MIL-A-8625, TYPE II, CLASS 2, SEALED. COLOR OR DYE SHALL RESULT IN AS CLOSE AS PRACTICAL, COLOR NUMBER 30277, SAND MATTE, OF FED. STD. 595
4. THIS ITEM IS A PART OF THE CONTAMINATED FUEL MODULE, TANKER-TRUCK RECEIPT MANIFOLD AND THE 50,000 GAL TPT OPTIONAL TANK CONFIGURATION.

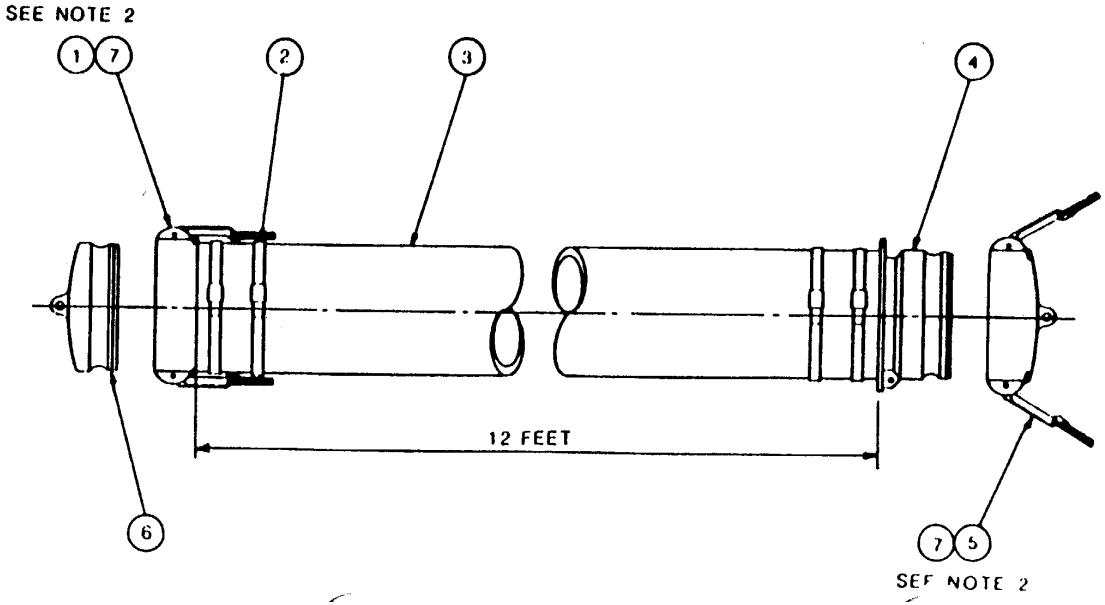
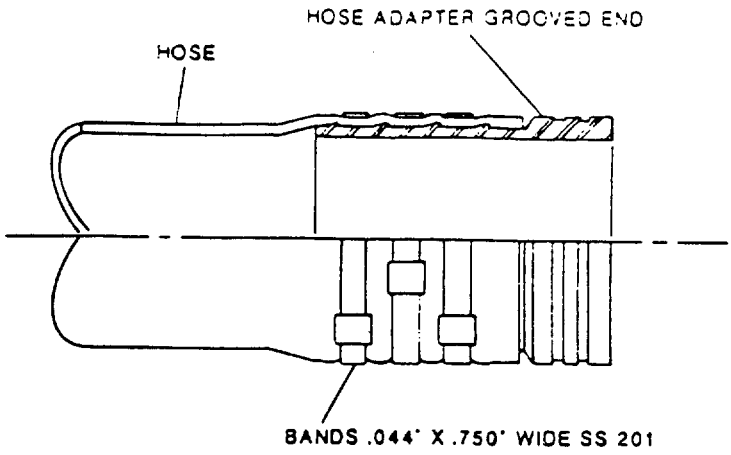
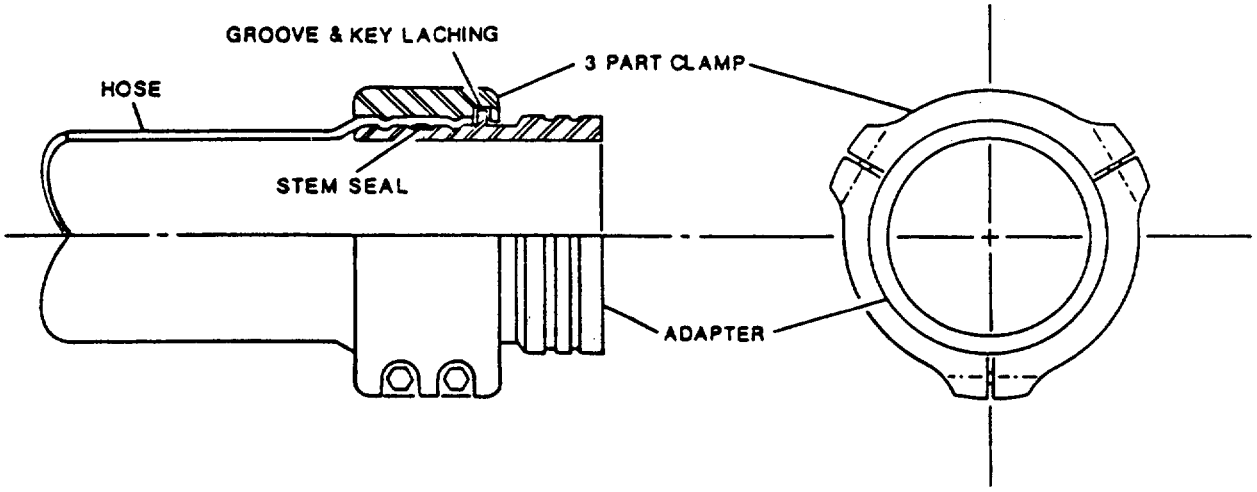


FIG. 6-6
4 INCH HOSE ASSEMBLY, SUCTION, 12 FT.
REF: U.S. ARMY DRAWING (97403) 13226E8283
NSN: 4720-00-727-1339



TYPICAL HOSE END
AS SUPPLIED
FIG. 6-7

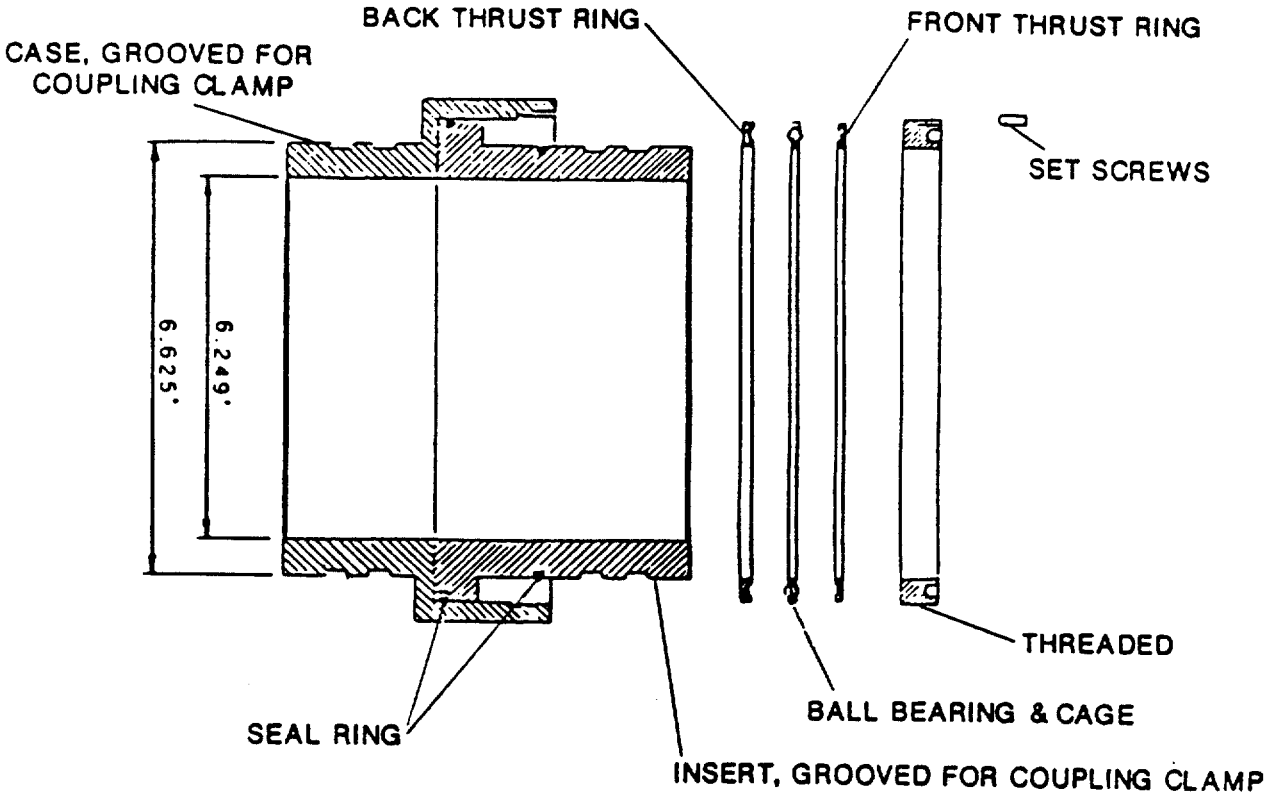


ALTERNATIVE END CONFIGURATIONS AVAILABLE
(DOUBLE GROOVED SHOWN)

(PRINCIPLE ONLY)
THREE PART HOSE

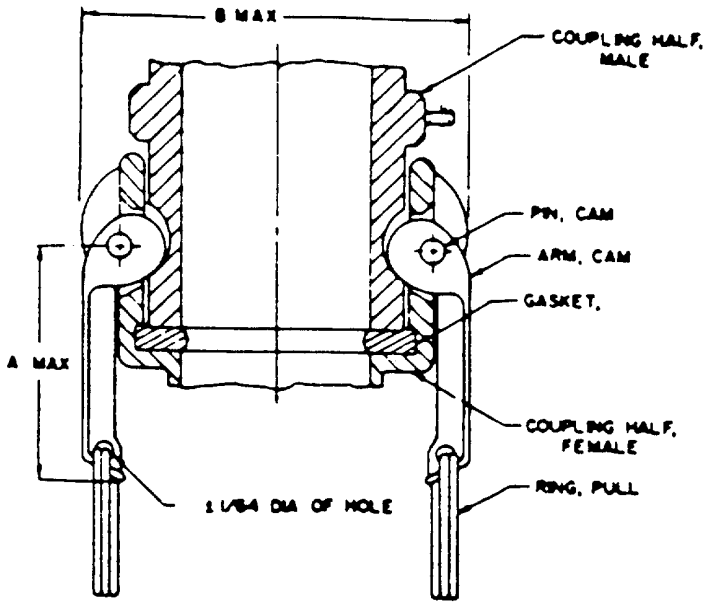
REPAIR CLAMP

FIG. 6-8



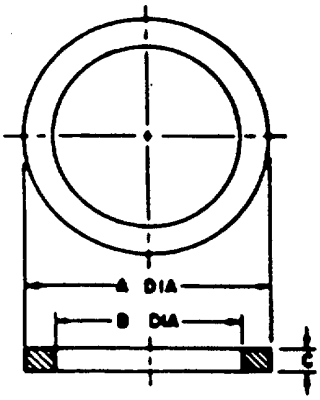
HOSELINE SWIVEL

FIG. 6-9



NOM. SIZE	DIMENSIONS		
	A	B	C
1	1-3/4	2-9/16	5/32
1-1/2	3	3-3/8	5/32
2	3	3-3/4	5/32
3	3-1/4	5-1/4	1/4
4	3-1/4	6-1/4	1/4
6	4-1/4	8-5/8	1/4

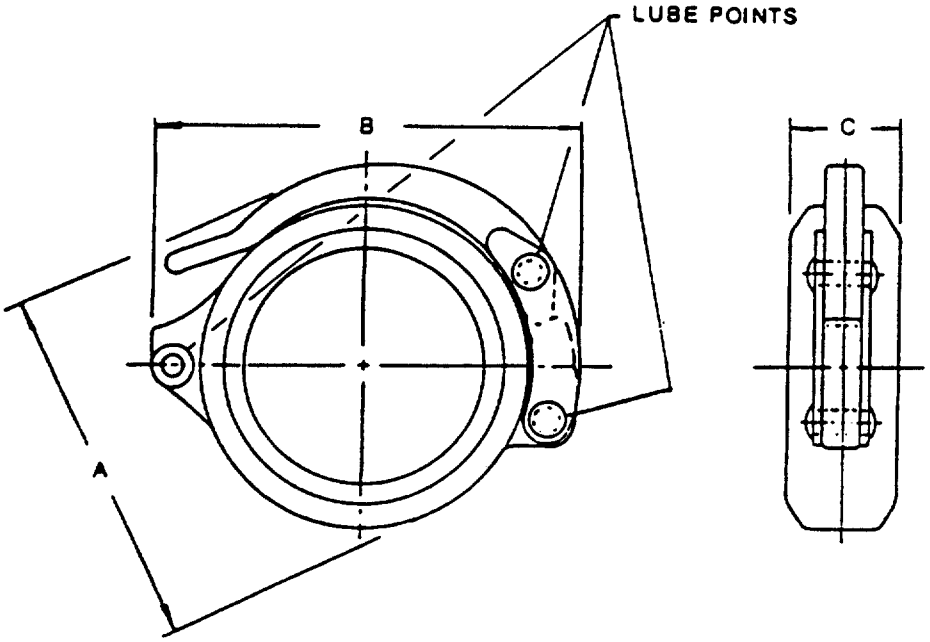
COUPLING ASSEMBLY



NOM. SIZE	DIMENSIONS		
	A	B	C
1	1-9/16	1-1/16	.250
1-1/2	2-3/16	1-5/8	.250
2	3-5/8	3	.250
3	3-3/4	3	.250
4	4-7/8	4	.250
6	7-1/16	6	.250

GASKET DIMENSIONS
COUPLING ASSEMBLY
QUICK DISCONNECT, CAM-LOCK

FIG. 6-10

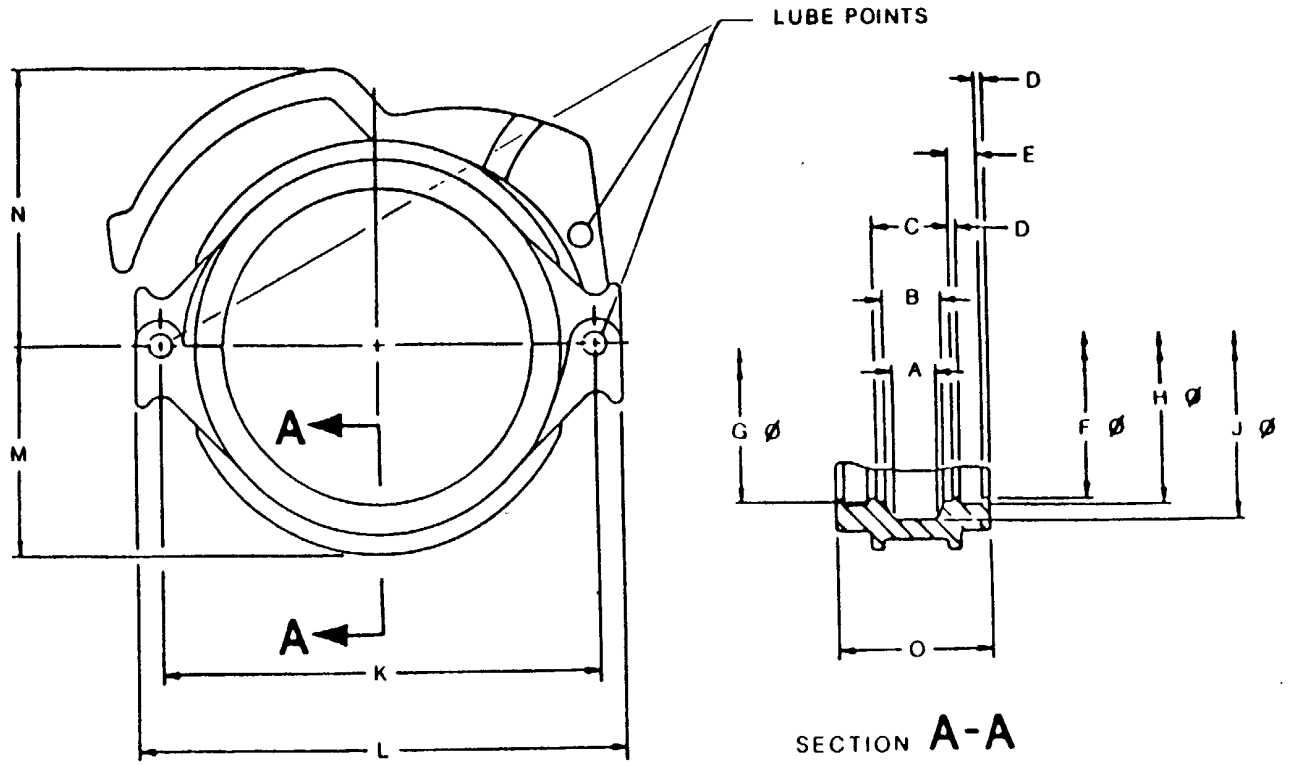


SCHEDULE

NOMINAL SIZE INCHES	COUPLING DIMENSIONS			NSN
	A	B	C	
4	6-7/8	7-3/4	2	
6	8-7/8	10-1/2	2	4730-10-209-4413

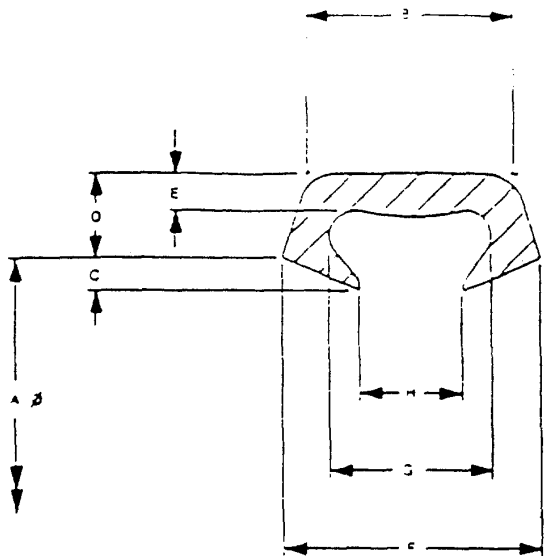
FIG. 6-11

4 INCH & 6 INCH COUPLING CLAMP
SINGLE GROOVE,
GENERAL DIMENSIONS
6-38



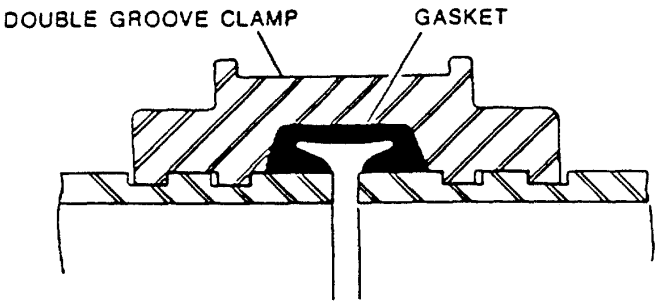
NOM SIZE		DIM A	DIM B	DIM C	DIM D	DIM E	DIM F	DIM G	DIA H	DIA J	DIM K .062	DIM L .062	DIM M .062	DIM N .125	DIM O .031
6	MAX	1.062	1.281	1.531	.202	.666	6.475	6.703	6.765	7.406	9.125	10.250	4.250	5.687	3.250
	MIN	1.000	1.218	1.468	.172	.646	6.455	6.641	6.703	7.344					

FIG. 6-12
6 INCH COUPLING CLAMP,
DOUBLE GROOVE
NSN 4730-01-181-4074

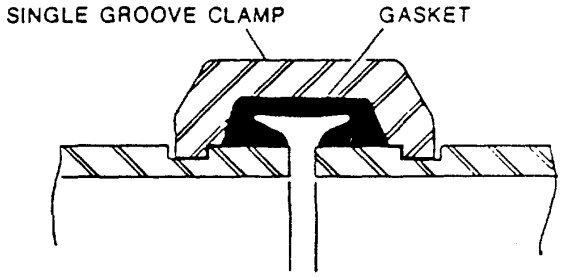


PIPE SIZE	DIA A	DIM B	DIM B	DIM C	DIM E	DIM F	DIM G	DIM H
6	6.492	.980	.153	.429	.184	1.225	.765	.490

GROOVED COUPLING GASKET



DOUBLE GROOVE GASKET
INSTALLATION

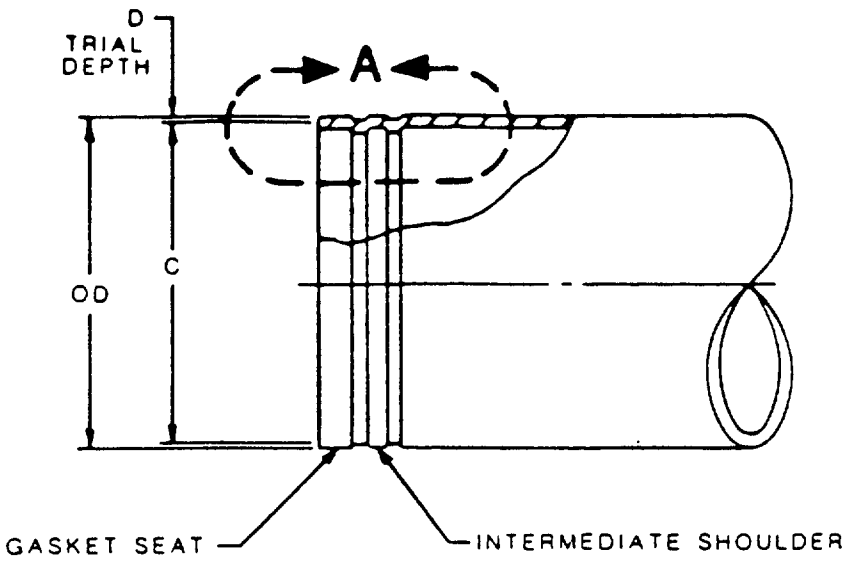


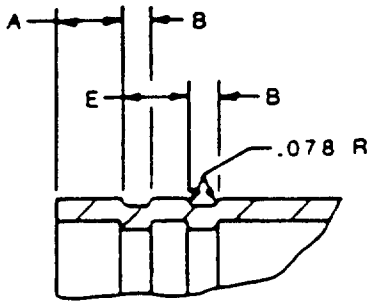
SINGLE GROOVE GASKET
INSTALLATION

NOTE: 1. GASKETS INTERCHANGEABLE
2. INNER GROOVES OF DOUBLE GROOVED CLAMPS ARE SAME DIMENSIONS AS SINGLE GROOVE CLAMPS.

GROOVED COUPLING GASKET AND INSTALLATION

FIG. 6-13





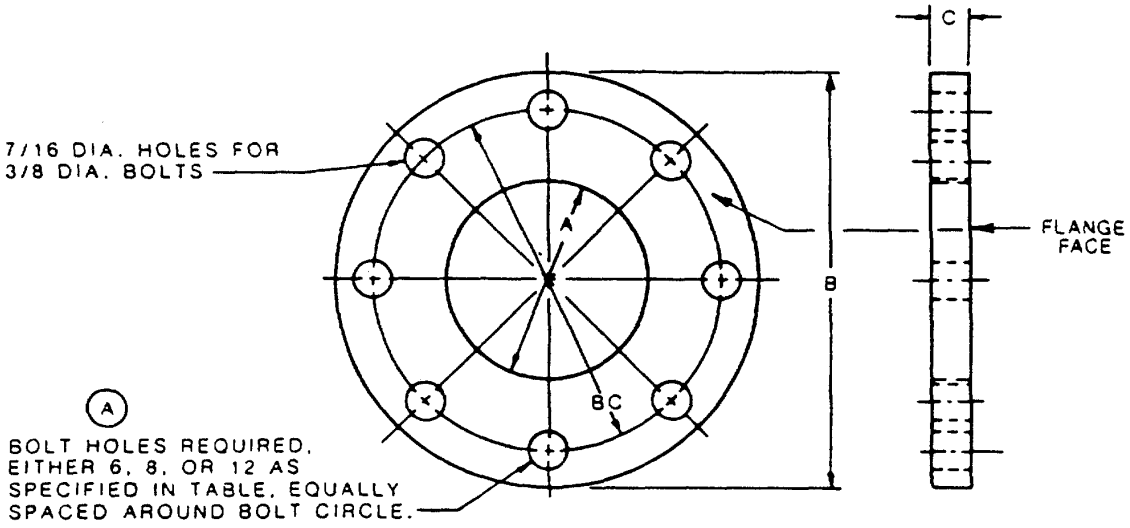
VIEW A
SCALE 1/1

NOMINAL PIPE SIZE	OD	DIM A	DIM B	DIM C	DIM D	DIM E
6	6.625 + .050 − .024	.625 ±.030	.281 +.031 −.000	6.455 + .000 − .030	.085	.656 ± .005

NOTE: PIPE SUPPLIED IN 19 FT. LONG SECTIONS. MAY BE CUT AND GROOVED TO LENGTH REQUIRED.

FIG. 6-14

6 INCH PIPE, DOUBLE ROLL GROOVED ENDS



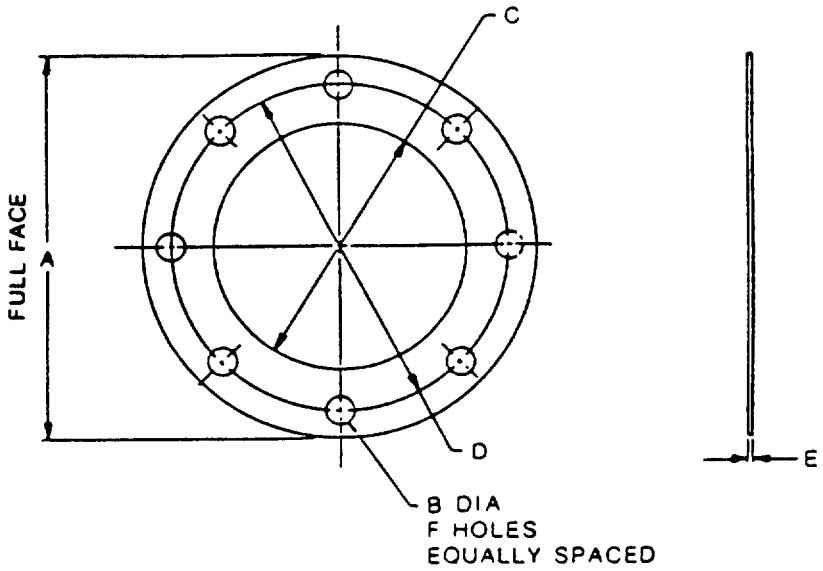
(A)

SIZE	A NOM	B	BC	C	BOLT HOLES
3	3	5-5/8	4-7/8	3/8	8
4	4	6-5/8	5-7/8	3/8	8
6	6	8-7/8	8-1/8	3/8	12

TOLERANCE ±1/64

FIG. 6-15

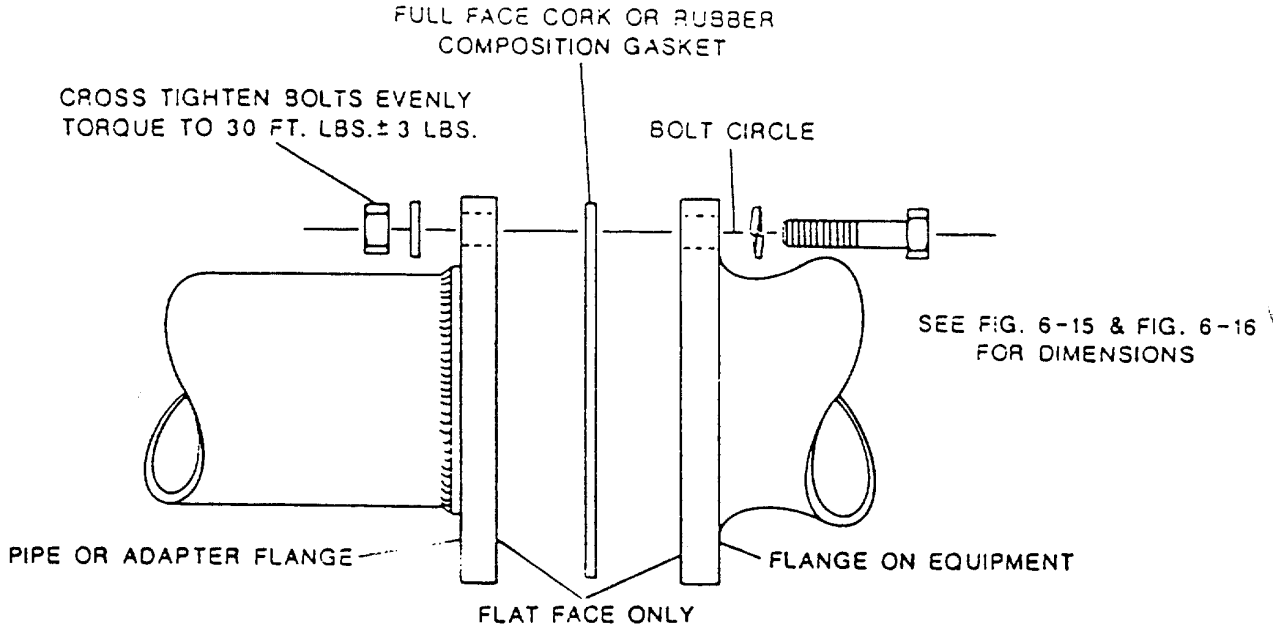
ALUMINUM FLANGE DIMENSIONS



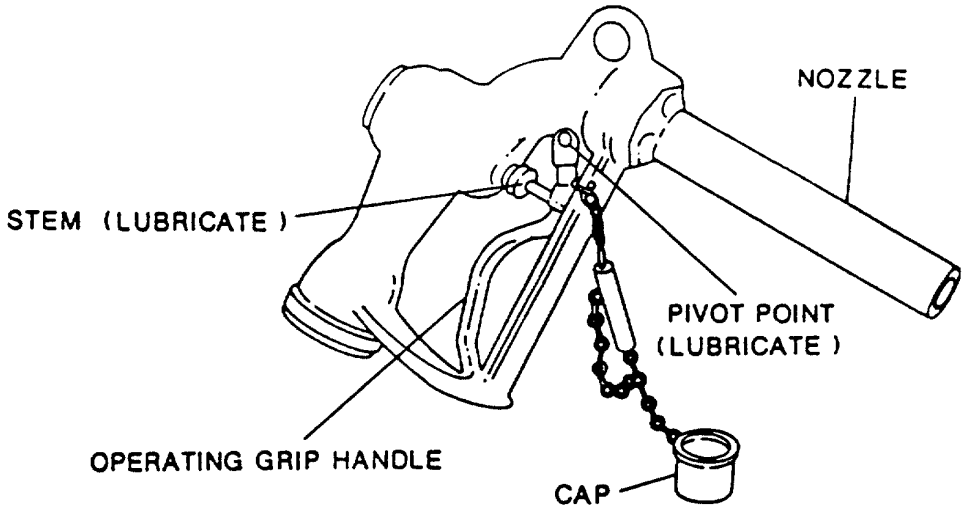
SIZE	DIA A	DIA B	DIA C	DIA D	DIA E	HOLE QTY F
3	5.75	$\frac{.450}{.435}$	3.00	4.875	$.062 \pm .015$	8
4	6.75	$\frac{.450}{.435}$	4.12	5.875	$.062 \pm .015$	8
6	9.00	$\frac{.450}{.435}$	6.00	8.125	$.062 \pm .015$	12

FIG. 6-16

FLANGE GASKET DIMENSIONS

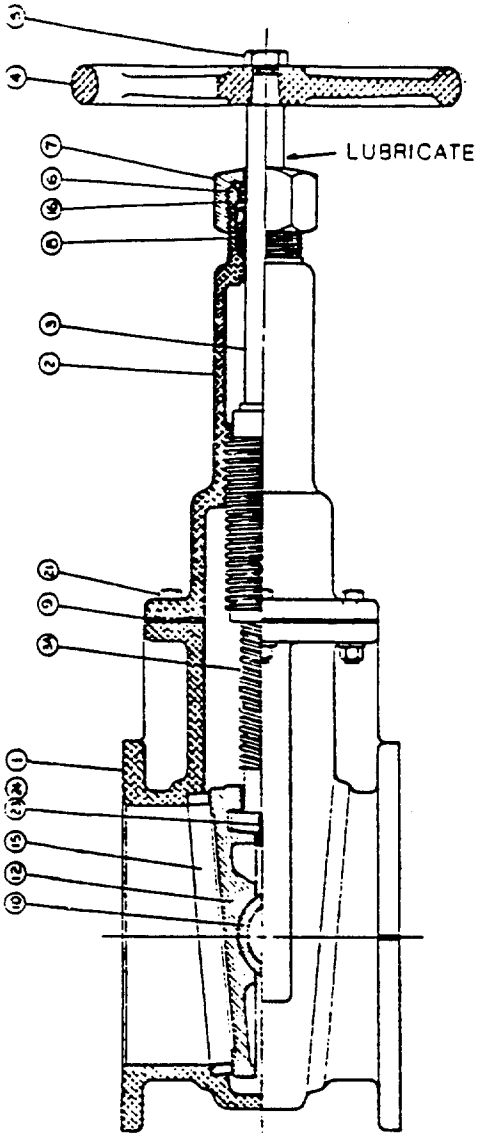


TYPICAL ALUMINUM FLANGE
MAKE UP CRITERIA
FIG. 6-17



REF. PARA 2-5.41

DISPENSING NOZZLE LUBRICATION
& NOMENCLATURE
FIG. 6-18

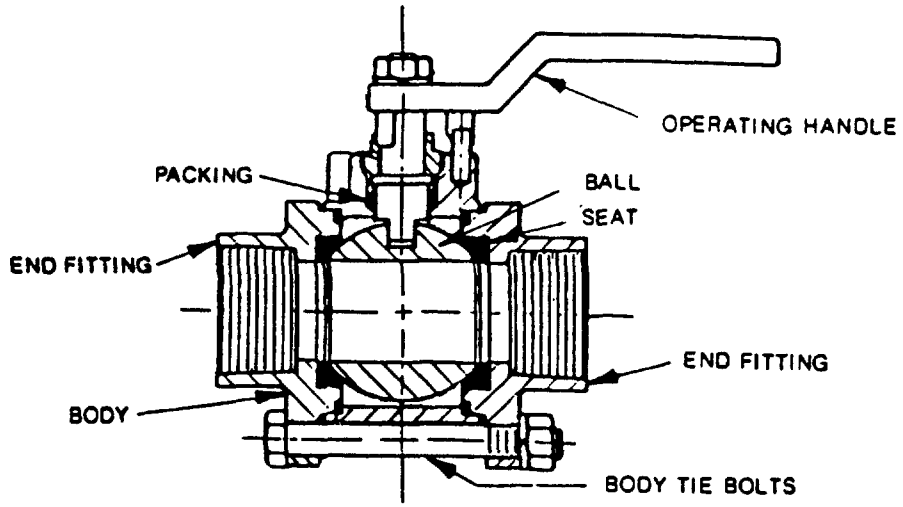


PARTS NOMENCLATURE

NO	NAME
1	BODY
2	BONNET
3	UPPER STEM
3A	LOWER STEM
4	HANDWHEEL
5	HANDWHEEL NUT
6	PACKING GLAND
7	PACKING NUT
8	PACKING RING

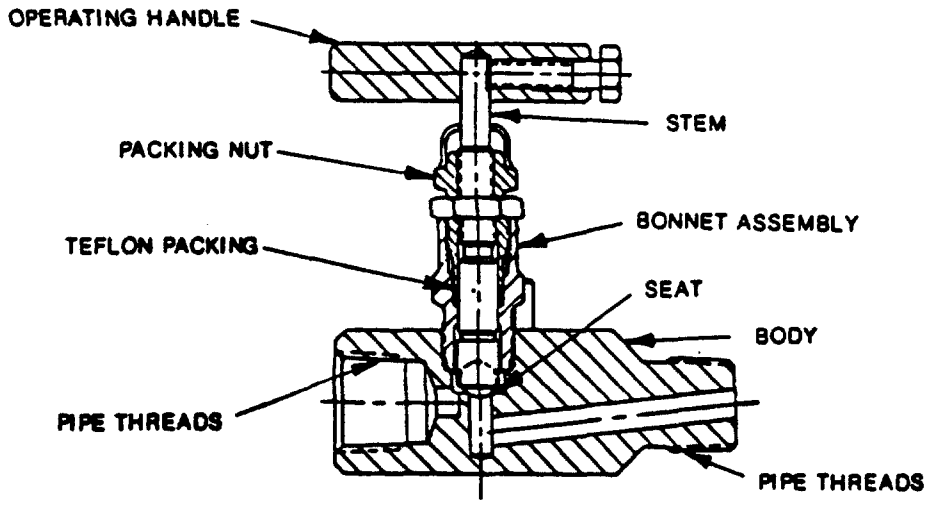
NO	NAME
9	BONNET GASKET
10	MALE DISC
12	FEMALE DISC
15	SEAT RING
16	PACKING GLAND SPRING
20	FLANGE GASKET
21	BOLT NUT & WASHER
23	LOWER STEM INSERT
24	SPRING PIN

TYPICAL ALUMINUM GATE VALVE
FIG. 6-19

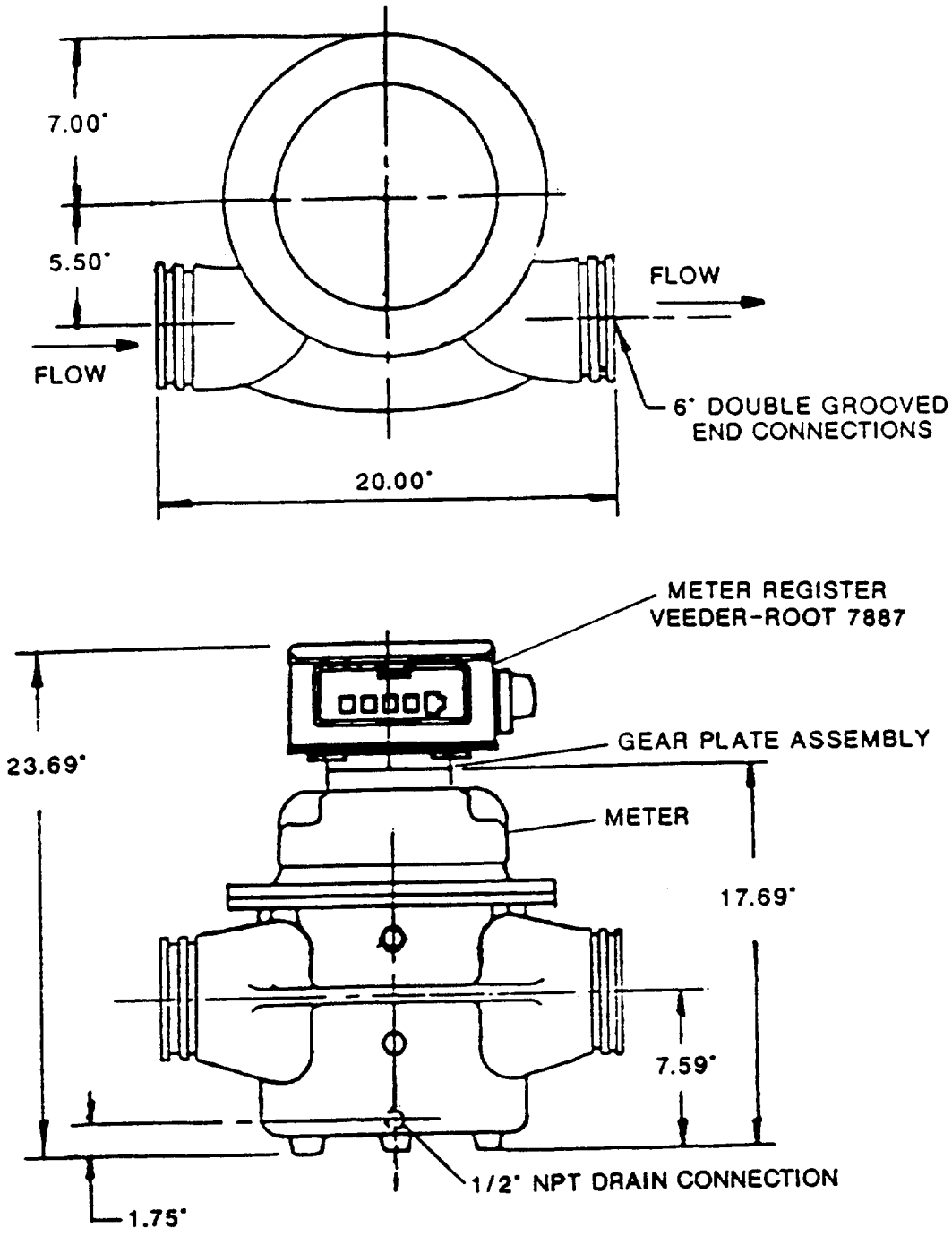


TYPICAL BALL VALVE
PARTS NOMENCLATURE

FIG. 6-20

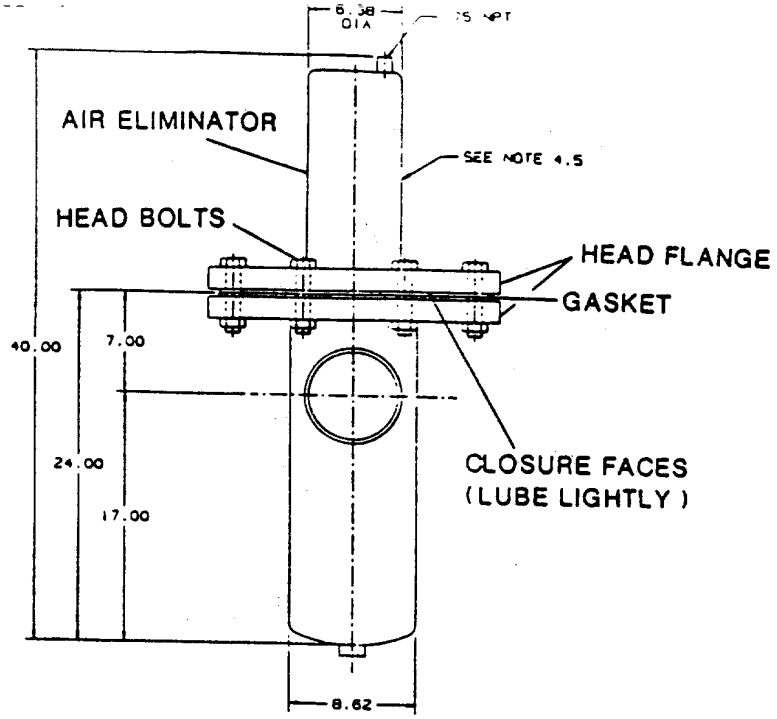


TYPICAL NEEDLE VALVE
PARTS NOMENCLATURE
FIG. 6-21



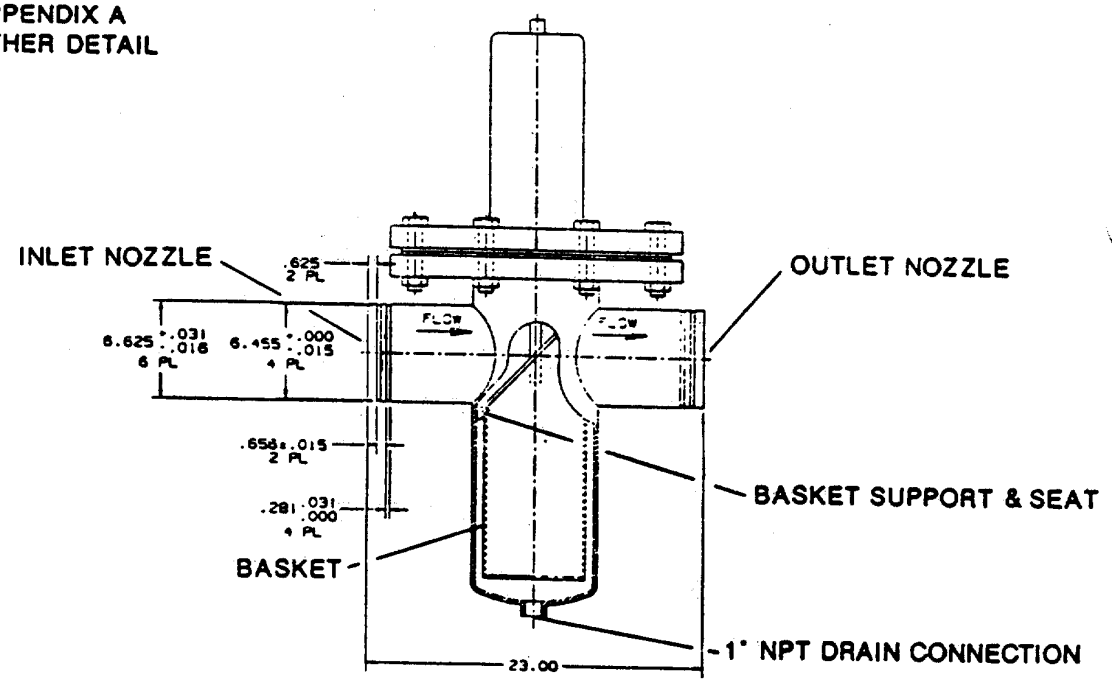
METER/SMITH METER CO.
SF-6V-NF
METER STRAINER ASSEMBLY

FIG. 6-22



DIMENSIONS IN INCHES

SEE APPENDIX A
FOR FURTHER DETAIL



TYPE FV WEAMCO
STRAINER
METER STRAINER ASSEMBLY
FIG. 6-23

CHAPTER 7 - DISASSEMBLY, PREPARATION FOR STORAGE AND SHIPMENT

OVERVIEW

Disassembly of the TPT is essentially the reverse of assembly. As the equipment is disassembled, it must be cleaned, flushed (if necessary) and/or evacuated. The original shipping containers should be utilized whenever possible. The disassembled equipment should be repacked into the containers on site, as close to the location of disassembly as possible. If the original container is not available an equivalent field fabricated container or heavy duty protective wrapping should be used. It is most important that all damaged or missing equipment be noted, and this information be marked on the container. The date of disassembly should also be marked on the container. This information should also be placed inside the container with other documents.

7-1 Drain, Flush, Drv, Disassemble

a. Collapsible Fabric Tanks

1) Drain fuel from tank with pump.

2) Disconnect filler and discharge hoses from elbows, then remove elbows. Pad fitting to prevent damage to tank upon rolling.

3) Squeeze excess fuel towards low drain fitting by rolling tank. Avoid sharp creases. Inspect tank bottom frequently, removing stones, sticks and other debris which may be stuck to tank bottom.

4) Drain excess fuel from tank through drain valve. Remove sludge if necessary, using a flush of water and detergent followed by a clean water rinse.

5) Remove tank from berm. Inspect tank for damage and remove fuel from tank surface using a mild detergent solution.

6) Dry inside of tank with air. Before inflating tank, be sure to secure tank with tie-downs.

CAUTION

Sludge may give off toxic as well as explosive vapors and can cause poisoning through inhalation or skin contact. Persons cleaning tanks must be adequately protected. All electrical equipment must be explosion proof.

CAUTION

Air/fuel mixtures are potentially explosive. Use only explosion-proof electrical equipment and enforce strict "No Smoking" rules.

NOTE

For more detailed disassembly, cleaning and repacking instructions for 5,000 bbl tank, see technical manual by ILC Dover. For 50,000 gallon tank, see TM 5-5430-210-12.

7-1 Drain, Flush, Drv, Disassemble - Cont'd.

b. Suction (Non-Collapsible) Hoseline

The hose sections are to be flushed with water, then dried, capped, and tagged with NSN.

c. Discharge (Collapsible) Hoseline - 4- and 6-inch

1) The preferred procedure is to use a hoseline displacement and evacuation kit (of proper size for hose) to displace the fuel and then evacuate and collapse the hoseline for packing. Tag with the NSN. For detailed procedural instructions, see TM 5-343, Section 9-24.

2) As an alternative, the hose sections can be flushed with water, then dried, capped and tagged with the NSN.

NOTE

Without evacuating and collapsing the hose, it may not be possible to repack the hose into flaking boxes.

d. Hose Less Than 4 Inches in Diameter. Drain, allow to dry completely. Cap and tag with the NSN. Water may be used to flush the hose if required.

e. Valves and Fittings. Flush with water, allow to dry. Cap or seal open ends. Tag with the NSN.

f. Pumps, Filter Separators, and Meter Strainers Assemblies. Do storage procedures per technical manual overpacked with the equipment.

g. Aluminum Pipe Sections. Drain fuel. If necessary, flush with water and/or swab. Allow to dry and cap.

7-2 Cleaning and Marking

a. Collapsible Fabric Tanks

1) Check tank exterior for punctures, scrapes, split seams, etc. Report any damage to supervisory personnel.

2) Clean any dirt and fuel from tank surface using mild detergent solution.

3) Tag tank and overpacked equipment with their NSN's after all is cleaned and inspected.

4) On tank tag, indicate type of fuel stored and date removed from service.

NOTE

For more detailed disassembly, cleaning and repacking instructions for 5,000 bbl tank, see technical manual by ILC Dover. For 50,000 gallon tank, see TM 5-5430-210-12.

7-2 Cleaning and Marking - Cont'd.

b. Hoseline (All). Clean all fuel and dirt from exterior of hose assemblies. Tag with the NSN, if not already done.

c. Valves and Fittings. Wipe fuel and dirt from all exterior surfaces. Mark with the NSN, if not already done. Make sure gaskets are clean.

d. Pumps, Filter Separators and Meter Strainers Assemblies. Follow procedures in appropriate manual, overpacked with equipment.

e. Aluminum Pipeline Sections

1) Wipe fuel and dirt from exterior of pipe.

2) Wipe dirt and fuel from coupling clamps.

3) Tag items with appropriate NSN.

7-3 Protective Action, Repack and Mark Containers

a. Collapsible Fabric Tanks

1) Inspect tank exterior. Remove dirt, sticks and any other debris.

2) Fold the tank from each end towards middle. Do not put sharp creases in tank. Inspect bottom of tank as rolling for debris. Do not roll sticks, etc. into folds. Be sure tank is clean before folding.

3) When tank is folded, place back into original container. Pack and brace the overpack equipment in container, after appropriate protective measures have been performed.

4) Mark the container to indicate the type of fuel stored in the tank, any missing or damaged items from the overpack and the date of repacking. This information should also be written on paper and placed inside the container in a waterproof envelope where it can be found easily when the container is opened.

NOTE

For more detailed disassembly, cleaning and repacking instructions for 5,000 bbl tank, see technical manual by ILC Dover. For 50,000 gallon tank, see TM 5-5430-210-12.

b. Hoseline

1) Inspect hose exterior and fittings, noting any damage.

2) For hose sections without flaking boxes, repack into original containers. Do not coil the hose in a tighter diameter than necessary to avoid damage to the hose.

3) Mark the container to indicate any missing or damaged hose assemblies and the date of repacking. This information should also be written on paper and placed inside the container in a waterproof envelope where it can be found easily when the container is opened.

4) For hoseline in flaking boxes, pack into the original flaking box. The procedure is outlined in TM 5-343. Be sure to bend the hose carefully to utilize the full width of the box for ease in repacking. A flaking box packing tool may be available for use. Mark flaking box indicating date hose was repacked.

c. Valves and Fittings.

1) Clean and inspect the exterior of all items, noting any damage. Touch up paint if necessary. Any bare metal (valve stem, etc.) should be coated with a proper preservative. Any scheduled lubrication should be done at this time.

2) Repack items into their original containers, using blocks, etc. to brace the items to prevent movement and damage during shipment. Make sure repacking procedure will keep valves and fittings free of dirt.

3) Mark the container to indicate any damaged or missing items and the date of repacking. This information should be written on a piece of paper and attached inside the container in a waterproof envelope where it can be found easily when the container is opened.

d. Pumps, Filter-Separators, and Meter-Strainer Assemblies.

1) Do the storage procedures in accordance with the technical manual overpacked with equipment.

2) Mark containers with any missing or damaged items and date of repack. This information should be written on a piece of paper and attached inside the container in a waterproof envelope where it can be found easily when the container is reopened.

e. Aluminum Pipe Sections.

1) Inspect, noting any damage. Touch up paint if necessary. Repack sections into unitizing frame.

2) Inspect coupling clamps, noting and tagging damaged units. Touch up paint if necessary. Repack into original container. Mark container to indicate missing or damaged items and date of repack. This information should be written on a piece of paper and attached inside the container in a waterproof envelope where it can be found easily when the container is opened.

CHAPTER 8 - PARTS LIST

8-1 Introduction

This Chapter illustrates and lists the parts necessary to support and maintain a Tactical Petroleum Terminal (TPT), Model WBEI-10002, NSN 3835-01-182-1976.

8-2 Part Number and Description

The part numbers and descriptions provided in the accompanying tabular listings are used to identify assemblies, sub assemblies and component parts of the one TPT.

8-3 Explanation of Columns

The following provides an explanation of columns found in those tabular listings:

a) Column (1) indicates the National Stock Number assigned to the assembly, sub assembly or item and will be used for requisitioning purposes. Where stock numbers are not available the column is left blank.

b) Column (2) contains an abbreviated nomenclature of the next higher assembly or subassembly.

c) Column (2a) "consisting of the following components' provides additional information which describes the individual component parts of the assembly/sub assembly listed, information contained therein is:

(1) brief description of the component part.

(2) the Manufacturers Federal Supply Code (FSCM) which is a five digit code (in parentheses) in accordance with the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 AND H4-2.

(3) Part number which identifies the component part within the assembly.

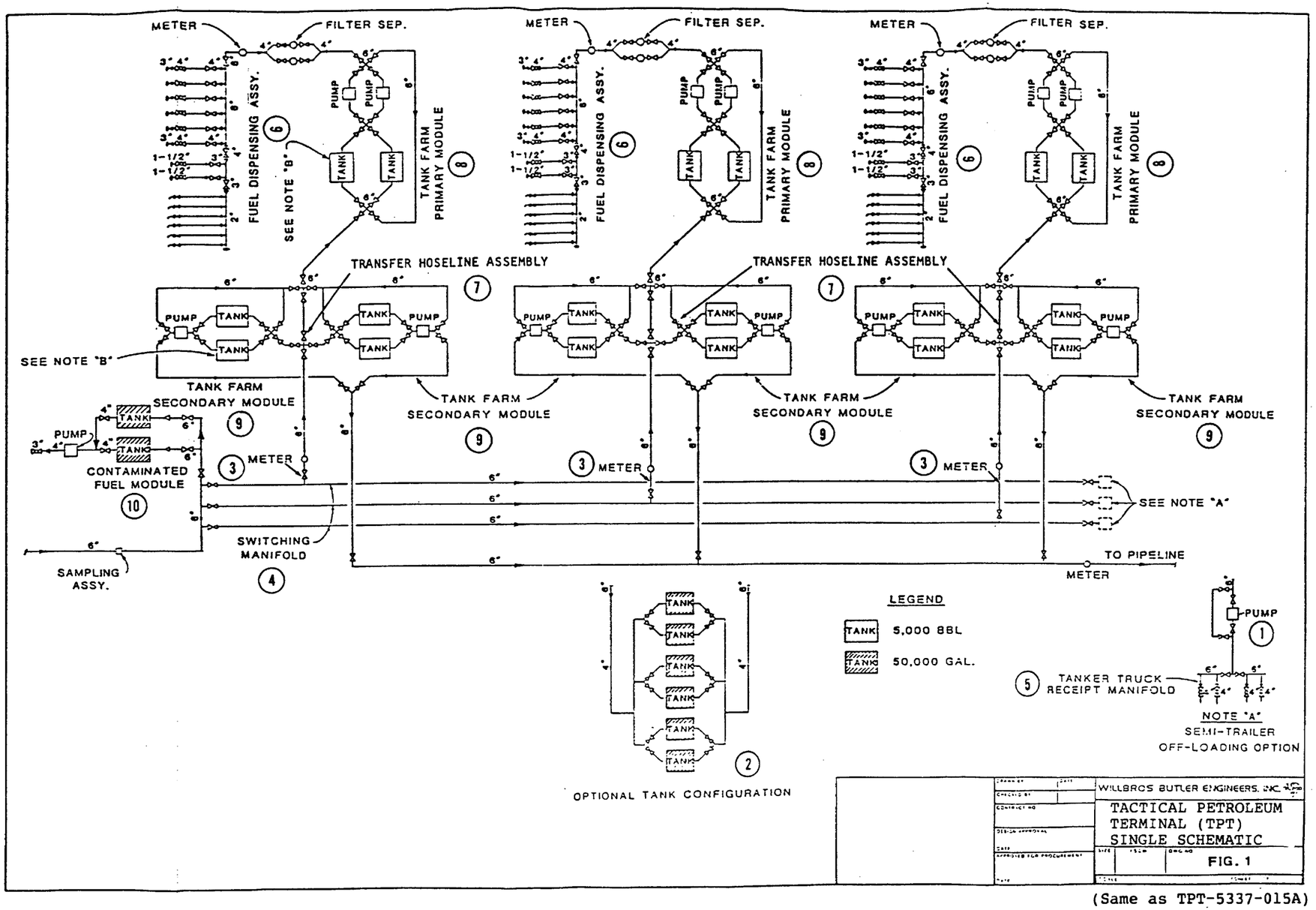
*d) Column (3) contains the drawing number listed in the description block.

e) Column (3a) lists the figure and index number identified on the corresponding illustration and indicates the location of the parts within the assembly.

f) Column (3b) shows the Unit of Issue of the corresponding part.

g) Column (3c) lists the total quantity of the given part required in the next higher assembly listed in the description block. This quantity is not necessarily the total required by the complete TPT.

*The drawing number in parenthesis below the U.S. Army drawing number is the WBEI sketch number modifying the U.S. Army drawings.



(Same as TPT-5337-015A)

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01 -182-1976	TERMINAL, PETROLEUM, TACTICAL (TPT) 210K GAL TANK	13226E8250 (REF. TPT-5357-015A)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4320-01-193-3429	PUMPING, ASSY, DED, SELF-PRIMING 600 GPM AT 150 PSI (97403) PD 4320-0014 GFE	1-1	EA	3
	50,000 GAL TANK TPT OPTION (90598) 25586-100 See Figure 31 for Breakdown	2	EA	1
	METER SKID ASSY 6 IN 800 GPM (Meter Strainer Assy) (90598) 25608-100 See Figure 35 for Breakdown	3	EA	7
3835-01-210-5593	SWITCHING MANIFOLD, 6 IN DBL GROOVE (97403) 13226E8255 See Figure 16 for Breakdown	4	EA	1
3835-01-210-5617	TANKER-TRUCK RECEIPT MANIFOLD, 6 IN (97403) 13226E8256 See Figure 14 for Breakdown	5	EA	3
4930-01-211-6835	FUEL DISPENSING ASSEMBLY (97403) 13226E8257 See Figure 18 for Breakdown	6	EA	3
3835-01-210-5613	TRANSFER HOSE L.INE ASSEMBLY, 6 IN (97403) 13226E8253 See Figure 36 for Breakdown	7	EA	3
3835-01-210-5611	TANK FARM, PRIMARY MODULE (97403) 13226E8251 See Figure 13 for Breakdown	8	EA	3

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-182-1976	TERMINAL, PETROLEUM, TACTICAL (TPT) 210K GAL TANK (CONTINUED)	13226E8250 (REF. TPT-5357-015A)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
3835-01-210-5612	TANK FARM, SECONDARY MODULE (97403) 1322668252 See Figure 8 for Breakdown	1-9	EA	6
3835-01-210-4556	CONTAMINATED FUEL MODULE (97403) 13226E8254 See Figure 2 for Breakdown	10	EA	1
4210-01-210-8728	FIRE SUPPRESSION EQUIPMENT SET (90598) 25623-100 Not Shown See Figure 37 and Vendor Data for Breakdown		EA	19
3835-01-187-1556	GUARD, ROADWAY CROSSING, 6 IN. HOSE LINE (81349) MIL-G-5307 Not Shown		EA	20
6630-01-008-5524	TESTING KIT, PETROLEUM, AVIATION FUEL CONTAMINATION, PORTABLE MIL-T-52849 (90598) 25502-1 Not Shown		EA	1
6230-01-56-5238	FLOODLIGHT SET (56681) HLT-3K-SK-MIL GFE Not Shown		EA	6

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-182-1976	TERMINAL, PETROLEUM, TACTICAL (TPT) 210K GAL TANK (CONTINUED)	13226E8250 (REF. TPT-5357-01 SA)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
8105-00-935-7101	BAGS, SAND: POLYPROPLENE PACKED 1000 BAGS PER EACH UNIT (TBD) MIL-B-52472B (ME) Not Shown	1-	EA	10

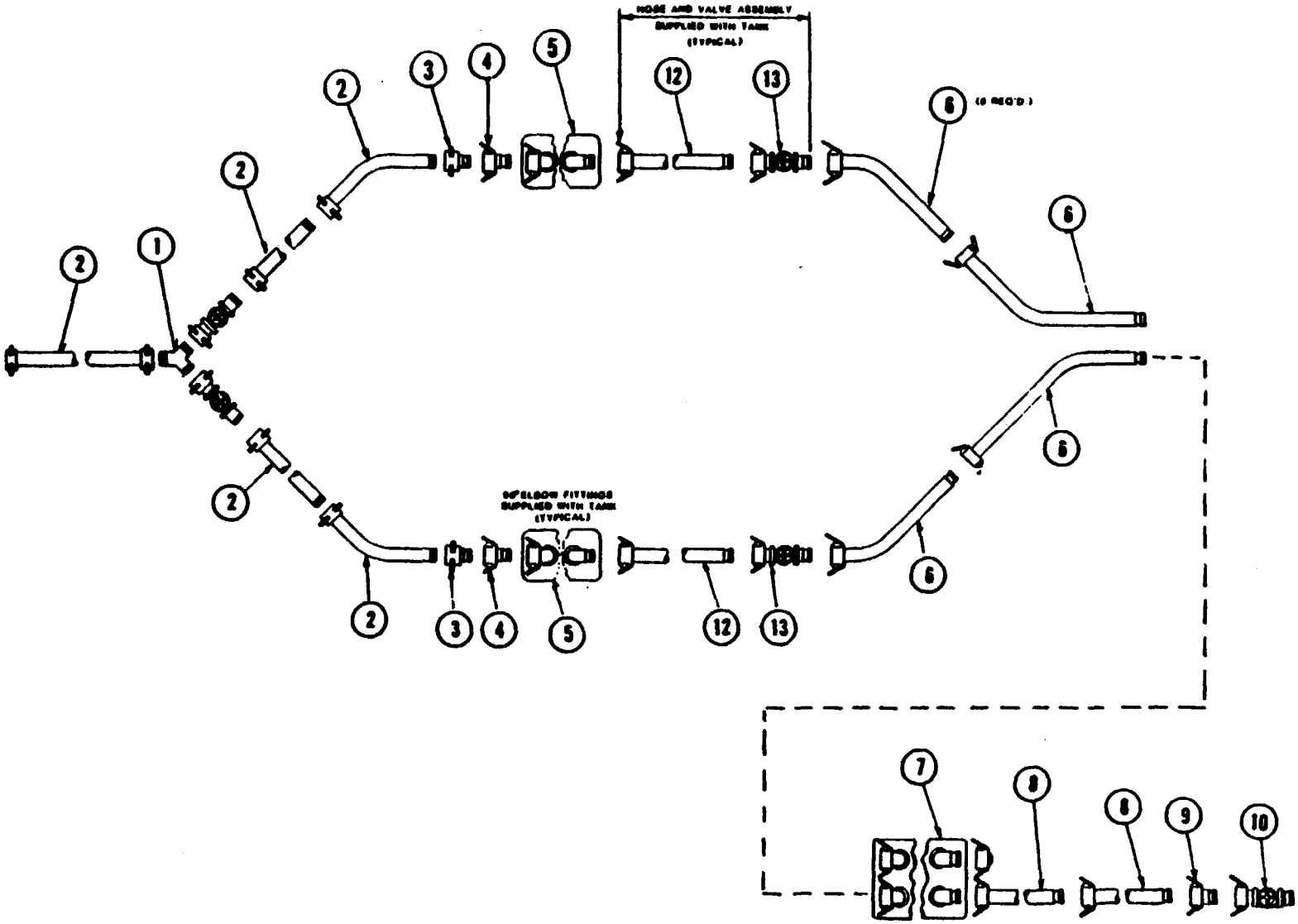


FIG.2 CONTAMINATED FUEL MODULE

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-4556	CONTAMINATED FUEL MODULE	13226E8254 (REF. TPT-5357-024)		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
3835-01-210-5592	Y ASSY 6 IN, GROOVED COUPLING (97403) 13226E8265 Refer to fig. 3 for breakdown.	2-1	EA	1
3835-01-210-5618	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 6 IN. ID, 50 FT. LG (97403) 133226E8270 Refer to fig. 4 for breakdown.	2	EA	5
	COUPLING, HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, NIPPLE ADAPTER, MALE BY EXTERNAL GROOVED PIPE, TYPE XIX, CLASS 1, 6 IN. NOM SIZE (96906) MS70100-3	3	EA	2
4730-01-079-8234	REDUCER, MALE BY FEMALE AND FEMALE BY MALE, QUICK DISCONNECT, CAM-LOCKING, TYPE XI, CLASS 1 (6 IN. FEMALE X 4 IN, MALE) (96906) MS49000-21	4	EA	2
5430-00-182-8181	TANK, FABRIC, COLLAPSIBLE, 50,000 GAL PETROLEUM (81349) MIL-T-52983	5	EA	2
4720-00-727-1339	HOSE ASSY, LIQUID FUEL SUCTION, NONCOLLAPSIBLE, 4 IN. ID, 12 FT LG (97403) 13226E8283	6	EA	8

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-4556	CONTAMINATED FUEL MODULE (CONTINUED)	13226E8254 (REF. TPT-5357-024)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4320-00-092-3551	PUMP ASSY, 350 GPM, 275 FT HD, POL (81349) MIL-P-52144 GFE	2-7	EA	1
4720-01-210-4560	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 4 IN. ID, 12 FT LG (97403) 133226E8285 Refer to fig. 5 for breakdown	8	EA	2
4730-00-951-3293	REDUCER, MALE BY FEMALE AND FEMALE BY MALE, QUICK DISCONNECT, CAM-LOCKING TYPE., TYPE XI, CLASS 1 (4 IN FEMALE BY 3 IN MALE) (96096) MS49000- 1	9	EA	1
4820-01-210-5605	VALVE ASSY, BALL, 3 IN, QUICK DISCONNECT (97403) 13226E8273 Refer to fig. 7 for breakdown	10	EA	1

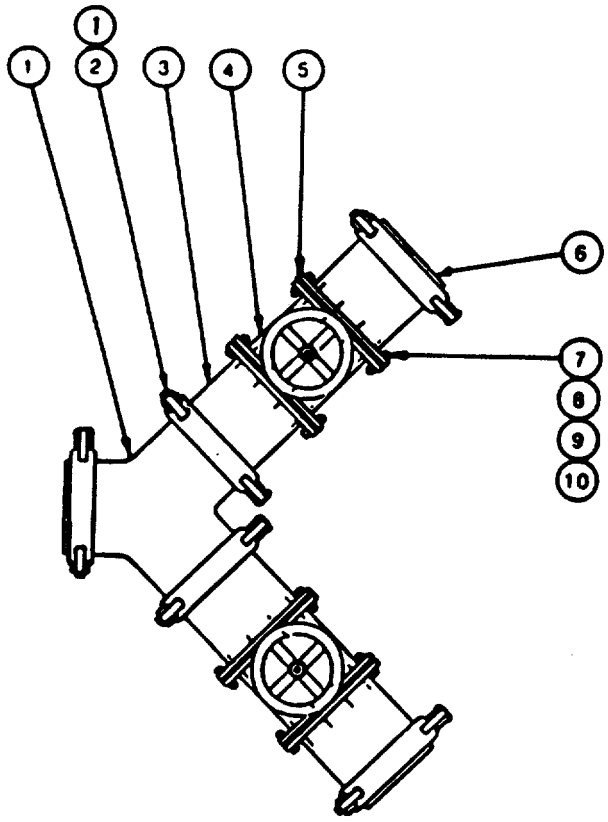


FIG. 3. 6 INCH WYE ASSEMBLY

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5592	Y ASSY, 6 IN., DOUBLE GROOVE	13226E8265		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
	Y, 6 IN., GROOVED COUPLING (79154) F-060-033-A-2C	3-1	EA	1
4730-01-209-4413	COUPLING, CLAMP GROOVED- END PIPE, QUICK DISCONNECT, 6 IN, W/GASKET (79154) C-060-078-P-OG	2	EA	S
5340-01-210-4561	ADAPTER, FLANGED TO DBL GROOVE (79154) F-E98-045-A-2C	3	EA	4
4820-200-197-8211	VALVE, GATE, ALUMINUM ALLOY, 6 IN FLANGED ENDS (41592) 676-FR-6 See Figure 28 For Breakdown	4	EA	2
5330-01-046-8458	GASKET, FLANGE, CORK, 9 IN OD, 6 IN APERATURE DIA (97403) 13220E 1069-3	5	EA	4
	CAP, 6 IN. DBL GROOVE (79154) F-060-060-A-2C	6	EA	3
5305-00-269-3214	SCREW, CAP HEXAGON HEAD, STEEL GRADE 5, CAD PL,. 375-16UNC-2A X 1.50 L (96906) MS90725-64	7	EA	48
5310-00-080-6004	WASHER, FLAT-ROUNDED, STEEL CAD PL GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	8	EA	48

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5618	Y ASSY, 6 IN, GROOVED COUPLING (CONTINUED)	13226E8265		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
5310-00-637-9541	WASHER, LOCK-SPRING HELICAL REGULAR (MEDIUM) SERIES, STEEL, CAD PL, .375 ID NOM SIZE (96906) MS35338-46	3-9	EA	48
5310-00-056-3395	NUT, PLAIN-HEXAGON, MACHINE SCREW, STEEL, CAD PL, .375-16UNC-2B (96906) MS35649-2382	10	EA	48
	GASKET, SYNTHETIC RUBBER (79154) G-060-075-0-T7	11	EA	5

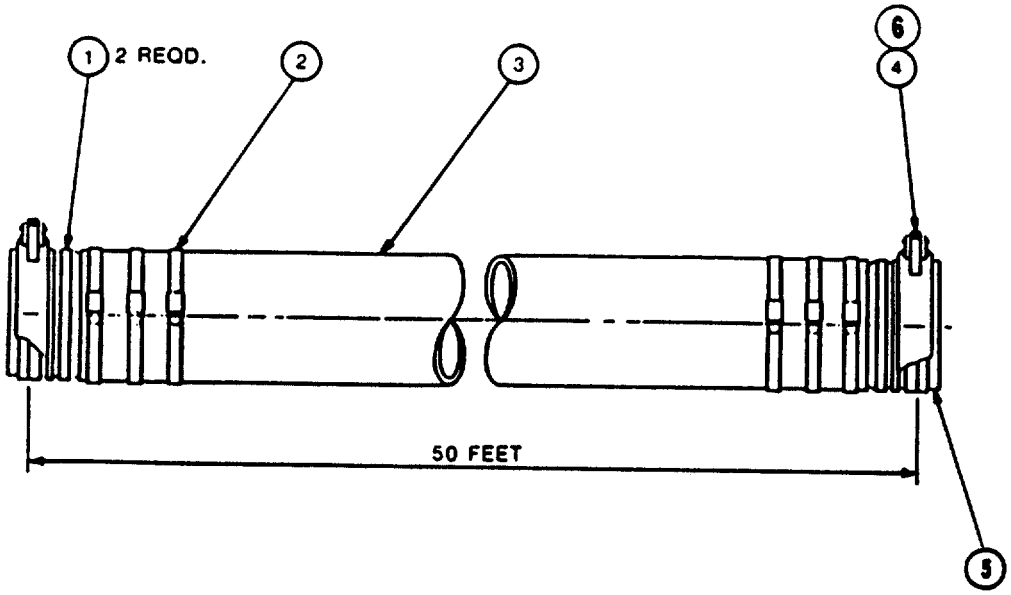


FIG. 4. 6 INCH HOSE ASSEMBLY, DISCHARGE, 50 FT.

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5618	HOSE ASSY, LIQUID FUEL DISCHARGE, COLLAPSIBLE, 6 IN ID, 50 FT LG	13226E8270		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	ADAPTER, HOSE TO GROOVE-END, 6 IN (79154) F-060-048-A-2C	4-1	EA	2
	CLAMP HOSE, 6 IN NOM SIZE, 0.750 IN BAND WIDTH, CORROSION-RESISTING STEEL WW-C-440 TYPE H (70847) J218	2	EA	6
	HOSE RUBBER (SYNTHETIC): FUEL, DISCHARGE COLLAPSIBLE, 6 IN, 50 FT LG (90598) 25582-2	3	EA	1
4730-01-209-4413	COUPLING, CLAMP GROOVED-END PIPE, QUICK DISCONNECT, 6 IN, W/GASKET (79154) C-060-078-P-OG	4	EA	2
	CAP, 6 IN, GROOVED COUPLING (79154) F-060-060-A-2C	5	EA	2
	GASKET, SYNTHETIC RUBBER 6 IN (79154) G-060-075-OT7	6	EA	2

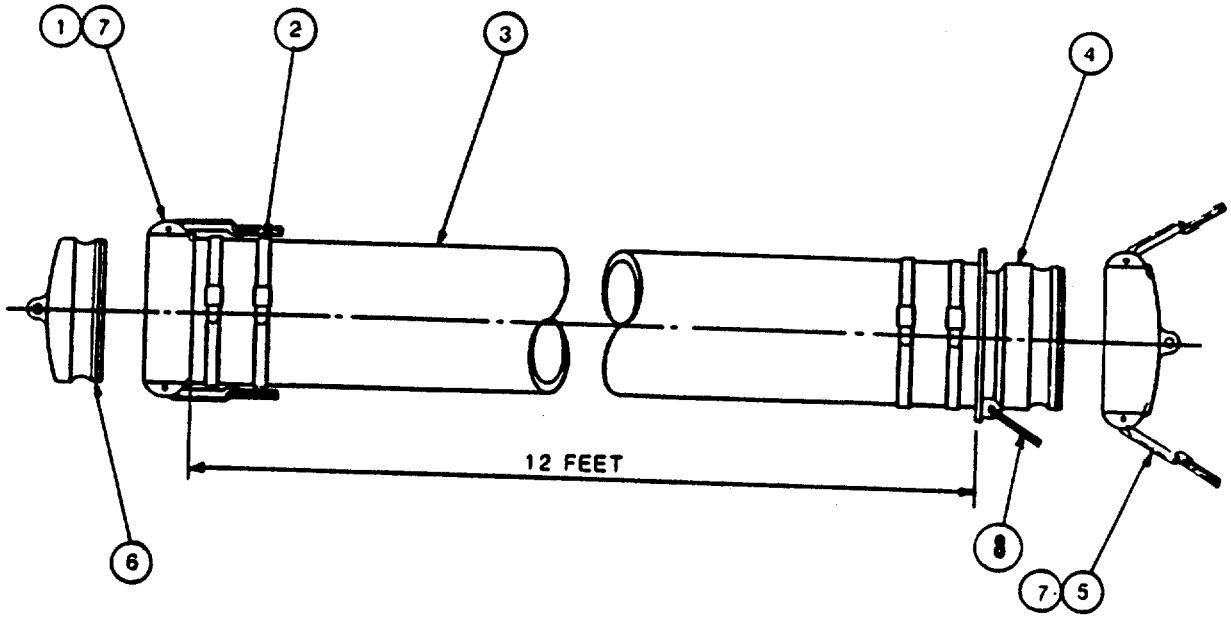


FIG. 5. 4 INCH HOSE ASSEMBLY, SUCTION, 12 FT.

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4720-00-727-1339	HOSE, ASSY, LIQUID FUEL, SUCTION, NONCOLLAPSIBLE, 4 IN ID, 12 FT LG	13226E8283		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, HOSE SHANK, TYPE VI CLASS 1,4 IN NOM SIZE (96906) MS27025-17	5-1	EA	1
	CLAMP, HOSE, 4 IN NOM SIZE, 0.750 IN BAND WIDTH, CORROSION-RESISTING STEEL WW-C-44C TYPE H (70847) J-215	2	EA	4
	HOSE, RUBBER, LIQUID FUEL, SUCTION, NONCOLLAPSIBLE, 4IN, 12 FT LG (81349) MIL-H-370D, TYPE II, SIZE 9	3	EA	1
4730-00-649-7388	COUPLING HALF, QUICK-DISCONNECT, CAM-LOCKING TYPE, MALE, HOSE SHANK, TYPE II, CLASS 1,4 IN NOM SIZE (96906) MS27021-17	4	EA	1
4730-00-640-6156	COUPLING HALF, QUICK-DISCONNECT, CAM-LOCKING TYPE, CAP, DUST,TYPE IX CLASS 1,4 IN NOM SIZE (96906) MS27028-17	5	EA	1
4730-00-640-6188	COUPLING HALF, QUICK-DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X CLASS 1,4 IN NOM SIZE (96906) MS27029-17	6	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4720-00-727-1339	HOSE, ASSY, LIQUID FUEL, SUCTION, NONCOLLAPSIBLE, 4 IN ID, 12 FT LG (CONTINUED)	13226E8283		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN NOM SIZE (96906) MS27030-9	5-7	EA	2
	RING, KEY (90598) 25549-1 (TBD) 3682	8	EA	1

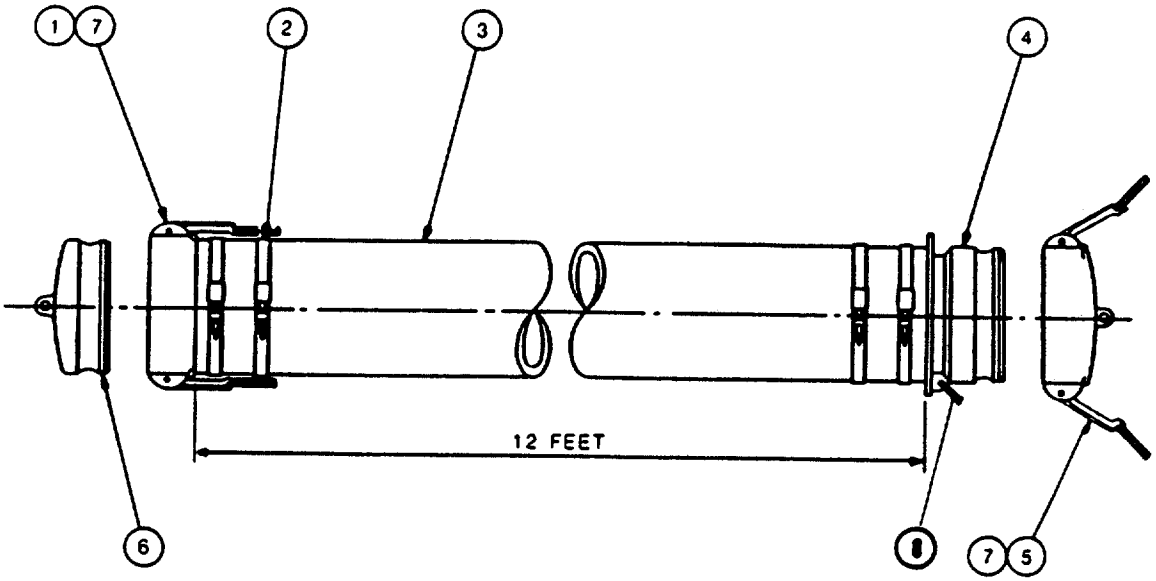


FIG. 6. 4 INCH HOSE ASSEMBLY, DISCHARGE, 12 FT.

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4720-01-210-4560	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 4IN ID, 12 FT LG	13226E8285-1		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, HOSE SHANK, TYPE VI, CLASS 1,4 IN NOM SIZE (96906) MS27025-17	6-1	EA	1
	CLAMP, HOSE, 4 IN NOM SIZE, 0.750 IN BAND WIDTH, CORROSION-RESISTING STEEL WW-C-440 TYPE (70847) J-215	2	EA	4
	HOSE, RUBBER(SYNTHETIC): FUEL, DISCHARGE, COLLAPSIBLE, 4 IN, 12 FT LG (81349) MIL-H-82127	3	EA	1
4730-00-649-7388	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, MALE, HOSE SHANK, TYPE II, CLASS 1,4 IN NOM SIZE (96906) MS27021-17	4	EA	1
4730-00-640-6156	COUPLING HALF, QUICK DIS-CONNECT CAM-LOCKING TYPE, CAP, DUST TYPE IX, CLASS 1, 4 IN. NOMINAL PIPE SIZE (96906) MS27028-17	5	EA	1
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1,4 IN NOM SIZE (96906) MS27029-17	6	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4720-01-210-4560	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 4IN ID, 12 FT LG (CONTINUED)	13226E8285-1		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5330-00-899-4509	GASKET, COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING (96906) MS27030-9	6-7	EA	2
	RING, KEY (TBD) 3682	8	EA	1

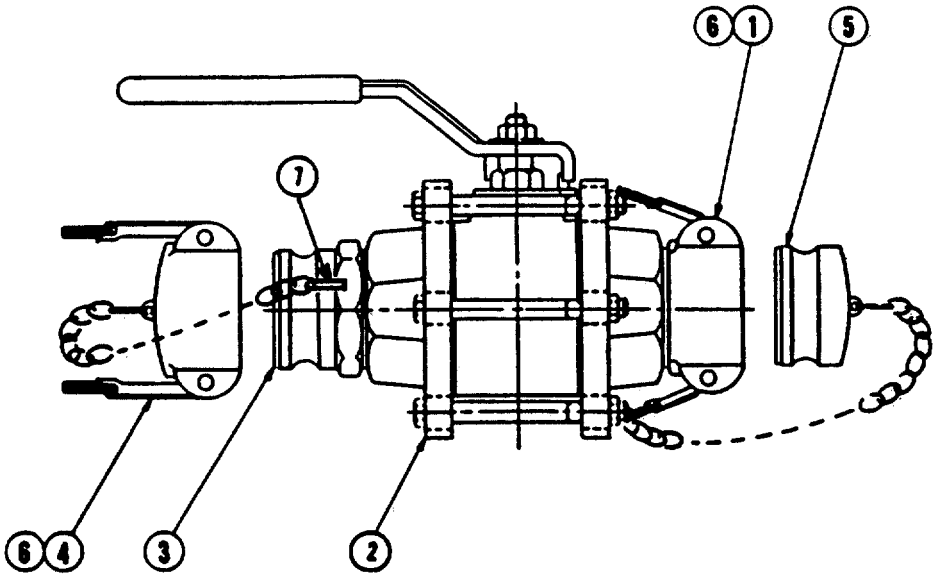


FIG. 7. 3 INCH BALL VALVE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	VALVE ASSY, BALL, 3 IN, QUICK DISCONNECT	13226E8273		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-00-837-4551	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, EXTERNAL PIPE THREAD, TYPE VII, 3 IN NOM SIZE (96906) MS27026- 15 CLASS I	7-1	EA	1
4820-01-078-3514	VALVE, BALL, ALUMINUM ALLOY, 3 IN, INTERNAL PIPE THREAD (92021) 3-SP-A- 19-S-2 See Appendix A for Breakdown	2	EA	1
4730-00-360-0913	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, MALE, EXTERNAL PIPE THREAD TYPE III, CLASS 1,3 IN NOM SIZE (96906) MS27022-15	3	EA	1
4730-00-929-0790	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X CLASS 1, 4 IN NOMINAL PIPE SIZE (96906) MS27029-1S5	4	EA	1
4730-00-929-0787	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX CLASS 1, 3 IN NOMINAL PIPE SIZE (96906) MS27028-15	5	EA	1
5330-00-088-9166	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 3 IN. NOMINAL PIPE SIZE (96906) MS27030-8	6	EA	2
	RING, KEY (TBD) 3682	7	EA	1

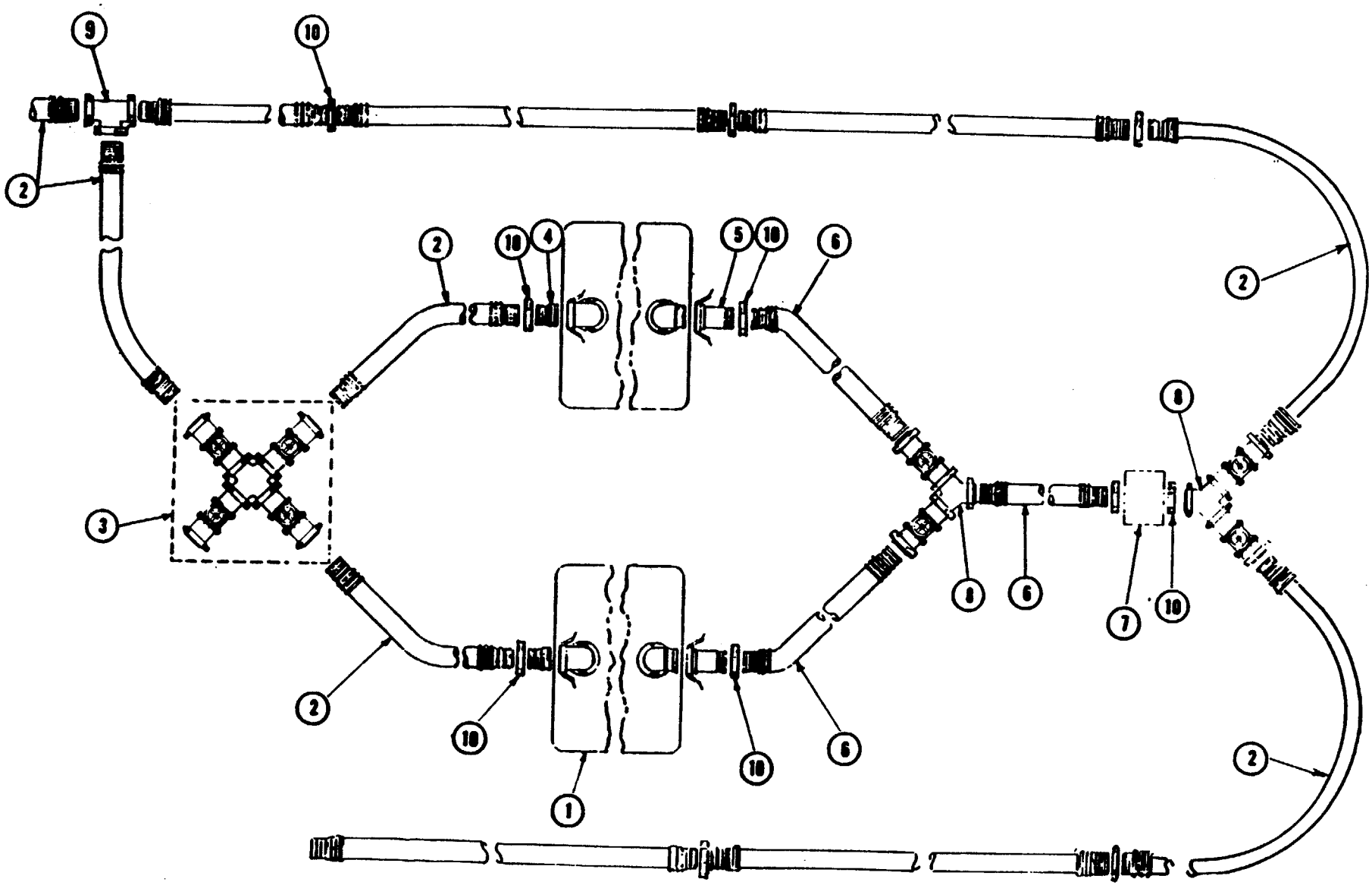


FIG. 8. TANK FARM, SECONDARY MODULE

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5612	TANK FARM, SECONDARY MODULE	13226E8252		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
5430-01-160-3528	TANK, FABRIC, COLLAPSIBLE, 5000 BARREL PETROLEUM (97403) PD5430-0001	8-1	EA	2
3825-01-210-5618	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 6 IN ID, 50 FT LG (97403) 13226E8270 SEE FIG. 4 FOR BREAKDOWN	2	EA	22
3835-01-210-5595	CROSSASSY,61N DBL GROOVE (97403) 13226E8266 SEE FIG. 9 FOR BREAKDOWN	3	EA	1
	COUPLING HALF, QUICK DIS-CONNECT, CAM-LOCKING TYPE, NIPPLE ADAPTER, MALE BY DBL GROOVE, TYPE XIX, CLASS 1,6 IN NOM SIZE (96906) MS70100-3	4	EA	2
4730-01-210-4559	COUPLING, ADAPTER ASSY, FEMALE, QUICK DISCONNECT BY DBL GROOVE, 6 IN NOM SIZE (97403) 13226E8267-100 SEE FIG. 10 FOR BREAKDOWN	5	EA	2
4720-01-210-5596	HOSE ASSY, LIQUID FUEL, SUCTION, NONCOLLAPSIBLE, 6 IN ID, 12 FT LG (97403) 13226E8271 SEE FIG 11 FOR BREAKDOWN	6	EA	19

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5612 (CONTINUED)	TANK FARM, SECONDARY MODULE	13226E8252		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4320-01-193-3429	PUMPING ASSY DIESEL-ENGINE-DRIVEN, SELF-PRIMING CENTRIFUGAL, 600 GPM AT 150 PSI (97403) PD 4320-0014 GFE	8-7	EA	1
3835-01-210-5592	Y ASSY, 6 IN, DBL GROOVE (97403) 13226E8265 SEE FIG 12 FOR BREAKDOWN	8	EA	2
4730-01-210-5628	TEE, 6 IN, DBL GROOVE (90598) 25507-1	9	EA	1
6685-00-514-5575	POLE, RANGE (81349) MIL-P-20192 (NOT SHOWN)		EA	4

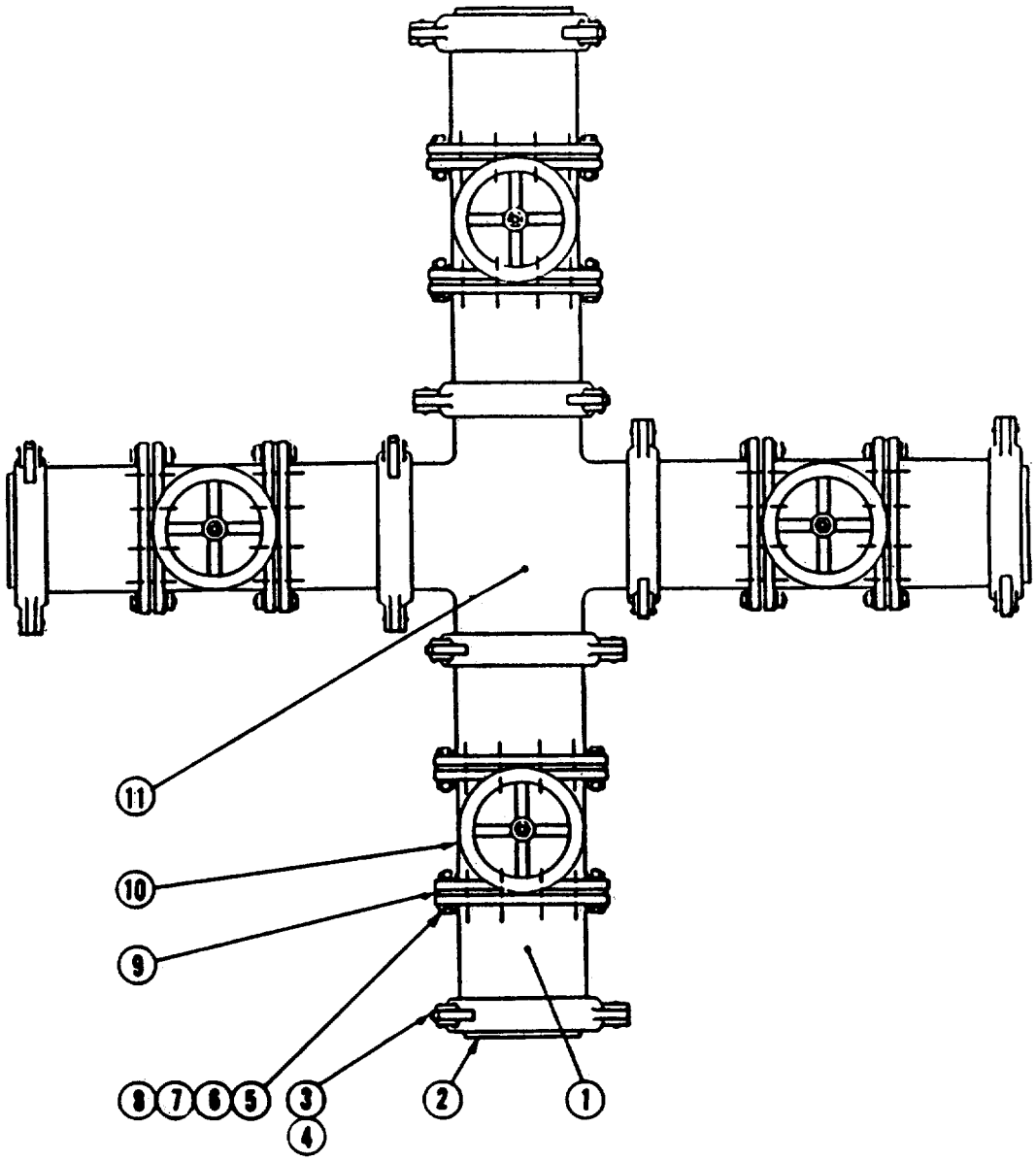


FIG. 9. 6 INCH CROSS ASSEMBLY, DOUBLE GROOVED ENDS

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5595	CROSS ASSY, 6 IN, GROOVED COUPLING	13226E8266		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
5430-01-210-4561	ADAPTER, FLANGED TO DBL GROOVE (79154) F-E98-045-A-2C	9-1	EA	8
	CAP, 6 DBL GROOVE (79154) 60A-DG	2	EA	4
4730-01-209-4413	COUPLING, CLAMP, GROOVED-END, PIPE, 6 IN (79154) C-060-078-P-OG	3	EA	8
	GASKET, SYNTHETIC RUBBER (79154) G-060-075-0-T7	4	EA	8
5305-00-269-3214	SCREW, CAP, HEX HEAD, STEEL, GR 5, CAD PL,. 375-16UNC-2A X 1.50L (96906) MS90725-64	5	EA	96
5310-00-080-6004	WASHER, FLAT-ROUND STEEL, CAD PL, GENERAL PURPOSE, 406 IN ID (96906) MS27183-14	6	EA	96
5310-00-637-9541	WASHER, LOCK-SPRING HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL, .375 IN NOM SIZE (96906) MS35338-46	7	EA	96
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW STEEL, CAD PL, .375-16UNC-2B (96906) MS35649-2382	8	EA	96

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5595	CROSS ASSY, 6 IN, GROOVED COUPLING (CONTINUED)	13226E8266		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5330-01-046-8458	GASKET, FLANGE, CORK, 9 IN OD 6 IN APERTURE DIA (97403) 13220E 1069-3	9-9	EA	8
4820-00-197-8211	VALVE, GATE, ALUMINUM ALLOY, 6 IN FLANGED ENDS (41592) 6.00 IN. 235-RF SEE FIG. 28 FOR BREAKDOWN	10	EA	4
	CROSS, 6 IN, DBL GROOVED COUPLING (90598) 25509-1	11	EA	8

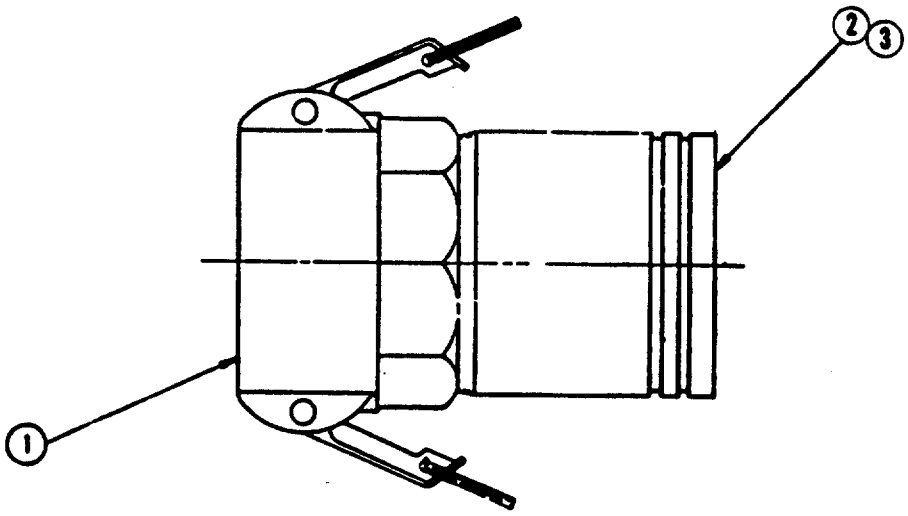


FIG. 10 COUPLING ADAPTER ASSEMBLY

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY,LIQUID FUEL SUCTION, NONCOLLAPSIB .E, 6 IN ID, 12 FT LG	13226E8267		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	COUPLING HALF, CAM LOCKING TYPE, FEMALE (96906) MS27024-19	10-1	EA	1
	PIPE, FITTING, GROOVED END (MIL-P- 10388) M 10388-A-07-AK-1-C-6A	2	EA	1
	TAPE, ANTI-SEIZE (MIL-T-27730) PTFE	3	Roll	A/RE

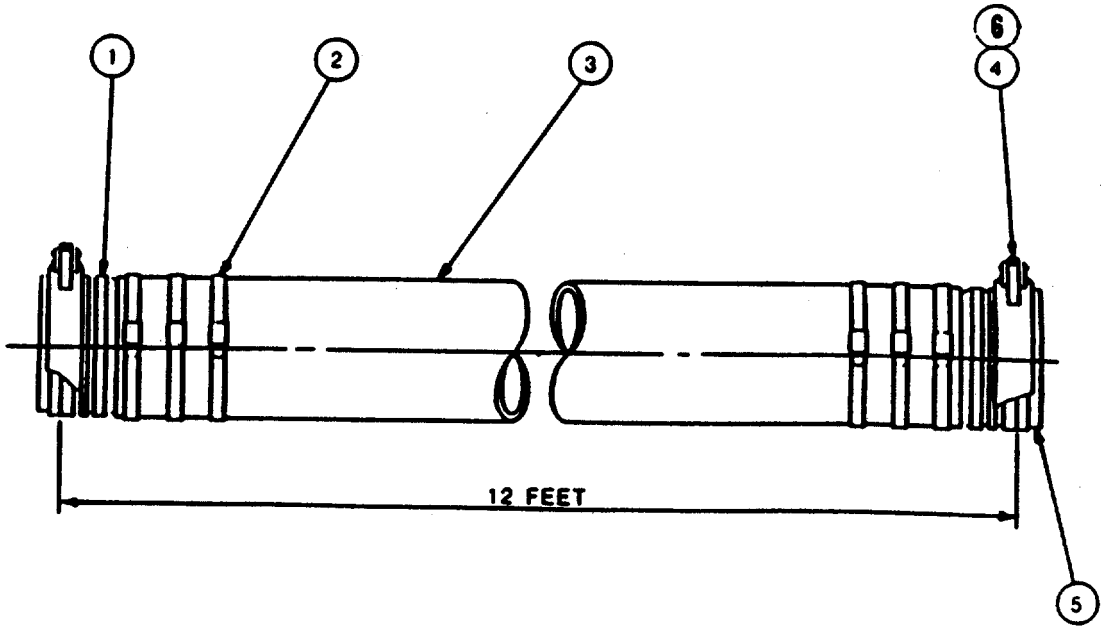


FIG. 11 6 INCH HOSE ASSEMBLY, SUCTION, 12 FT.

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4720-01-210-5596	HOSE ASSY,LIQUID FUEL SUCTION, NONCOLLAPSIB .E, 6 IN ID, 12 FT LG	13226E8267		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	ADAPTER, HOSE TO GROOVED-END, 6 IN (79154) F-060-048-A-2C	1	EA	2
	CLAMP, HOSE 6 IN NOM SIZE, 0.750 IN BAND WIDTH, CORROSION-RESISTING STEEL (70847) J218	2	EA	6
	HOSE, RUBBER, LIQUID FUEL SUCTION NONCOLLAPSIBLE, 6IN, 12 FT LG (90598) 25583-2	3	EA	1
4730-01-209-4413	COUPLING, CLAMP, GROOVED-END PIPE, 6 IN (79154) C-060-078-P-0G	4	EA	2
	CAP, 6 IN, DBL GROOVED (79154) F-060-060-A-2C	5	EA	2
	GASKET, SYNTHETIC RUBBER, 6 IN NOM SIZE (79154) G-060-075-0-T7	6	EA	2

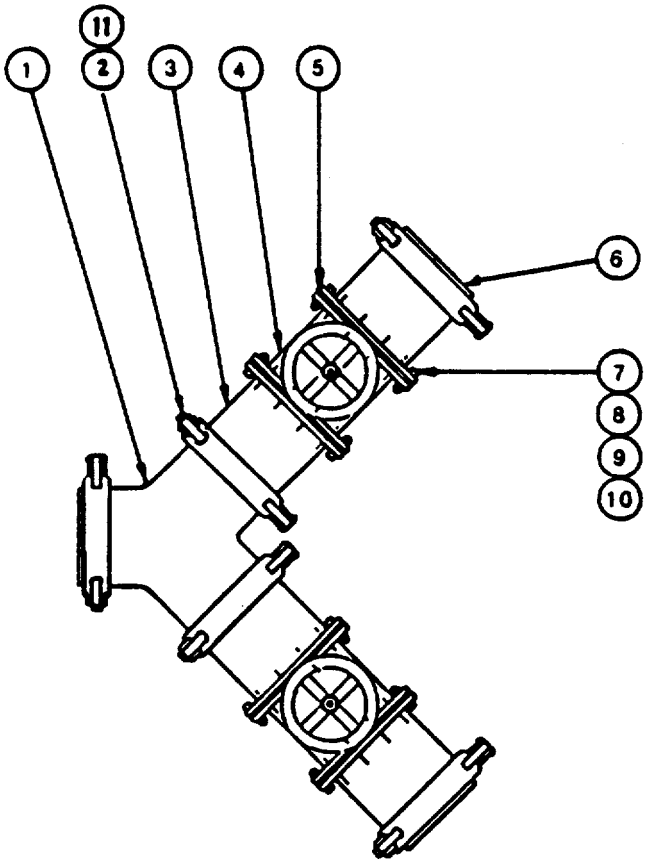


FIG. 12 Y ASSEMBLY, 6 IN, DBL GROOVE

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5592	Y ASSY, 6 IN, DBL GROOVE	13226E8265		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
	Y, 6 IN, DBL GROOVE (79154) F-060-033-A-2C	12-1	EA	1
4730-01-209-4413	COUPLING, CLAMP GROOVED- END PIPE, 6 IN, (97403) 13226E 1575-9	2	EA	5
5340-01-210-4561	ADAPTER, FLANGED TO DBL GROOVE (79154) F-E98-045-A-2C	3	EA	4
4870-00-197-8211	VALVE, GATE, ALUMINUM ALLOY, 6 IN FLANGED ENDS (41592) 6.00 IN. 235-RF SEE FIG. 28 FOR BREAKDOWN	4	EA	2
5330-01-046-8458	GASKET, FLANGE, CORK, 9 IN OD, 6 IN APERATURE DIA (81718) H2621M	5	EA	4
	CAP, NOM, 6 DBL GROOVE (79154) 60A-DG	6	EA	3
5305-00-269-3214	SCREW, CAP HEX HEAD, STEEL GR 5, CAD PL, .375-16UNC-2A X 1.50L (96906) MS90725-64	7	EA	48
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL CAD PL GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	8	EA	48
5310-00-637-9541	WASHER, LOCK-SPRING HELICAL REGULAR (MEDIUM) SERIES, STEEL, CAD PL, .375 ID NOM SIZE (96906) MS35338-46	9	EA	48

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5592	Y ASSY, 6 IN, DBL GROOVED COUPLING (CONTINUED)	13226E8265		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-056-3395	NUT,HEX HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16UNC-2B (96906) MS35649-2382	12-10	EA	48
	GASKET, SYNTHETIC RUBBER, 6 IN. NOM (97403) PD 4630-0006	11	EA	5

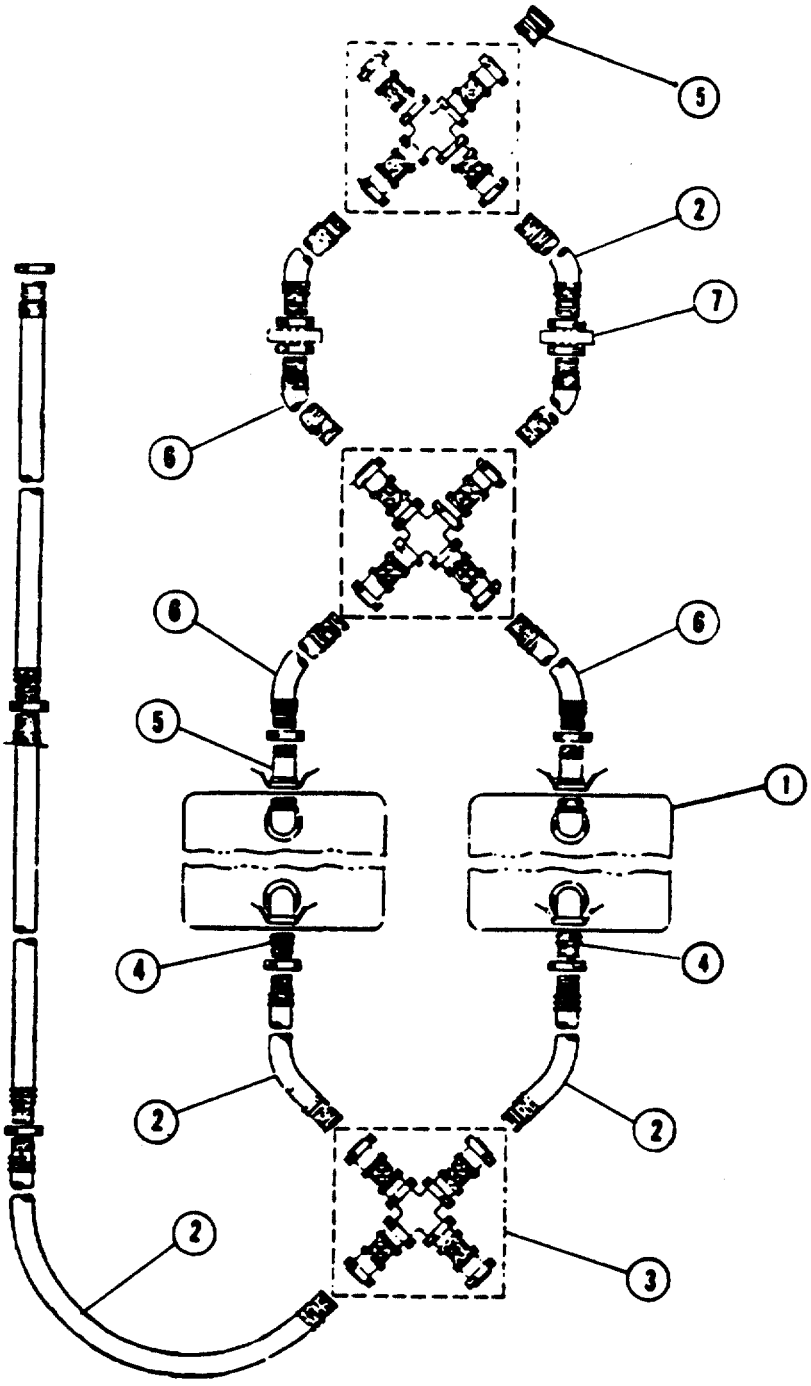


FIG. 13 TANK FARM, PRIMARY MODULE

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5611	TANK FARM, PRIMARY MODULE	13226E8251		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
5430-01-160-3528	TANK, FABRIC, COLLAPSIBLE, 5000 BARREL PETROLEUM (97403) PD5430-0001 GFE	13-1	EA	2
3835-01-210-5618	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 6 IN ID, 50 FT LG (97403) 13226E8270 SEE FIG. 4 FOR BREAKDOWN	2	EA	14
3835-01-210-5595	CROSS ASSY, 6 IN, DBL GROOVE COUPLING (97403) 13226E8266 SEE FIG. 9 FOR BREAKDOWN	3	EA	3
	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, NIPPLE ADAPTER, MALE BY DBL GROOVE PIPE, TYPE XIX, CLASS 1,6 IN NOM SIZE (96906) MS70100-3	4	EA	2
4730-01-210-4559	COUPLING, ADAPTER ASSY, FEMALE, QUICK DISCONNECT BY DBL GROOVE, 6 IN NOM SIZE (97403) 13226E8267-100 SEE FIG. 10 FOR BREAKDOWN	5	EA	2
4720-01-210-5596	HOSE ASSY, LIQUID FUEL SUCTION, NONCOLLAPSIBLE, 6 IN ID, 12 FT LG (97403) 13226E8271 SEE FIG 11 FOR BREAKDOWN	6	EA	20

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5612	TANK FARM, PRIMARY MODULE (CONTINUED)	13226E8251		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4320-01-193-3429	PUMPING ASSY DIESEL-ENGINE-DRIVEN, SELF-PRIMING CENTRIFUGAL, 600 GPM AT 150 PSI (97403) PD 4320-0014 GFE	13-7	EA	2
6685-00-514-5575	POLE, RANGE (81349) MIL-P-20192 (NOT SHOWN)		EA	4

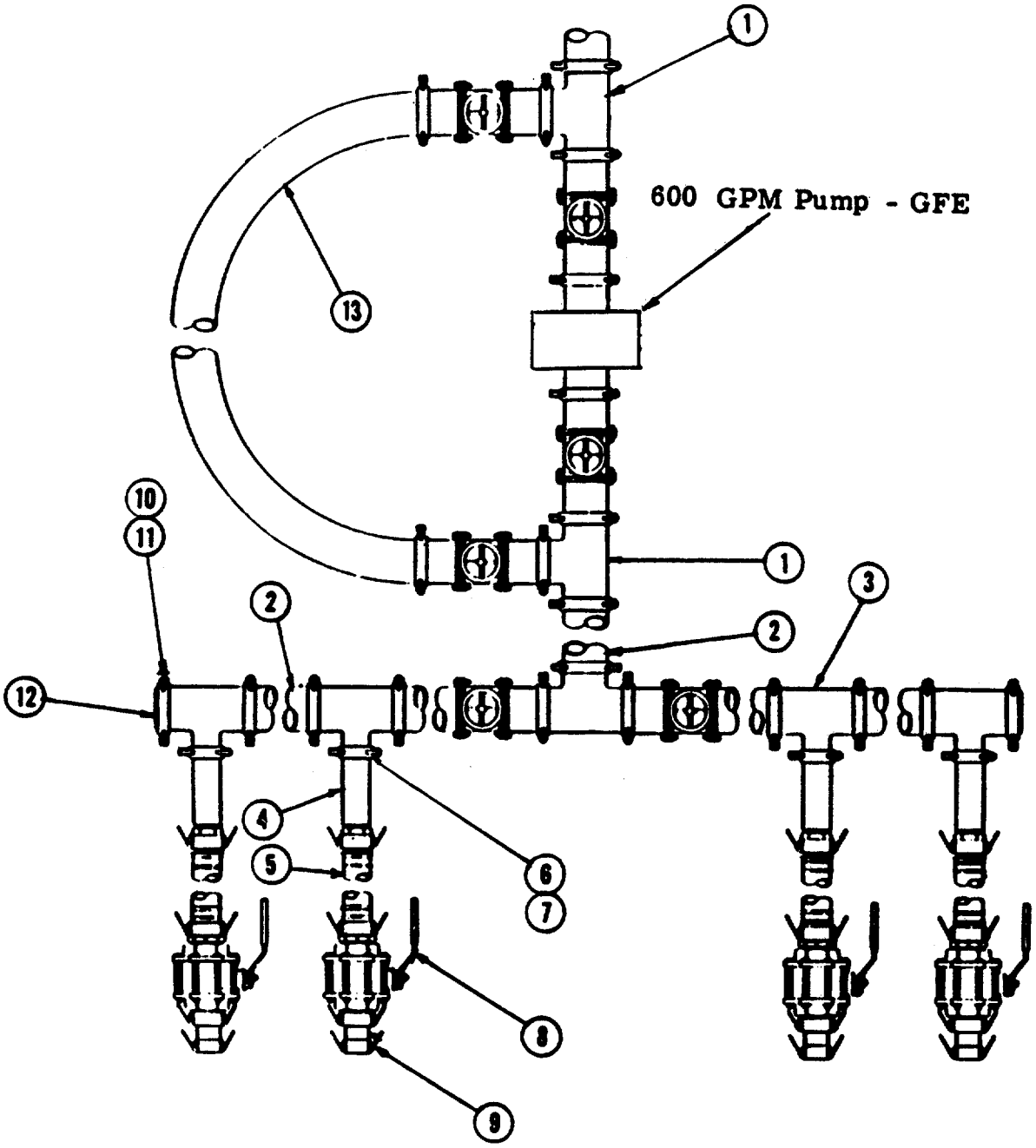


FIG. 14 TANKER TRUCK RECEIPT MANIFOLD

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5617	TANKER-TRUCK RECEIPT MANIFOLD, 6 IN	13226E8256		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-01-211-9548	TEE, 6 IN DBL GROOVE (97403) 13226E8272	14-1	EA	3
4720-01-210-5596	HOSE ASSY, LIQUID FUEL, SUCTION, NONCOLLAPSIBLE, 6IN ID, 12 FT LG (97403) 13226E8271 See Fig. 11 for Breakdown	2	EA	18
4730-01-210-5625	TEE FITTING, 6 X 6 X 4 DBL GROOVE (79154) F-F09-025-A-2A	3	EA	4
	COUPLING, ADAPTER ASSY, FEMALE (97403) 13226E8267-101 See Fig. 10 for Breakdown	4	EA	4
4720-00-727-1339	HOSE ASSY, LIQUID FUEL, SUCTION, NONCOLLAPSIBLE, 4 IN ID, 12 FT LG (97403) 13226E8283-1 See Fig. 5 for Breakdown	5	EA	16
	COUPLING, CLAMP; GROOVED-END PIPE, 4 IN (79154) C-040-078-P-OG	6	EA	4
	GASKET, SYNETHIC RUBBER PRE-LUBRICATED W/DRY LUBRICANT 4 IN NOM SIZE (79154) G-040-075-0-T7	7	EA	2

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5617	TANKER-TRUCK RECEIPT MANIFOLD, 6 IN (CONTINUED)	13226E8256		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4820-01-211-9547	VALVE ASSY, BALL, 4 IN, QUICK DISCONNECT (97403) 13226E8279 See Fig. 15 for Breakdown	14-8	EA	4
4730-951-3296	REDUCER, MALE BY FEMALE AND FEMALE BY MALE, QUICK DISCONNECT, CAM-LOCKING TYPE, TYPE X1, CLASS I (3 IN FEMALE BY 4 IN MALE) (96906) MS49000-9	9	EA	4
4730-01-209-4413	COUPLING, CLAMP GROOVED-END PIPE, 6 IN (79154) C-050-078-P-OG	10	EA	2
	GASKET, SYNTHETIC RUBBER PRE-LUBRICATED W/DRY LUBRICANT 6 IN NOM SIZE (79154) G-060-075-0-T7	11	EA	2
	CAP, 6 IN, DBL GROOVE (79154) F-F98-045-A-2C See Fig. 10 for Breakdown	12	EA	2
	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 6 IN ID, 50 FT LG (97403) 13226E8270 See Fig. 4 for Breakdown	13	EA	2

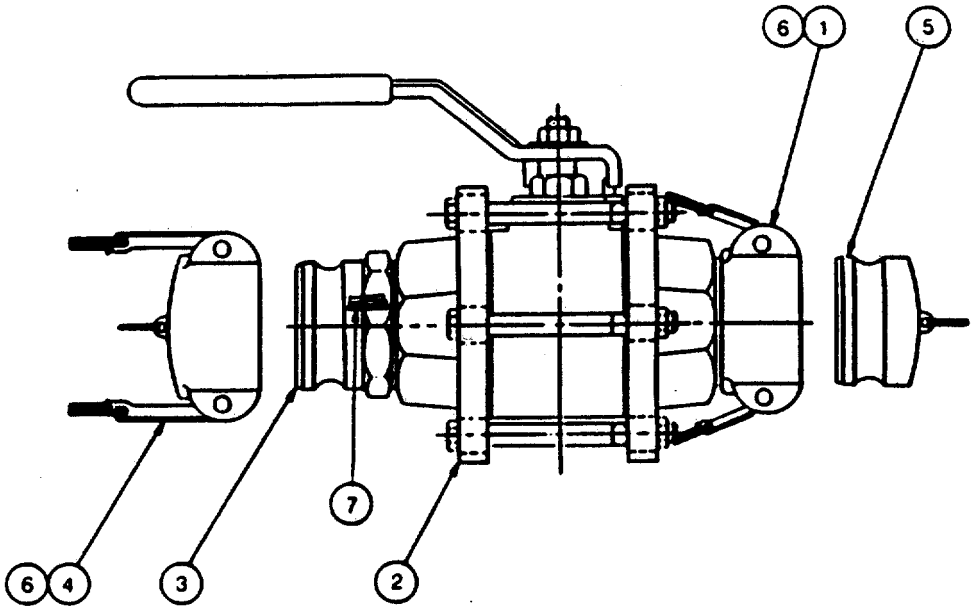


FIG. 15 4 INCH BALL VALVE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-211-9547	VALVE ASSY, BALL, 4 IN, QUICK DISCONNECT	13226E8279		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-00-873-4551	COUPLING HALF, QUICK DIS-CONNECT CAM-LOCKING TYPE, FEMALE EXTERNAL PIPE THREAD, TYPE VII, 4 IN NOM SIZE (96906) MS27026-17 CLASS 1	15-1	EA	1
4820-01.078-3514	VALVE, BALL, ALUMINUM ALLOY, 4 IN, INTERNAL PIPE THREAD (92021) 4-SP-A-20-S-2 See Appendix A for Breakdown	2	EA	1
4730-00-360-0913	COUPLING HALF, QUICK DIS-CONNECT, CAM-LOCKING TYPE, MALE, EXTERNAL PIPE THREAD, TYPE III, CLASS 1,4 IN NOM SIZE (96906) MS27022-17	3	EA	1
4730-00-640-6156	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX, CLASS 1, 4 IN NOM SIZE (96906) MS27028-17	4	EA	1
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, IN NOM SIZE (96906) MS27029-17	5	EA	1
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN NOM SIZE (96906) MS27030-9	6	EA	2

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-211-9547	VALVE ASSY, BALL, 4 IN, QUICK DISCONNECT (CONTINUED)	13226E8279		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	RING, KEY (TBD) 3682	15-7	EA	1

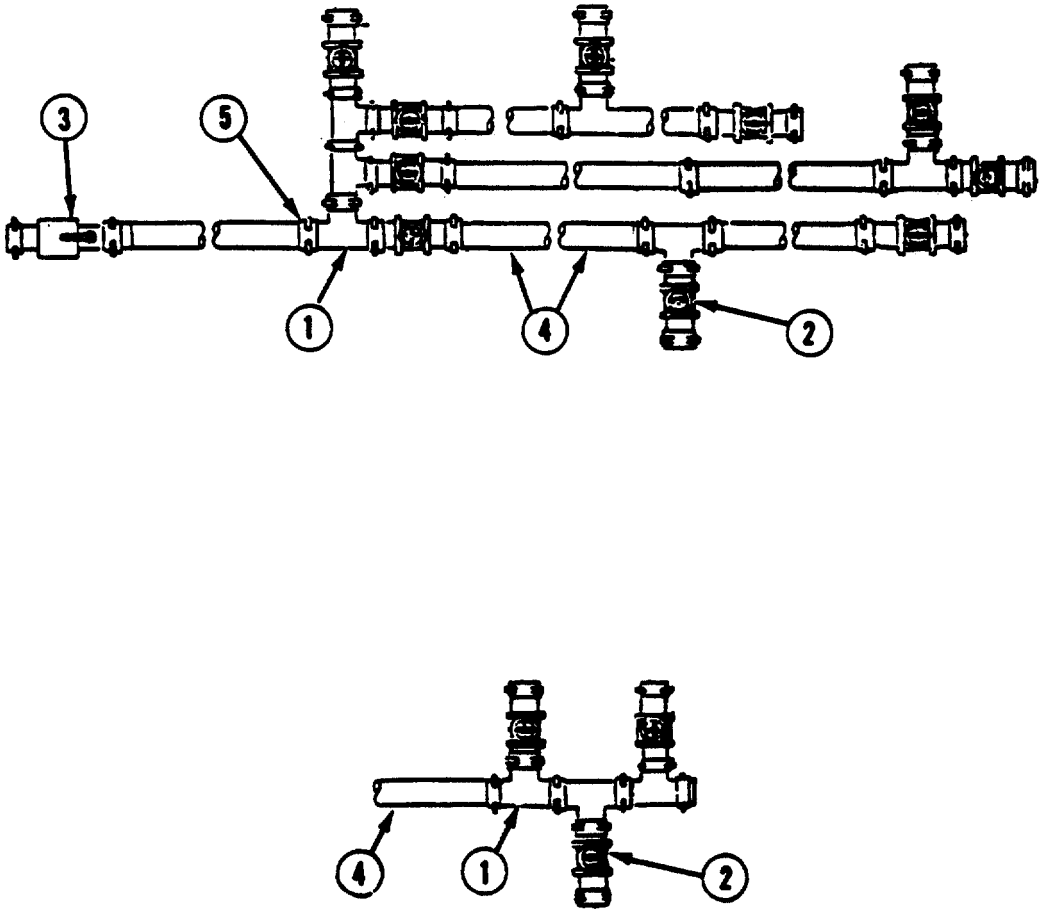


FIG. 16 SWITCHING MANIFOLD, 6 IN

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5593	SWITCHING MANIFOLD, 6 IN, DOUBLE GROOVE	13226E8255 (REF. TPT-5357-022)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4730-01-210-5628	TEE, 6 IN, DBL GROOVE (90598) 25507-1	16-1	EA	9
	VALVE ASSY, GATE, ALUM, 6 IN., DBL GROOVE (90598) 25585-100 See figure 17 for breakdown	2	EA	13
	SAMPLING ASSY (90598) 25589-1 See figure 29 for breakdown	3	EA	1
	PIPELINE BUNDLE, 475 FT (97403) TL-TA-CPL-20093 GFE	4	EA	1
	COUPLING, CLAMP, PIPE BOLTLESS, SET 6 IN DBL GROOVE (97403) TL-TA-CPL-20091 GFE	5	EA	1

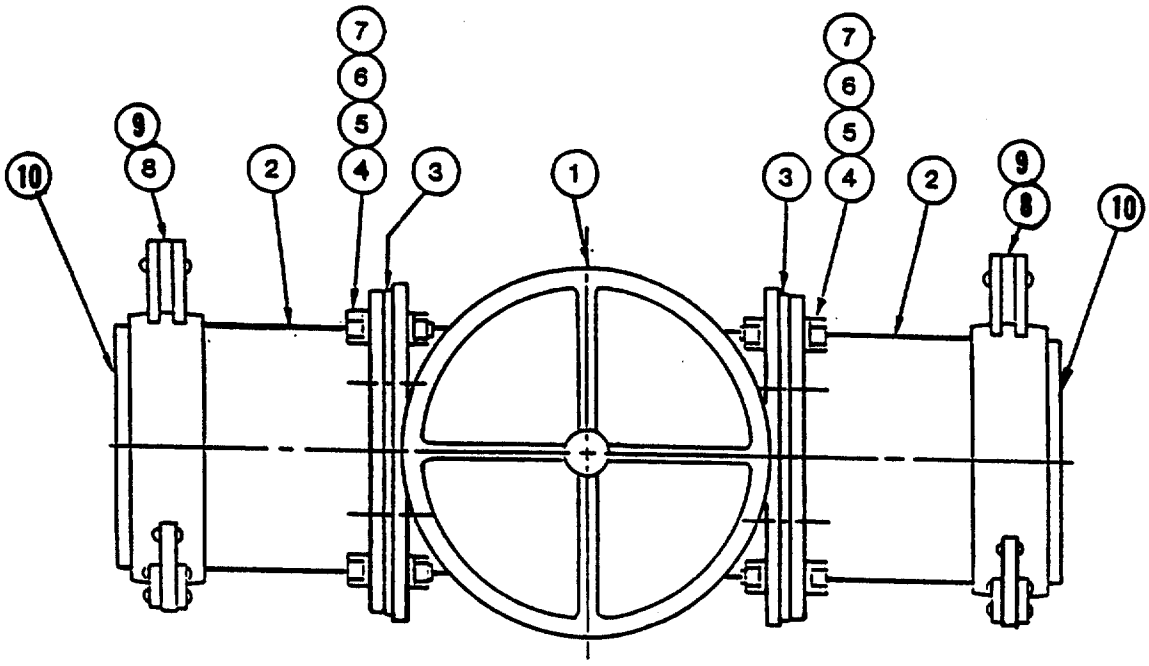


FIG. 17 VALVE ASSY, ALUM 6 IN

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	VALVE ASSEMBLY, GATE, ALUM 6 IN	25585-100 (REF. TPT-5357-007)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4820-00-197-8211	VALVE, GATE, 6 IN. FLANGED ENDS, 150 PSI WP (41592) 6.00 IN. 235-RF See fig 28 for breakdown	17-1	EA	1
5340-01-210-4561	ADAPTER, FLANGED TO DOUBLE GROOVED-END PIPE CONNECTION, ALUMINUM, 6.00 IN. (79154) F-E98-045-A-2C	2	EA	2
5330-01-046-8458	GASKET, FLANGE, CORK, 9 IN. O.D., 6 IN. APERATURE DIAMETER (97403) 13220E1069-3	3	EA	2
5305-00-269-3214	SCREW, CAP HEXAGON HEAD, STEEL, CAD. PL., 0.375-16 UNC-2A, 1.500 LONG (96906) MS90725-64	4	EA	24
5310-00-080-6004	WASHER, FLAT, ROUND STEEL, CAD. PL., GENERAL PURPOSE, 0.406 IN. 0D. (96906) M527183-14	5	EA	24
5310-00-637-9541	WASHER, LOCK SPRING, HELICAL, REGULAR, SERIES, STEEL, CAD. PL., 0.375 IN. NOM. SIZE (96906) M535338-46	6	EA	24
5310-00-056-3395	NUT, PLAIN, HEXAGON, CARBON-STEEL CAD.PL. 0.375-16 UNC-2B (96906) M535649-2382	7	EA	24

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	VALVE, ASSEMBLY, ALUM 6 IN., DG (CONTINUED)	25585-100		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4730-01-209-4413	COUPLING, CLAMP, GROOVED-END PIPE, 6 IN. NOM. SIZE (79154) C-050-078-P-OG	17-8	EA	2
	GASKET, SYNETHITIC RUBBER, PRE-LUBRICATED WIDRY LUBRICANT 6 IN. NOM SIZE (79154) G-060-075-0-T7	9	EA	2
	CAP, ALUMINUM, 6" NOM. SIZE (79154) F-060-060-A-2C	10	EA	2

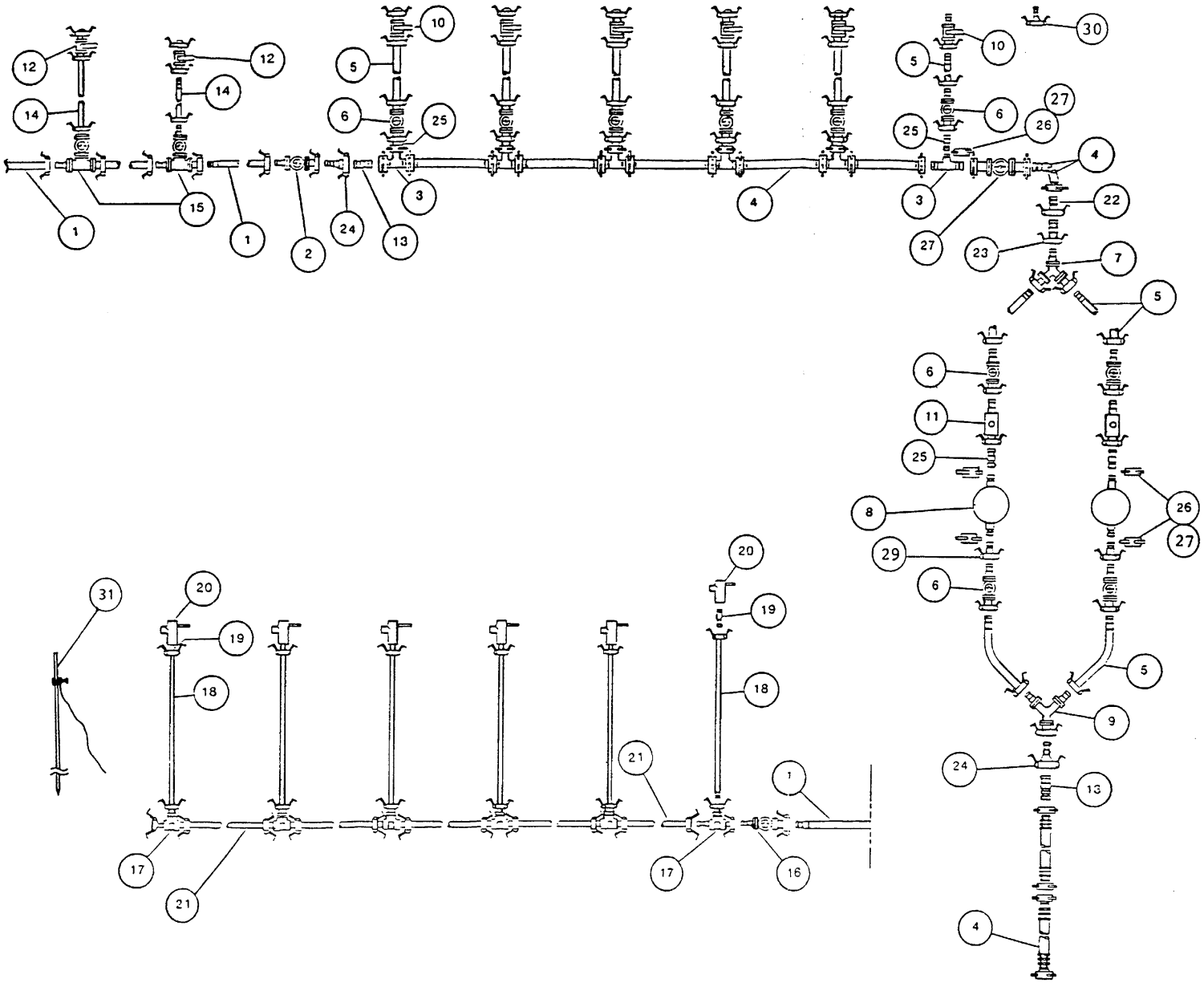


FIG. 18 FUEL DISP. ASSEMBLY

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4930-01-211-6835	FUEL DISPENSING ASSEMBLY	13226E8257		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4720-00-083-0048	HOSE ASSY, RUBBER, SYNTHETIC, LIQUID PETROLEUM FUELS, DISPENSING, COLLAPSIBLE, 3 IN ID, 50 FT LG, W/QUICK DISCONNECT CAM-LOCKING FITTINGS (1MALE AND 1 FEMALE) (90598) 25503-102 See figure 19 for breakdown	18-1	EA	3
4820-01-210-5624	VALVE ASSY, REDUCER, 4 IN TO 3 IN, QUICK DISCONNECT (97403) 13226E8263 See figure 20 for breakdown	2	EA	1
4730-01-210-5625	TEE FITTING, 6X6X4, DBL GROOVE (90598) 25508-1	3	EA	6
3835-01-210-5618	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 6 IN ID, 50 FT LG DBL GROOVE (97403) 13226E8270 See figure 4 for breakdown	4	EA	13
4720-00-083-0047	HOSE ASSY, RUBBER, SYNTHETIC, LIQUID PETROLEUM FUELS, DISPENSING, COLLAPSIBLE, 4 IN ID, 25 FT LG, W/QUICK DISCONNECT CAM-LOCKING FITTINGS (90598) 25503-101 See figure 19 for breakdown	5	EA	10

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4930-01-211-6835	FUEL DISPENSING ASSEMBLY (CONTINUED)	13226E8257		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4820-01-210-5605	VALVE ASSY, 4 IN QUICK DISCONNECT (97403) 13226E8282 See figure 21 for breakdown	18-6	EA	10
	Y ASSY, FLANGED, 4 IN, QUICK DISCONNECT, FEMALE X MALE (97403) 13226E8258 See figure 22 for breakdown	7	EA	1
4330-00-177-8485	FILTER-SEPARATOR, LIQUID FUEL, FRAME MOUNTED, 350 GPM CAPACITY (97403) 13217E9320 GFE	8	EA	2
3835-01-210-5630	Y ASSY, FLANGED, 4 IN, QUICK DISCONNECT, MALE X FEMALE (97403) 13226E8274 See figure 23 for breakdown	9	EA	I
4820-01-211-9547	VALVE ASSY, BALL, 4 IN, QUICK DISCONNECT (97403) 13226E8279 See figure 15 for breakdown	10	EA	6
4370-01-013-7590	ADAPTER, WATER DETECTION KIT (97403) 13220E9406-2 See figure 30 for breakdown	11	EA	2
4820-01-210-5615	VALVEASSY, 1.5 IN, BALL, QUICK DISCONNECT (97403) 13226E8276 See figure 24 for breakdown	12	EA	2

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4930-01-211-6835	FUEL DISPENSING ASSEMBLY (CONTINUED)	13226E8257		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, NIPPLE ADAPTER, MALE BY DBL GROOVE, TYPE XIX,CLASS 1 6 IN NOM SIZE (96906) MS70100-3	18-13	EA	2
4720-00-901-7624	HOSE ASSY, RUBBER, SYNTHETIC, LIQUID PETROLEUM FUELS, DISPENSING, COLLAPSIBLE, 1.5 IN ID, 25 FT LG, W/QUICK DISCONNECT CAM-LOCKING FITTINGS (90598) 25503-105 See figure 19 for breakdown	14	EA	2
4730-01-209-9209	TEE ASSY, FLANGED, REDUCER, 3 IN, QUICK DISCONNECT (97403) 13226E8260 See figure 25 for breakdown	15	EA	2
	VALVE ASSY, REDUCER, 3 IN QUICK DISCONNECT (97403) 13226E8264 See figure 26 for breakdown	16	EA	6
4730-01-210-5627	TEEASSY, REDUCER, QUICK DISCONNECT 2X2X1 (97403) 13226E8262 See figure 27 for breakdown	17	EA	6

PARTS LIST

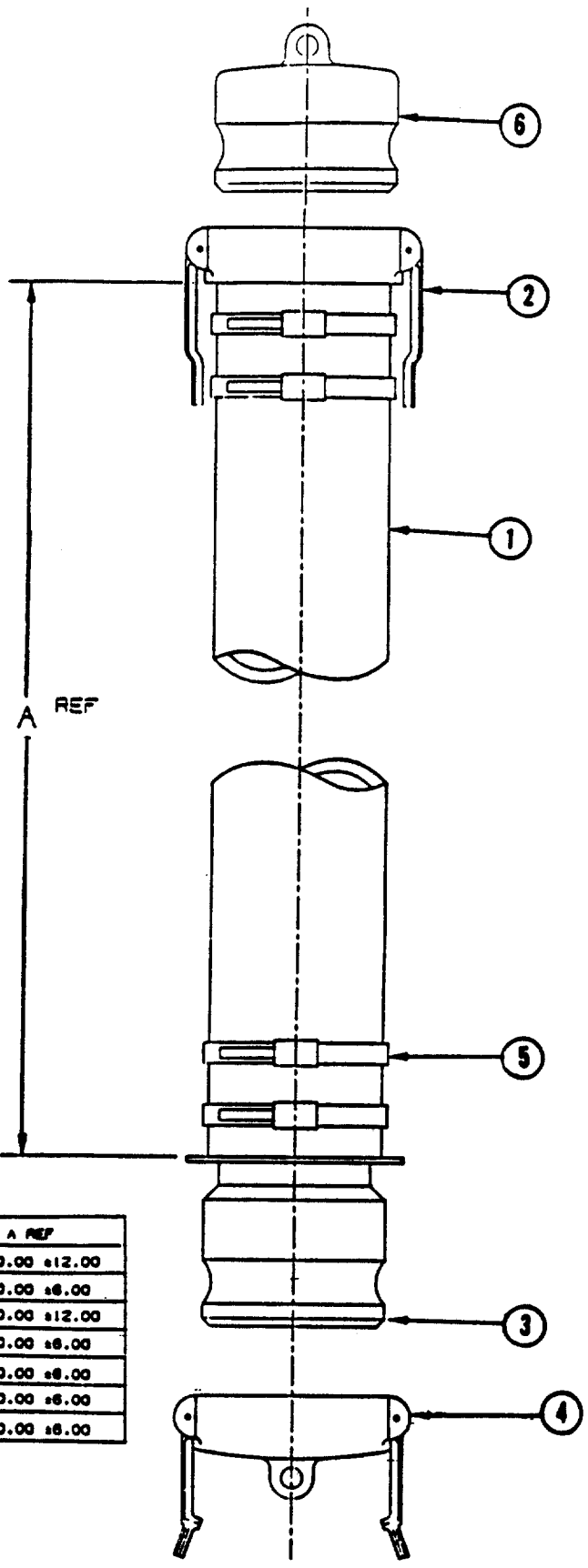
NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4930-01-211-6835	FUEL DISPENSING ASSEMBLY (CONTINUED)	13226E8257		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
18- 4730-00-084-7435	HOSE ASSY, RUBBER, SYNTHETIC, LIQUID PETROLEUM FUELS, DISPENSING,COLLAPSIBLE, 1 IN ID, 25 FT LG, W/QUICK DIS-CONNECT CAM-LOCKING (90598) 25503-106 See figure 19 for breakdown	18	EA	6
4730-00-084-7435	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE MALE, EXTERNAL PIPE THREAD, TYPE III, CLASS 1 (96906) MS27022-5	19	EA	6
4930-00-902-4642	NOZZLE, FUEL AND OIL SERVICING, NONAUTOMATIC SHUTOFF, 1 IN (81349) MIL-N-52110 TYPE 1, SIZE CLASS 8, STYLE 2	20	EA	6
	HOSE ASSY, RUBBER, SYNTHETIC, LIQUID PETROLEUM FUELS, DISPENSING, COLLAPSIBLE, 2 IN ID, 25 FT LG, W/QUICK DISCONNECT CAM-LOCKING FITTINGS (90598) 25503-104 See figure 19 for breakdown	21	EA	5
4730-01-210-4559	COUPLING, ADAPTER ASSY FEMALE BY DBL GROOVE, 6 IN NOM SIZE (97403) 1322E8267-1	22	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4930-01-211-6835	FUEL DISPENSING ASSEMBLY (CONTINUED)	13226E8257		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	REDUCER, MALE BY FEMALE AND FEMALE BY MALE, QUICK DISCONNECT, CAM-LOCKING TYPE, TYPE XI, CLASS 1 (96906) MS49000-23	18-23	EA	1
4730-01-079-8234	REDUCER, MALE BY FEMALE AND FEMALE BY MALE, QUICK DISCONNECT, CAM-LOCKING TYPE, TYPE XI, CLASS 1 (96906) MS49000-21	24	EA	2
	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING, TYPE, NIPPLE ADAPTER, MALEBY DBL G ROOVE, TYPE XIX, CLASS 1, 4 IN NOM SIZE (96906) MS70100-1	25	EA	8
	COUPLING, CLAMP, GROOVED-END PIPE, 4 IN NOM SIZE (90598) 25584-1	26	EA	10
	GASKET, SYNETHETIC RUBBER, PRE-LUBRICATED W/DRY LUBRICANT 4 IN NOM SIZE (90598) 25584-3	27	EA	10
	VALVE ASSY, 6 IN, GATE ALUMINUM, DBL GROOVE ENDS (90598) 25585-100 See figure 17 for breakdown	28	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4930-01-211-6835	FUEL DISPENSING ASSEMBLY (CONTINUED)	13226E8257		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	COUPLING, ADAPTER, ASSY, FEMALE 4 NOM SIZE (97403) 13226E8267-2 See figure 10 for breakdown	18-29	EA	2
4720-01-951-3293	REDUCER, FEMALE BY MALE, QUICK DISCONNECT, CAM-LOCKING TYPE, TYPE XI, CLASS I (96906) MS49000- 1	30	EA	6
5975-01-050-5707	GROUND ROD, BRASS, SELF-DRIVING, TYPE III, CLASS B, 9 FT LG W/12 FT. CABLE (81349) W-R-550A	31	EA	14



DASH NO.	HOSE ID REF	A REF
-100	4.00 ±.03	600.00 ±12.00
-101	4.00 ±.03	300.00 ±6.00
-102	3.00 ±.03	600.00 ±12.00
-103	3.00 ±.03	300.00 ±6.00
-104	2.00 ±.03	300.00 ±6.00
-105	1.50 ±.03	300.00 ±6.00
-106	1.00 ±.03	300.00 ±6.00

FIG. 19 HOSE ASSY, RBR, COLL.

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE	25503-100		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
	25503-100 ASSY USES:	19-		
	HOSE, RUBBER, SYNTH, LIQUID PETRO FUEL (90598) 25581-1	1	EA	1
	COUPLING HALF, 4 IN FEMALE (96906) MS27025-17	2	EA	1
	COUPLING HALF, 4 IN MALE (96906) MS27021-17	3	EA	1
	CAP, 4 IN. W/GASKET (96906) MS27028-17	4	EA	1
	PLUG,41N. (96906) MS27029- 17	5	EA	1
	CLAMP, 5 IN. TYPE H (70847) J-215	6	EA	4

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE (CONTINUED	25503-101		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	25503-102 ASSY USES: HOSE, RUBBER, LIQUID PETRO FUEL (90598) 25581-2	19-1	EA	1
	COUPLING HALF, 3 IN FEMALE (96906) MS27025-17	2	EA	1
	COUPLING HALF, 3 IN MALE (96906) MS2702 1-17	3	EA	1
	CAP, 4 IN. W/GASKET (96906) MS27028-17	4	EA	I
	PLUG,31N. (96906) MS27029-17	5	EA	1
	CLAMP, 5 IN. TYPE H (70847) J-215	6	EA	I

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PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE (CONTINUED)	25503-102		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	25503-102 ASSY USES:	19-		
	HOSE, RUBBER, LIQUID PETRO FUEL (90598) 25581-2	1	EA	1
	COUPLING HALF, 3 IN FEMALE (96906) MS27025- 17	2	EA	1
	COUPLING HALF, 3 IN MALE (96906) MS27021-17	3	EA	1
	CAP, 4 IN. W/GASKET (96906) MS27028-17	4	EA	1
	PLUG, 3 IN. (96906) MS27029-17	5	EA	I
	CLAMP, 5 IN. TYPE H (70847) J-215	6	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE (CONTINUED)	25503-103		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	25503-103 ASSY USES: HOSE, RUBBER, LIQUID PETRO FUEL (90598) 25581-4	19- 1	EA	1
	COUPLING HALF, 3 IN FEMALE (96906) MS27025- 15	2	EA	1
	COUPLING HALF, 3 IN MALE (96906) MS27021-15	3	EA	1
	CAP, 3 IN. W/GASKET (96906) MS27028- 5	4	EA	1
	PLUG, 3 IN. (96906) MS27029-15	5	EA	1
	CLAMP, 4 IN. TYPE H (70847) J-213	6	EA	4

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE (CONTINUED)	25503-104		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	25503-104ASSY USES: HOSE, RUBBER, LIQUID PETRO FUEL (96598) 25581-5	19- 1	EA	I
	COUPLING HALF, 2 IN FEMALE (96906) MS27025-11	2	EA	1
	COUPLING HALF, 2 IN MALE (90906) MS27021-11	3	EA	1
	CAP, 3 IN. W/GASKET (96906) MS27028-t 1	4	EA	1
	PLUG,31N. (96906) MS27029-1 1	5	EA	1
	CLAMP, 4 IN. TYPE H (70847) J-210	6	EA	4

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE (CONTINUED)	25503-105		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	25503-105 ASSY USES:.			
	HOSE, RUBBER, LIQUID PETRO FUEL (90598) 25581-6	19-1	EA	1
	COUPLING HALF, 2 IN. FEMALE (96906) MS27025-9	2	EA	1
	COUPLING HALF, 1.5 IN. MALE (96906) MS27021-9	3	EA	1
	CAP, 1.5 IN. W/GASKET (96906) MS27028-9	4	EA	1
	PLUG, 1.5 IN. (96906) MS27029-9	5	EA	1
	CLAMP, 2.25 IN. TYPE H (70847) J-208	6	EA	4

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	HOSE ASSY, RUBBER, COLLAPSIBLE (CONTINUED)	25503-106		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	25503-106 ASSY USES:	19-		
	HOSE, RUBBER, LIQUID PETRO FUEL (90598)25581-7	1	EA	1
	COUPLING HALF, 1 IN., FEMALE (96906) MS27025-5	2	EA	1
	COUPLING HALF, 1 IN., MALE (96906) MS27021-5	3	EA	1
	CAP, 1 IN. W/GASKET (96906) MS27028-5	4	EA	1
	PLUG,1 IN. (96906) MS27029-5	5	EA	1
	CLAMP, 1.75 IN. TYPE H (70847) J-206	6	EA	1

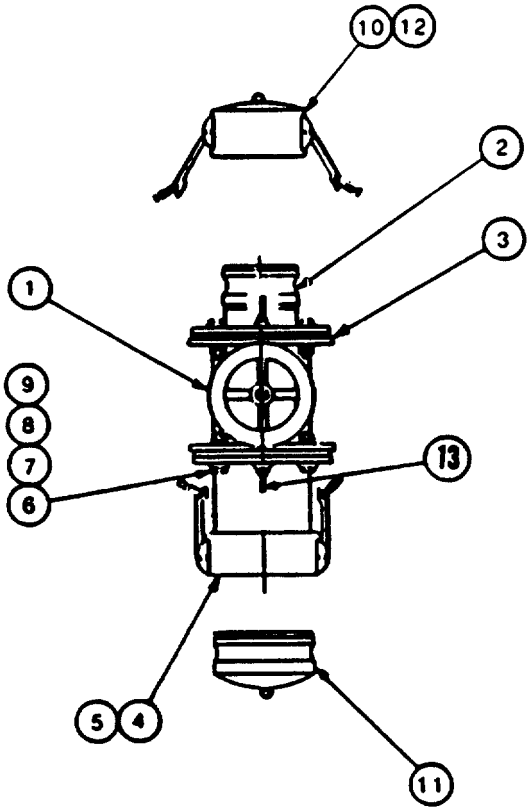


FIG. 20 4 INCH REDUCER VALVE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-210-5624	VALVE ASSY, REDUCER, 4 IN, QUICK DISCONNECT	13226E8263		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4820-00-766-8191	VALVE, GATE, ALUMINUM ALLOY, 4 IN FLANGED ENDS (81718) 676-FR-4 See Appendix A for Breakdown	20-1	EA	1
4730-00-901-4260	COUPLING HALF, REDUCER, QUICK DISCONNECT, CAM-LOCKING, 3 IN MALE BY 4 IN FLANGE (90598) 25538-1	2	EA	1
5330-00-647-2072	GASKET, FLANGE, CORK, 6.75 IN OD, 4 IN APERATURE DIA. (97403) 13220E 1069-1	3	EA	2
4730-00-840-5348	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS 1,4 IN NOM SIZE (96906) MS27027-17	4	EA	1
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN NOM SIZE (96906) MS27030-9	5	EA	1
5305-00-269-3214	SCREW, CAP HEX-HEAD, STEEL, GR 5, CAD PL, .375-16UNC-2A X 1.50L (96906) MS90725-64	6	EA	16
5310-00-080-6004	WASHER, FLAT-ROUND STEEL, CAD PL, GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	7	EA	16

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-210-5624	VALVE ASSY, REDUCER, 4 IN, QUICK DISCONNECT (CONTINUED)	13226E8263		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL., .375 IN NOM SIZE (96906) MS35338-46	20-8	EA	16
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16UNC-28 (96906) MS35649-2382	9	EA	16
4730-00-929-0787	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX, CLASS 1, 3 IN NOM SIZE (96906) MS27028-15	10	EA	1
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, 4 IN NOM SIZE (96906) MS27029-17	11	EA	1
5330-00-088-9166	GASKET-COUPLING, HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 3 IN NOM SIZE (96906) MS27030-8	12	EA	1
	RING, KEY (TBD) 3682	13	EA	2

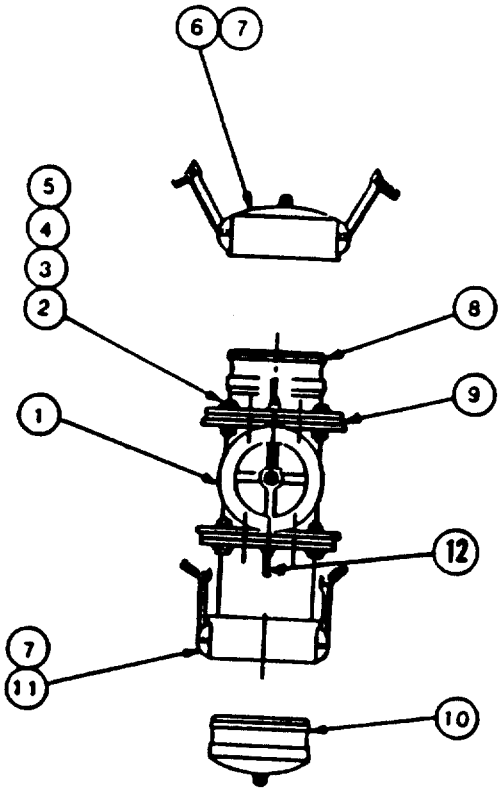


FIG. 21 4 INCH VALVE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-210-5605	VALVE ASSY, 4 IN, QUICK DISCONNECT	13226E8282		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4820-00-766-8191	VALVE, GATE, ALUMINUM ALLOY, 4 IN FLANGED ENDS (76364) C-35551 SEE APPENDIX A FOR BREAKDOWN	21-1	EA	1
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL GR 5, CAD PL, .375-16UNC-2A X 1.50L (96906) MS90725-64	2	EA	16
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL, CAD PL GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	3	EA	16
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL., .375 IN NOM SIZE (96906) MS35338-46	4	EA	16
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16U NC-28 (96906) MS35649-2382	5	EA	16
4730-00-640-6156	CAP, COUPLING HALF, QUICK DISCONNECT,CAM-LOCKING TYPE DUST, TYPE IX, CLASS 1,4 IN NOM SIZE (96906) MS27028-17	6	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-210-5605	VALVE ASSY, 4 IN, QUICK DISCONNECT (CONTINUED)			13226E8282
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, DUST, TYPE X, CLASS 1, 4 IN NOM SIZE (96906) MS27030-9	21-7	EA	2
4730-00-840-5347	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, DUST, TYPE IV, CLASS 1,4 IN NOM SIZE (96906) MS27023-17	8	EA	1
533-00-647-2072	GASKET, FLANGED, CORK, 6.75 IN. OD, 4 IN APERATU RE DIA (97403) 13220E1069-1	9	EA	2
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, 4 IN NOM SIZE (96906) MS27029-17	10	EA	I
4730-00-840-5348	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS 1, 4 IN NOM SIZE (96906) MS27027-17	11	EA	1
	RING, KEY (TBD) 3682	12	EA	2

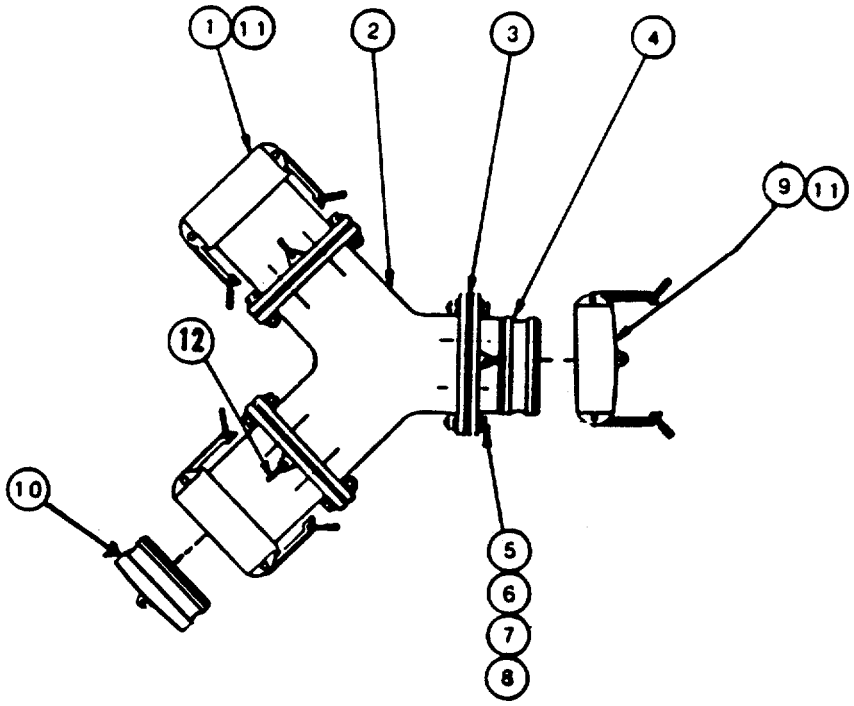


FIG. 22 4 INCH WYE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-210-5626	Y ASSY, FLANGED, 4 IN, QUICK DISCONNECT	13226E8258		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-00-840-5348	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS 1,4 IN NOM SIZE (96906)MS27027-17	22-1	EA	2
	Y CONNECTION, QUICK DISCONNECT, CAM-LOCKING TYPE, FLANGE TYPE XX CLASS 1, 4 IN NOM END SIZES (96906) MS39336-1	2	EA	1
5300-00-647-2072	GASKET, FLANGED, CORK, 6.75 IN. OD0. 4 IN APERATURE DIA (81718) C2479M	3	EA	3
4730-00-840-5347	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, DUST, TYPE IV, CLASS 1,4 IN NOM SIZE (96906) MS27023-17	4	EA	1
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL, GRS, CAD PL., 375-16UNC-2A X 1.50L (96906) MS90725-64	5	EA	24
5310-00-0806004	WASHER, FLAT-ROUND, STEEL, CAD PL, GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	6	EA	24
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL, 375 IN NOM SIZE (96906) MS35338-46	7	EA	24

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-210-5626	VALVE ASSY, FLANGED, 4 IN, QUICK DISCONNECT (CONTINUED)	13226E8258		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-056-3395	NUT, PLAIN-HEXAGON, SCREW, STEEL, CAD PL, .375-16UNC-2B (96906) MS35649-2382	22-8	EA	24
4730-00-640-6156	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX, CLASS 1,4 IN NOM SIZE (96906) MS27028-17	9	EA	1
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, DUST, TYPE X, CLASS 1,4 IN NOM SIZE (96906) MS27029-17	10	EA	2
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN NOM SIZE (96906) MS27030-9	11	EA	3
	RING, KEY (TBD) 3682	12	EA	3

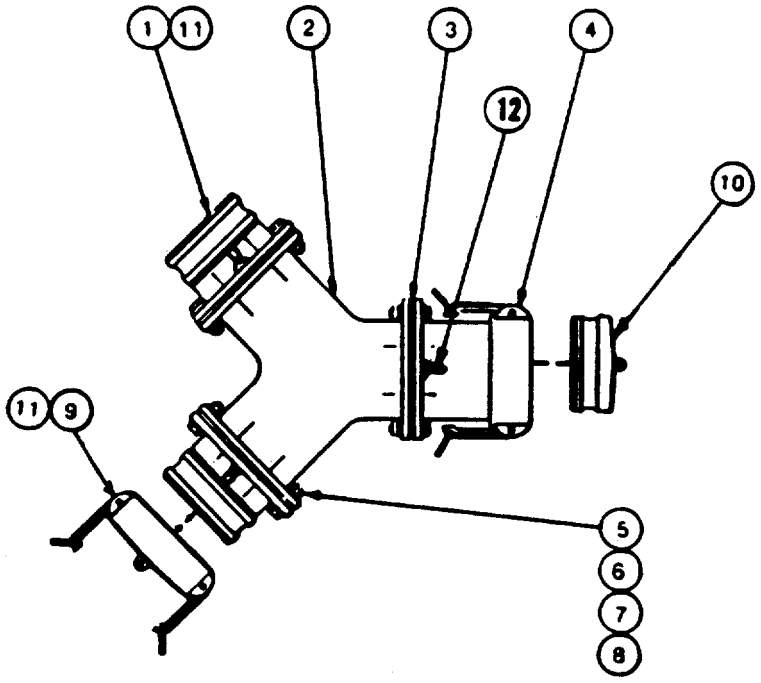


FIG. 23 4 INCH WYE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5630	Y ASSY, 4 IN	13226E8274		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-00-840-5348	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS I, 4 IN NOM SIZE (96906) MS27027-17	23-1	EA	1
	Y CONNECTION, QUICK DISCONNECT, CAM-LOCKING TYPE, FLANGE TYPE XX, CLASS 1, 4 IN NOM END SIZE (96906) MS39336-1	2	EA	1
5330-00-647-2072	GASKET, FLANGED, CORK, 6.75 IN OD, 4 IN APERATURE DIA (97403) 13220E1069-1	3	EA	3
4730-00-840-5347	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, MALE, FLANGED, TYPE IV, CLASS 1, 4 IN NOM SIZE (96906) MS27023-17	4	EA	2
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL, GR 5,C AD PL,. 375-16UNC-2A X 1.S0L (96906) MS90725-64	5	EA	24
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL, CAD PL, GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	6	EA	24

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5630	Y ASSY, 4IN (CONTINUED)			13226E8274
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL, .375 IN NOM SIZE (96906) MS35338-46	23-7	EA	24
5310-00-056-3395	NUT, PLAIN-HEXAGON, MACHINE SCREW, STEEL, CAD PL,. 375-16 UNC-2B (96906) MS35649-2382	8	EA	24
4730-00-640-6156	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX, CLASS1, 4 IN NOM SIZE (96906) MS27028-17	9	EA	2
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, 4 IN NOM SIZE (96906) MS27029-17	10	EA	1
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN NOM SIZE (96906) MS27030-9	11	EA	3
	RING, KEY (TBD) 3682	12	EA	3

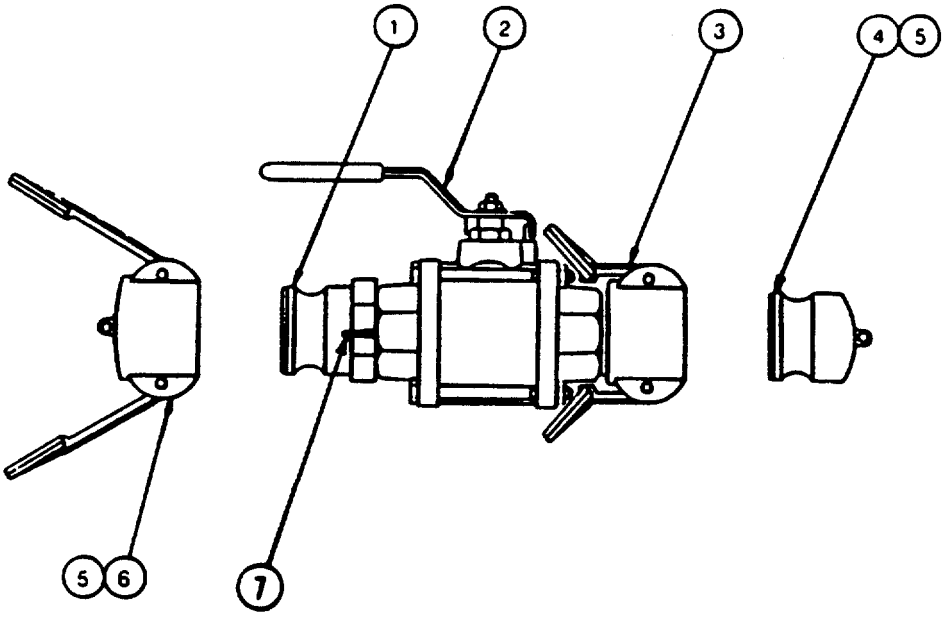


FIG. 24 1.50 INCH BALL VALVE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-210-5615	VALVE ASSY 1.5 IN, BALL, QUICK DISCONNECT	13226E8276		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4730-00-203-1010	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, FEMALE, EXTERNAL PIPE THREAD, TYPE VII, CLASS I, 1.50 IN NOM SIZE (96906) MS27026-9	24-1	EA	1
	VALVE, BALL, ALUMINUM ALLOY 1.50 IN, INTERNAL PIPE THREAD (92021) 1.5-SP-A-16-S-2 See Appendix A for Breakdown	2	EA	1
4730-00-360-0589	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, MALE, EXTERNAL PIPE THREAD, TYPE III, CLASS I, 1.50 IN NOM SIZE (96906) MS27022-9	3	EA	1
4730-00-929-0791	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX, CLASS 1.50, IN NOM SIZE (96906) MS27028-9	4	EA	1
5340-00-823-5316	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1.50, IN NOM SIZE (96906) MS27029-9	5	EA	1
5330-00-360-0595	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 1.5 IN, NOM SIZE (96906) MS27030-5	6	EA	2

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-210-5615	VALVE ASSY 1.5 IN, BALL, QUICK DISCONNECT (CONTINUED)	13226E8276		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	RING, KEY (TBD) 3682	24-7	EA	1

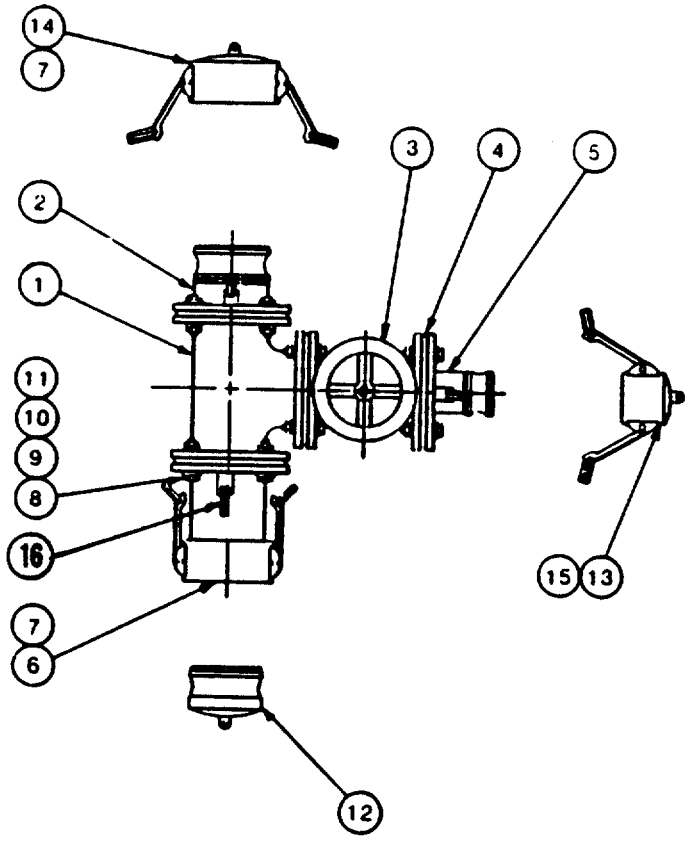


FIG. 25 3 INCH TEE ASSEMBLY, REDUCER, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-209-9209	TEE ASSY, FLANGED, REDUCER 3 IN, QUICK DISCONNECT	13226E8260		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-00-075-2420	TEE, FLANGE, ALUMINUM ALLOY, LEG LG 3.25 IN,3 IN DIA ALL ENDS, 7.75 IN O/A LG (80691) 5661X29-1	25-1	EA	1
4730-00-889-2380	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, MALE, FLANGED, TYPE IV, CLASS I, 3 IN NOM SIZE (96960) MS27023-15	2	EA	1
4820-00-075-2417	VALVE, GATE, FLANGED, ALUM, 3 IN NOM SIZE (81718) 676-FR-3 Refer to Appendix A for Breakdown	3	EA	1
5330-00-075-2419	GASKET, FLANGE, CORK, 5.75 IN OD,3 IN APERATURE DIA (97403) 13220E 1069-4	4	EA	4
4730-00-901-4260	REDUCER, 3 IN FLANGE BY 1.5 IN MALE, QUICK DISCONNECT, CAM-LOCKING,TYPE (81718) 633-LAT1-1/2X3	5	EA	1
4730-00-889-2378	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VII, CLASS 1, 3 IN NOM SIZE (96906) MS27027-15	6	EA	1
5330-00-088-9166	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 3 IN, NOM SIZE (96906) MS27030-8	7	EA	2

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-209-9209	TEE ASSY, FLANGED, REDUCER, 3 IN, QUICK DISCONNECT (CONTINUED)	13226E8260		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL GR 5, CAD PL,.375-16 UNC-2A X 1.SOL (96906) MS90725-64	25-8	EA	32
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL, CAD PL GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	9	EA	32
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL., .3751N NOM SIZE (96906) MS35338-46	10	EA	32
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16UNC-2B (96906) MS35649-2382	11	EA	32
4730-00-929-0790	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, 3 IN NOM SIZE (96906) MS27029-15	12	EA	1
4730-00-869-5426	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, DUST, TYPE IX, CLASS 1, 1.5 IN NOM SIZE (96906) MS27028-9	13	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-209-9209	TEE ASSY, FLANGED, REDUCER, 3 IN, QUICK DISCONNECT (CONTINUED)	13226E8260		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4730-00-929-0787	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, DUST, TYPE IX, CLASS 1, 3 IN NOM SIZE (96906) MS27028-1 5	25-14	EA	1
5330-00-360-0595	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 1.5 IN NOM SIZE (96906) MS27030-5	15	EA	1
	RING, KEY (TBD) 3682	16	EA	3

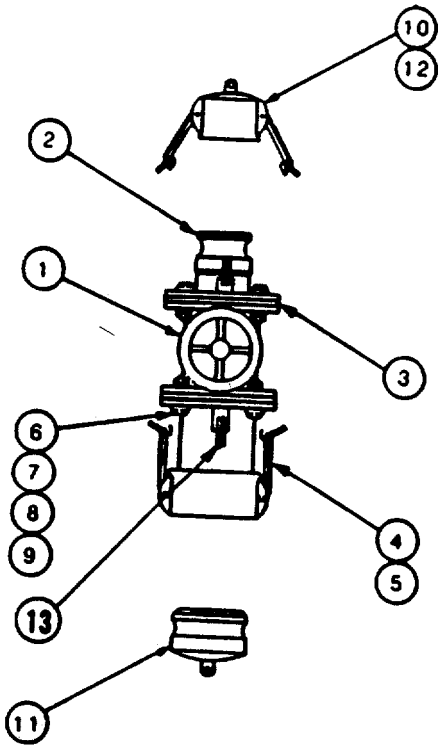


FIG. 26 3 INCH VALVE ASSEMBLY, REDUCER, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-214-9128	VALVE ASSY, REDUCER, 3 IN, QUICK DISCONNECT	13226E8264		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4820-00-075-2417	VALVE, GATE, ALUMINUM ALLOY, 3 IN FLANGED ENDS (81718) 676FR3	26-1	EA	1
	COUPLING HALF, REDUCER, QUICK DISCONNECT, CAM-LOCKING, 2 IN MALE BY 3 IN FLANGE (90598) 25537-1	2	EA	1
5330-00-075-2419	GASKET, FLANGE, CORK, 5.75 IN OD, 3 IN APERATURE DIA (97403) 13220E1069-4	3	EA	2
4730-00-889-2378	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS 1, 3 IN NOM SIZE (96906) MS27027-15	4	EA	1
5330-00-088-9166	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE,3 IN NOM SIZE (96906) MS27030-8	5	EA	1
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL GR 5, CAD PL,.375-16 UNC-2A X 1.50L (96906) MS90725-64	6	EA	16
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL CAD PL, GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	7	EA	16

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-01-214-9128	VALVE ASSY, REDUCER, 3 IN, QUICK DISCONNECT (CONTINUED)	13226E8264		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL., .375 IN NOM SIZE (96906) MS35338-46	26-8	EA	16
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16U NC-2B (96906) MS35649-2382	9	EA	16
4730-00-649-9100	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, CAP, DUST, TYPE IX, CLASS 1, 2 IN NOM SIZE (96906) MS27028- 11	10	EA	1
4730-00-929-0790	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, 3 IN NOM SIZE (96906) MS27029-15	11	EA	1
5330-00-612-2414	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 2 IN NOM SIZE (96906) MS27030-6	12	EA	1
	RING, KEY (TBD) 3682	13	EA	2

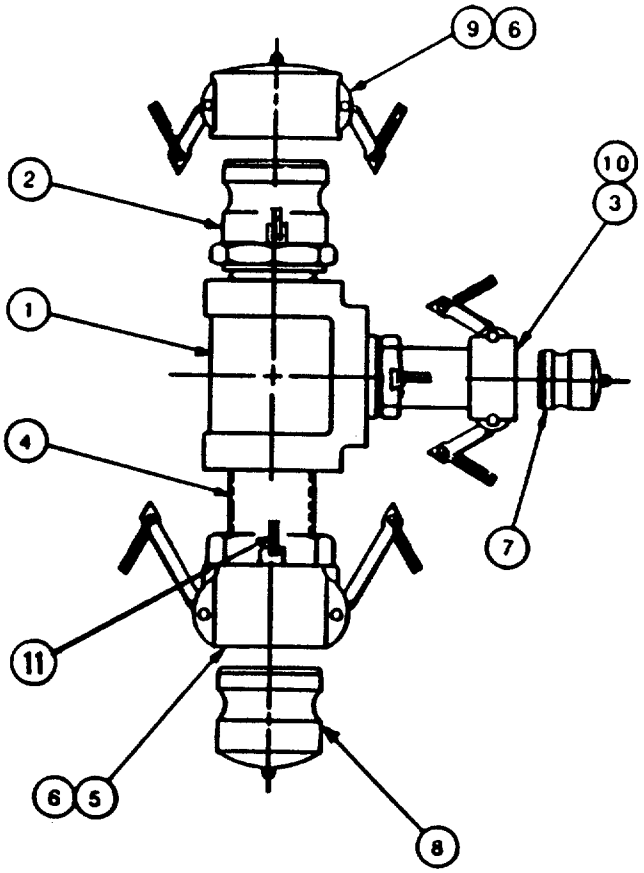


FIG. 27 2 INCH TEE ASSEMBLY, REDUCER, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-210-5627	TEE ASSY, REDUCER, QUICK DISCONNECT	13226E8262		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	TEE FITTING, PIPE, ALUMINUM ALLOY, (INT THREAD) 150 PSI, 2X2X2 (90598) 255546-1	27-1	EA	1
4730-00-938-7997	COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, MALE, EXTERNAL PIPE THREAD, TYPE III, CLASS 1, 2 IN NOM SIZE (96906) MS27022-11	2	EA	1
4730-00-901-2886	REDUCER, EXTERNAL PIPE THREAD BY QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, TYPE XIII, CLASS 1 (2 IN THD END BY 1 IN FEMALE) (96906) MS49002-5	3	EA	1
	NIPPLE, 2 IN BY 3 IN LG (90598) 25544-1	4	EA	1
4730-00-649-9103	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, INTERNAL PIPE THREAD, TYPE 5, CLASS 1, 2 IN NOM SIZE (96906) MS27024-11	5	EA	1
5330-00-612-2414	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 2 IN NOM SIZE (96906) MS27030-6	6	EA	2

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-210-5627	TEE ASSY, REDUCER, QUICK DISCONNECT (CONTINUED)	13226E8262		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4940-00-360-0715	PLUG, COUPLING, QUICK DISCONNECT, CAM-LOCKING TYPE, DUST, TYPE X CLASS 1, 1 IN NOM SIZE (96906) MS27029-5	27-7	EA	1
4730-00-915-5127	PLUG, COUPLING HALF, QUICK DISCONNECT CAM-LOCKING TYPE, DUST, TYPE X, CLASS 1, 2 IN NOM SIZE (96906) MS27029-11	8	EA	1
4730-00-649-9100	PLUG, COUPLING HALF, QUICK CAP, COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, DUST, TYPE IX, CLASS 1, 2 IN NOM SIZE (96906) MS27028-11	9	EA	1
5330-00-080-9167	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 1 IN NOM SIZE (96906) MS27030-3	10	EA	1
	RING, KEY (TBD) 3682	11	EA	3

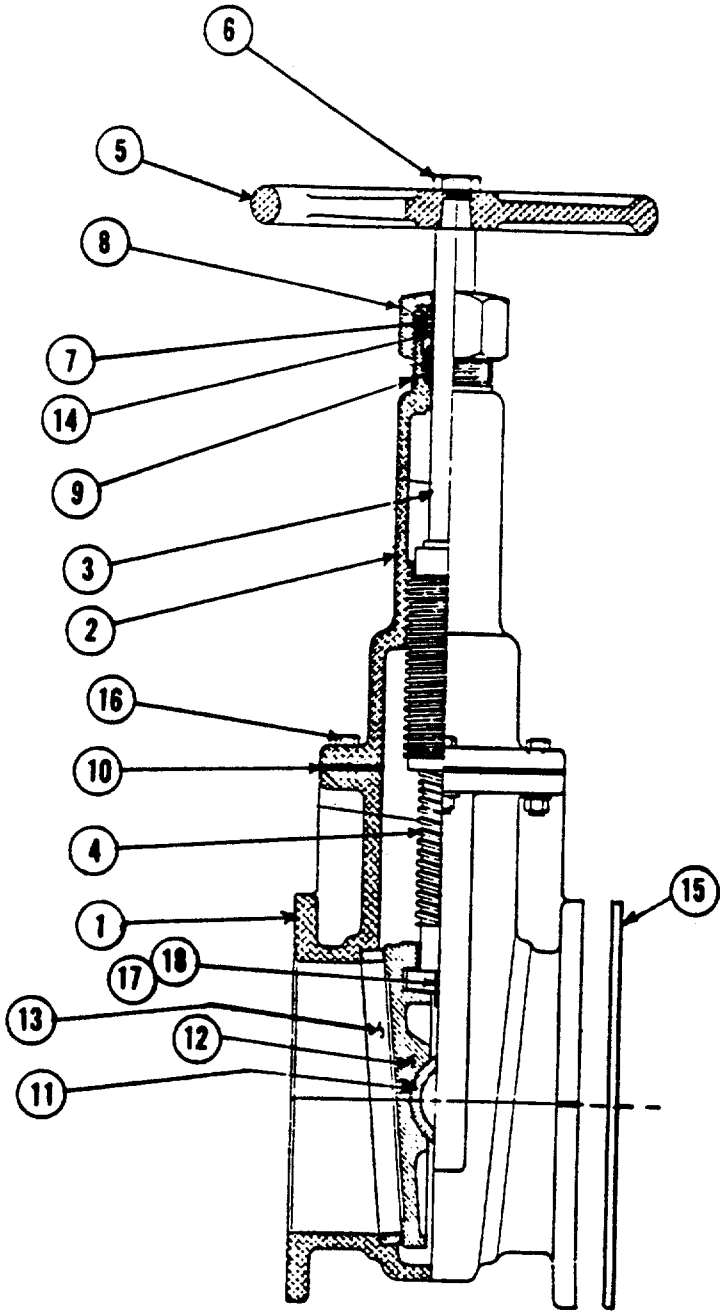


FIG. 28 VALVE, GATE, ALUM, 6 IN

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-00-197-821	VALVE, GATE, ALUMINUM, 6 IN	6.00 IN. 235-RF		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	BODY (41592) 6" 235-RF1	28-1	EA	1
	BONNET (41592) 6" 235-RF2	2	EA	1
	STEM, UPPER (41592) 6" 235-RF3	3	EA	1
	STEM, LOWER (41592) 6" 235-RF3A	4	EA	1
	HANDWHEEL (41592) 6" 235-RF4	5	EA	1
	NUT, HANDWHEEL (41592) 6" 235-RF5	6	EA	1
	PACKING, GLAND (41592) 6" 235-RF6	7	EA	1
	PACKING, NUT (41592) 6" 235-RF7	8	EA	1
	PACKING, RING (41592) 6” 235-RF8	9	EA	1
	GASKET, BONNET (41592) 6" 235-RF9	10	EA	1
	DISC, MALE (41592) 6" 235-RF10	11	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4820-00-197-8211	VALVE, GATE, ALUMINUM, 6 IN (CONTINUED)	6.00 IN. 235-RF		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	DISC, FEMALE (41592) 6" 235-RF12	28-12	EA	1
	SEAT, RING (41592) 6" 35-RF1S	13	EA	1
	SPRING, PACKING, GLAND (41592) 6" 235-RF16	14	EA	1
	GASKET, FLANGE (41592) 6” 235-RF20	15	EA	1
	BOLT, NUT, WASHER (41592) 6" 235-RF21	16	EA	6
	INSERT, LOWER STEM (41592) 6" 235-RF23	17	EA	1
	PIN, SPRING (41592) 6" 235-RF24	18	EA	1

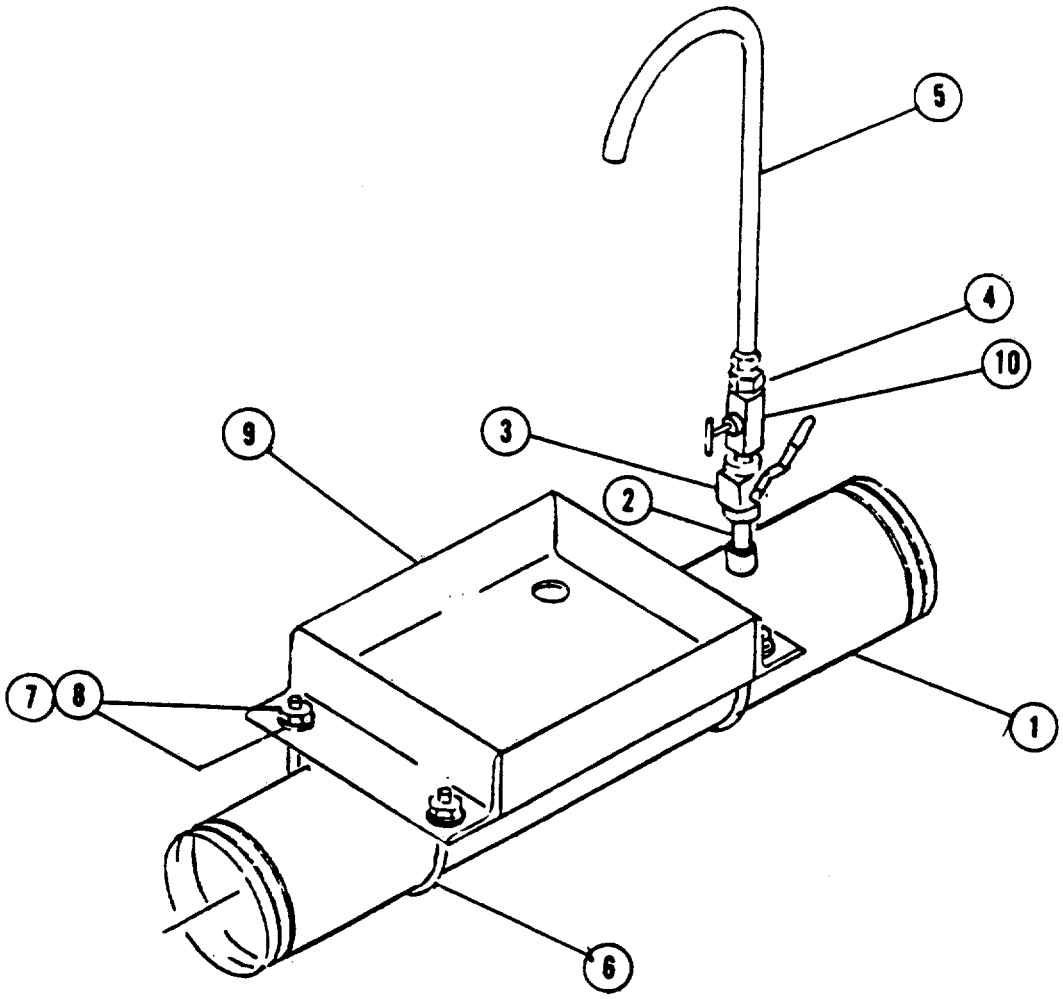


FIG. 29 FUEL SAMPLING ASSEMBLY

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	FUEL SAMPLING ASSEMBLY	25589-100		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	WELDMENT, SAMPLING PIPE (90598) 25592-100	29- 1	EA	1
	NIPPLE, ALUM 1/2 IN. MXF (90598) 25593-1	2	EA	1
	VALVE, HAND 1/2 IN. MXF (8T690) F-3333-RRR See Appendix A for Breakdown	3	EA	1
	FITTING, COMPRESSION TUBE (90598) 25604-100	4	EA	1
	TUBE, ALUMINUM 1/2 X 26 IN. (90598) 25595-1	5	EA	1
	U-BOLTS, STEEL (90598) 25596-1	6	EA	2
	NUT, HEX, STEEL 5/8-11UNC-2B (96906) MS51967-20	7	EA	8
	WASHER, PLAIN, STEEL (96906) MS27183-22	8	EA	8
	WELDMENT, SAMPLING TABLE (90598) 25599-100	9	EA	1
	VALVE, NEEDLE MXF 1/2 IN. (01343) H7VS-44Q See Appendix A for Breakdown	10	EA	1

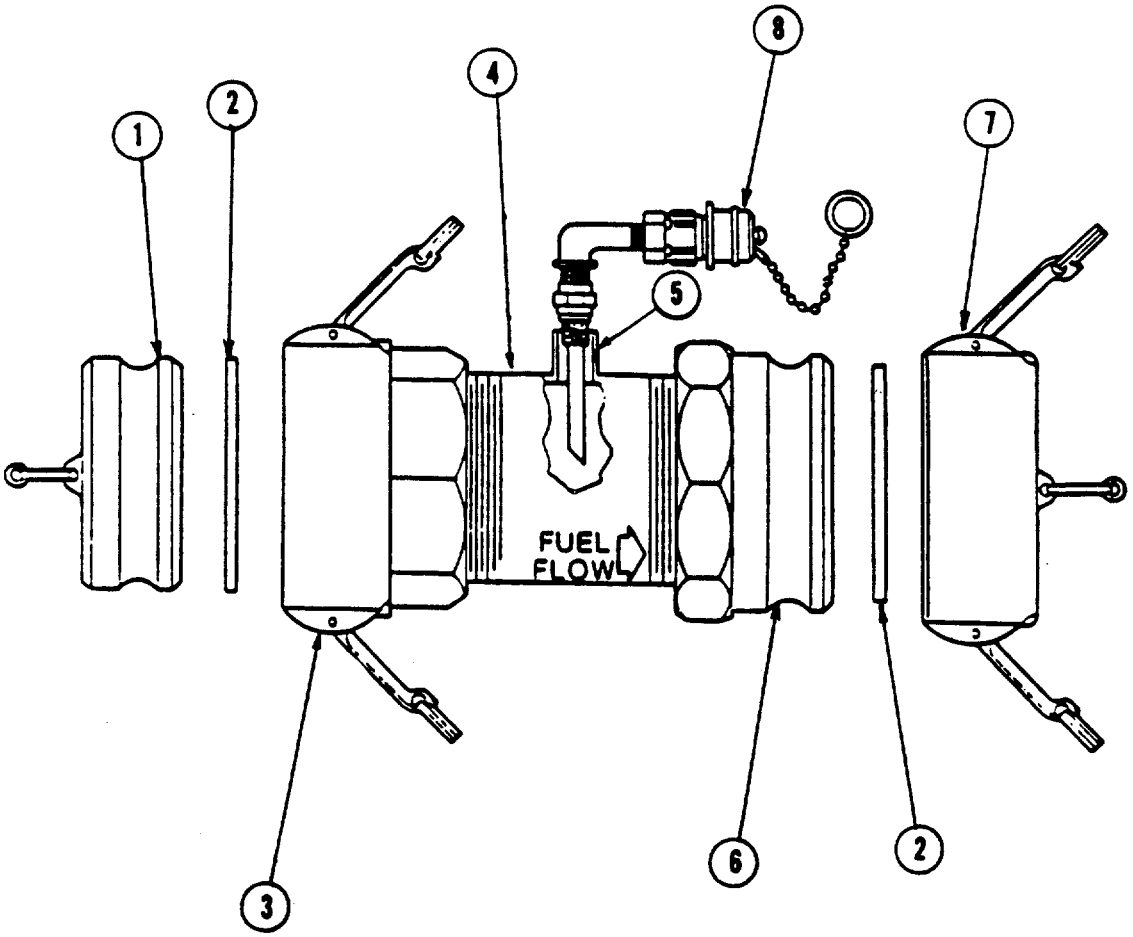


FIG. 30 WATER DETECTOR KIT ADAPTER

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4730-01-013-7590	WATER DETECTOR KIT ADAPTER	13220E9406-2		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	PLUG, DUST (96906) MS27029-17	30-1	EA	1
	GASKET (96906) MS27030-9	2	EA	2
	COUPLING-HALF, FEMALE (96906) MS27024-17	3	EA	1
	NIPPLE, PIPE, 4 IN. NPT X 6 IN LONG (96906) MIL-P-25995 TYPE II	4	EA	1
	FITTING, ADAPTER (96906) MS2618/1 E02X MIL-F-52618	5	EA	1
	COUPLING-HALF, MALE (96906) MS27020-17	6	EA	1
	CAP, DUST (96906) MS27028-17	7	EA	1
	PROBE ASSY (97403) 13220E9914-2	8	EA	1

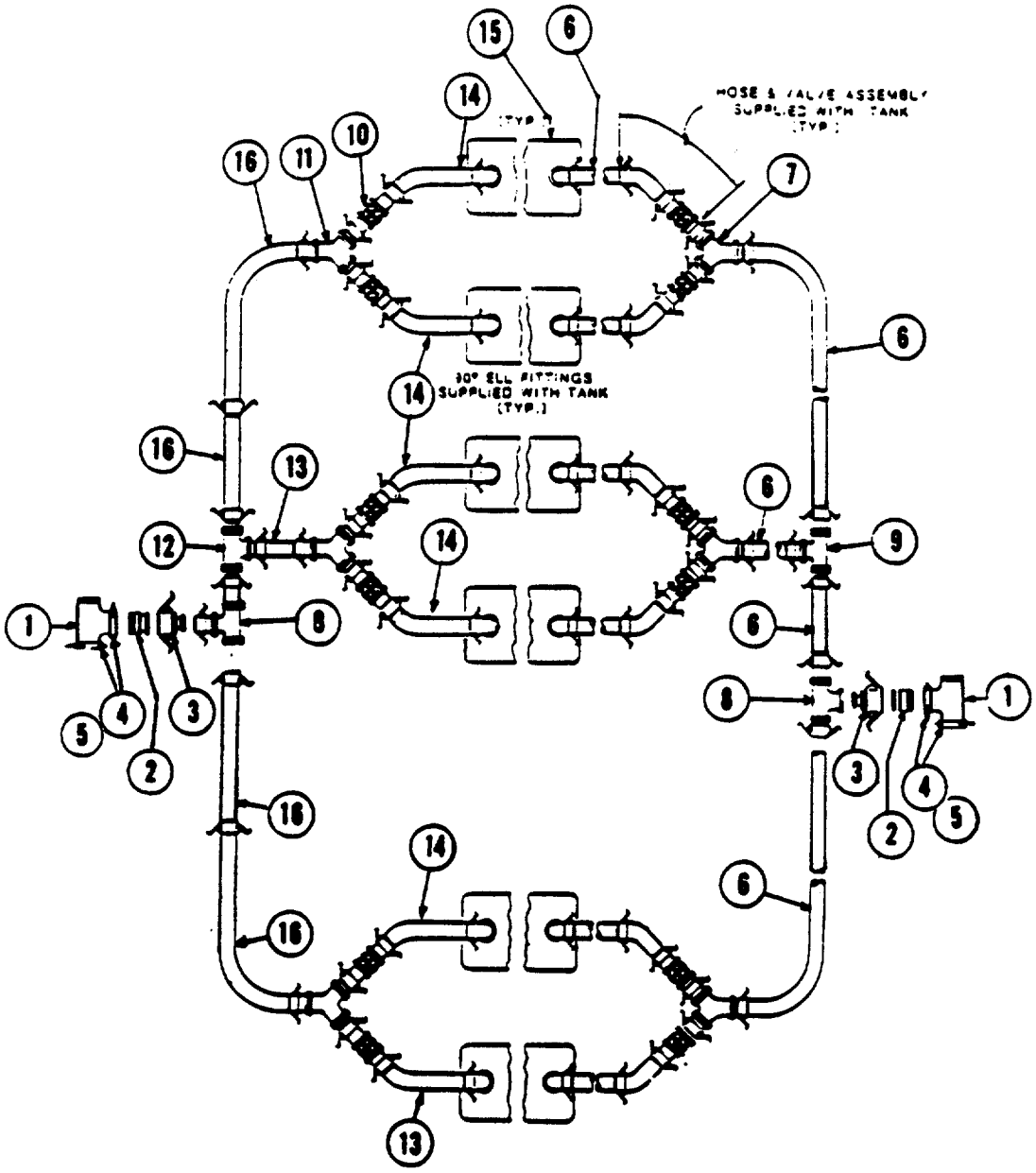


FIG. 31 50,000 GAL. TANK OPTION

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	50,000 GAL TANK, TPT OPTIONAL CONFIGURATION	25586-100 (REF. TPT-5357-002)		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-01-210-5628	TEE, 6 IN, DBLGROOVE (71954) F-060-020-A-2C	31-1	EA	2
	COUPLING HALF, QUICK DISCONNECT, NIPPLE ADAPTER, MALE BY DBL. GROOVED END PIPE, TYPE XIX, CLASS I, 6 IN NOM SIZE (96906) MS70100-3	2	EA	12
4730-01-079-8234	REDUCER, QUICK DISCONNECT, CAM-LOCKING TYPE XI, CLASS 1, (6 IN FEMALE BY 4 IN MALE) (96906) MS49000-21	3	EA	12
4730-01-209-4413	COUPLING, CLAMP, GROOVED-END PIPE, 6 IN NOM SIZE (79154) C-050-078-P-OG	4	EA	14
	GASKET, SYNTHETIC RUBBER, PRE-LUBRICATED W/DRY LUBRICANT, 6 IN NOM SIZE (79154) G-060-075-0-T7	5	EA	14
4720-00-727-1339	HOSE ASSY, LIQUID, FUEL, SUCTION, NON-COLLAPSIBLE, 4 IN. ID, 12 FT LG (97403) 13226E8283-1 See figure 5 for breakdown	6	EA	40
4730-01-210-5626	Y ASSY, FLANGED 4 IN, QUICK DISCONNECT (97403) 13226E8258-1 See figure 22 for breakdown	7	EA	3

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	50,000 GAL TANK, TPT OPTIONAL CONFIGURATION (CONTINUED)	25586-100 (REF. TPT-5357-002)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	TEE ASSY, FLANGED 4 IN, QUICK DISCONNECT, ONE MALE AND TWO FEMALE COUPLINGS, CAM-LOCKING (97403) 13226E8275-1 See figure 22 for breakdown	31-8	EA	2
	TEE ASSY, FLANGED 4 IN, QUICK DISCONNECT, THREE FEMALE CAM-LOCKING COUPLINGS (90598) 25587-100 See figure 33 for breakdown	9	EA	1
4820-01-210-5605	VALVE ASSY, 4 IN, QUICK DISCONNECT, CAM-LOCKING (97403) 13226E8282-1 See figure 21 for breakdown	10	EA	6
3835-01-210-5630	Y ASSY, FLANGED 4 IN, QUICK DISCONNECT, TWO MALE AND ONE FEMALE CAM-LOCKING COUPLINGS (997403) 13226E8274-1 See figure 23 for breakdown	11	EA	3
	TEE ASSY, FLANGED 4 IN, QUICK DISCONNECT, THREE MALE CAM-LOCKING COUPLINGS (90598) 25588-100 See figure 34 for breakdown	12	EA	1
4720-01-210-4560	HOSE ASSY, LIQUID FUEL, COLLAPSIBLE, 4 IN ID, 12 FT LG (97403) 13226E8285-1 See figure 6 for breakdown	13	EA	5

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	50,000 GAL TANK, TPT OPTIONAL CONFIGURATION (CONTINUED)	25586-100 (REF. TPT-5357-002)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4720-00-083-0047	HOSE ASSY, RUBBER, SYNTHETIC, LIQUID PETROLEUM FUELS, DISCHARGE, COLLAPSIBLE, 4 IN ID, 25 FT LG (90598) 25503-101 See figure 19 for breakdown	31-14	EA	10
5430-00-182-8181	TANK, FABRIC, COLLAPSIBLE, 50,000 GAL PETROLEUM (81349) MIL-T-52983 GFE	15	EA	6
4720-00-083-0046	HOSE ASSY, LIQUID FUEL, DISCHARGE, COLLAPSIBLE, 4-IN ID, 50 FT LG, QUICK DISCONNECT (90598) 25503-100 See figure 19 for breakdown	16	EA	4

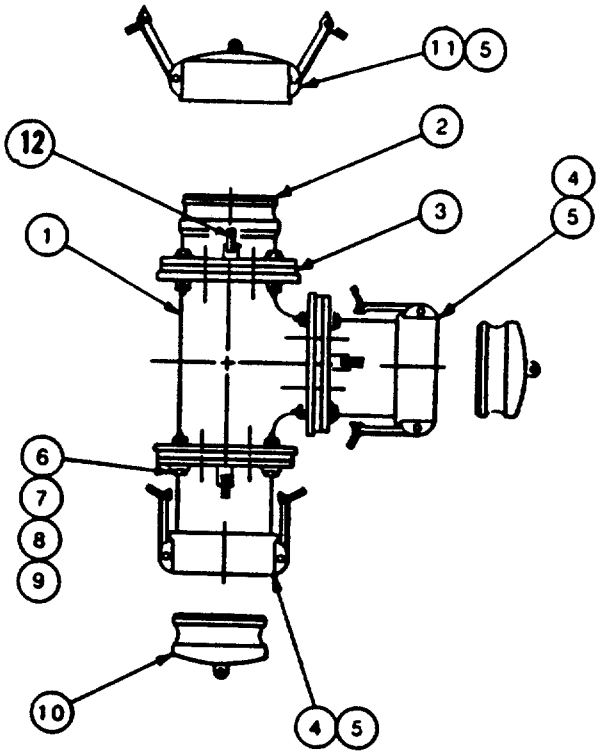


FIG. 32 4 INCH TEE ASSEMBLY, QUICK DISCONNECT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	TEE ASSY, FLANGED, 4 IN, QUICK DISCONNECT	13226E8275		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4730-00-804-5346	TEE, FLANGED, ALUMINUM ALLOY 4 IN DIA ALL ENDS (97403) 13216E8243-1	32-1	EA	1
4730-00-840-5347	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, MALE, FLANGED, TYPE IV, CLASS I, 4 IN NOM SIZE (96906) MS27023-17	2	EA	1
5330-00-647-2072	GASKET,FLANGE,CORK, 6.75 IN OD, 4 IN APERATURE DIA (97403) 13220E 1069-1	3	EA	3
4730-00-840-5348	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS 1,4 IN NOM SIZE (96906) MS27027-17	4	EA	2
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN, NOM SIZE (96906) MS27030-9	5	EA	3
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL, GR 5, CAD PL, .375-16 UNC-2A X 1.50L (96906) MS90725-64	6	EA	24
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL, CAD PL, GENERAL PURPOSE, 406 IN ID (96906) MS27183-14	7	EA	24

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	TEE ASSY, FLANGED, 4 IN, QUICK DISCONNECT (CONTINUED)	13226E8275		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM SERIES, STEEL, CAD PL, .375 IN NOM SIZE (96906) MS35338-46	32-8	EA	24
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16UNC-2B (96906) MS35649-2382	9	EA	24
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1,4 IN NOM SIZE (96906) MS27029-17	10	EA	2
4730-00-640-6156	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, DUST, TYPE IX, CLASS 1, 4 IN NOM SIZE (96906) MS27028-17	11	EA	1
	RING, KEY (TBD) 3682	12	EA	3

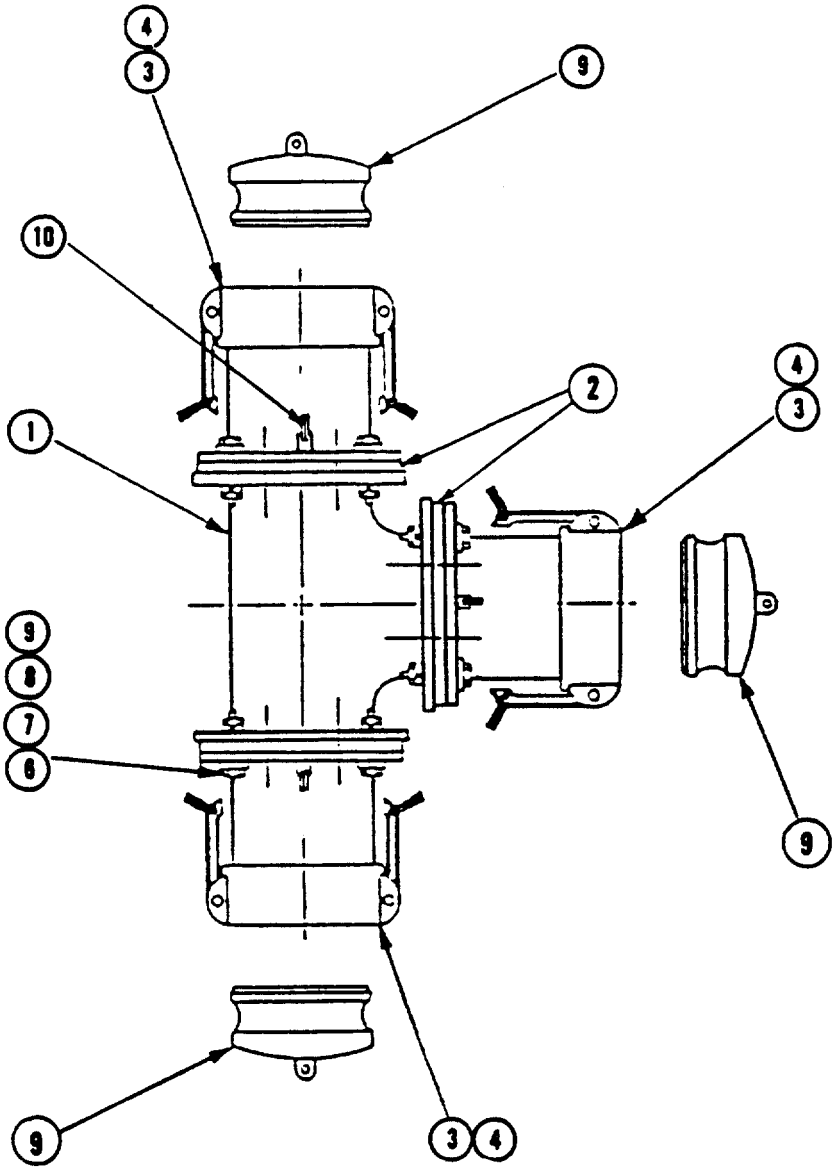


FIG. 33 FLANGED TEE ASSY, 4 IN, FEM

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	TEE ASSY, FLANGED, 4 IN, QUICK DISCONNECT	25587-100 (REF. TPT-5357-004)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4730-00-840-5346	TEE, FLANGE, ALUMINUM ALLOY, LEG LG 4.25 IN, 4 IN DIA ALL ENDS, 8.5 IN O/A LG (97403) 13216E8243-1	33-1	EA	1
5330-00-647-2072	GASKET, FLANGE, CORK, 6.75 IN OD,4 IN APERATURE DIA (97403) 13220E1069-1	2	EA	3
4730-00-840-5348	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, FEMALE, FLANGED, TYPE VIII, CLASS 1,4 IN NOM SIZE (96906) MS27027-17	3	EA	3
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN, NOM SIZE (96906) MS27030-9	4	EA	3
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL, GR 5,CAD PL, .375-16UNC-2A X 1.50L (96906) MS90725-64	5	EA	24
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL, CAD PL, GENERAL PURPOSE, 406 IN ID 96906) MS27183-14	6	EA	24
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL, .375 IN NOM SIZE (96906) MS35338-46	7	EA	24

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	TEE ASSY, FLANGED, 4 IN, QUICK DISCONNECT (CONTINUED)	25587-100 (REF. TPT-5357-004)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL,CAD PL, .375-16UNC-2B (96906) MS35649-2382	33-8	EA	24
4730-00-640-6188	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE X, CLASS 1, 4 IN NOM SIZE (96906) MS27029-17	9	EA	3
	RING, KEY (TBD) 3682	10	EA	3

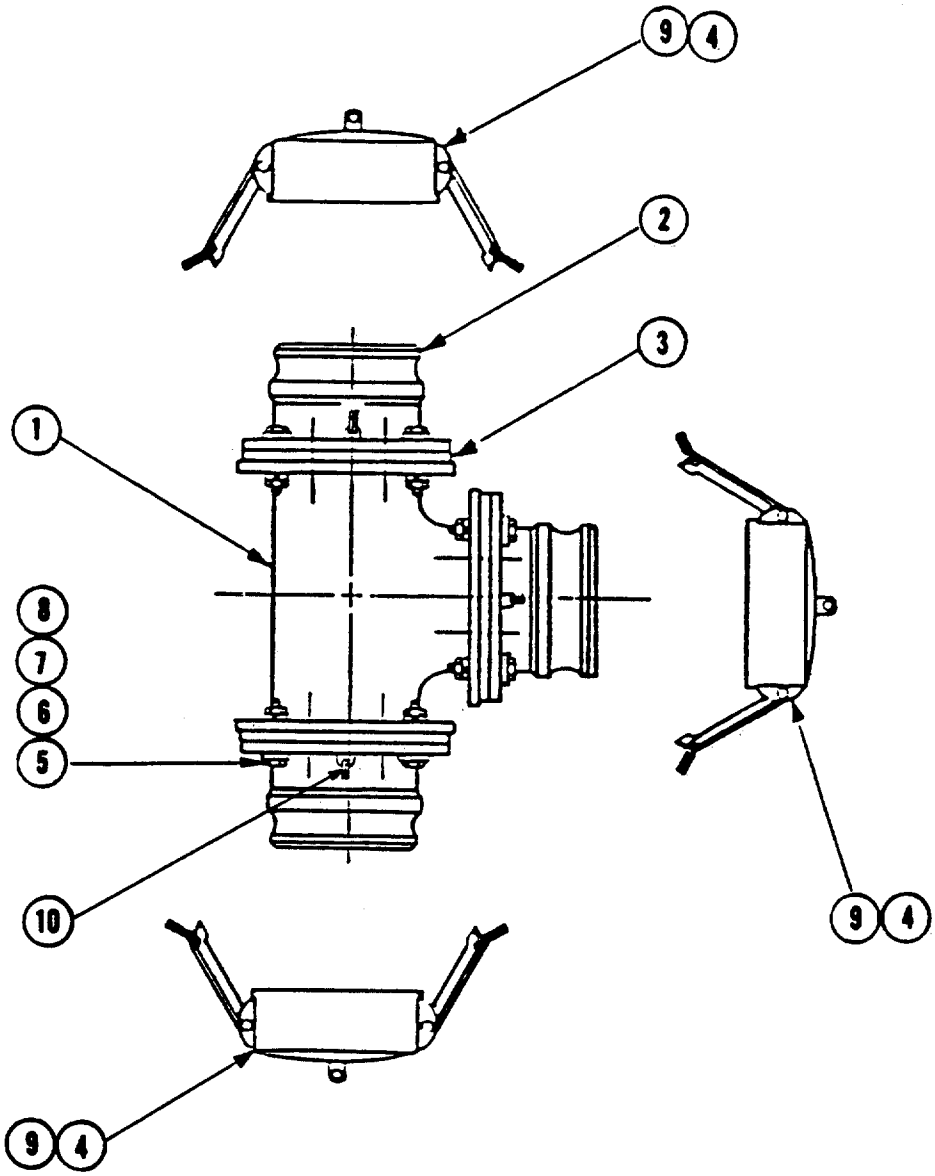


FIG. 34 FLANGED TEE ASSY, 4 IN, MALE

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
5310-00-056-3395	TEE ASSY, FLANGED, 4 IN MALE, QUICK DISCONNECT	25588-100 (REF. TPT-5357-003)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
4730-00-840-5346	TEE, FLANGE, ALUMINUM ALLOY, 4 IN (97403) 13216E8243-1	34-1	EA	1
4730-00-840-5347	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, MALE, FLANGED, TYPE IV, CLASS 1,4 IN NOM SIZE (96906) MS27023-17	2	EA	3
5330-00-647-2072	GASKET, FLANGE, CORK, 6.75 IN OD, 4 IN APERATURE DIA (97403) 13220E 1069-1	3	EA	3
5330-00-899-4509	GASKET-COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, 4 IN NOM SIZE (96906) MS27030-9	4	EA	3
5305-00-269-3214	SCREW, CAP, HEX-HEAD, STEEL, GR 5,CAD PL, .375-16UNC-2A X 1.50L (96906) MS90725-64	5	EA	24
5310-00-080-6004	WASHER, FLAT-ROUND, STEEL, CAD PL, GENERAL PURPOSE, .406 IN ID (96906) MS27183-14	6	EA	24
5310-00-637-9541	WASHER, LOCK-SPRING, HELICAL, REGULAR (MEDIUM) SERIES, STEEL, CAD PL, .375 IN NOM SIZE (96906) MS35338-46	7	EA	24

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
5310-00-056-3395	TEE ASSY, FLANGED, 4 IN MALE, QUICK DISCONNECT (CONTINUED)	25587-100 (REF. TPT-5357-003)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
5310-00-056-3395	NUT, HEX-HEAD, MACHINE SCREW, STEEL, CAD PL, .375-16UNC-28 (96906) MS35649-2382	34-8	EA	24
4730-00-640-6156	COUPLING HALF, QUICK DISCONNECT, CAM-LOCKING TYPE, PLUG, DUST, TYPE IX, CLASS 1,4 IN NOM SIZE (96906) MS27028-17	9	EA	3
	RING, KEY (TBD) 3682	10	EA	3

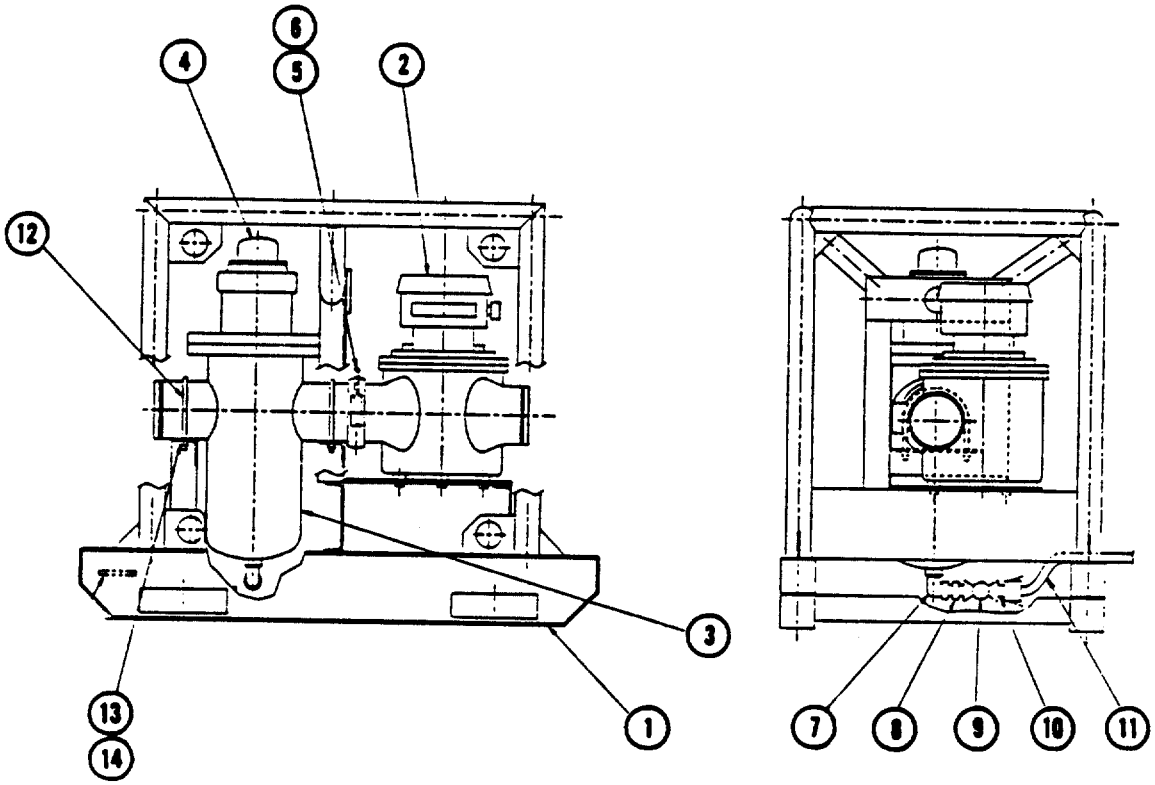


FIG. 35 METER STRAINER ASSY

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	METER SKID ASSY 6"-800 GPM (METER STRAINER ASSY)	25608-100 (REF. TPT-5357-019)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	WELDMENT, METER SKID (90598) 25609-100	35- 1	EA	1
	METER, POSITIVE DISPLACEMENT, ALUMINUM,800 GPM, 6" DBL GROOVED ENDS W/COUNTER AND DISPLAY IN U.S. GALLONS, 150 PSI WORKING PRESSURE (TBD) SF-6V-NF See Appendix A for Breakdown	2	EA	1
	STRAINER, VERTICAL, IN-LINE, W/40 MESH SCREEN, 6" DBL GROOVE ENDS, 150 PSI WORKING PRESSURE, 800 GPM (90598) 25606-1 See Appendix A for Breakdown	3	EA	1
	AIR RELEASE HEAD, 150 PSI WORKING PRESSURE MOUNTED ON STRAINER (90598) 25607-1	4	EA	1
4730-01-209-4413	COUPLING, CLAMP, GROOVED END PIPE 6 IN. NOM SIZE (79154) C-050-078-P-OG	5	EA	1
	GASKET, SYNTHETIC RUBBER, PRE-LUBRICATED, 6 IN. NOM SIZE (79154) G-060-075-0-T7	6	EA	1
	ELBOW, STREET, 1-1/4" NPT, 3000 PSI ANSI 816.11 (90598) 31034-4	7	EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
	METER SKID ASSY 6" -800 GPM (METER STRAINER ASSY) (CONTINUED)	25608-100 (REF. TPT-5357-019)		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	REDUCER, BUSHING, HEX HEAD, 1-1/4" X 1" NPT, ANSI B16.11 (90598) 25602-1	35- 8	EA	1
	VALVE, BALL, M X F, NPT, 1000 PSI, 1' NOM PIPE SIZE (90598) 25603-1 See figure 36 for breakdown	9	EA	1
4730-00-084-7435	COUPLING HALF, QUICK DISCONNECT, CAM LOCKING, 1" MNPT (96906) MS2702Z-5 TYPE III, CLASS I, SIZE 05	10	EA	1
4720-00-083-0049	HOSE ASSY, QUICK DISCONNECT, CAM-LOCKING, 1" MALE X 1" FEMALE, 25 FTLG (90598) 25503-106 See figure 19 for breakdown	11	EA	1
	U-BOLT.50 DIA (90598)31037-1	12	EA	2
	NUT, 1/2 IN HEX HEAD (90598) 31033-1	13	EA	4
	WASHER, BEVELED (88779) TBD (90598) 25518-1	14	EA	4

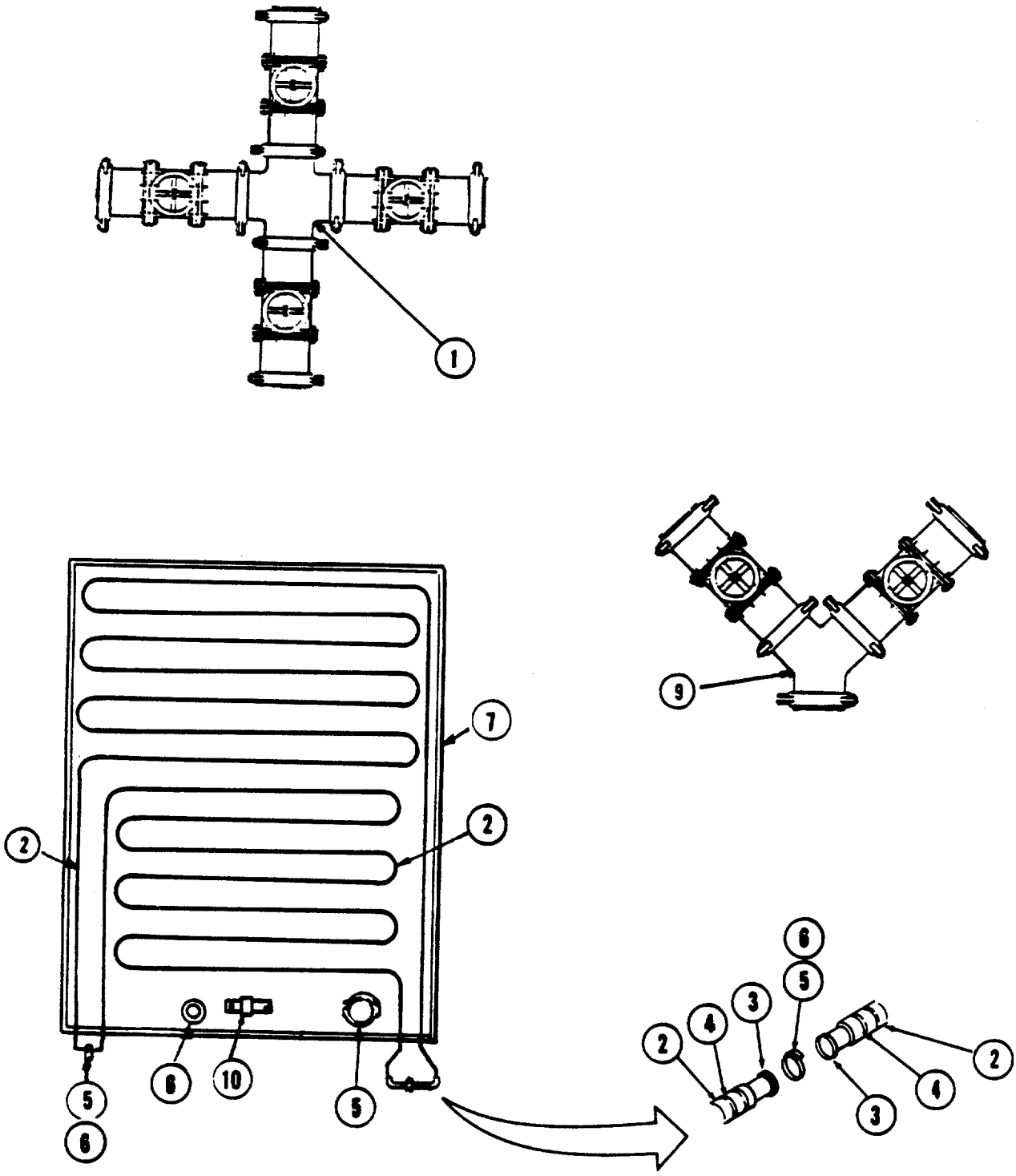


FIG. 36 TRANSFER HOSE LINE ASSEMBLY, 6 IN

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5613	TRANSFER HOSE LINE ASSEMBLY, 6 IN	13226E8253		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
3835-01-210-5595	CROSS ASSY, 6 IN, DBL GROOVE (97403) 13225E9182	36-1	EA	2
	HOSE, RUBBER (SYNTHETIC): FUEL, DISCHARGE, COLLAPSIBLE, 6 IN., 250 FT. LG. (81349) MIL-H-82127	2	EA	56
	ADAPTER, HOSE TO DBL GROOVE, 6 IN. (97403) 13226E8269	3	EA	112
	CLAMP, HOSE, 6 IN. NOM SIZE, 0.750 IN. BANDWIDTH, CORROSION-RESISTING STEEL (81348) WW-C-440, TYPE H	4	EA	336
4730-01-209-4413	COUPLING, CLAMP, GROOVED- END PIPE, 6 IN. NOM SIZE (97403) 13226E 1575-9	5	EA	84
	GASKET, SYNTHETIC RUBBER, PRE-LUBRICATED W/DRY LUBRICANT, 6 IN. NOM SIZE (97403) PD 4730-0016	6	EA	84
	FLAKING BOX ASSY (97403) 1322E9182-10	7	EA	28

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
3835-01-210-5613	TRANSFER HOSE LINE ASSEMBLY, 6 IN (CONTINUED)	13226E8253		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
3835-01-210-5592	Y ASSY, 61N., DBLGROOVE (97403) TL-TA-CPL-20018	36-9	EA	1
	SWIVEL, 6 IN., DBL GROOVE 150 PSI WORKING PRESSURE (RED HEAD BRASS) SWV-6	10	EA	28

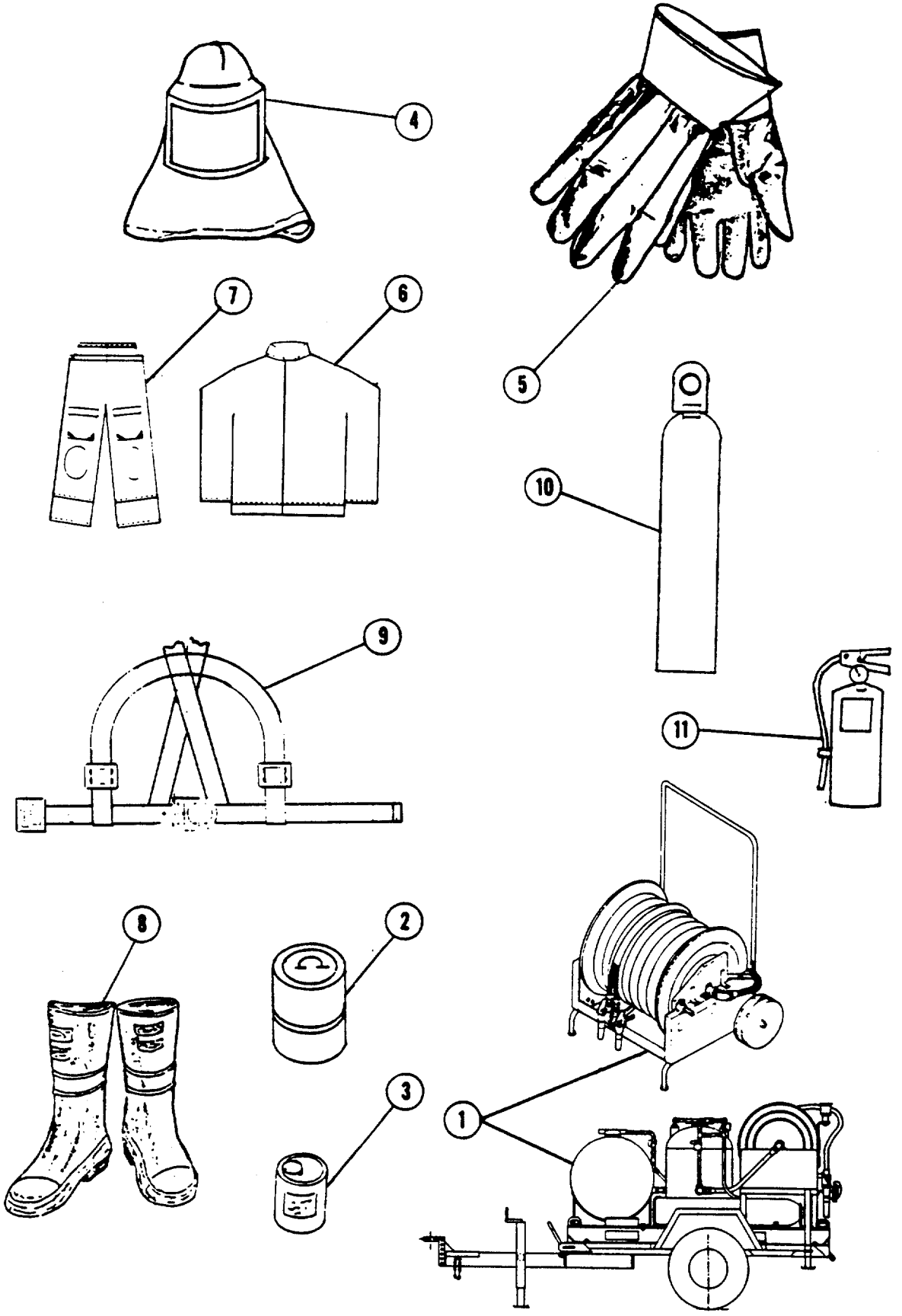


FIG. 37 FIRE SUPPRESSION EQUIPMENT

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4210-01-210-8728	FIRE SUPPRESSION EQUIPMENT	25623-100		
	CONSISTING OF THE FOLLOWING COMPONENTS	FIG.& INDEX NO.	U/I	QTY
4210-01-210-6466	EXTINGUISHER, FIRE DRY CHEMICAL AND AFFF, SELF CONTAINED, TRAILER MOUNTED W/REMOTE HOSE CART, WHEEL MOUNTED (64903) 04453 See Appendix A for Breakdown	37-1	EA	1
4210-00-752-9343	DRY CHEMICAL, FIRE, PURPLE K (50 LB CAN) (81439) 0-D-1407	2	EA	36
4210-01-056-8343	FOAM LIQUID, FIRE (5 GAL) (81439) MIL-F-24385	3	EA	5
	HOOD, FIRE, KEVLAR (93934) 566HK	4	EA	3
	GLOVES, FIRE, KEVLAR (93934) GL-2-KM	5	EA	4
	COAT, FIRE, KEVLAR (M) (93934) 1576MK-M	6	EA	1
	COAT, FIRE, KEVLAR (L) (93934) 1576MK-L		EA	1
	COAT, FIRE, KEVLAR (S) (93934) 1576MK-S		EA	1
	TROUSER, FIRE, KEVLAR (M) (93934) 2576MK-M	7	EA	1
	TROUSER, FIRE, KEVLAR (L) (93934) 2576MK-L		EA	1

PARTS LIST

NATIONAL STOCK NUMBER	DESCRIPTION	DRAWING NO.		
4210-01-210-8728	FIRE SUPPRESSION EQUIPMENT (CONTINUED)	25623-100		
	CONSISTING OF THE FOLLOWING COMPONENTS	**FIG.& INDEX NO.**	**U/I**	**QTY**
	TROUSER, FIRE, KEVLAR (S) (93934) 2576MK-S	37-EA	1	
	BOOTS, FIRE, RANGER, KNEE (SIZE 8) (85960) 3124/27-8	8	PR	1
	BOOTS, FIRE, RANGER, KNEE (SIZE 9) (85960) 3124/27-9		PR	1
	BOOTS, FIRE, RANGER, KNEE (SIZE 10) (85960) 3124/27-10		PR	1
	BOOTS, FIRE, RANGER, KNEE (SIZE 7) PR (85960) 3124/27-7		PR	1
	BOOTS, FIRE, RANGER, KNEE (SIZE 6) PR (85960) 3124/27-6		PR	1
3835-01-210-5594	HARNESS, SHOULDER, NYLON (83295) 235N	9	EA	1
	N_2 CYLINDER W/SUPERIOR VALVE 300 CU. FT (07464) 05053300	10	EA	8
	EXTINGUISHER, FIRE, DRY CHEMICAL, 20 LBCAPACITY, TYPE 1, CLASS 2, SIZE 20 (81348) A-A-393	11	EA	5

APPENDIX A

OVERVIEW

The information contained in this appendix is provided to supplement the operating instructions, maintenance instructions and parts list contained in the body of this manual. The information is comprised of commercial data, vendor data sheets, and government publications as applicable.

APPENDIX A

SUPPLEMENTAL TECHNICAL DATA

TABLE OF CONTENTS

APPENDIX A

PART I

SUPPLEMENTAL TECHNICAL DATA

APPENDIX A

PART I

SUPPLEMENTAL TECHNICAL DATA

TECHNICAL MANUAL

FOR

SELF CONTAINED DRY CHEMICAL
AND AQUEOUS FILM FORMING FOAM
FIRE EXTINGUISHER MODEL NO. 450 PKP/100 AFFF

APPENDIX A

U.S. MARINE CORPS TECHNICAL MANUAL

OPERATION INSTRUCTIONS AND MAINTENANCE INSTRUCTIONS

EXTINGUISHER, FIRE, DRY CHEMICAL AND AQUEOUS FILM FORMING FOAM SELF-CONTAINED MODEL NO. 450 PKP/100 AFFF 03638MC NSN-4210-01-205-2246

FIRE COMBAT, INC.

M00027-84-C-0871

OCTOBER 1985

APPENDIX A

LIST OF EFFECTIVE PAGES

Insert latest change pages; dispose of superseded pages in accordance with applicable regulations.

NOTE

On a changed page, the portion of the text affected by the latest change is indicated by a vertical line or other change symbol in the outer margin of the page. Changes to the illustrations are indicated by miniature pointing hands. Changes to wiring diagram are indicated by shaded areas.

Total number of pages in this manual is 112 consisting of the following:

Page Number	#Change No.
Title	0
A	0
A i- A vii	0
A viii blank	0
A 1-1 - A 1-2	0
A 1-26 blank	0
A 2-1 - A 2-16	0
A 3-1 - A 3-62	0

#Zero in this column indicates an original page.

APPENDIX A

TABLE OF CONTENTS

APPENDIX A

TABLE OF CONTENTS (CONTINUED)

LIST OF ILLUSTRATIONS

APPENDIX A

LIST OF ILLUSTRATIONS (CONTINUED)

LIST OF TABLES

APPENDIX A

SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore, do not appear elsewhere in this manual. These are recommendations that personnel should understand and apply during any phase of operation or maintenance where applicable.

USE ALL POSSIBLE PRECAUTIONS WITH NITROGEN PRESSURE

All dry chemical and AFFF system piping and components should be considered charged until the system is deactivated for any particular maintenance function.

Ensure that systems are deactivated before loosening any connection, hoses, or nozzles.

Never uncouple nozzles or connections to hose reel cart until hoses are depressurized and cleared.

Use care to ensure valves are closed, and protective covers installed, when possible, during installation, removal or shipment of the high pressure nitrogen cylinders.

AVOID SPILLAGE OF CHEMICAL AGENTS

When possible during test procedures, drain hoses into suitable containers. AFFF concentrate is corrosive, and although the dry chemical agents are considered non-toxic, discharge of large quantities may temporarily interfere with visibility.

Should the eyes become irritated from contact with either agent, flush immediately with clean fresh water. After spillage of either fire-fighting agent occurs, the areas should be decontaminated immediately by flushing with water.

The following warnings appear in the text in this manual, and are repeated here for emphasis:

WARNING

Be sure lifting device is capable of lifting the specified weights, or personal injury could result. (Page 1-14)

APPENDIX A

WARNING

Pressure in tank must be vented off through handline before fill cap is removed. (Page 3-11 and 3-13).

WARNING

Use normal precautions when cleaning with compressed air to prevent injury to personnel. Compressed air for cleaning purposes will not exceed 30 psi. User should wear safety goggles, and should not direct the stream of air toward himself or other persons. (Pages 1-18, 3-11, and 3-36)

WARNING

The nitrogen cylinders are originally charged with 2400 psig pressure. Use caution when performing any of the following steps where personnel may be exposed to cylinder pressure. (Page 1-19)

WARNIING

Special heat resistant clothing, including hood, coat, pants, gloves and preferably boots, must be worn while fighting any large scale petroleum fire. (Page 2-13)

WARNING

120/240 VAC used in operation of this equipment. DEATH on contact may result if personnel fail to observe safety precautions. (Page 3-7)

APPENDIX A

WARNING

Four pressure relief holes are drilled in the threaded portion of the filler cap approximately three threads before the cap is released. If pressure is heard escaping through these holes while the cap is being removed, stop removal until all pressure has escaped; otherwise serious injury to personnel could result. Page 3-12 and 3-14)

WARNING

Be sure system is depressurized before installing gage. (Page 3-17)

WARNING

The nitrogen pressure used in fire extinguisher operation can be extremely dangerous to personnel if proper precautions are not taken. Before attempting replacement of any part of a system, close the nitrogen cylinder valve and vent all pressure in system by opening nozzle on hose reel. (Page 3-18 and 3-21)

WARNING

Do not attempt to remove pressure gage unless nitrogen cylinder is under zero pressure. Nitrogen gas under high pressure can cause serious personal injury. (Page 3-24)

APPENDIX A

WARNING

Nitrogen cylinder valves must be removed only with cylinder under zero pressure. Nitrogen gas under high pressure can cause serious personal injury. (Page 3-24)

WARNING

When using Trichlorethylene, MIL-T-7003, make sure there is adequate ventilation, as the fumes are toxic. Avoid prolonged exposure of bare skin to fumes. (Page 3-37)

WARNING

Exhaust all pressure from cylinder, leaving valve handle fully open, before attempting to remove or disassemble any part of nitrogen cylinder valve. Cylinder under pressure can cause personal injury. (Page 3-46)

APPENDIX A

CHAPTER 1
GENERAL INSTRUCTIONS

Section I. GENERAL DESCRIPTION AND SPECIFICATION DATA

A 1-1. SCOPE. This manual covers the initial preparation, operation and the first through fourth maintenance echelons of the Model 450PKP/100AFFF03638MC Self-Contained Dry Chemical Aqueous Film Forming Foam (AFFF) Fire Extinguisher. This equipment was procured under contract M00027-84-C-0071.

A 1-2. PURPOSE. The equipment covered by this manual is intended for fire protection of U.S. Marine Corps bulk fuel systems. In particular these include the Tactical Airfield Fuel Dispensing System (TAFDS) described in NAVAIR 19-190TM, and the Amphibious Assault Fuel System (AAFS) described in ENG-50 or ENG-TM-06674A-15. These tactical moveable fuel systems contain a series of large, lightweight, nylon impregnated or polyester bladder type fuel tanks. Capacity of each tank is either 10,000 or 20,000 gallons. The tanks are used to store MOGAS, AVGAS, Turbine or Diesel fuel. These tanks are normally arranged in farms of six tanks (60,000 or 120,000 gallon capacity). If tank farms are carefully installed a single model 450PKP/100AFFF03638MC fire extinguisher can protect an entire six-tank farm with the use of the 150-foot remote hose reel.

A 1-3. GENERAL DESCRIPTION.

a. The model 450PKP/100AFFF03638KC twin agent fire extinguisher is skid mounted and easily relocated when necessary. It is equipped with two fire fighting agents. These agents are a dry chemical and an Aqueous Film Forming Foam. The dry chemical extinguishes fires by breaking up flame propagation, and is compatible with mechanical foam. Water mixed with the Aqueous Film Forming Foam (AFYF) concentrate forms a foam which is then used to form a film over the extinguished area, effectively preventing reignition. These two agents are stored in containers on the extinguisher, making the unit self-contained. A 150-foot, noncollapsible hose and discharge nozzle is provided for each chemical agent. The hoses are twinned by encasing them in a single cover for convenience in storage and use; while the nozzles are close-coupled by a tie bar. The hose is stored on a twin agent hose reel at the front of the unit when not in use. Additional area coverage without moving the extinguisher is provided by a remote cart. This coverage is necessary to reach bulk fuel bladder tanks spaced sufficiently far apart to prevent secondary fires in adjacent tanks. Without this 150 foot remote hose cart, additional extinguishers would be required.

b. The following dry chemical and Aqueous Film Forming Foam (AFFF) are used on this fire extinguisher.

(1) Potassium bicarbonate (Purple K) conforming to MIL-F22287A or Federal Specification O-D-1407.

(2) Aqueous Film Forming Foam (AFFF) conforming to MIL-F-24385, type 6.

A 1-4. PHYSICAL DSCRIPTION. The Self Contained Dry Chemical and AFFF Fire Extinguisher (figure 1-1) hereinafter referred to as "the extinguisher" is built for rugged use and is treated with corrosion resisting coatings and polyurethane base paint. The unit is therefore extremely durable over a wide range of climatic conditions. The frame is of heavy gage steel, welded, with steel skids integrated into it. The frame also has slots provided for lifting with a forklift and lifting eyes to anchor the fire extinguisher to a truck-bed or aircraft floor and to facilitate lifting or towing. The frame provides a stable platform for the two independent fire-fighting systems comprising the extinguisher. The remote hose cart provided with the fire extinguisher is also constructed for rugged use. The two-wheel cart is equipped with a hose reel and hoses identical to those of the fire extinguisher. Hoses of both units, as well as the discharge nozzles, are equipped with quick-disconnect fittings which allow rapid connections of the additional hoses. Physical properties of the uncrated fire extinguisher are presented in Table 1-1.

A 1-5. FUNCTIONAL DESCRIPTION.

a. Intended Use. The twin agent fire extinguisher is designed and constructed to be effective in fighting fires generated by hydrocarbon fuels. It is intended for use in providing fire protection to the Tactical Airfield Fuel Dispensing System (TAFDS) and the Amphibious Assault Fuel System (AAFS).

b. Capabilities.

(1) The fire extinguisher has the capability of extinguishing 100/130 aviation gas fires in 1500 square feet berms (diked areas). It will do so using a 6% AFFF solution and a dry chemical (Purple K).

(2) The extinguishers fire fighting capabilities are determined by its extinguishing agent, capacity, hose length, and skill of the operator.

c. Limitations.

(1) The magnitude of the fuel tank fire is determined by the size and shape of the berm, wind velocity, and the type of fuel. If the bladder tanks are installed too close together within the tank farms, a second tank, and probably all six may ignite from the first fire; in this case all six tanks will be lost without additional fire fighting equipment. If the tanks are installed and spaced as shown in figure 1-6, however, a single extinguisher will extinguish burning fuel in any single 20,000 gallon tank. This is contingent upon the extinguisher being placed as indicated in figure 1-6, and charged with a dry chemical and a AFFF solution.

(2) At least two, and preferably three, operators are required to fight a berm fire with this equipment. Although only one operator will be manning the nozzle, the other operators are necessary to assist in dragging and maneuvering the hoses, particularly when climbing or moving up and down the berm dikes. This is made necessary by the weight of the combined 150-foot lengths of twinned handline, approximately 193 pounds. The two operators nearest the nozzle

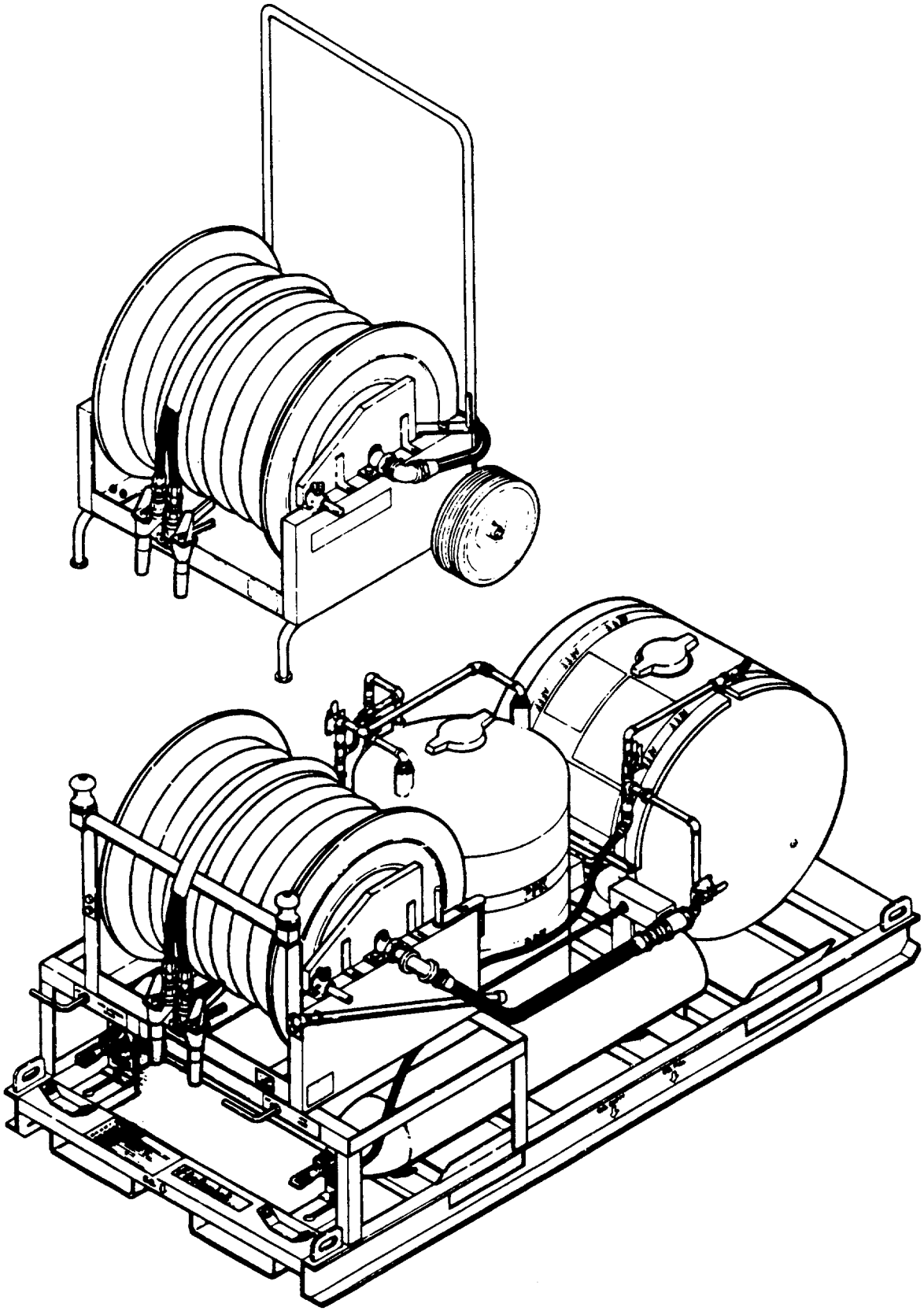


Figure A 1-1. Twin Agent Fire Extinguisher.

APPENDIX A

Table A 1-1. Reference Data Model 450 PKP/ 100 AFFF 0363MC Fire Extinguisher

Manufacturer.....Fire Combat, Inc.

Model..... 450PKP/100AFFF03638MC

Type..... Twin Agent

Dimensions (Base Unit)..... 95 in. long, 48 in. wide, 51 in. high
(Remote Hose Cart) 48 in. long, 45 in. wide, 59 in. high

Weight (Basic Unit)
- Without chemical agents (Full N_2 Cylinders).....1970 lbs.
- Fully serviced.....3260 lbs.

Weight (Remote Hose Cart).....455 lbs.

Twinned Hose Length:
- Basic Unit.....150 ft.
- Remote Hose Cart.....150 ft.

Operating Pressure (Tanks and Hoses).....220-240 psi

Capacities:
- Dry Chemical (Potassium Bicarbonate).....450 lbs.
- 6% AFFF Solution.....100 gallons
- Nitrogen (N_2).....2 ea. 300 cu. ft. cylinders

Nitrogen (N_2) Specifications..... Type 1, class 1, grade B, of BB-N-411

Heater Power Requirements.....120/240 volts, 1 phase, 60 hertz, 1300 watts

Flow Rates:
- AFFF (150 ft. hose).....51 gals. per minute
  (300 ft. hose).....40 gals. per minute
- Dry Chemical (150 ft. hose)..... 5.7 lbs. per second
  (300 ft. hose)..... 4.4 lbs. par second

Continuous Flow Time:
- 150 ft. hose:
  - AFF Minute,.....1 Minute, 58 Seconds
  - Dry Chemical.....1 Minute, 19 Seconds
- 300 ft. hose:
  - AFFF..... 2 Minutes, 30 Seconds
  - Dry Chemical.....1 Minute, 42 Seconds

APPENDIX A

Table A 1-1. Reference Data Model 450 PKP/100 AFFF 03638MC Fire Extinguisher (Continued)

Operating Temperature Range (w/ AFFF heater)	40° to 130° F
Weatherproofing	Use of non-ferrous metals and treatment of non-ferrous metals with corrosion-resistant coatings, primer and paints.

should be highly skilled, in order that the second man can replace the first if the need arises. The third man may be a semi-trained operator, assisting only in maneuvering the hose. However, it is preferred that he also be well trained, in order to back up the first two operators. Operators must be protected by special helmets and protective clothing whenever using this equipment to fight a fire.

(3) If the tanks and berms are installed as indicated in figure 1-6, a single tank fire burning unhampered to completion would consume all 20,000 gallons of fuel in approximately 3 hours and 25 minutes. Unless other open, adjacent quantities of spilled fuel are burning none of the adjacent tanks will ignite from the long-duration fire, regardless of wind conditions. Since a single fully charged, properly installed and adequately manned extinguisher can extinguish one such fire, it can protect an entire six-tank farm because initially only one fire would occur. If the tanks are spaced further apart than shown, the 300-foot hoses cannot reach the most remote tank if the wind is blowing in an unfavorable direction, i.e., towards the extinguisher. It is not feasible to increase hose length beyond 300 feet; the internal friction decreases the nozzle pressure, flow rate and nozzle range to the extent that an entire berm cannot be covered from one position. However the extinguisher will have sufficient quantities of agents and range, even with 300 feet of hose, to cover the berm and extinguish the fire with minimum movement of the nozzle operator, provided that;

(a) The operator is experienced or well trained,
(b) The operator attacks the fire from a close-in, upwind position on the berm (normal procedure), and,
(c) The berms are small in area.

(4) Successful extinction of fires in berms requires a close-in position be taken by the extinguisher operators. This is made necessary by the 40-50 foot range of the extinguishers chemical agents, combined by their limited quantities. Such proximity to intense heat by extinguisher operators makes the wearing of protective clothing mandatory.

A 1-6. COMPONENTS.

a. Dry Chemical Tank. The dry chemical container (1, figure 1-2) is a vertical mounted cylindrical tank constructed of steel. All joints and connections are welded.

APPENDIX A

Table A 1-2. Reference Data, Major Components

Dry Chemical Tank

Manufacturer	Fire Combat, Inc.
Dimensions	24 in dia. x 37-9/16 in. in height
Material	Steel
Construction	All welded
Capacity	450 lb. Potassium Bicarbonate
Mounting	Bolted to extinguisher frame
Working Pressure	250 psi
Safety Device	Self-resetting pressure relief valve
Weight	272 lbs.

AFPFF Tank

Manufacturer	Fire Combat, Inc.
Dimensions: Length	40 in.
Width (outside dia.)	30 in.
Height.	32 in.
Material	Steel (inside coated with coal tar epoxy)
Construction	All welded
Safety Devices	Self-resetting pressure relief valve and a 203° F fusible plug temperature relief valve
Weight	350 lbs.
Capacity	100 gallons

Nitrogen (N_2) Cylinder Assemblies

Manufacturer: Assemblies	Fire Combat, Inc.
Cylinders	Taylor Warton
Gauges	Mija Products
Cylinder Valves	Superior Valve Co.
Dimensions	9-1/4 in. OD x 61-1/2 in. (including protective cap)
Weight (Full)	165 lbs.
Material and Construction (Cylinder only)	Non-shattering steel conforming to DOT Reg. 3AA
Capacity	300 cubic feet N_2
Pressure Fully Charged)	2400 psi
Mounting	Hold-down brackets

Nitrogen (N_2) Pressure Regulator - Dry Chemical

Manufacturer: Modification	Fire Combat, Inc.
Actual Valve	Victor Equipment Co.
Model	SR700E-H.C.
Dimensions	6-1/2 in. long, 4.0 in. wide
Material	Stainless steel and bronze
Capacity (Flow)	Adjustable to 30,000 c.f.h. @ 200 psig
Mounting	Manifold connections
Safety Device	Self-resetting non-adjustable pressure relief valve

Table A 1-2. Reference Data, Major Components (Continued)

Nitrogen (N_2) Pressure Regulator - AFFF

Manufacturer: Modification ..... Fire Combat, Inc.
Actual Valve ..... Victor Equipment Co.
Model SR-450-E
Dimensions ..... 5-1/4 in. long, 3-3/4 in. wide
Material ..... Brass/Stainless Steel
Capacity (Flow) ..... Adjustable to 11,300 c.f.h. @ 200 psig
Mounting ..... Manifold connections
Safety Device ..... Self-resetting non-adjustable pressure relief valve

Check Valve

Manufacturer ..... Watts Regulator Company
Model ..... No. 601
Type ..... Push Check
Dimensions ..... 2-1/8 in. long x 1-1/4 in. wide
Size openings ..... 1/2 in.
Weight ..... Negligible
Operating Position ..... Vertical
Material ..... Bronze/Stainless Steel
Mounting ..... Manifold (Threaded ends)

Charge and Purge Valve

Manufacturer ..... Watts Regulator Co.
Model 70-101
Type ..... Ball
Dimensions ..... 2-1/16 in. long, 1-5/16 in. wide, 2-5/16 in. high
Handle Length (Valve centerline to tip) ..... 3”

Shutoff Valves, AFFF and Dry Chemical

Manufacturer: Modification ..... Fire Combat, Inc.
Actual Valve ..... Watts Regulator Co.
Model B6800
Type ..... Ball
Dimensions ..... 4-1/2 in. Long, 3 in. wide, 6 in. high
Material ..... Brass
Mounting ..... Manifold (Threaded ends)

Pressure Relief Valves

Manufacturer ..... F.C. Kingston Co.
Model ..... Fig. 115
Type ..... Self-resetting
Dimensions ..... 1 in. dia. x 4-1/2 in. long
Weight ..... Negligible
Pressure Setting ..... 250 psi
Material ..... Brass
Mounting ..... Manifold (1/2 in. threaded and)

Table A 1-2. Reference Data, Major Components: (Continued)

Hose Reels

Manufacturer	D.A.C. Enterprises
Model	30-26-2-12S
Type	Hand cranked
Dimensions	
(Without crank)	35-1/2 in. long, 30 in. wide, 30 in. high
Hose Capacity	150 ft. twinned hose
Weight (Without hose)	170 lb.
Material	Steel
Mounting	Bolted to extinguisher or remote hose cart frame
Inlet and Outlet Size	1-1/2 in. NPT

Twinned Handline Assembly

Manufacturer	Fire Combat, Inc.
Hoses	2 ea. 1 in. ID non-collapsible
Jacket	Woven polyester
Static Ground	Internally bonded in hose
Hose Connections	1 in. FNPT and 1 in. MNPT, plug quick disconnect fittings at outlet end
Dry Chemical Hose	Reel end, female fitting; nozzle end, male end/w female coupler installed
AFFF Hose	Reel end, female fitting; nozzle end, male end w/female nipple installed
Length	150 ft.
Material: Hoses	Synthetic rubber
Hose fittings	Brass
Mounting	On hose reels
Weight (Hoses & Covering)	193 lbs.

Twin Nozzle Assembly

Manufacturer:	Fire Combat, Inc.
Type	Squeeze grip operated
Number Nozzles	2
Dimensions	14-1/2 in. long, 10-1/2 in. wide, 7-1/2 in. high
Weight	13 lb.
Material	Aluminum, stainless steel and brass

Frame Assembly

Manufacturer	Fire Combat, Inc.
Construction	All welded
Foundation	Integrated skids
Hoisting Provisions	4 lifting eyes and forklift tine slots (used also for hoisting complete unit)
Dimensions: Basic Frame	9595 in, long, 48 in. wide, 6 in. high
Highest Welded Support	20 in.
Weight	460 lb.
Material	Steel

APPENDIX A

Table A 1-2. Reference Data, Major Components (Continued)

Remote Hose Cart

Manufacturer	Fire Combat, Inc.
Type	Portable
Hose Storage	
(150 ft. twinned handline)	Model 30-26-2-12S
Number of Wheels	2 (16 x 4 semi-pneumatic)
Input Hose Quick Disconnects:	
Dry Chemical Hose	Female nipple (On right side, facing handle)
AFFF Hose	Female coupler (On left side, facing handle)
Dimensions (With hose reel):	
Length	48 in.
Width (With wheels installed)	45 in.
Height	59 in.
Weight (Fully equipped)	454 lbs.
Weight of Twinned Handline	193 lbs.

It is-designed to hold 450 pounds of dry chemical agent at 220-240 psi operating pressure. The unit has no moving parts and is rigidly bolted to the fire extinguisher frame. A four-inch fill opening is provided. The fill cap has long, built-in handles for easy removal and replacement without tools. A non-adjustable pressure relief valve, preset to 250 psig at the factory, is installed in the tank plumbing to protect the tank from excessive pressure in the unlikely event of complete pressure regulator failure.

NOTE

Both the dry chemical tank and the AMPP tank are provided further overpressure protection by the additional feature of the N_2 pressure regulators. Each regulator is equipped with a non-adjustable pressure relief valve which is pre-set for 400 psig.

b. AFFF Tank. The AFFF container (2, figure 1-2) is a horizontal mounted cylindrical tank constructed of steel and lined for corrosion protection against the AFFT. All joints and connections are welded. It is designed to hold 94 gallons of water and six gallons of AFFF concentrate at 220-240 psi operating pressure. An electric heater is installed on the outside of the tank, and covered with insulation. This allows the AFFF mixture to be maintained at operating fluidity in ambient temperatures to -40°F. The unit has no moving parts and is rigidly bolted to the fire extinguisher frame. A fill opening and cap, identical to those on the dry chemical tank, are provided. A temperature relief plug, fusible at 203° F, is installed in the bottom of the tank where it is always in contact with the AFFT. The plug is a safety device, guarding against over-heating of the AFFF in case of AFFF tank heater thermostat

failure or proximity to fire. The temperature relief plug also acts as a drain plug. The tank's plumbing also contains an adjustable, self-resetting pressure relief valve, preset to 250 psig, which protects the tank against pressures in excess of 250 psi.

c. Nitrogen Cylinder. Two nitrogen cylinder assemblies (3, figure 1-2),are provided, one for pressurizing each fire-fighting agent container. Each cylinder, fully charged, contains 300 cubic feet of nitrogen (N_2) at 2400 psi. Quick-opening lever operated valves requiring only 90 degrees rotation of the handles to be fully open, are installed in the cylinder inlet-outlet opening. A 0-3000 psi gage is installed in the valve, on the cylinder side of the cutoff. Thus the gage continually reads cylinder pressure, regardless of the valve position. Protective covers are installed over the valve and gage during shipment. The cylinder assemblies are installed horizontally, one on either side of the extinguisher, in racks provided for that purpose. They are held in place by hold-down brackets. The cylinder valves are attached to regulators leading to their respective chemical agent container when ready for use.

d. Nitrogen Regulators. A high volume pressure regulator (4, figure 1-2) is connected to each nitrogen cylinder by a high pressure hose. The regulators are preset at the factory to reduce nitrogen pressure to 220-240 psig working pressure. Equipment is protected from pressure build-up, or failure of, the pressure regulator by a non-adjustable, self-resetting pressure relief valve installed in one of the regulators outlet ports.

e. Shutoff Valves. The shutoff valves are located in the chemical agent discharge plumbing. The dry chemical valve (7, figure 1-2) is located next to the dry chemical tank and the AFFF valve (8, figure 1-2) is located next to the AFFF tank. Each valve is connected to a valve rod that extends to the front of the fire extinguisher and is used to operate the valve. Each valve has an identification plate, located on the skid frame next to each valve rod handle, to indicate the chemical agent it controls. The purposes of the valve is to prevent discharge of chemical agents when it is desired to pressurize tanks without discharging chemicals into reel or handline, and prevent moisture from entering tanks. The valve also allows hose blowdown without pressurizing tanks.

f. Charge Valves. Two one-half inch ball valves are used on this fire extinguisher to control nitrogen flow to the agent tanks. When the charge valve (5, figure 1-2) is open, nitrogen pressurizes the dry chemical tanks. When the charge valve (6, figure 1-2) is open, nitrogen pressurizes the AFFF tank.

g. Purge Valves. Two one-half inch ball valves are used on this fire extinguisher to clean the dry chemical and AFFF hand lines of agent. The dry chemical purge valve is shown as item 9 in figure 1-2. The AFFF dry chemical purge valve is shown as item 10 in figure 1-2.

h. Check Valves. Check valves (11, figure 1-2) are installed in the nitrogen lines downstream of the pressure regulators. The valves prevent back-flow of chemical agents into the respective nitrogen pressure regulators.

i. Pressure Relief Valves. A pressure relief valve (12, figure 1-2) is located downstream of the pressure regulator and check valve in each of the nitrogen manifolds. The function of the relief valves is to guard against overpressurization of the systems in the event of pressure regulator failure. Each of these self-resetting valves is factory adjusted to relieve pressure at 250 psi. The valve is safety wired to prevent CARELESS tampering with the pressure relief valve.

j. AFFF Tank Heater. The heater (13, figure 1-2) is attached to the bottom of the AFFF tank and is used to heat the AFFF solution when the tank temperature falls below 450 F.

k. Hose Reels. A hose reel (14, figure 1-2) capable of storing 150 feet of twin handline hose is mounted on the front of the fire extinguisher. Swivel joints at each reel inlet provide rotatable connections between hoses and hose reel, while serving as bearings to allow easy rotation of the reels' storage drum. Two sprockets, chin and hand crank provide a manual means of rewinding the hose onto the reel after use. Thus the reel provides convenient storage for hose while keeping it connected to the chemical tanks, and readily available. A second reel (8, figure 1-3) identical to the one on the fire extinguisher, is mounted on a two-wheeled cart, completely separate from the fire extinguisher. It provides storage for 150 additional feet of twinned hose. The use of quick-disconnect fittings allow the hoses to be connected together rapidly for additional coverage when required.

I. Twinned Handline Assemblies. The twinned handline assemblies (15, figure 1-2) transmit the chemical agents from the hose reels to the discharge nozzles. Each unit is comprised of two one inch, non-collapsible hoses, 150 feet long and encased in a woven polyester jacket. Outlet ends-of the hoses are equipped with quick disconnect fitting for increased flexibility. Couplings are arranged so that the remote reel and nozzle cannot be connected to improper agents. The hoses are internally grounded.

m. Twin Nozzle Assembly. The twin nozzle assembly (16, figure 1-2) serves two basic functions. First, it is the operator's final control of the pressurized chemical agents. Opening either of the nozzles, which are closely coupled by a tie bar bracket, allows the respective chemical agent to be discharged. The nozzles second function is to disperse the

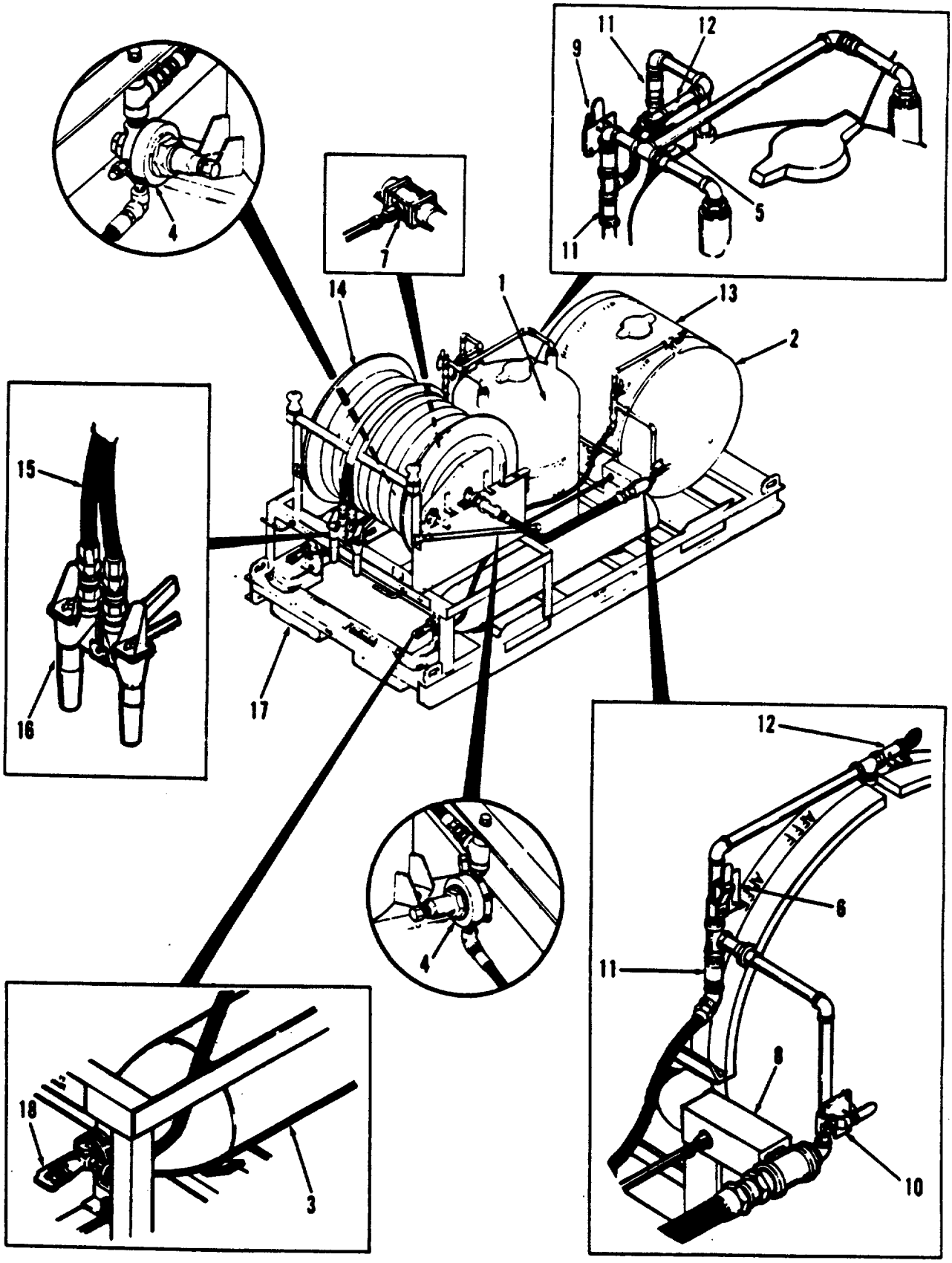


Figure A 1-2. Fire Extinguisher Components

APPENDIX A

LEGEND FOR FIGURE A 1-2.

1. Dry Chemical Tank
2. AFFF Tank
3. Nitrogen (N_2) Cylinder (2)
4. Nitrogen Regulator (2)
5. Dry Chemical Charge Valve
6. AFFF Charge Valve
7. Dry Chemical Shutoff Valve
8. AFFF Shutoff Valve (Location)
9. Dry Chemical Purge Valve
10. AFFF Purge Valve
11. Check Valves (2)
12. Pressure Relief Valve (3)
13. AFFF Heater
14. Hose Reel
15. Twinned Handline
16. Twin Nozzle Assembly
17. Skid Frame Assembly.
18. Nitrogen Cylinder Valves

LEGEND FOR FIGURE A 1-3.

1. Inlet Hose (2)
2. Inlet Quick-Disconnect Couplers (2)
3. Crank Assembly
4. Outlet Quick Disconnect Couplers (2)
5. Nozzle Assembly
6. Hose Cart
7. Brake
8. Hose Reel

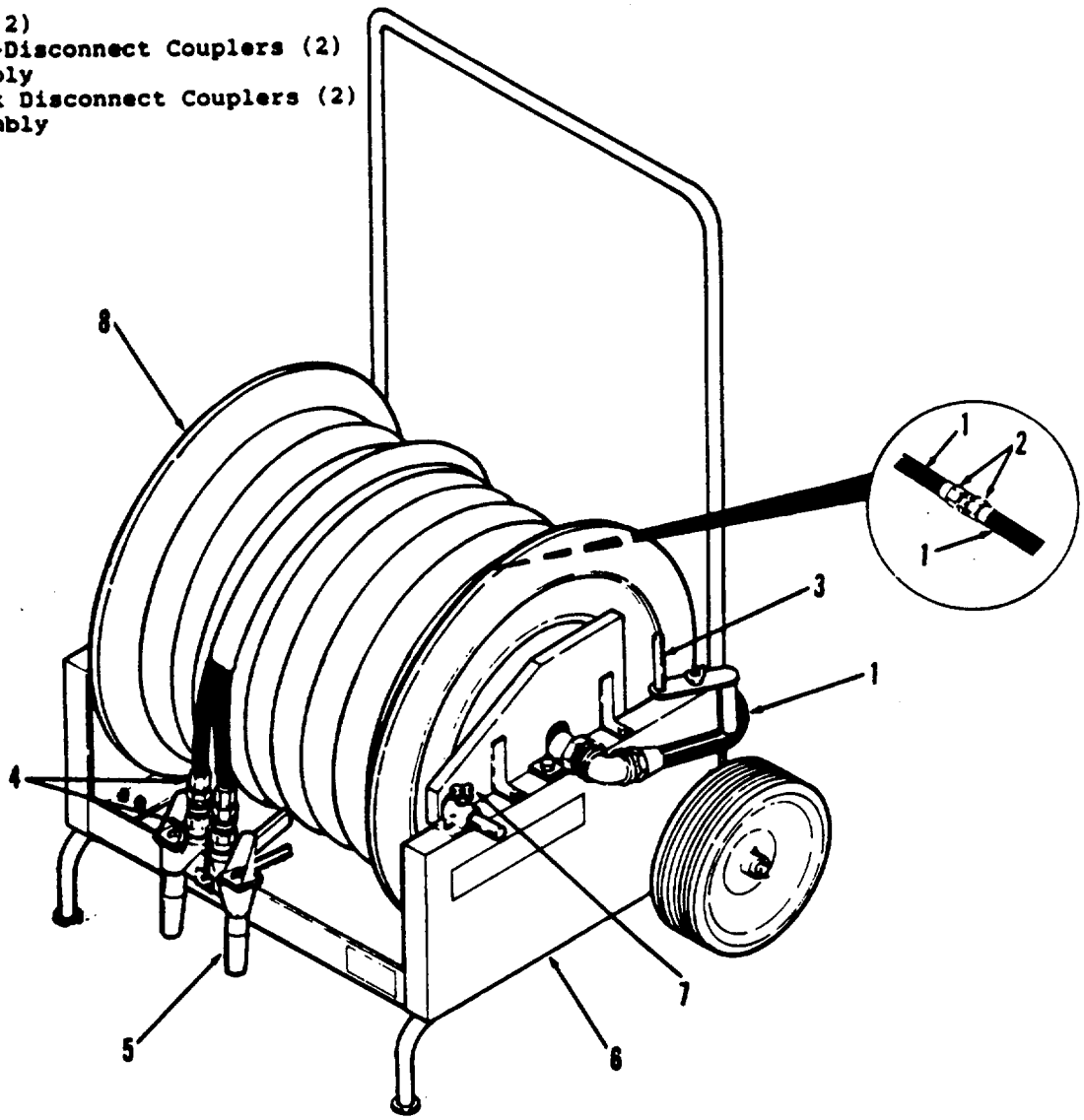


Figure A 1-3. Remote Hose Reel Cart Components

chemical agents in a pre-determined pattern. This requirement accounts for the difference in the two nozzles. Each has a tip designed to disperse its particular chemical agent in the most effective pattern. The AFFF nozzle is an air aspirating type.

n. Skid Frame Assembly. The frame assembly (17, figure 1-2) is constructed of steel, all joints welded. Supports for most of the other major components are welded onto the basic frame. Steel skids are integrated into the frame and are provided with slots for lifting by forklift. Eye brackets are welded to each corner to provide sling attachments for hoisting or tie-down points for shipment.

o. Remote Nose Reel Carl. The remote hose reel cart (figure 1-3) is not attached to the fire extinguisher. It can be considered a major component thereof, however, inasmuch as it doubles the effective reach of the handline. A hose reel identical to the one on the fire extinguisher is mounted on the cart. The hose reel stores 150 feet of twinned hoses. The outlet ends of the hoses are equipped with a twin nozzle assembly of the same type used on the fire extinguisher. The inlet connections to the cart are equipped with quick-disconnect fittings, allowing it to be attached to the fire extinguisher hoses easily and rapidly.

Section II. PREPARATION FOR USE

A 1-7. HANDLING.

a. Unloading.

(1) Special instructions for unloading the fire extinguisher are unnecessary. The fire extinguisher, six gallons of AFFF, manual and funnel are packed together, while the remote hose cart is packed separately. The frame of the fire extinguisher has openings for forklift tines. The remote hose cart can be lifted using forklift tines placed under the pallet it is attached to. Additionally, both allow the use of slings for hoisting where forklifts are not available.

WARNING

Be sure lifting device is capable of lifting the specified weights or personal injury could result.

CAUTION

If forklift is used, ensure tines are through the slots in both skids. If a crane is used on the four lifting eyes, ensure sling is sufficiently long, and spreader bars adequate, to protect the equipment. Failure to take these precautions could result in extensive damage to the fire extinguisher.

(2) Lift the fire extinguisher with either a forklift or crane and sling. Remember that the fire extinguisher weighs approximately 2475 pounds, the remote hose cart approximately 455 pounds. The preferred method, when using a crane (or helicopter) is to lift the unit by the four lifting eyes on the skid frame. When hoisting the fire extinguisher the lateral and longitudinal centers of gravity must be used to center the extinguisher. Figure 1-4 illustrates the extinguishers center of gravity markings. The longitudinal axis CG is located approximately midway between the openings provided for forklift tines, and is given for both charged and uncharged conditions. The lateral axis CG falls at the approximate center of the frame.

b. Unpacking.

(1) Remove all loose equipment from the fire extinguisher. Loose equipment consists of:

(a) Funnel.

(b) Six-gallon plastic container of AFFF concentrate.

(c) Copy of this manual.

(2) Cut four bands securing cart to pallet and then remove cart.

(3) Release brake (2, figure 2-6) and completely unwind hose from fire extinguisher hose reel. Remove the plastic protective covering from the hose. Rewind hose on hose reel. Tighten hose reel brake.

(4) Release brake (7, figure 1-3) and completely unwind hose from remote hose reel cart. Remove the plastic protective covering from the hose. Rewind hose on hose reel. Tighten hose reel brake.

A 1-8. INSTALLATION.

a. General. The Model 450PKP/100AFFF03638MC fire extinguisher is designed for either portable or stationary use. The most common installation will be the stationary mode, where the fire extinguisher is intended to fight berm fires, with additional reach provided by the portable remote hose reel.

b. Portable Mode. For portable use, the fire extinguisher may be secured to a truck, a tractor or other vehicle with u-bolts. Refer to figure 1-5 for proper installation.

c. Stationary Mode.

(1) The fire extinguisher design provides for a wide selection of sites when used in the stationary mode. Precise leveling of the unit is not required.

(2) Refer to figure 1-6 for recommended locations with respect to bulk fuel tanks and remote hose cart to provide safety of operation and maximum effectiveness.

(3) Space requirements for the fire extinguisher present no problems for base. or field operations. A review of the units dimensions in table 1-1 will indicate only a limited area is used. With the exception of

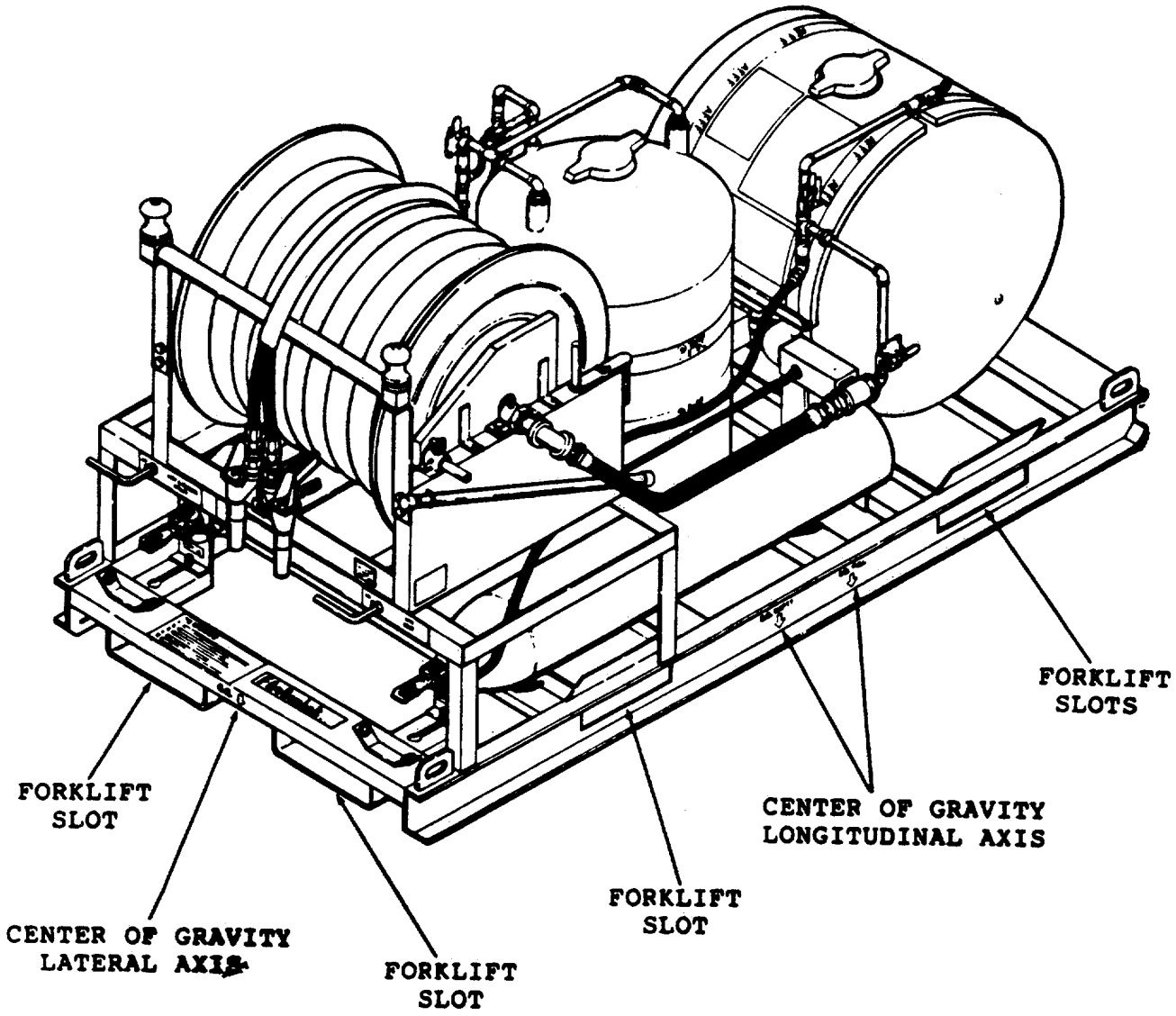


Figure A 1-4. Location of Forklift Slots and Center of Gravity Markings

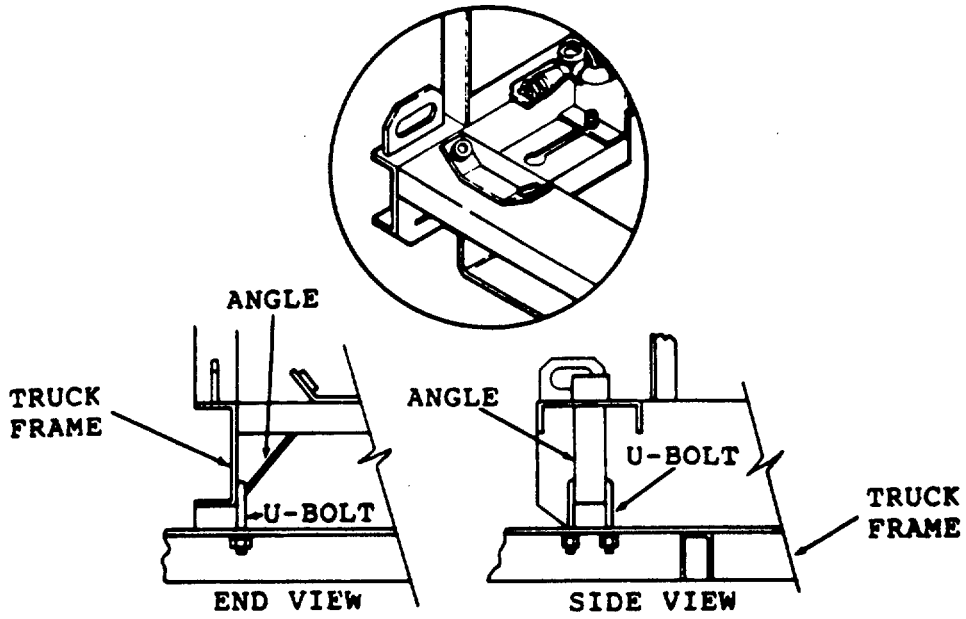


Figure A 1-5. Portable Mode Installation

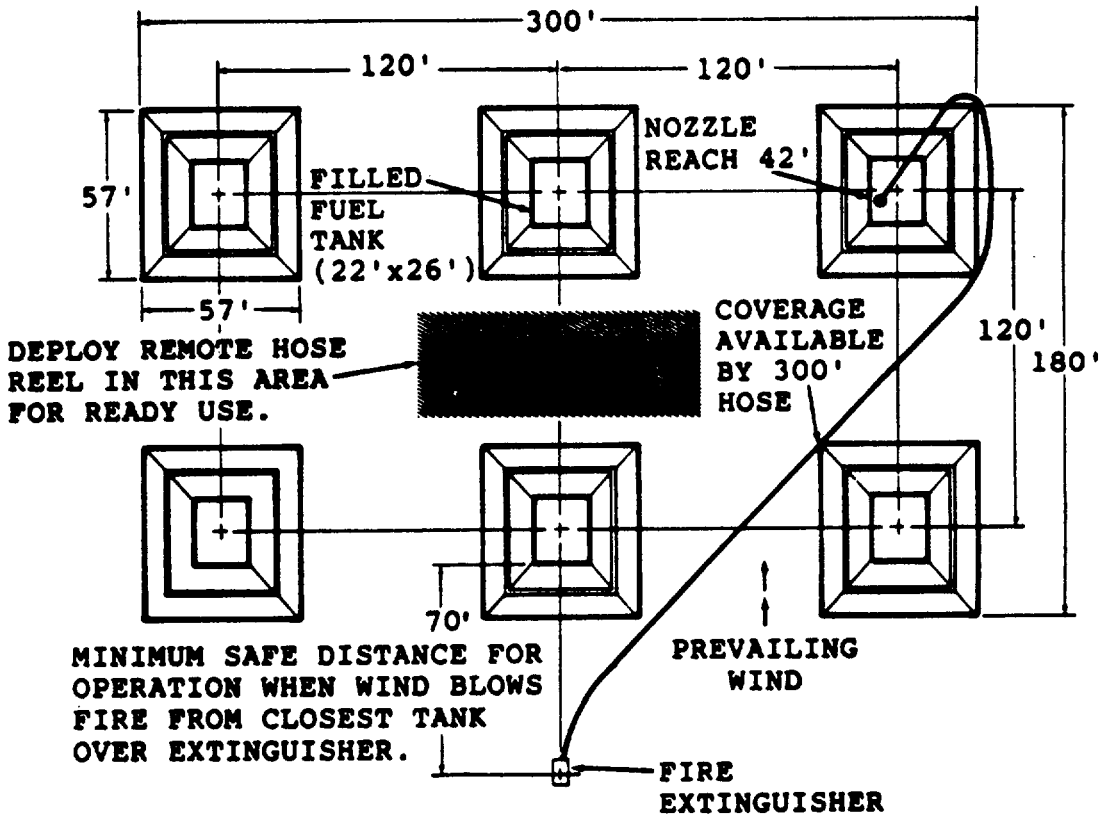


Figure A 1-6. Location of Fire Extinguisher And Remote Hose Reel Cart

electrical power for very cold weather operation the unit is self-contained and space-consuming auxiliary equipment is not required. The unit is not heat-generating, and can be used in a relatively confined space, providing sufficient working area for maintenance and servicing is provided.

(4) The fire extinguisher is virtually corrosion free, due to the materials used in its construction and the corrosion treatment used in its finish. This fact, coupled with the use of a blanket type heater for the AFFF liquid tank, makes it satisfactory for unrestricted installation in unprotected areas. The unit and its controls are mostly metal. This makes it desirable, when operating in extremely hot climates, to provide a shade of some sort. This will require the use of gloves by operating and maintenance personnel.

d. Tank Heater. The AFFF tank is equipped with a heater for cold weather operation. The heating system is compatible with a 120/240 volt, 1 phase, 60 hertz, AC power supply, provided by the using organization.

A 1-9. SERVICING.

a. Removal of Protective Compounds. No protective compounds are used in shipping the fire extinguisher. It may become soiled during shipment, however.

WARNING

Use normal precautions when cleaning with compressed air to prevent injury to personnel. Compressed air for cleaning purposes will not exceed 30 psi. User should wear safety goggles, and should not direct the stream of air toward himself or other persons.

b. Cleaning. Clean exterior of the fire extinguisher with any approved cleaning solvent, using a soft brush or cloth. Inaccessible areas may be cleaned with compressed air.

c. Lubrication. No lubrication is required prior to using the fire extinguisher. Swivel assembly of both hose reels, local and remote, are lubricated at the factory prior to shipment, as are the bearings of the remote hose reel cart wheels.

A 1-10. INITIAL SERVICING WITH CHEMICAL AGENTS.

Initial servicing of the fire extinguisher is considerably more complex than normal replenishment. Initial servicing will be fully covered in the next three paragraphs.

NOTE

When refilling dry chemical tank be sure NO water is introduced into the tank. If the funnel has been used to fill the AFFF tank with water, ensure the funnel is completely dry prior to using it with the dry chemical.

APPENDIX A

a. Dry Chemical Tank. The dry chemical tank is filled with 450 pounds of powdered potassium bicarbonate (Purple K) prior to shipment. Remove the fill cap (1, figure 1-7), take a handful of powder and check to see that it crumbles easily and pours freely between spread fingers. This action is to assure powder has not become wet and caked. If caked, replace powder according to paragraph 3-10a.

b. AFFF Tank. Service the AFFF tank as follows: NOTE AFFF water mixture is subject to freezing. If 'freezing weather conditions exist do not service the AFFF tank until the heater receptacle is installed and adequate power is available.

(1) Remove AFFF fill cap (2, figure 1-7).

(2) Pour the six gallons of AFFF concentrate supplied with fire extinguisher into tank. AFFF concentrate will freeze, but the plastic container(s) used for shipment will expand safely with the ice. The AFFF can be used satisfactorily after it thaws out.

(3) Fill tank to within 4-1/2 inches of top of fill collar with water. Although not absolutely necessary, use of a hose, held against the bottom of the tank while filling, will assure more complete mixing of the solution, while retarding foaming action. Any further stirring of the solution after initial filling is not required.

(4) Ensure that fill cap gasket is in place, replace fill cap and tighten hand tight.

(5) If freezing weather exists, or is imminent, connect power source to AFFF heater.

c. Nitrogen Cylinders.

WARNING

The nitrogen cylinders are originally charged with 2400 psig pressure. Use caution when performing any of the following steps where personnel may be exposed to cylinder pressure.

Connect nitrogen cylinders (3, figure 1-2) to respective chemical tank as follows (figure 1-7):

(1) Remove by unscrewing the cylinder shipping caps. Store the shipping caps for reshipping purposes or for transporting cylinder for recharge.

(2) Rotate each nitrogen cylinder until the pressure gage (4, figure 1-7) is straight up.

(3) Connect the swivel nut from the dry chemical regulator hose (5, figure 1-7) to the left nitrogen cylinder, tighten securely with a wrench.

(4) Connect the swivel nut from the AFFF regulator hose (6, figure 1-7) to the right nitrogen cylinder, tighten securely with a wrench.

d. Position of Extinguisher Controls. Controls. Leaving the nitrogen cylinder valve closed, check that the rest of the extinguisher controls are in the following

1. Fill Cap Dry Chemical
2. Fill Cap AFFF
3. Dry Chemical Nitrogen Cylinder (2)
4. Pressure Gage (2)
5. Dry Chemical Regulator Hose
6. AFFF Regulator Hose
7. AFFF Purge Valve
8. AFFF Charge Valve
9. AFFF Shutoff Valve (Location)
10. Dry Chemical Purge Valve
11. Dry Chemical Charge Valve
12. Dry Chemical Shutoff Valve
13. Retainer Wires (4)
14. AFFF Nitrogen Cylinder

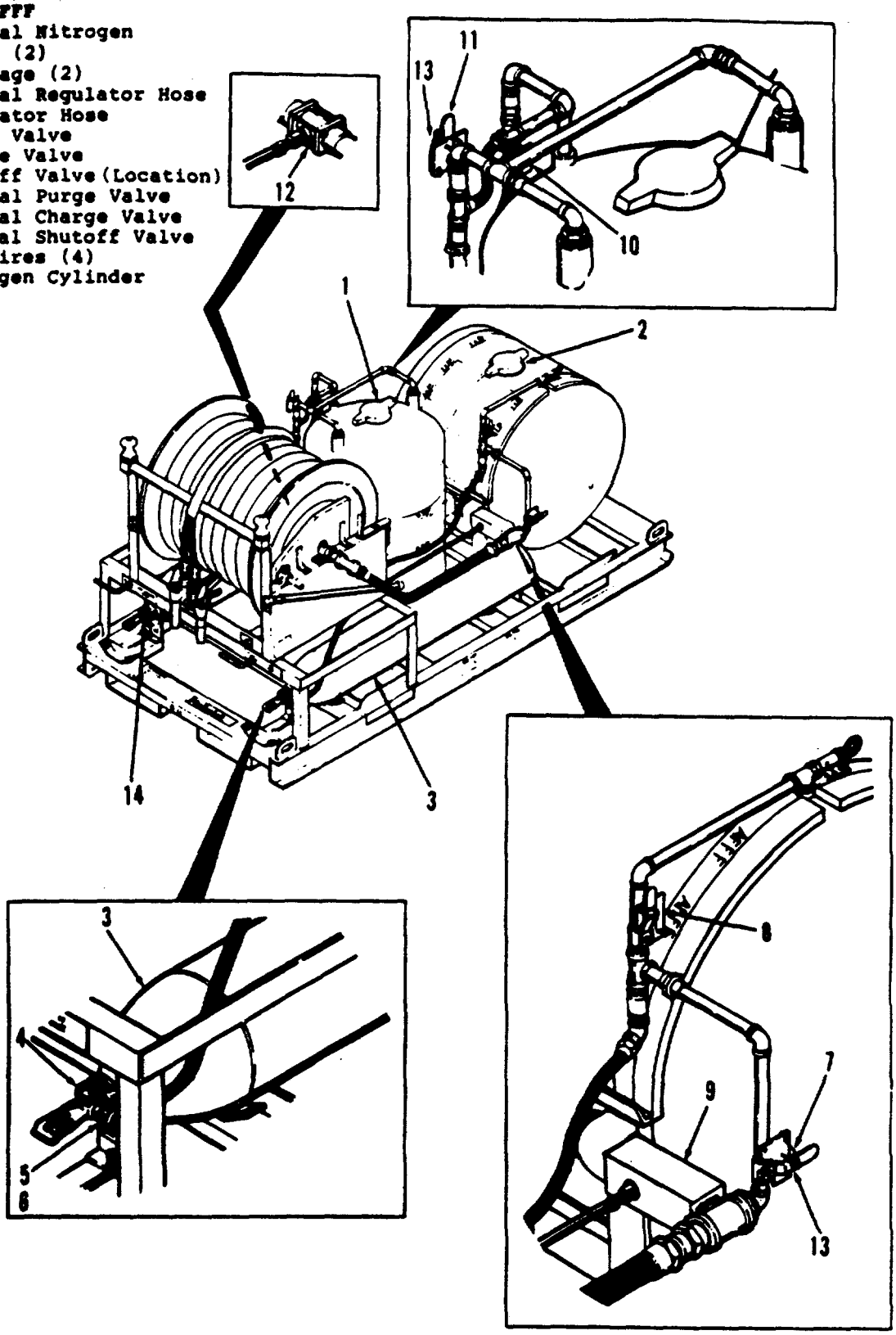


Figure A 1-7. Servicing Points.

positions and retainer wires are in place. (Refer to figure 1-2 for control locations):

(1) AFFF system.

(a) Purge Valve (10) closed and AFFF nozzle closed.
(b) Charge Valve (6) open.
(c) AFFF Shutoff Valve (8) closed.

(2) Dry chemical system.

(a) Purge valve (9) closed and dry chemical nozzle closed.
(b) Charge valve (5) open.
(c) Dry chemical shutoff valve (7) closed.

A 1-11. INITIAL CHECKOUT AND ADJUSTMENT.

a. Visual Inspection. Perform a complete visual inspection of the fire extinguisher for:

(1) Completeness and condition of loose equipment listed in paragraph 1-7b.

(2) Loss of parts or damage to the fire extinguisher during loading, shipment, unloading or unpacking.

(3) Visible damage to pressure relief valves.

(4) Cracked or broken nitrogen cylinder valve gage cover glasses.

(5) Electrical connections for loose, broken or shorted wires.

(6) Leaks, cracks, dents, chaffing, or evidence of binding in piping, hoses and lines.

(7) Security of tank cap installation.

(8) Minimum charge (1700 psi) in nitrogen cylinders.

b. Operational Checks.

(1) Start the operational checks by checking all fire extinguisher valves, with exception of the nitrogen cylinder valves, for freedom of operation. Return all valves to original positions as specified in paragraph 1-104,and replace retainer wires.

(2) Open nitrogen valves and check for audible or visual leaks in systems.

(3) Check for free unwinding of hose from reels (both basic unit and remote hose reel) with brake (7, figure 1-3) released. Check that brake holds when set. Check that cranks operate freely to rewind handlines onto reel.

(4) Reset the extinguisher as follows:

(a) Close the nitrogen cylinder valves (18, figure 1-2).
(b) Close the charge valves (5 and 6).
(c) Open the purge valves (9 and 10).
(d) Open the AFFF discharge nozzle to clear handline and depressurize AFFF tank.
(e) Open the dry chemical nozzle to clear handline and depressurize the dry chemical tank.
(f) After both tanks are depleted of pressure close both nozzles and purge valves (9 and 10).

(g) Open both charge valves (5 and 6).

(h) Check N_2 cylinders for minimum of 1700 psi.

(i) Rewind hoses, on both hose reels, and set hose reel brake with minimum tension required to prevent reel from unwinding from weight of hose or possible vibration.

c. Electrical Check. Using an ohmmeter, check heater system ground and handline assembly ground for continuity. Connect ohmmeter to ground pin and frame to check heater system ground. Connect ohmmeter to nozzle and frame to check handline.

A 1-12. RELOCATION. Relocate the fire extinguisher as follows:

a. Disconnect heater electrical system from power source; stow electric cable.

b. Stow discharge hoses on both hose reels, set hand brake to prevent reels from unwinding.

c. The fire extinguisher may be moved reasonably short distances with either forklift or crane, while the remote hose reel cart may be rolled or lifted by frame.

d. For longer distances load the fire extinguisher on truck, trailer, or other suitable carrier with forklift or crane; move to new location and unload as previously discussed in paragraph 1-7a.

e. Refer to paragraph 1-6 for location of extinguisher and remote hose cart in relation to bulk fuel tanks.

A 1-13. PREPARATION FOR LIMITED STORAGE AND SHIPMENT . Prepare the fire extinguisher for limited storage and reshipment as follows (figure 1-8):

a. If storage in below freezing weather is anticipated empty the AFFF tank by removing the drain plug (1) in the bottom of the tank and draining the AFFF into suitable container(s).

b. Disconnect the electrical power connection.

c. Ensure both hose assemblies are reeled onto hose reels; set reel hand brakes.

d. Ensure nozzle assembly (2) and hose reel cranks (3) are properly stowed on holders provided for that purpose.

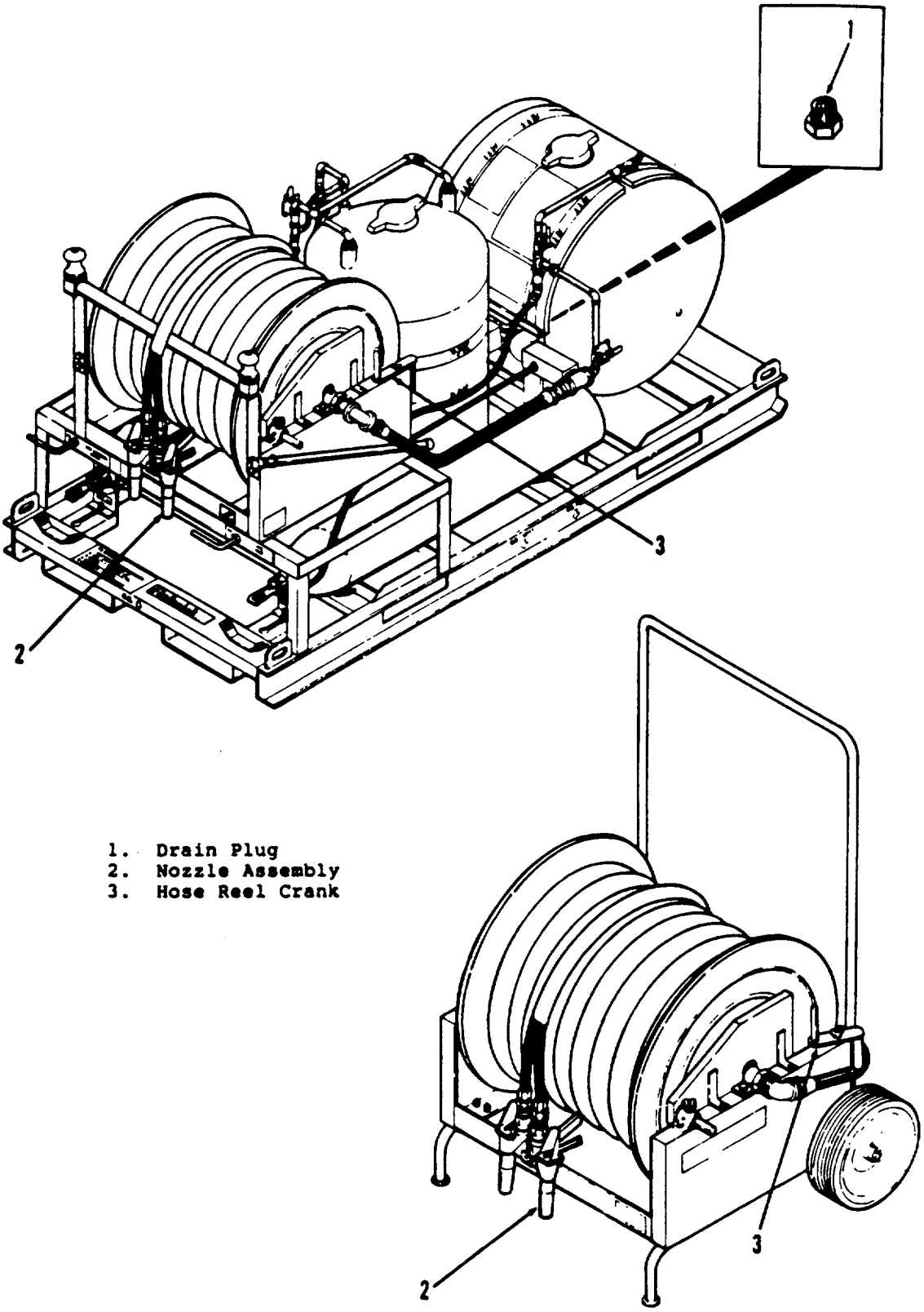
e. Ensure all valves, except charge valves, are closed.

f. Disconnect swivel nuts from nitrogen cylinder valves; install protective valve covers removed in paragraph 1-10c. Cover swivel nuts with tape or other protective covering.

g. Ensure that AFFF tank and dry chemical tank fill caps are in place and hand tightened.

h. Replace six gallons of AFFF concentrate.

i. Pack all loose items on fire extinguisher, and cover extinguisher with plastic to protect it.



1. Drain Plug
2. Nozzle Assembly
3. Hose Reel Crank

Figure A 1-8. Storage Check Points

APPENDIX A

Section III. DEMOLITION TO PREVENT ENEMY USE

A 1-14. GENERAL. When capture or abandonment of the model 450PKP/ 100AFFF03638MC fire extinguisher to an enemy is imminent, the responsible unit commander must make the decision to either destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction.

A 1-15. DEMOLITION TO RENDER THE FIRE EXTINGUISHER INOPERATIVE.

a. Demolition by Mechanical Means. Mechanically demolish the extinguisher as follows:

(1) Open nitrogen cylinder valves and hose nozzles and discharge agents.

(2) Use fire axes, hammers, pry bars, pickaxes, or similar tools to:

(a) Sever twin handlines in several places.

(b) Sever high pressure hoses from nitrogen cylinders.

(c) Sever low pressure lines in all accessible areas.

(d) Destruct nitrogen pressure regulators.

(e) Destruct and/or break off all pressure relief valves.

(f) Empty all AFFF and dry chemical containers in the area.

b. Demolition by Misuse. The fire extinguisher's safety devices, coupled with its rugged design, effectively preclude any extensive damage by misuse.

A 1-16. DEMOLITION BY EXPLOSIVES OR WEAPON FIRE.

a. Demolition by Explosives. The fire extinguisher can be effectively rendered inoperative without use of explosives.

b. Demolition by Weapons Fire. Small arms weapon fire can be effectively used to:

(1) Destruct pressure regulators, manifold lines, hoses and hose reels.

(2) Deplete nitrogen supply by destroying cylinder gages.

(3) Render most valves inoperative.

(4) Render nozzles inoperative.

(5) The thickness of the AFFF and dry chemical container walls, combined with their mostly curved surfaces, makes it unlikely that small arms fire would be effective in destroying. It is recommended that .50 caliber weapons and armor-piercing ammunition be used for this purpose, guarding against possible ricochets.

A 1-17. DEMOLITION BY SCATTERING AND CONCEALING PARTS . The fire extinguisher can be rendered inoperative quickly and easily by removing several components or parts. These parts are small enough to be easily carried and disposed of by hiding, burying, or submerging in bodies of water. After depleting the nitrogen supply by opening the nitrogen cylinder valves and hose nozzles, dispose of the following easily removed components, or parts:

a. Nitrogen pressure regulator adjusting screws.

b. High pressure gages.

c. Nozzle assembly.

d. Tank caps and gaskets.

A 1-18. PRIORITY OF COMPONENT DESTRUCTION. Priority of component destruction is as follows:

a. Pressure regulators.

b. Manifolds.

c. Nozzles.

d. AFFF tank and dry chemical tank.

e. Hoses.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. THEORY OF OPERATION

A 2-1. GENERAL. The relationship of the operator to the model 450 PKP/100 AFFF 03638MC fire extinguisher is basically that of a fire-fighter using the extinguisher as an emergency tool, rather than that of an operator of a machine in continual use. For this reason, the extinguisher and its remote hose reel are to be kept in the ready status at all times when not in use. The extinguisher can then be put into use quickly with a minimum amount of time and motion on the operator's part. After the fire has been extinguished by the dry chemical and sealed against reignition by the AFFF, the operator can then take the time necessary to recharge the unit and return it to an operational ready status.

A 2-2. MECHANICAL THEORY. The twin-agent fire extinguisher consists of two completely independent systems, one for the dry chemical fire-fighting agent, the other for the AFFF. The arrangement of the systems is illustrated in figure 2-1. Nitrogen gas (N_2) is used to expel both chemical agents. The high pressure nitrogen supply is reduced to 220-240 psi system working pressure by pressure regulators installed in the nitrogen supply lines. Each system has its own nitrogen supply sufficient to completely discharge the chemical agent and purge all lines of residual agents.

a. Dry Chemical System. When the quick-opening gas valve on the dry chemical system UN cylinder is opened, nitrogen flows through the regulator, is reduced to system operating pressure 230 psi, then is sent through a check valve into the piping for the dry chemical tank. The check valve prevents back-flow of agent to the regulator when the nitrogen charge on the cylinder is low. From the check valve, the nitrogen flows through the normally open charge valve and is induced into the dry chemical agent through two gas tubes inside the dry chemical tank. Rubber sleeves on the gas tubes prevent agent back-up into the tubes. Inside the tank, the nitrogen fluidizes or aerates the dry chemical agent and pressurizes the system up to the product valve. A relief valve installed in the piping at the top of the dry chemical tank protects the system from over-pressurization in event of regulator malfunction. The check valve next to the relief valve provides for blowdown and purging of the discharge lines, but also serves to prevent the nitrogen charge from entering the dry chemical tank except through the gas tubes. To bring the fluidized dry chemical up to the nozzle the operator opens the dry chemical shutoff valve by turning the control rod one-quarter turn counterclockwise. Dispensing of the dry chemical is accomplished by squeezing the trigger on the dry chemical nozzle.

b. AFFF System. The foam (AFFF) system is very similar to the dry chemical system except aeration is not required because the AFFF solution is already in a liquid state. This system will pressurize more rapidly than the dry chemical system because the void in the top of the AFFF tank is relatively small and nitrogen is induced directly into the top

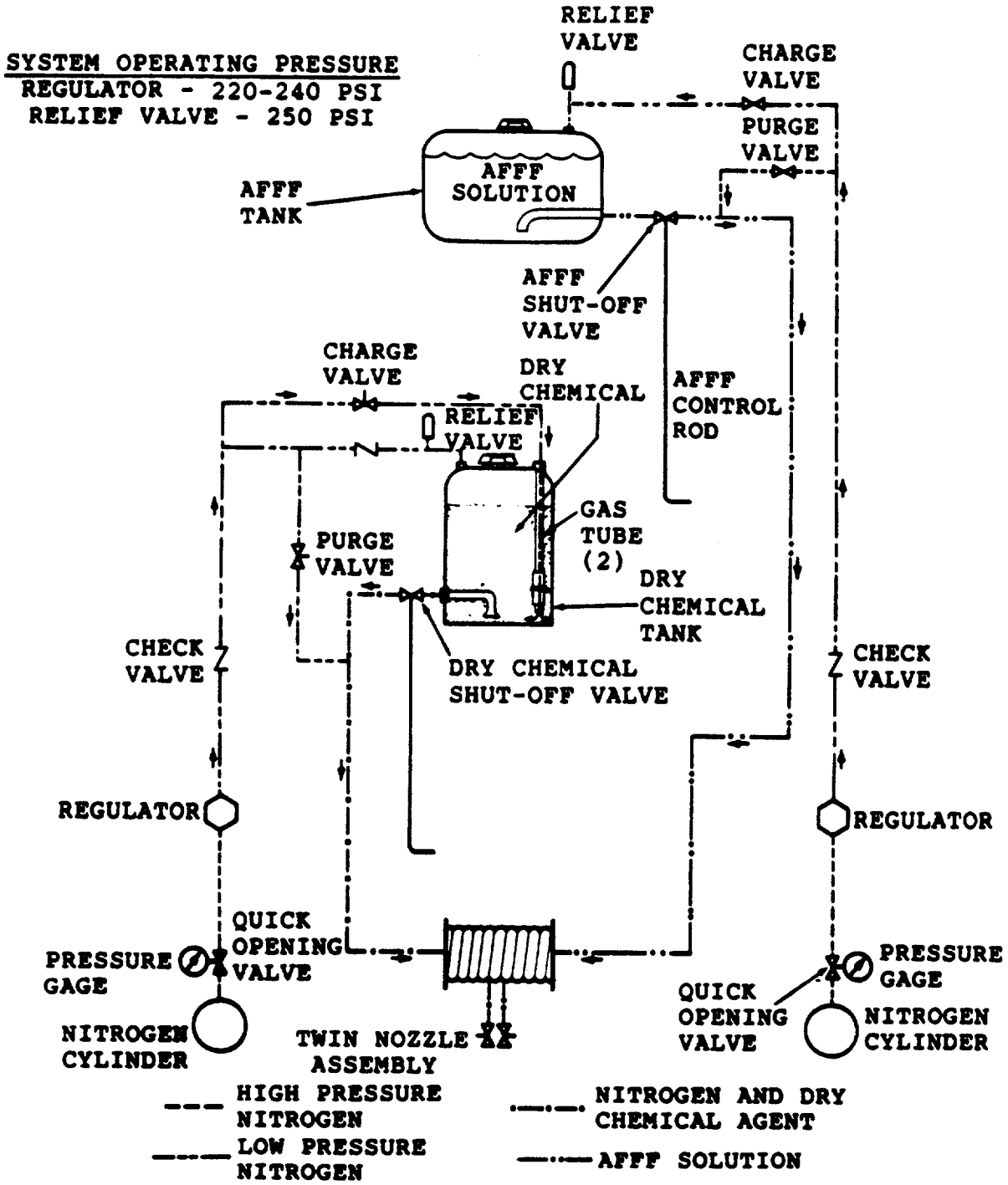


Figure A 2-1. Fire Extinguisher Flow Diagram

of the tank. The system pressurizes within a few seconds when the quick-opening gas valve on the AFFF system nitrogen cylinder is opened. With the product valve and charge valve in the open position, the AFFF tank will be charged almost instantaneously up to the AFFF shut-off valve. To bring the AFFF solution up to the nozzle, the operator opens the AFFF shut-off valve by turning the control rod one-quarter turn counterclockwise. A check valve between the pressure regulator and the charge valve prevents agent back-up and subsequent regulator damage in event of low charge in the nitrogen cylinder. A pressure relief valve on top of the tank protects against over-pressurization in event of pressure regulator failure. For cold weather operation, a heater with thermostat is provided to keep the AFFF solution in a liquid and free-flowing condition.

c. Hose Reel. The hose reel attached to the skid frame provides a convenient method of storing the hoses used in dispensing of the twin fire-fighting agents. Rotating joints on each side of the hose reel are the inlets. The rotating joints also act as bearings to support the drum and allow it to turn freely. The chemical agents flow through tubes inside the drum to side-by-side outlets which protrude through an opening at one end of the drum. These two outlets connect to the dispensing hoses and turn with the drum to allow the hoses to be wound on the drum. A sprocket and chain drive with a hand crank is provided for rewinding of the hoses onto the drum. The hose reel stores 150 feet of twin handline, and can be secured against rotation by an adjustable brake on the hand crank drive bearing.

d. Remote Hose Reel. The remote hose reel (figure 1-3) is the same as the one attached to the skid frame except that it is mounted on a two-wheel cart and can be easily moved as needed to increase the area coverage of the fire extinguisher. Inlets to the hose reel are equipped with quick disconnect fittings for coupling the hoses to the nozzle ends of the two main discharge hoses. The nozzles can be quickly removed from the fire extinguisher handline and attached to the remote hose reel handline. The quick disconnect fittings are oriented to prevent wrong connections.

e. Twin Agent Nozzles. Two discharge nozzles, one for each chemical agent, are fastened together with a tie bar at the end of the twin handline. Each tip is designed to provide the optimum discharge pattern for the chemical agent being dispensed. Disc shutoffs inside the nozzles control the discharge from the handlines. Squeezing the trigger fully completely opens the shutoff valve, allowing unrestricted flow of chemical agent through the nozzle body to the tip. The nozzle tips are easily removed for cleaning in event of plugging.

A 2-3. ELECTRICAL THEORY.

a. Description. The only electrical component in the fire extinguisher is the AFFF tank heater (figure 2-2), used only in cold weather operation. The heater installation consists of two resistance-type heater strips installed around the lower circumference of the AFFF tank and two 45-inch long strips of heat tape wrapped around the outlet tube and the shutoff valve. The heater strips and tape are connected as

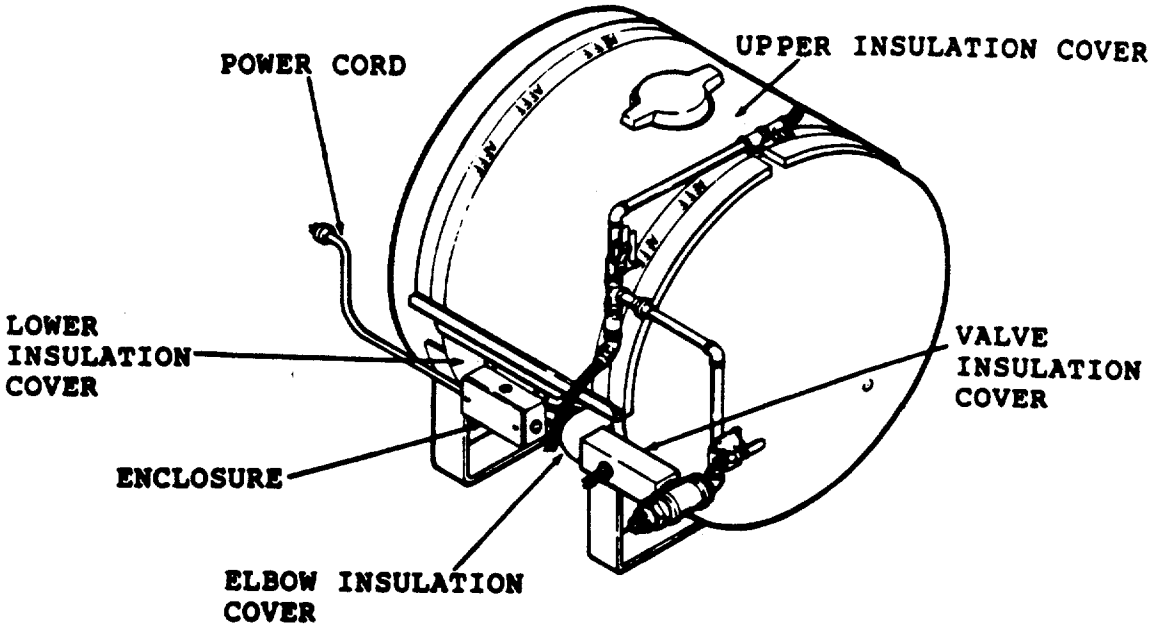


Figure A 2-2. Tank Heater Installation

shown in figure 2-3 to a power cord in an electrical enclosure. Power to the heaters is controlled by two thermostats whose connections are also made in the enclosure. The thermostats are held against the tank side and are used to sense agent temperature. The entire circumference of the tank is covered with an insulating blanket which is held in place by a metal wrapper. The outlet tube, as well a as the shutoff valve, are also covered with insulation and a protective wrapper.

b. Heater Operation. The heater is wired at the factory to operate on 120VAC, 1 phase, 60 hertz power (figure 2-3). A 240VAC, 1 phase, 60 hertz power source may be used, providing the wire connections are changed from a parallel circuit to a series circuit as shown in figure 2-3 and the plug is changed to an acceptable type.

When the temperature of the AFFF solution is above a nominal 75°F both thermostat contacts are open and no current is flowing through the circuit. When the temperature of the solution drops to a nominal 65°F, the "high temperature" thermostat closes, but since it is in series with the "low temperature" thermostat, there is still no current flow. When the AFFF solution temperature within the tank falls to below a nominal 45°F, the low temperature thermostat closes, completing the electrical circuit.

Current flowing through the resistance wire of the heating elements heats the AFFF tank until the solution temperature is raised to above a nominal 55°F, at which point the low temperature thermostat again functions to open the circuit. If the low temperature thermostat fails, the solution temperature will only rise to a nominal 75°F where the high temperature thermostat opens the electrical circuit. Thus the high temperature thermostat actually operates as a safety device.

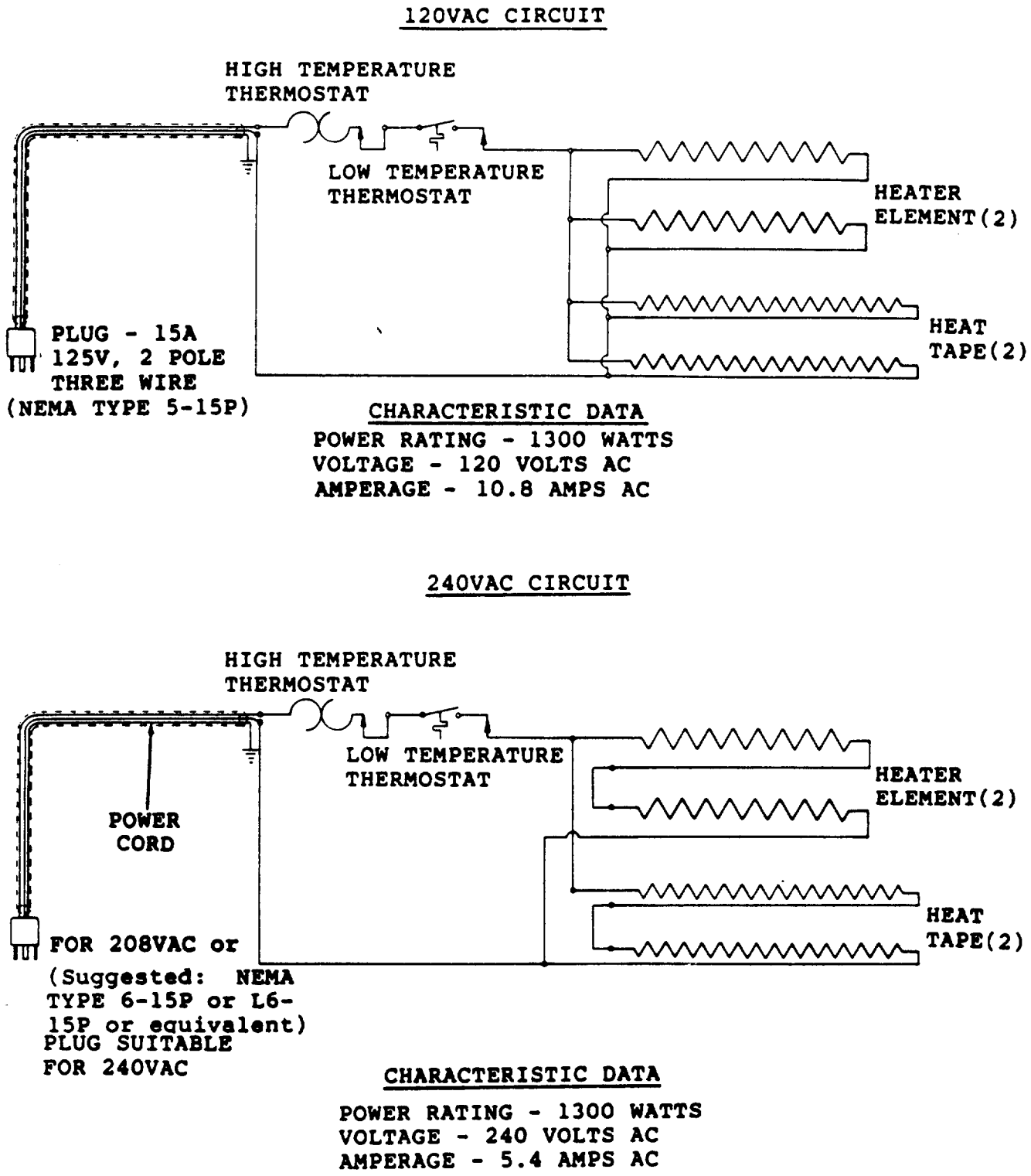


Figure A 2-3. AFFF Tank Heater Electrical Schematic

Section II. SERVICE REQUIREMENTS OF OPERATOR

A 2-4. SERVICE UPON RECEIPT OF FIRE EXTINGUISHER. Upon receipt of the model 450PKP/100 AFFF 03638MC fire extinguisher, operating personnel should inspect, lubricate, and check for completeness of equipment as outlined in table 2-1.

A 2-5. SERVICE REQUIREMENTS PRIOR TO, DURING, AND AFTER OPERATION.

a. General. To insure that the equipment is ready for operation at all times, it must be inspected systematically before and after operation so that defects or inadequate changes may be discovered and corrected, or replenished, before they result in serious damage failure. The necessary preventive maintenance services will be performed before operation. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Because the unit is intended for emergency use only, and because its operation is limited by its supply of chemical agents and expellent, there will normally be no deficiencies durinq operations

Table A 2-1. Operator's Acceptance Inspection

INSPECTION ITEM	REQUIREMENT
Dry Chemical Level	Full condition - See table 3-5.
AFFF Level - (After initial set-up, with 6 gallons AFFF and 94 gallons of water)	Within 2 inches of bottom of fill collar. See table 3-6.
N_2 Cylinder Pressures	Above 1700 psi
Agent Tank Valve Positions	Both valves closed
Hose Reel Brake	Lightly tensioned against unwinding
Discharge Nozzles	Nozzles easily opened and closed, no binding, properly stored on nozzle brackets.
AFFF Tank Heater	Cold Weather: Properly heats solution
	Warm Weather: Continuity and ground check per para. 1-11c.
Equipment Supplied with Extinguisher	Per para. 1-7b.

sufficiently critical to stop operations. After-operation services shall be performed by the operator after every operating period. Defects or unsatisfactory operating characteristics beyond the scope of the operator to correct must be reported at the earliest opportunity to organizational maintenance.

b. Before and After Operation Services. Before and After operation service shall be performed in accordance with table 2-2.

Table A 2-2. Operator's Daily Services

BEFORE OPERATION	AFTER OPERATION	SERVICE TO BE PERFORMED
X	X	Inspect nitrogen cylinder gages. Replace cylinders per para. 3-10c if cylinder pressure is less than 1700 psi.
	X	Purge discharge lines and handlines of residual chemicals per para. 3-10.
X		Check hose reel hand brake to ensure tension is only sufficient to hold reels stationary, while allowing hose to be unwound without undue force.
	X	Inspect AFFF supply. Use dipstick to determine quantity of AFFF concentrate. Replenish per para. 3-10 as required.
	X	Inspect dry chemical supply. Use dipstick and table 3-5 to determine quantity of dry chemical. Replenish per para. 3-10 as required.
	X	Stow hoses by rewinding onto hose reels. Stow nozzles on nozzle holder. Locate remote reel for ready use.
X	X	Return all valves to normal or ready position according to instruction decal attached to skid frame.

Section III. CONTROLS AND INSTRUMENTS

A 2-6. LOCATION AND FUNCTION OF CONTROLS AND INSTRUMENTS . This section describes, locates, illustrates, and furnishes the operator, crew, or organizational maintenance personnel sufficient information pertaining to the various controls and instruments provided for the proper operation of the fire extinguisher.

A 2-7. AFFF SYSTEM. The AFFF System components are located on the right hand side of the skid frame, as viewed from the hose reel end, and include the horizontally-mounted tank at the rear of the unit.

a. Nitrogen Cylinder Discharge Valve. The nitrogen cylinder valve (1, figure 2-4) is the primary control

for the AFFF system. This quick opening valve is mounted on the outlet of the nitrogen N2 cylinder. Lifting the handle up 90 degrees completely opens the valve and pressurizes the AFFF system, provided the charging valve in the system is in the stand-by or open position. Pushing the handle down shuts off the nitrogen supply to the system.

b. Nitrogen Cylinder Pressure Gage. The 0-3000 psi pressure gage (2, figure 2-4) installed on the quick-opening valve attached to the outlet of the nitrogen cylinder is on the cylinder side of the cutoff. The gage gives a continual reading of cylinder pressure, regardless of valve position. Normal reading on the gage when cylinder is fully charged is 2400 psi at 700F. Minimum pressure indication for fire extinguisher operation is 1700 psi at 70°F.

c. Nitrogen Pressure Regulator. The pressure regulator (3, figure 2-4) is mounted under the hose reel frame and connected by high pressure hoses to the nitrogen cylinder and to the AFFF system piping. The function of the regulator is to reduce the high pressure nitrogen supply to system working pressure 230 psi. The pressure regulator is pre-set at 230 psig and should not require readjustment in normal operation.

d. Charge Valve. The charge valve (4, figure 2-4) controls the pressurization of the AFFF tank. This valve is kept in a normally open position to ensure the "ready" status of the extinguisher in event of fire. Normally, the valve should be closed only when it is necessary to purge the AFFF discharge and dispensing lines with nitrogen directly from the nitrogen cylinder. With the charge valve closed, the lines can be purged without pressurizing the tank.

e. Purge Valve. The purge valve (5, figure 2-4), controls the tank bypass line and permits purging of the discharge lines and dispensing hose with nitrogen directly from the nitrogen cylinder. This valve is normally closed except when necessary to apply additional nitrogen pressure if tank top pressure is insufficient to purge the lines.

f. AFFF Control Rod. Located at the front of the unit, the AFFF control rod (6, figure 2-4) puts the AFFF shutoff valve within easy reach for quick actuation of the AFFF system. The rod connects through a u-joint to the AFFF shutoff valve on the outlet of the AFFF tank. Turning the control rod 90 degrees counterclockwise fully opens the discharge line of the AFFF tank. To stop the product discharge, the valve rod is returned to the closed position.

g. Twin Agent Nozzle. The nozzle (7, figure 2-4) is quick coupled to the dispensing hose for the AFFF system. As viewed from the hand grips the AFFF nozzle is the left nozzle of the twin nozzle assembly. Squeezing the nozzle lever opens the shutoff valve in the nozzle. The AFFF nozzle is an air aspirating type which provides an approximate reach of 50 feet, with 8. 5-foot spray pattern and a foam expansion ratio of five to one under normal operating conditions. The nozzle places final control of the AFFF discharge in the operator's hand after the system is activated. When not in use, the nozzle is stored as part of the twin nozzle assembly on a nozzle bracket.

1. Nitrogen Cylinder Discharge Valve
2. Pressure Gage
3. Nitrogen Pressure Regulator
4. Charge Valve
5. Purge Valve
6. Control Rod
7. Twin Agent Nozzle

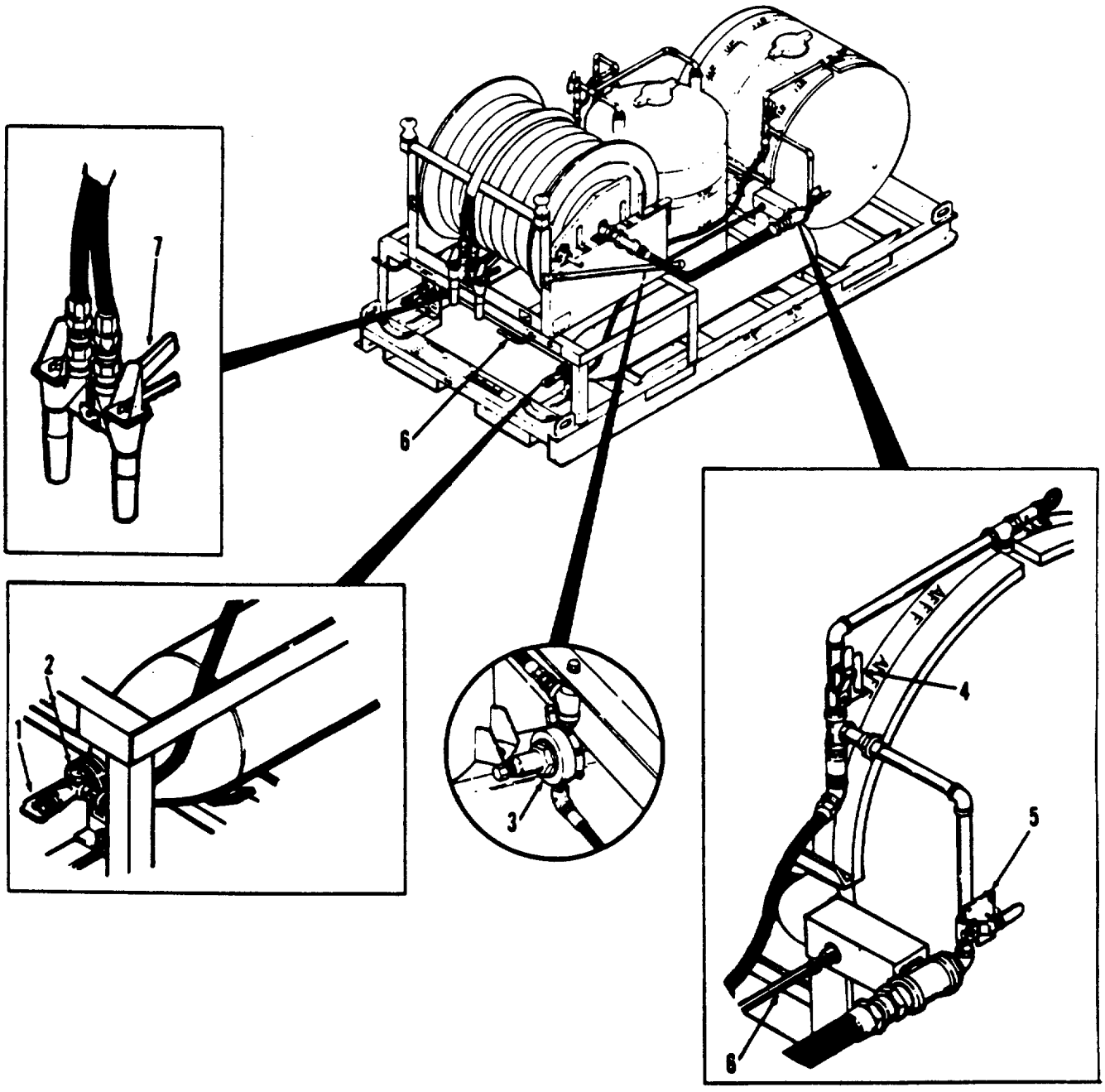


Figure A 2-4. AFFF System Controls

A 2-8. DRY CHEMICAL SYSTEM. The dry chemical system components are located on the left side of the skid frame and includes the vertically-mounted tank at the center of the unit.

a. Nitrogen Cylinder Discharge Valve. The nitrogen cylinder valve (1, figure 2-5) is the primary control for the dry chemical system. This quick-opening valve is mounted on the outlet of the nitrogen N cylinder. Lifting the handle up 90 degrees completely opens the valve and pressurizes the system provided the charging valve in the system is in the stand-by or open position. Pushing the handle down shuts off the nitrogen supply to the system.

b. Nitrogen Cylinder Pressure Gage. The 0-3000 psi pressure gage (2, figure 2-5) installed on the quick-opening valve attached to the outlet of the nitrogen cylinder is on the cylinder side of the cutoff. The gage gives a continual reading of cylinder pressure, regardless of valve position. Normal reading on the gage when cylinder is fully charged is 2400 psi at 700F. Minimum pressure indication for fire extinguisher operation is 1700 psi at 70°F.

c. Nitrogen Pressure Regulator. The pressure regulator (3, figure 2-5) for the dry chemical system is slightly larger than the AFFF system regulator, to provide the larger volume of nitrogen needed for fluidizing the dry chemical agent and filling the larger void in the dry chemical tank. The pressure regulator (3, figure 2-4) is mounted under the hose reel frame and connected by high pressure hoses to the nitrogen cylinder and to the dry chemical system piping. The function of the regulator is to reduce the high pressure nitrogen supply to system working pressure 230 psi. The pressure regulator is pre-set at 230 psig and should not require readjustment in normal operation.

d. Charge Valve. The charge valve (4, figure 2-5) controls the pressurization of the dry chemical tank. This valve is kept in a normally open position to ensure the "ready" status of the extinguisher in event of fire. Normally, the valve should be closed only when it is necessary to purge the dry chemical discharge and dispensing lines with nitrogen directly from the nitrogen cylinder. With the charge valve closed, the lines can be purged without pressurizing the tank.

e. Purge Valve. The dry chemical purge valve (5, figure 2-5) controls the tank bypass line and permits purging of the discharge lines and dispensing hose with nitrogen directly from the nitrogen cylinder. This valve is normally closed except when necessary to apply additional nitrogen pressure if tank top pressure is insufficient to purge the lines.

f. Dry Chemical Control Rod. Located at the front of the unit, the dry chemical control rod (6, figure 2-5) puts the dry chemical shutoff valve within easy reach for quick actuation of the dry chemical system. The rod connects through a u-joint to the dry chemical shut-off valve on the outlet of the dry chemical tank. Turning the control rod 90 degrees counterclockwise fully opens the discharge line of the dry chemical tank. To stop the product discharge, the valve rod is returned to the closed position.

g. Twin Agent Nozzle. The dry chemical nozzle (7, figure 2-5) is the right hand nozzle of the twin

nozzle assembly, as seen from the operator's viewpoint. Squeezing the nozzle lever opens the shutoff valve in the nozzle, releasing the pressurized and fluidized chemical agent. The nozzle tip is designed to dispense the dry chemical in a semi-dispersed pattern at flow rates up to 6 pounds per second, with an approximate reach of 50 feet. The tip can be easily unscrewed from the nozzle for cleaning in event of plugging. When not in use, the nozzle is stored as part of the twin nozzle assembly on nozzle bracket.

A 2-9. HOSE REEL. Two controls are located on the hose reel, one is

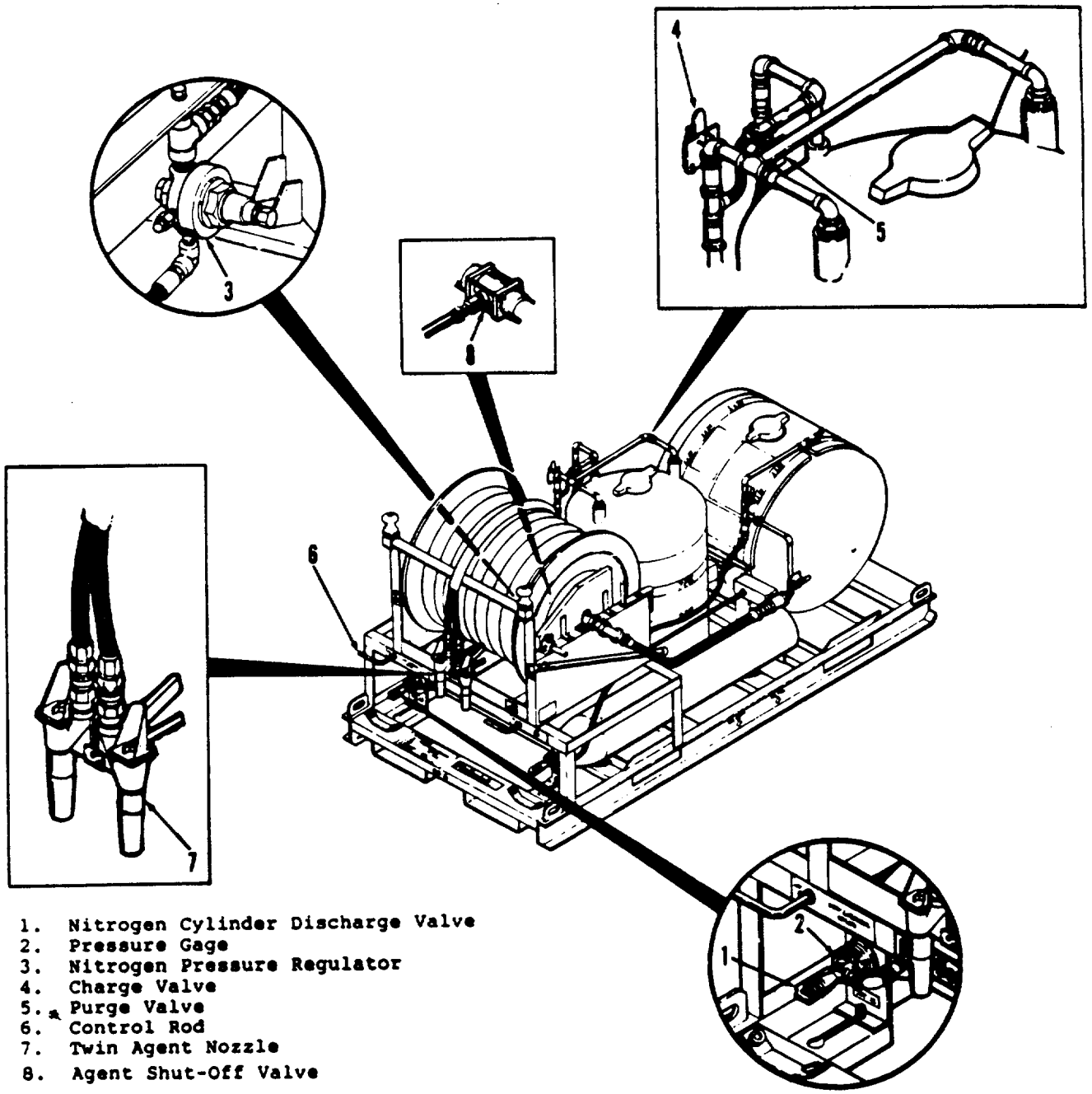


Figure A 2-5. Dry Chemical System Controls

the hand crank and the other is the brake.

a. Hose Reel Crank. The hand crank (1, figure 2-6) for the hose reel is stored on the side of the hose reel frame when not in use. To rewind the hose, the operator slides the crank onto the chain drive sprocket shaft and turns the shaft clockwise. The hand crank is not used when unwinding the hoses from the reel.

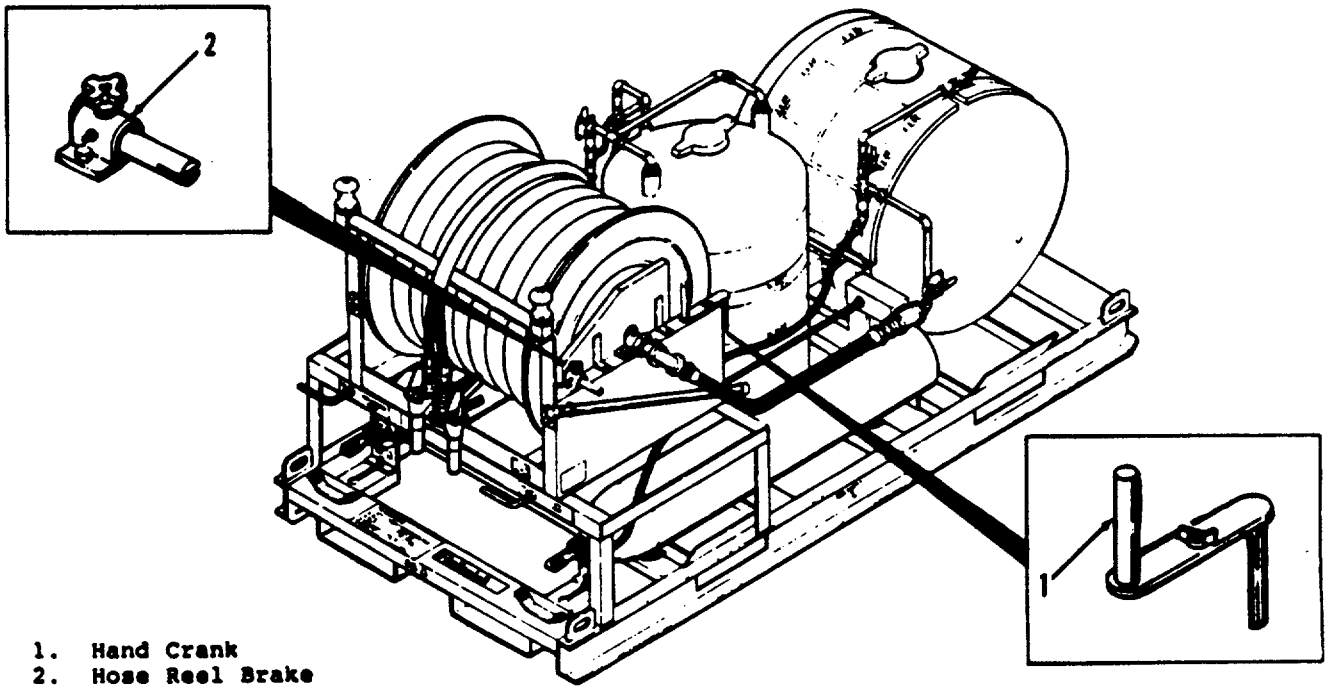
b. Hose Reel Brake. The brake (2, figure 2-6) has an adjusting knob which applies pressure through a spring to a brake disc in contact with the sprocket drive shaft. Tension on the brake is increased by turning the knob clockwise. The brake should be tensioned sufficiently to hold the hose reel against the weight of the stored hose to prevent unwinding. Excess tension will result in rapid wear of the brake disc and difficult unspooling of the hoses.

A 2-10. REMOTE HOSE REEL.

The remote hose reel (figure 2-7) has no controls other than the hand crank (1) and brake (2) which are identical to the stationary hose reel. See paragraph 2-9 above. The remote hose reel is mounted on a two-wheeled cart and has a push-pull handle for maneuvering the hose reel in event of fire.

a. Twin Agent Nozzle. The remote hose reel is equipped with a twin-agent nozzle (3, figure 2-7) of the same type used on the extinguisher. It is attached to the twin-line hose, ready for use, and anchored to the hose reel frame with a mounting bracket.

b. Quick-Disconnected Fittings. The quick-disconnects (4, figure 2-7) are located at the rear of the remote hose reel. The fittings are oriented to prevent wrong connection of the hoses.



1. Hand Crank
2. Hose Reel Brake

Figure A 2-6. Hose Reel Controls

1. Hand Crank
2. Hose Reel Brake
3. Twin Agent Nozzle
4. Quick Disconnects
5. Input Hoses

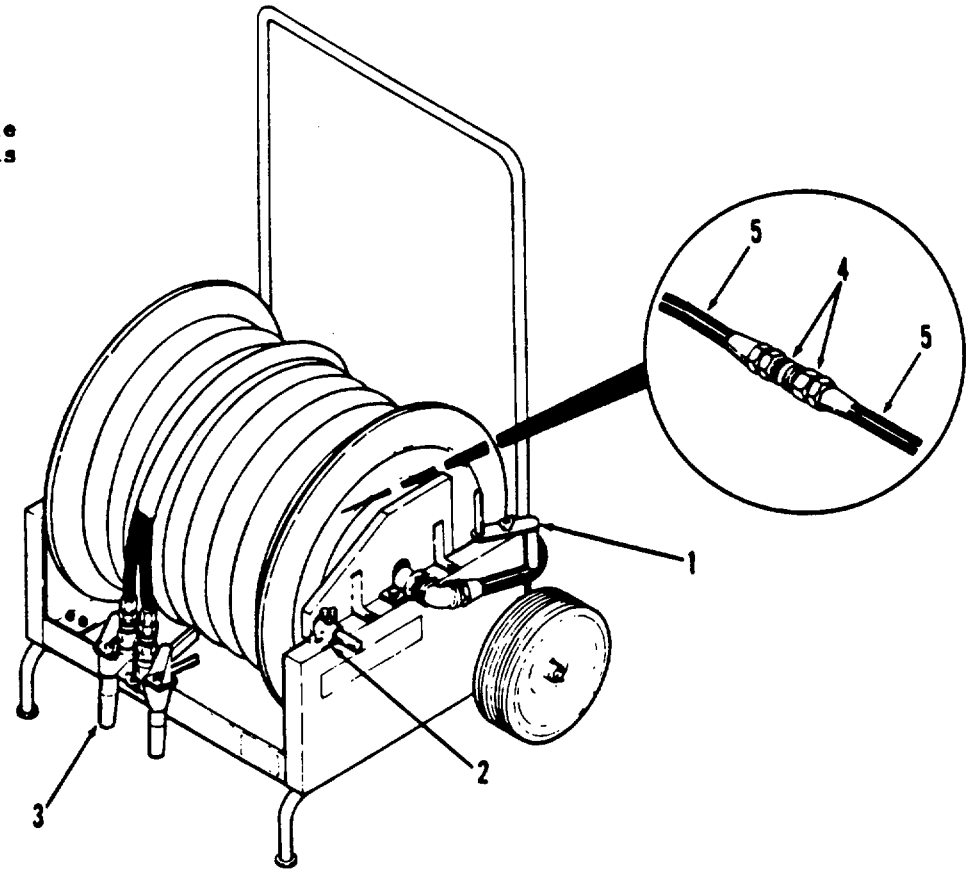


Figure A 2-7. Remote Hose Reel

Section IV. OPERATION UNDER SPECIFIC CONDITIONS

A 2-11. GENERAL. The instructions in this section are for the information and guidance of the personnel responsible for the operation of the model 450 PKP/100 AFFF 03638MC fire extinguisher. It is essential that the operator and all assisting personnel know how to perform each operation necessary to successfully extinguish various fires. This section gives instructions on charging, using, and returning the fire extinguisher to an operational ready status. The only variations from normal operation will be created by climatic conditions. This section will instruct the operator on additional requirements created by extreme climatic changes.

A 2-12. OPERATION UNDER NORMAL CONDITIONS.

WARNING

Special heat resistant clothing, including hood, coat, pants, gloves and preferably boots, must be worn while fighting any large scale petroleum fire.

a. Valve Positions. The valves in the AFFF and dry chemical systems should be placed in the following normal conditions prior to operating.

(1) Dry Chemical System.

(a) Dry Chemical Shut-Off Valve - Closed
(b) Purge Valve - Closed
(c) Charge Valve - Open
(d) Nitrogen Cylinder -Closed

(2) AFFF System.
(a) AFFF Shut-OFF Valve - Closed
(b) Purge Valve - Closed
(c) Charge Valve - Open
(d) Nitrogen Cylinder - Closed

b. Operation. The fire extinguisher as emergency equipment is always maintained in an operational ready status. When the unit is needed for fighting a fire, proceed as follows:

NOTE

If remote hose reel is needed in reaching the fire, connect the remote unit to the base unit per paragraph c before opening the nitrogen cylinder valves.

(1) Open both nitrogen cylinder valves. The AFFF tank will pressurize in 1-2 seconds, the dry chemical tank should pressurize within 10 seconds.

(2) Rotate the AFFF control rod and the dry chemical control rod to full open position. The system discharge lines will pressurize up to the twin nozzle assembly.

(3) Remove nozzle assembly from nozzle bracket and withdraw all the hose from the reel.
(4) Approach fire from upwind and attack fire with open dry chemical nozzle, sweeping side to side.
(5) When headway is gained on fire, open AFFF nozzle.
(6) Work fire slowly downwind with both nozzles open.

NOTE

Full flow AFFF can be maintained for approximately two minutes. The dry chemical agent will dispense within approximately 75 seconds at full flow.

(7) When fire is extinguished, close both nozzles.
(8) When area clears, verify that no smoldering pockets remain to reignite the fuel.

c. Operation with Remote Hose Reel. When the remote hose reel is needed to extend the reach of the fire extinguisher, proceed as follows.

CAUTION

Shut off nitrogen supply and depressurize systems before connecting remote hose reel.

(1) Extend handline assembly from fire extinguisher hose reel to its maximum length (150 feet).
(2) Pull the remote hose reel cart to the end of the handline.
(3) Remove twin nozzle assembly from handline hoses by releasing the quick-disconnects on the nozzle.
(4) Separate the cart input hoses (5, figure 2-7) by releasing

the quick-disconnect fittings (4, figure 2-7).

(5) Insert the appropriate hose and fitting into each of the hose cart inlet couplers.

(6) Open both nitrogen cylinder valves. The AFFF tank will pressurize in 1-2 seconds, the dry chemical tank should pressurize within 10 seconds.

(7) Rotate the AFFF control rod and the dry chemical control rod to full open position. The system discharge lines will pressurize up to the twin nozzle assembly.

(8) The remote hose reel provides 150 feet additional hose. Full flow times with 300 feet of hose will be approximately 30 seconds longer than with 150 feet of hose. See NOTE under paragraph b above.

d. Returning Extinguisher to Operational Ready Status. Immediately after each use, the fire extinguisher should be returned to an operational ready or standby status. Hose line clean-out must take place immediately after the tank has been completely or partially discharged with hoses removed from hose reel.

(1) Close shut-off valves by turning AFFF and dry chemical control rods to closed position.

(2) Close charge valves.

(3) Open purge valves.

(4) Close nitrogen cylinder valves.

(5) Slowly open AFFF and dry chemical nozzles and allow flow until hoses have cleared. Clearing is complete when discharge stream becomes gassy for approximately 10 seconds.

(6) When tank has vented completely, close nozzles on handlines.

(7) Wind hoses onto hose reel. Return nozzles to nozzle bracket.

(8) If remote hose reel cart was used, disconnect from main unit hoses. Reconnect inlet hoses (5, figure 2-7) at rear of cart. Reconnect the twin nozzle to the fire extinguisher twin agent hose.

(9) Replenish the AFFF and dry chemical tanks as required. See paragraph 3-10. Check the nitrogen cylinders and replace if pressure is below required 1700 psi. See paragraph 3-10c.

(10) Return all valves to normal or ready status. See paragraph 2-12a.

(11) Thoroughly hose down any contaminated areas of the fire extinguisher and the surrounding area with clean water. Use care not to float AVGAS or other fuels into areas that could become hazardous.

A 2-13. OPERATION UNDER EMERGENCY CONDITIONS. If either the AFFF or dry chemical system fails to operate or becomes inoperative during operation, the remaining system may be used to extinguish the fire. The systems operate completely independent of each other.

A 2-14. OPERATION UNDER UNUSUAL CONDITIONS.

a. Operation In Extreme Cold. In freezing cold weather operations the fire extinguisher AFFF tank heater must be

used at all times. The heater is only designed to maintain the temperature of the AFFF chemical agent above freezing in temperatures to -40°F. (-40°C) When temperatures are expected to drop below -40° F, an auxiliary heater should be installed. A plugged 1-inch opening is provided in the end of the AFFF tank to accept an immersion or dipstick-type heater.

b. Operation in Extreme Heat or Desert Regions. The fire extinguisher is designed to operate effectively in any tropical climate. Operational procedures should include supplying shade for the fire extinguisher and/or requiring personnel to wear gloves as protection against hot metal surfaces. In desert regions, additional protection should be provided to shield the fire extinguisher against blowing sand.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

Section I. INTRODUCTION

A 3-1. DEFINITION AND SCOPE. This chapter provides the information necessary for maintenance of the fire extinguisher. Maintenance is defined as the action taken to retain material in, or restore it to, a serviceable condition. This chapter will consist of, in addition to Section I, the following sections:

Section II, Tools and Equipment.

Section III, Preventive Maintenance Services.

Section IV, Troubleshooting.

Section V, Organizational Maintenance.

Section VI, Field Maintenance.

Section VII, Care and Preparation for Storage.

A 3-2. FORMS, RECORDS, AND REPORTS. Record and report forms are an important control consideration in the planning and implementation of equipment maintenance. Consistent inspection procedures, repair parts requirement forecasting, repair parts requisitioning, and economical, effective shop procedures are dependent upon strict adherence to the preparation and use of all record and report forms currently prescribed by directives for maintenance facilities. All record and report forms which are required by current directives to be maintained by maintenance facilities shall be carefully processed in accordance with such directives.

Section II. TOOLS AND EQUIPMENT

A 3-3. TOOLS AND MATERIALS SUPPLIED WITH THE EQUIPMENT.

a. General. Tools and equipment supplied with the fire extinguisher, but not necessarily part of the basic unit, are listed in this paragraph.

(1) Installation tool (1, figure 3-1) is used for removal and replacement of twin-line hose or fittings. The tool is stored inside the primary hose reel frame and held in place with a u-bolt.

(2) Dipstick (2, figure 3-1), used in AFFF tank replenishment, is an aluminum yardstick which is used to measure from top of tank to top of solution to determine quarts of AFFF concentrate required during servicing. It is stored in a protective tube attached to the fire extinguisher when not in use.

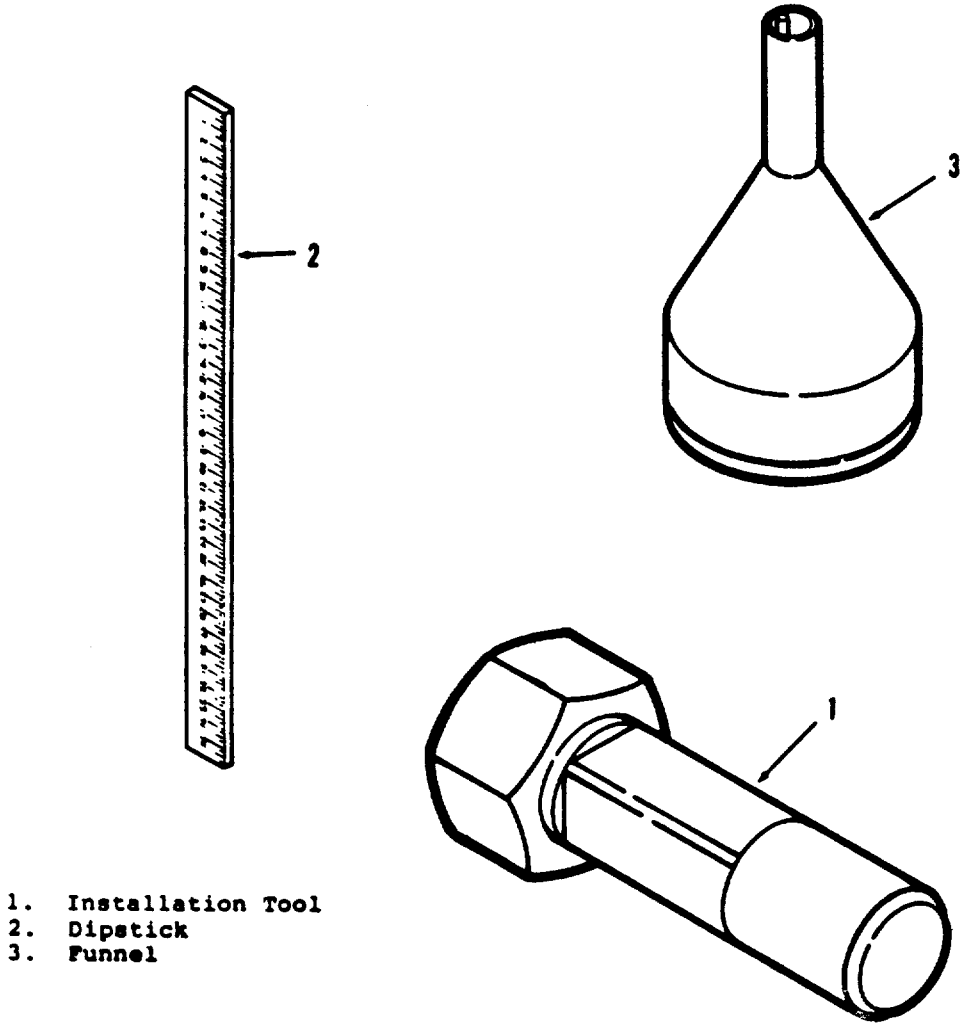
(3) Fill Funnel (3, figure 3-1) is provided for servicing the dry chemical tank. No provisions are made for storing the funnel on the fire extinguisher.

(4) Hose Reel Cranks, one for each hose reel, are to be attached in the side of the hose reel frame (3, figure 1-8).

(5) Remote Hose Reel Cart. The remote hose reel cart is self-contained in that it can be rolled to

the most favorable location for parking (see figure 1-6). It is designed for open area use, but keeping the unit under cover will extend its useful service life.

b. Special Tools and Equipment. The installation tool, dipstick, and funnel are the only special tools or equipment supplied with the fire extinguisher. No other special tools or equipment are required for first or second echelon maintenance beyond ordinary organizational maintenance tools.



1. Installation Tool
2. Dipstick
3. Funnel

Figure A 3-1. Special Tools

Section III. PREVENTATIVE MAINTENANCE SERVICES

A 3-4. PREVENTATIVE MAINTENANCE. Table 3-1 lists the preventative maintenance required for the fire extinguisher. These requirements are in addition to the normal daily maintenance requirements for ensuring that the equipment is in ready status for emergency operation. Refer to Table 3-1.

Table A 3-1. Preventative Maintenance Services

FREQUENCY		MAINTENANCE CHECK	CRITERIA
Bi-Annually	Annually		
X		HIGH PRESSURE LEAK TEST. 1. Close all AFFF and dry chemical system shutoff valves. 2. Open Nitrogen cylinder valves. 3. Check all fittings, connections and hoses, from nitrogen cylinders to pressure regulators, for leaks. Use soap solution.	No evidence of leaks for five minutes.
X		Check pressure relief valves for obstructions.	
X		Remove fill caps and check that pressure relief holes in fill collars are free of obstructions.	
X		Examine fill cap gaskets for elasticity, clean and coat lightly with a good grade of heat resistant grease.	Replace gaskets if brittle, cut, cracked or deformed.
X		Inspect threads in fill caps and on fill openings for nicks, cross-thread-ing and rough edges.	
	X	Using soap and water, thoroughly clean the equipment to remove all traces of dirt and chemicals.	
	X	Check for signs of cor-rosion or other physical damage. If necessary, scrape and repaint the unit.	

Table A 3-1. Preventative Maintenance Services (Continued)

FREQUENCY		MAINTENANCE CHECK	CRITERIA
Bi-Annually	Annually		
	X	Check for signs of un-authorized repairs to the tanks (such as makeshift welds or brazing.	Unauthorized welding to an ASME tank is cause for replacement.
	X	Fully unwind the hand hose lines and check thoroughly for signs of wear, abrasions, or deformity.	If hose shows signs of damage, replace it.
	.X.	Check hose couplings for tightness, corrosion or cracks.	
X		Check tank mounting for tightness.	Replace mounting bolts if severely corroded.
	X	AFFF HEATER. 1. Cold Weather Check. (ambient temperature less than 40°F). a. Ensure power has been applied to heater a minimum of 4 hours. b. Immerse a thermometer in AFFF liquid for 3 minutes.	AFFF temperature above 40° F.
	X	2. Warm weather check (Ambient temperature above 50°F). a. Measure resistance with ohmmeter between each power lead to ground. See figure 2-3 for schematic.	Infinity

Section IV. TROUBLESHOOTING

A 3-5. GENERAL. This section provides information for troubleshooting the fire extinguisher and includes indication of trouble, determination of cause, and the remedial action necessary for repair or adjustments.

A 3-6. TROUBLE-SHOOTING PROCEDURES. A trouble-shooting chart is provided in table 3-2, and is intended as a guide to isolate malfunctions to certain areas or components. For each symptom one or more probable causes and possible remedies are listed. An asterisk by an item in the remedy column indicates that necessary repairs are beyond operator capability. The operator will call in maintenance personnel from the applicable maintenance echelon to perform those tasks.

Table A 3-2. Trouble-Shooting Chart

SYMPTOM	PROBABLE CAUSE	POSSIBLE REMEDY
DRY CHEMICAL SYSTEM NITROGEN CYLINDER GAGE INDICATES LOSS OF PRESSURE, CYLINDER VALVE CLOSED.	Low temperature.	Check the Nitrogen cylinder gage indication and ambient temperature against table 3-4.
	Nitrogen cylinder valve leaking.	Adjust per paragraph 3-llb. If leakage continues with cylinder valve closed, replace cylinder.
	Leakage in gage or fittings.	With valve closed, check high pressure gage and fittings with soap solution. Tighten or replace as necessary.*
AUDIBLE INDICATION OF NITROGEN CYLINDER DISCHARGE, SYSTEM FULLY CHARGED, NOZZLE CLOSED.	Leakage in system lines, tank filler cap, or relief valve.	Leakage with system pressurized will normally be immediately evident and easily located. Repair or replace faulty component.*
DECREASED FLOW OF DRY CHEMICAL AGENT.	Plugged pickup tube.	Depressurize system and examine dry chemical powder. If powder is damp or caked, replace.

Table A 3-2. Trouble-Shooting Chart (Continued)

SYMPTOM	PROBABLE CAUSE	POSSIBLE REMEDY
DECREASED FLOW OF DRY CHEMICAL AGENT.	Plugged pickup tube.	Close charge valve, open purge valve and dry chemical valve, then open nitrogen cylinder valve to clear pickup tube. Return valves to normal operating position.
	Packed handline hose resulting in incomplete clean-out.	Clear hose per paragraph 3-28.
	Partially closed dry chemical valve.	Open valve completely.
	Defective regulator.	Check system operating pressure. Must be within 220-240 psi. See paragraph 3-11.
	Low charge on Nitrogen cylinder.	Replace cylinder.
AFFF SYSTEM NITROGEN CYLINDER GAGE INDICATES PRESSURE LOSS	See probable causes and possible remedies for same symptom in DRY CHEMICAL SYSTEM.	
DECREASED FLOW OF AFFF AGENT.	AFFF valve partially closed. Low system pressure.	Open AFFF valve fully. Check that system pressure is within limits 220-240 psi.
	Defective pressure regulator.	Replace regulator. See Paragraph 3-17.
NO AFFF DISCHARGE WHEN NOZZLE IS OPEN, SYSTEM PRESSURIZED.	Shutoff valve is closed.	Check system valves are in normal operating position.

Table A 3-2. Trouble-Shooting Chart (Continued)

SYMPTOM	PROBABLE CAUSE	POSSIBLE REMEDY
NO AFFF DISCHARGE WHEN NOZZLE IS OPEN, SYSTEM PRESSURIZED.	In freezing temperatures, AFFF heater not performing properly. .	See AFFF TANK HEATER.
AFFF TANK HEATER **NOTE** **All symptoms and corrections assume temperature below 40°F.**	**WARNING** **120/240 VAC used in operation of this equipment. DEATH on contact may result if personnel fail to observe safety precautions.**	
HEATER DOES NOT OPERATE AT CORRECT TEMPERTURE (AFFF) (partially frozen)	Low voltage from power source.	*Using volt-ohmmeter with insulated probes, check continuity of heater and thermostats; also check voltage across heater power source output terminals. If incorrect, replace power source.
	Defective thermostat.	Replace thermostat.*
HEATER INOPERATIVE AT ANY TEMPERATURE. (Power Source okay).	Open or shorted lead in heater blanket.	Disconnect power cord from receptacle. Connect ohmmeter across the power circuit terminals of the heaters in the electrical enclosure. Ohmmeter reading should be 11 ohms nominal for the 120 volt connection or 44 ohms nominal for the 240 volt connection. If reading is other than this, check heater wiring and individual heater for damage. Replace heater blanket properly after any repair work is completed.

Table A 3-2. Trouble-Shooting Chart (Continued)

SYMPTOM	PROBABLE CAUSE	POSSIBLE REMEDY
HEATER INOPERATIVE AT ANY TEMPERATURE (Power Source okay).	Open thermostat or heater element.	If test above indicates infinity and no break in wiring harness, an open heater element or thermostat is indicated. **NOTE** **An alternative to thermostat or heater blanket replacement in all remedies above is installation of an immersion type heater in the 1-inch plug on end of AFFF tank.**

Section V. ORGANIZATION MAINTENANCE

A 3-7. DEFINITION AND SCOPE.

a. Definition. Organizational maintenance is that maintenance which is the responsibility of and performed by a using organization. Its phase normally consists of inspecting, servicing, lubricating, adjusting, and replacement of parts, minor assemblies, and sub-assemblies not requiring specialized skills.

b. Scope. Organizational maintenance includes first and second echelons of maintenance. First echelon maintenance is that performed by the operator. Second echelon maintenance is that designated to be performed by specially trained personnel provided for that purpose in the using organization.

A 3-8. PERIODIC INSPECTION. In addition to all other inspections previously outlined, the fire extinguisher will be periodically inspected in accordance with table 3-3. Those preventive maintenance functions in table 3-1 which are identical to and coincide with any of the inspection requirements of table 3-3 will be performed concurrently when possible.

A 3-9. LUBRICATION. Overall lubrication of the fire extinguishing unit will be done in accordance with the Lubrication Chart (table 3-4) and specific instructions in this paragraph. Operators and maintenance personnel should consult latest revisions of general lubrication instructions and directives for possible improvement in lubricants or procedures.

a. Hose Reel. Several items on the hose reel require periodic lubrication. Lubrication intervals will depend on frequency of use. Intervals specified should be regarded as minimum lubrication requirements.

Table A 3-3. Periodic Inspection Chart

FREQUENCY	TITLE OF WORK ITEM	APPLICABLE PARAGRAPH
Quarterly, or more frequently if conditions warrant.	Check dry chemical powder in tank for caking.	Para. 1-10
	Check gages on Nitrogen cylinders for dirty, cracked or broken glass or case.	None
	Check Nitrogen cylinder pressures. Replace either cylinder if pressure is below 1700 psi.	Para. 3-10
	Ensure that all valves and quick-disconnect fittings work freely.	Para. 1-11
	Inspect AFFF and dry chemical tanks and system lines, hoses and handlines for evidence of wear, kinks, fraying or corrosion.	None
	Check electrical connector pins and receptacle of AFFF tank heater for moisture, corrosion, or distortion.	

(1) SWIVEL JOINTS. The swivel joints (1, figure 3-2) are the side inlets to the hose reel and also are the bearings for the hose reel drum. A grease fitting is installed on top of each swivel joint. Lubricate upon receipt of equipment and at twelve month intervals with Molykote 33 or equivalent.

(2) DRIVE BEARING AND BRAKE ASSEMBLY. A grease fitting is installed on the drive bearing housing (2, figure 3-2) for lubrication of the chain drive shaft. Lubricate in accordance with item 1.

(3) DRIVE CHAIN. The roller chain (3, figure 3-2) should be thoroughly cleaned before lubricating. Use a wire brush and compressed air to remove accumulated dirt or grease. Lubricate thoroughly with SAE 30 engine oil, MIL-02104 or equivalent, making sure the oil reaches the chain pins and rollers. Wipe off excess oil. Lubricate at monthly intervals to minimize rust and corrosion when not in use.

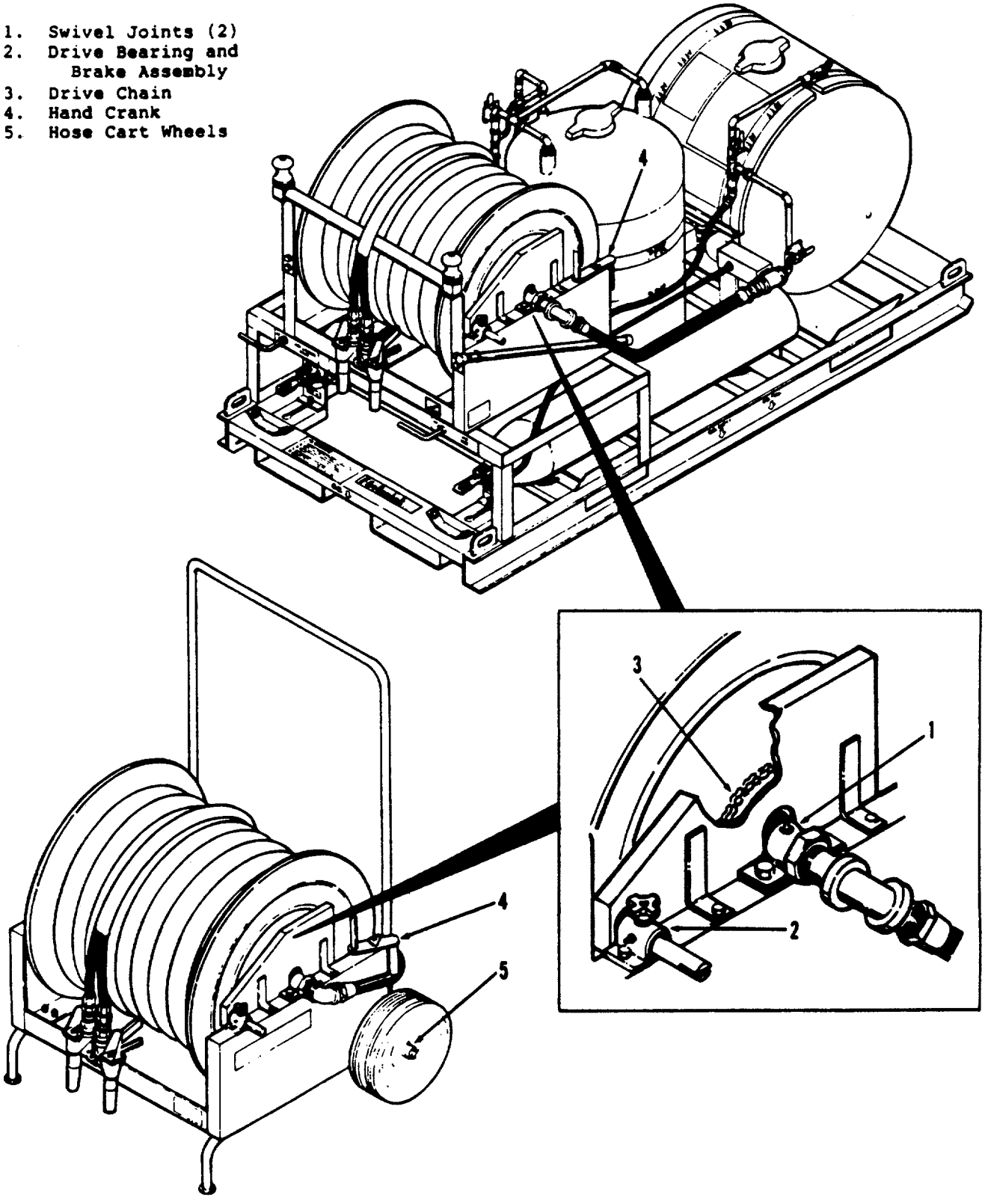


Figure A 3-2. Lubrication Points

Table A 3.4. Lubrication Chart

LUBRICATION POINT	LUBRICANT	INTERVAL
Hose Reel Swivel Joints (bearings)	Molykote 33 or equivalent	Annually
Drive Chain, Hose Reel	SAE 30 engine oil, MIL-02104	Monthly
Drive Bearing Annually and Brake	Molykote 33 or equivalent	
Hand Crank	SAE 30 engine oil, MIL-02104	Quarterly
Remote Hose Reel Cart (wheels)	General Purpose Grease, Fed. Spec. VV-G-632-A	Quarterly

WARNING

Use normal precautions when cleaning with compressed air to prevent injury to personnel. Compressed air for cleaning purposes will not exceed 30 psi. User should wear safety goggles, and should not direct the stream of air toward himself or other persons.

(4) HAND CRANK. Periodically lubricate hand swivel of the hand crank assembly (4, figure 3-2) with SAE 30 engine oil, MIL-02104, or equivalent as required to keep hand swivel rotating freely.

b. Remote Hose Reel.

(1) HOSE REEL. Lubricate remote hose reel in accordance with instructions under item a above.

(2) HOSE REEL CART. A grease fitting is installed in each wheel hub. Lubricate with general purpose grease, Fed. Spec. WVV-G-632A, MIL-L-10924, or equivalent at quarterly intervals.

A 3-10. SERVICING. Complete servicing of the fire extinguisher after each use is the responsibility of organizational maintenance.

a. Servicing Dry Chemical Tank. The dry chemical tank is serviced after use as follows:

(1) Close N_2 cylinder valve and dry chemical valve.

(2) Open purge valve and dry chemical hose nozzle to depressurize tank and clear handline.

WARNING

Four pressure relief holes are drilled in the threaded portion of the filler cap approximately three threads before the cap is released. If pressure is heard escaping through these holes while the cap is being removed, stop removal until all pressure has escaped; otherwise serious injury to personnel could result.

WARNING

Pressure in tank must be vented off through handline before fill cap is removed.

(3) SLOWLY remove filler cap on dry chemical tank, after ensuring tank is depressurized.

(4) Measure depth of dry chemical remaining in dry chemical tank with dipstick provided with the extinguisher (figure 3-1). The number of inches from the top of the fill collar to the remaining chemical is used to determine the pounds of dry chemical required to recharge the tank. See Table 3-5.

(5) Use funnel (figure 3-1) provided with the extinguisher to fill tank to proper level with dry chemical powder (nominally 450 pounds). Install cap and tighten hand tight.

NOTE

The same funnel can be used for servicing both dry chemical and AFFF concentrate. Always service dry chemical first, to ensure the funnel is dry. Any liquid in dry chemical tank can cause dry chemical to cake and not to discharge.

PKP LEVEL	TO REFILL TANK, ADD:
FROM TOP OF FILL COLLAR TO SURFACE OF PKP. INCHES Fresh Fill To Settled Condition	
4-1/2" - 8-1/2"	-FULL-
8-1/2" - 11-1/2"	50 LBS. PKP
11-1/2" - 14"	100
14-1/2" - 17"	150
18" - 20"	200
21-1/2" - 23"	250
24-1/2" - 25-1/2	300
28" - 28-1/2"	350
31" - 31-1/2"	400
36	450

NOTE

MEASUREMENTS SHOULD ONLY BE TAKEN AFTER PKP IS COMPLETELY SETTLED.

(6) Return system valves to normal or ready status, paragraph 2-12.

b. Servicing AFFF tank.

(1) Close N2 cylinder valve and AFFF shutoff valve.

(2) Open AFFF hose nozzle to clear handline and depressurize AFFF tank.

WARNING

Pressure in tank, must be vented off through handline before fill cap is removed.

(3) SLOWLY remove filler cap on AFFF tank, after ensuring tank is depressurized.

Table A 3-6. 6% AFFF Liquid Level Refill Table.

LIQUID LEVEL:	TO REFILL TANK, ADD:	
FROM TOP OF FILL COLLAR TO SURFACE OF LIQUID. INCHES	AFFF U.S. GALLONS	WATER
4-1/2	----------FULL----------	
7	1/2	8
9-1/4	1	15-1/2
11-1/2	1-1/2	23-1/2
13-1/2	2	31
15-1/2	2-1/2	39
17	3	47
18-1/2	3-i/2	55
20-1/2	4	63
22-1/2	4-1/2	70-1/2
24-3/4	5	78
27	5-1/2	86
31-1/4	6	94

NOTE:

100 GALLON TANK TO BE REFILLED ON LEVEL GROUND.

WARNING

Four pressure relief holes are drilled in the threaded portion of the filler cap approximately three threads before the cap is released. If pressure is heard escaping through these holes while the cap is being removed, stop removal until all pressure has escaped; otherwise serious injury to personnel could result.

(4) Measure depth of fluid remaining in AFFF tank with dipstick provided with the extinguisher (figure 3-1). The number of inches from the top of the fill collar to the remaining fluid is used to determine the gallons of AFFF concentrate required to obtain a 6% AFFF solution when the tank is filled. See Table 3-6.

(5) Pour required amount of AFFF concentrate into tank.

(6) Fill AFFF tank with water to within 4-1/2 inches of top of filler neck.

NOTE

Use of a hose, if available, held against tank bottom while filling will aid in Fixing the solution and prevent excessive foaming.

(7) Install cap and tighten hand tight.

(8) Return system valves to normal or ready status, paragraph 2-12.

c. Servicing Nitrogen Cylinders. Replace either nitrogen cylinder when cylinder pressure is below 1700 psi, after comparing reading with table 3-7.

(1) With cylinder valve closed and system depressurized, remove outlet adapter (1, figure 3-3) from outlet of quick-opening valve.

(2) Loosen retaining bolts (2) and remove cylinder stop plate (3). It is not necessary to remove the bolts completely.

(3) Remove cylinder by pulling straight outward then up as the cylinder clears the slides on the cylinder support plates.

(4) Install shipping cap (4) and return cylinder to field maintenance facility for recharging or replacement.

(5) Install new cylinder and secure with stop plate. Tighten retaining bolts securely.

(6) Remove shipping cap, check cylinder gage to ensure cylinder is fully charged. Compare with table 3-5. Momentarily open cylinder valve a small amount to clear any dirt from valve outlet.

(7) Connect outlet adapter and high pressure hose to valve outlet and tighten securely.

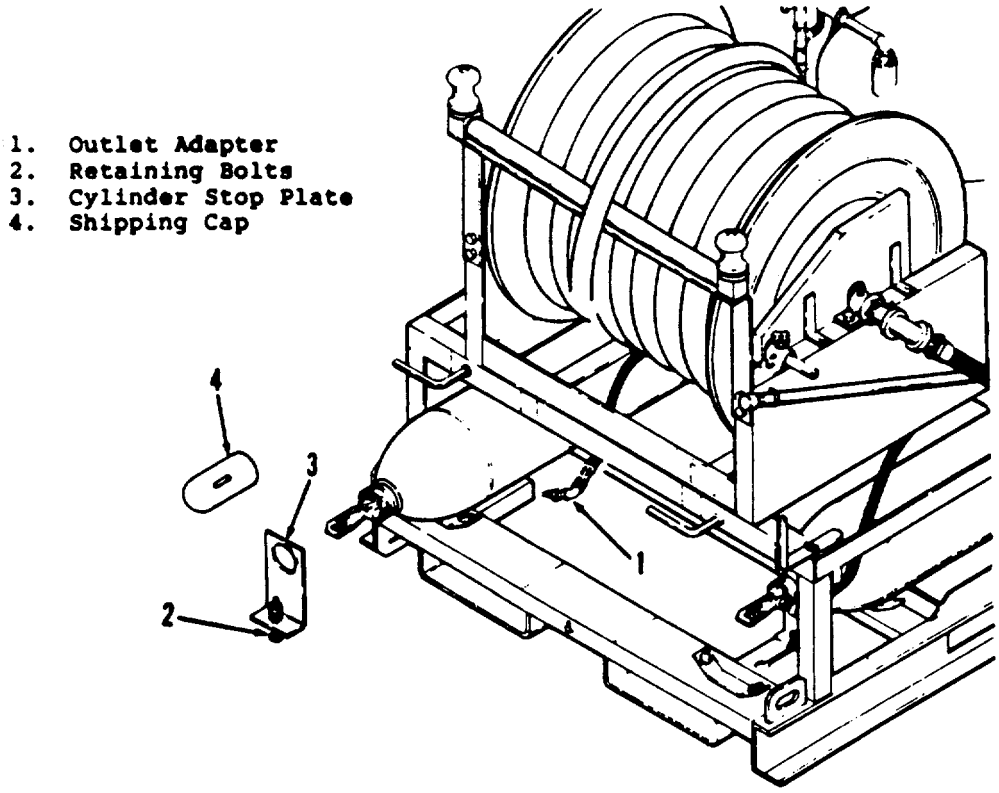
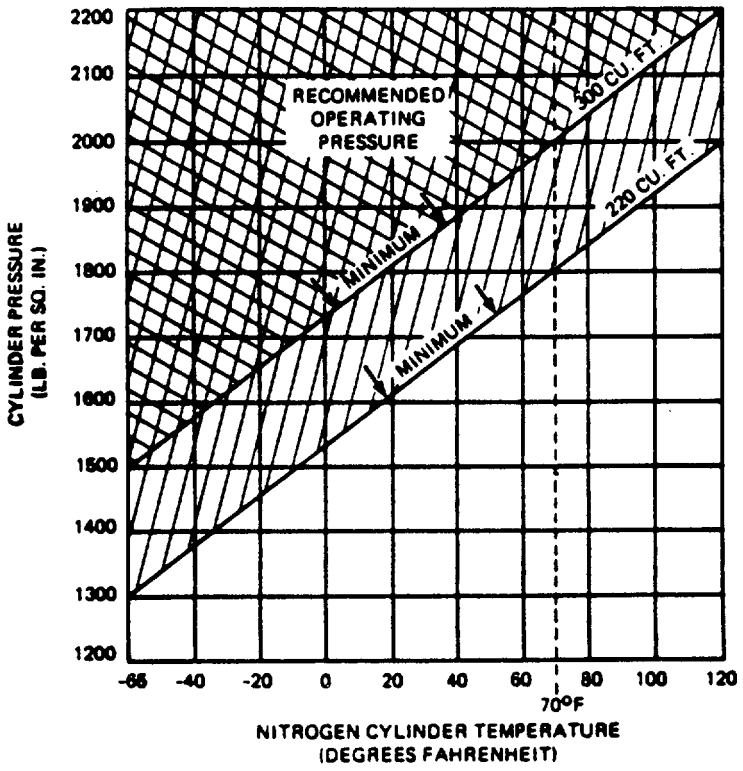
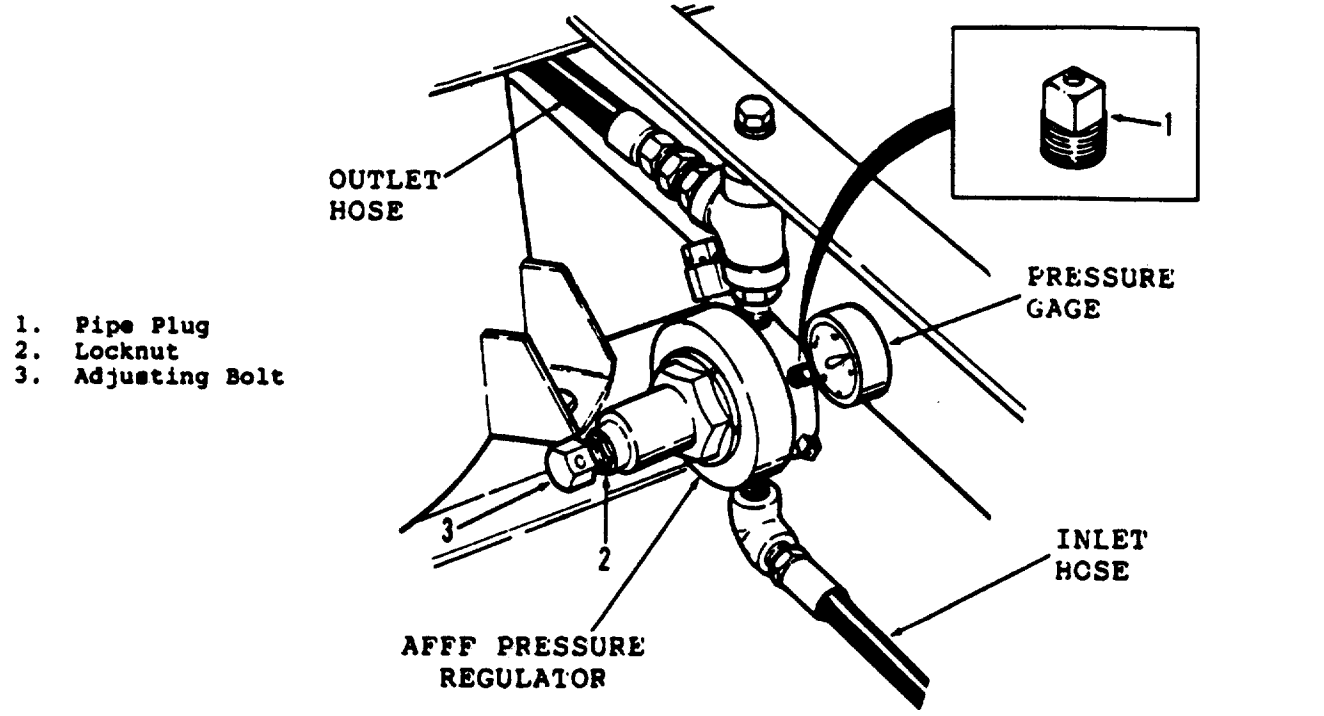


Figure A 3-3. Nitrogen Cylinder Removal

Table A 3-7. Nitrogen Cylinder Versus Temperature Chart





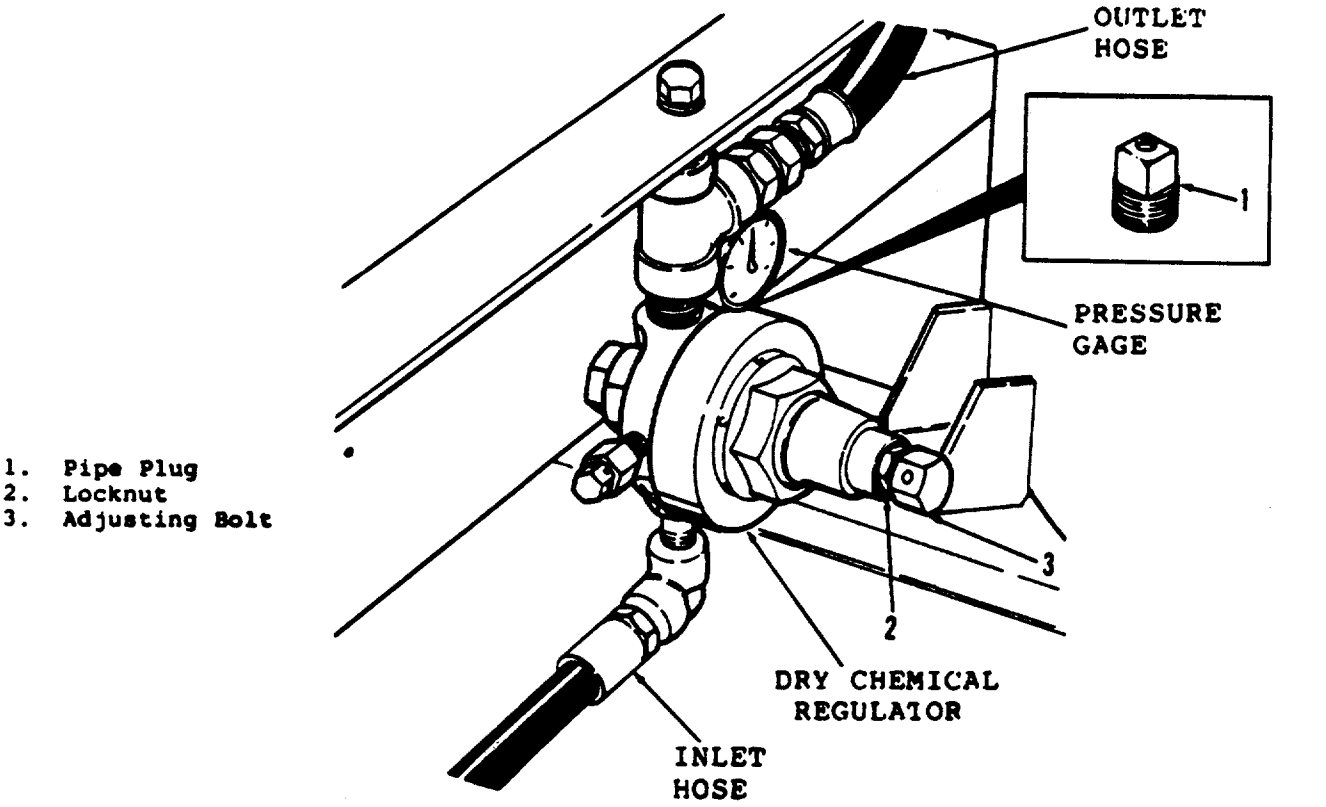


Figure A 3-4. Regulator Adjustment

APPENDIX A

A 3-11. ADJUSTMENTS.

a. Nitrogen Pressure Regulators. The nitrogen pressure regulators will normally be removed and returned to the field maintenance facility for adjustments. When a replacement regulator is not available, field adjustments can be made to preclude removing the fire extinguisher from service.

WARNING
Be sure system is depressurized before installing gage.

(1) Ensure that the fault is in the suspected regulator by installing a 0-300 psi pressure gage in place of the pipe plug (1, figure 3-4) in the regulator assembly.

(2) Close the charge valve.

(3) Open N2 cylinder valve in affected system.

(4) Remove locking wire on adjusting bolt.

(5) While observing the low pressure gage, use a wrench to loosen locking nut (2) and turn adjusting bolt (3) on pressure regulator to obtain reading between 220 and 240 psi. Turn adjusting bolt clockwise to increase pressure, counterclockwise to decrease pressure. Secure adjusting bolt with lockwire.

(6) Depressurize system, remove low pressure gage and reinstall pipe plug (1) in regulator. Restore system to standby status, paragraph 2-12a.

b. Nitrogen Cylinder Valve. Normal wear of the nitrogen cylinder valve seat may cause the valve to leak occasionally. The valve is designed for easy adjustment to stop such leaks. See figure 3-5.

1. Handle
2. Locknut
3. Set Screw
4. Cap Nut
5. Pressure Relief

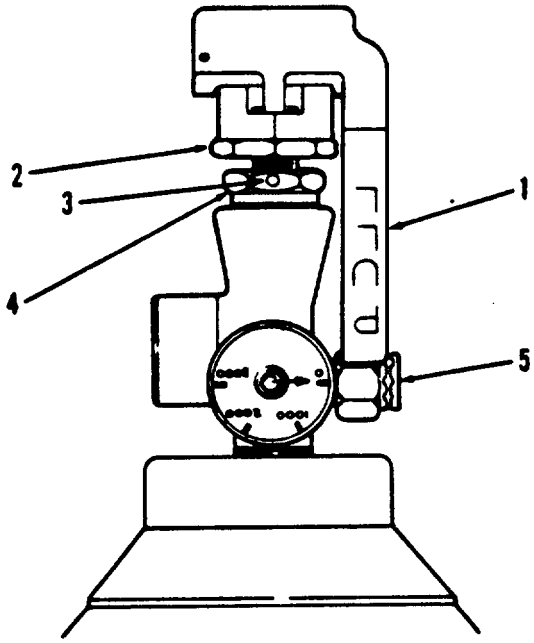


Figure A 3-5. Nitrogen Cylinder Valve Adjustment

(1) Loosen setscrew (3).

(2) Loosen locknut (2).

(3) Turn handle until it contacts the pressure relief (5).

(4) Tighten setscrew (3).

(5) Turn handle (1) clockwise until leak stops.

(6) Tighten locknut securely.

(7) Loosen set screw (3) in cap nut (4).

(8) Rotate handle to desired position for normal operation.

(9) Tighten setscrew (3).

NOTE

While positioning handle to its operating position, ensure that the handle, locknut, and shaft move together, and the locknut does not loosen.

c. Hose Reel Chain. Occasionally the drive chain on the hose reel may need adjustment to remove tension or slack. Adjust as follows:

(1) Loosen the two bolts (12, figure 3-23) securing the hose reel brake (30) to the frame (28).

(2) Slide the hose reel brake bracket in either direction until proper tension is obtained. Chain should be tight enough that it does not come off of sprockets, but not too tight to cause binding. Sprockets must be aligned properly.

(3) Tighten the two bolts securely.

A 3-12. REPLACEMENT OF PARTS, MINOR ASSEMBLIES, AND SUBASSEMBLIES.

Replacement of parts, minor assemblies, and subassemblies is necessary due to failure, wrong adjustment, modification, and normal wear. Replacement is normally the responsibility of organizational maintenance.

NOTE

Be sure new replacement seals, gaskets, cotter pins, hardware, etc. are on hand before discarding such used items as directed in the replacement instructions.

WARNING

The nitrogen pressure used in fire extinguisher operation can be extremely dangerous to personnel if proper precautions are not taken. Before attempting replacement of any part of' a system, close the nitrogen cylinder valve and vent all pressure in system by opening purge valve nozzle on hose reel.

A 3-13. AFFF TANK REPLACEMENT.

For ease of removal and installation, the tank piping should be removed along with the tank, figure 3-6. See WARNING above.

a. Removal.

(1) Depressurize system. (See WARNING above.) Drain AFFF by removing fusible plug (1).

(2) Remove AFFF nitrogen cylinder. (Refer to paragraph 3-10c.

(3) Loosen swivel end of hose (2) at regulator tee subassembly. Disconnect low pressure hose (2) from elbow (3) on tank piping.

(4) Disconnect discharge hose (4) from short nipple (5) on tank discharge piping.

(5) Unplug heater.

(6) Disconnect valve rod (6) from AFFF shutoff valve by removing nut (7) from ball valve (8).

(7) Remove four mounting bolts (9), with flat washers, and lock washers, and nuts. The mounting hardware is stainless steel. Retain for reassembly.

(8) Use a suitable crane and sling to lift AFFF tank and piping from skid frame.

CAUTION

Do not lift on piping. Damage to piping may occur.

b. Disassembly. Remove piping from AFFF tank as follows:

(1) Uncouple union (10). Using a pipe wrench, loosen and remove brass pipe (11) along with attached piping from tee on top inlet of tank. Then remove tee (12), close nipple (13) and relief valve (14) from inlet port.

(2) Remove protective covering, insulation and heat tape from outlet tube and shutoff valve.

(3) Using a pipe wrench, remove remaining piping from tank outlet port.

(4) Remove heater assembly only if necessary. Refer to paragraph 3-42.

c. Assembly. If piping components were disassembled beyond extent indicated in b above, reassemble components into piping subassemblies.

NOTE

Before connecting pipe fittings, apply four wraps of teflon tape (MIL-T-27730A) one to two threads from end of any male pipe fitting. Apply two to three drops of Loctite 342 at the leading edge of the tape. Surface of tape must be clean and free from dirt, grease or oil before applying Loctite.

(1) Installpiping subassembly on tank outlet port as shown in figure 3-6. Wrap outlet tube and shutoff valve with heat tape, insulation and protective covers. Seam with white plastic tape.

(2) Install relief valve (14), tee (12), and nipple (13) on inlet port.

(3) Install piping subassembly into tee (12). Recouple piping subassemblies at union (10).

(4) If removed, install heater assembly. Refer to paragraph 3-42.

d. Installation.

(1) Install fusible plug (1) in drain port of AFFF tank.

(2) Using suitable equipment, lift tank and related piping into position on skid frame. Install stainless steel bolts, flat washers, lock washers and nuts to secure tank to frame, figure 3-6.

APPENDIX A

(3) Connect discharge hose (4) to short pipe nipple (5) on discharge piping. Seal all pipe fittings per instructions in NOTE, paragraph 3-13c.

(4) Connect low pressure hose (2) from regulator to 45° elbow (3) on inlet piping. Tighten swivel end of hose (2) to regulator tee subassembly.

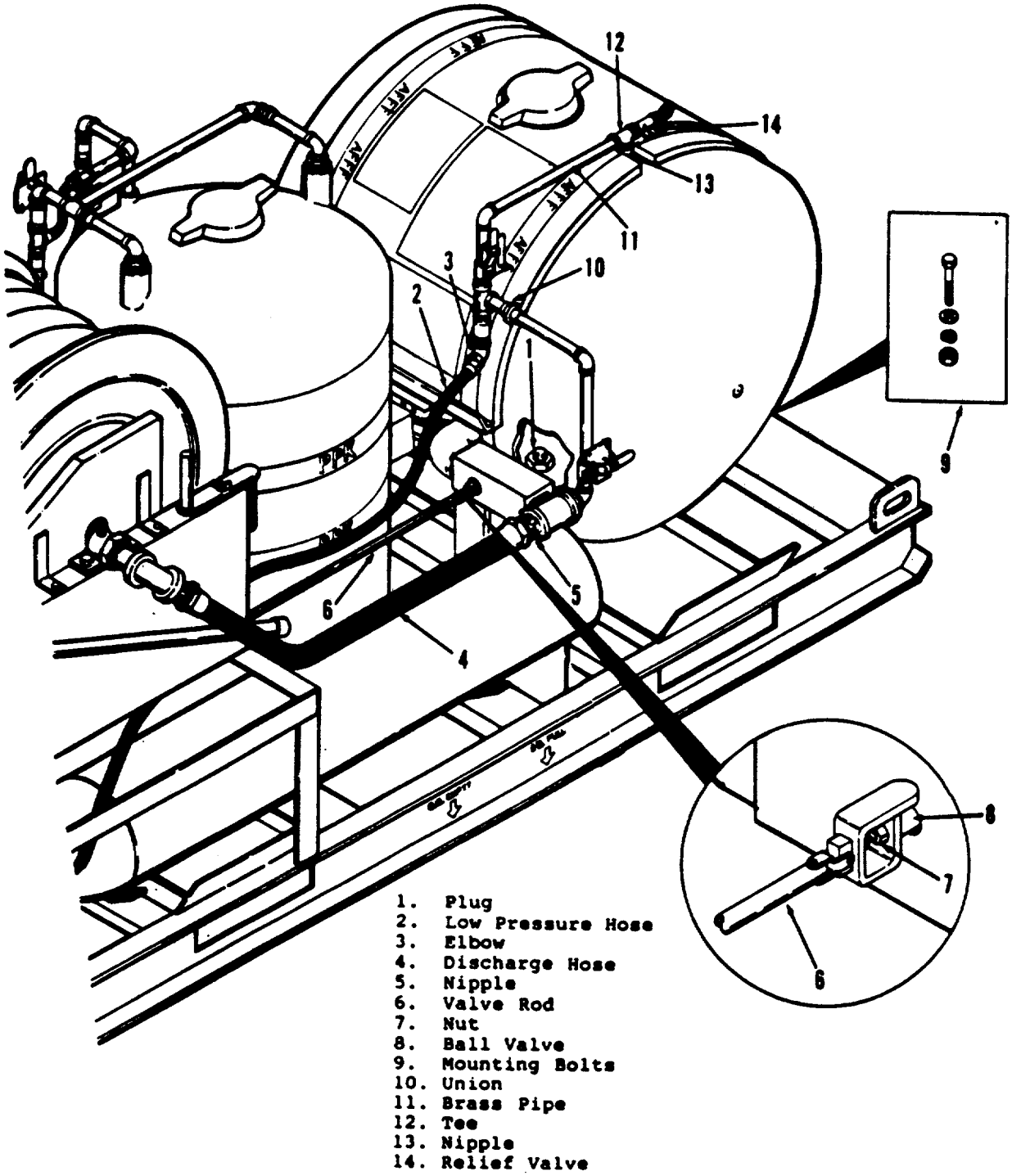


Figure A 3-6. AFFF Tank And Piping

(5) Connect valve rod (6) to AFFF shutoff valve by installing nut (7) on ball valve (8).

(6) Install AFFF nitrogen cylinder. Refer to paragraph 3-10c.

(7) Pressurize system and check for leaks. Use a soap solution of dishwashing detergent and water, to detect minor leakage.

NOTE

Slow bubble leakage only permitted through pipe joint compound in packings and gasketed joints. No leakage permitted in taper threaded joints.

(8) Return AFFF system to standby status, paragraph 2-12a.

A 3-14. DRY CHEMICAL TANK REPLACEMENT.

For ease of removal and installation, the dry chemical system piping should be removed with the tank. Before disassembling or removing system piping, adhere to WARNING below.

WARNING

The nitrogen pressure used in fire extinguisher operation can be extremely dangerous to personnel if proper precautions are not taken. Before attempting replacement of any part of a system, close the nitrogen cylinder valve and vent all pressure in system by opening nozzle on hose reel.

a. Removal.

(1) Depressurize system, paragraph 3-12.

(2) Remove dry chemical nitrogen cylinder. Refer to paragraph 3-10c.

(3) Disconnect hose (1, figure 3-7) from regulator tee assembly (20) in tank inlet piping.

NOTE

Be sure dry chemical shutoff valve is closed to prevent spillage during removal.

(4) Disconnect hose reel inlet hose (3) from tank discharge plumbing at nipple (4).

(5) Disconnect valve rod (5) from dry chemical shutoff valve by removing nut (6) from ball valve (7).

(6) Remove four mounting bolts (8) with flat washers, lockwashers, and nuts. The mounting hardware is stainless steel. Retain for reassembly.

(7) Use suitable equipment to lift tank and piping from skid frame.

b. Disassembly. Remove piping from dry chemical tank as follows:

(1) Remove hose (21, figure 3-7) from swivel adapter (22).

(2) Uncouple two unions (9) in tank inlet piping.

(3) Disconnect hose (10) from swivel adapter (23) using a pipe wrench, unscrew short pipe (12) from tank discharge port.

(4) With a pipe wrench, unscrew short pipe (13) from vent port on top of tank.

APPENDIX A

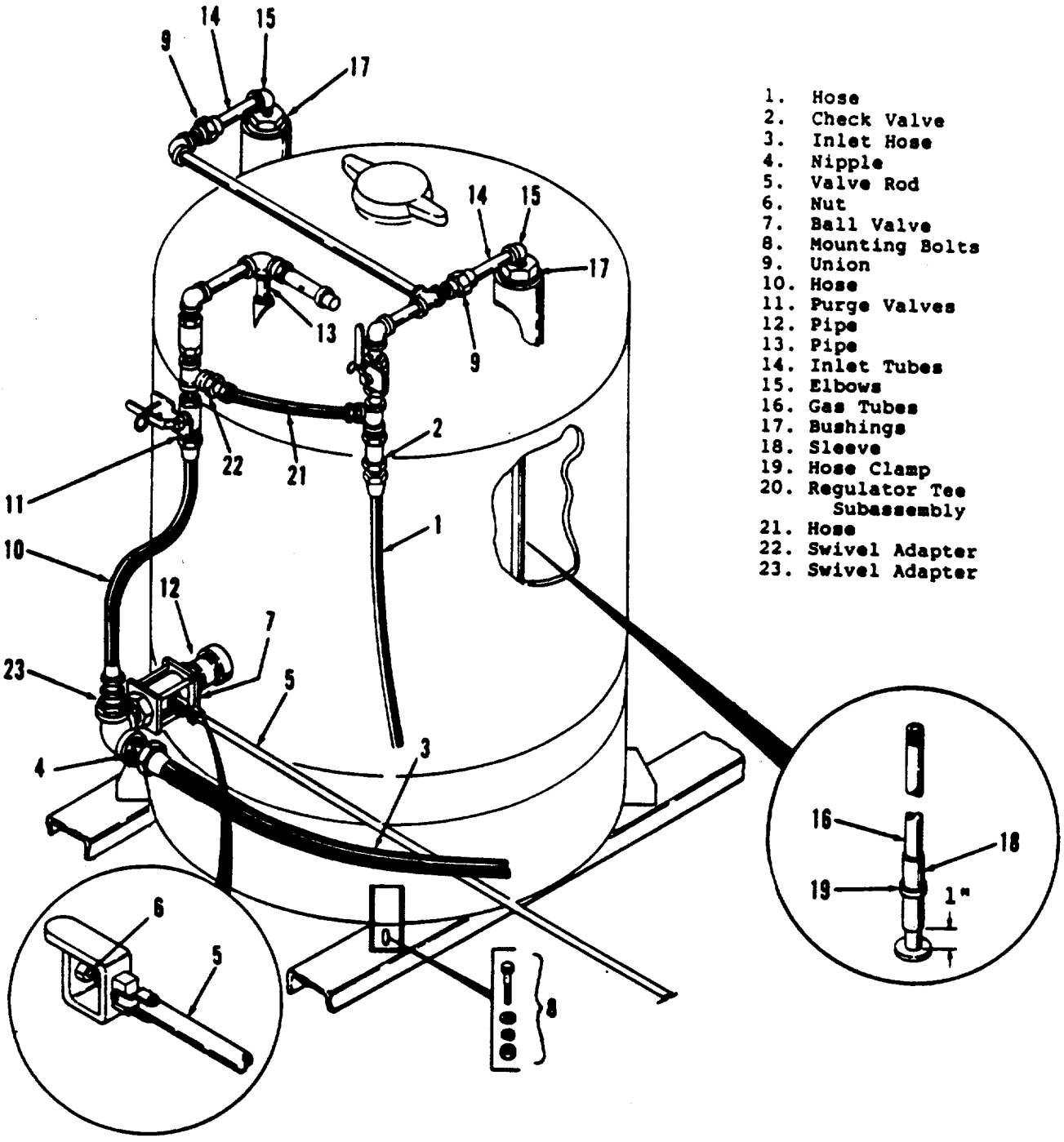


Figure A 3-7. Dry Chemical Tank And Piping

(5) Remove two inlet tubes (14) by unscrewing elbows (15) from tank bushings in inlet ports.

(6) To remove gas tubes (16) from tank, remove bushings (17) from inlet ports and pull tubes straight up out of tank.

c. Assembly.

(1) Clean gas tubes (16) thoroughly, making sure holes in tubes are open. Assemble sleeve (18) on gas tube and secure in dimension shown, figure 3-7, with hose clamp (19). Install tank bushing (17) on threaded end of gas tube. Tighten securely. Do this for both gas tubes.

(2) Insert gas tube assemblies into inlet ports of dry chemical tank. Tighten tank bushings securely.

(3) Install elbows (15) and inlet tubes (14) into tank bushings.

(4) If piping was disassembled beyond extent indicated in b above, subassemble piping before installation, per arrangement shown in figure 3-7.

NOTE

Before connecting pipe fittings, apply four wraps of teflon tape (MIL-T-27730A) one to two threads from end of any male pipe fitting. Apply two to three drops of Loctite 342 at the leading edge of the tape. Surface of tape must be clean and free from dirt, grease or oil before applying Loctite.

(5) Connect piping subassembly to tank by turning short pipe (13) into vent port on top of tank. Tighten securely.

(6) Connect discharge piping assembly by turning short pipe (12) into tank discharge port.

(7) Connect hose (10) to bottom of swivel adapter (23).

(8) Couple the assembled piping to the inlet tubes at unions (9).

(9) Connect hose (21) to swivel adapter (22).

d. Installation.

(1) Using suitable equipment, lift tank and attached piping into position on skid frame. Secure tank to frame with stainless steel bolts, flat washers, lock washers, and nuts previously removed.

(2) Connect hose reel inlet hose (3) to nipple (4). Seal all pipe fittings using instructions in NOTE, paragraph 3-14c.

(3) Attach high pressure hose (1) to regulator tee subassembly.

(4) Connect valve rod (5) to dry chemical valve (7) with nut (6).

(5) Install Dry Chemical nitrogen cylinder. Refer to paragraph 2-10c.

(6) Pressurize system and check for leaks. Use a soap solution of dishwashing detergent and water.

NOTE

Slow bubble leakage only permitted through pipe joint compound in packings and gasketed joints. No leakage permitted in taper threaded joints.

6. Service tank and nitrogen cylinder as required to return system to ready status, paragraph 3-10.

APPENDIX A

A 3-15. PRESSURE GAGE REPLACEMENT.
The pressure gage is part of the nitrogen cylinder valve and is under cylinder pressure even when the quick-opening valve is closed. If gage is broken or inoperative, return entire cylinder assembly to field maintenance personnel.

WARNING

Do not attempt to remove pressure gage unless nitrogen cylinder is under zero pressure. Nitrogen gas under high pressure can cause serious personal injury.

A 3-16. NITROGEN CYLINDER VALVE.
Replacement of the quick-opening valve on the nitrogen cylinder will normally be accomplished by field maintenance personnel, because the valve must be removed only with cylinder completely discharged. If valve requires replacement, return entire cylinder assembly to field maintenance facility, with a tag attached explaining the need for replacement.

WARNING

Nitrogen cylinder valves must be removed only with cylinder under zero pressure. Nitrogen gas under high pressure can cause serious personal injury.

A 3-17. AFFF SYSTEM PRESSURE REGULATOR.

a. Removal.

(1) Completely depressurize AFFF system, paragraph 3-12.

(2) Remove AFFF nitrogen cylinder. Refer to paragraph 3-10c.

(3) Disconnect hose (3, figure 3-8), from swivel adapter (9) at outlet of pressure regulator.

(4) Remove bolt (5) and lockwasher (6) which fastens regulator tee to hose reel mounting bracket on skid frame. Remove the regulator with the regulator tee.

(5) Remove hose (1), elbow (2) and short nipple (7) from regulator inlet. Remove tee (4) and short nipple (10) from regulator outlet.

b. Installation.

(1) Before assembling or installing pipe fittings, seal threads using instructions in NOTE, paragraph 3-14c. Assemble short nipples (7 and 10, figure 3-8) into inlet and outlet ports of pressure regulator. Install elbow (2), with attached hose (1), on nipple in regulator inlet port. Install tee (4) on nipple in outlet port.

(2) Fasten regulator assembly to frame as shown, figure 3-8, using 1/2-inch x 3/4-inch stainless steel bolt and lockwasher installed into threads of merchant plug (8) in regulator tee.

(3) Connect hose (3) to swivel adapter (9) on outlet.

(4) Reinstall AFFF nitrogen cylinder. Refer to paragraph 3-1c.

(5) Pressurize system and check for leaks, paragraph 3-13.

(6) Return system to standby status, paragraph 2-12a.

APPENDIX A

1. Hose
2. Elbow
3. Hose
4. Regulator Tee
5. Bolt
6. Lockwasher
7. Nipple, Stainless Steel
8. Merchant Plug
9. Swivel Adapter
10. Nipple

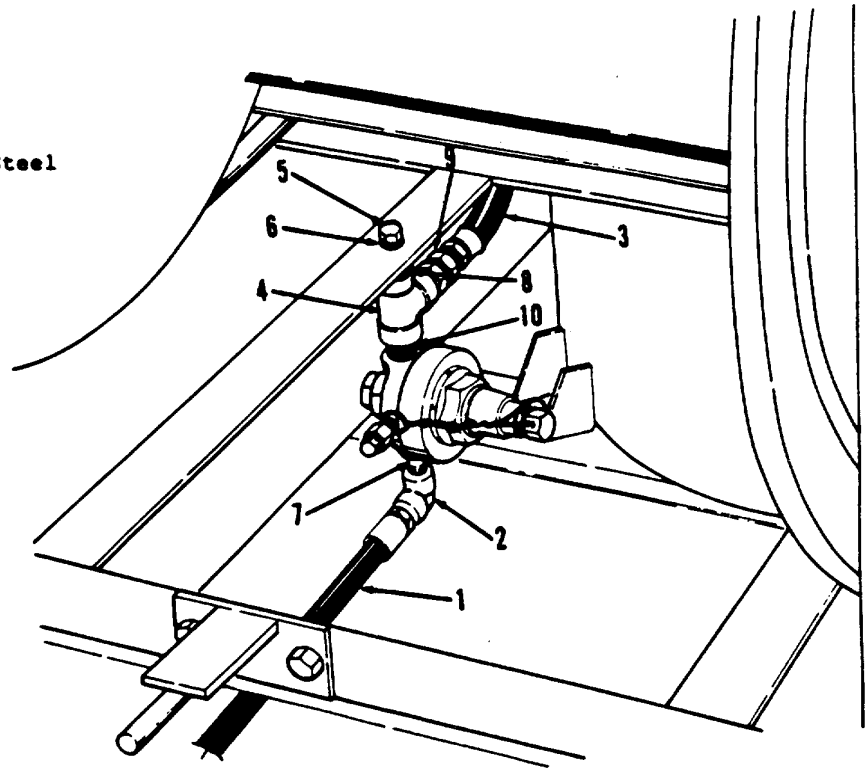
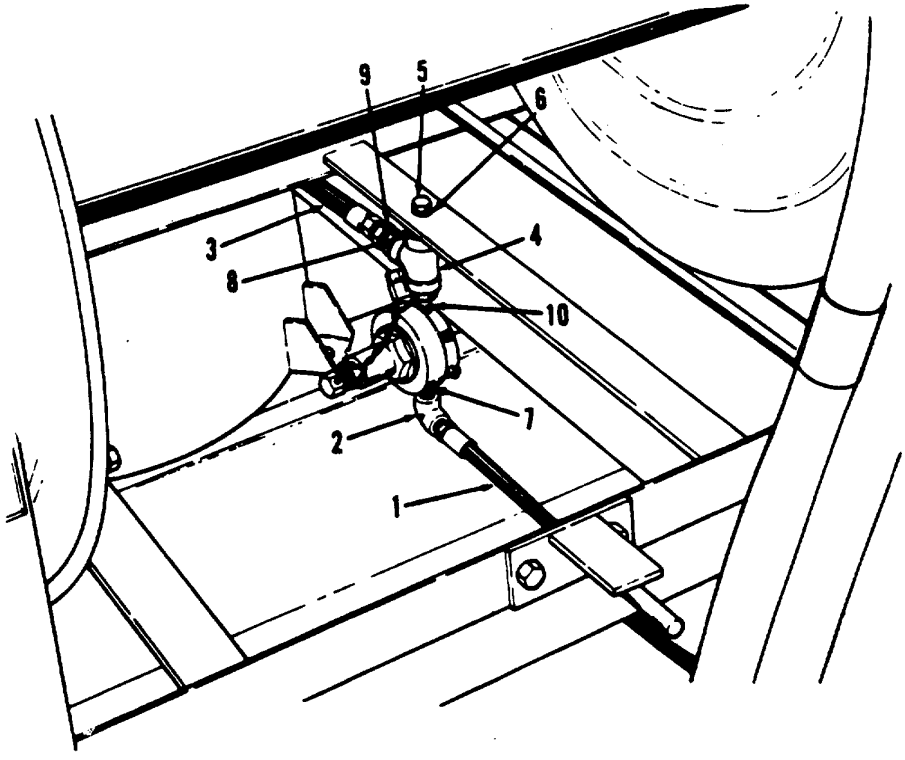


Figure A 3-8. AFFF Regulator Replacement



1. Hose
2. Elbow
3. Hose
4. Regulator Tee
5. Bolt
6. Lockwasher
7. Nipple (2)
8. Merchant Plug
9. Swivel Adapter
10. Nipple

Figure A 3-9. Dry Chemical Regulator Replacement

APPENDIX A

A 3-18. DRY CHEMICAL PRESSURE REGULATOR.

a. Removal.

(1) Completely depressurize dry chemical system, paragraph 3-12.

(2) Remove dry chemical nitrogen cylinder. Refer to paragraph 3-10c.

(3) Disconnect hose (3, figure 3-9) from swivel adapter (9) at outlet of pressure regulator.

(4) Remove bolt (5) and lock washer (6) which fastens regulator tee to hose reel mounting bracket on skid frame. Remove the regulator with the regulator tee.

(5) Remove hose (1), elbow (2) and short. nipple (7) from regulator inlet. Remove tee (4) and short nipple (10) from regulator outlet.

b. Installation.

(1) Before assembling or installing pipe fittings, seal threads using instructions in NOTE, paragraph 3-14c. Assemble short nipples (7 and 10, figure 3-9) into inlet and outlet ports of pressure regulator. Install elbow (2), with attached hose (1), on nipple in regulator inlet port. Install tee (4) on nipple in outlet port.

(2) Fasten regulator assembly to frame as shown, figure 3-9, using 1/2-inch x 3/4-inch stainless steel bolt and lock washer installed into threads of merchant plug (8) in regulator tee.

(3) Connect hose (3) to swivel adapter (9) on outlet.

(4) Reinstall dry chemical nitrogen cylinder. Refer to paragraph 3-10c.

(5) Pressurize system and check for leaks, paragraph 3-14.

(6) Return system to standby status, paragraph 2-12a.

A 3-19. AFFF SHUTOFF VALVE.

a. Removal.

(1) Depressurize AFFF system and drain AFFF tank below level of discharge port. Draining can be accomplished without removing the fusible drain plug by disconnecting discharge hose (1, figure 3-10) from tee (2), then opening shut-off valve (3) and allowing AFFF solution to drain into suitable container. Leave hose disconnected. Remove protective covering, insulation and heat tape from outlet tube and shutoff valve.

(2) Disconnect valve rod (4) from AFFF shutoff valve by removing nut (5).

(3) Uncouple piping at union (6). Using a pipe wrench, rotate elbow (7) and attached piping slightly outward away from tank. Remove purge valve (8) along with attached piping as an assembly from short pipe (9).

(4) Remove pipe (10) and tee (2) from shutoff valve. Then remove shutoff valve (3) from pipe (11).

b. Installation.

(1) Before assembling or installing pipe fittings, seal threads using instructions in NOTE, paragraph 3-14c. Assemble shut-off valve (3) to short pipe (11). Assemble pipe (10) and tee (2) to shut-off valve. Assemble purge valve (8) and attached piping to tee (2) as shown, figure 3-10.

(2) Recouple piping at union (6). Connect discharge hose (1) to tee (2).

(3) Connect valve rod (4) to shutoff valve by installing nut (5).

(4) Wrap the outlet tube and shutoff valve with heat tape. Install insulation and protective

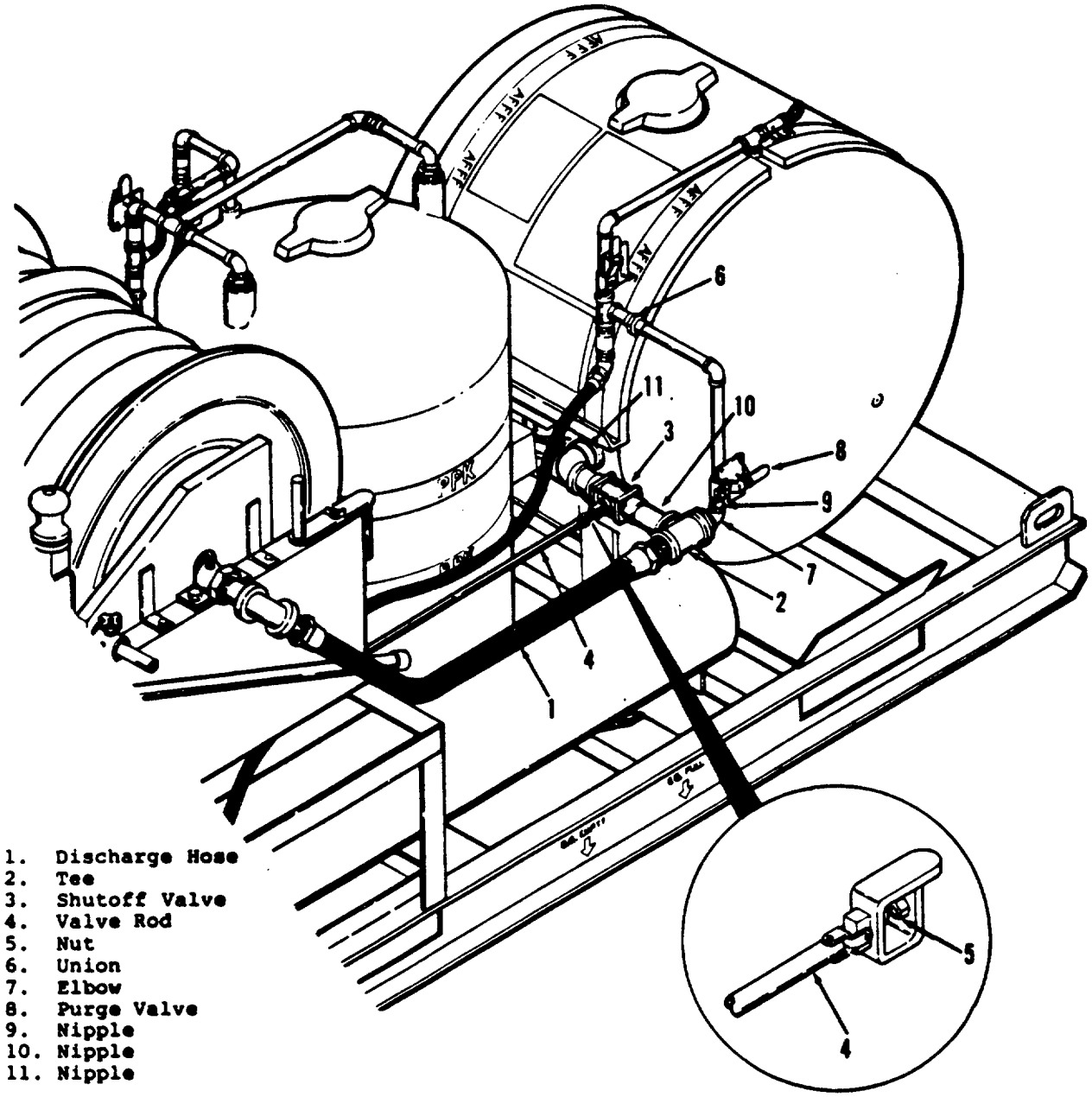


Figure A 3-10. AFFF Shutoff Valve Replacement

covering. Secure with white plastic tape.

(5) Pressurize system and check for leaks, paragraph 3-13.

(6) Return system to standby status, paragraph 2-12a.

A 3-20. DRY CHEMICAL SHUTOFF VALVE.

a. Removal.

(1) Depressurize dry chemical system completely, paragraph 3-12.

(2) Disconnect valve rod (1, figure 3-11) from dry chemical valve by removing nut (2).

(3) Uncouple discharge hose (4) at nipple (5). Disconnect hose (6) from swivel adapter (7).

(4) Remove shutoff valve (3) along with short pipe (8) and side outlet elbow (9) from tank discharge port. A small amount of chemical will drain from pickup tube inside tank when valve is removed. If chemical continues to flow, release any residual pressure in tank by loosening fill cap.

(5) Remove swivel adapter (7), nipple (8) and elbow (9) as an assembly from shutoff valve.

b. Installation.

(1) Before assembling or installing pipe fittings, seal threads using instructions in NOTE, paragraph 3-14c. Assemble valve assembly (3) on pipe (10), as shown in figure 3-11. Install nipple (8) and elbow (9) and swivel adapter (7) into valve (3).

(2) Connect hose (6) to swivel adapter (7) in side outlet elbow. Recouple discharge hose (4) to nipple (5).

(3) Connect valve rod (1) to shutoff valve by installing nut (2) to shut-off valve (3).

(4) Tighten fill cap, pressurize system and check for leaks, paragraph 3-14.

(5) Return dry chemical system to standby status, paragraph 2-12a.

A 3-21. PRESSURE RELIEF VALVES.

a. Removal.

(1) Depressurize system completely, paragraph 3-12.

(2) Using a wrench on the hex of the relief valve, unscrew valve from piping.

b. Installation.

(1) Before assembling or installing pipe fittings, seal threads using instructions in NOTE, paragraph 3-14c. Assemble relief valve on piping. Tighten securely.

(2) Pressurize system and check for leaks, paragraph 3-13.

A 3-22. FUSIBLE PLUG.

a. Removal.

(1) Access to plug is through bottom of skid frame. (Figure 1-8).

(2) Depressurize AFFF tank completely. Plug removal will result in tank draining. Be prepared to collect any AFFF solution remaining in tank.

(3) Using a wrench on hex of plug, turn plug counterclockwise to remove.

APPENDIX A

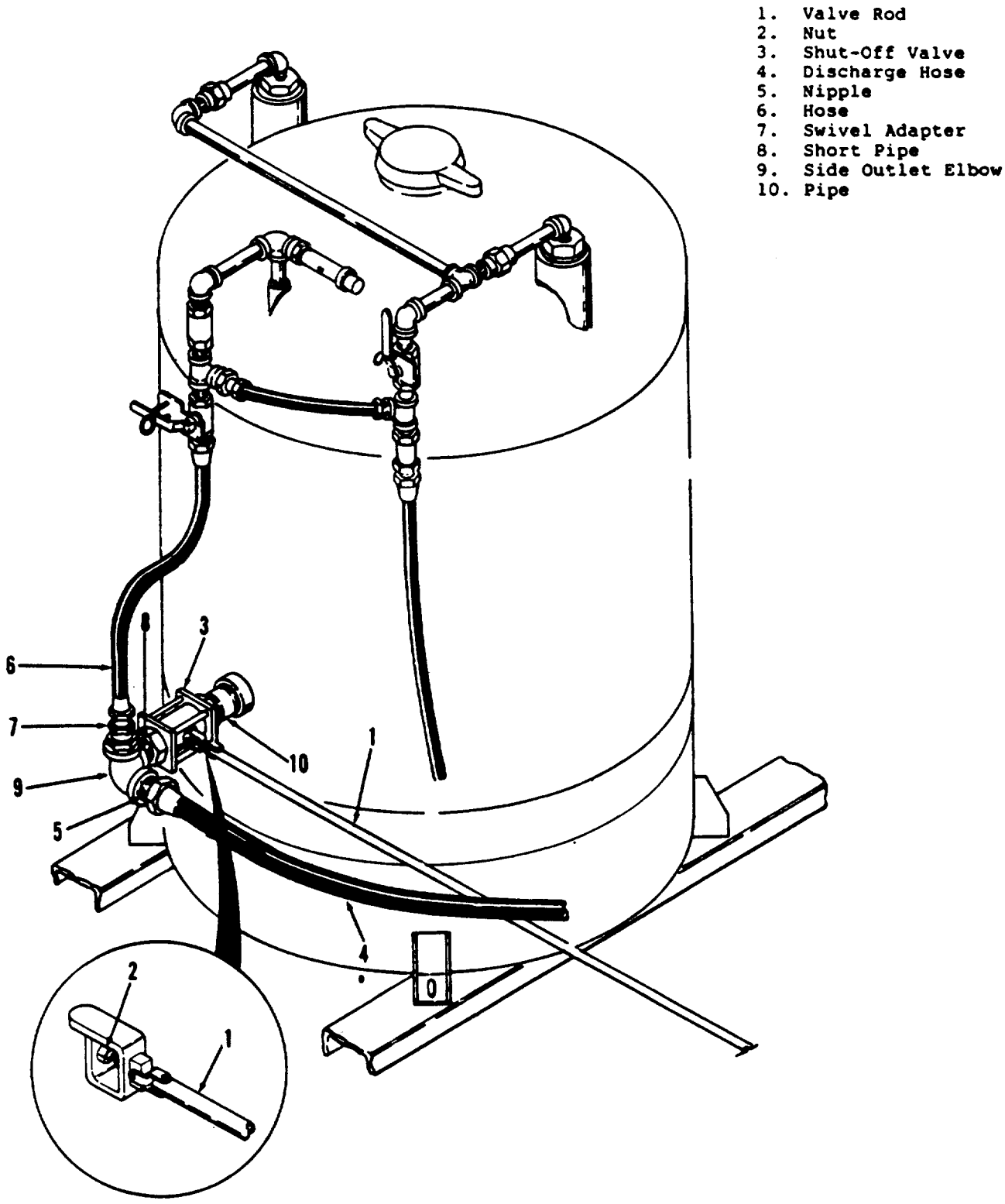


Figure A 3-11. Dry Chemical Shutoff Valve Replacement

b. Installation.

(1) Seal threads of fusible plug using instructions in NOTE, paragraph 3-14c.

(2) Insert the plug into drain port of tank and tighten securely.

A 3-23. DISCHARGE NOZZLES. Removal procedures are identical for the two discharge nozzles.

a. Removal. To remove either nozzle proceed as follows (figure 3-12):

(1) Remove twin nozzle assembly from its bracket and disconnect it from the handline assembly by releasing the quick disconnect fitting (1, figure 3-12).

(2) Separate the two nozzles by removing the four screws (2) securing the tie bar (3) to the nozzles.

(3) Using a suitable wrench unscrew the quick-disconnect fitting (1) from the nozzle.

(4) If the nozzle is being replaced as a complete unit the removal is complete. If, however, only the shutoff valve is being replaced, the nozzle barrel (4 or 5) must be removed.

(5) All that is required to remove the nozzle barrel is to turn it counterclockwise.

1. Quick-disconnect fittings
2. Screw (4)
3. Tie-bar
4. AFFF Nozzle Barrel
5. Dry Chemical Nozzle Barrel
6. AFFF Nozzle Shutoff Valve
7. Dry Chemical Nozzle Shutoff Valve

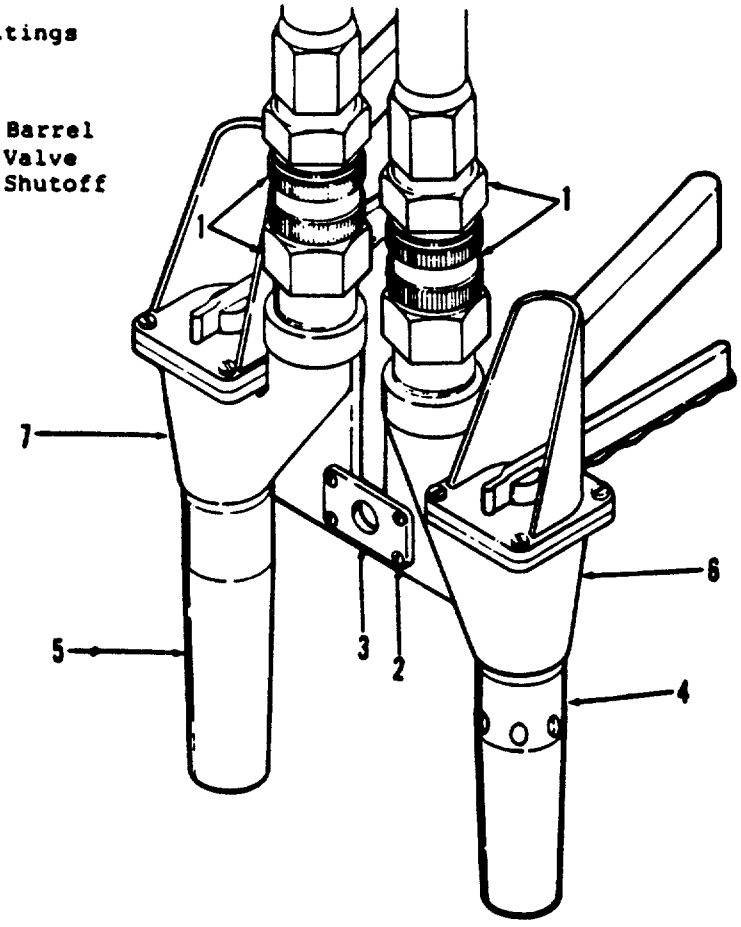


Figure A 3-12. Discharge Nozzle Replacement

b. Installation.

(1) Reassemble the nozzle tip to the shutoff valve by threading it on clockwise.

(2) Attach the tie bar (3) to the nozzles using four screws (2).

(3) Reinstall the quick-disconnects (1) to the nozzles. Seal pipe threads using instructions in NOTE, paragraph 3-14c.

(4) Connect twin nozzle assembly to twin handline with quick disconnects and stow twin nozzle assembly on bracket. Replace hairpin cotter.

A 3-24. TWIN AGENT HAND LINE

a. Removal. Use the following procedure to remove handling assembly from hose reel.

(1) Completely depressurize AFFF and dry chemical systems. Open the twin agent nozzles to ensure that all pressure is released from handlines. Remove nozzle.

(2) Unwind handline assembly completely from hose reel. Hose connections are accessible through cutout in reel drum when all hose is removed from hose reel.

(3) Disconnect handline hoses from tubes protruding through cutout in drum.

b. Repair. Emergency replacement of a defective hose can be accomplished as follows:

(1) With system depressurized, and handlines completely from hose reel, disconnect faulty hose from hose reel outlet tube. Connect replacement hose to the outlet tube.

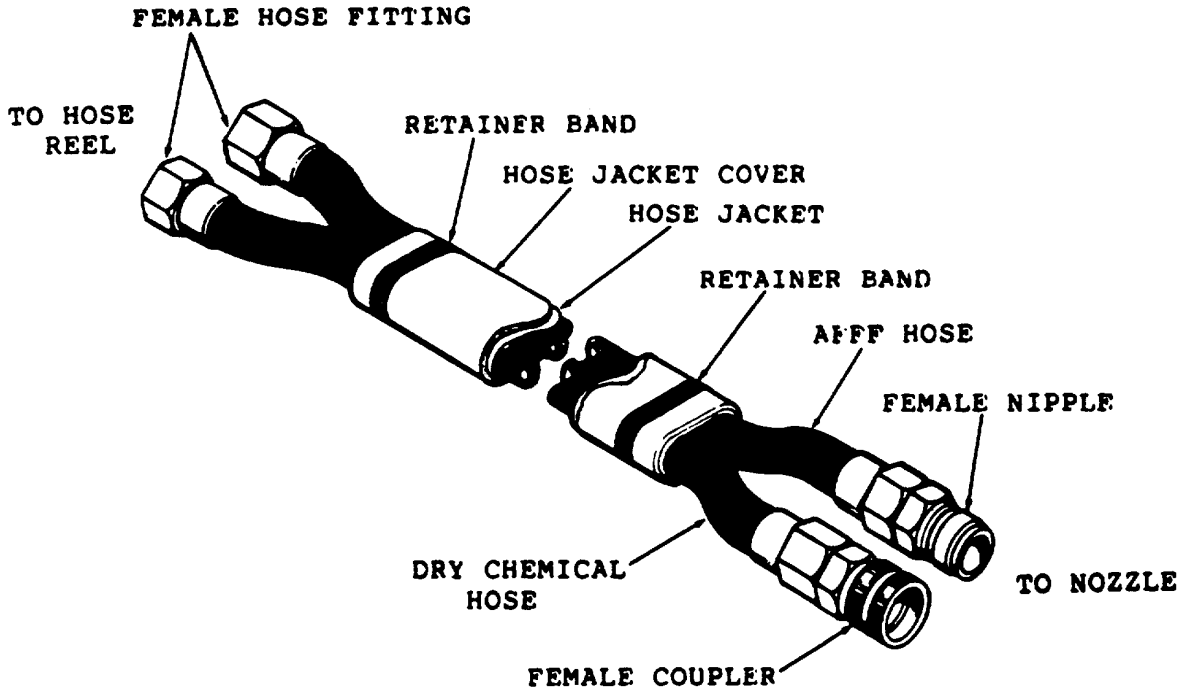


Figure A 3-13. Twin-Agent Handline Repairs

(2) Run the replacement hose along the handline removed from hose reel. Tie replacement hose to handline assembly at intervals of three to five feet with wire, cord, electrical tape, or other available material.

(3) Disconnect faulty hose from twin agent nozzle. Remove the quick-disconnect fitting from the faulty hose and install in replacement hose. Seal pipe threads using instructions in NOTE, paragraph 3-14c.

(4) Connect replacement hose to twin agent nozzle.

NOTE

Twin agent hoses are internally grounded by a wire which is integral with the hose. If a hose or a section of hose being replaced in an emergency or otherwise, by a hose which is not internally grounded; an external ground wire should be installed to ensure operator protection against static shocks.

(5) If, after emergency is over, a complete handline assembly is not available, the factory-supplied jacket may be slit, the defective hose discarded and the replacement hose inserted in its place, then tied together as described in step 2.

c. Installation. Use the following procedure to install handline on hose reel.

(1) String handline out in a straight line in front of hose reel, with nozzle ends away from the hose reel.

(2) Connect handline hoses to respective outlet tubes protruding through cutout in reel drum. Tighten securely.

(3) Wind handline assembly evenly onto hose reel drum, using hand crank.

(4) Attach nozzles.

(5) Store nozzles on nozzle holder bracket.

A 3-25. HOSE REEL (SKID FRAME MOUNTED).

a. Removal.

(1) Ensure that nitrogen valves are closed and both systems depressurized.

(2) For easier removal to lessen the weight of the hose reel assembly, twin handline assembly (5, figure 3-14) should be removed from hose reel. See instructions, paragraph 3-24.

(3) At left side of hose reel, uncouple dry chemical hose (3, figure 3-7) at nipple (4), then remove hose (3) and elbow from swivel joint on side of hose reel.

(4) At right side of reel, uncouple AFFF discharge hose at nipple (1, figure 3-14), then remove hose (2), and elbow (3) from swivel joint (4) on hose reel.

(5) Remove mounting bolts (6), flat washers (7), lockwashers (8) and nuts (9). Using a forklift or other available lifting equipment, remove hose reel from skid frame.

b. Installation.

(1) Position hose reel on skid frame supports, with name plate on hose reel facing outwards. Install mounting

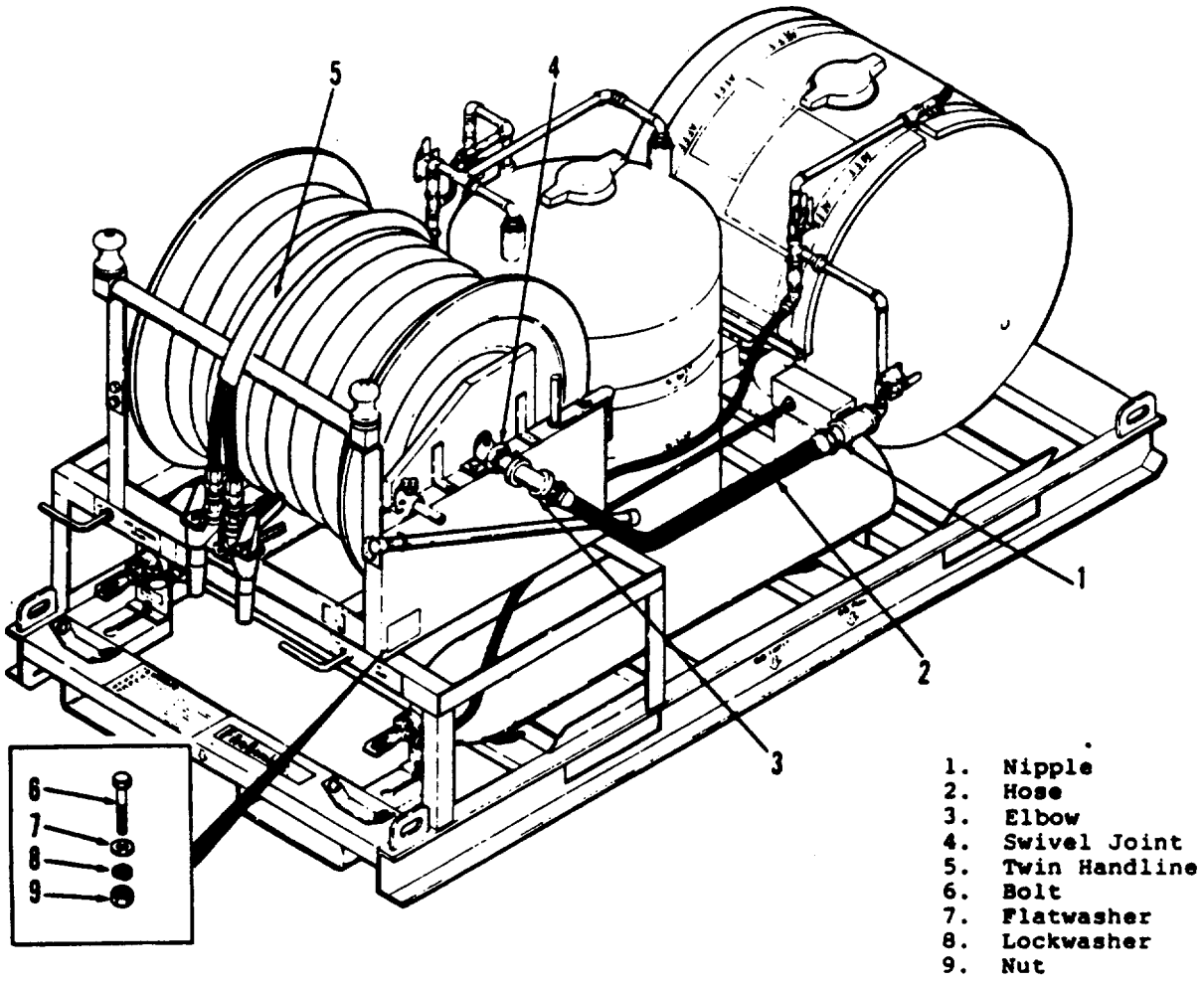


Figure A 3-14. Hose Reel Replacement - Skid

bolts (6), flat washers (7), lockwashers (8), and nuts (9) to fasten hose reel to mounting frame, figure 3-14.

(2) Connect AFFF discharge hose (2) and elbow (3) to swivel joint (4) on right side of hose reel, figure 3-14. Use procedures in NOTE, paragraph 3-14c to seal pipe connections against leakage. Connect discharge hose to tank piping at nipple (1).

(3) Connect dry chemical hose (3, figure 3-7) and elbow to swivel joint (4) on right side of hose reel, figure 3-14. Use procedures in NOTE, paragraph 3-14c to seal pipe connections against leakage. Connect the discharge hose to dry chemical tank discharge plumbing at nipple (4) figure 3-7).

(4) Install twin handline assembly (5, figure 3-14) paragraph 3-23d.

(5) Ensure that twin-agent nozzles are connected and closed. Put valves in normal operating position.

(6) Pressurize systems and check for leaks, paragraphs 3-13 and 3-14.

(7) Return fire extinguisher to standby status, paragraph 3-10.

APPENDIX A

A 3-26. REMOTE HOSE REEL.

a. Removal.

(1) Uncouple inlet hoses (1, figure 3-15 at rear of cart. Disconnect inlet hoses (1) and nipples (2) from swivel joints (5) at each side of hose reel.

(2) To lessen weight of hose reel, it is recommended that the twin handline assembly (3) should be removed from the hose reel. See instructions, paragraph 3-24a.

(3) Remove mounting u-bolts and j-bolts, lockwashers, and nuts (4 and 6). Lift hose reel from cart with suitable lifting device.

b. Installation.

(1) Position hose reel on cart, with crank on left as viewed from handle end. install mounting u-bolts and j-bolts, lockwashers, and nuts (4 and 6) as shown, figure 3-15. Tighten securely.

(2) Seal threads of nipples (2) using instructions in NOTE, paragraph 3-14c, then install inlet nipples (2) and hoses (1). Recouple inlet hoses at rear of cart.

(3) Install twin handline (3), same as main hose reel, per instructions in paragraph 3-24b.

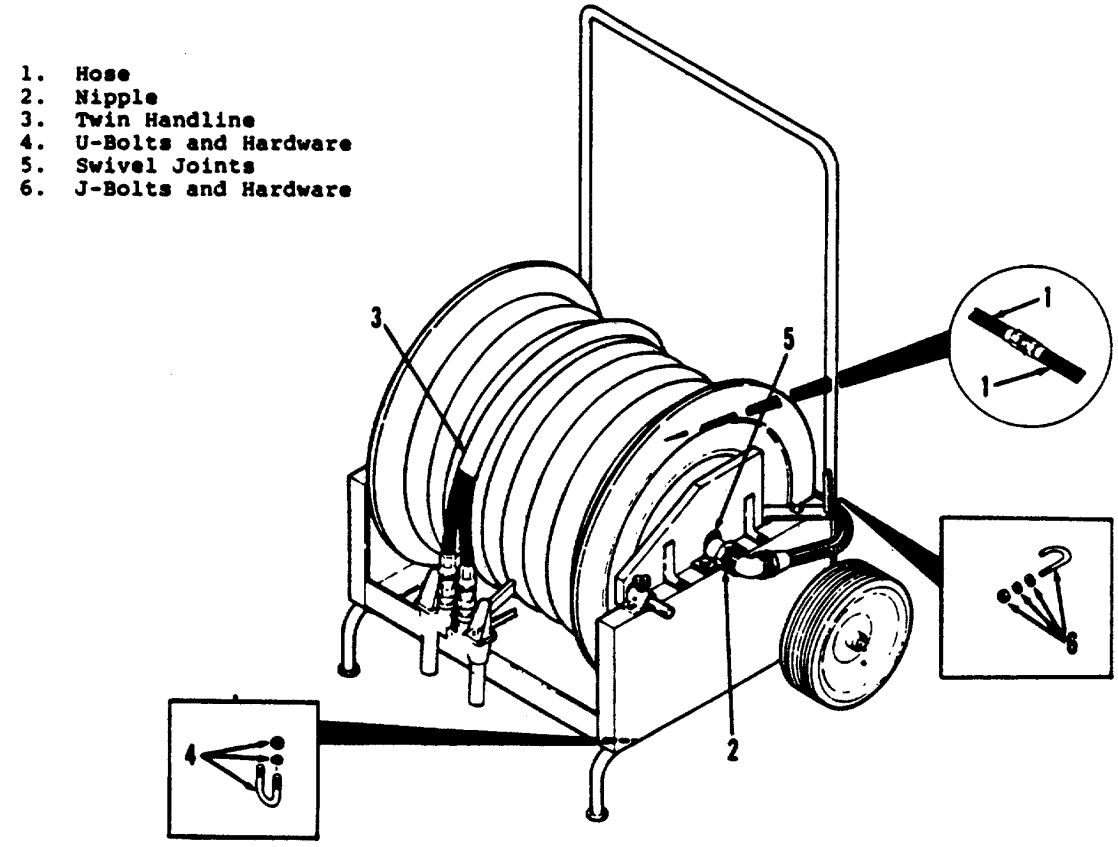


Figure A 3-15. Hose Reel Replacement - Cart

APPENDIX A

A 3-27. HOSES, TUBING, VALVES, FITTINGS, AND COMMON HARDWARE ITEMS.

a. General. Refer to figures 3-4 and 3-5 when replacing individual parts of tank plumbing, being sure to take proper precautions that system is depressurized prior to disassembly of piping. See paragraph 3-12.

CAUTION
Cover open ends of all plumbing using suitable closures to prevent system contamination.

b. Hoses, Tubing, Valves and Fittings. Removal of hoses, tubes, valves, or pipe fittings from tank piping normally involves opening the plumbing at the nearest union or hose connection. Pay particular attention to location and orientation of items before removal to assure correct installation. Basic instructions for disassembly of tank piping into subassemblies is contained in paragraphs 3-13 and 3-14. Instructions for reassembly and testing after installation also apply.

c. Common Hardware Items. For maximum protection against corrosion, use only corrosion resistant replacement hardware. In event of unavailability of parts, standard hardware can be substituted temporarily. Damaged threads or rounded corners on nuts and heads of bolts is cause for replacement.

A 3.28. GENERAL CLEANING. Both the dry chemical and AFFF systems are normally closed, therefore, interior contamination will be limited to that created by the firefighting agents used in the systems. Interior cleaning of components will normally be limited to those times the components are disassembled for overhaul or corrective maintenance. Exteriors should be kept clean at all times. Normal daily clean-up routine should be sufficient. Any approved cleaning solvent may be used for cleaning, and compressed air may be used for cleaning inaccessible areas.

NOTE
Care should be exercised during the cleaning routine to preclude inadvertent movement of valve handles. Although no damage is likely to result from such handle movement, it could cause a malfunction in operation when the unit is next used.

There are three exceptions to the general statement concerning cleaning of components. The two nozzle discharge valves may become clogged and require cleaning on occasion. Additionally, wet or damp dry chemical powder, or inadequate cleaning of the dry chemical hose after use, can cause caking of the powder in the hose, just as residual solution in AFFF hose may freeze, plugging that hose.

a. Cleaning Dry Chemical Discharge Nozzle. The discharge nozzles must be partially disassembled for cleaning. Disassembly and cleaning steps are as follows:

(1) Remove the two screws (2, figure 3-12) from the tie bar and separate the Dry Chemical nozzle.

(2) Disconnect the dry chemical hose.

(3) Remove the male disconnect adapter (1) from the nozzle.

(4) Turn nozzle tip (5) counterclockwise to remove it from the shutoff valve body (7). The interior

of both shutoff valve and tip are now accessible for cleaning.

CAUTION

Use of metal tools, such as screwdrivers, awls, etc., is discouraged; any scraped or gouged areas in the dry chemical passageway will compound clogging problems, and may cause leaks.

(5) Clean accumulations of dry chemical powder from inside the tip and shutoff valve with a soft wood or hard rubber scraper.

WARNING

Use normal precautions when cleaning with compressed air to prevent injury to personnel. Compressed air for cleaning purposes will not exceed 30 psi. User should wear safety goggles, and should not direct the stream of air toward himself or other persons.

(6) After nozzle is completely cleaned, use clean dry compressed air or nitrogen to remove all traces of dry chemical powder or foreign matter.

(7) Reassembly of the dry chemical nozzle is accomplished in reverse order of disassembly, as follows:

(a) Thread the tip (5) onto shutoff valve body (7), tighten securely.

(b) Attach the nozzle to the tie bar with two screws (2).

(c) Install quick-disconnect fitting (1).

(d) Connect the nozzle to the dry chemical discharge hose.

b. Cleaning AFFF Discharge Nozzle. Remove the AFFF nozzle from the tie bar and disconnect it from the discharge hose per steps (1) and (2) of preceding paragraph a.

(1) Turn nozzle tip (4, figure 3-12) counterclockwise to remove it from the shutoff valve (6).

(2) Soak both the tip and nozzle for a minimum of 30 minutes in a warm water and soap solution.

(3) Flush both shutoff valve and tip under a strong stream of water. Open valve fully to allow flow of water. Repeat with handle in various intermediate positions.

(4) Repeat step (3) while backflushing.

(5) Reassemble the nozzle and attach it to the AFFF discharge hose.

c. Clearing Dry Chemical Discharge Hose. The dry chemical discharge hose can be cleared of caked dry chemical powder by taking the action described in steps (1) through (7).

CAUTION

End of hose must be secured during hose-cleaning operations to prevent lashing action of hose when powder and gases are discharged.

(1) Unwind handline to its maximum length.

(2) Remove hose from discharge nozzle by uncoupling quick disconnect fitting.

(3) Put discharge end of hose in suitable large container to avoid contaminating area.

(4) Close charge valve and dry chemical shutoff valve; open purge valve.

(5) Open dry chemical system nitrogen cylinder valve.

(6) Flex and knead the hose in the clogged area (easily determined by firmness of hose) until lumps are broken. The dry chemical will be exhausted from hose.

(7) Close nitrogen cylinder valve and purge valve; open charge valve.

(8) Connect hose to discharge nozzle; rewind handline onto reel.

Section VI. FIELD MAINTENANCE

A 3-29. DEFINITION AND SCOPE.

a. General. Field maintenance support for the fire extinguisher will be minimal because the fire extinguisher is simple in design, rugged in construction, and is not in continuous operation. Field maintenance support will be required only to repair the components for which adequate tools, facilities and test equipment are not available at organizational maintenance level.

b. Scope. Field maintenance support includes third and fourth echelons of maintenance and will generally be limited to repair and overhaul of fire extinguisher components. This will include cleaning, testing, disassembly, assembly, and adjustment of components.

A 3-30. CLEANING, INSPECTION, AND REPAIR.

a. Cleaning Instructions. This paragraph contains instructions relating to suitable materials and cleaning methods for cleaning component parts.

(1) RUBBER PARTS. Clean all rubber parts using dry cleaning solvent, Federal Specification PD-680. Agitate frequently and use a soft bristle brush to clean crevices. Dry parts with filtered, low pressure, compressed air.

CAUTION

Do not allow dry cleaning solvent, Federal Specification P-D-680 to come in contact with electrical components.

WARNING

Use normal precautions when cleaning with compressed air to prevent injury to personnel. Compressed air for cleaning purposes will not exceed 30 psi. User should wear safety goggles, and should not direct the stream of air toward himself or other persons.

WARNING

When using Trichlorethylene, MIL-T-7003, make sure there is adequate ventilation, as the fumes are toxic. Avoid prolonged exposure of bare skin to fumes.

(2) ELECTRICAL COMPONENTS. Clean electrical components with a clean, soft bristle brush with Trichlorethylene, MIL-T-7003.

Dry parts with filtered, low pressure, compressed air or a clean lint-free cloth.

(3) UNPAINTED METAL SURFACES. Clean all unpainted metal surfaces using dry cleaning solvent, Federal Specification P-D-680. Dry parts with filtered, low pressure, compressed air or a clean, lint-free cloth. Do not dry bearings with compressed air or spin bearings While they are not lubricated.

(4) PAINTED METAL SURFACES. Clean painted, metal surfaces as follows:

(a) Wash with mild soapwater solution and rinse with clear water.

(b) Accumulations of dirt can be scrubbed off with a bristle brush that has been dipped in dry cleaning solvent, Federal Specification P-D-680. Rinse part in clean solvent to remove remaining residue.

(c) Dry parts with filtered, low pressure, compressed air or a clean lint-free cloth.

b. Inspection. Inspect all internal parts for pitting, corrosion, or other damage. Inspect exterior parts, valve bodies, etc. for internal wear, cracks, or damaged threads.

c. Repair. Any parts showing wear or damage, making the part unusable, should be replaced. Replace all o-rings, packings, seals, seats and gaskets at assembly. Replace any hardware items, nuts, bolts, etc. with rounded corners, distortion or damaged threads.

A 3-31. AFFF NITROGEN PRESSURE REGULATOR. (figure 3-16)

a. Disassembly.

(1) Clean outside of regular A 3-38 tor before disassembling, paragraph 3-30.

(2) Remove seal wire (19), loosen lock nut (2), and loosen adjusting screw (1), releasing spring tension.

(3) Put body of regulator in a vise with protective jaws. Use care not to damage ports or machined surfaces. Using an adjustable wrench on hex of housing cap (3), turn the cap counterclockwise to remove it from the body.

(4) Remove diaphragm assembly (8), adjusting springs (6, 7), and spring button (5) from housing cap.

(5) Using socket wrench, remove nozzle (10), turning it counterclockwise to remove it from threads in bore inside body. Lift out the seat assembly (12) and valve spring (13). Unscrew seat assembly (12) from nozzle (10). Remove and discard the nozzle gasket (11), gland (14), and friction washer (15).

(6) Remove and discard the diaphragm slip ring (9).

b. Assembly.

(1) Be sure all parts are clean, dry and in serviceable condition before assembling.

(2) Install new friction washer (15) in center counterbore inside body, followed by gland (14) and valve spring (13). Put new nozzle gasket (11) on shoulder at base of threaded bore for nozzle inside the body. Install seat assembly (12) into valve spring. Install nozzle (10) and tighten securely.

(3) Put new diaphragm slip ring (9) in groove on body.

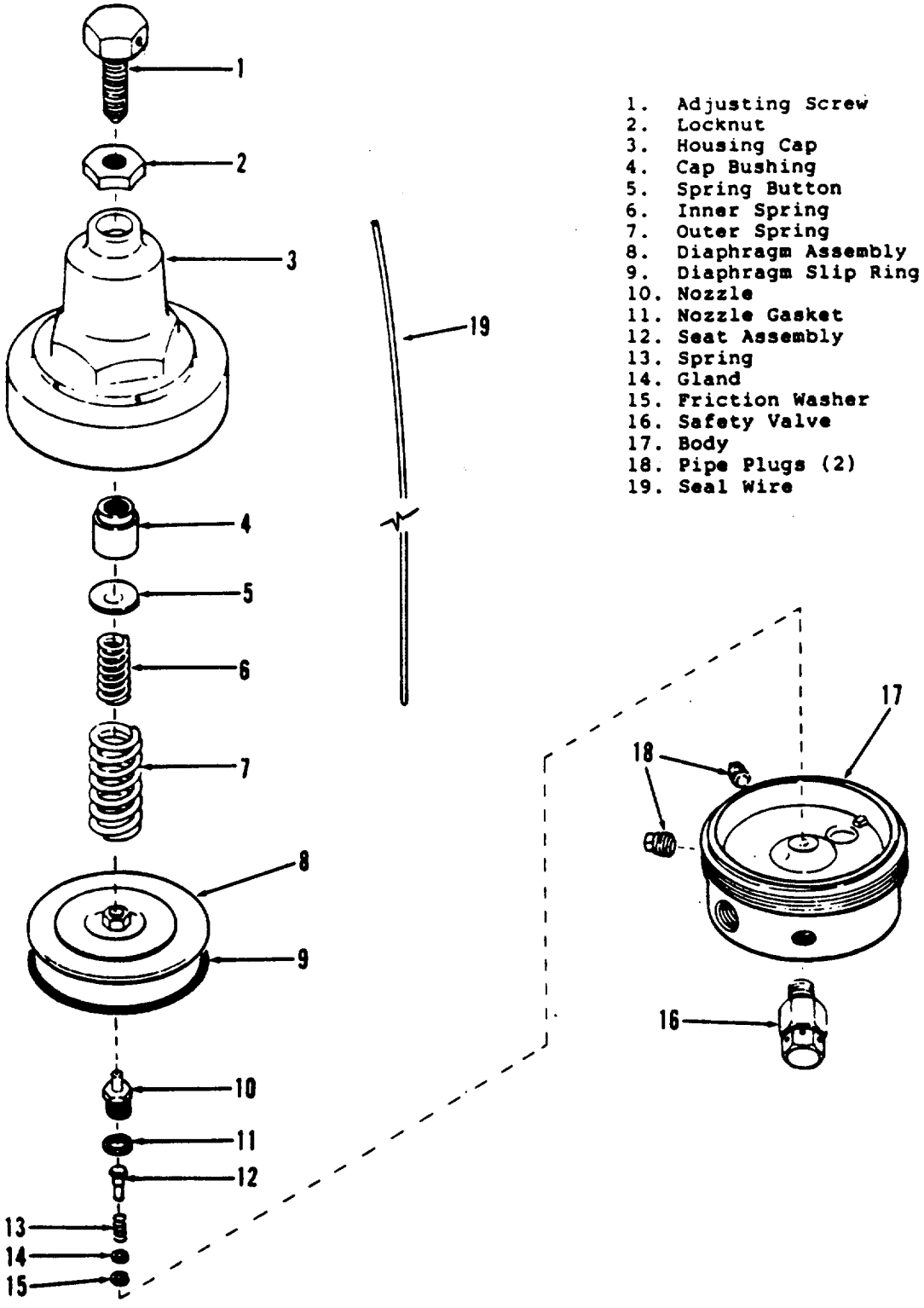


Figure A 3-16. AFFF Pressure Regulator Assembly

(4) Install new diaphragm assembly (8) over slip ring and nozzle in body, centering it on the slip ring.

(5) Put inner and outer adjusting springs (6, 7) on diaphragm backing plate. Put spring button (5) on top of the two springs, convex side of button toward springs.

(6) Install housing cap (3) over assembled components in body, thread clockwise onto body and tighten securely.

(7) Install adjusting screw (1) and locknut (2) into spring housing cap. Turn screw clockwise only until spring resistance is encountered.

c. Adjustment. The nitrogen pressure regulator can be calibrated, or adjusted, using the following procedure:

(1) Leave pressure relief valve in one low pressure outlet port. Install one-quarter inch pipe plugs in other low pressure port and high pressure port. See port orientation, top view of housing cap, figure 3-17.

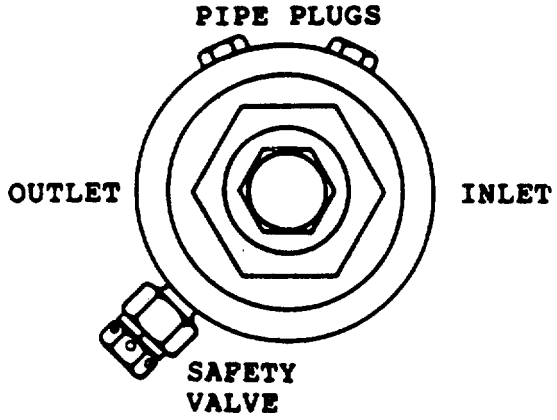


Figure A 3-17 AFFF Pressure Regulator

(2) Connect pressure regulator outlet to a test gage and a shutoff valve or control valve.

(3) Connect regulator inlet to a controlled source of clean, dry compressed air or nitrogen capable of supplying a minimum of 2000 psi pressure to the regulator inlet.

(4) Turn the pressure adjusting screw (1, figure 3-16) clockwise until considerable resistance from spring tension is encountered.

(5) Open the shutoff or control valve a very small amount to allow a small flow through regulator.

(6) Slowly open the valve to pressure source while observing test gage. Ensure that output pressure is not exceeding 200 psi while increasing input pressure to 2000 psi.

(7) Slowly turn regulator adjusting screw clockwise until test gage indicates 230 ±10 psi.

(8) Alternately open and close flow control valve and observe that test gage pressure remains between 220 and 240 psi. Check for leakage. No leaks allowed. Tighten locknut and then recheck pressure setting.

(9) Close pressure source valve and disconnect regulator from test set-up.

(10) Install seal wire (19) to prevent tampering with setting.

(11) Seal all regulator openings with plugs or tape and return unit to use or storage.

APPENDIX A

A 3-32. DRY CHEMICAL PRESSURE REGULATOR. (figure 3-18)

a. Disassembly.

(1) Remove seal wires (20), loosen locknut (2), then remove adjusting screw (1), releasing spring tension.

(2) Put the body of the regulator in a vise with soft jaws. Clamp across hex on body, using care not to damage any ports or machine surfaces. Using an adjustable wrench on hex of spring housing cap, turn the cap (3) counterclockwise to remove from body (11).

(3) Remove spring button (5), inner adjusting spring (6), and outer adjusting spring (7).

(4) Remove the diaphragm assembly (8), deflector (10) and stem extension (14) from regulator body. Discard diaphragm o-ring (9).

(5) Remove the back plug (19), o-ring (18), spring (17), and seat assembly (16). Discard the o-ring.

(6) Use a socket wrench to remove nozzle (15).

(7) Remove safety valve (12) and pipe plugs (13) from outlet ports.

b. Assembly

NOTE
All parts should be clean and dry before assembling.

(1) Place regulator in a soft-jawed vice with bottom up. Install nozzle (15) in opening in body, tighten with socket wrench.

(2) Install seat assembly (16) on nozzle, centering it on the stem extension (14).

(3) Put spring (17) into bore of seat assembly (16).

(4) Install new o-ring (18) on back plug (19), using care not to damage o-ring on plug threads. Install the back plug into body and tighten to 35 foot pounds of torque.

(5) Remove regulator from vise, turn end cap end upward.

(6) Put a new diaphragm o-ring (9) on body, seating fully in its groove on lip of body.

(7) Install stem extension (14) through center of nozzle into recess in bottom of centralizer bushing at center of diaphragm assembly.

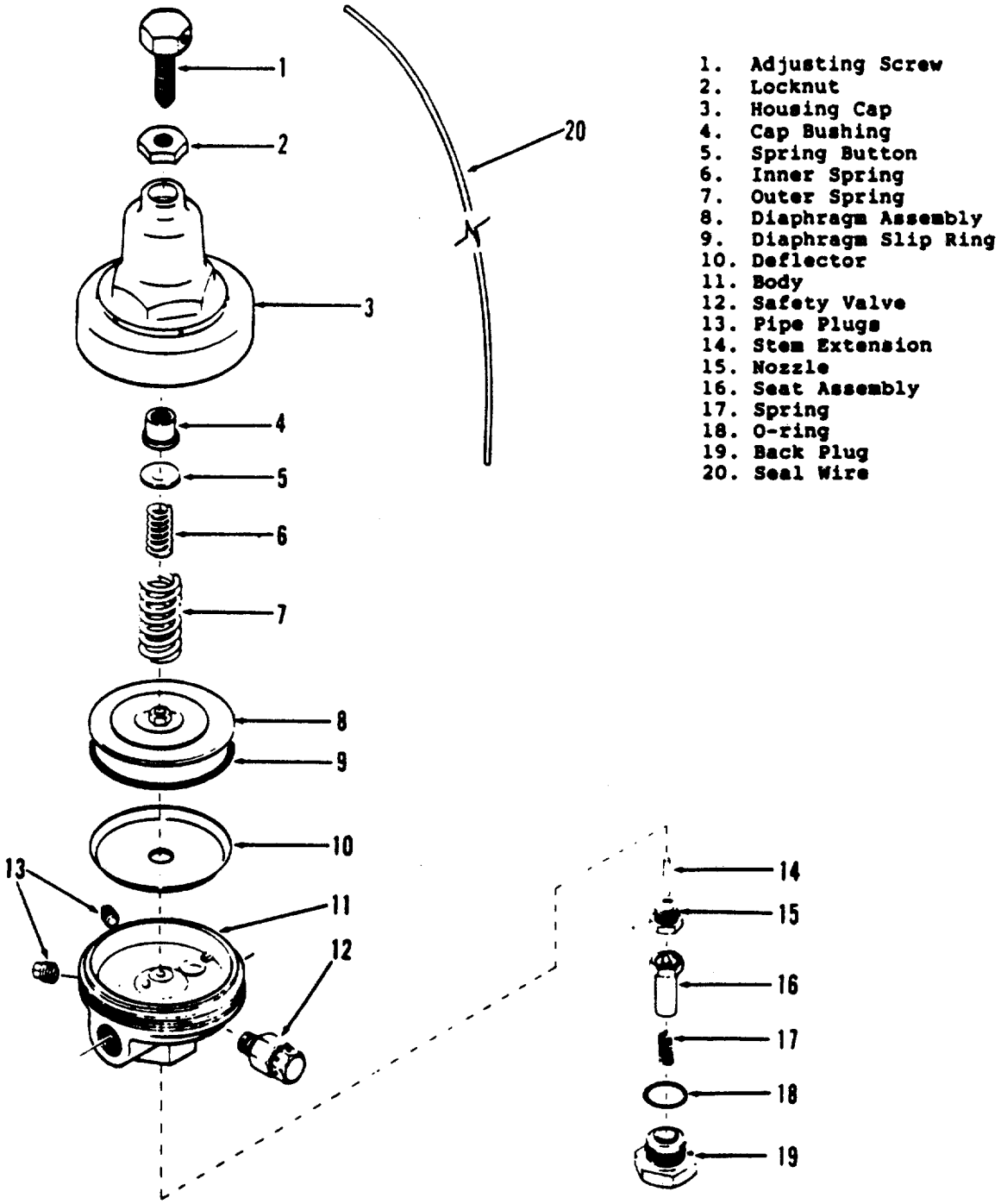
(8) Install deflector (10) and new diaphragm assembly (8) on body, centering it over diaphragm o-ring.

(9) Place inner adjusting spring (6) and outer adjusting spring (7) over the diaphragm nut at center of diaphragm assembly. Put spring button (5) on top of the assembled springs, convex side of button toward the springs.

(10) Inspect the threads in bushing (4) of spring housing cap (3). If threads show any evidence of wear or distortion, the spring housing cap should be replaced.

(11) Install spring housing cap (3) carefully over the assembled springs and diaphragm, and thread it onto body (11). Tighten to 50 foot pounds of torque.

(12) Coat threads of safety valve (12) and pipe plugs (13) lightly with Loctite 59-31, or equivalent sealant; install in body outlet ports.



1. Adjusting Screw
2. Locknut
3. Housing Cap
4. Cap Bushing
5. Spring Button
6. Inner Spring
7. Outer Spring
8. Diaphragm Assembly
9. Diaphragm Slip Ring
10. Deflector
11. Body
12. Safety Valve
13. Pipe Plugs
14. Stem Extension
15. Nozzle
16. Seat Assembly
17. Spring
18. O-ring
19. Back Plug
20. Seal Wire

Figure A 3-18. Dry Chemical Pressure Regulator Disassembly

(13) Install adjusting screw (1) along with locknut (2) in spring housing cap (3). Turn screw clockwise only until resistance of springs is encountered.

c. Adjustment. Adjust the dry chemical pressure regulator, using same procedure and specifications as per AFFF pressure regulator, paragraph 3-29c. Refer to figure 3-19 for orientation of regulator ports.

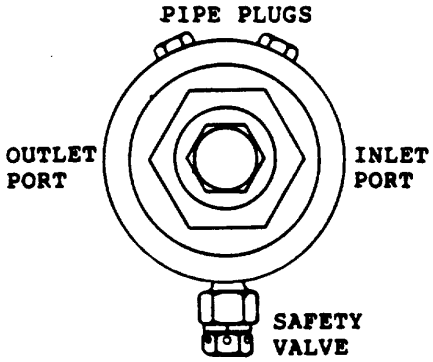


Figure A 3-19. Dry Chemical Pressure Regulator

A 3-33. SHUTOFF VALVES. The two ball valves for dry chemical and AFFF shutoff are identical and are repaired by following the same procedure.

a. Disassembly. (figure 3-20)

(1) Clamp valves body in a vise, valve stem up.

(2) Note position of the coupling (1) for correct orientation at assembly. Remove locknut (2) and lift coupling from valve stem.

(3) Remove packing nut (3).

(4) Remove two nuts (13) and body bolts (8) farthest from stem and loosen the other two bolts (8). Remove valve body (12) from between the two adapters (7).

(5) Remove seats (10) and body seals (9) and discard. Pull brass ball (11) from body.

(6) Push valve stem (6) down into body cavity and remove from body bore.

(7) Pull packing (4) from valve stem bore and discard.

(8) Remove thrust washer (5) from valve stem.

b. Assembly. (figure 3-20)

(1) Install thrust washer (5) over threaded end of valve stem (6). Insert the valve stem through body cavity into valve stem bore in body.

(2) Insert brass ball (11) into body cavity, aligning ball groove with flats on bottom of valve stem. Rotate stem as necessary to engage ball groove.

(3) Install a new seat (10) on each side of ball, making sure the conical side is towards ball.

(4) Install new body seals (9) over seats.

(5) Position body (12) between the adapters (7) being sure alignment tabs rest on the two bolts. Insert body bolts (8). Install nuts (13) and tighten evenly, making sure body adapters are seated firmly against body and body seals are not pinched. Tighten nuts securely.

(6) Carefully install new packing (4) over valve stem and push it down evenly to seat in valve stem bore.

(7) Install packing nut (3) and tighten securely.

(8) Install coupling (1) on valve stem and secure with locknut.

APPENDIX A

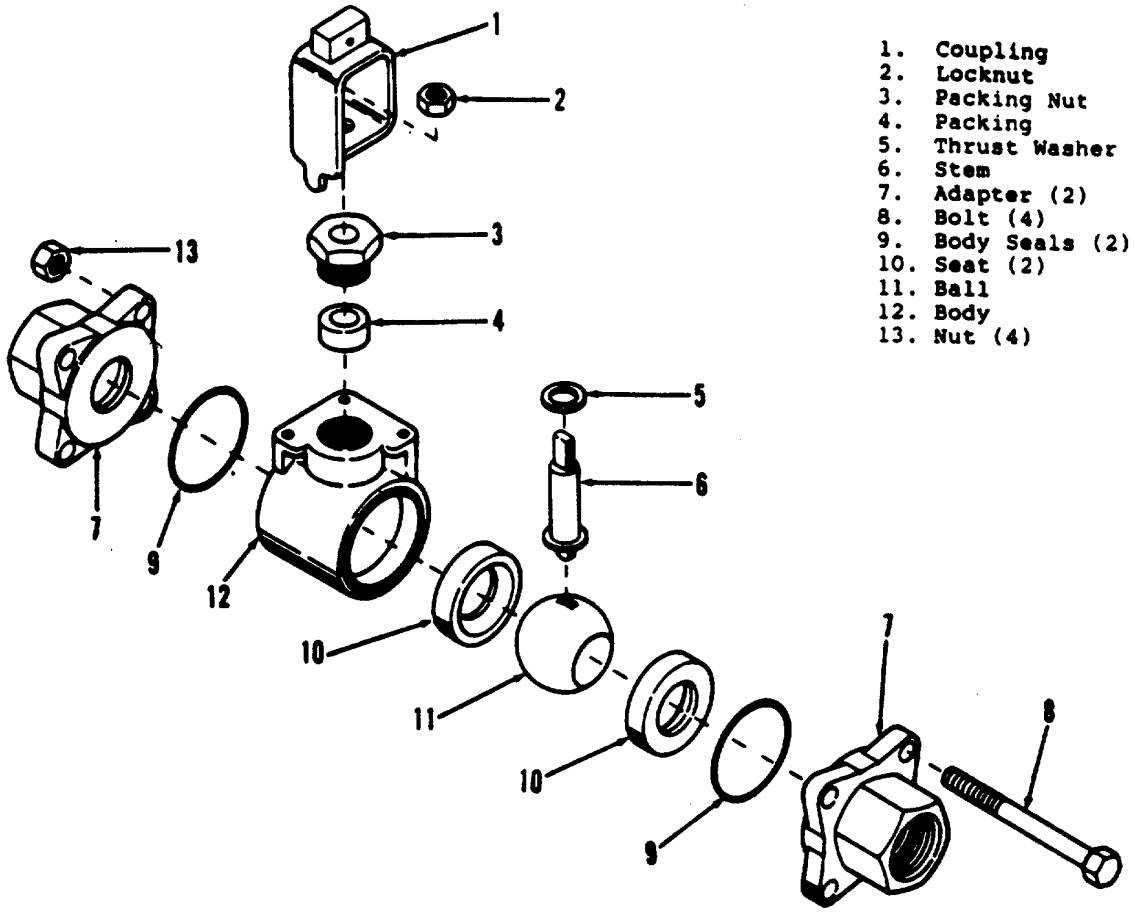


Figure A 3-20. Shutoff Valve Assembly

A 3-34. PURGE AND CHARGE VALVES. (figure 3.21)

a. Disassembly. To Disassemble ball valves, use the following procedure:

(1) Put handle of valve in OFF position, hold handle to prevent stem rotation, then remove locknut (2). Lift handle from valve stem.

(2) Clamp valve in vise and remove packing nut (3).

(3) Clamp body of valve in a vise with adapter (8) end up. Turn the adapter (8) counterclockwise to remove from valve body. The ball (10), along with teflon seats (7) and body seal (8) can now be removed from valve bore.

(4) Push valve stem (6) down into body cavity and remove from adapter end of valve., Remove thrust washer (5).

(5) Remove packing (4) from body.

b. Assembly.

(1) Put thrust washer (5) on stem (6). Insert stem through adapter end of body and into its bore.

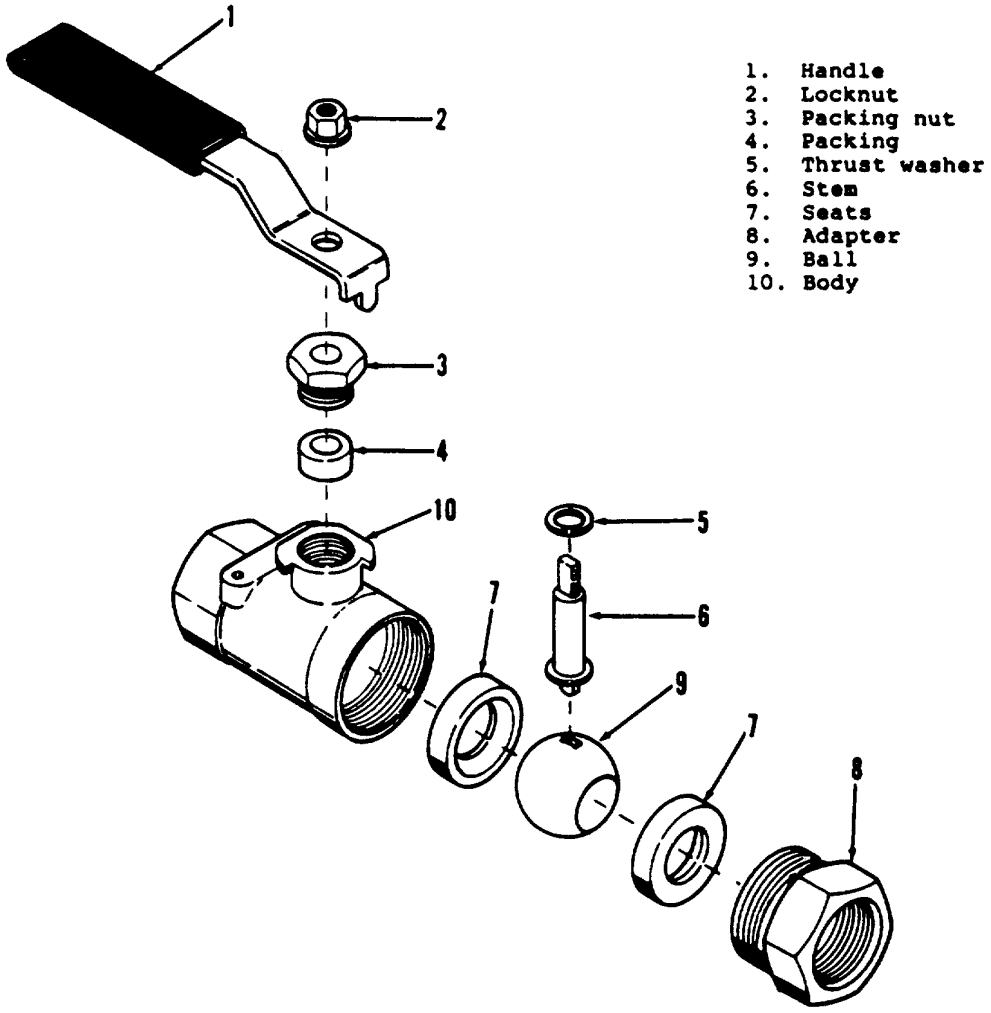


Figure A 3-21. Purge And Charge Valve Assembly

(2) Install a new seat (7) into valve bore, chamfer toward ball. Insert ball (9) into valve body, engaging groove on outer circumference of ball with flats on bottom of valve stem. Install a new seat (7), chamfer toward ball, seating it firmly against ball.

(3) Coat threads of adapter (8) with Loctite 271 (red). Install adapter (8) and tighten securely.

(4) Carefully install new packing (4) into threaded bore for valve stem on side of valve body.

(5) Install packing nut (3) over valve stem and into threaded bore. Tighten packing nut securely.

(6) Install handle (1) on stem, positioning as in original installation, and secure with locknut (2).

A 3-35. NITROGEN CYLINDER VALVE.

Complete disassembly of the quick release nitrogen valve is seldom required, and never until cylinder is empty. The seat assembly can be replaced by removing the handle assembly, consisting of items 1 through 10, figure 3-22, as a unit. The following procedure gives instructions for complete disassembly of the valve.

a. Disassembly. (figure 3-22)

WARNING

Exhaust all pressure from cylinder, leaving valve handle fully open, before attempting to remove or disassemble any part of nitrogen cylinder valve. Cylinder under pressure can cause personal injury.

1. Handle
2. Handle Pin
3. Roll Pin
4. Roller
5. Cam
6. Bushing (2)
7. Handle Bracket
8. Locknut
9. Retainer Nut
10. Set Screw
11. Barrel
12. Stem
13. Disc
14. Seat Holder Retainer
15. Seat Holder
16. Seat
17. Spring
18. Valve Body
19. O-Ring
20. Safety Disc
21. Safety Nut
22. Gage

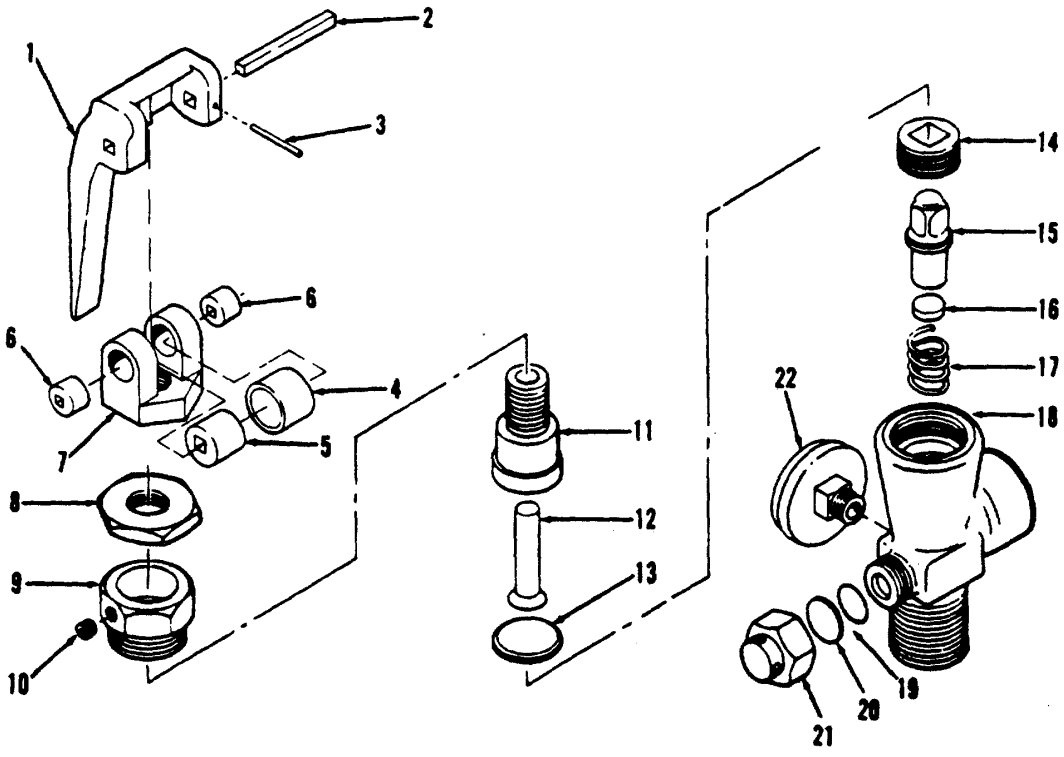


Figure A 3-22. Nitrogen Cylinder Valve Assembly

(1) Pressure gage (22) can be removed by unscrewing it from the port in valve body, using a wrench on flats at bottom of gage

(2) Remove roll pin (3) from handle (1) using a small drift punch.

(3) Raise handle to open position to relieve spring tension.

(4) Lightly tap handle pin (2) with punch to remove pin. Remove handle.

(5) Lift roller (4) and cam (5) from handle bracket.

(6) Remove bushings (6) from handle bracket.

(7) Loosen locknut (8) and turn handle bracket (7) counterclockwise to remove from barrel (11). Remove locknut.

(8) Loosen set screw (10) in the retainer nut (9). Remove retainer nut and barrel (11).

(9) Lift stem (12), and disc (13) from body. Disc comprised o: 5 pieces. Keep them in proper order.

(10) Using a wrench on shoulder of seat holder (15), turn seat holder retainer counterclockwise to remove. Lift the seat holder and retainer from valve body.

(11) Separate the seat (16) and seat holder (15). Discard seat.

(12) Lift spring (17) from valve body.

(13) Remove safety nut (21), safety disc (20), and o-ring (19) from valve body. Discard the o-ring.

b. Assembly. (figure 3-22)

(1) Assemble safety disc (20) with new o-ring (19) into safety nut (21). Thread safety nut assembly onto spud on body and tighten securely to a torque of 35 to 40 lb-ft.

(2) Put spring (17) into valve bore in body.

(3) Insert a new seat (16) into the seat holder (15). Install this assembly into center of spring (17) inside body, square end up.

(4) Place seat holder retainer (14) over square end of seat holder (15). Press down on retainer with sufficient. pressure to overcome spring tension while threading retainer into body. After threads are started, use a socket wrench on square end of seat holder to tighten retainer snugly against shoulder in body.

(5) Put disc (13) over seal holder and seat it firmly against shoulder on holder.

(6) Assemble stem (12) into barrel (11) and install as an assembly on the disc (13) with threaded end of barrel up.

(7) Install retainer nut (9) over barrel, thread into body and tighten securely.

(8) Thread locknut (8) onto barrel.

(9) Thread handle bracket (7) onto barrel.

(10) Insert bushings (6) into sides of handle bracket.

(11) Assemble cam (5) into roller and install as an assemble between ears on handle bracket. Center punch mark on cam should be

up to align with handle in open position.

(12) Position handle over handle bracket, align holes in bushings with those in cam, and install square pin (2).

(13) Put handle in closed position and install roll pin (3).

(14) Place handle in open position. Turn handle bracket until resistance is felt when handle is at 90° body center line. Hold handle and tighten lock nut. Turn handle to proper location. See figure 3-5. Tighten set screw.

(15) Install pressure gage into port on valve body and tighten securely.

A 3-36. HOSE REEL. The hose reel on the extinguisher and the remote hose reel are identical except for the guide roller assembly which is used only on the main hose reel.

Repair procedures are the same for both, except as noted.

NOTE

Make sure hose is removed from hose reel before disassembling.

a. Disassembly. (figure 3-23)

(1) Hose reel, extinguisher only: Remove guide roller and mounting bracket as an assembly by removing four bolts (43), flatwasher (46), lockwashers (44), and nuts (45).

(2) Remove chain guard (23) by removing two bolts (24), along with flat washers (25).

(3) Locate master link in chain (22). Remove master link and chain.

(4) Remove bolts (12) and lockwashers (26) from bearing housing (13) on both sides of reel drum. Remove top bearing housings.

LEGEND FOR FIGURE 3-23

1. Drum Assembly
2. Button Head Bolt
3. Flange
4. Button Head Bolt
5. Lockwasher
6. Reel Disc
7. Hex Nut
8. Spacer
9. Drum
10. Tube Assembly
11. Tooth Sprocket
12. Hex Head Bolt
13. Bearing Housing
14. Swivel Joint Assembly
15. Female Swivel Joint
16. Grease Fitting
17. Set Screw
18. Quad Ring
19. Quad Ring
20. Steel Ball
21. Male Swivel Joint
22. Roller Chain
23. Guard
24. Bolt
25. Lockwasher
26. Lockwasher
27. Hex Nut
28. Frame Assembly
29. Nameplate
30. Drive Bearing and Brake Assembly
31. Tooth Sprocket
32. Collar
33. Key
34. Shaft
35. Knob
36. Brake Stud
37. Spring
38. Brake Disc
39. Drive Bearing w/Bushing
40. Crank Assembly
41. Crank
42. Spring Pin
43. Bolt
44. Lockwasher
45. Nut
46. Flat Washer
47. Flat Washer
48. Grease Fitting

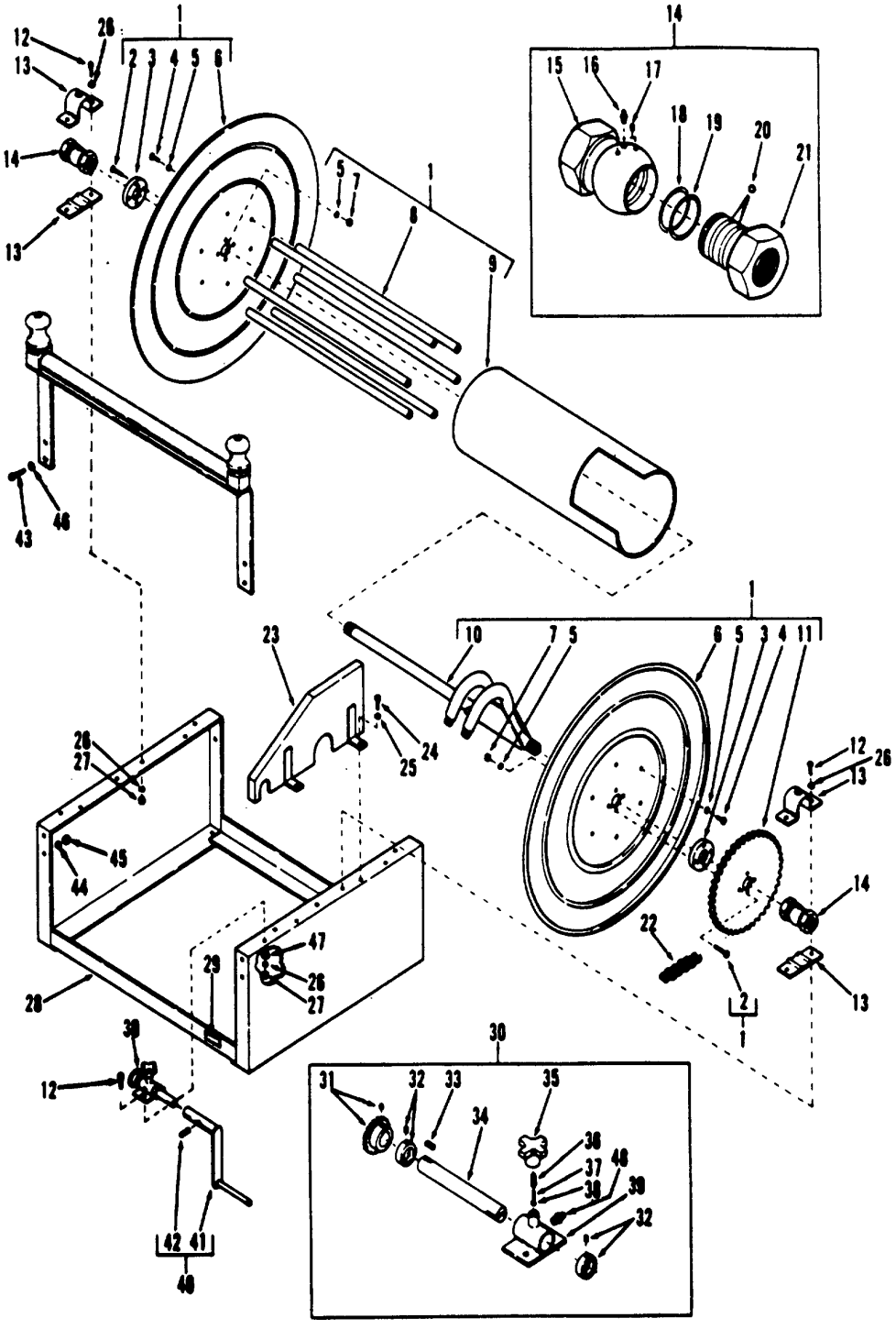


Figure A 3-23. Hose Reel Assembly

(5) Lift drum assembly (1) including swivels (14) from hose reel frame (28).

CAUTION

Do not overheat swivel joint as damage to seals or body may occur.

(6) Using a torch, heat the inside hex of swivel joint only until swivel can be turned with a wrench. Turn swivels (14) counterclockwise to remove from tube assembly (10).

(7) Remove brake assembly (30) from hose reel frame by removing two bolts (12), flatwashers (47), lockwashers (26), and nuts (27).

(8) Disassemble drum as follows:

(a) Remove sprocket (11) and support flange (3) by removing four bolts (2), along with lockwashers (5), and nuts (7).

(b) To remove support flange (3) on other side of reel drum, first remove the four bolts (2), lockwashers (5), and nuts (7), then remove the two tack welds securing flange to pipe.

(c) Remove bolts (4) and lockwashers (5), six per side, to separate discs (6) from spacers (8). Pull reel discs from tube assembly (10) and drum (9).

b. Assembly. (figure 3-23)

(1) Subassemble brake and swivel joints per instructions in paragraphs 3-37 and 3-38 respectively.

(2) Subassemble drum as follows:

(a) Attach six spacers (8) to one disc (6) with bolts (4) and lockwashers (5). Tighten securely.

(b) Slide drum (9) over the assembled spacer, insert tube assemble (10), then attach remaining disc (6) to spacers with six bolts (4) and lockwashers (5).

(c) Attach support flange (3) and sprocket (11) to the reel disc (6) nearest cutout in drum using four bolts (2), lockwashers (5), and nuts (7).

(d) Attach the remaining support flange (3) to other disc with four bolts (2),.lockwashers (5), and nuts (7). Tighten all bolts securely. Center drum assembly on tube assembly allowing 3/16" for sprocket thickness. Tack weld supportflange (3), 2 places to tube assembly.

(3) Apply Loctite PST for stainless steel (Source Control Dwg. 213-0150) to the inner most four threads in one end of the swivel joint (14). Apply Loctite 271 red (MIL-S-46163, type II O) in three places to all but the first four threads on the drum assembly tube. Loctite must be applied 8t ambient temperatures above 60° F, but below 120° F. Install swivel joint (14) on drum assembly tube until tight. Repeat procedure for other swivel joint. Allow Loctite to set for a minimum of one hour before proceeding further.

(4) Position the lower plates of bearing housings (13) on hose reel frame. Lift drum assembly into position on plates. Position swivels so grease fittings are up. Install bearing housings (13) and secure with bolts (12) and lockwashers (26).

(5) Install brake assembly (30) on hose reel frame using two bolts (12), flatwashers (47), lockwashers (26), and nuts (27).

(6) Install chain (22) on sprockets and connect master link.

(7) Adjust drive chain tension per paragraph 3-11c.

(8) Adjust hose reel brake per paragraph 2-9.

(9) Install chain guard (23) with two bolts (24) and flat washers (25).

(10) Main hose reel only: Attach guide roller and mounting bracket assembly to front of hose reel frame using four bolts (43), flatwashers (46), lockwashers (44), and nuts (45).

A 3-37. HOSE REEL BRAKE. The drive bearing and brake assembly can be repaired according to the following instructions. See figure 3-23.

a. Disassembly.

(1) Unscrew knob (35) and stud (36) as an assembly from brake housing.

(2) Tilt housing to remove spring (37) and brake disc (38).

(3) Loosen set screws in collars (32) on either side of brake assembly.

(4) Remove shaft (34) from drive bearing assembly (39). Pull brake assembly and bearing (39) from shaft (34).

b. Assembly.

(1) Slide one collar (32) onto shaft (34) from crank end.

(2) Slide brake housing and bearing assembly (39) onto shaft.

(3) Install remaining collar (32).

(4) Insert new brake disc (38) and spring (37) into brake housing bore so brake disc rests squarely on shaft (34).

(5) Install knob and stud (35, 36). Tighten brake adjusting knob sufficient to prevent rotation of brake housing on shaft. Final adjustment of brake will be made after installation on hose reel. See paragraph 2-9 and 2-11. Tighten set screws on collars after proper alignment.

A 3-38. HOSE REEL SWIVEL JOINTS.

a. Disassembly. (figure 3-23)

(1) Remove two setscrews (17) from swivel housing (15), (female portion of swivel joint).

(2) Using care not to lose any of the balls (20), turn swivel housing (15) so setscrew holes are downward. Slowly rotate the male swivel joint (21) to allow the steel balls (20) to fall out through the open setscrew holes in the swivel housing. It may be necessary to tap the housing with a soft hammer to free the balls. If necessary, pour clean kerosene into the setscrew holes to fill the swivel grooves and dissolve any accumulation of grease that would prevent removal of the balls.

(3) When all the balls in both grooves are removed, pull the male swivel joint (21) from the housing.

(4) Remove and discard the quad rings (18 & 19) from male swivel joint (21).

b. Assembly. (figure 3-23)

(1) Lubricate new quad rings (18, 19), with Molykote 33 grease or equivalent in respective grooves on male swivel joint (21). The larger ring is fitted to the groove nearest the shoulder on male swivel joint, the smaller ring goes in the groove nearest the lip of the swivel Joint. Use care not to roll, cut, or distort rings during installation.

(2) Carefully insert and rotate male joint (21) into female joint.

(3) Align the grooves in male joint with setscrew holes in female joint.

(4) Install 31 steel balls (20) into each of the grooves.

(5) Turn male swivel joint so one of the steel balls is directly below one for the setscrew. Coat threads of setscrew (17) with Loctite 271 (red). Install setscrew and tighten until contact is made with ball directly below setscrew hole. Back off setscrew one-quarter of a turn.

(6) Repeat step 5 to install the remaining setscrew.

(7) Rotate swivel joint by hand to check for binding or restriction. If swivel joint binds, loosen setscrew an additional 1/8turn maximum. If binding persists, disassemble swivel joint and locate cause of binding.

(8) Lubricate swivel joint completely by applying grease gun to fitting on swivel housing. Use Molykote 33 grease or equivalent.

A 3-39. HOSE REEL GUIDE ROLLERS.

a. Disassembly. (figure 3-24)

(1) Remove caps (11) from spools (3). Remove two nuts (6) and lockwashers (5). Remove guide roller from its mounting bracket (10).

(2) Pull end spools (3) and pedestals (4) from roller axle.

(3) Remove spool (3) and bolt (2) from pedestal (4).

(4) Remove spool (3) from bolt (2). Remove bushing (1) from spool.

(5) Pull axle (7) from roller tube (9).

(6) Pull end bearings (8) from roller tube only if replacement is necessary.

b. Assembly. (figure 3-24)

(1) Install end bearings into tube, if removed.

(2) Insert axle through end bearings and center the roller on the axle.

(3) Apply Molykote 33 grease or equivalent to entire exterior of bushings (1). Install bushings (1) into spools (3).

(4) Slide spool (3) onto bolt (2), followed by pedestal (4).

(5) Slide spool pedestals onto axle ends.

(6) Position the roller assembly on its mounting bracket (12) and secure with lockwashers (5) and nuts (6). Install caps (11) into spools (3).

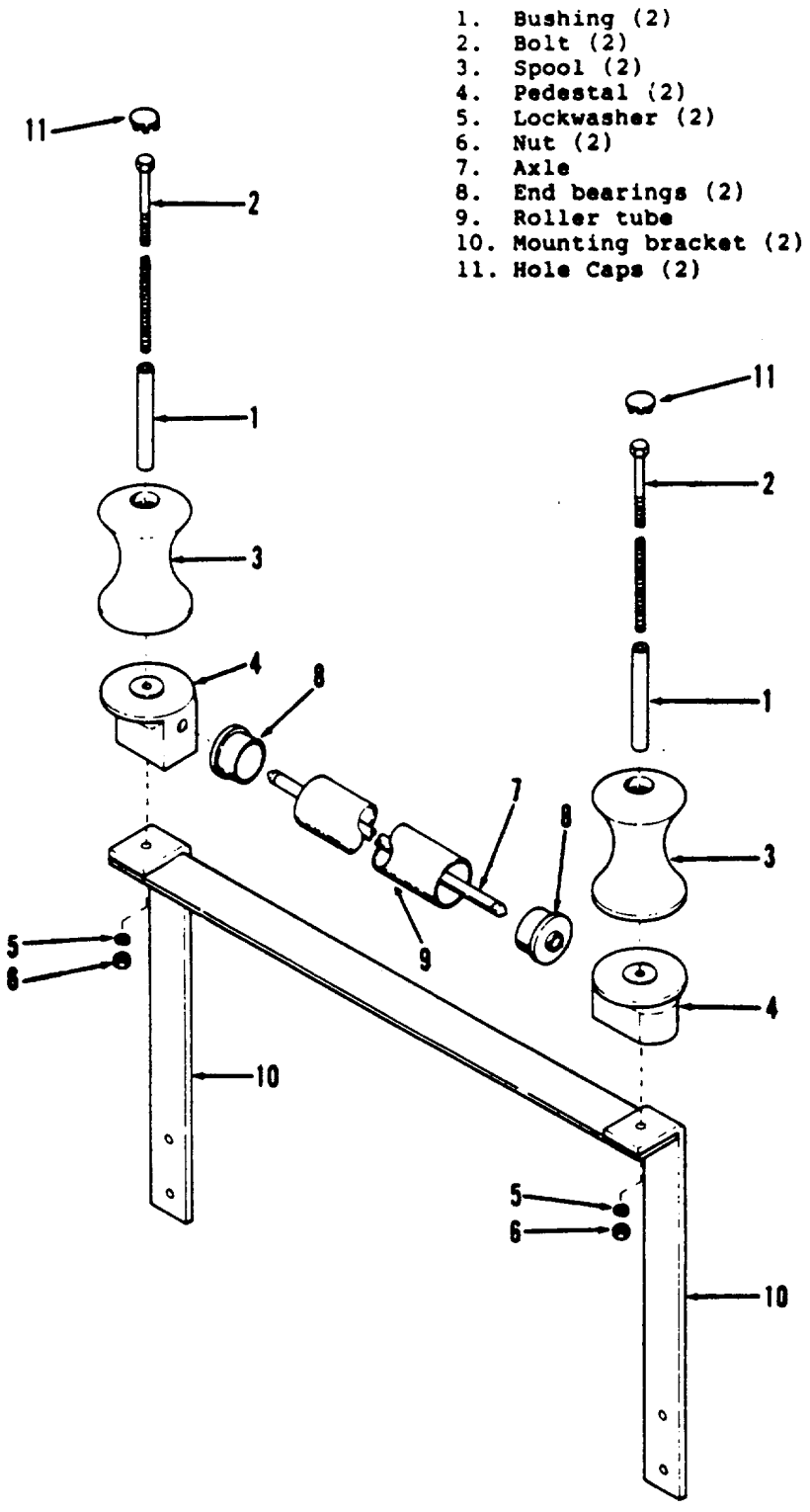


Figure A 3-24. Guide Roller Assembly

APPENDIX A

A 3-40. DISCHARGE NOZZLES. The discharge nozzle shutoff valves should normally arrive at the field maintenance facility separated from tie bar. The nozzle barrel(s) and quick disconnect(s) will normally have been removed. If the complete twin nozzle assembly is forwarded, remove the discharge nozzles per paragraph 3-23.

a. Disassembly. (figure 3-25)

(1) Clamp valve body (3) in a vise, handle end down. Unscrew forward seat (1) from valve body. Remove and discard o-ring (2) from forward seat.

(2) Remove screw (4), valve seal washer (5), seal (6), and valve stem washer (7).

(3) Remove spring (8) from stem. Remove stem (18) with valve lever attached. Using a pin type wrench, unscrew rear seal (11) from valve body. Discard body o-ring (10), rod wiper (9) from rear seal.

(4) Note position of handles on right and left hand valve assemblies for correct positioning at assembly. Remove four screws (13) from handle assembly. Remove valve handle (12).

(5) Drive out spring pin (16). Remove valve lever (14) from stem (18).

b. Assembly.

(1) Be sure all parts are free from dirt and chips prior to assembling.

NOTE

Apply a moderate amount of silicone grease, MIL-S-8660B to all o-rings and sliding surfaces prior to assembly.

(2) Install rod wiper (9) into bore of rear seal (11). Lubricate o-ring (10) with silicone grease and install on outer diameter of rear seal (11). Install o-ring over shoulder of rear seal (1), not over threads, using gare not to cut o-ring.

(3) Lubricate the inner circumference of the rod wiper (9).

Install the rear seal (11) into the valve body (3). Tighten rear seal (11) securely, using a pintype wrench.

(4) Install valve lever (14) onto the valve stem (18). Install spring pin (16). Lubricate o-ring (17) and install in groove on stem (18).

(5) Install stem into body through rear seal.

(6) Clamp lever (14) in a soft jaw vise. Install spring (8) over stem (18).

(7) Put valve seal washer (5) on pan head machine screw (4), with smaller diameter of seal washer next to head of screw.

(8) Lubricate seal (6) with silicone grease and install seal over shoulder of valve seal washer.

(9) Slide stem washer (7) onto screw, with larger diameter toward seal already installed on screw.

(10) Make sure threads of screw (4) and threads inside stem (18) are clean and dry. Apply Loctite primer "T" to threads and allow to dry.

(11) Apply a moderate amount of Loctite 242 (blue) to male threads of screw (4), using care not to allow Loctite to contact the seal (6). While holding the seal and washers in position, thread the screw (4) into stem (18) and tighten to 24 inch pounds. Let Loctite allow to dry for 1 hour.

(12) Lubricate o-ring (2) with silicone grease and install on forward seat (1). Thread the seal into the valve body (3) and tighten securely.

(13) Install valve handle (12), positioning as in original assembly. Handle on left hand valve assembly will be rotated 1800 in respect to inlet.

1. Forward seat
2. O-ring
3. Valve body
4. Screw
5. Valve seal washer
6. Seal
7. Valve stem washer
8. Spring
9. Rod wiper
10. O-ring
11. Rear seal
12. Valve handle
13. Screw (4)
14. Lever
15. Button (2)
16. Spring pin
17. O-ring
18. Valve stem

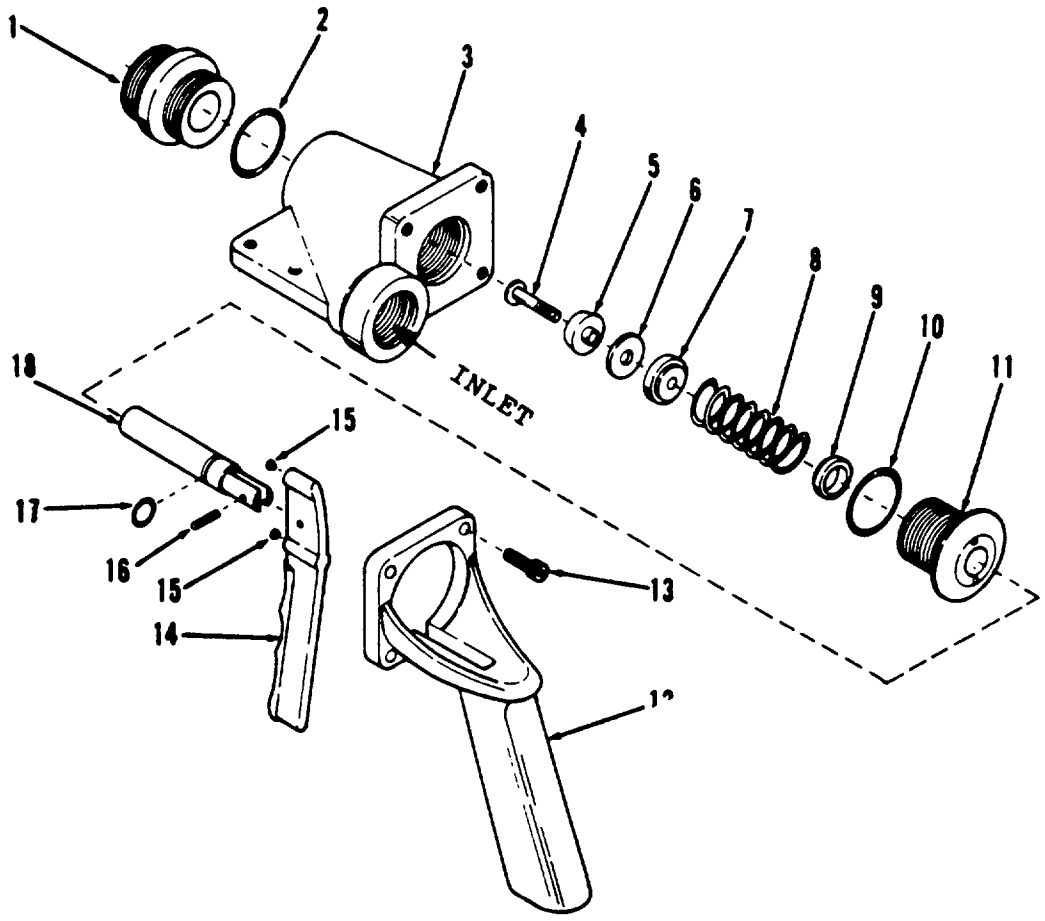


Figure A 3-25. Nozzle Assembly

A 3-41. TWIN AGENT HOSE ASSEMBLY.

a. Emergency Repair. Maintenance and emergency repair of twin handlines will normally be accomplished by first and second echelon maintenance personnel and are included in paragraph 3-24.

b. Installation of Hose End Fittings. A special tool (figure 3-1) is required for installation of hose fittings. Refer to figure 3-26 and proceed as follows:

NOTE

When replacing a damaged fitting on one hose, be sure hoses are identical length to assure proper installation to hose reel or nozzle.

(1) When removing damaged fitting for replacement, cut fitting from hose as near to fitting as possible.

(2) Trim hose end neatly, keeping end square. Pull a 1/4-inch length of grounding wire through hose cover and fold back over hose cover.

(3) Install ferrule onto hose, turning hose counter-clockwise until it bottoms against ferrule. Refer to (A), figure 326.

(4) Insert tool (b, figure 3-26) into coupling. Apply grease to taper end of coupling. Insert coupling into ferrule and tighten with clockwise motion (C) until coupling is bottomed against ferrule.

(5) Perform leak test (to 340 psi).

(6) Check for electrical continuity from coupling to coupling on each hose to ensure integrity of grounding wire.

NOTE

Twin agent hoses are internally grounded by a wire which is integral with the hose. If a hose or a section of hose being replaced in an emergency or otherwise, by a hose which is not internally grounded, an external ground wire should be installed to ensure operator protection against static shocks. See paragraph 3-24.

A 3-42. AFFF TANK HEATER

a. Testing

(1) Heater does not function below 40°F.

(a) Unplug the power cord from its receptacle

(b) Remove the enclosure (figure 3-28) and bypass the thermostats by connecting a jumper wire between the power cord and the heater wires. Refer to figure 3-27.

(c) Plug in the power cord to its receptacle. If heater does not function the problem lies in the heater blankets. Replace heater blankets. If heaters function the problem is in the thermostats.

(2) Testing thermostats.

(a) If ambient temperature is below 40oF the thermostats can be tested on the fire extinguisher. With the power cord plugged into its receptacle, connect a voltmeter across the wire leads of each of the thermostats. Line voltage indicates that the thermostat contacts are not closing and the thermostat is faulty. Replace thermostat.

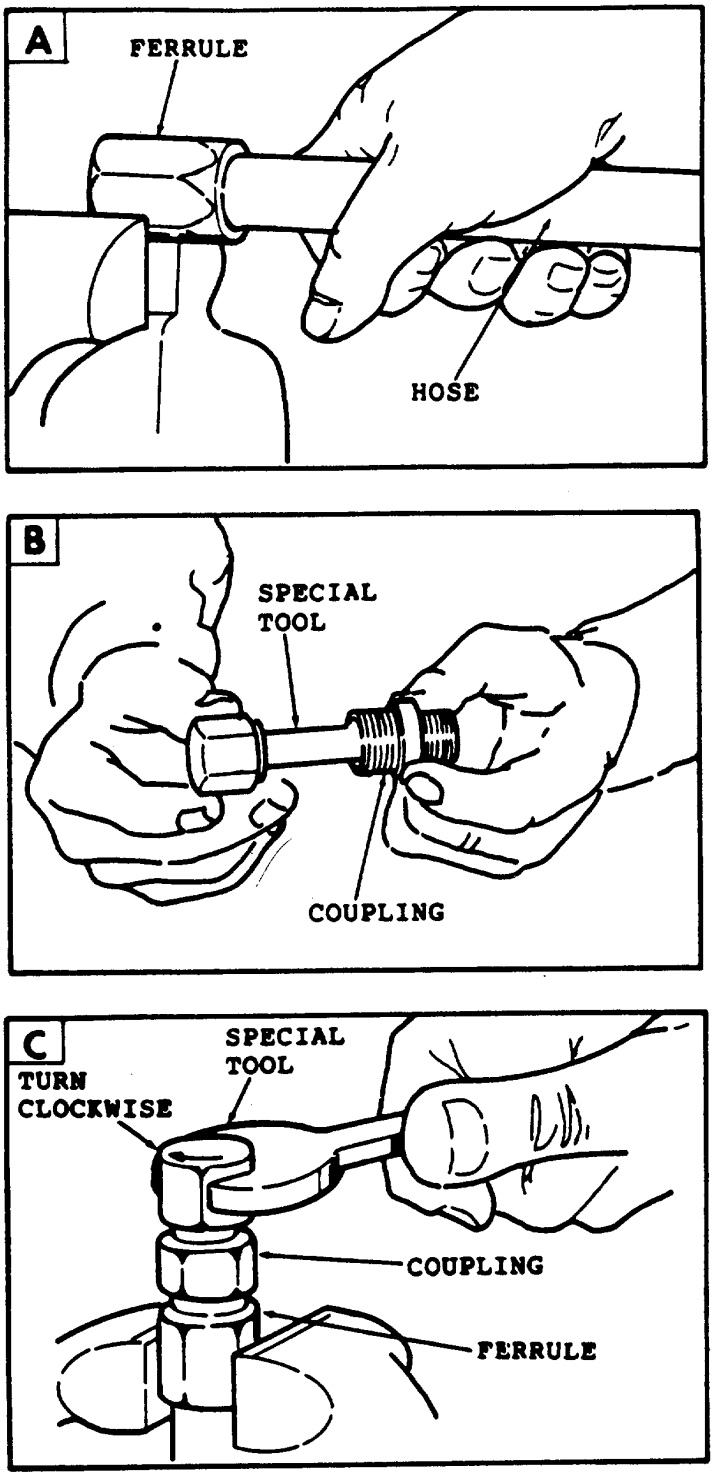


Figure A 3-26. Hose End Fitting Assembly

(b) If ambient temperature is above 40°, remove the thermostats from the fire extinguisher and place them in a refrigerated area (example: refrigerator, box of ice, etc.) and check continuity to see which or both thermostats are faulty. No continuity indicates contacts are not closing and thermostat is malfunctioning.

b. Heater Insulation Replacement.

(1) Remove AFFF tank from skid. Refer to paragraph 3-13a.

(2) Remove the enclosure cover (figure 3-28) from the enclosure or insulation wrapper by removing two screws. Disconnect the wires from the two heater blankets and two pieces of heat tape.

(3) Remove two screws, lockwashers, and nuts securing upper and lower insulation wrappers together.

(4) Remove the two thermostats.

(5) Remove upper and lower insulation wrappers and insulation from AFFF tank.

(6) If insulation on tank outlet and shutoff valve needs replacement proceed as follows: (a) Remove the insulation protectors from the elbow and shutoff valve. Be careful not to damage the protectors.

(b) Remove the insulation from the elbow shutoff valve and pipe, and replace them with new insulation.

(c) Install protective covering previously removed.

(7) Place new insulation on top of AFFF tank, and on top of lower insulation wrapper.

(8) Place upper insulation wrapper over the insulation. Hook the lower insulation wrapper into the upper insulation wrapper.

(9) Coat the contacting surface of each thermostat with heat sink paste. Install each thermostat in its hole in the lower insulation. Be sure wires are placed through holes first.

(10) Bring the upper and lower insulation wrappers together and clamp in place. Install two screws, lockwashers and nuts. Remove clamp.

(11) Reconnect the wires using wiring diagram Figure 3-27 as a reference.

(12) Install the enclosure cap using two screws.

(13) Seal the insulation exposed around the fill collar with sealant to prevent water from settling around fill collar and being absorbed into insulation.

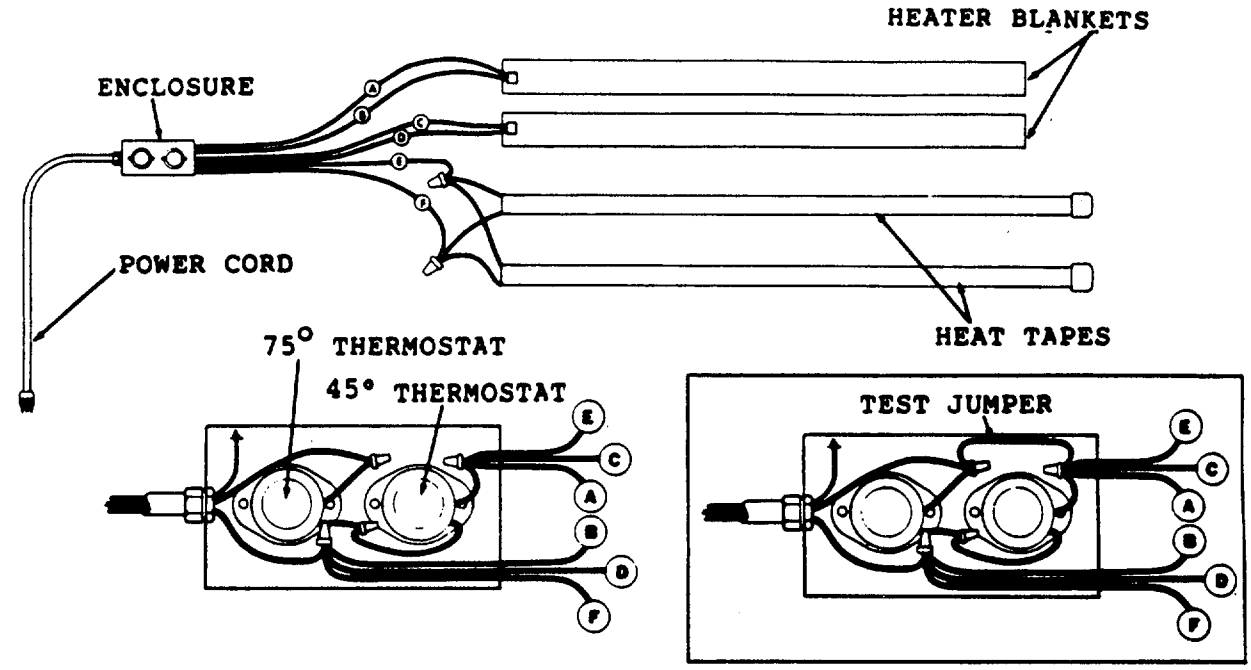
(14) Install AFFF tank to skid using instructions in paragraph 3-13d.

c. Thermostat Replacement.

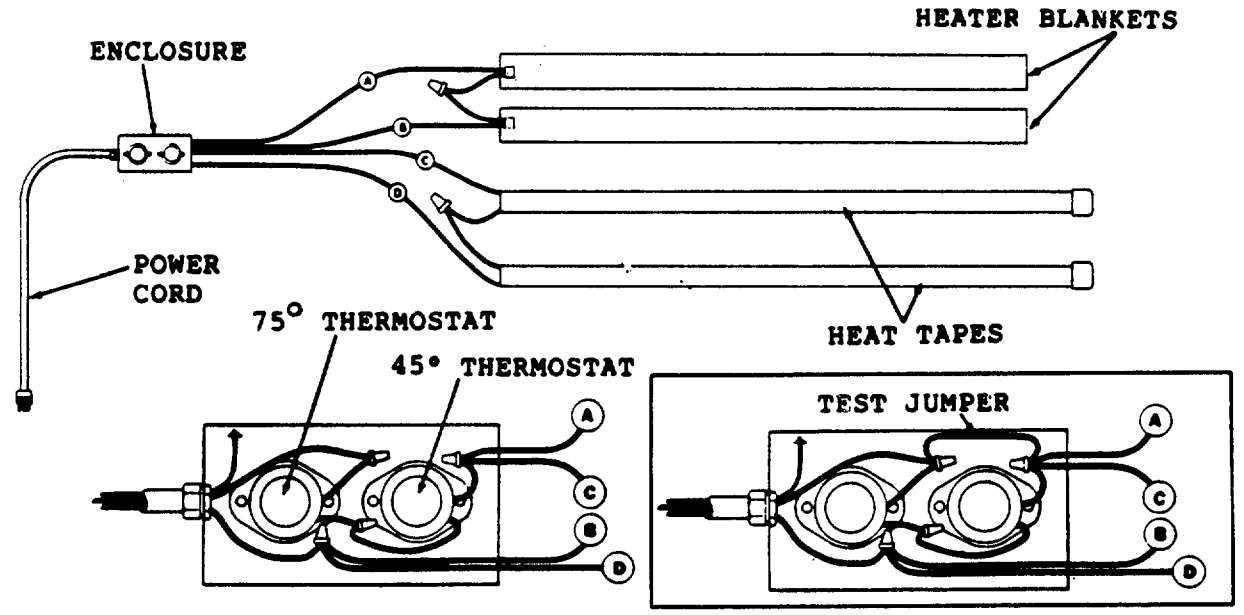
NOTE

AFFF tank assembly need not be removed from skid to replace a thermostat, but with the tank removed, replacement will be easier.

(1) Remove AFFF tank from skid. Refer to paragraph 3-13a.



(PARALLEL) 120VAC CIRCUIT



(SERIES) 240VAC CIRCUIT

Figure A 3-27. AFFF Heater Wiring Diagram

1. AFFF Tank
2. Screw (2)
3. Lockwasher (2)
4. Nut (2)
5. Upper Insulation Wrapper
6. Upper Insulation
7. Lower Insulation Wrapper
8. Lower Inul
8. Lower Insulation
9. Elbow Insulation Protector
10. Valve Insulation Protector
11. Elbow Insulation
12. Valve Insulation
13. Pipe Insulation
14. Heat Tape (2)
15. Heater Blanket (2)
16. Wire Nut (6)
17. Black Jumper Wire
18. White Jumper Wire
19. High Temperature Thermostat
20. Low Temperature Thermostat
21. Strain Relief
22. Enclosure
23. Screw (4)
24. Powercord
25. Plug

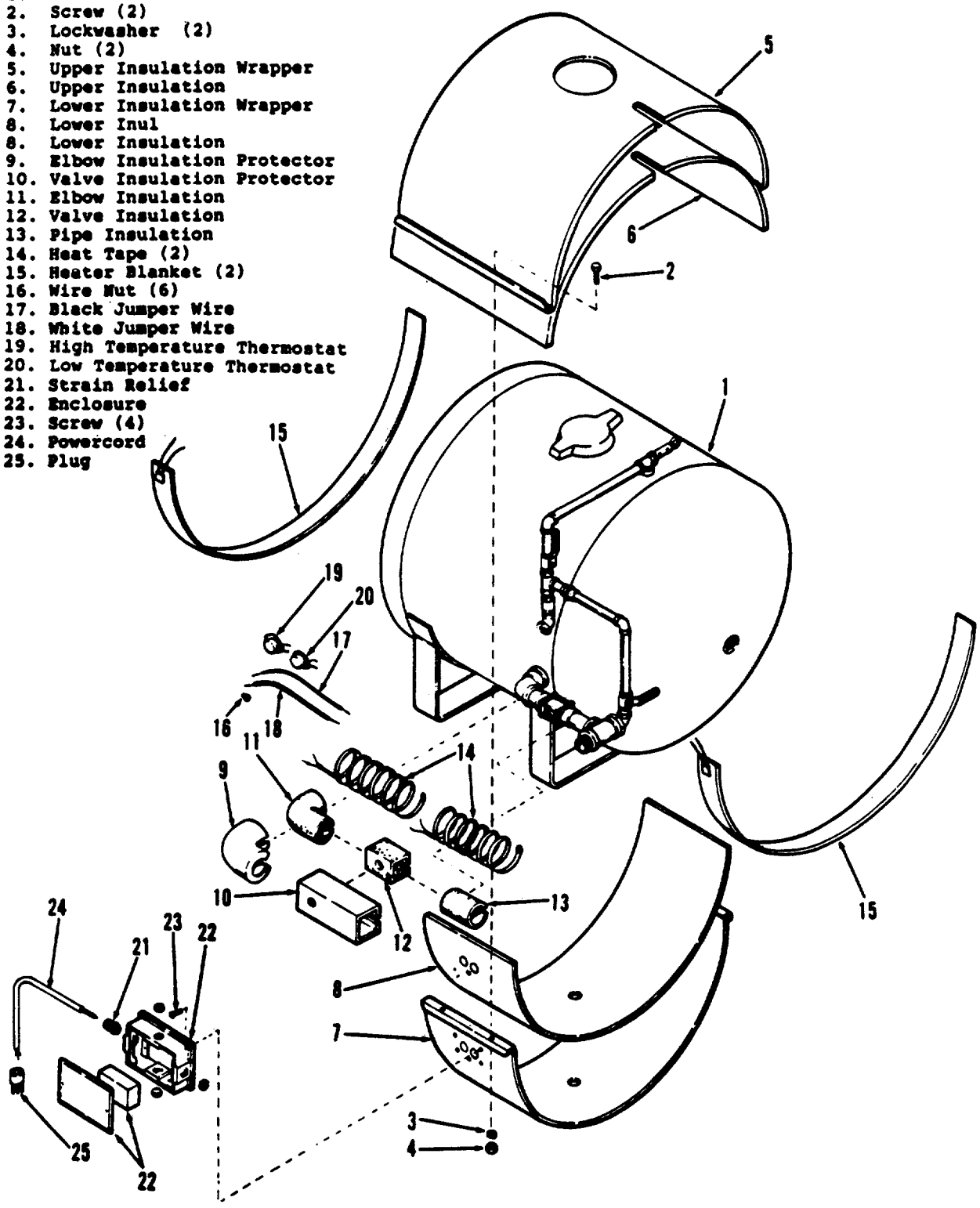


Figure A 3-28. AFFF Heater Assembly

(2) Remove the enclosure cover from the enclosure on the lower wrapper by removing four screws. Disconnect the wires of the faulty thermostat.

(3) Remove the two screws, lockwashers, and nuts securing the upper and lower insulation wrappers together. Separate the lower wrapper just far enough to expose the thermostats. Remove the faulty thermostat.

(4) Coat the contacting surface of each thermostat with heat sink paste . Install the new thermostat in the hole in the insulation wires first.

(5) Bring the upper and lower insulating wrappers together and clamp in place. Install two screws, lockwashers, and nuts. Remove clamp.

(6) Reconnect the wires of the thermostat, and install the enclosure to the lower insulation wrapper.

(7) If removed, install the AFFF tank assembly to the skid frame. Refer to paragraph 3-13d.

d. Heater Blanket Replacement.

(1) Remove AFFF tank assembly from the skid frame. Refer to paragraph 3-13a.

(2) Refer to b above and remove the lower insulation wrapper and insulation. The upper wrapper and insulation need not be removed.

(3) With a chalk pencil mark the outline of the faulty heater blanket on the AFFF tank. Peel the heater blanket from the AFFF tank.

(4) Make sure surface of AFFF tank, where heater blanket was removed, is clean.

(5) Peel the backing from the new heater blanket. Locate the heater blanket on the AFFF tank between the chalk outline and press in place. Use a roller or suitable tool to thoroughly press the heater blanket in place.

(6) Install lower insulation and wrapper. Refer to instructions in b above.

(7) Install AFFF tank assembly to skid frame. Refer to paragraph 3-13d.

Section III. CARE AND PREPARATION FOR STORAGE

A 3-43. STORAGE NOT EXCEEDING THREE MONTHS.

a. Preparation for Storage. Preparation for storage of the fire extinguisher will include a technical inspection, complete cleaning, and covering.

(1) Technical Inspection. Perform a technical inspection to determine completeness and operational condition of the unit.

(a) Visually inspect fire extinguisher per instructions in paragraph 1-11.

(b) Check operation of extinguisher per paragraph 1-11b.

(c) Drain AFFF solution from tank, paragraph 3-13.

(d) Complete storage preparations per steps a through i, paragraph 1-13.

(2) Cleaning. Clean the equipment thoroughly per instructions in paragraph 1-9. Dry completely with clean, lint-free cloths, or moisture-free compressed air, taking proper precaution against blown particles. See WARNING, paragraph 3-9.

(3) Protection. The equipment should be covered with a canvas or other protective cover in a manner that will permit air circulation and prevent condensation on the unit. Avoid plastic covers under direct exposure to sun.

b. Storage Location. The fire extinguisher can be stored in any convenient, out-of-the-way location that is dry and relatively dust-free, away from direct rays of the sun. Rapid heating and cooling of the equipment under protective cover will cause condensation and contribute to rust.

A 3-44. LONG-TERM STORAGE.

Preparation for extended storage of the fire extinguisher is identical with the procedures outlined above for short-term storage.

APPENDIX A

PART I

SUPPLEMENTAL TECHNICAL DATA

PARTS LIST
FOR SELF CONTAINED
FIRE EXTINGUISHER AND CART
W/TRAILER CHASSIS ASSY

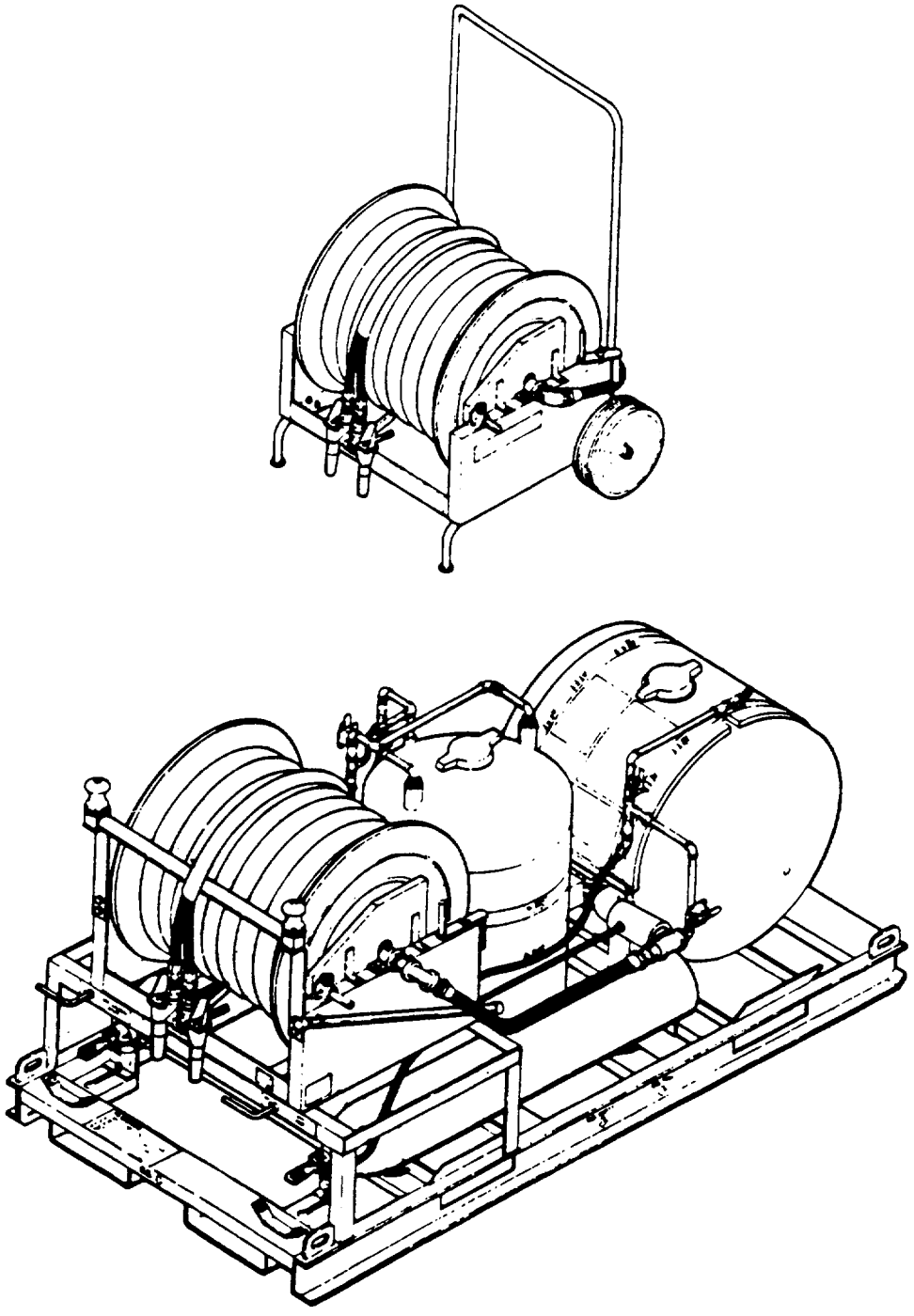


Figure A4-1.

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
	Fire Extinguisher and Cart	64903	03638	0001

Figure No. A4-1 Title Fire Extinguisher and Cart

1 of 1 Sheet 1 of 1

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OED-731 (4/76)

Figure No. A4-1
A4-2

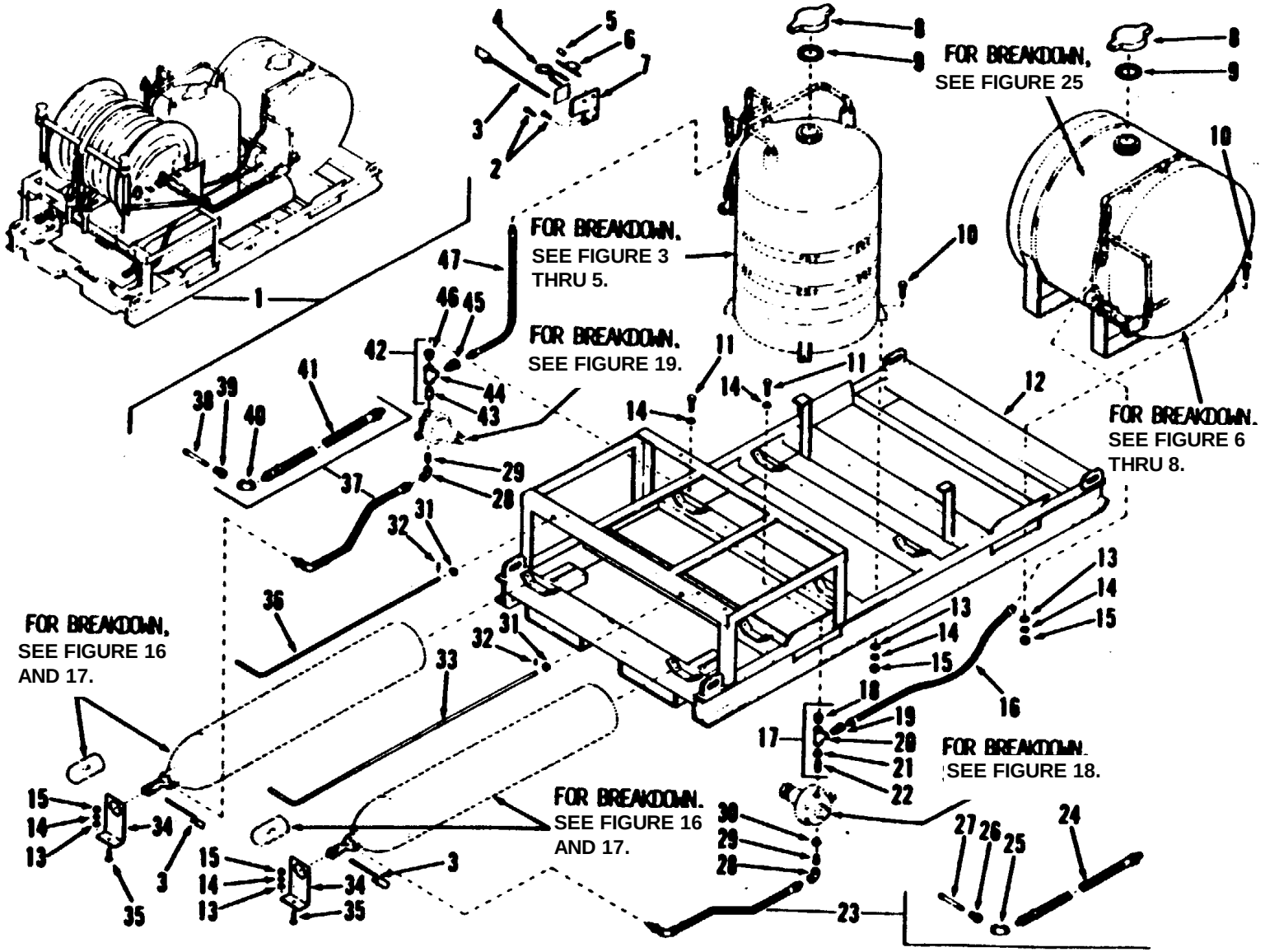

Figure A4-2 (Sheet 1 of 3)

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Extinguisher, Fire	64903	04453	0002
2	Screw	96906	MS51957-59	0011
3	Seal, Red Plastic	24871	134-RE	0054
4	Pin, Pull	64903	04905	0051
5	Sleeve, Cable	76691	18-11-B4	0053
6	Cable	64903	05134-12	0052
7	Bracket, Nameplate	64903	04294	0050
8	Cap, Fill	64903	02373	0057
9	Gasket, Fill Cap	64903	01724	0058
10	Screw	96906	MS35307-413	0007
11	Screw	96906	MS35307-407	0031
12	Frame, Skid	64903	04676	0043
13	Washer, Flat	96906	MS15795-917	0008
14	Washer, Lock	96906	MS35338-143	0009
15	Nut	96906	MS51971-5	0010
16	Hose	64903	05008-35	0068
17	Tee Assembly	64903	04682	0100
18	Plug, Merchant	64903	04640	0102
19	Adapter, Swivel	87680	981120808	0105
20	Tee	19207	138105	0101
21	Bushing, Reducing	96906	MS51887-9	0103
22	Nipple, Short	96906	MS51873-29	0104
23	Hose Assy, L.P.	64903	04330-30	0090
24	Hose	64903	04329-30	0091
25	Elbow, 90°	64903	03911	0092

Figure No. A4-2 Title FIRE EXTINGUISHER

1 of 3 Sheet 1 of 2

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OED-731 (4/78)

Figure No. A4-2
A4-4

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
26	Nut	63026	0973-0003	0093
27	Swivel	63026	0970-0005	0094
28	Elbow, 90°	64903	03911	0065
29	Nipple, Short	64903	02476-SH	0066
30	Bushing, Reducer	88044	AN912-55	0067
31	Bushing, Flange	64903	04293	0047
32	Pin, Spring	96906	MS171560	0046
33	Rod, Valve	64903	04672	0044
34	Plate, Cyl. Stop	64903	04673	0063
35	Bolt, Carriage	64903	04200	0027
36	Rod, Valve	64903	04671	0045
37	Hose Assy. L.P.	64903	05108-25	0095
38	Swivel	64903	05107	0099
39	Nut	63026	0973-0003	0098
40	Elbow, 90°	64903	03911	0097
41	Hose	64903	04329-25	0096
42	Tee Assembly	64903	04681	0106
43	Nipple, Short	96906	MS51873-75	0108
44	Tee	19207	138105	0107
45	Adapter, Swivel	8Z680	981120808	0109
46	Plug, Merchant	64903	04640	0110
47	Hose	64903	05008-23	0069

Figure No. A4-2 Title FIRE EXTINGUISHER

1 of 3 Sheet 2 of 2

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OSD-731 (4/76)

Figure No. A4-2

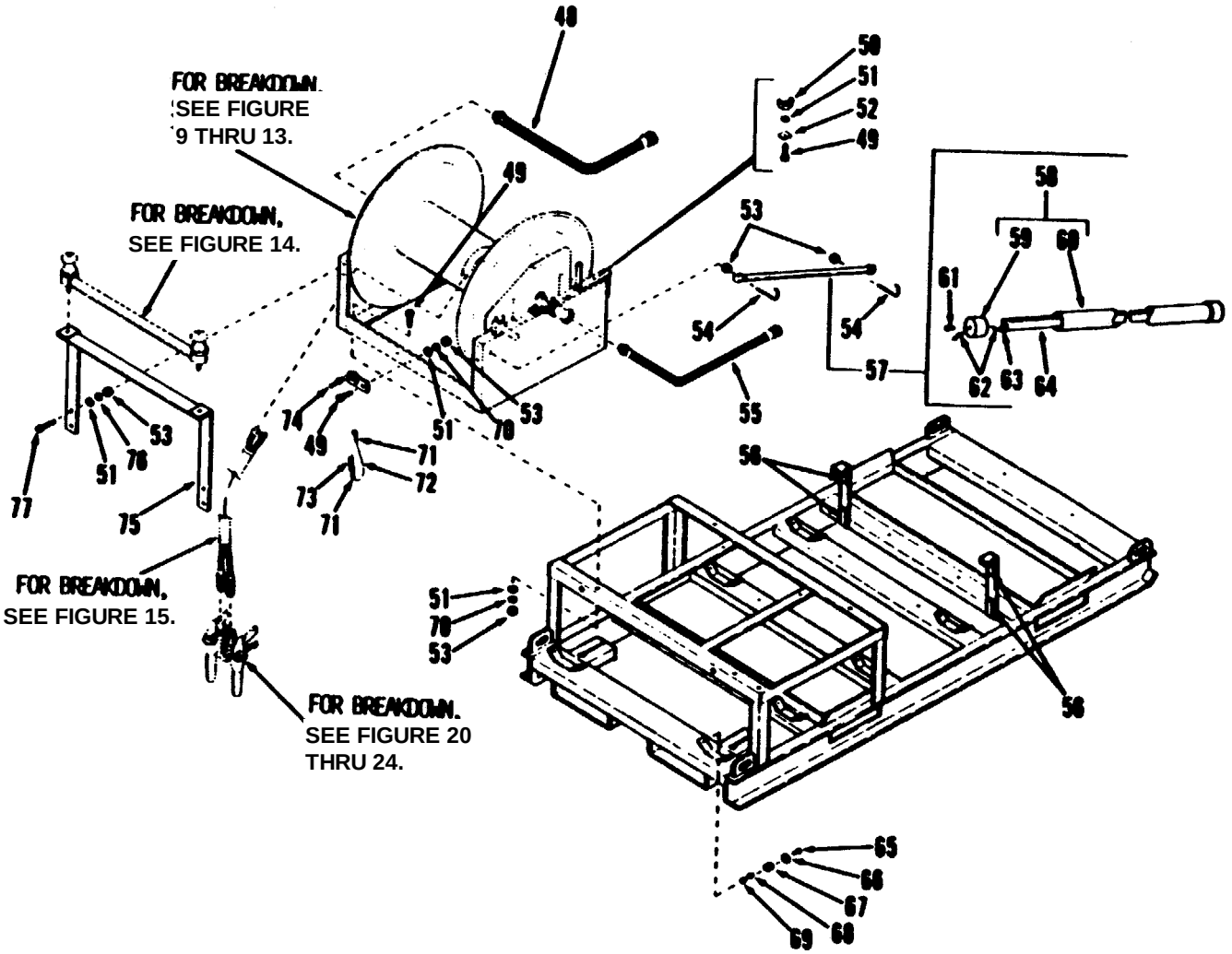

Figure A4-2 (Sheet 2 of 3).

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
48	Hose, Dry Chemical	64903	05100-30	0061
49	Screw	96906	MS35307-360	0016
50	Nut, Wing	96906	MS35425-42	0022
51	Washer, Flat	96906	MS15795-913	0017
52	Pad, Rubber	64903	05195	0059
53	Nut	96906	MS51971-3	0019
54	J-Bolt	64903	05133	0033
55	Hose, AFFF	64903	05100-41	0062
56	Pad	64903	05278	0064
57	Tube Assy, Dipstick	64903	05270	0111
58	Tube, Dipstick	64903	05143	0112
59	Cap, Pipe	64903	05671	0113
60	Tube	64903	05664	0113A
61	Rivet, Pop	64903	05259	114
62	Sleeve, Cable	76691	18-11-B4	0113B
63	Cable	64903	05134-10	0116
64	Dipstick	96906	05178	0115
65	Screw	96906	MS35307-309	0003
66	Washer, Flat	96906	MS15795-809	0004
67	Button, Slide	64903	04562	0048
68	Washer, Flat	96906	MS35338-139	0005
69	Nut, Hex	96906	MS51971-1	0006
70	Washer, Lock	96906	MS35338-141	0018
71	Cable Sleeve	76691	18-11-B4	0073
72	Wire	64903	05134-20	0072

Figure No. A4-2 Title FIRE EXTINGUISHER

2 of 3 Sheet 1 of 2

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OED-731 (4/79)

Figure No. A4-2

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
73	Pin, Cotter	88044	AN415-7	0071
74	Holder, Nozzle	64903	05221	0070
75	Bracket, Hose Roller	64903	05141	0060
76	Washer, Lock	96906	MS35338-141	0018
77	Screw	96906	MS35307-361	0023

Figure No. A4-2 Title FIRE EXTINGUISHER

2 of 3 Sheet 2 of 2

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OSD-731 (4/76)

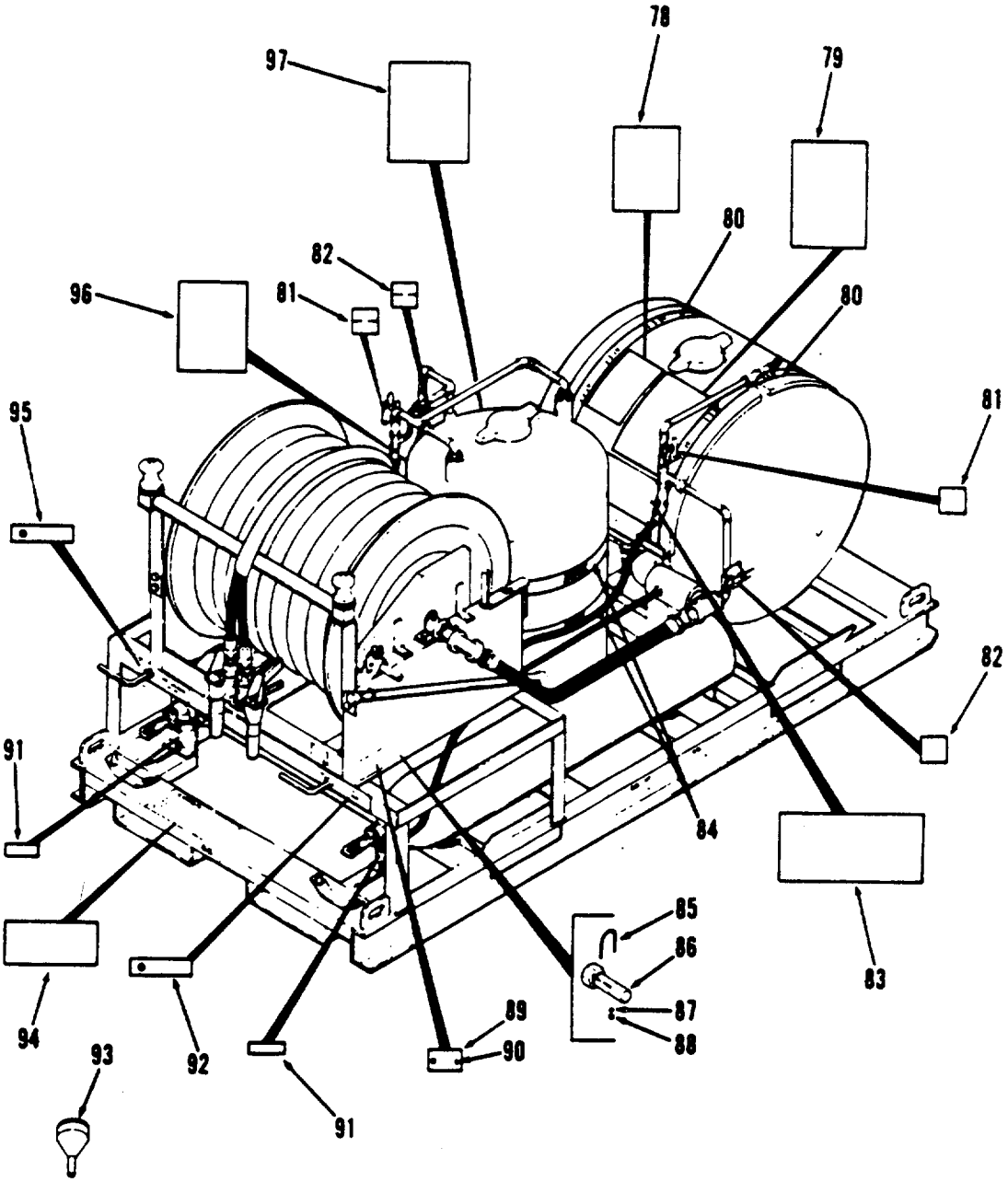

Figure A4-2 (Sheet 3 of 3)

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
78	Table, AFFF Refill	64903	04654	0080
79	Plate, AFFF Data	64903	03904	0074
80	Band, AFFF Tank	64903	05109	0055
81	Plate, Charge	64903	04303	0077
82	Plate, Purge	64903	04302	0076
83	Warning, Tank Heater	64903	04971	0084
84	Band, PKP Tank	64903	05110	0056
85	U-Bolt	64903	05099	0040
86	Tool, Installation	64903	05272	0087
87	Washer, Lock	96906	MS35338-140	0041
88	Nut, Hex	96906	MS51971-2	0042
89	Plate, ID	64903	05216	0086
90	Screw, Drive	96906	MS21318-27	0039
91	Nameplate	64903	04699	0081
92	Plate, AFFF Valve	64903	04470	0078
93	Funnel, Dry Chemical	64903	01539	0089
94	Plate Instruction	64903	04966	0083
95	Nameplate	64903	04300	0075
96	Table, PKP Refill	64903	04972	0085
97	Plate, PKP Data	64903	04842	0082

Figure No. A4-2 Title FIRE EXTINGUISHER

3 of 3 Sheet 1 of 1

A4-10

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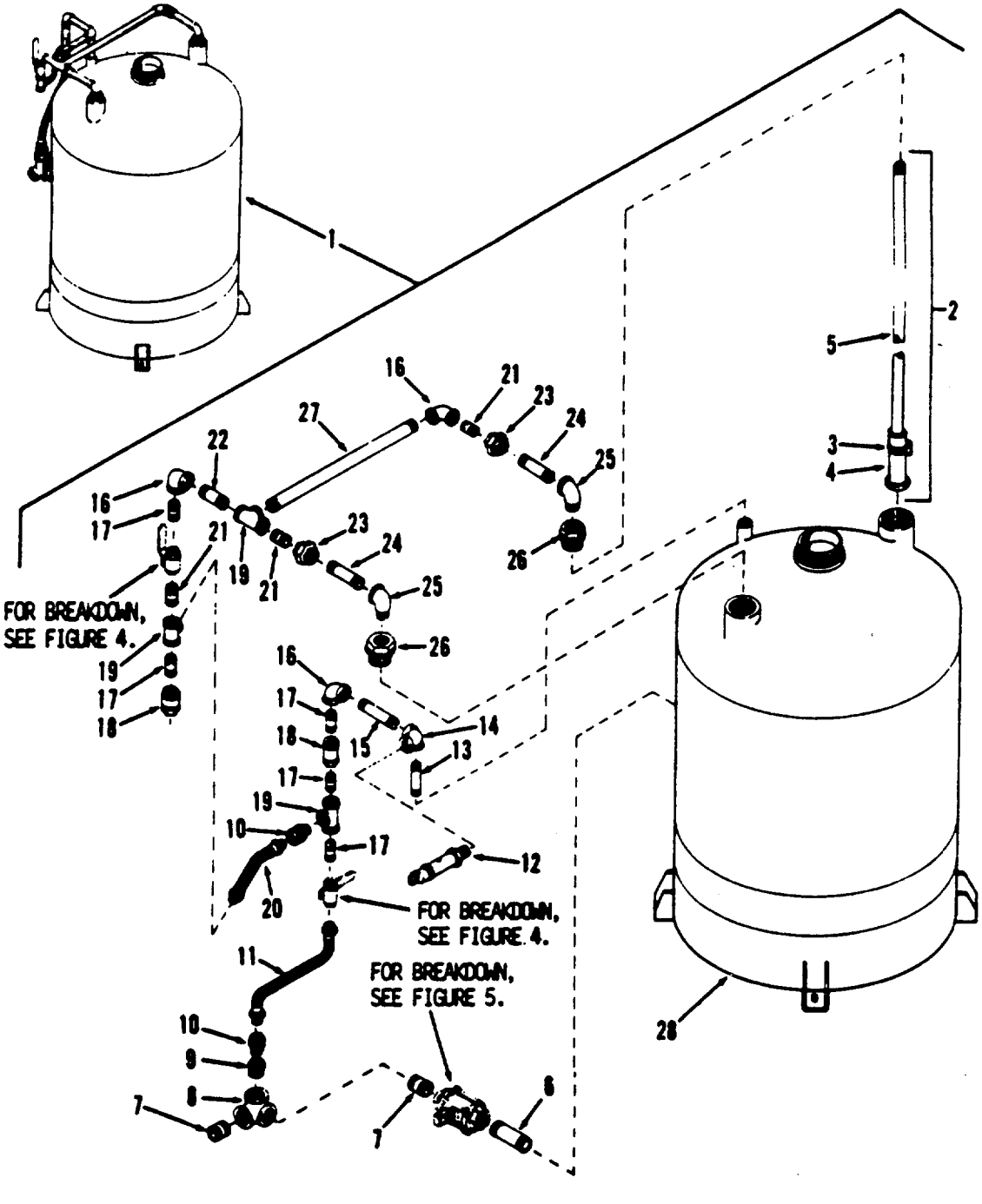
OSD-731 (4/76)

Figure No. A4-2
A4-10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FOR BREAKDOWN,
SEE FIGURE 4.
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FOR BREAKDOWN,
SEE FIGURE 4.
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FOR BREAKDOWN,
SEE FIGURE 5.
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Figure A4-3.

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Tank, Dry Chemical, Assembly	64903	04675	0118
2	Tube, Gas, Assembly	64903	05285	0140
3	Clamp, Hose	96906	MS35842 - 11	0143
4	Sleeve, Rubber	64903	01723	0142
5	Tube, Gas	64903	05284	0141
6	Nipple	96906	MS51953 - 151B	0139
7	Nipple	64903	02406-SH	0138
8	Elbow, Side Outlet	82666	FIG609-1-1/4	0137
9	Bushing, Reducer	96906	MS51887 - 35	0135
10	Adapter, Swivel	8Z680	981120808	0133
11	Hose Assembly	64903	05008 - 15	0136
12	Valve, Relief	75336	FIG115 - ½	0124
13	Nipple	96906	MS51953 - 78B	0130
14	Elbow, Side Outlet	82666	FIG609-1/2	0128
15	Nipple	96906	MS51953 - 82B	0144
16	Elbow, 90°	82666	FIG601-1/2	0124
17	Nipple	96906	MS51953 - 75B	0131
18	Valve, Check	79227	601 - ½	0132
19	Tee	19207	138105	0125
20	Hose Assembly	64903	05008 - 7	0134
21	Nipple, Close	96906	MS51953 - 73B	0123
22	Nipple	96906	MS51953 - 79B	0129
23	Union	83149	WWU53103TA	0122
24	Nipple	96906	MS51953 - 813	0121
25	Elbow, 90° Street	96906	MS39230 - 4	0120

Figure No. 3 A4-3 Title DRY CHEMICAL TANK ASSEMBLY

1 of 1 Sheet 1 of 2

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OED-731 (4/76)

Figure A4-3. DRY CHEMICAL TANK ASSEMBLY (Sheet 1 of 2)

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
26	Bushing	64903	04435	0119
27	Pipe	64903	02403 - 17	0127
28	Tank, 450 LB	64903	02376	0145

Figure No. 3 A4-3 Title DRY CHEMICAL TANK ASSEMBLY

1 of 1 Sheet 2 of 2

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OED-731 (4/78)

Figure A4-3. DRY CHEMICAL TANK ASSEMBLY (Sheet 2 of 2)

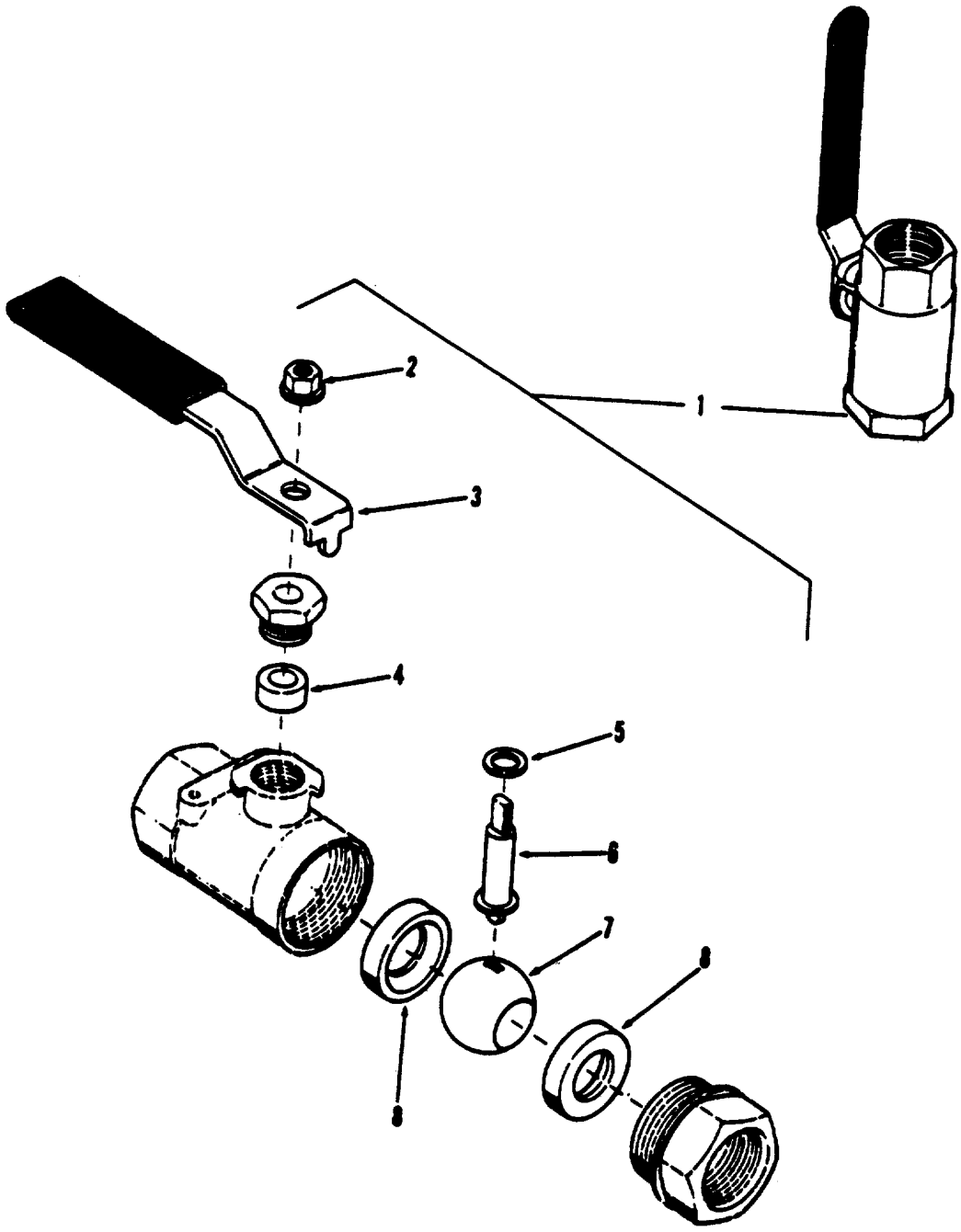

Figure A4-4.

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve, Ball	79227	B6400 - ½	0146
2	Nut, Lock	79227	BV5AA51	0151
3	Handle	79227	SAB4A54 - 2	0152
4	Packing	79227	BV4A41-VT	0150
5	Washer, Thrust	79227	BV4A73 - VT	0153
6	Stem	79227	BV4A	0149
7	Ball	79227	BV4A6	0147
8	Seat	79227	BV4A16 - DFP	0148

Figure No. A4-4. Title BALL VALVE

1 of 1 Sheet 1 of 1

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OED-731 (4/78)

Figure A4-4. BALL VALVE (Sheet 1 of 1)

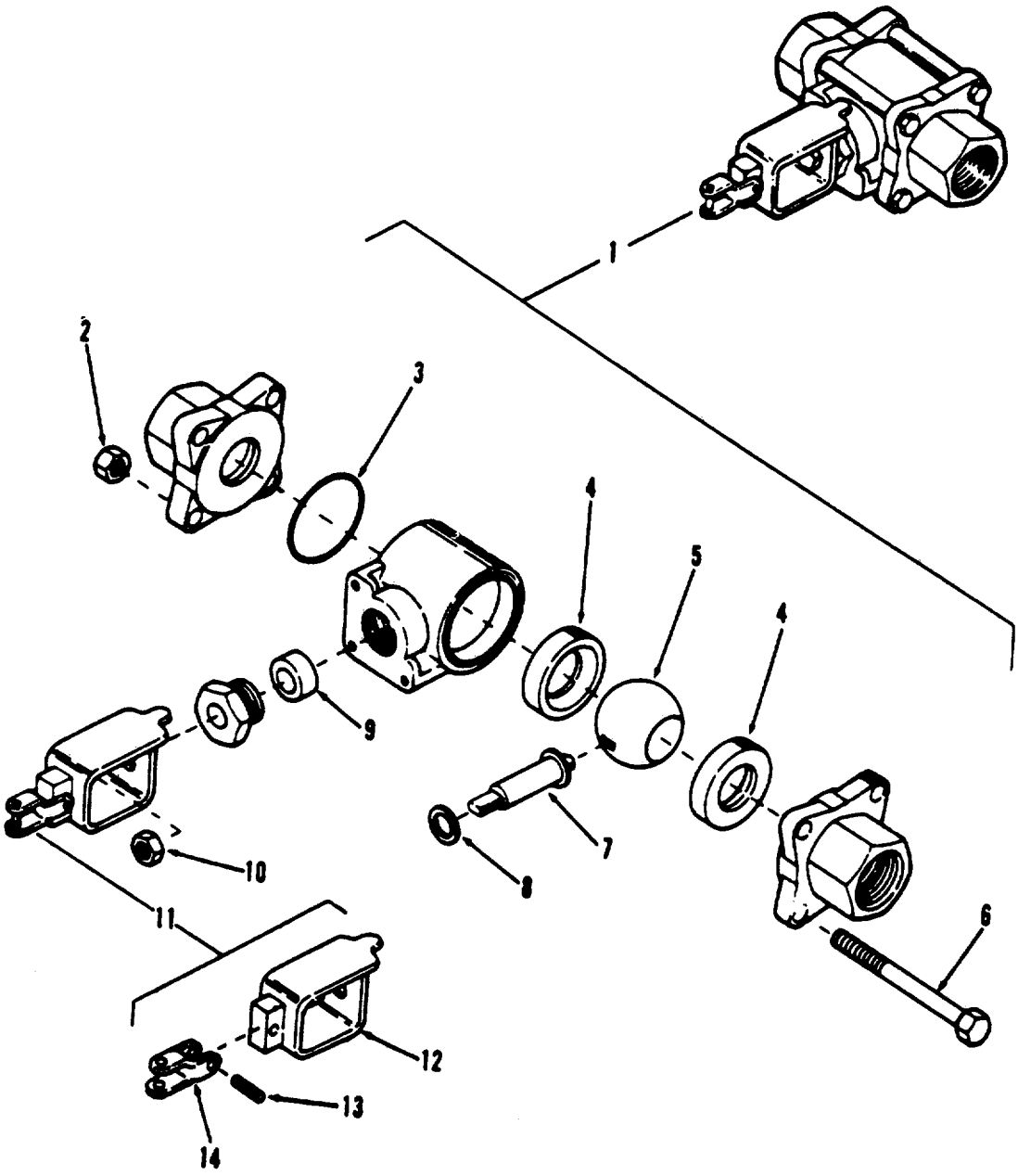

Figure A4-5.

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve Assembly, Ball	64903	04898	0154
2	Nut, Hex	96906	MS51967 - 11	0166
3	Seal, Body	79227	BV5D102 - VT	0167
4	Seat	79227	BV5D16 - DFP	0160
5	Ball	79227	BV5D6	0159
6	Screw	96906	MS90725 - 97	0162
7	Stem	79227	BV5SSDA27	0161
8	Washer, Thrust	79227	BV573 - VT	0165
9	Packing	79227	BV5C41 - VT	0163
10	Nut, Lock	79227	BV5BA51	0164
11	Coupling Assembly	64903	05254	0155
12	Coupling	64903	04843	0156
13	Pin, Spring	96906	MS171560	0158
14	U - Joint	64903	04844	0157

Figure No. 5 A4-5. Title BALL VALVE ASSEMBLY

1 of 1 Sheet 1 of 1

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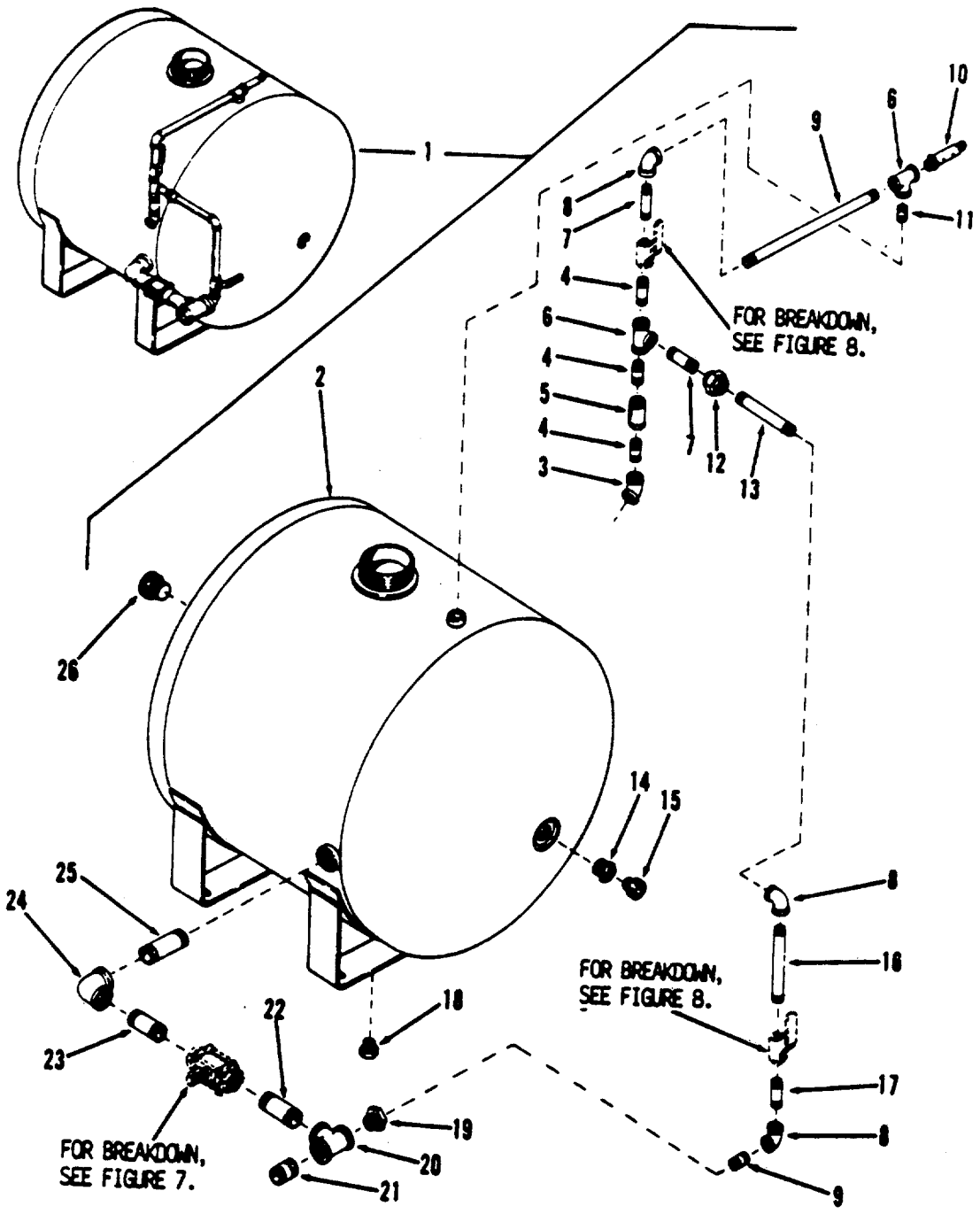
OED-731 (4/76)

Figure A4-5. BALL VALVE ASSEMBLY (Sheet 1 of 1)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FOR BREAKDOWN, SEE FIGURE 8.
FOR BREAKDOWN, SEE FIGURE 8.
FOR BREAKDOWN, SEE FIGURE 7.

Figure A4-6

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Tank Assembly, AFFF	64903	04674	0168
2	Tank, AFFF	64903	02394	0197
3	Elbow, 45°	64903	03118	0195
4	Nipple	96906	MS51846 - 60	0177
5	Valve, Check	79227	601-1/2	0194
6	Tee	88044	AN917 - 4	0190
7	Nipple	96906	MS51946 - 66	0193
8	Elbow, 90°	96906	MS14311 - 3P	0176
9	Pipe	64903	02433 - 15.5	0192
10	Valve, Relief	75336	FIG115 - ½	0191
11	Nipple, Close	96906	MS51846 - 58	0175
12	Union	81439	WWU516B27	0180
13	Pipe	64903	02433 - 6.5	0179
14	Bushing, Reducer	34646	34115-1-1/4 x 1	0199
15	Plug	96906	MS27769 - S7	0200
16	Pipe	64903	02433 - 7.5	0178
17	Nipple	96906	MS51846 - 63	0202
18	Plug, Fusible	64903	04492	0198
19	Bushing, Reducer	96906	MS14315 - 16	0174
20	Tee	88044	AN917 - 10	0173
21	Nipple, Short	64903	02436 - SH	0171
22	Nipple	96906	MS51846 - 121	0172
23	Nipple	96906	MS51846 - 120	0196
24	Elbow, 90°	96906	MS14311 - 6P	0170
25	Nipple	96906	MS51846 - 122	0169

Figure No. A4-6. Title: AFFF TANK ASSEMBLY

1 of 1 Sheet 1 of 2

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OED-731 (4/78)

Figure No. A4-6. AFFF TANK ASSEMBLY (Sheet 1 of 2)

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
26	Plug, 1¼"	96906	MS27769 - S8	0201

Figure No. A4-6. Title AFFF TANK ASSEMBLY

1 of 1 Sheet 2 of 2

A4-20

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OED-731 (4/76)

Figure No. A4-6. AFFF TANK ASSEMBLY (Sheet 2 of 2)

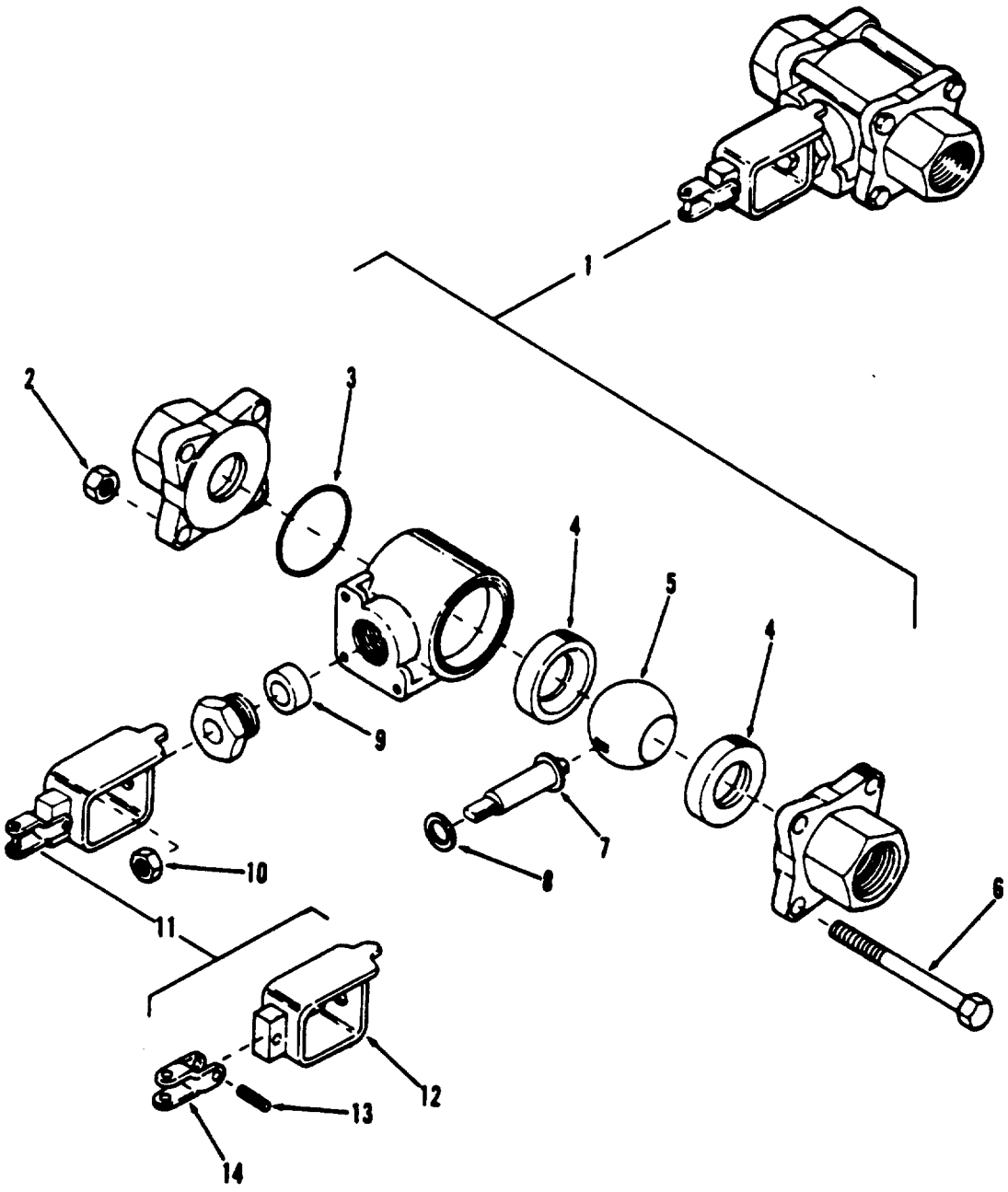

Figure A4-7

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve Assembly, Ball	64903	04895	0203
2	Nut, Hex	96906	MS51967 - 11	0215
3	Seal, Body	79227	BV5D102 - VT	0216
4	Seat	79227	BV5D16-DFD	0209
5	Ball	79227	BV5D6	0208
6	Screw	96906	MS90725 - 97	0211
7	Stem	79227	BV5C27	0210
8	Washer, Thrust	79227	BV573 - VT	0214
9	Packing	79227	BV5C41 - VT	0212
10	Nut, Lock	79227	BV5BA51	0213
11	Coupling Assembly	64903	05254	0204
12	Coupling	64903	04843	0205
13	Pin, Spring	96906	MS171560	0207
14	U - Joint	64903	04844	0206

Figure No. A4-7. Title BALL VALVE ASSEMBLY

1 of 1 Sheet 1 of 1

A4-22 Writer's initials BL

OED-731 (4/76)

Figure A4-7. BALL VALVE ASSEMBLY (Sheet 1 of 1)

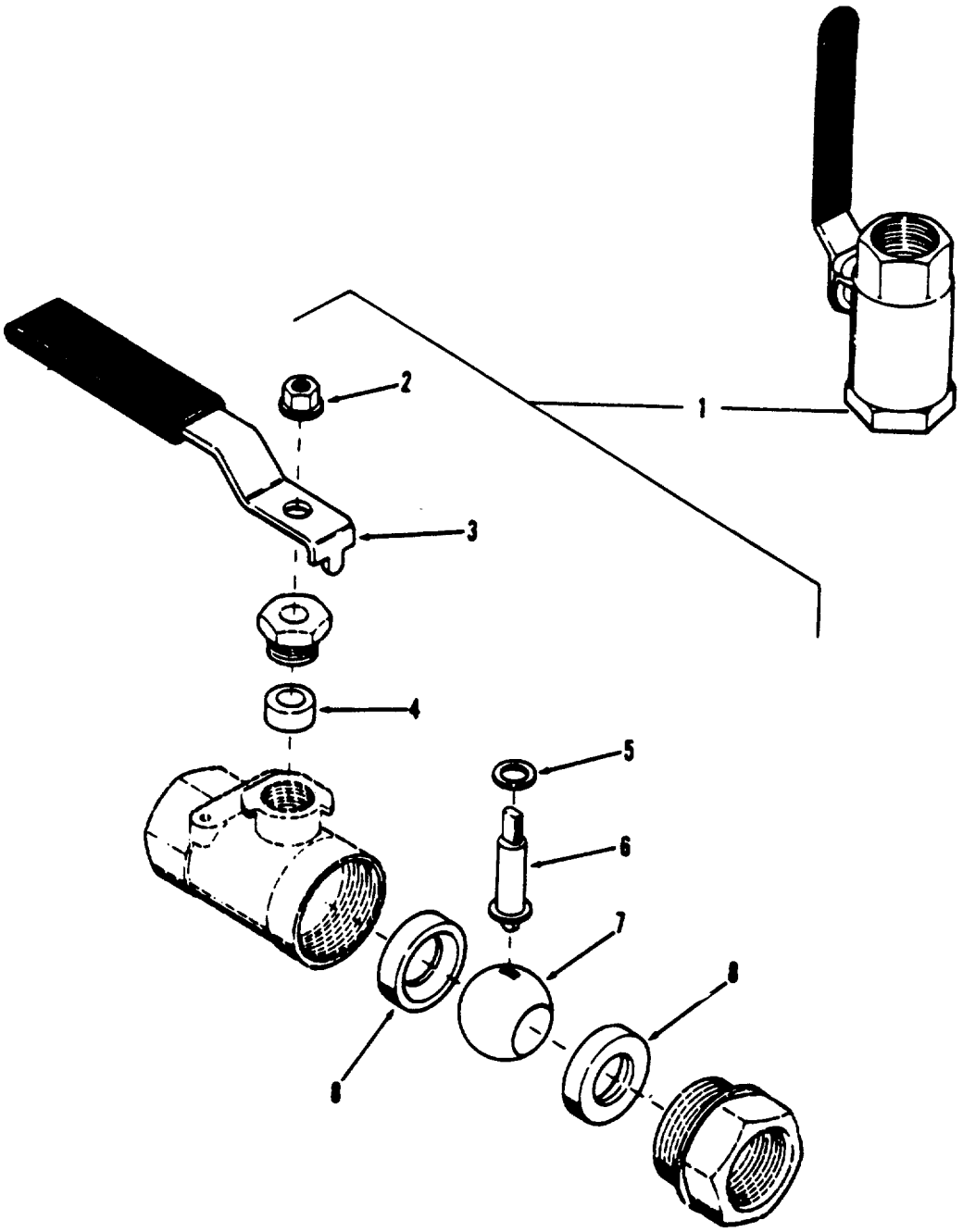

Figure A4- 8

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve, Ball	79227	B6400 - ½	0217
2	Nut, Lock	79227	BV5AA51	0224
3	Handle	79227	SAB4A54 - 2	0222
4	Packing	79227	BV4A41 - VT	0221
5	Washer, Thrust	79227	BV4A73 - VT	0223
6	Stem	79227	BV4A	0220
7	Ball	79227	BV4A6	0218
8	Seat	79227	BV4A16-DFP	0219

Figure No. A4-8. Title BALL VALVE

1 of 1 Sheet 1 of 1

A4-24 Writer's initials BL

OED-731 (4/76)

Figure A4-8. BALL VALVE (Sheet 1 of 1)

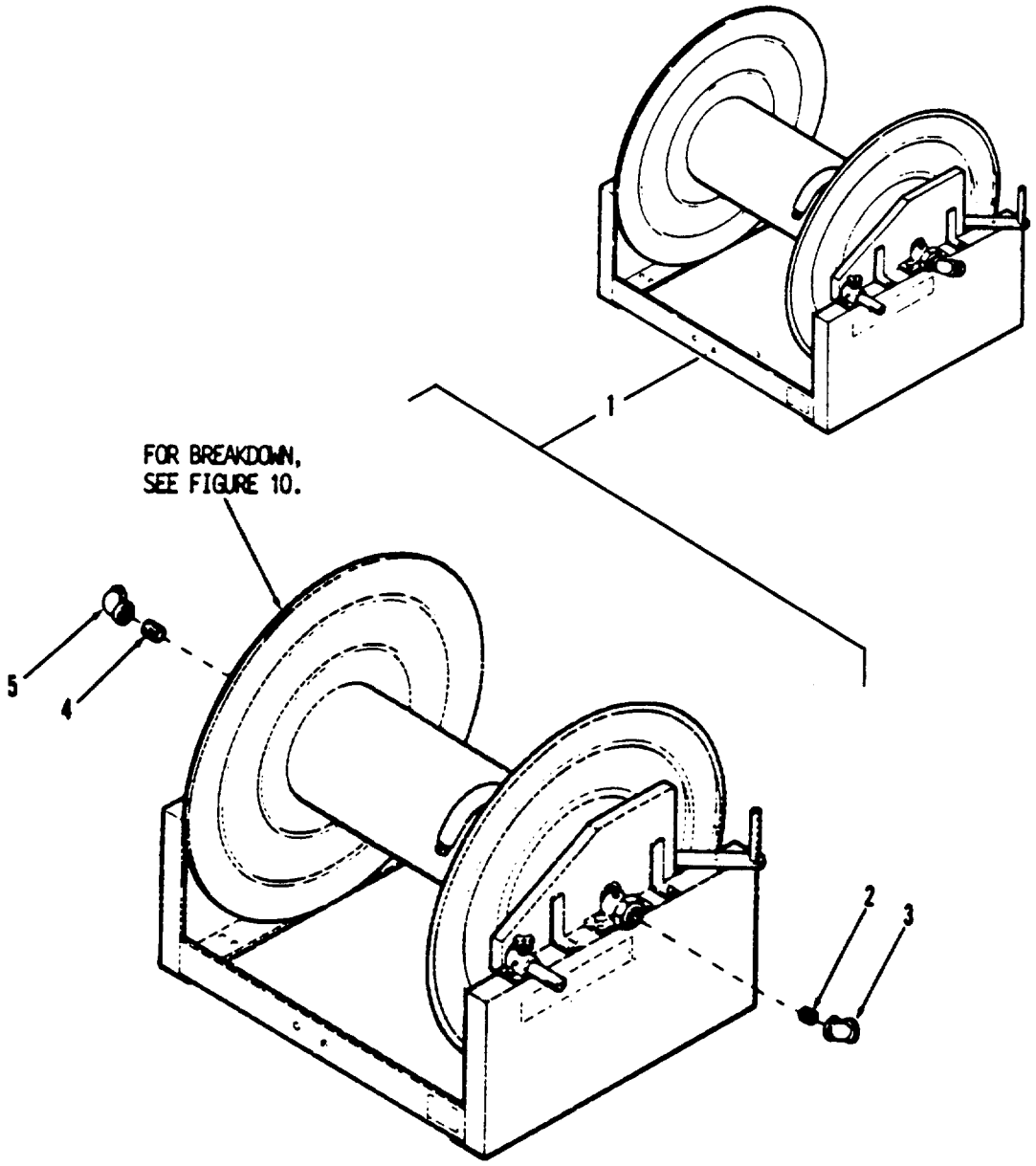

Figure A4-9

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Reel Assembly, Hose	64903	05050	0235
2	Nipple	64903	02436 - SH	0236
3	Elbow, 90°	96906	MS14311 - 6P	0237
4	Nipple	64903	02406 - SH	0238
5	Elbow, 90°	82666	FIG601-1-1/4	0239

Figure No. A4-9 Title HOSE REEL ASSEMBLY

1 of 1 Sheet 1 of 1

A4-26 Writer's initials BL

OED-731 (4/76)

Figure A4-9. HOSE REEL ASSEMBLY (Sheet 1 of 1)

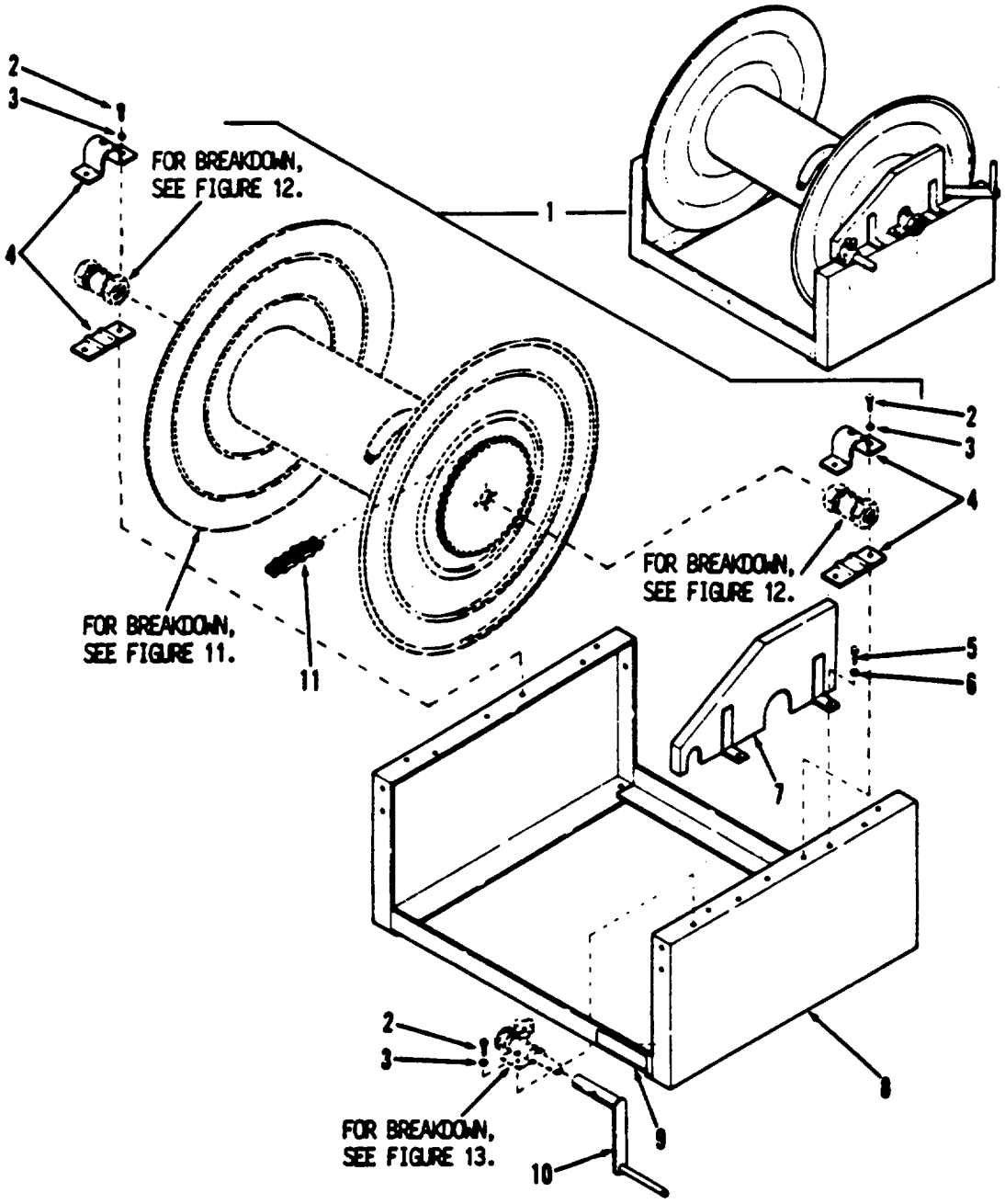
2
3
1
FOR BREAKDOWN,
SEE FIGURE 12.
4
1
1
2
3
4
FOR BREAKDOWN,
SEE FIGURE 12.
FOR BREAKDOWN,
SEE FIGURE 11.
11
5
6
7
2
3
FOR BREAKDOWN,
SEE FIGURE 13.
8
9
10

Figure A4-10

PL No.	APPENDIX A		Date	
Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Reel, Hose	66477	C - 0 - 1000	0240
2	Screw	96906	MS35307 - 360	0241
3	Washer, Lock	96906	MS35338 - 141	0242
4	Closure, Bearing	66477	A - 0 - 1180	0248
5	Screw	96906	MS35307 - 308	0246
6	Washer, Lock	96906	MS35338 - 139	0247
7	Guard	66477	B - 0 - 1189	0250
8	Frame	66477	B - 0 - 1181	0252
9	Plate, Name	66477	A - 0 - 1213	0251
10	Crank	66477	B - 0 - 1069	0253
11	Chain, Roller	66477	A - 0 - 1183	0249
Figure No. A4-10.	Title HOSE REEL ASSEMBLY			
1 of 1	Sheet 1 of 1			
A4-28			Writer's initials BL	

OSD-731 (4/78)

Figure A4-10. HOSE REEL ASSEMBLY (Sheet 1 of 1)

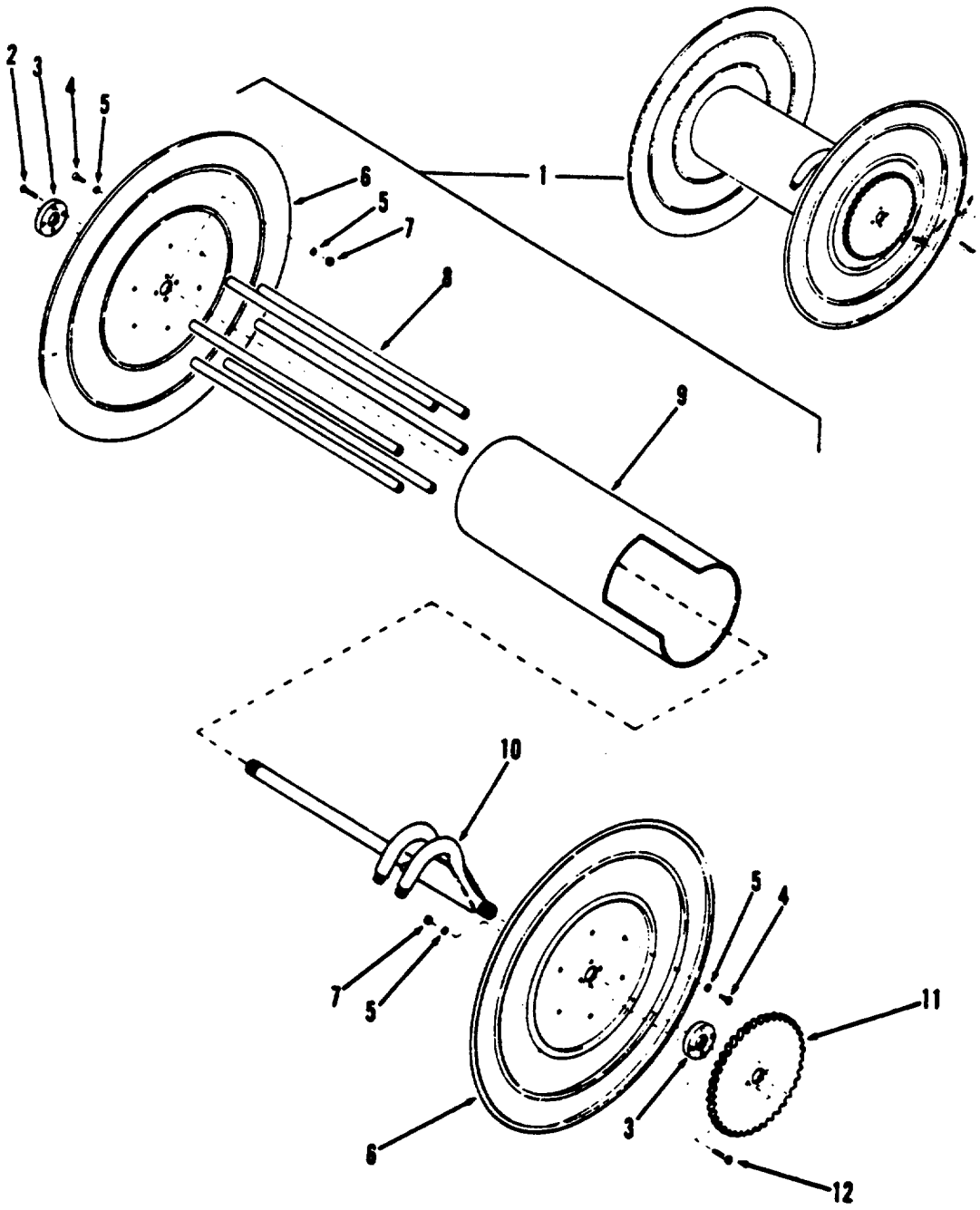

Figure A4-11

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Drum Assembly	66477	B - 0 - 1182	0254
2	Screw	66477	A - 0 - 1104	0257
3	Flange	66477	B - 0 - 1010	0256
4	Screw	66477	A - 0 - 1102	0265
5	Washer, Lock	96906	MS35338 - 46	0259
6	Disc	66477	B - 0 - 1056	0264
7	Nut	96906	MS51967 - 8	0260
8	Spacer	66477	B - 0 - 1011	0263
9	Drum	66477	B - 0 - 1007	0261
10	Tube Assembly	66477	B - 0 - 1002	0262
11	Sprocket	66477	B - 0 - 1034	0255
12	Screw	66477	A - 0 - 1106	0258

Figure No. A4-11. Title DRUM ASSEMBLY

1 of 1 Sheet 1 of 1

A4-30 Writer's initials BL

DED-731 (6/76)

Figure A4-11. DRUM ASSEMBLY (Sheet 1 of 1)

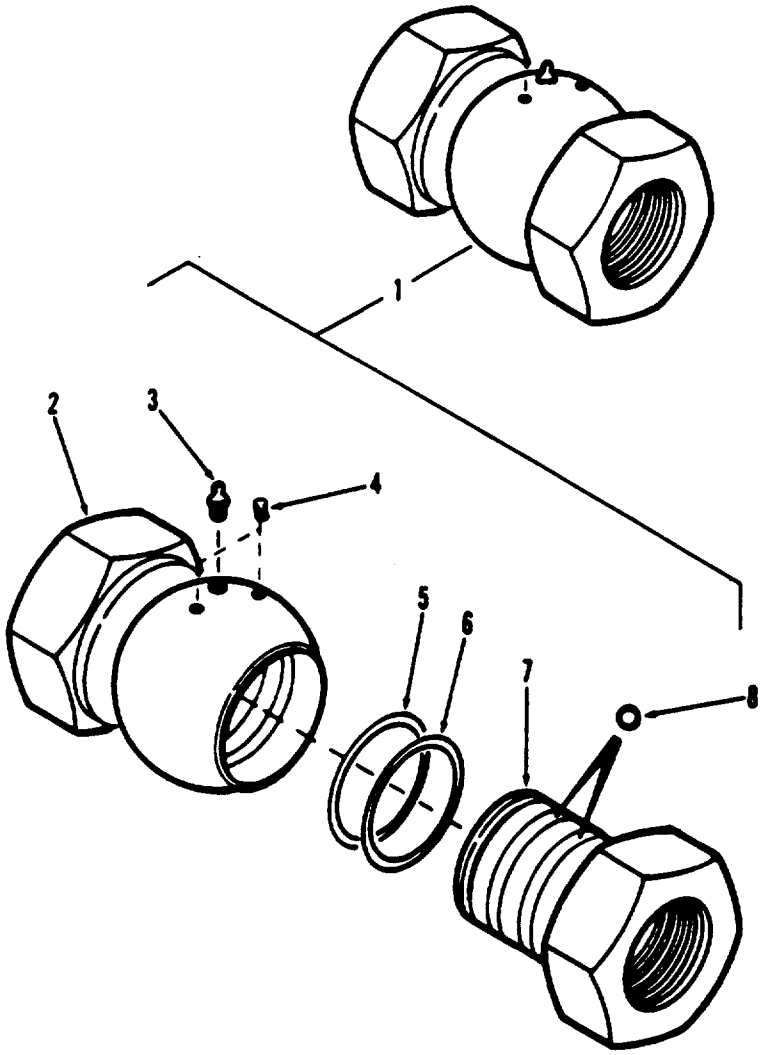

Figure A4-12

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Joint Assembly, Swivel	66477	B - 0 - 1020	0267
2	Joint Assembly, Female	66477	B - 0 - 1022	0268
3	Fitting, Grease	96906	MS15001 - 1	0270
4	Screw, Set	66477	A - 0 - 1027	0274
5	Ring, Quad	66477	A - 0 - 1028	0271
6	Ring, Quad	66477	A - 0 - 1029	0272
7	Joint Assembly, Male	66477	B - 0 - 1021	0269
8	Ball, Steel	66477	A - 0 - 1023	0273
9	Kit, Seal	66477	A - 0 - 1206	0275

Figure No. A4-12. Title SWIVEL JOINT ASSEMBLY

1 of 1 Sheet 1 of 1

A4-32 Writer's initials BL

GSD-731 (4/79)

Figure A4-12. SWIVEL JOINT ASSEMBLY (Sheet 1 of 1)

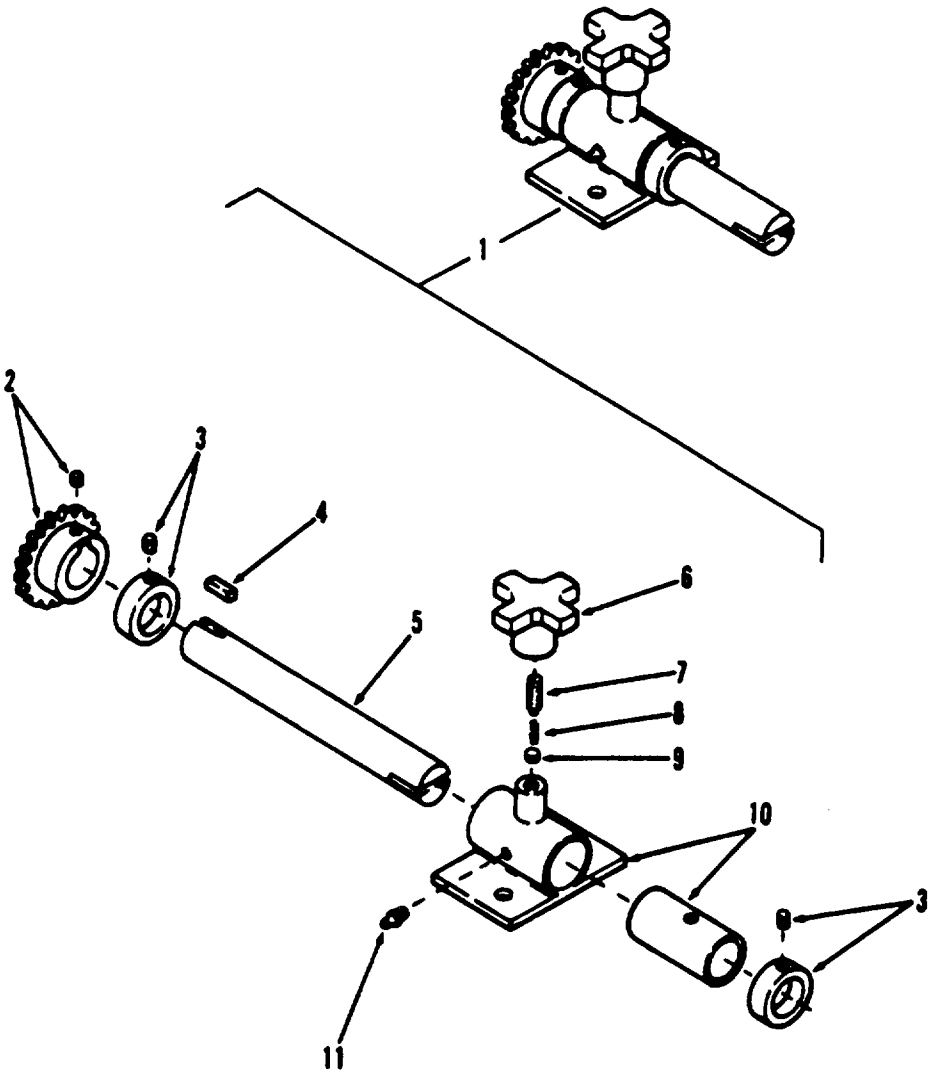

Figure A4-13

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Brg & Brake, Drive	66477	B - 0 -1087	0280
2	Sprocket	66477	B - 0 -1033	0281
3	Collar	66477	B - 0 - 1045	0283
4	Key	66477	A - 0 - 1048	0282
5	Shaft	66477	B - 0 - 1072	0289
6	Knob	66477	A - 0 - 1090	0284
7	Stud	66477	B - 0 - 1019	0285
8	Spring	66477	A - 0 - 1214	0286
9	Disc	66477	A - 0 - 1043	0287
10	Bearing, Drive	66477	B - 0 - 1038	0289A
11	Fitting, Grease	96096	MS51967 - 8	0288

Figure No. A4-13. Title DRIVE BRG & BRAKE

1 of 1 Sheet 1 of 1

A4-34

Writer's initials BL

DSD-731 (6/78)

Figure A4-13. DRIVE BRG & BRAKE (Sheet 1 of 1)

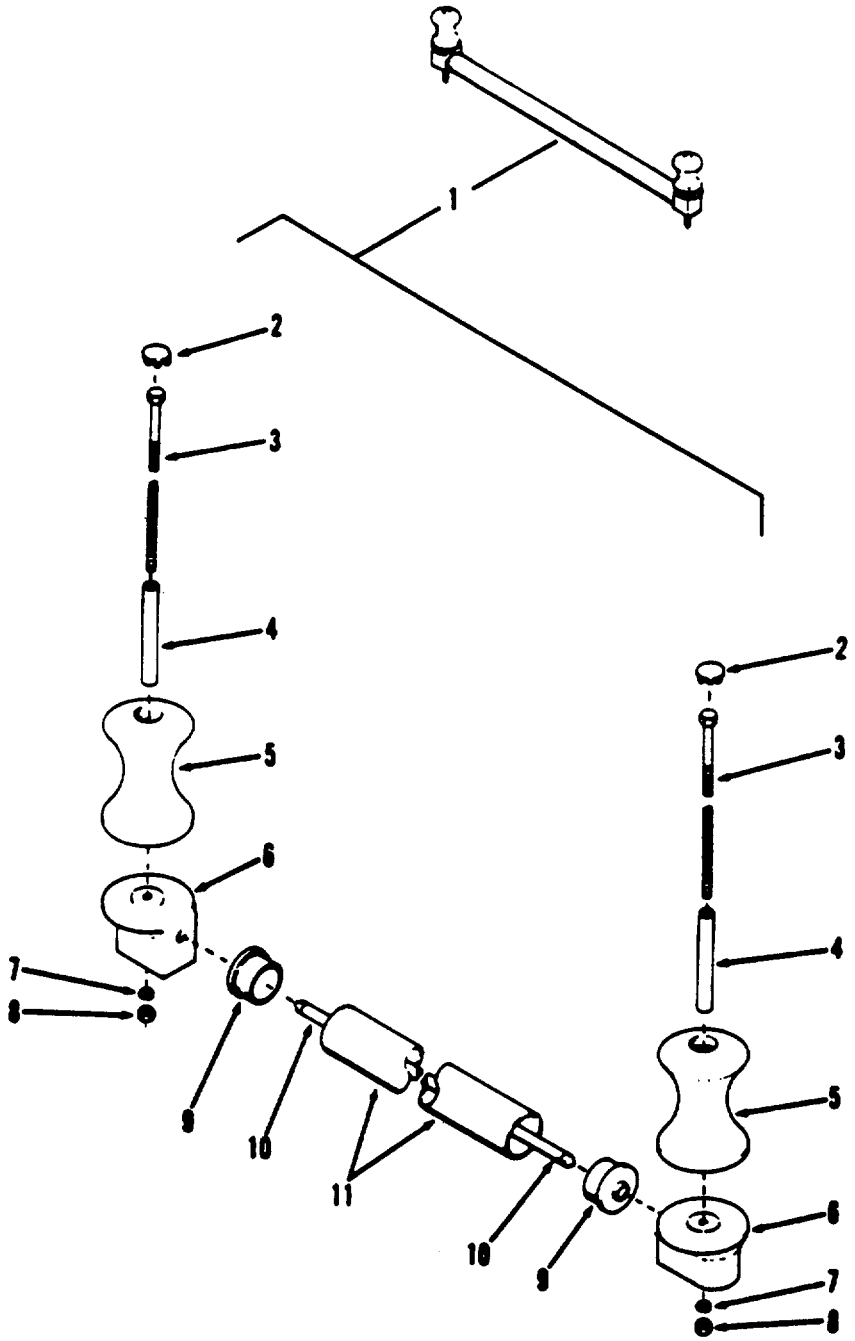

Figure A4-14

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Roller Assembly, Hose	64903	05046	0290
2	Plug, Hole	64903	05292	0300
3	Screw	96906	MS90725 - 400	0294
4	Bushing	64903	05095	0293
5	Spool	64903	05135	0292
6	Pedestal	64903	05136	0291
7	Washer, Lock	96906	MS35338 - 143	0295
8	Nut	96906	MS51971 - 5	0296
9	Bearing	71041	571021616D-1/2	0298
10	Axle, Roller	64903	05042 - 26.75	0297
11	Tube, Roller	64903	05291	0299

Figure No. A4-14. Title HOSE ROLLER ASSEMBLY

1 of 1 Sheet 1 of 1

A4-36 Writer's initials BL

OSD-721 (6/78)

Figure A4-14. HOSE ROLLER ASSEMBLY (Sheet 1 of 1)

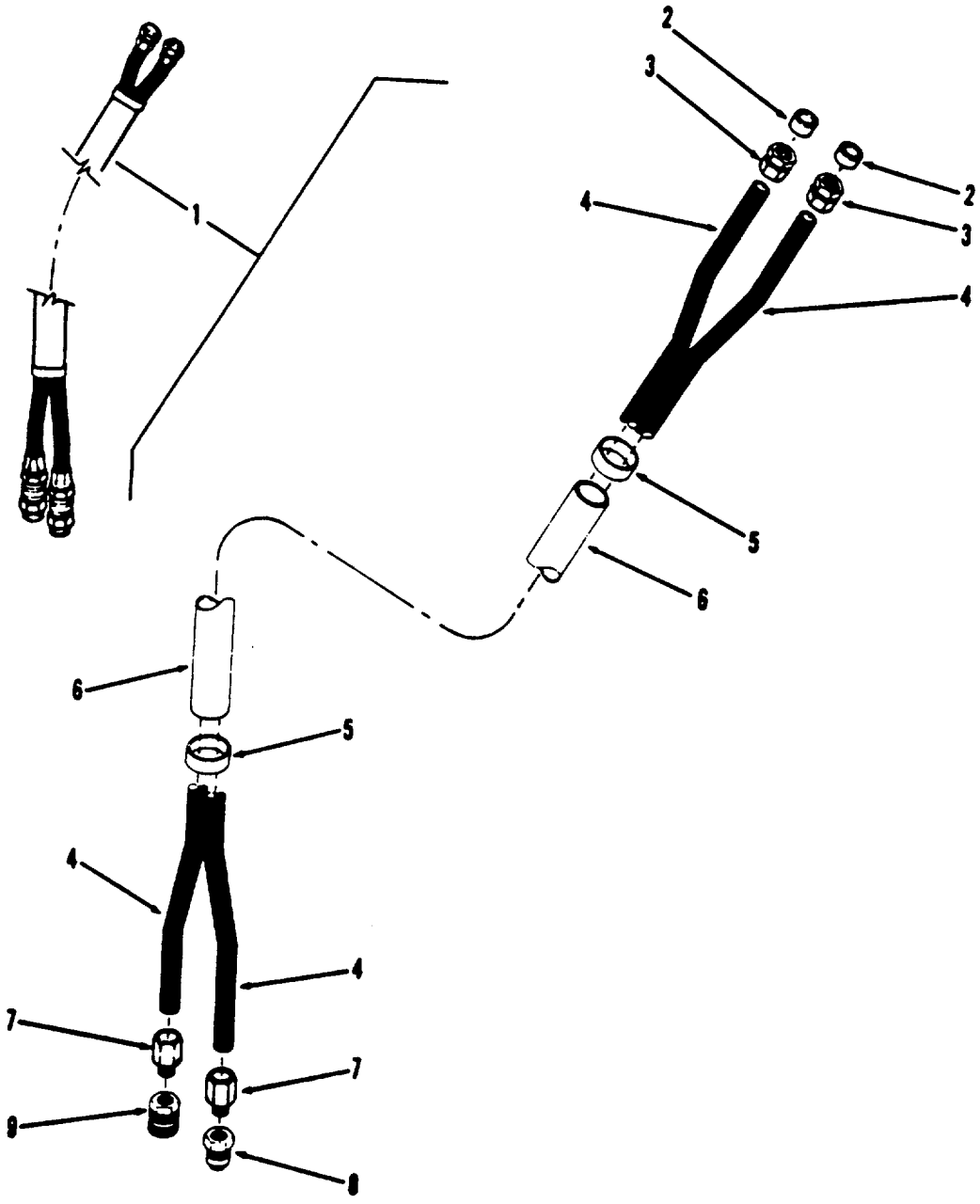

Figure A4-15

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Hose Assembly	64903	04965	0301
2	Gasket	64903	05138	0307
3	Fitting, Female Hose	64903	04963	0303
4	Hose	73002	7265 - 1002	0302
5	Band, Retainer	64903	04962	0306
6	Jacket, Hose	64903	02386-150	0305
7	Fitting, Male Hose	64903	04964	0304
8	Q. D. Nipple	97111	BST - N8	0309
9	Q. D. Coupler	97111	BST - 8	0308

Figure No. A4-15. Title TWIN AGENT HOSE ASSEMBLY

1 of 1 Sheet 1 of 1

A4-38 Writer's initials BI

DED-731 (4/79)

Figure A4-15. TWIN AGENT HOSE ASSEMBLY (Sheet 1 of 1)

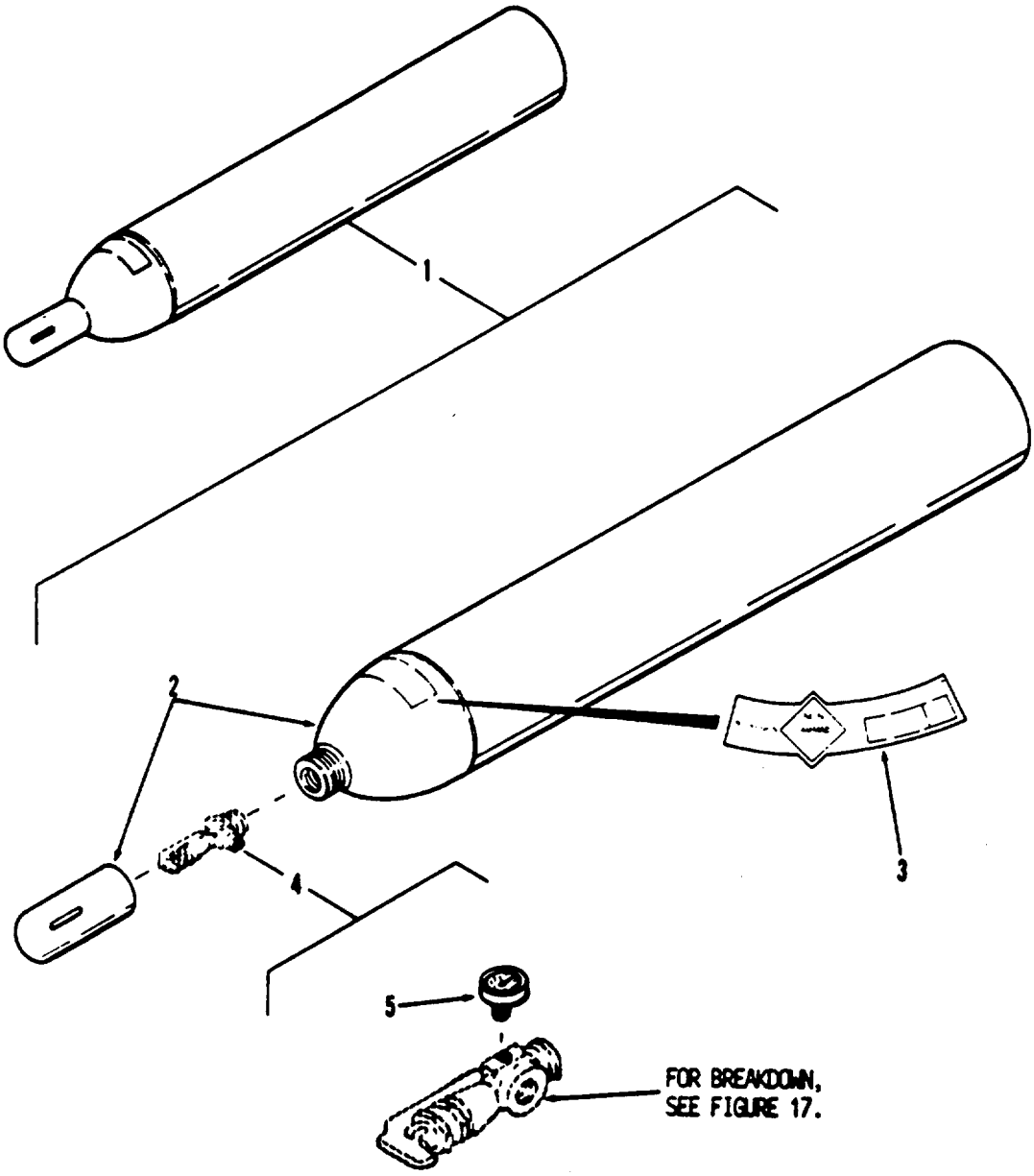

Figure A4-16

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Cylinder Assembly, N_2	64903	05274	0310
2	Cylinder, N_2	64903	04514	0312
3	Sticker	64903	05131	0311
4	Valve Assembly, N_2	64903	04630	0313
5	Gage	61610	M30R	0314

Figure No.	Title
A4-16	N_2 CYLINDER ASSEMBLY
1 of 1	Sheet 1 of 1
A4-40	Writer's initials BL

OSD-731 (4/76)

Figure A4-16. N_2 CYLINDER ASSEMBLY (Sheet 1 of 1)

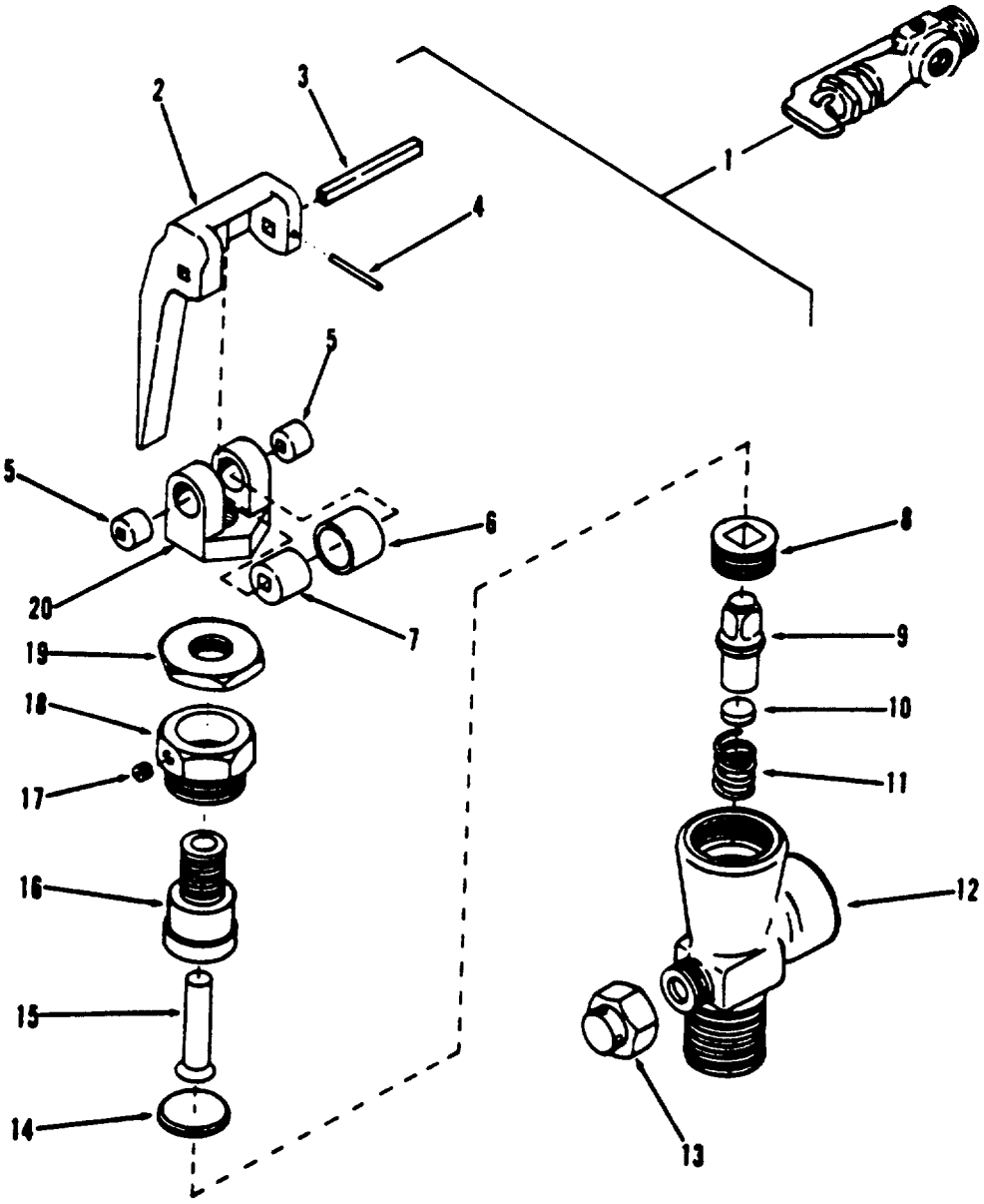

Figure A4-17

LEGEND SHEET

APPENDIX A

PL No

Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve Assembly, N_2	64903	0444.1	0315
2	Handle	64903	04403	0316
3	Pin	58553	P5898-16	0317
4	Pin, Spring	96906	MS9048-015	0318
5	Bushing	58553	P5898-10	0321
6	Roller	58553	P5898-12	0319
7	Cam	58553	P5898-13	0320
8	Ret., Seat Holder	58553	P1250-4	0329
9	Holder, Seat	58553	P1250A-10	0330
10	Seat	58553	P1250-18N	0331
11	Spring	58553	P1250-11	0332
12	Body, Valve	58553	P1250X1-1-580	0333
13	Safety Device	58553	P1200S-25C	0334
14	Diaphragm Set	58553	P5502-6	0328
15	Stem	58553	P5898-7	0327
16	Barrel	58553	P5898-5	0326
17	Screw, Set	96906	MS51963-24	0325
18	Nut, Retainer	58553	P5898-3	0324
19	Locknut	58553	P5898-14	0323
20	Bracket, Handle	58553	P5898-15	0322

Figure No. A4-17

Title N_2 VALVE ASSEMBLY

1 of 1

Sheet 1 of 1

A4-42

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OED-731 (4/78)

Figure No. A4-17 A4-42

APPENDIX A

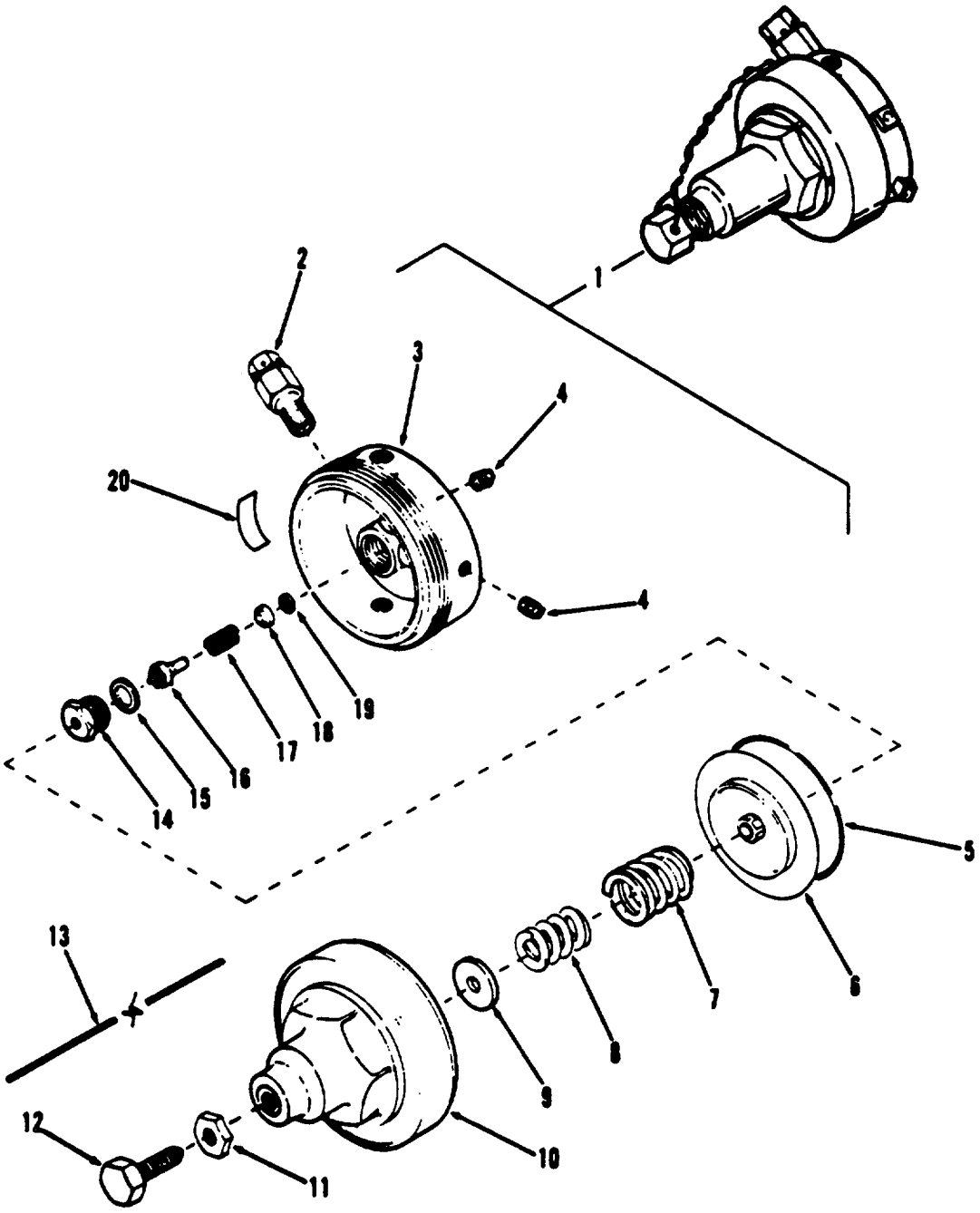


Figure A4-18

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Regulator	64903	04652	0337
2	Valve, Safety	63026	0600 - 0018	0351
3	Body	63026	0701 - 0202	0345
4	Plug, Pipe	63026	1105 - 0007	0338
5	Ring, Diaphragm Slip	63026	1407 - 0187	0344
6	Diaphragm Assembly	63026	0730 - 0030	0343
7	Spring, Adj. Outer	63026	0761-0086	00357
8	Spring, Adj. Inner	63026	0761 - 0085	0356
9	Button, Spring	63026	0706 - 0005	0341
10	Cap, Housing	63026	0720 - 0052	0340
11	Nut, Lock	63026	1409 - 0035	0342
12	Screw, Adjusting	63026	0750 - 0050	0339
13	Seal, Wire	1T149	MS20995-C-032	0360
14	Nozzle	63026	0702 - 0054	0346
15	Gasket, Nozzle	63026	1408-0086	0347
16	Seat Assembly	63026	0740 - 0131	0349
17	Spring, Valve	63026	0762 - 0006	0348
18	Gland	63026	0708 - 0003	0350
19	Washer, Friction	63026	1408 - 0033	0358
20	Decal	63026	0707 - 0142	0359

Figure No. A4-18. Title AFFF REGULATOR

1 of 1 Sheet 1 of 1

A4-44

Writer's initials BI

DSD-731 (6/78)

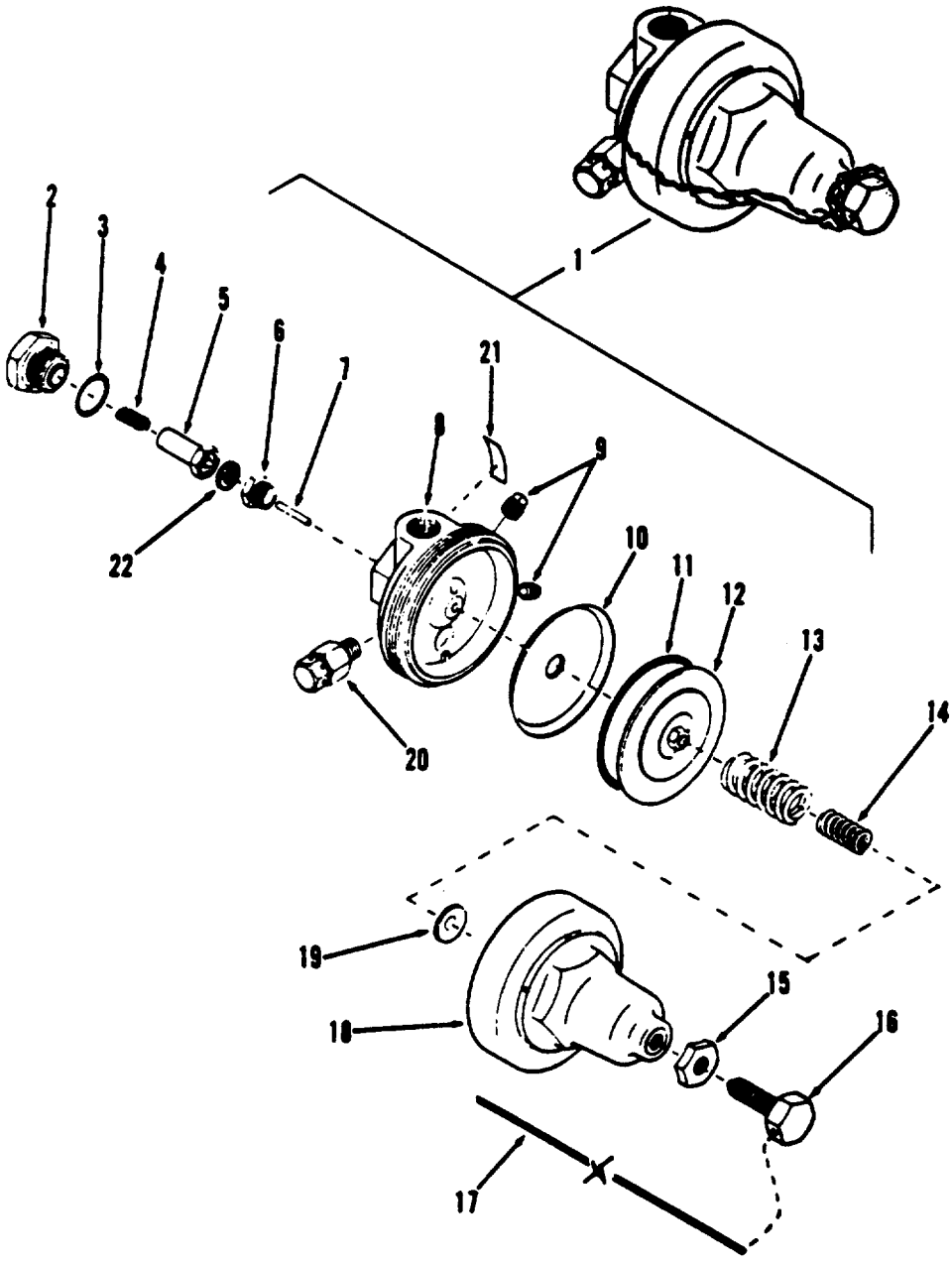


Figure A4-19

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Regulator	64903	04695	0361
2	Plug, Back	63026	0799 - 1110	0366
3	O - Ring	63026	1407 - 0018	0367
4	Spring, Valve	63026	0762 - 0037	0368
5	Seat Assembly	63026	0799 - 1112	0365
6	Nozzle	63026	0799 - 0104	0371
7	Extension, Stem	63026	0744 -0006	0364
8	Body	63026	0701 - 0173	0372
9	Plug, Pipe	63026	1105 - 0007	0377
10	Deflector	63026	0799 - 1111	0369
11	Ring, Diaphragm Slip	63026	1407 - 0187	0376
12	Diaphragm Assembly	63026	0730 - 0004	0363
13	Spring, Adj. Outer	63026	0761 - 0086	0379
14	Spring, Adj. Inner	63026	0761 - 0085	0380
15	Nut, Lock	63026	1409 - 0035	0378
16	Screw, Adjusting	63026	0750 - 0050	0362
17	Seal, Wire	1T149	MS20995-C-032	0382
18	Cap, Housing, Spring	63026	0720 - 0052	0373
19	Button, Spring	63026	0706 - 0005	0374
20	Valve, Safety	63026	0600 - 0018	0375
21	Decal	63026	0707 - 0142	0381
22	Gasket	63026	1408-0101	0370

Figure No. A4-19 Title DRY CHEMICAL REGULATOR

1 of 1 Sheet 1 of 1

A4-46

Writer's initials BL

DSD-731 (4/78)

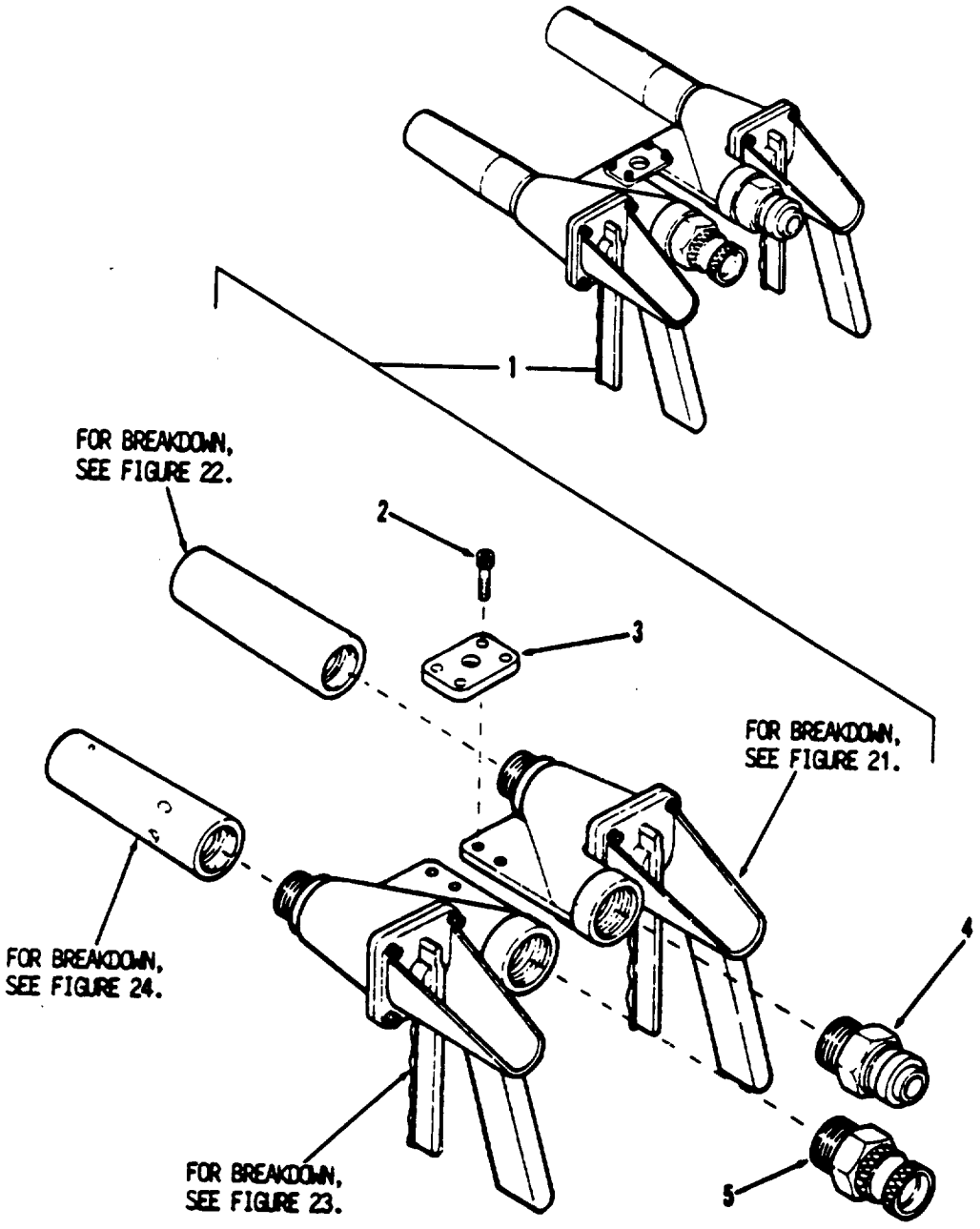

1
FOR BREAKDOWN, SEE FIGURE 22.
2
3
FOR BREAKDOWN, SEE FIGURE 21.
FOR BREAKDOWN, SEE FIGURE 24.
4
FOR BREAKDOWN, SEE FIGURE 23.
5

Figure A4-20

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Nozzle Assembly, Agent	64903	05000	0383
2	Screw	96906	MS16995-50	0384
3	Plate, Retaining	64903	01637	0383A
4	Nipple	97111	BST - N8M	0385
5	Coupler	97111	BST - 8M	0386

Figure No. A4-20 Title AGENT NOZZLE ASSEMBLY

1 of 1 Sheet 1 of 1

A4-48

Writer's initials BL

DSD-731 (6/79)

Figure No. A4-20 A4-48

APPENDIX A

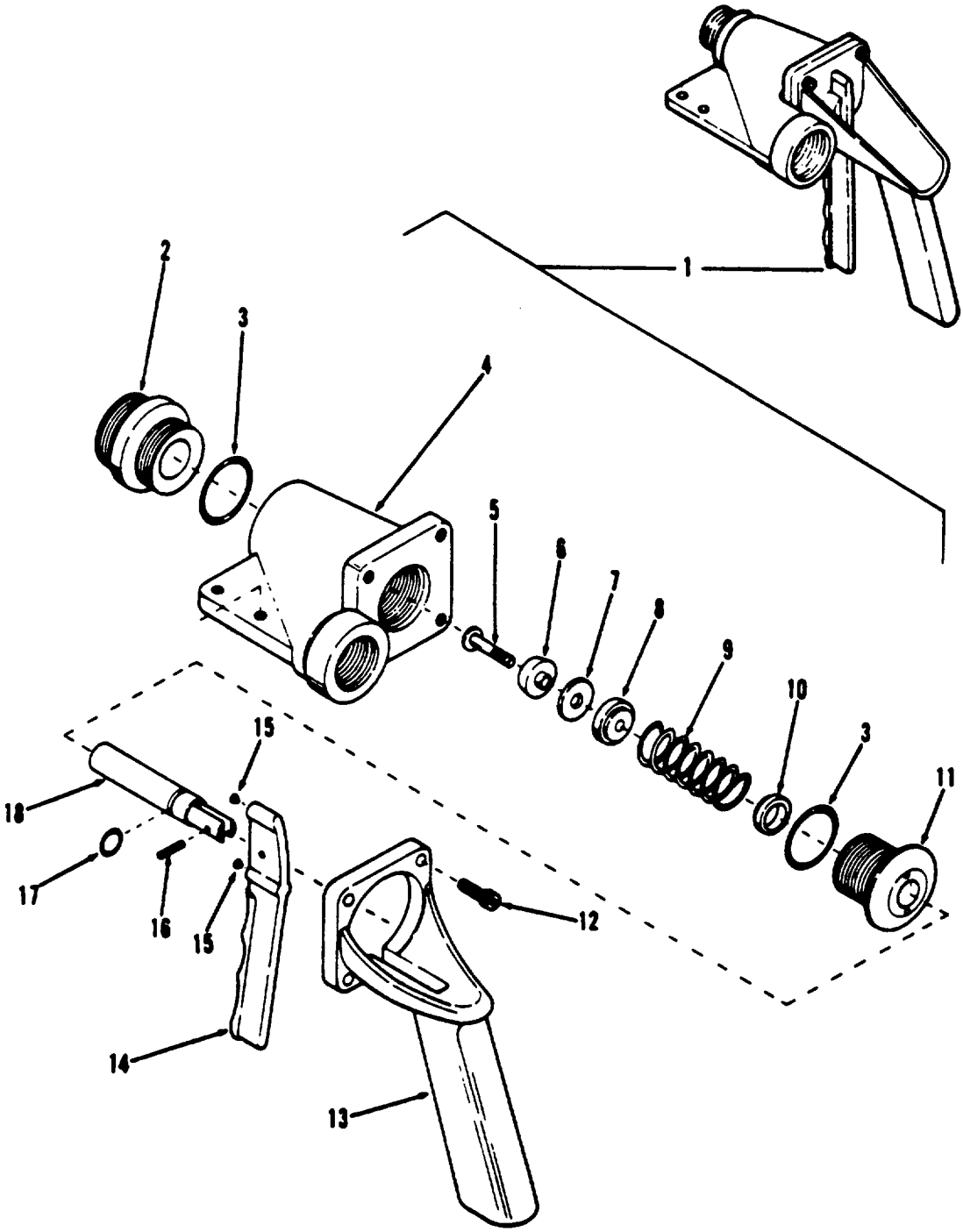


Figure A4-21

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve, Dry Chemical	64903	05157	0387
2	Seat, Forward	64903	01531	0392
3	O - Ring	07322	8218	0399
4	Body	64903	01533	0390
5	Screw	96906	MS51957 - 83	0394
6	Washer, Seal	64903	01587	0395
7	Seal	64903	01519	0396
8	Retainer, Spring	64903	01508	0397
9	Spring, Compression	64903	01536	0404
10	Wiper, Rod	02697	D-625	0398
11	Seal, Rear	64903	01532	0391
12	Screw	96906	MS16995 - 50	0403
13	Handle	64903	01534	0389
14	Lever	64903	01535	0388
15	Button, Drive	23050	817386	0401
16	Pin, Spring	96906	MS171588	0402
17	O - Ring	07322	8111	0400
18	Stem	64903	05161	0393

Figure No. A4-21. Title DRY CHEMICAL VALVE

1 of 1 Sheet 1 of 1

A4-50

Writer's initials BL

GED-731 (4/79)

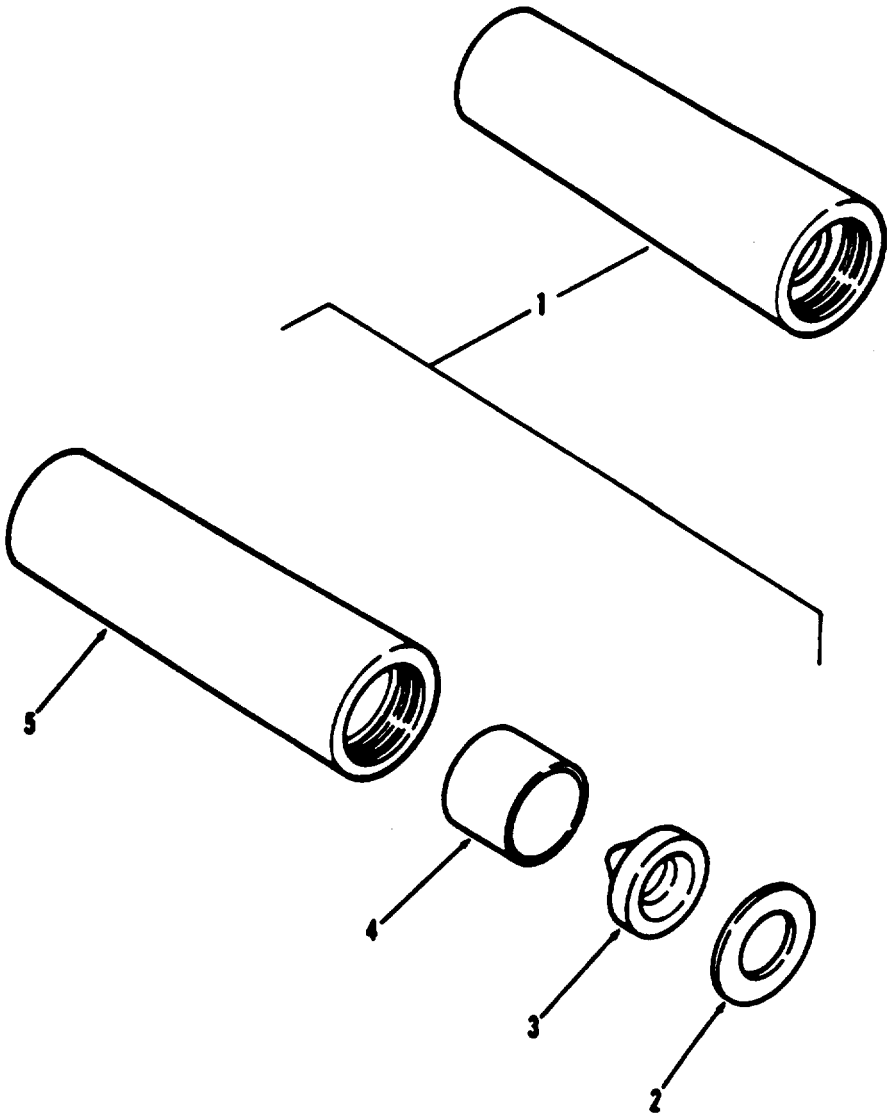


Figure A4-22

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Nozzle, Dry Chemical	64903	01706	0405
2	Gasket	64903	01609	0406
3	Tip, Nozzle	64903	01625	0409
4	Sleeve	64903	01634	0408
5	Barrel, Nozzle	64903	01610	0407

Figure No. A4-22 Title DRY CHEMICAL NOZZLE

1 of 1 Sheet 1 of 1

A4-52 Writer's initials BI

DED-731 (4/79)

Figure No. A4-22 A4-52

APPENDIX A

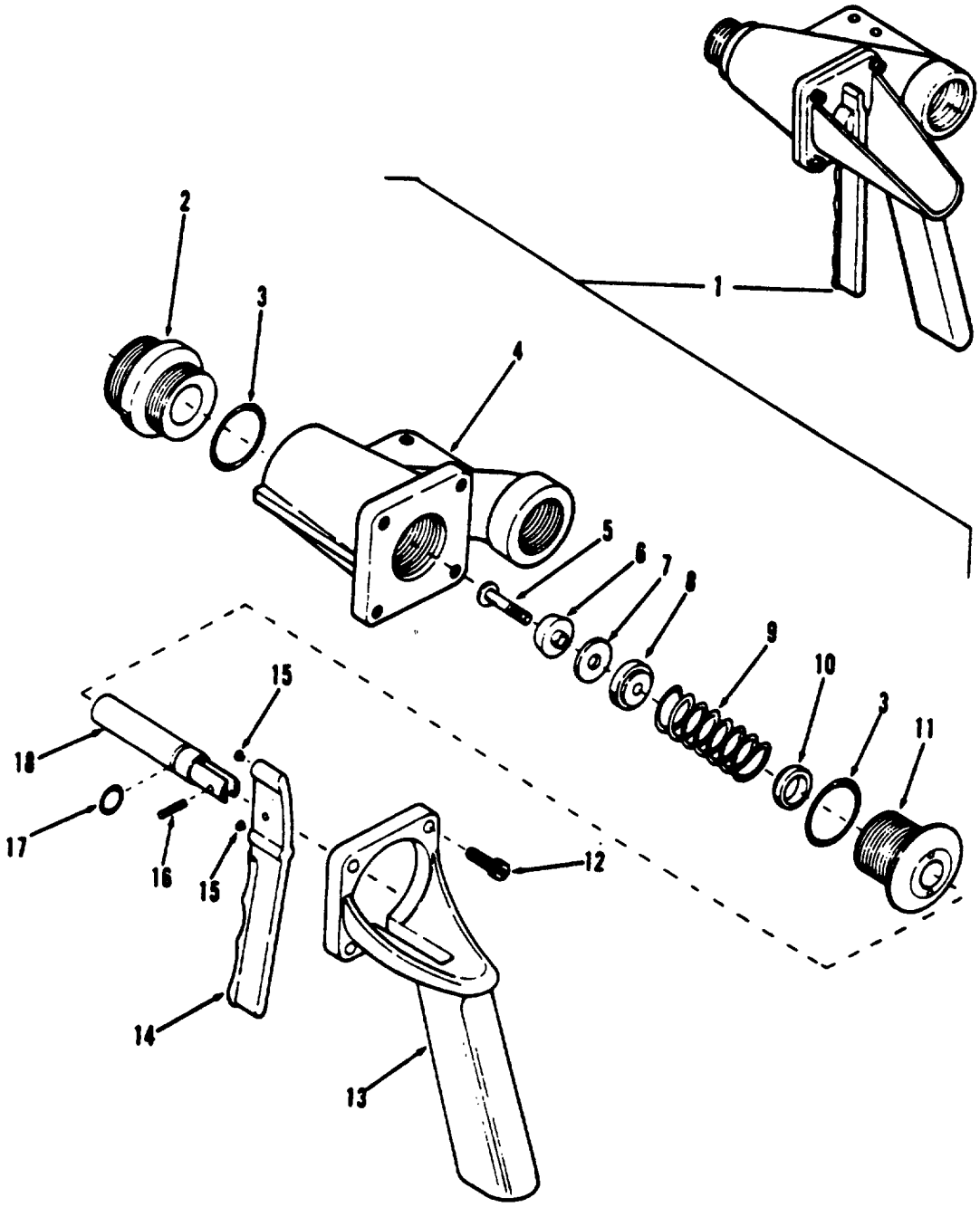


Figure A4-23

APPENDIX A

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve Assembly, AFFF	64903	05158	0410
2	Seat, Forward	64903	01531	0415
3	O - Ring	07322	8218	0422
4	Body	64903	01533	0413
5	Screw	96906	MS51957 - 83	0417
6	Washer, Seal	64903	01587	0418
7	Seal	64903	01519	0419
8	Retainer, Spring	64903	01508	0420
9	Spring, Compression	64903	01536	0427
10	Wiper, Rod	02697	D - 625	0421
11	Seal, Rear	64903	01532	0414
12	Screw	96906	MS16995 - 50	0426
13	Handle	64903	01534	0412
14	Lever	64903	01535	0411
15	Button, Drive	23050	817386	0424
16	Pin, Spring	96906	MS171588	0425
17	O - Ring	07322	8111	0423
18	Stem	64903	05161	0416

Figure No. A4-23 Title AFFF VALVE ASSEMBLY

1 of 1 Sheet 1 of 1

A4-54 Writer's initials BL

DSD-731 (4/79)

Figure No. A4-23 A4-54

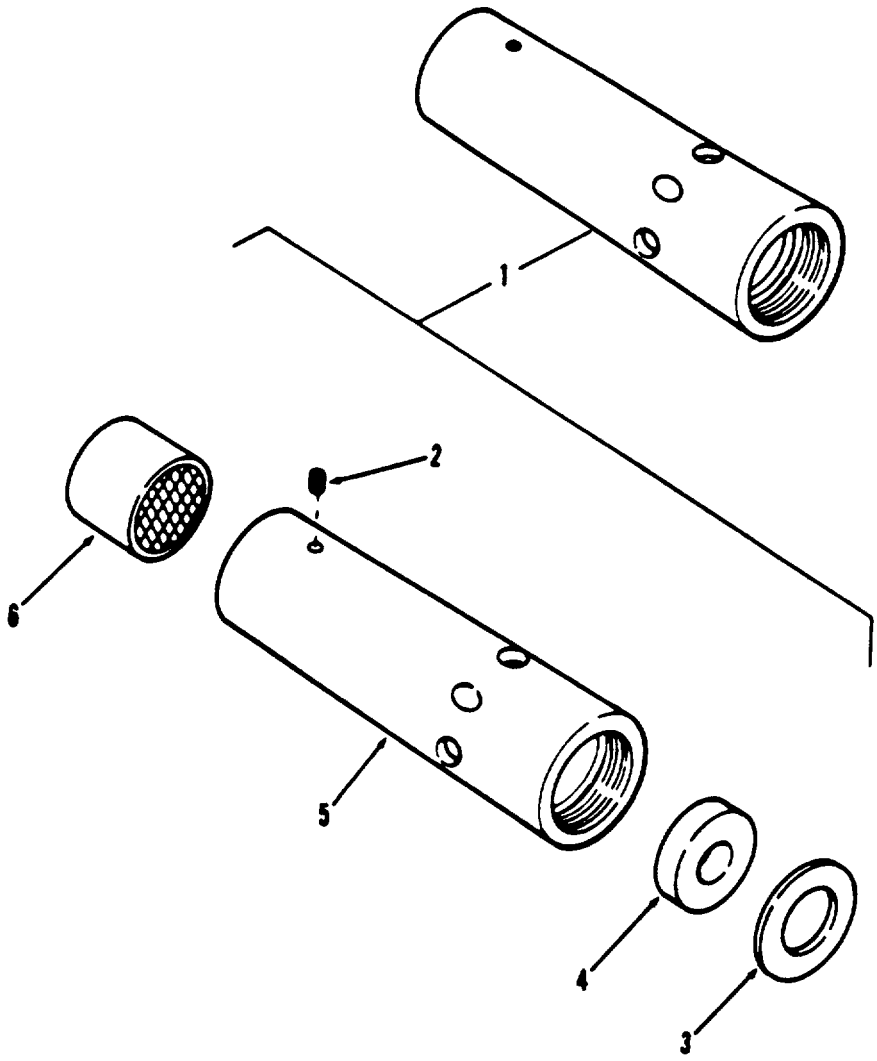


Figure A4-24

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Nozzle, AFFF	64903	05137	0428
2	Screw, Set	96906	MS51963 - 46	0433
3	Gasket	64903	01609	0432
4	Plate, Orifice	64903	05154	0431
5	Barrel, Nozzle	64903	05148	0429
6	Screen	64903	05149	0430

Figure No. A4-24 Title AFFF NOZZLE

1 of 1 Sheet 1 of 1

A4-56 Writer's initials BL

OSD-731 (4/79)

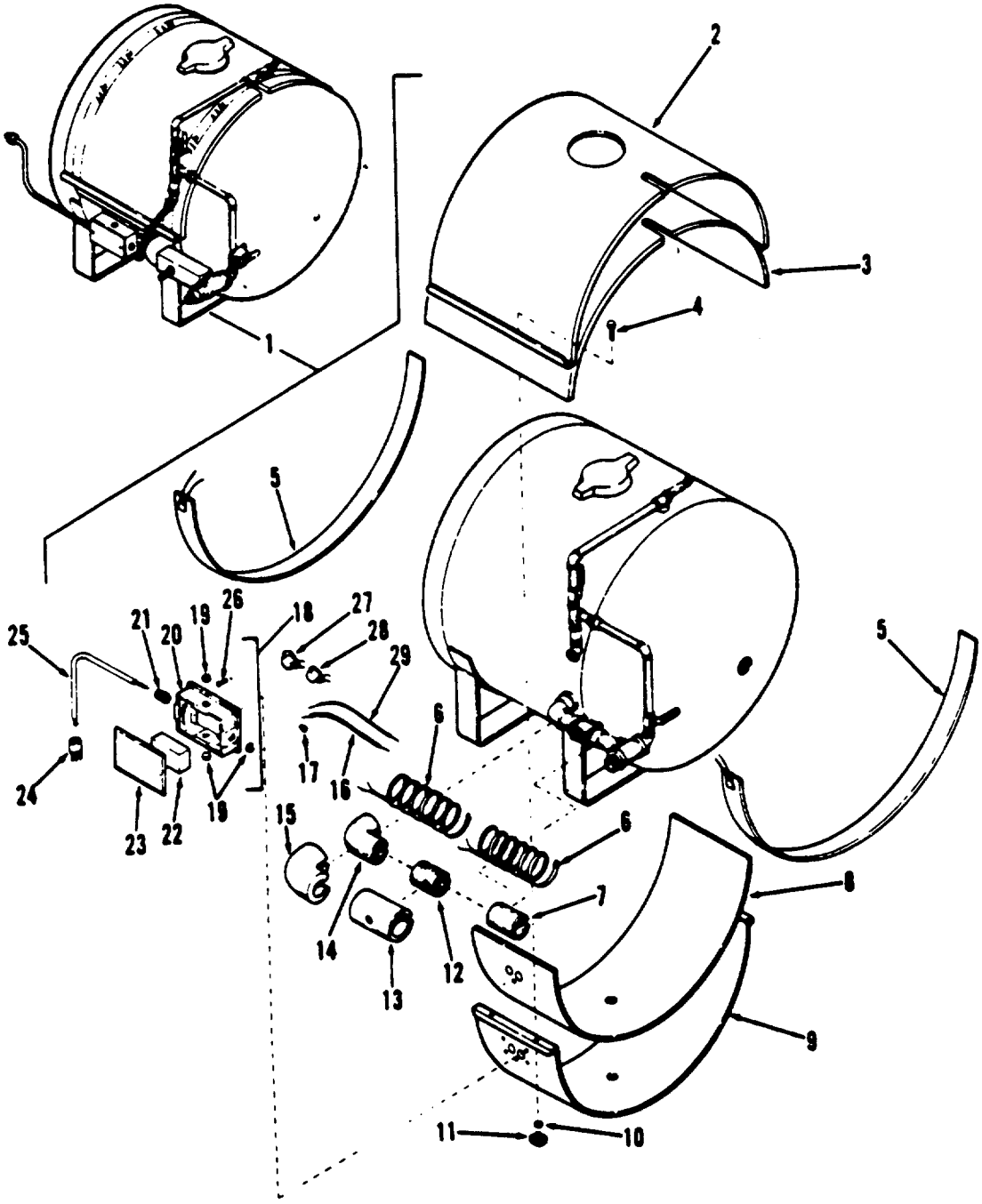


Figure A4-25

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Heater Assembly, AFFF	64903	05189	0434
2	Wrapper, Insulation	64903	05142	0437
3	Blanket, Insulation	64903	05120	0442
4	Screw	96906	MS35206 - 271	0438
5	Blanket, Heater	64903	05111	0435
6	Cable, Heating	64903	05198	0460
7	Insulation, Pipe	64903	05194	0445
8	Blanket, Insulation	64903	05188	0441
9	Wrapper, Insulation	64903	05186	0436
10	Washer, Lock	96906	MS35338 - 141	0439
11	Nut, Square	64903	05222	0440
12	Insulation, Valve	64903	05196	0446
13	Protector, Insulation	64903	05209	0447
14	Insulation, Elbow	64903	05121	0443
15	Protector, Insulation	64903	05192	0444
16	Wire, White Jumper	81349	MS5086-5-18-9	0462
17	Splicer, Wire	30119	30 - 073	0463
18	Enclosure Assembly	64903	05246	0449
19	Plug, Knock - Out	08556	388	0451
20	Enclosure	64903	05201	0450
21	Relief, Strain	81992	SHC1017	0452
22	Pad, Rubber	64903	05208	0455
23	Cover	64903	05247	0454
24	Plug, Power	79409	1447	0465
25	Cord, Power	64903	05199 - 18	0464

Figure No. A4-25 Title AFFF HEATER ASSEMBLY

1 of 1 Sheet 1 of 2

A4-58 Writer's initials BL

DSD-721 (4/79)

APPENDIX A

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
26	Screw	96906	MS51957 - 30	0453
27	Thermostat, 45°	81439	27777	0456
28	Thermostat, 75°	81439	27788	0457
29	Wire, Black Jumper	81349	MS5086-5-18-0	0461

Figure No. A4-25 Title AFFF HEATER ASSEMBLY

1 of 1 Sheet 2 of 2

Writer's initials RI

A4-59

DED-731 (4/78)

Figure No. A4-25 A4-59

APPENDIX A

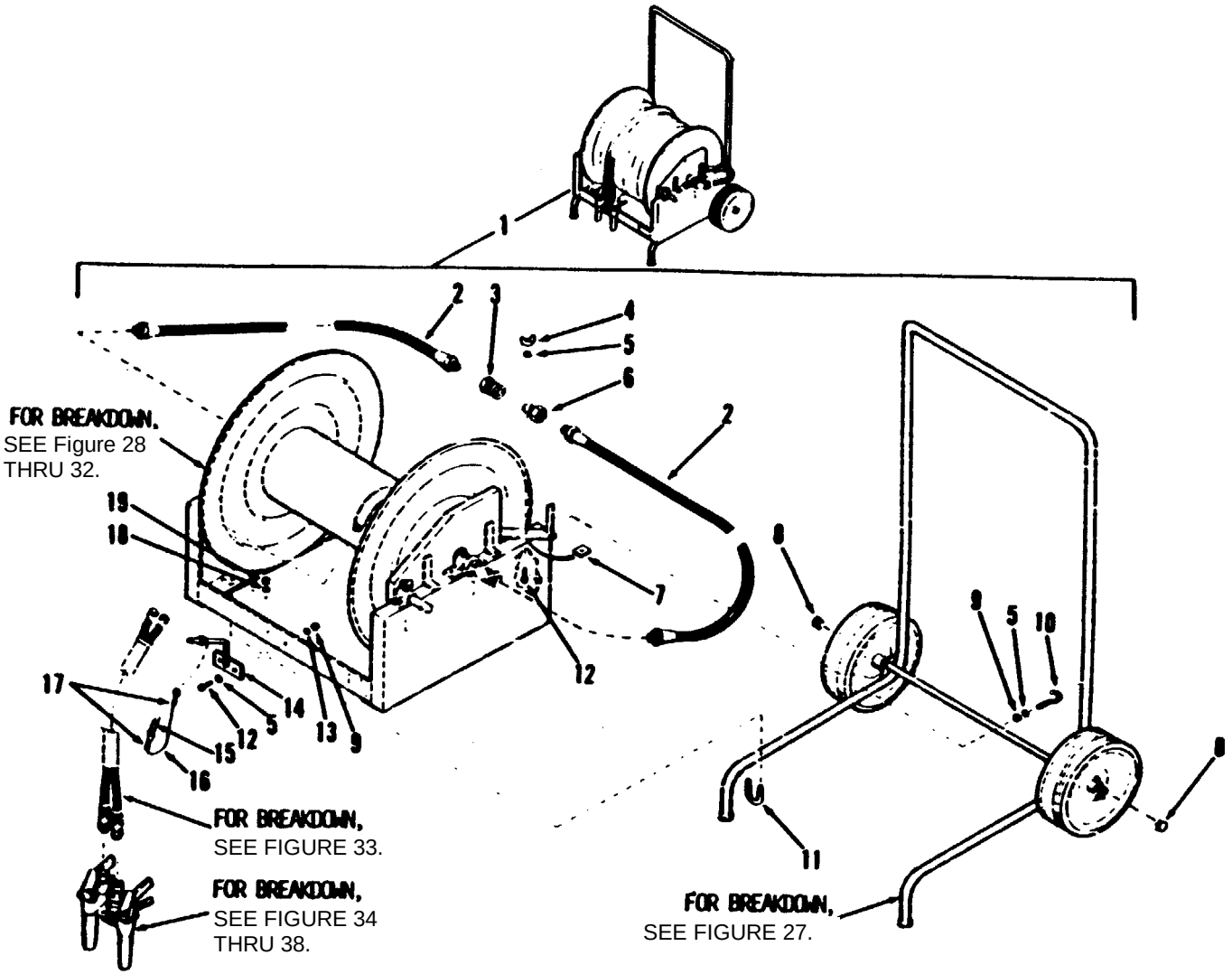


Figure A4-26

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Cart, Auxilary Hose	64903	04955	0466
2	Hose Assembly	64903	05051 - 32.5	0481
3	Coupler	97111	BST - 8	0483
4	Nut, Wing	96906	MS35425 - 42	0469
5	Washer, Flat	96906	MS15795 - 913	0468
6	Nipple	97111	BST - N8	0482
7	Pad, Rubber	64903	05195	0480
8	Cap, Dust	51819	1.375-24	0489
9	Nut, Hex	96906	MS51971 - 3	0475
10	J - Bolt	64903	05053	0473
11	U - Bolt	64903	05099	0470
12	Screw	96906	MS35307 - 360	0467
13	Washer, Lock	96906	MS35338 - 141	0478
14	Holder, Nozzle	64903	05223	0484
15	Pin, Cotter	88044	AN415 - 7	0485
16	Wire	64903	05134 - 20	0486
17	Sleeve, Cable	76691	18-11-B4	0487
18	Washer, Lock	96906	MS35338 - 140	0471
19	Nut	96906	MS51971 - 2	0472

Figure No. A4-26 Title AUXILIARY HOSE CART ASSEMBLY

1 of 1 Sheet 1 of 1

A4-61 Writer's initials BL

DSD-731 (4/79)

APPENDIX A

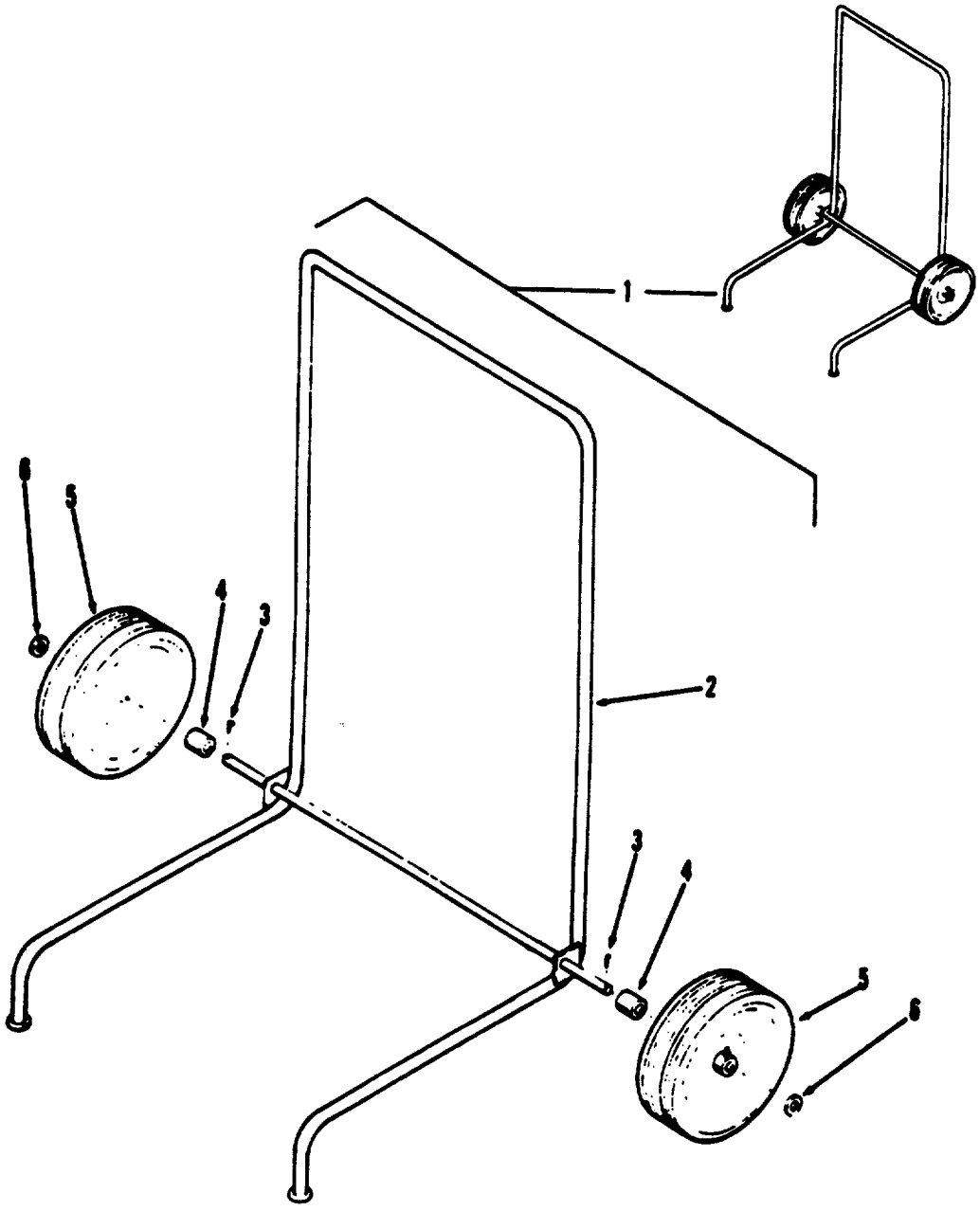


Figure A4-27

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Cart, Hose Reel	64903	0495A	0490
2	Frame	64903	05145	0491
3	Pin, Cotter	96906	MS24665-355	0495
4	Spacer	64903	05009	0493
5	Wheel	64903	05144	0492
6	Washer, Flat	64903	05054	0494

Figure No. A4-27 Title HOSE REEL CART

1 of 1 Sheet 1 of 1

Writer's initials BL

A4-63

OED-731 (4/79)

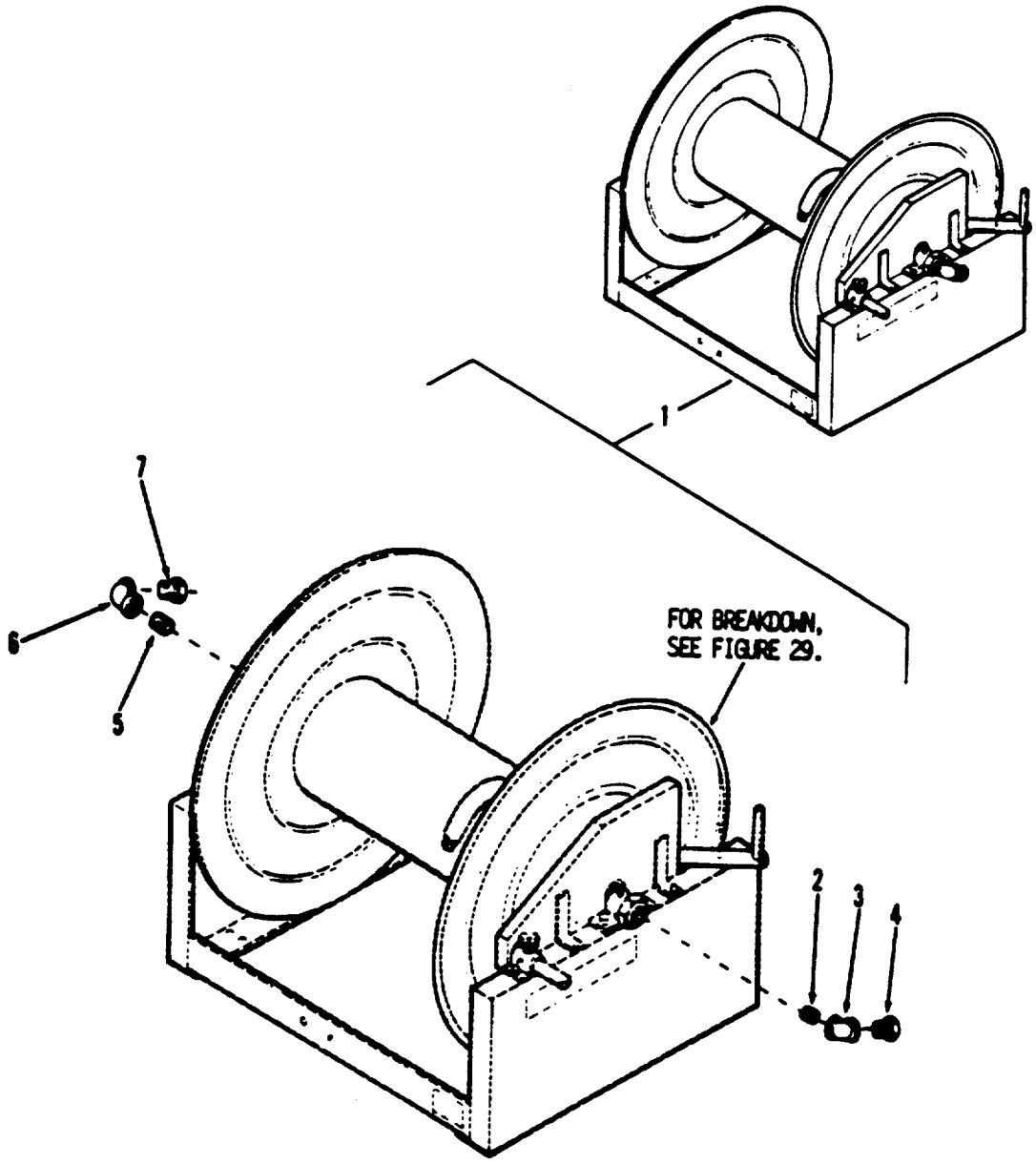


Figure A4-28

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Reel Assembly, Hose	64903	05253	0496
2	Nipple	64903	02436-SH	0497
3	Elbow, 90°	96906	MS14311-6P	0498
4	Bushing, Reducer	96906	MS14315-14	0502
5	Nipple	64903	02406-SH	0499
6	Elbow, 90°	82666	FIG601-1-1/4	0500
7	Bushing, Reducer	96906	MS51887-31	0501

Figure No. A4-28 Title HOSE REEL ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL A4-65

OED-731 (4/78)

Figure A4-28 A4-65

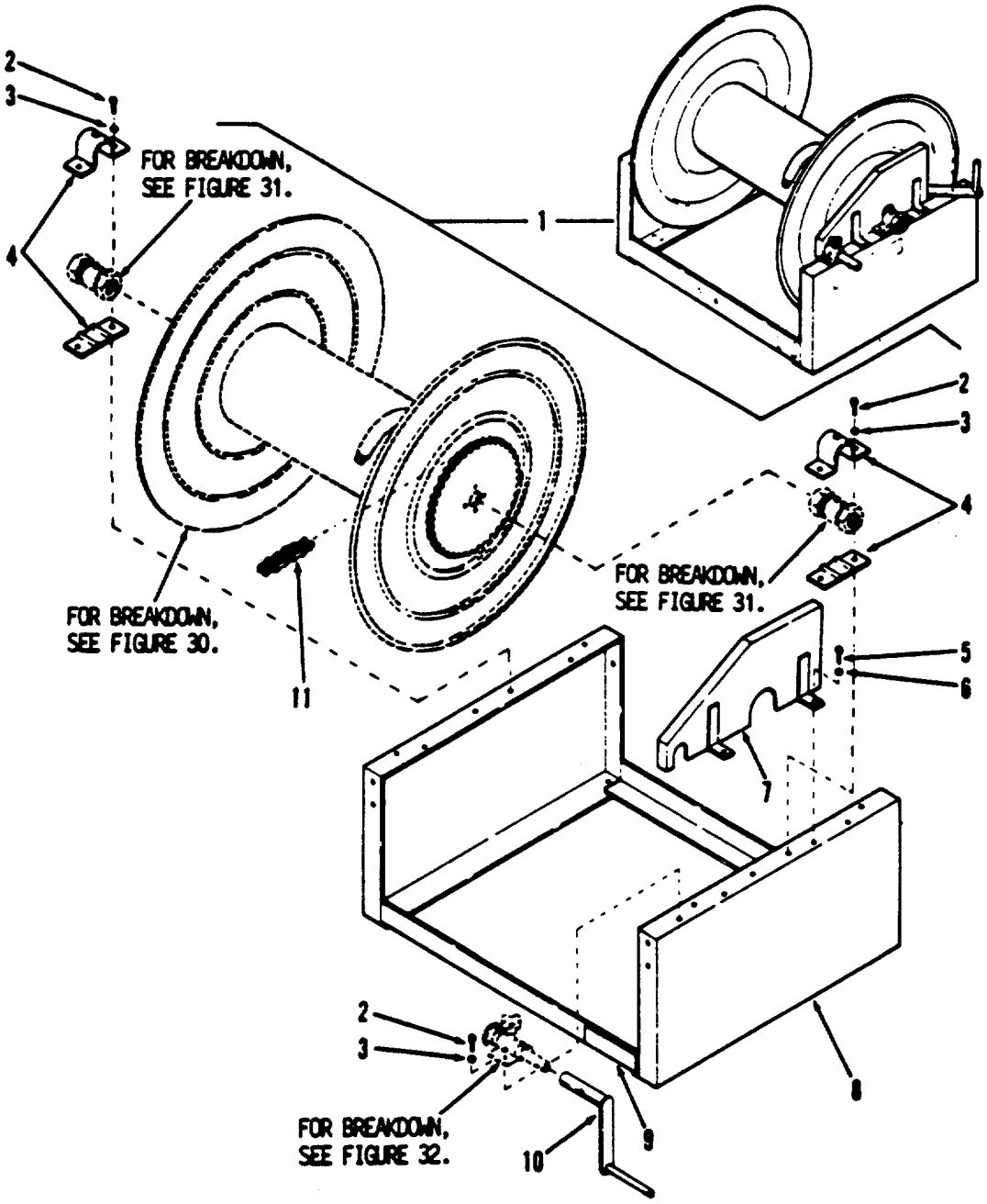

2
3
FOR BREAKDOWN,
SEE FIGURE 31.
1
4
2
3
4
FOR BREAKDOWN,
SEE FIGURE 31.
FOR BREAKDOWN,
SEE FIGURE 30.
11
5
6
7
2
3
8
FOR BREAKDOWN,
SEE FIGURE 32.
9
10

Figure A4-29

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Reel, Hose	66477	C-0-1000	0503
2	Screw	96906	MS35307-360	0504
3	Washer, Lock	96906	MS35338-141	0505
4	Closure, Bearing	66477	A-0-1180	0510
5	Screw	96906	MS35307-308	0508
6	Washer, Lock	96906	MS35338-139	0509
7	Guard	66477	B-0-1189	0512
8	Frame	66477	B-0-1181	0514
9	Plate, Name	66477	A-0-1213	0513
10	Crank	66477	B-0-1069	0515
11	Chain, Roller	66477	A-0-1183	0511

Figure No. A4-29 Title HOSE REEL ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL

DSD-731 (4/79)

Figure No. A4-29 A4-67

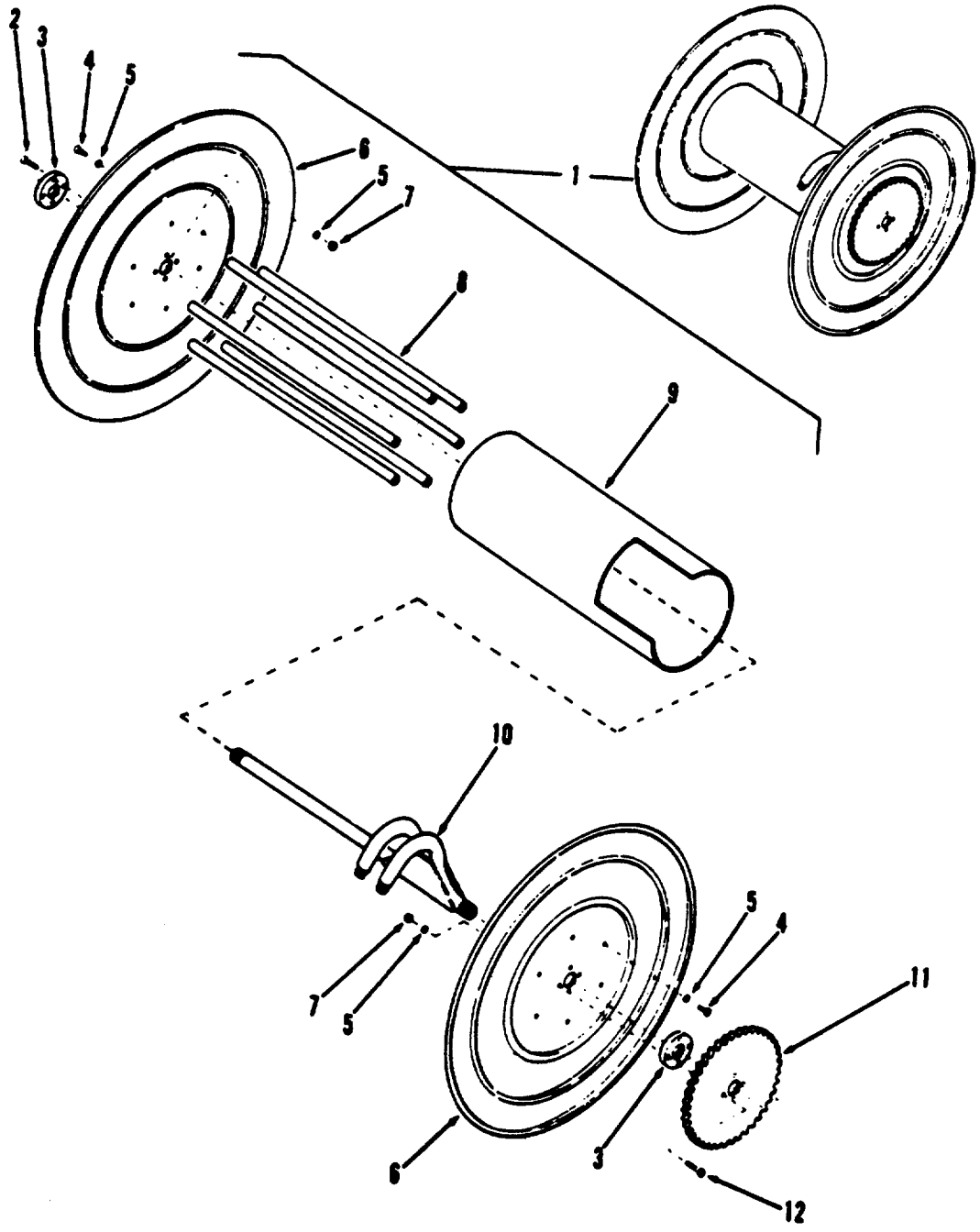


Figure A4-30

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Drum Assembly	66477	B-0-1182	0516
2	Screw	66477	A-0-1104	0519
3	Flange	66477	B-0-1010	0518
4	Screw	66477	A-0-1102	0527
5	Washer, Lock	96906	MS35338-46	0521
6	Disc	66477	B-0-1056	0526
7	Nut	96906	MS51967-8	0522
8	Spacer	66477	B-0-1011	0525
9	Drum	66477	B-0-1007	0523
10	Tube Assembly	66477	B-0-1002	0524
11	Sprocket	66477	B-0-1034	0517
12	Screw	66477	A-0-1106	0520

Figure No. A4-30 Title DRUM ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL

GED-731 (4/78)

Figure A4-30 A4-69

APPENDIX A

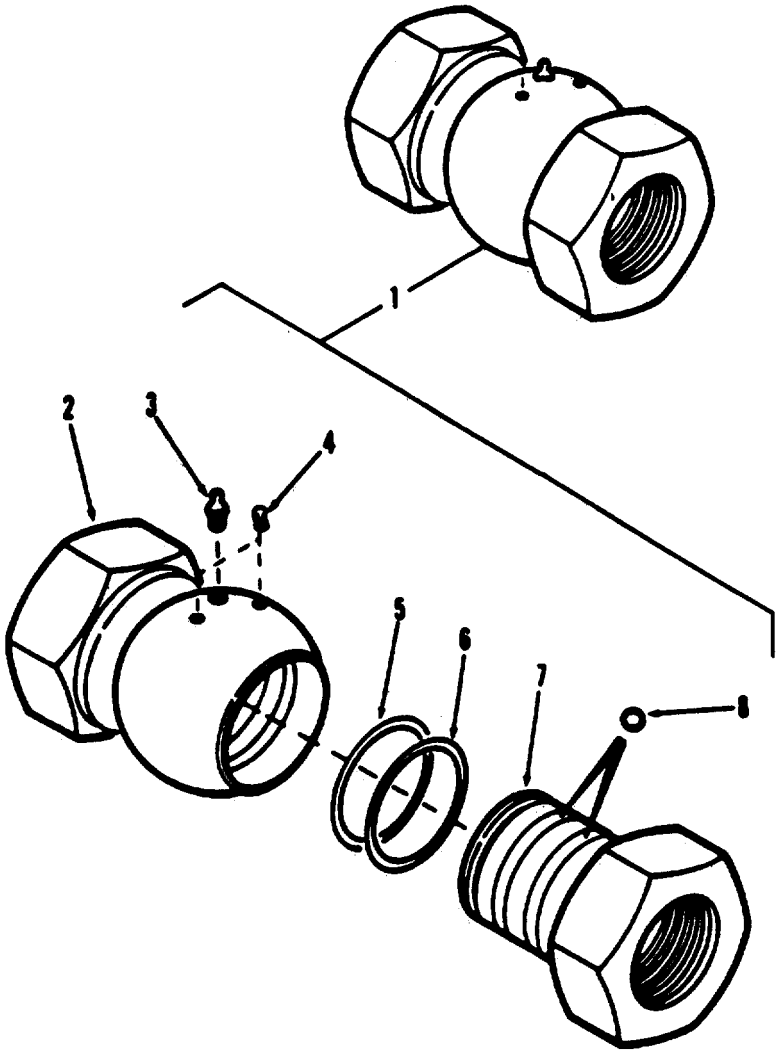


Figure A4-31

LEGEND SHEET

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Joint Assembly, Swivel	66477	B-0-1020	0529
2	Joint Assembly, Female	66477	B-0-1022	0530
3	Fitting, Grease	96906	MS15001-1	0532
4	Screw, Set	66477	A-0-1027	0536
5	Ring, Quad	66477	A-0-1028	0533
6	Ring, Quad	66477	A-0-1029	0534
7	Joint Assembly, Male	66477	B-0-1021	0531
8	Ball, Steel	66477	A-0-1023	0535
	Kit, Seal	66477	A-0-1206	0537

Figure No. A4-31 Title SWIVEL JOINT ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL A4-71

OSD-731 (4/79)

Figure No. A4-31

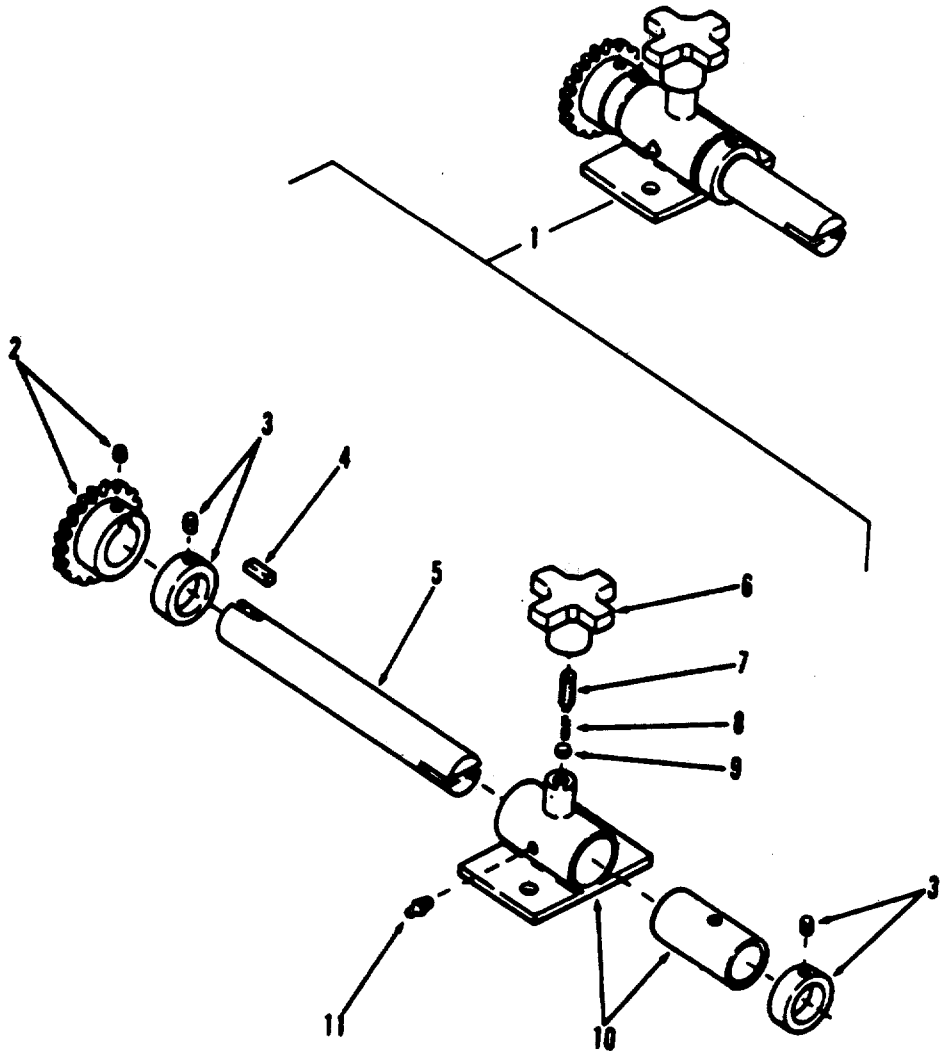


Figure A4-32

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Bearing & Brake, Drive	66477	B-0-1087	0542
2	Sprocket	66477	B-0-1033	0543
3	Collar	66477	B-0-1045	0545
4	Key	66477	A-0-1048	0544
5	Shaft	66477	B-0-1072	0551
6	Knob	66477	A-0-1090	0546
7	Stud	66477	B-0-1019	0547
8	Spring	66477	A-0-1214	0548
9	Disc	66477	A-0-1043	0549
10	Bearing, Drive	66477	B-0-1038	0552
11	Fitting, Grease	96906	MS51967-8	0550

Figure No. A4-32 Title DRIVE BEARING & BRAKE

1 of 1 Sheet 1 of 1

Writer's initials BL A4-73

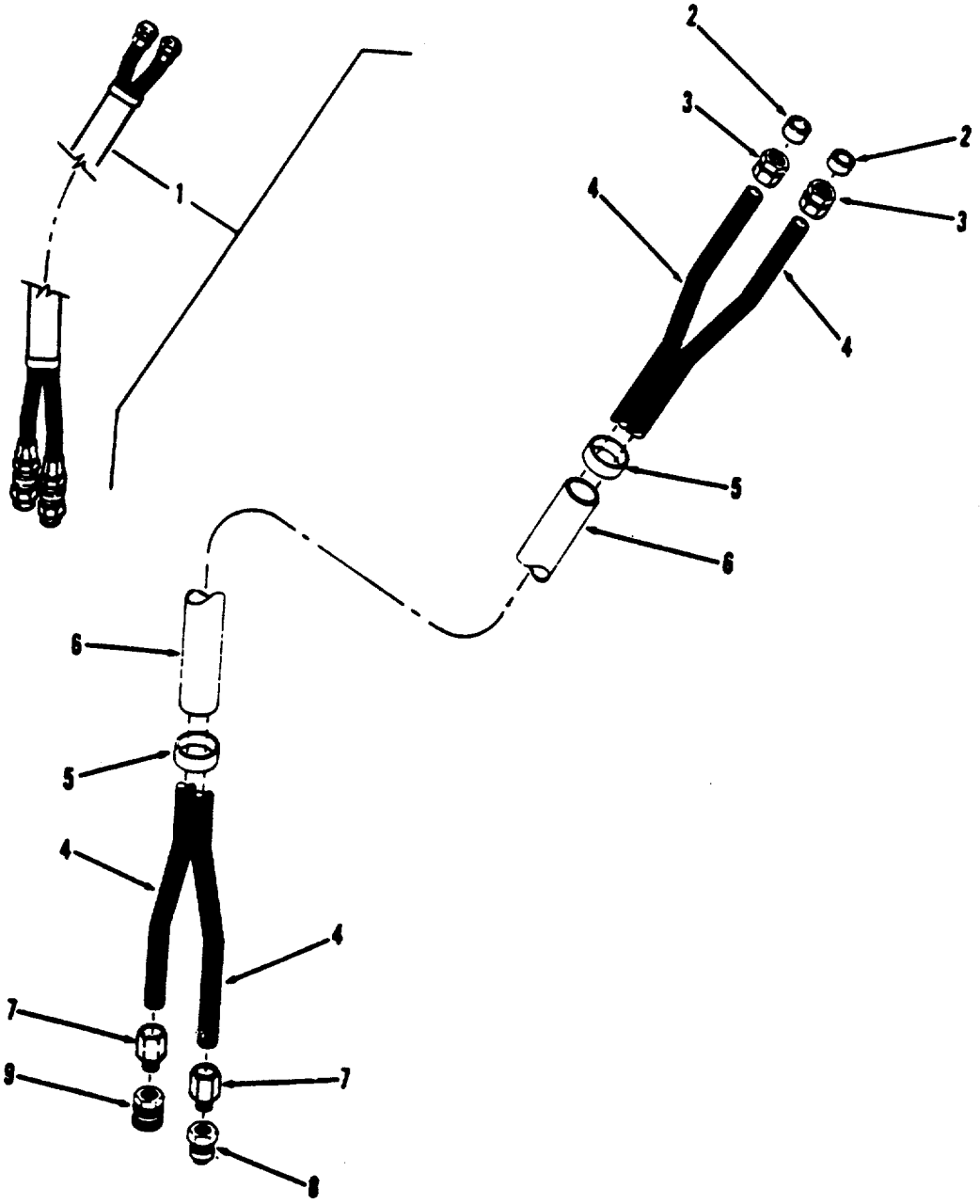


Figure A4-33

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Hose Assembly, Twin Agent	64903	04965	0553
2	Gasket	64903	05138	0559
3	Fitting, Female Hose	64903	04963	0555
4	Hose	73002	7265-1002	0554
5	Band, Retainer	64903	04962	0558
6	Jacket, Hose	64903	02386-150	0557
7	Fitting, Male Hose	64903	04964	0556
8	Nipple	97111	BST-N8	0561
9	Coupler	97111	BST-8	0560

Figure No. A4-33 Title TWIN AGENT HOSE ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL A4-75

OSD-731 (4/78)

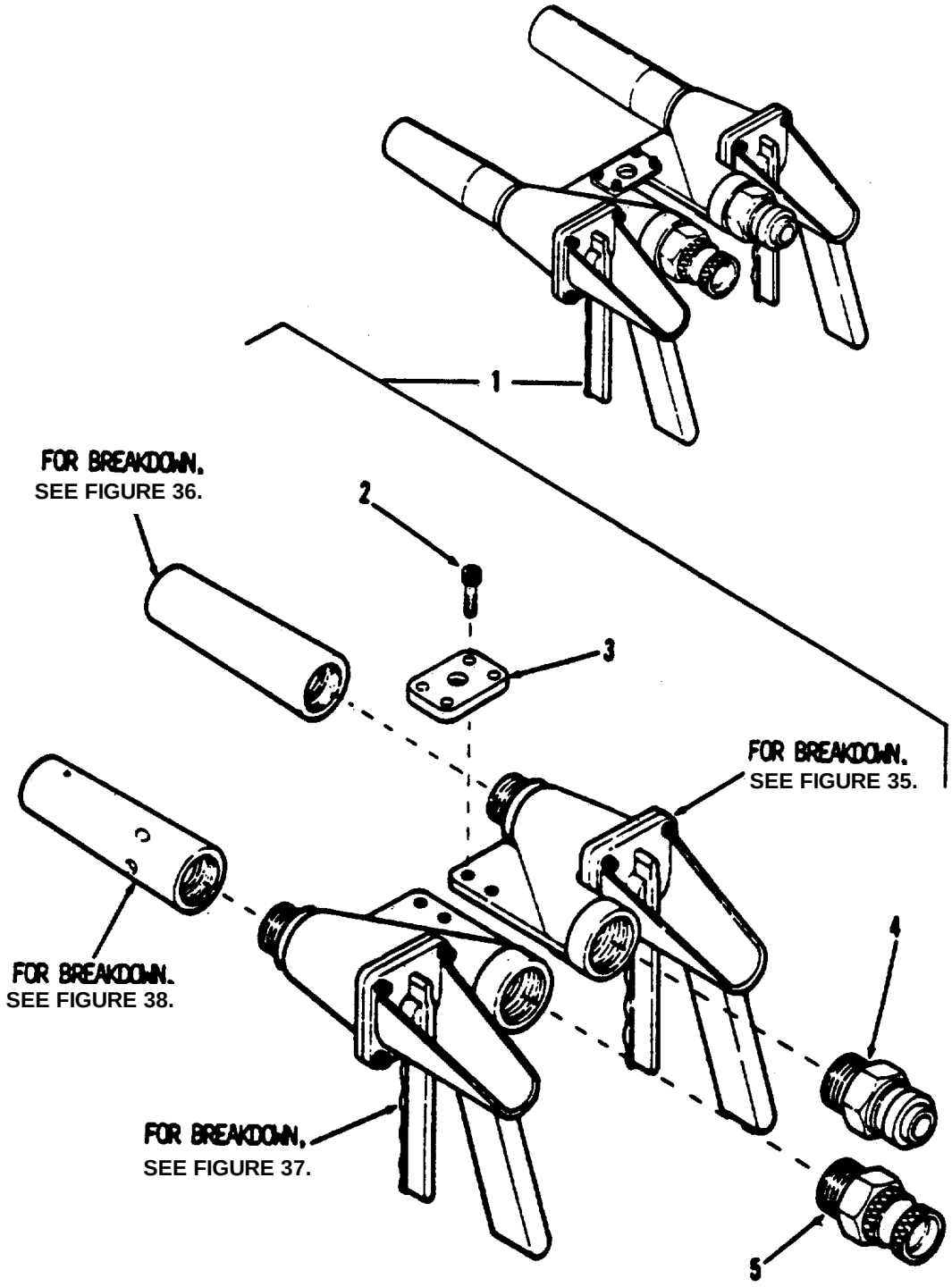

1
FOR BREAKDOWN.
SEE FIGURE 36.
2
3
FOR BREAKDOWN.
SEE FIGURE 35.
FOR BREAKDOWN.
SEE FIGURE 38.
4
FOR BREAKDOWN.
SEE FIGURE 37.
5

Figure A4-34

APPENDIX A

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Nozzle Assembly, Agent	64903	05000	0562
2	Screw	96906	MS16995-50	0564
3	Plate, Retaining	64903	01637	0563
4	Nipple	97111	BST-N8M	0565
5	Coupler	97111	BST-8M	0566

Figure No. A4-34 Title AGENT NOZZLE ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL

OSD-731 (4/78)

Figure No. A4-34

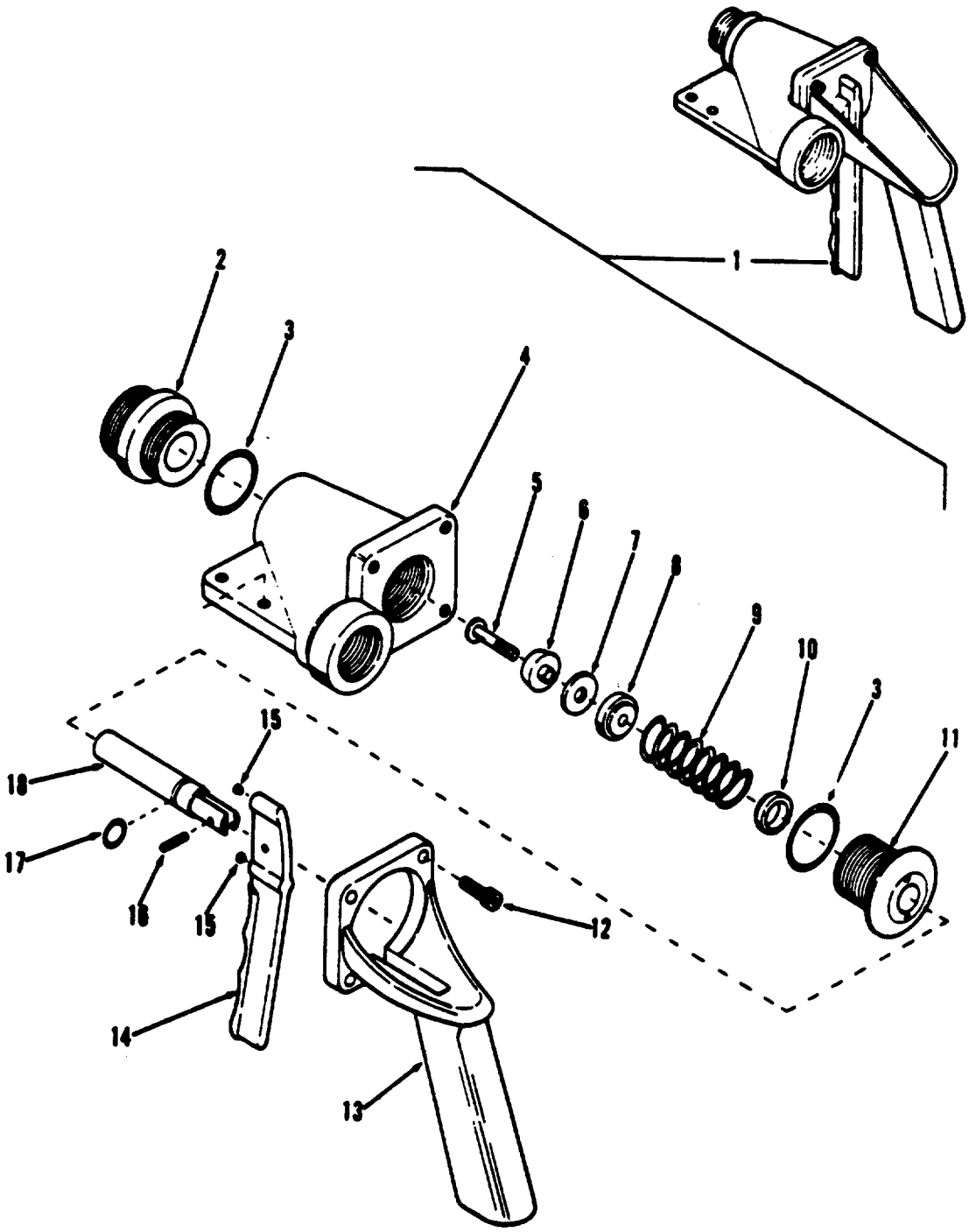


Figure A4-35

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve, Dry Chemical	64903	05157	0567
2	Seat, Forward	64903	01531	0572
3	O-Ring	07322	8218	0579
4	Body	64903	01533	0570
5	Screw	96906	MS51957-83	0574
6	Washer, Seal	64903	01587	0575
7	Seal	64903	01519	0576
8	Retainer, Spring	64903	01508	0577
9	Spring, Compression	64903	01536	0584
10	Wiper, Rod	02697	D-625	0578
11	Seal, Rear	64903	01532	0571
12	Screw	96906	MS16995-50	0583
13	Handle	64903	01534	0569
14	Lever	64903	01535	0568
15	Button, Drive	23050	817386	0581
16	Pin, Spring	96906	MS171588	0582
17	O-Ring	07322	8111	0580
18	Stem	64903	05161	0573

Figure No. A4-35 Title DRY CHEMICAL VALVE

1 of 1 Sheet 1 of 1

Writer's initials BL A4-79

OED-731 (4/79)

Figure No. A4-35
A4-79

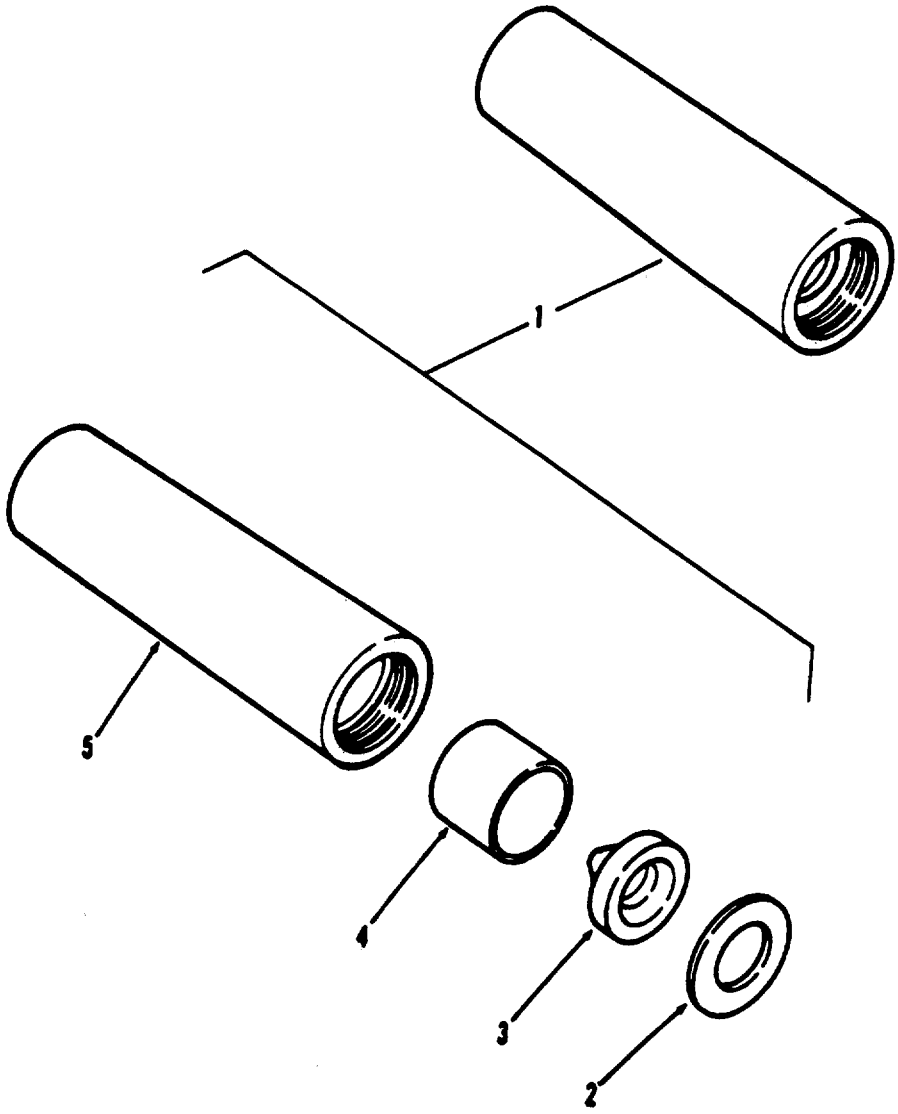


Figure A4-36

LEGEND SHEET

PL No. APPENDIX A Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Nozzle, Dry Chemical	64903	01706	0585
2	Gasket	64903	01609	0586
3	Tip, Nozzle	64903	01625	0589
4	Sleeve	64903	01634	0588
5	Barrel, Nozzle	64903	01610	0587

Figure No. A4-36 Title DRY CHEMICAL NOZZLE

1 of 1 Sheet 1 of 1

Writer's initials BL A4-81

OSD-781 (4/78)

Figure No. A4-36
A4-81

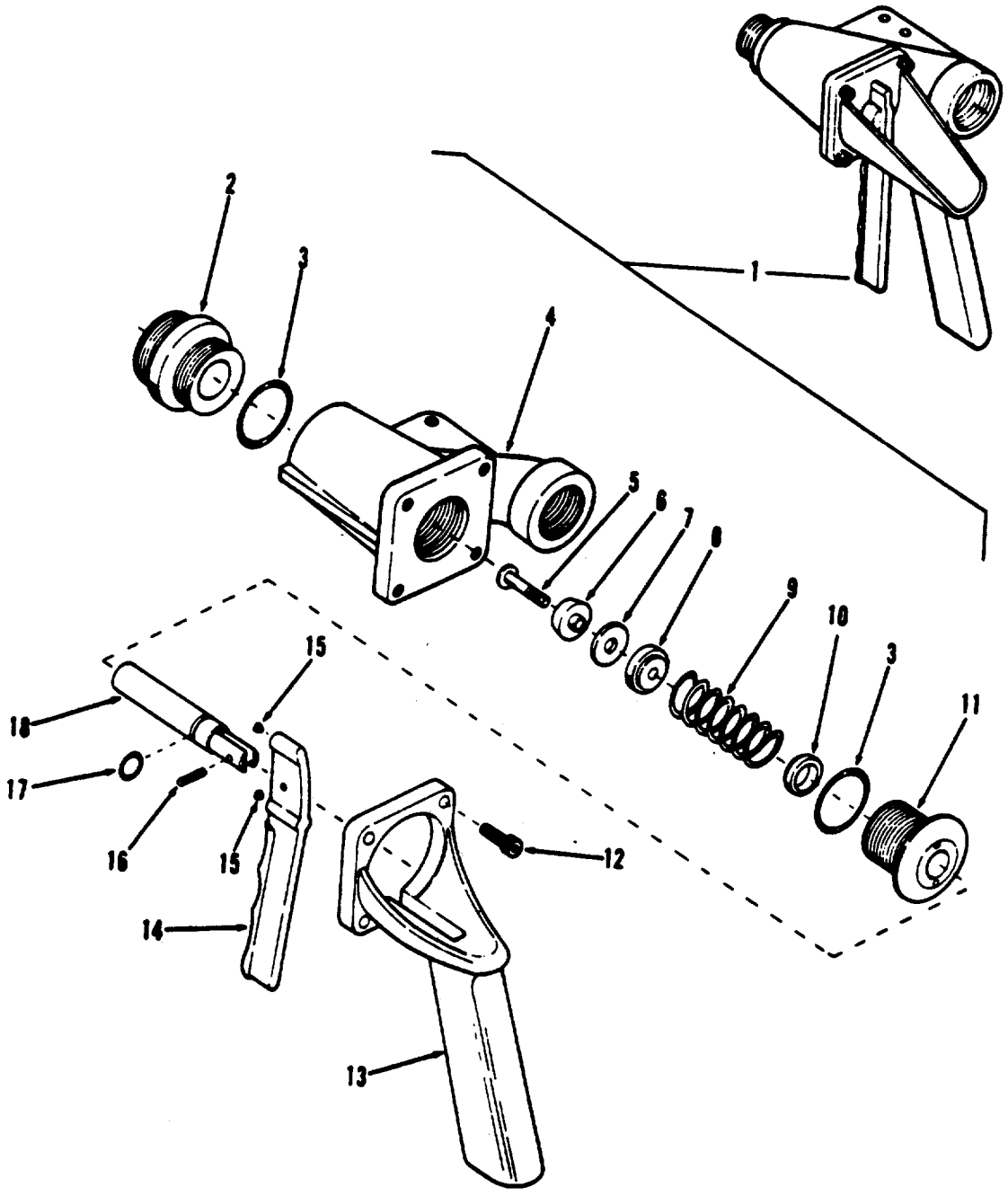


Figure A4-37

LEGEND SHEET

APPENDIX A

PL No. _____ Date _____

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Valve Assembly, AFFF	64903	05158	0590
2	Seat, Forward	64903	01531	0595
3	O-Ring	07322	8218	0602
4	Body	64903	01533	0593
5	Screw	96906	MS51957-83	0597
6	Washer, Seal	64903	01587	0598
7	Seal	64903	01519	0599
8	Retainer, Spring	64903	01508	0600
9	Spring, Compression	64903	01536	0607
10	Wiper, Rod	02697	D-625	0601
11	Seal, Rear	64903	01532	0594
12	Screw	96906	MS16995-50	0606
13	Handle	64903	01534	0592
14	Lever	64903	01535	0591
15	Button, Drive	23050	817386	0604
16	Pin, Spring	96906	MS171588	0605
17	O-Ring	07322	8111	0603
18	Stem	64903	05161	0596

Figure No. A4-37 Title AFFF VALVE ASSEMBLY

1 of 1 Sheet 1 of 1

Writer's initials BL A4-83

GSD-781 (4/78)

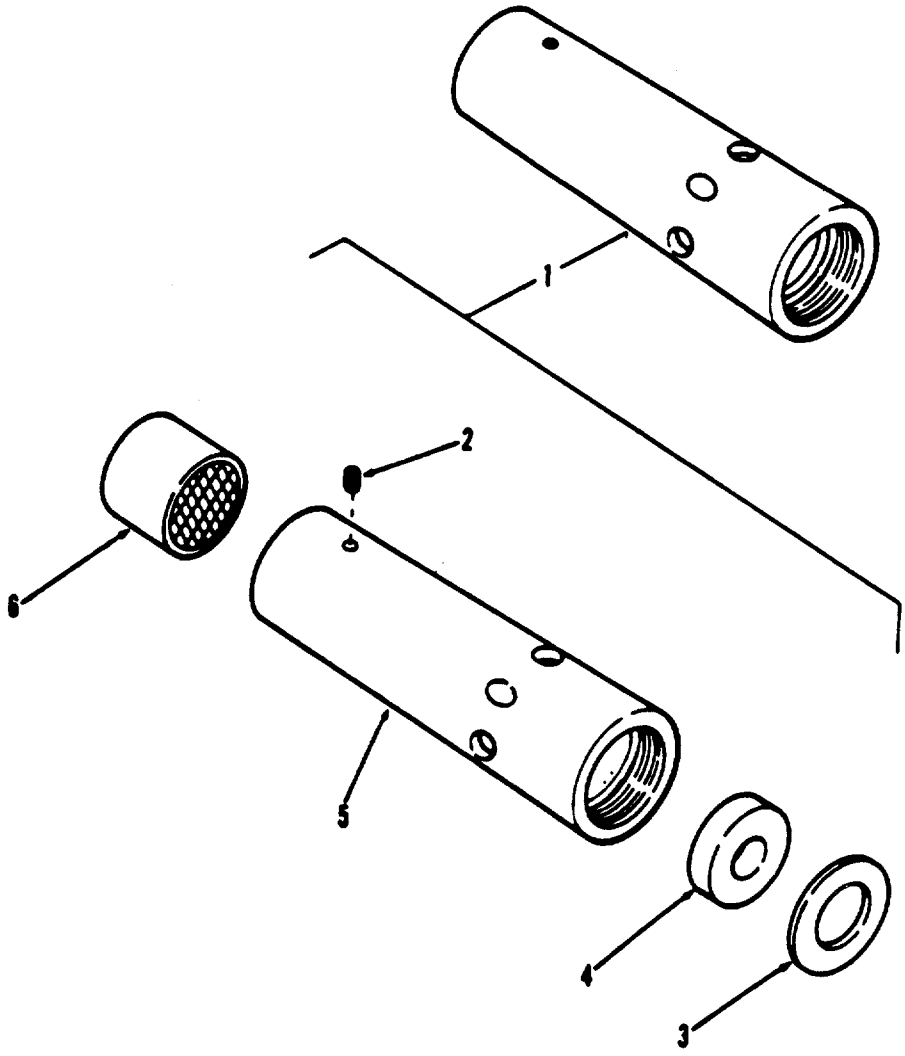


Figure A4-38

PL No. Date

Illustration key No.	Item name	Mfr code	Part No.	PL item No.
1	Nozzle, AFFF	64903	05137	0608
2	Screw, Set	96906	MS51963-46	0613
3	Gasket	64903	01609	0612
4	Plate, Orifice	64903	05154	0611
5	Barrel, Nozzle	64903	05148	0609
6	Screen	64903	05149	0610

Figure No. A4-38 Title AFFF NOZZLE

1 of 1 Sheet 1 of 1

Writer's initials BL

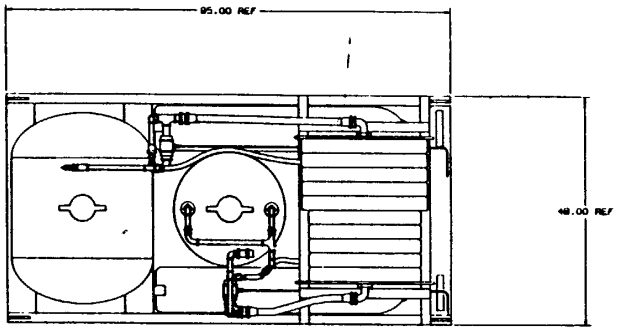
OSD-731 (4/76)

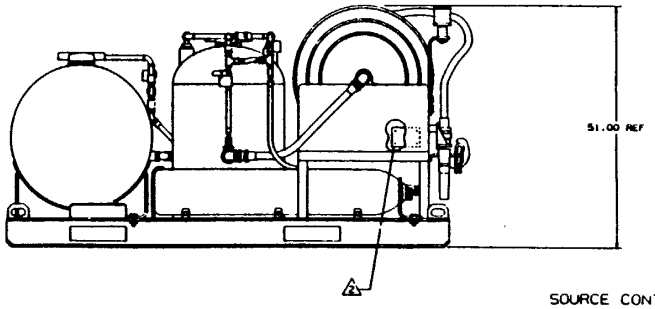
Figure No. A4-38
A4-85/(A4-86 Blank)

NO.	ME AND ADDRESS
53	MBAT 7 ATTE, WI 54143

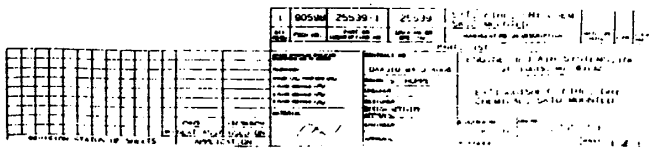
NOTES:

1. THE ASSY SHALL BE IN ACCORDANCE W/ MIL SPEC. CAT. TYPE, DRY CHEM AND AQ FILM FORMING FOAM, MIL-E-25405B(NC), 6 SEPTEMBER 1983
2. DATA PLATE INFO SHALL BE PROVIDED BY E.A.S.I. ENGINEERING
3. FINISH STEEL:
   - 3.1 CLN AND PRETREAT USING THE APPLICABLE METHOD AND TYPE PER TT-C-490
   - 3.2 APPLY TT-P-664 PRMR MIN DRY - FILM THKNS SHALL BE THAT THKNS LISTED UNDER TABLE I OF MIL-T-704
   - 3.3 APPLY MIL-E-52788 ENAM FINISH COAT, TYPE I, COLOR NO. 30277, SAND MATTE, OF FED-STD-595, MIN DRY - FILM THKNS SHALL BE THAT THKNS LISTED UNDER TABLE I OF MIL-T-704
4. FINISH ALUMINUM:
   - 4.1 CLN AND PRETREAT USING THE APPLICABLE METHOD AND TYPE PER TT-C-490
   - 4.2 APP.Y TT-P-1757 PRMR MIN DRY - FILM THKNS SHALL BE THAT THKNS LISTED UNDER TABLE I OF MIL-T-704
   - 4.3 APPLY MIL-E-52788 ENAM FINISH COAT, TYPE I, COLOR NO. 30277, SAND MATTE, OF FED-STD-595, MIN DRY - FILM THKNS SHALL BE THAT THKNS LISTED UNDER TABLE I OF MIL-T-704
5. FIRST ARTICLE AND PROD TEST PROC AND SCHED ARE TO BE APPROVED BY E.A.S.I. ENGINEERING PRIOR TO FIRST UNIT PROD
6. ONLY THE ITEM DESCRIBED ON THIS DRAWING WHEN PROCURED FROM THE VENDOR(S) LISTED HEREON IS APPROVED BY ENGINEERED AIR SYSTEMS, INC. ST. LOUIS, MO 63132 FOR USE IN THE APPLICATION(S) LISTED HEREON. A SUBSTITUTE ITEM SHALL NOT BE USED WITHOUT PRIOR APPROVAL BY E.A.S.I.
7. IDENTIFICATION OF THE APPROVED SOURCE(S) OF SUPPLY HEREON IS NOT A GUARANTEE OF PRESENT OR CONTINUED AVAILIBILITY AS A SOURCE OF SUPPLY FOR THE ITEM DESCRIBED ON THE DRAWING





SOURCE CONTROL DRAWING



ST. LOUIS, MO., 63132

NOTES:

1. THE UNIT SHALL BE A 3/4 TON CARGO TRAILER CHASSIS, M116A2 LESS SERVICE BRAKES AND LIGHTING, MODIFIED AS FOLLOWS:

   1.1 THE TRAILER SHALL MOUNT AND TRANSPORT THE SKID MOUNTED FIRE EXTINGUISHER AS SHOWN ON ENGINEERED AIR SYSTEMS, INC. DRAWING NO. 29530.

   1.2 TWO EACH STANDARD M116A2 HAND LEVER PARKING BRAKES ARE REQUIRED.

   1.3 THE TRAILER SHALL ACCOMMODATE THE FIRE EXTINGUISHER AS SHOWN ON ENGINEERED AIR SYSTEMS, INC. DRAWING NO.29530 WITH THE HOSE REEL ASSEMBLY MOUNTED AT THE REAR OF THE TRAILER. THE SKID MOUNTED FIRE EXTINGUISHER WEIGHS 2,480 LBS EMPTY AND 3,280 LBS WHEN FULLY CHARGED. THE FIRE EXTINGUISHER LONGITUDINAL CENTER OF GRAVITY MEASURED FROM THE HOSE REEL END OF THE SKID IS 44.38 INCHES EMPTY, AND 53.75 INCHES WHEN CHARGED. THE TRAILER SHALL MOUNT THE FIRE EXTINGUISHER PLACING THE CENTER OF GRAVITY FORWARD OF THE AXLE IN BOTH THE CHARGED AND EMPTY CONDITIONS. THE TRAILER/SUSPENSION SHALL INCORPORATE A CENTER OF GRAVITY SUCH THAT THE COMPLETE TRAILER MOUNTED FIRE EXTINGUISHER WITH BOTH TANKS FULLY CHARGED SHALL TILT NOT MORE THAN 20° FROM HORIZONTAL WHEN LIFTED FROM THE FIRE EXTINGUISHER LIFT BAR. THE TOTAL WEIGHT OF THE SKID MOUNTED FIRE EXTINGUISHER IS CONSIDERED TO REST ON THE TWO OUTER LONGITUDINAL C-CHANNELS OF THE FIRE EXTINGUISHER SKID. (REF. 48 INCH WIDTH).

   1.4 THE FRAME AND SUSPENSION OF THE TRAILER SHALL BE MODIFIED (AS REQUIRED) TO TRANSPORT THE FULLY CHARGED FIRE EXTINGUISHER AT 10 MPH CROSS COUNTRY AND 55 MPH ON PAVED HIGHWAY. THE UNDERSLUNG LEAF SPRINGS SHALL BE RATED IN ACCORDANCE WITH THE SPRUNG GROSS WEIGHT WHEN THE FIRE EXTINGUISHER IS FULLY CHARGED. STANDARD M116A2 TIRES SHALL BE USED PROVIDED THEY ARE RATED FOR THE TOTAL GVW OF THE ASSEMBLY. THE AXLE SHALL HAVE A 6,000 LB LOAD RATING.

   1.5 A 14 GAUGE STEEL DECK COVER PLATE WHICH WILL FULLY COVER THE BOTTOM OF THE FIRE EXTINGUISHER SKID SHALL BE PERMANENTLY ATTACHED TO THE FRAME OF THE TRAILER.

   1.6 THE MOUNTING PROVISIONS WHICH PROVIDE A 4.0 LONGITUDINAL, 1.5 G LATERAL, AND 4.0 VERTICAL RESTRAINT FOR THE FIRE EXTINGUISHER SHALL BE PROVIDED AS FOLLOWS: TEN EACH 1/2 INCH DIA. GRADE FIVE BOLTS WITH STEEL MOUNTING CLIPS, 5 EACH PER SIDE. THE CLIPS SHALL BOLT THROUGH THE TRAILER FRAME AND OVERLAP THE LONGITUDINAL SKID CHANNELS, AND SHALL BE SPACED TO PREVENT DAMAGE OR SEPARATION WHEN THE UNIT IS LIFTED. THERE SHALL BE WELDED STEEL STOPS AT THE FRONT OF THE SKID AND BOLTED STEEL STOPS AT THE REAR OF THE SKID ON THE TRAILER FRAME.

   1.7 THE TRAILER SHALL BE EQUIPPED WITH A 5,000 LB CAPACITY RETRACTABLE FRONT JACK SCREW WITH A SAND SHOE BASE. THERE SHALL BE TWO RETRACTABLE JACK STANDS WITH SAND SHOE BASES AT THE REAR (ONE EACH SIDE).

   1.8 FENDERS SHALL BE PROVIDED TO PROTECT THE FIRE EXTINGUISHER FROM MUD AND DEBRIS.

   1.9 ALL WELDING SHALL BE IN ACCORDANCE WITH MIL-STD-1261.

   1.10 FINAL FINISH REQUIREMENTS:

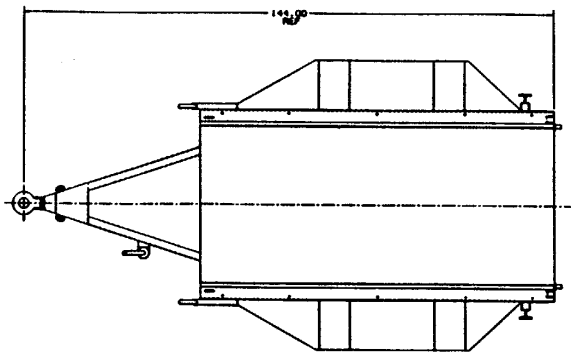
      1.10.1 CLEAN AND TREAT PER THE APPLICABLE METHOD OF TT-C-490.

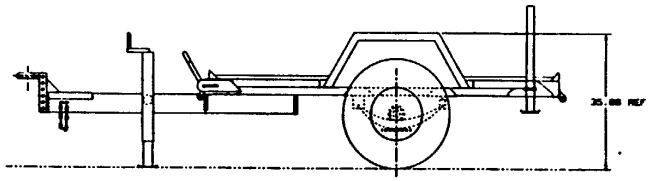
      1.10.2 APPLY TT-P-664 PRIMER. MINIMUM DRY FILM THICKNESS SHALL BE THAT THICKNESS LISTED UNDER TABLE I OF MIL-T-704.

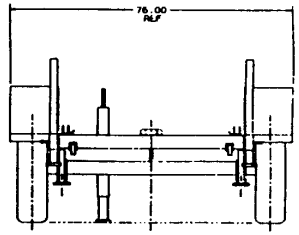
      1.10.3 APPLY MIL-E-52788 ENAMEL FINISH COAT, TYPE I, COLOR NUMBER 34227, SAND MATTE, OF FED-STD-595. MINIMUM DRY-FILM THICKNESS SHALL BE THAT THICKNESS LISTED UNDER TABLE I OF MIL-T-704.

2. TESTING REQUIREMENTS SHALL BE SPECIFIED BY ENGINEERED AIR SYSTEMS, INC. ENGINEERING.

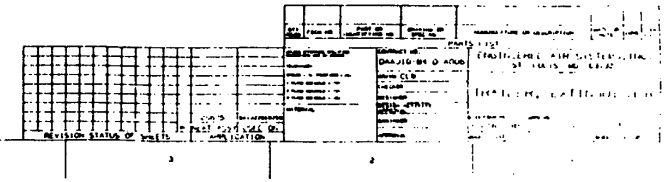
A4-88

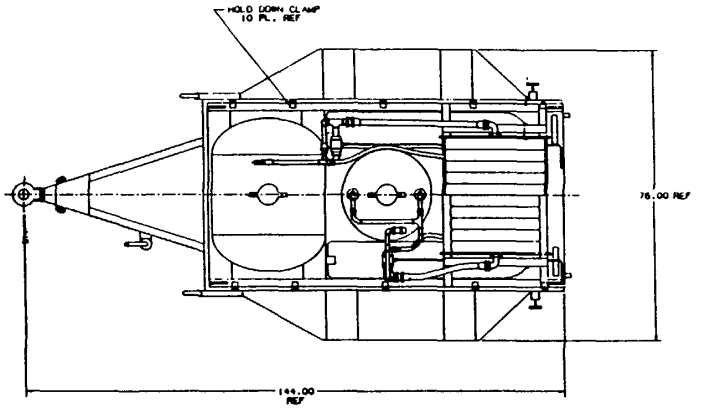


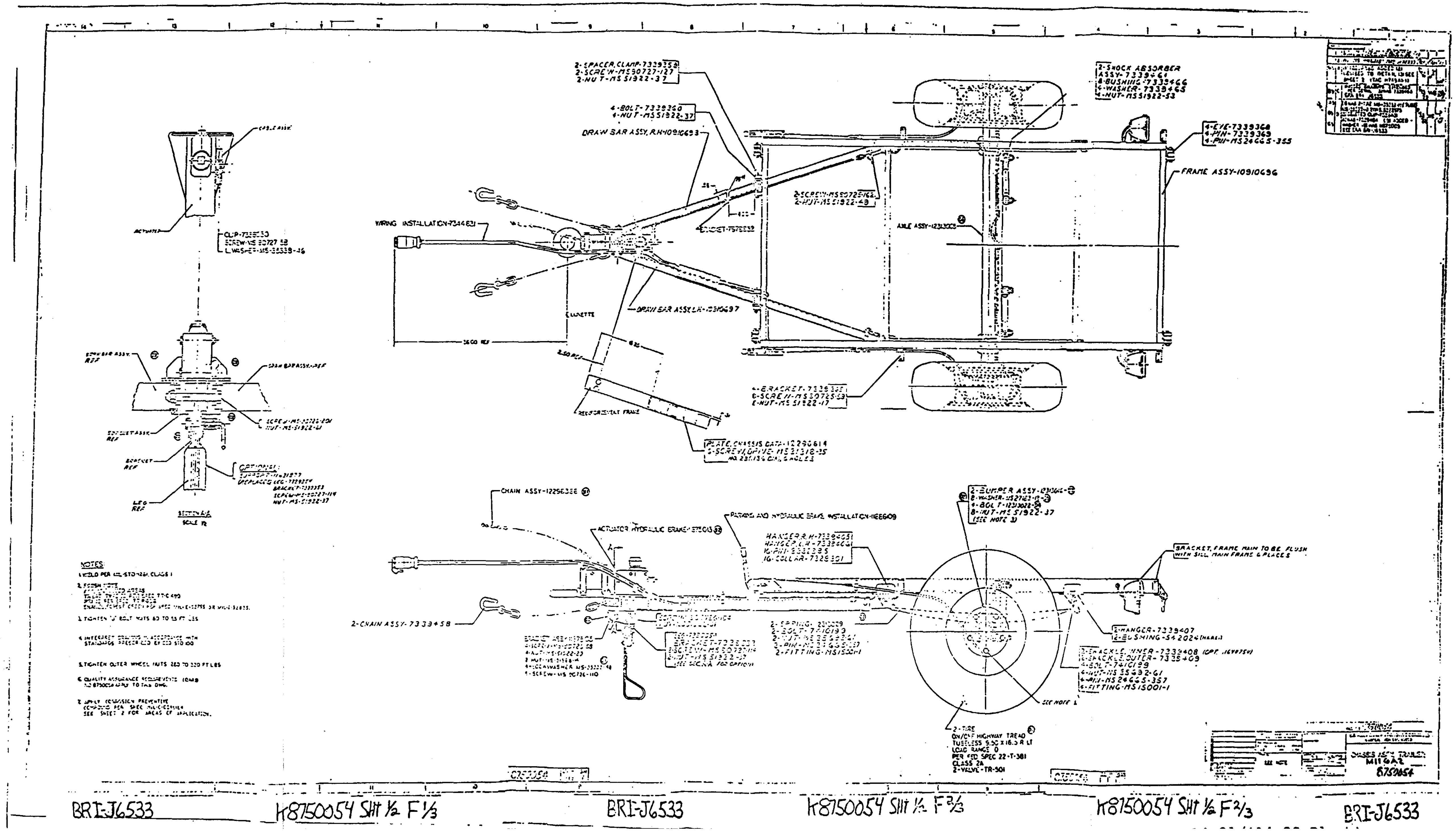




SOURCE CONTROL DRAWING




HOLD DOWN CLAMP
10 PL. REF
76.00 REF
144.00
REF
2
1
74.38 REF


DRAW BAR ASSY, R.H-10910653
WIRING INSTALLATION-7344631
FRAME ASSY-10910696
AXLE ASSY-12313025
CHAIN ASSY-12256326
2-CHAIN ASSY-7333458
NOTES:
BRI-J6533
K8750054 SHT ½ F⅓
K8750054 SHT ½ F⅔

APPENDIX A

PART II

VENDOR INFORMATION

APPENDIX A

PART II

VENDOR INFORMATION

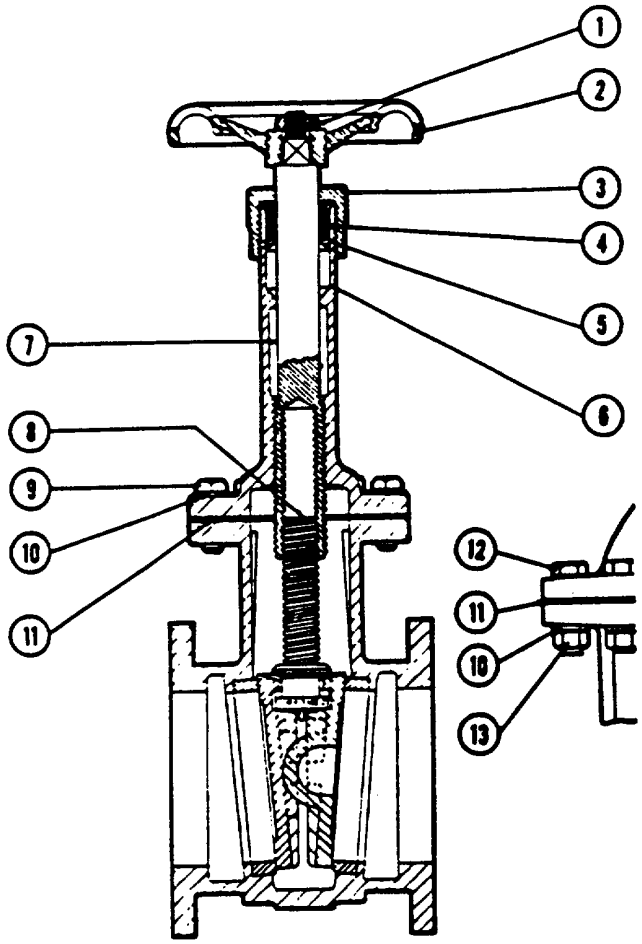
GATE VALVES

3 INCH
DOVER CORPORATION 676-FR-3

4 INCH
MILWAUKEE VALVE COMPANY C-35551

6 INCH
MORRISON BROS. COMPANY 235-RF

APPENDIX A



KEY	SIZE	PART NO.	DESCRIPTION
1	3"	H-369-RB	Nut
1	4",6"	H-959-M	Nut
2	3"	H-2614-AG	Handwheel
2	4"	C-74-AG	Handwheel
2	6"	C-1128-AG	Handwheel
3	3"	H-673-B	Packing Nut
3	4",6"	H-665-B	Packing Nut
4	3"	H-245-M	Spring
4	4",6"	H-669-M	Spring
5	3"	H-202-RB	Packing Gland
5	4",6"	H-668-M	Packing Gland
6	3"	H-3397-M	Packing
6	4",6"	H-667-M	Packing
7	3"	H-2582-RB	Bonnet Stem

KEY	SIZE	PART NO.	DESCRIPTION
7	4"	C-72-RB	Bonnet Stem
7	6"	C-1127-RB	Bonnet Stem
8	3"	H-4753	Disc Stem Sub-Assy.
8	4"	C-73-B	Disc Stem
8	6"	H-4304	Disc Stem Sub-Assy.
9	3"	H-5635-M	Cap Screw
9	4"	H-633-M	Cap Screw
10	3"	H-5636-M	Lock Wasner
10	4",6"	H-2525-M	Lock Wasner
11	3"	C-1599-M	Gasket
11	4"	C-75-M	Gasket
11	6"	C-1129-M	Gasket
12	6"	H-603-M	Bolt
13	6"	H-6454-M	Nut

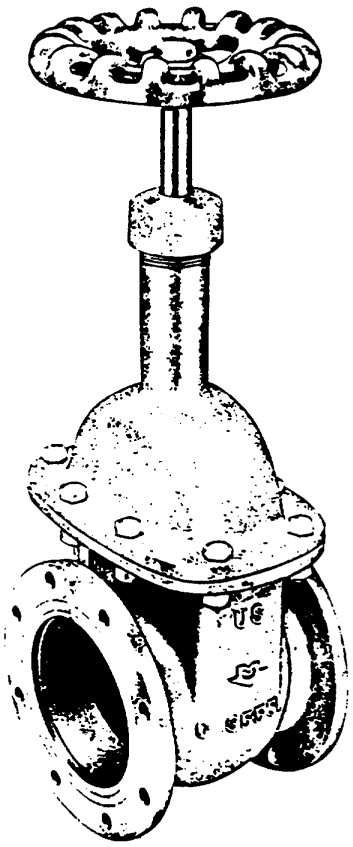
DOVER CORPORATION/OPW DIVISION

GATE C-35551

ALUMINUM

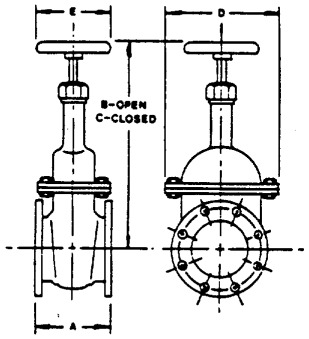
Tank Trucks • Bulk Plants • Filling Stations
Rising Stem • Double Disc • Bolted Bonnet
Round Flange Ends

APPENDIX A



These rugged aluminum with bronze trim gate valves are built for long life with positive closure. Can be repacked under pressure. Internal parts are quickly and easily replaced.

MILITARY SPECIFICATION	
C-35551	Conforms to MIL-V-58039 Type I



DIMENSIONS-INCHES

SIZE	A	B	C	D	E
3	5	12 7/8	11 3/8	5 15/16	5
4	5 3/8	15 5/8	14 1/2	7 5/8	5
6	6 1/4	19 3/8	17 1/2	9 1/8	6

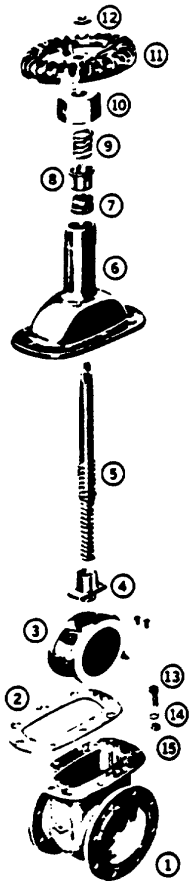
FLANGE SPECIFICATIONS-INCHES

Size	O.D.	Thickness	B.C. Dia.	Bolt Dia.	No. Bolts
3	5 5/8	5/8	4 7/8	7/16	8
4	6 1/4	3/8	5 7/8	7/16	8
6	9	1/2	8 1/8	7/16	12

8 84

MILWAUKEE VALVE COMPANY
2375 South Burrell Street Milwaukee, Wisconsin 53207
Valves built to take it...since 1901

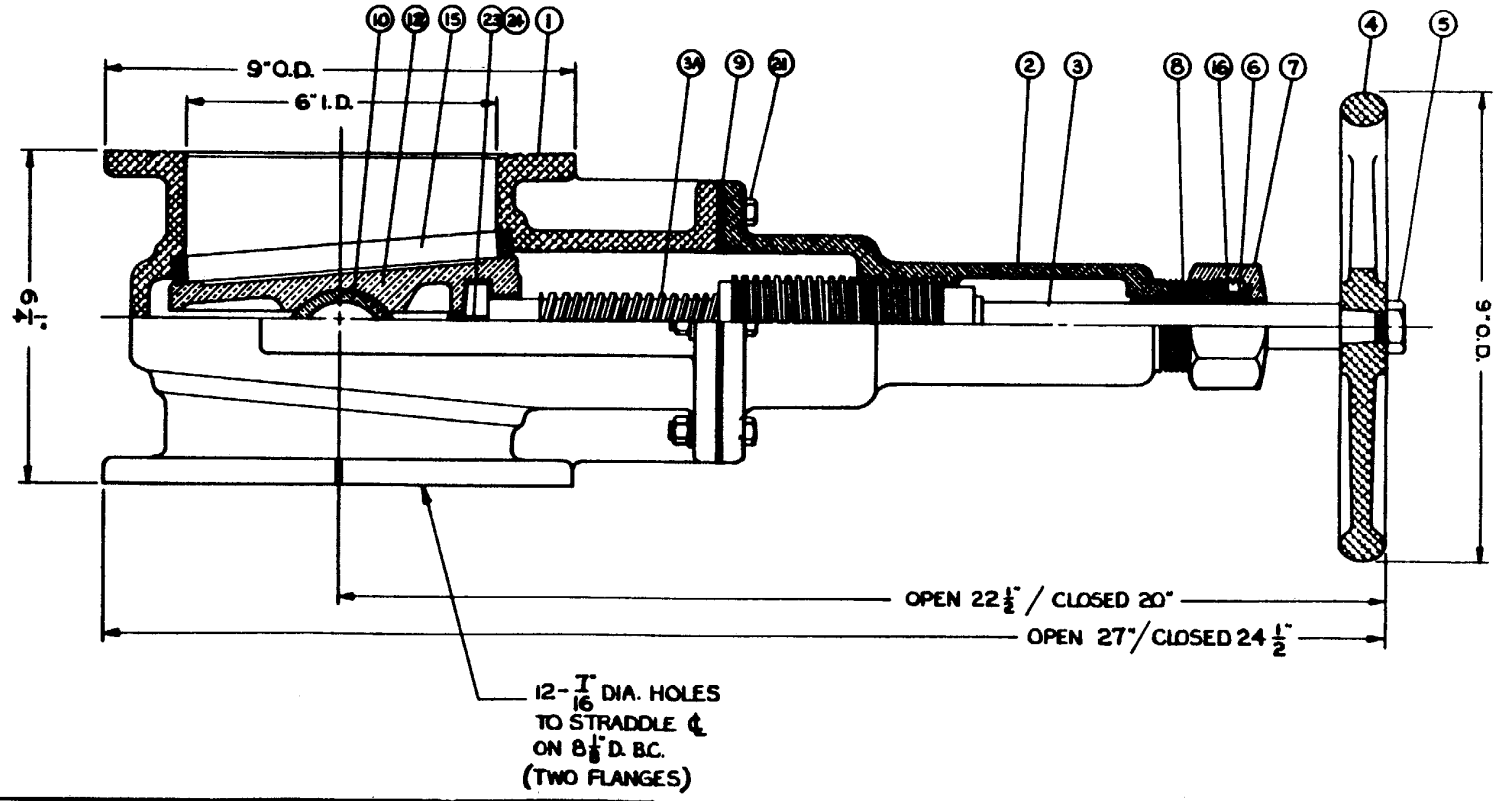
GATE C-35551
REPAIR PARTS LIST
APPENDIX A



NO.	DESCRIPTION	SIZE-INCHES PART NO.		
		3	4	6
1	Body	2093-L	2093-N	2093-S
2	Gasket	66173-L	66173-N	66173-S
3	Disc Assembly	84168-L	84168-N	84168-S
4	Pull Nut	3042-L	3042-N	3042-S
5	Stem	26264-L	26264-N	26264-S
6	Bonnet	23194-L	23194-N	23258-S
7	Packing	6593-L	65107-K	6593-S
8	Gland	363-G	363-H	363-S
9	Gland Spring	70171-L	70171-N	70171-S
10	Stuff Nut	2864-L	2855-L	2855-N
11	Handwheel	7699-K	7660-L	7660-L
12	Wheel Nut	3116-M	31112-H	3162-M
13	Bonnet Screw	4247-E	4256-L	4256-L
14	Bonnet Lock Washer	38084-B	38084-C	38084-C
15	Bonnet Hex Nut	3198-B	3198-C	3198-C

MILWAUKEE VALVE COMPANY
2375 South Burrell Street Milwaukee, Wisconsin 53207
Valves built to take it...since 1901

A5-3



PARTS LIST

NO.	NAME	NO.	NAME
1	BODY	9	BONNET GASKET
2	BONNET	10	MALE DISC
3	UPPER STEM	12	FEMALE DISC
3A	LOWER STEM	15	SEAT RING
4	HANDWHEEL	16	PACKING GLAND SPRING
5	HANDWHEEL NUT	20	FLANGE GASKET
6	PACKING GLAND	21	BOLT NUT & WASHER
7	PACK NUT	23	LOWER STEM INSERT
8	PAC RING	24	SPRING PIN

MORRISON BROS. CO.
DUBUQUE, IOWA.

ASSEMBLY
6" T.T. FLANGED GATE VALVE
FIG. NO. 235-RF

SCALE HALF
DRAWN BY J.C.
CHECKED BY
DATE 12-8-83
DRAW NO B-5984-O

REVISION CHART

DATE	DESCRIPTION	SIGNED

APPENDIX A

PART II

VENDOR INFORMATION

COUPLING CLAMPS

4 INCH
VICTAULIC C-040-078-P-0G

6 INCH
VICTAULIC C-050-078-P-0G

RAPID DEPLOYMENT PIPING...
now even faster

1. Apply pre-lubricated gasket.

2. Engage one piece housing into grooves.

3. Engage integral locking handle.

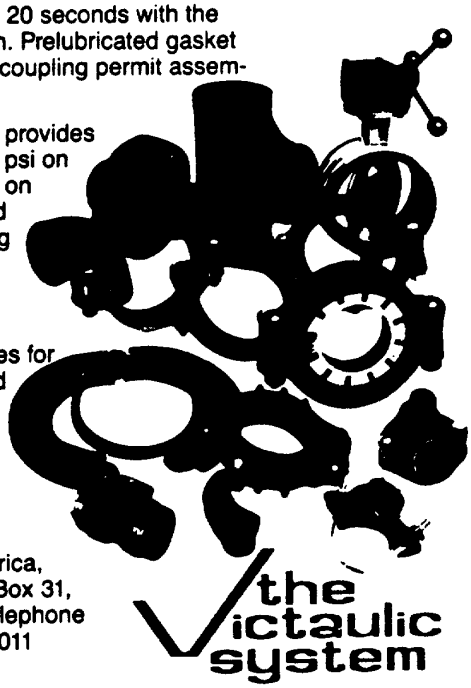
4. Snap closed for complete joint.

Victaulic® Snap-Joint®
the 20-second coupling

Rapid deployment piping can be assembled (and disassembled) in only 20 seconds with the Victaulic Snap-Joint system. Prelubricated gasket and locking toggle closure coupling permit assembly without tools.

New double groove design provides working pressures to 1,000 psi on standard steel and 600 psi on lightwall. No special welded nipples. Easy field grooving with portable tools.

Victaulic also has a complete line of grooved pipe couplings, fittings and valves for varied military, defense and related applications. Victaulic has served the military piping market since 1925 and continues with newer, faster ways to join pipe. Write for details, Victaulic Company of America, World Headquarters, P.O. Box 31, Easton, PA 18042 USA, Telephone 215-252-6400, Telex: 5868011 VICAM UW.



the Victaulic system

(Enter No. 97 on Inquiry Card for more data)

A6-1

APPENDIX A

PART II

VENDOR INFORMATION

BALL VALVES

1.5 INCH
PITTSBURGH BRASS MANUFACTURING 1.5-SP-A-16-S-2

3 INCH
PITTSBURGH BRASS MANUFACTURING 3-SP-A-19-S-2

4 INCH
PITTSBURGH BRASS MANUFACTURING 4-SP-A-20-S-2

PITTSBURGH BRASS
MANUFACTURING CO.
VALVE DIVISION
Sandy Hill Road, Irwin, Pa. 15642
412/863-0550

Engineering Data Form E
APPENDIX A

Torquing PBM Ball Valves to Compensate for Normal Seat and Seal Wear *(Adjust-o-Seal® Design)*

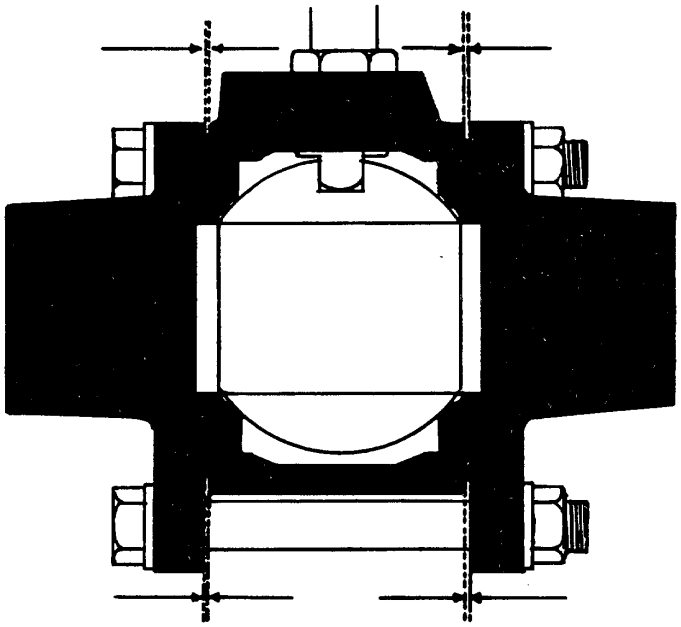
Effective Jan. 2, 1976

BACKGROUND: As maintenance people know from experience, to correct an ordinary ball valve showing signs of leakage due to normal wear of seals and seats, it is necessary to take these time-consuming steps:

(1) Unbolt valve and remove it from the line. (2) Disassemble valve and replace seals and seats. (3) Reassemble valve. (4) Rebolt valve to line. (Note: Even "swing-out" valves must be unbolted.)

With a PBM Ball Valve none of these maintenance steps is required. Instead, a fast and easy torquing of body bolts restores the valve to its original efficiency.

The result is a substantial savings in maintenance costs and, since the system does not have to be closed for this repair, a worthwhile increase in production.



THE DESIGN PRINCIPLE

Pittsburgh Brass has engineered a unique "take-up" spacing between the valve's body and its end fittings.

After long service on the line, if the valve should show signs of leakage due to normal wear of seats and seals, a simple torquing of body bolts provides the exact adjustment required to restore the valve to its former leak-tight condition.

This torquing can be repeated over and over many times to compensate for normal wear.

A PBM EXCLUSIVE

Thoroughly tested in the field for the past 10 years, Adjust-o-Seal Design has proved its worth in thousands of piping installations and is available only from Pittsburgh Brass Manufacturing.

TORQUING INFORMATION

Arrows indicate the built-in torquing space between body of valve and end fittings to compensate for normal seat and seal wear.

To make adjustment: Body bolts should be torqued evenly and just to the point where free movement of the ball is not affected. Valve will then function efficiently over an additional long service period.

ADJUST-O-SEAL DESIGN IS A STANDARD FEATURE ON ALL PBM BALL VALVES

Two-Way, SP and SS Series | Flush Tank Series | Flush Tank, Multi-Port Series | Multi-Port Series | Multi-Port, Diverting Series

A7-1

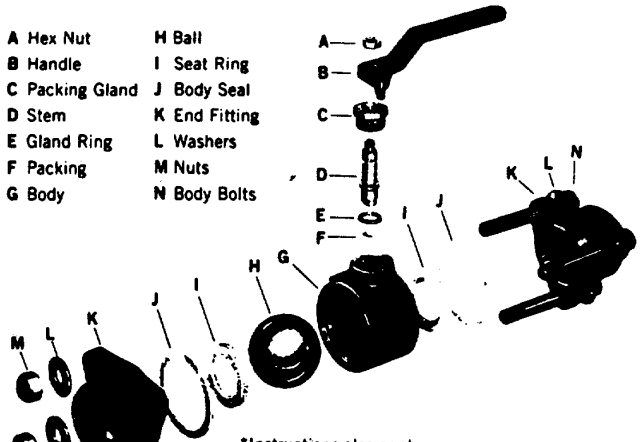
Engineering Data Form F

PITTSBURGH BRASS
MANUFACTURING CO.
VALVE DIVISION
Sandy Hill Road, Irwin, Pa. 15642
412/863-0550

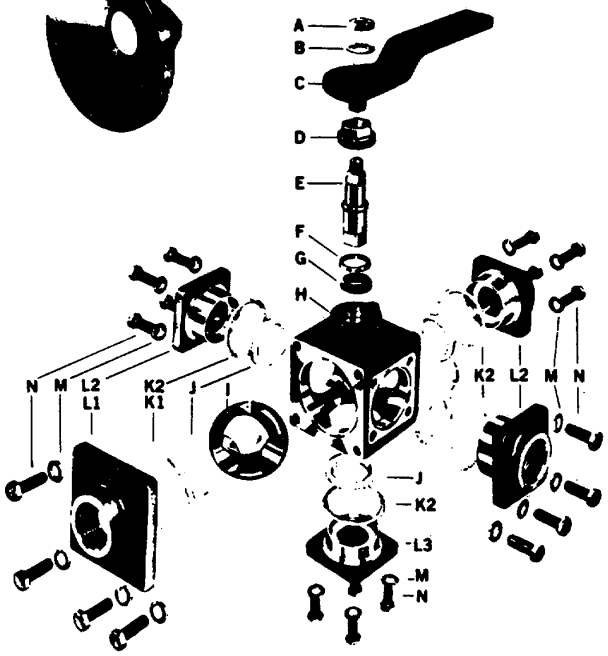
Maintenance and Assembly Instructions for 2-Way and Multi-Port Ball Valves

Effective Jan. 2, 1976

A Hex Nut
B Handle
C Packing Gland
D Stem
E Gland Ring
F Packing
G Body
H Ball
I Seat Ring
J Body Seal
K End Fitting
L Washers
M Nuts
N Body Bolts



*Instructions also apply to Flush Tank Ball Valves



A Hex Nut
B Flat Washer
C Handle
D Packing Gland
E Stem
F Gland Ring
G Stem Packing
H Body
I Ball
J Seat Ring
K1 End Body Seal
K2 Side Body Seal
L1 End Fitting
L2 Side Fitting
L3 Side or Bottom Blank
M Lock Washer
N Machine Screw

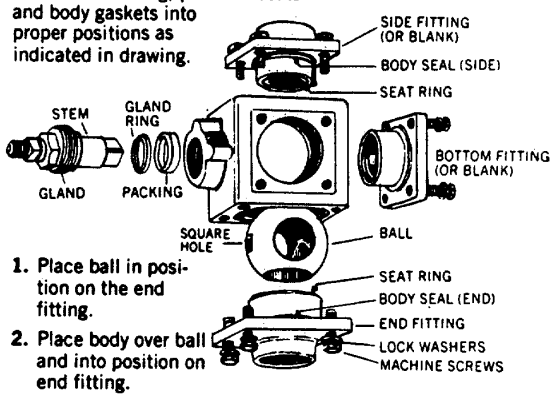
A7-2

2-WAY BALL VALVES

1. Ball should be in closed position.
2. Be sure seats are not damaged or scored.
3. Torque up bolts or cap screws evenly, alternating back and forth across valve. Also use feeler gage, if necessary, to obtain uniform gap between end fitting and body. Ball must be in closed position when tightening bolts.
4. Rotate ball back and forth while torquing up on bolts or cap screws — to avoid getting it too tight.
5. The slot in the top of the valve stem should always line up with the port in the ball.
6. Ball Valve should not be used for close throttling because of deformation or "wire drawing" on teflon seat.

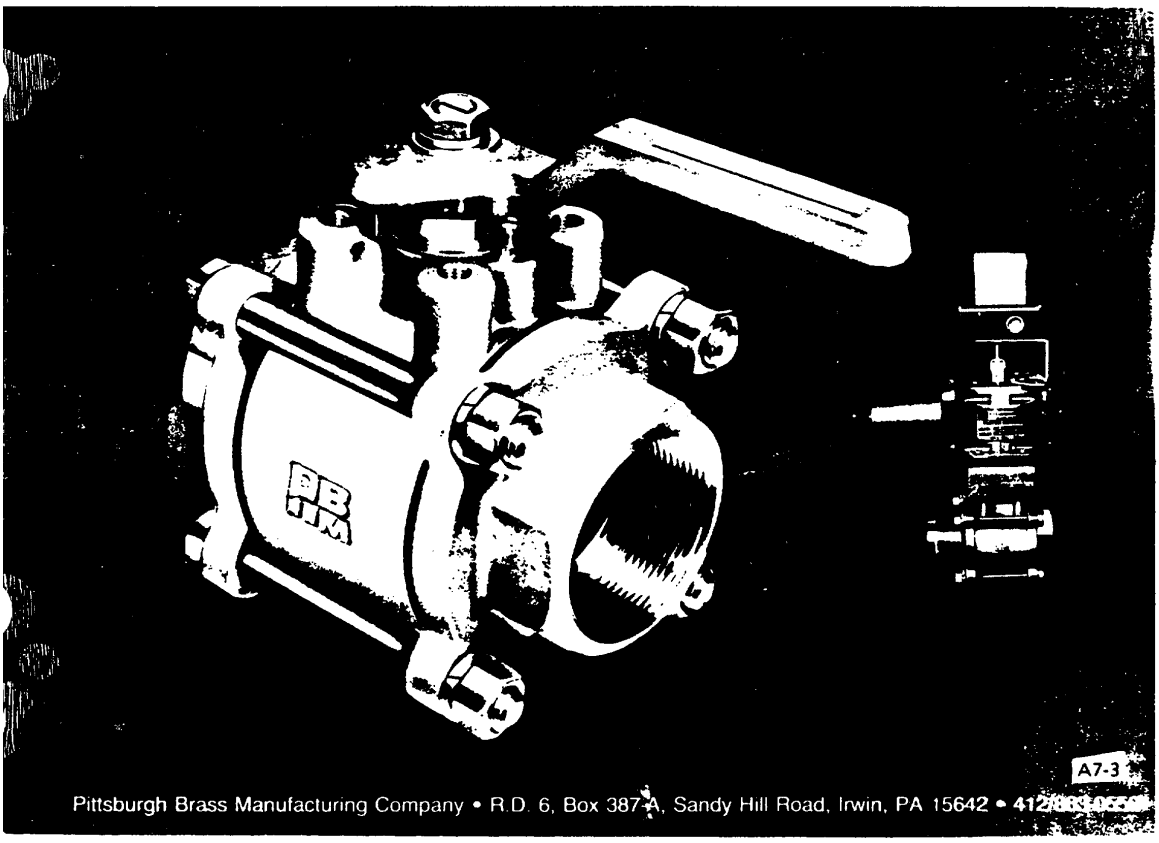
MULTI-PORT BALL VALVES

Before assembling, place all seats and body gaskets into proper positions as indicated in drawing.



1. Place ball in position on the end fitting.
2. Place body over ball and into position on end fitting.
3. Place stem packing, gland ring, stem and gland into body in sequential order. Engage stem into ball.
4. Tighten gland to hand-tight position.
5. Place one (1) side fitting 180° opposite end fitting that is in place.
6. Tighten bolts on side fitting evenly, rotate valve 180°, tighten bolts on end fitting evenly. (Rotate Ball while tightening bolts.)
7. Place remaining two (2) side fittings into position and tighten evenly.
8. Secure bottom blank into place. (Applies to 3" and 4" sizes only.)
9. Rotate ball several times, then tighten down firmly on gland. (If a leak should develop around stem while in service, retighten.)
10. Place handle in position and secure with flat washer and locknut.

Two-Way Ball Valves



PBM

and what it stands for

Not many manufacturers today can look back to a start-up in 1899. PBM can. And production has been a continuous operation since then.

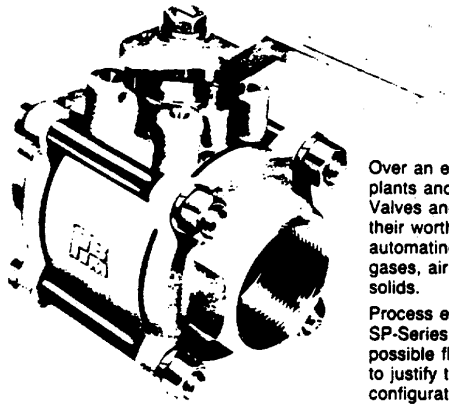
From machine shop contract work in the earliest days, through blast furnace tuyere cocks and fittings in the middle years, to ball valves and actuators since the early '60's, PBM's hallmark has been a dependable product at a competitive price.

This commitment to dependability begins at the design stage and continues through engineering, component manufacturing, assembly and testing. We believe that product integrity and performance is what the customer looks for since quality means long service life.

We are dedicated to an on-going program of continuous improvement in all we do. We know we must meet and even exceed our customers' expectations.

Index

Two-way SP-Series Ball Valves (Special Port — Extra Large)



Over an ever-increasing range of plants and processes, PBM Ball Valves and Actuators are proving their worth in controlling and automating the transmission of gases, air, liquids, and semi-solids.

Process engineers find the SP-Series ideal where the highest possible flow is important enough to justify the larger port configurations.

This Reference Book describes the many unique features of these valves not only in basic design, but in engineering flexibility, operational and maintenance efficiency, as well.

Operating Features that set these valves apart:

- Straight-through flow in either direction. Passages are smooth and without internal pockets or obstructions that could impede flow.
- Easy, quarter-turn from open to close.
- Bubble tight; positive shut-off sealing.

Pipe Size	Port Size
¼"	⅜"
⅜"	⅜"
½"	⅜"
¾"	13/16"
1"	1"
1¼"	1¼"
1½"	1½"
2"	1 15/16"
2½"	2½"
3"	2¾"
4"	3½"
6"	5¼"
8"	6¼"

Adjust-O-Seal Design

"More Turns For The Dollar"

This patented design employs a unique "take-up" spacing between the valve's body and end fittings. When normal wear occurs. A FAST, EASY TORQUING OF BODY BOLTS RESTORES THE VALVE TO ITS OPERATING CONDITION. Saves time, reduces maintenance costs and does not slow down production.

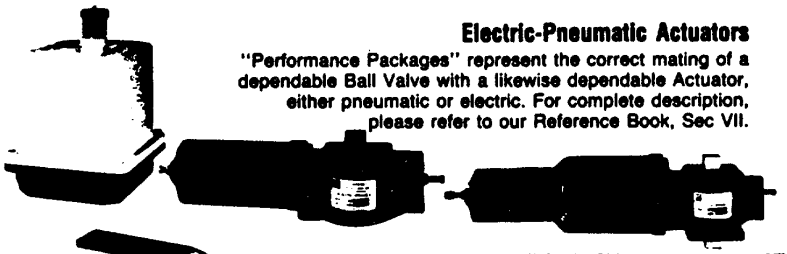
- **No galling or seizing (the lubricity of Teflon* seats eliminates this problem)**
- **No additional unions needed.**
- **A positive stop assures proper positioning of ball.**
- **Easy installation from a wide selection of end fittings.**
- **Compact design, low silhouette; valve fits in tight places.**
- **Manual or power operation.**
- **Valve's handle indicates open-close position.**
- **Wide choice of operating handles available for special needs.**

*Teflon is a Registered Trademark of the E.I. du Pont de Nemours & Company

Construction Features for Dependability and Long Service Life

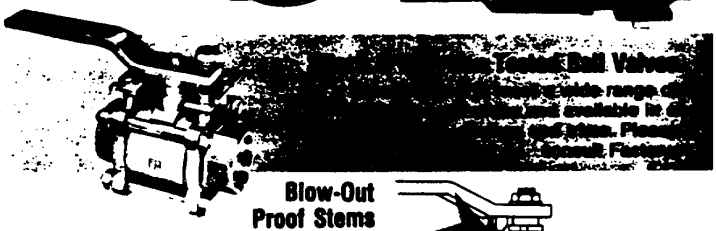
- Castings are extra heavy for added strength, increased resistance to wear and permit deep accurate threads.
- Balls are precision-machined, then carefully polished. Low torque operation is assured.
- Stems, regardless of body material, are 316 stainless steel.
- Seats and seals are glass-filled Teflon* to provide low coefficient of friction and are chemically inert. Ratings to 450°F. are standard; higher ratings available.
- Body bolts are extra strong and are fitted with lock washers under the nuts. For valves in certain metals, bolts are cadium-plated to resist corrosion. Other metals have bolting of 18-8 S/S.
- Rugged handles are generous size, easy-grip, and attached to stems with lock washers.

Options that meet special needs



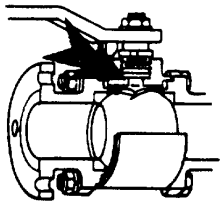
Electric-Pneumatic Actuators

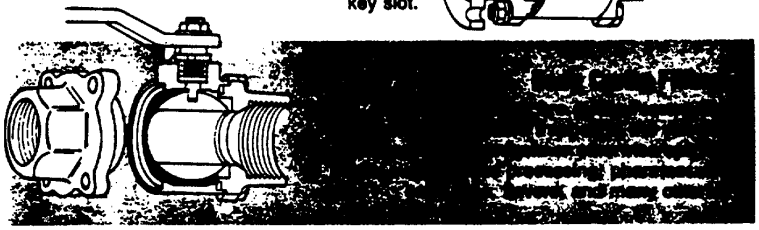
"Performance Packages" represent the correct mating of a dependable Ball Valve with a likewise dependable Actuator, either pneumatic or electric. For complete description, please refer to our Reference Book, Sec VII.



Blow-Out Proof Stems

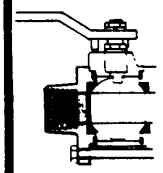
For severe and hazardous service conditions, our special bottom entry design is highly recommended. This unique blow-out proof design features square stem/ball engagement providing four times the bearing surface of a conventional key slot.



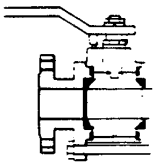


For additional options such as bodies, bolts, balls, stems, seats and seals, plus a wide selection of operating handles, please consult factory.

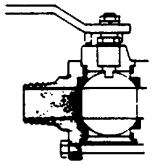
End Fittings for easier Installations



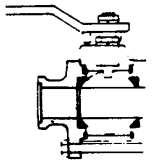
FEMALE NPT



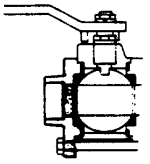
150# FLANGE



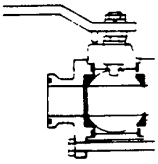
MALE NPT



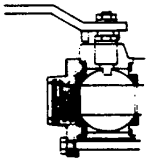
CHERRY-BURRELL (I-LINE Quick Disconnect



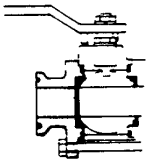
SOLDER JOINT



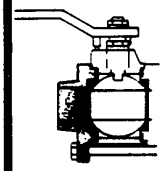
CHERRY-BURRELL (Q-LINE Quick Disconnect



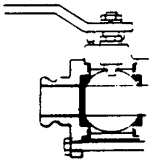
SIL-BRAZED



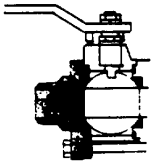
T-KLAMP (TUBING) Quick Disconnect



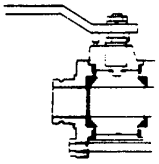
SOCKET WELD



CAM LOCK (HOSE) Quick Disconnect



BUTT WELD



GROOVED ENDS Quick Disconnect

Fits Aeroquip, Marman and Victaulic Adapters

A7-5

Metals - and their properties

316 STAINLESS STEEL (Austenitic Grade)—complies with A351-GR-CF8M.
This metal is exceptionally corrosive-resistant to such reducing solutions as sulphuric and fatty acids. Since it does not pit readily, it is a good choice for handling acetic acid and chloride operations, including sea water.

BRONZE—complies with ASTM Spec. No. B-62 (CDA Alloy No. 836)
The superior properties of this metal recommend it as the ideal choice for all general purpose (non-corrosive) applications. It is versatile and well suited for steam, air, water, oil and gas lines. "UL" listed in sizes up to 2" with F.N.P.T. ends.

WELDEX—complies with MIL-C-60-653
This highly popular material provides almost the same high strength of steel, but it is priced somewhat lower. It features extreme resistance to shock, vibration, fire, and freezing hazards and is recommended for water, air, natural gas and oil services. This material is weldable. "UL" listed in sizes up to 4" with F.N.P.T. ends.

CARBON STEEL—complies with A216-WCB.
This is a highly versatile material, with extreme strength, making it very useful when valves require unusual resistance to shock, vibration, fire and freezing hazards. It efficiently handles water, air, natural gas and oil and other non-corrosive media.

ALUMINUM—complies with SG-70A-T6
This material, noted equally for its strength and lightness, becomes an ideal choice for handling such media as nitric, chromic, and most of the organic acids.

For Valve sizes in each of these metals, please see Materials of Construction Chart, Page 5.

C_V factors for 'SP' series Ball Valves

C_V is defined as the number of U.S. gallons of water per minute, at standard conditions (60 F° @ 14.7 PSIA) that will flow through a valve at a 1 PSIG Pressure drop across the Valve.

PIPE SIZE	"SP" SIZE	C_V FACTOR
¼"	SP-12-.25	18
⅜"	SP-12-.375	18
½"	SP-12	18
¾"	SP-13	35
1"	SP-14	53
1-¼"	SP-15	83
1-½"	SP-16	120
2"	SP-17	200
2-½"	SP-18	330
3"	SP-19	400
4"	SP-20	650
6"	SP-22	1450
8"	SP-24	2050

Nomenclature

- GPM — U.S. Gallons per Minute
- W — Pound per hour*
- Q — Cubic feet per hour @ 60°F and 14.7 PSIA
- G — Specific Gravity
- $\bar{V}$ — Specific volume of inlet steam
- °F — Inlet gas temperature
- P_1 — Inlet pressure in PSIA
- P_2 — Outlet pressure in PSIA
- ΔP — Pressure drop across the valve in PSI. Must not be greater than half the absolute inlet pressure
- PSIA = PSIG + 14.7

*Pounds per hour may be converted to standard cubic feet per hour by the following formula.

$$Q = \frac{W}{0.0764\ G}$$

The Sizing Formulas

(1). LIQUID:

$$C_V = GPM\sqrt{\frac{G}{\Delta P}}$$

$$GPM = C_V\sqrt{\frac{\Delta P}{G}}$$

$$\Delta P = \left[\frac{GPM}{C_V}\right]^2 (G)$$

(2). SATURATED STEAM

$$C_V = \frac{W}{2.1}\sqrt{\frac{1}{\Delta P\ (P_1 + P_2)}}$$

$$W = 2.1\ C_V\sqrt{\Delta P}\sqrt{P_1 + P_2}$$

$$\Delta P = \left[\frac{\bar{V}}{.0159\ W}\right]^2 C_V$$

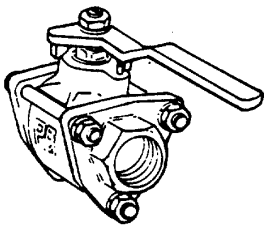
(3). GAS:

$$C_V = \frac{Q}{1360}\sqrt{\frac{G\ (460 + °F)}{\Delta P}}\sqrt{\frac{2}{P_1 + P_2}}$$

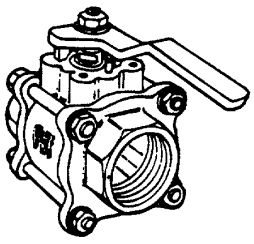
$$Q = (1360)\ C_V\sqrt{\frac{\Delta P}{G\ (460 + °F)}}\sqrt{\frac{P_1 + P_2}{2}}$$

$$\Delta P = \left[\frac{Q}{(1360)\ C_V}\right]^2\left[\frac{(460 + °F)\ G}{P_1}\right]$$

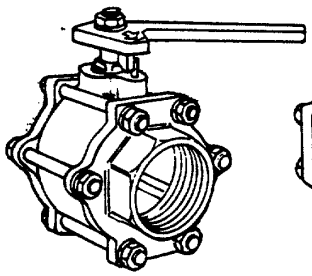
Bolt Configurations



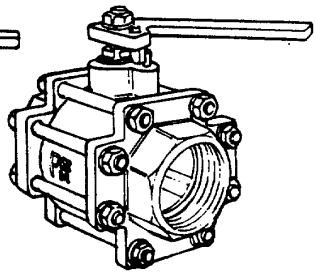
3 Bolts for ¼", ⅜", ½", ¾" and 1" Valves



4 Bolts for 1¼", 1½", 2", and 2½" Valves



6 Bolts for 3" Valves



8 Bolts for 4", 6" and 8" Valves

Materials of Construction

	316 STAINLESS STEEL PBM Code H	BRONZE[4] PBM Code B	WELDEX[5] PBM Code D	CARBON STEEL PBM Code E	ALUMINUM PBM Code A
SIZES	¼", ⅜", ½", ¾", 1", 1¼", 1½", 2", 3", 4", 6", 8"	¼", ⅜", ½, ¾", 1", 1¼", 1½", 2", 2½", 3", 4"	¼", ⅜", ½", ¾", 1", 1½", 2", 2½", 3", 4"	½", ¾", 1", 1½", 2", 3", 4", 6", 8"	¼", ⅜", ½", ¾", 1", 1¼", 1½", 2" 2½", 3", 4"
BODY & END FITTINGS	316 Stainless Steel (ASTM A351, Grade CF 8M)	Bronze (85-5-5-5) B-62	Weldex (MIL-C-60-653)	Carbon Steel (A216-WCB)	Aluminum (SG-70-A-T6)
BALL	316 S/S (ASTM A351, Grade CF8M)	S/S for ¼" thru ¾" Bronze (85-5-5-5) B-62 for 1" to 4"	S/S for ¼" thru ¾" Hard Chrome Plated Steel for 1" to 4"	S/S for ¼" thru ¾" Hard Chrome Plated Steel for 1" to 8"	S/S for ¼" thru ¾" Aluminum (SG-70-A-T6)
STEM	316 S/S	316 S/S	316 S/S	316 S/S	316 S/S
GLAND	Stainless Steel	Bronze	Stainless Steel	Stainless Steel	Stainless Steel
BODY BOLTS	18-8 Stainless Steel	18-8 Stainless Steel	Cadmium Plated Steel	Cadmium Plated Steel	18-8 Stainless Steel
HANDLE	Weldex for 3" & 4" Cast Bronze for all other sizes	Weldex for 2½", 3" & 4" Cast Bronze for all other sizes	Weldex for 2½", 3", & 4" Cast Bronze for all other sizes	Weldex for 3" & 4" Cast Bronze for all other sizes	Weldex 2½", 3" & 4" Cast Bronze for all other sizes
SEAT BODY SEAL STEM PACKING	Glass-filled Teflon[2].	Glass-filled Teflon[2].	Glass-filled Teflon[2].	Glass-filled Teflon[2].	Glass-filled Teflon[2].
RATINGS TENSILE STRENGTH	80,000 PSI	37,000 PSI	65,000 PSI	70,000 PSI	36,000 PSI
YIELD STRENGTH	42,000 PSI	17,000 PSI	50,000 PSI	36,000 PSI	24,000 PSI
ELONGATION IN 2"	50%	30%	22%	22%	5%
WORKING[1] PRESSURE	400 PSIG Max.	300 PSIG Max.	400 PSIG Max.	400 PSIG Max.	300 PSIG Max.
WORKING TEMP.[1]	450° F Max.[3]	450° F Max.	450° F Max.	450°F Max.[3]	450°F Max.
HYDROSTATIC TEST	600 PSIG	450 PSIG	600 PSIG	600 PSIG	450 PSIG
END FITTINGS FEMALE NPT	¼" thru 4"	¼" thru 4"	¼" thru 1" 1½" thru 4"	½" thru 1" 1½" thru 4"	¼" thru 4"
MALE NPT	½" thru 1" 1½" thru 4"	½" thru 2"	½" thru 1" 1½" thru 4"	N.A.	N.A.
BUTT WELD	½" thru 1" 1½" thru 8"	SOLDER JOINT ½" thru 4"	N.A.	¾", 1", 1½", 2" 3" thru 8"	N.A.
SOCKET WELD	¼" thru 4"	¼" thru 4"	¼" thru 1" 1½" thru 4"	½" thru 1" 1½" thru 4"	N.A.
GROOVED ENDS	½" thru 1" 1½" thru 8"	SIL-BRAZE & GROOVED ½" thru 4"	½" thru 1", 1½", 2", 3", 4"	¾", 1", 1½", 2" 3" thru 8"	N.A.
150 # FLANGE	½" thru 1", 1½", 2", 3" thru 8"	1", 1½" thru 4"	1", 1½" thru 4"	1", 1½", 2" 3" thru 8"	1", 1½" thru 4"

NOTES:

1. *Max. Press. & temp. shown are not simultaneous. See Pressure Temp. Chart Page 7.*
2. *Optional: 50%-316 S/S filled Teflon®. Rating: 500°F.*
3. *6" & 8" Max. Temp. 375°F.*
4. *"UL" Listed in sizes up to 2" when supplied with Female NPT Ends.*
5. *"UL" Listed in sizes up to 4" when supplied with Female NPT Ends.*

A7-7

Engineering Data

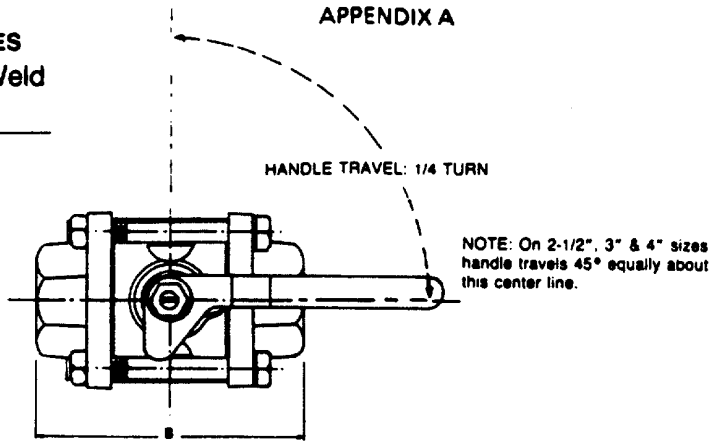
Dimensions for SP SERIES

Female NPT • Socket Weld

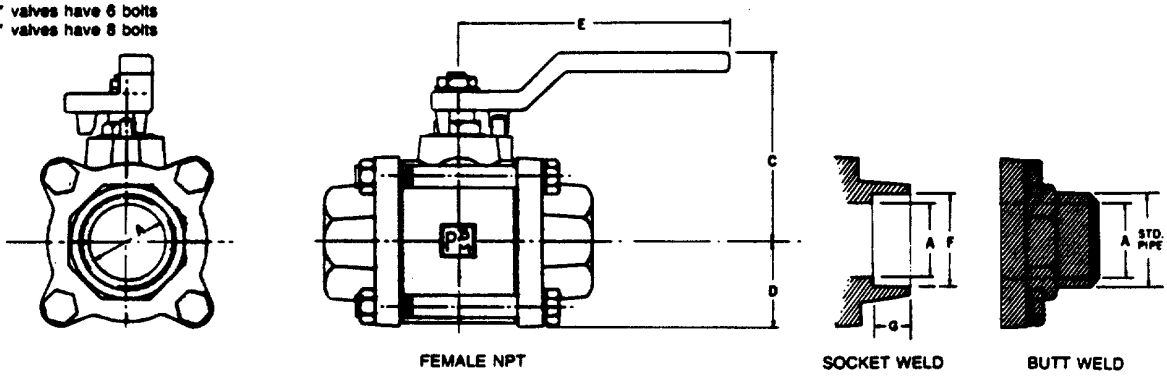
¼" thru 4"

Butt Weld

½" thru 4"



1/4", 3/8", 1/2", 3/4" & 1" valves have 3 bolts
1-1/4", 1-1/2", 2" & 2-1/2" valves have 4 bolts
3" valves have 6 bolts
4" valves have 8 bolts



FEMALE NPT | SOCKET WELD | BUTT WELD

PIPE SIZE (Inch)	FEMALE NPT					SOCKET WELD		APPROX. WT. (LBS.)				
	A Port Dia.	B Length	C Height	D	E Handles	F Dia.	G Depth	Bronze	Weldex	S/S	AL	C/S
¼"	.62"	3.12"	2.16"	1.34"	3.69"	.56"	.81"	2	1½	1¾	¾	1¾
⅜"	.62"	3.12"	2.16"	1.34"	3.69"	.69"	.81"	2	1½	1¾	¾	1¾
½"	.62"	3.12"	2.16"	1.34"	3.69"	.86"	.81"	2	1½	1¾	¾	1¾
¾"	.81"	3.44"	2.28"	1.47"	3.69"	1.06"	.81"	2¼	1¾	2¼	¾	2¼
1"	1.00"	3.88"	2.86"	1.69"	4.31"	1.34"	.94"	3¾	3	3½	1¼	3½
1¼"	1.25"	4.54"	3.78"	1.56"	5.50"	1.69"	1.12"	7½	6¼	7¼	2½	7¼
1½"	1.50"	5.38"	4.03"	1.70"	5.50"	1.92"	1.16"	9½	8	9	3	9
2"	1.94"	5.75"	4.38"	2.03"	5.50"	2.41"	1.12"	12¾	11½	12½	4	12½
2½"	2.50"	8.31"	5.31"	2.77"	12.00"	2.94"	1.56"	31½	28½		10	
3"	2.75"	8.62"	6.69"	3.88"	12.00"	3.55"	1.88"	50	45	48	16	48
4"	3.50"	10.50"	7.14"	4.47"	12.00"	4.55"	2.12"	82	75	72	26	72

(NOTE: Male NPT, Solder-Joint, T-Klamp, Cherry Burrell, Sil-Braze, and Grooved Ends are available in certain sizes and metals. Call or write us for data.)

PIPE SIZE (Inch)	BUTT WELD					APPROX. WT. (LBS.)			
	A Port Dia.	B Length	C Height	D	E Handle	Weldex	S/S	AL	C/S
½"	.62"	3.12"	2.16"	1.34"	3.69"	1¾	2	¾	2
¾"	.81"	3.44"	2.28"	1.47"	3.69"	2	2½	1	2½
1"	1.00"	3.88"	2.86"	1.69"	4.31"	3¼	3¾	1½	3¾
1½"	1.50"	5.38"	4.03"	1.70"	5.50"	8½	9½	3¼	9½
2"	1.94"	5.75"	4.38"	2.03"	5.50"	12	13	4¼	13
3"	2.75"	8.62"	6.69"	3.88"	12.00"	45½	48½	16	48½
4"	3.50"	10.50"	7.14"	4.47"	12.00"	76	73	26½	73

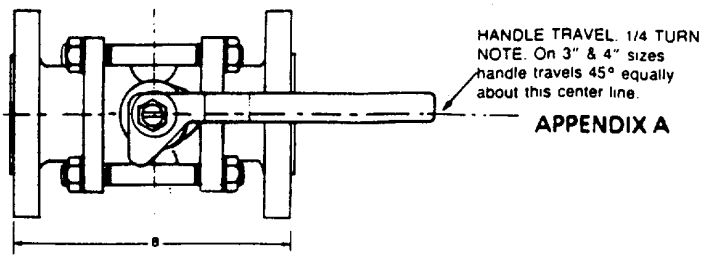
Sch 40 dimensions shown. Sch 10 and Sch 5 Butt Weld Ends also available.

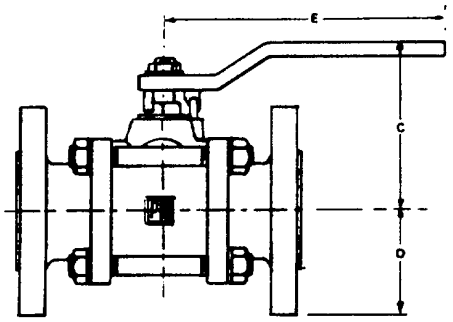
Engineering Data

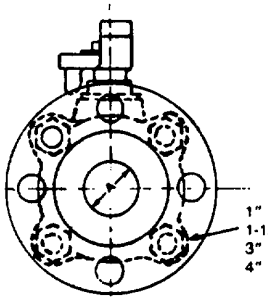
Dimensions for SP SERIES

150" Flange

1" thru 4"



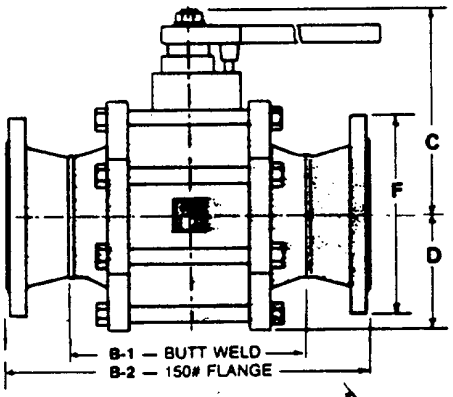


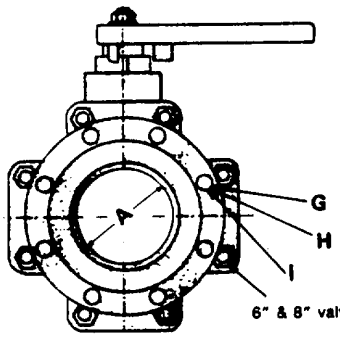


150 LB. FLANGE

PIPE SIZE (Inch)	A Port Dia.	B Length	C Height	D Height	E Handle	F Flg. OD	G Dia. BC	H No. Bolt Holes	I Bolt. Dia.	APPROX. WT. (LBS.) Bronze	Weldex	S/S	AL	C/S
1"	1.00"	6.31"	2.86"	2.12"	4.31"	4.25"	3.12"	4	.50"	7½	5¾	7	2½	7
1½"	1.50"	6.97"	4.03"	2.50"	5.50"	5.00"	3.88"	4	.50"	17	14¼	16	5½	16
2"	1.94"	8.41"	4.38"	3.00"	5.50"	6.00"	4.75"	4	.62"	26	23½	25½	8¼	25½
3"	2.75"	12.00"	6.69"	3.75"	12.00"	7.50"	6.00"	4	.62"	77	69½	74	24½	74
4"	3.50"	12.88"	7.20"	4.50"	12.00"	9.00"	7.50"	8	.62"	116	106	102	36¾	102

Consult Factory for ½" and ¾" sizes





Engineering Data

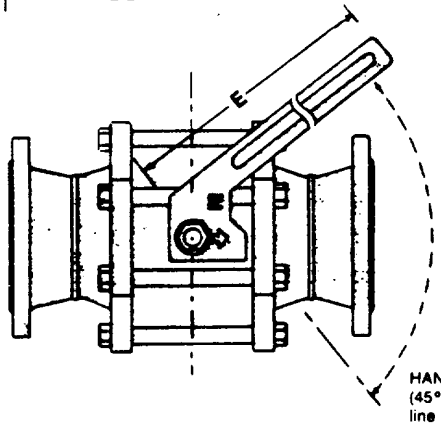
Dimensions for SP SERIES

Butt Weld	6" & 8"
150# Flange	6" & 8"

PIPE SIZE (Inch)	BUTT WELD ENDS A Port Dia.	B-1 Length	C Height	D Height	E Handle	WT. (LBS.) S/S	C/S
6"	5.25"	13.00"	11.00"	6.31"	15.00"	215	215
8"	6.25"	14.62"	11.78"	7.62"	15.00"	310	310

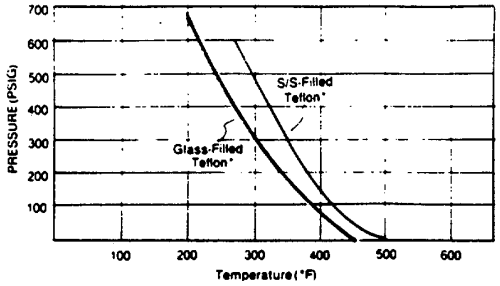
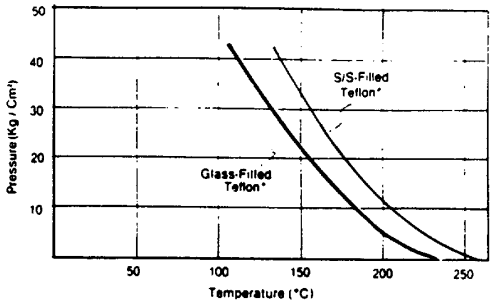
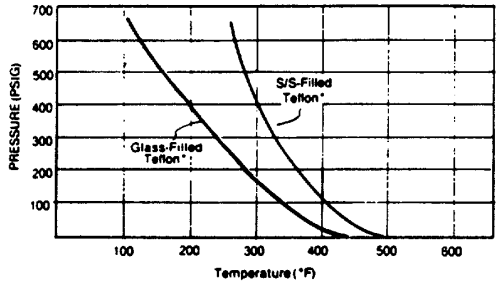
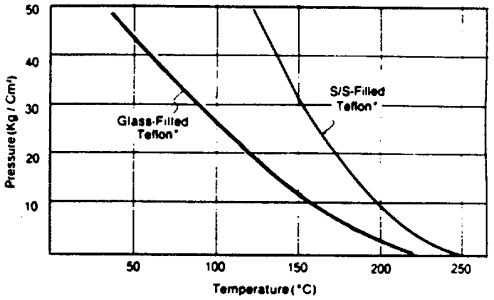
150 LB. FLANGE

PIPE SIZE (Inch)	B-2 Length	F Flg. OD	G Dia. BC	H No. Bolt Holes	I Bolt Dia.	WT. (LBS.) S/S	C/S
6"	20.00"	11.00"	9.50"	8	.75"	265	265
8"	22.62"	13.50"	11.75"	8	.75"	400	400



Engineering Data: Seat Ratings for stainless steel filled Teflon* and glass-filled Teflon* Seats in Standard Two Way Ball Valves (Pressure VS Temperature — both English and Metric)

APPENDIX A

	ENGLISH (PSIG vs °F)	METRIC (Kg/CM² vs °C)
1/4" thru 2 1/2"		
3" thru 8"		

How to Specify Two-Way Ball Valves, SP-Series *(With Options)*

Valve Size		Valve Body Materials		End Fittings		Ball & Gland Materials		Seat & Seal Materials		Cavity Fillers		Stems		Manual Operators	
Pipe Size	PBM Code	PBM Code	Description	PBM Code	Description	PBM Code	Description	PBM Code	Description	PBM Code	Description	PBM Code	Description	PBM Code	Description
1/4"	12-25	B	= Bronze	S	= Female NPT	B0	= 316 Stainless Steel Ball	2	= Glass-filled Teflon* (This is standard material)	F0	= Glass-Filled Teflon* Body Cavity Fillers	E0	= 316 Stainless Steel 4" Stem Extension	H0	= Square Operating Nut
3/8"	12-375	H	= 316 Stainless Steel	M	= Male NPT	B1	= 316 Stainless Steel Ball & Gland	S0	= 50% 316 Stainless Steel-Filled Teflon* Seats. Asbestos Body Gaskets. Hi Temp Stem Packing	F1	= Body Prepared to Accept Cavity Fillers	E1	= 316 Stainless Steel 4" Stem & Gland Extension	H1	= Spring-Return Handle
1/2"	12	D	= Weldex	SJ	= Solder Joint	B2	= Monel Ball	S1	= 50% 316 Stainless Steel-Filled Teflon* Seats Only	F2	= UHMWPE Body Cavity Fillers	E2	= 316 Stainless Steel 6" Stem Extension	H2	= Spring Return Handle With Fusible Link
3/4"	13	E	= Carbon Steel	SW	= Socket Weld	B3	= Monel Ball, Stem & Gland	S2	= One (1) Fire-Safe Seat. Asbestos Body Gaskets. Hi Temp Stem Packing			E3	= 316 Stainless Steel 6" Stem & Gland Extension	H3	= Chain-Wheel Operator
1"	14	A	= Aluminum	BW	= Butt Weld	B4	= Bronze Ball	S3	= One (1) Fire-Safe Seat Only			0E	= Bottom Entry Stem	H4	= Manual Gear Operator
1 1/4"	15	M	= Monel	BWT	= Butt Weld (Tube)	B6	= Chrome Plated Steel Ball	S4	= Two (2) Fire-Safe Seats. Asbestos Body Gaskets. Hi Temp Stem Packing					H5	= Less Handle
1 1/2"	16			F-15	= 150# Flange	B8	= Monel Stem and Gland Ring	S5	= Two (2) Fire-Safe Seats Only					H6	= Less Handle Prepared For Field Actuator Mounting
2"	17			TT	= T-Klamp (Tube)	00	= Without Ball	S6	= UHMWPE Seats & Seals					H7	= 304 Stainless Steel Handle
2 1/2"	18			CBI	= Cherry-Burrell (I-Line)			S7	= Asbestos Gaskets. High-Temp Stem Packing					H8	= Locking Device
3"	19			CBQ	= Cherry-Burrell (Q-Line)			S8	= Kynar Seats & Seals					0H	= With Handle prepared for Actuator Mounting
4"	20			G	= Grooved Ends (Victaulic, Aeroquip, Marman, etc.)			95	= Less Seats & Seals						
6"	22														
8"	24														

Example

If you want a 2" Ball Valve, Special Port, Extra Large Size in 316 Stainless Steel with Glass-filled Teflon* Seats & Seals and Female NPT End Fittings and with Body Cavity Fillers, order 2". SP-H-17-S•2/F0.

Valve Size	Valve Series	Valve Material Code	Valve Size Code	End Fitting Code	Standard Seat & Seal Code • Body Cavity
2"	• SP •	H	• 17 •	S	• 2/F0

DISCLAIMER: Due to continuous product improvements, we reserve the right to modify or change design without incurring any liability to furnish or install such modifications or changes on products previously or subsequently sold.

Marketing

Our Ball Valves reach the marketplace through a national network of carefully selected Distributors who work closely with Sales and Service Engineers at the Factory. Please contact us for the name of the PBM Distributor in your area.

A7-10

PBM PITTSBURGH BRASS MANUFACTURING

R.D. 6, Box 387-A, Sandy Hill Road, Irwin, PA 15642
412/863-0550 • TLX 86-6236

5M 785 LITHO USA

APPENDIX A

MAINTENANCE AND ASSEMBLY INSTRUCTIONS FOR PBM BALL VALVES

Two-Way Valves "SP" Series

1.) PBM valves are designed with an "Adjust-o-Seal" feature. If the valves show signs of leakage due to normal seat and seal wear, torque up the body bolts evenly alternating from body bolt to body bolt until leakage stops and valve operates smoothly. The following should be noted with respect to torque on body bolts.

a. There should always be a space between end fittings and body initially. This is the adjust-o-seal feature that allows for the external adjustment or the seats and seals.

b. Valve body bolts should only be tightened until you reach the breakaway torque's off the valve stem listed below. (do not exceed maximum)

Valve Size		Breakaway Torque
1/4", 3/8", 1/2"	SP-12	4 ft/lbs.
3/4"	SP-13	5 ft/lbs.
1"	SP-14	7 ft/lbs.
1-1/4"	SP-15	11 ft/lbs.
1-1/2"	SP-16	16 ft/lbs.
2"	SP-17	20 ft/lbs.
2-1/2"	SP-18	32 ft/lbs.
3"	SP-19	44 ft/lbs.
4"	SP-20	68 ft/lbs.
6"	SP-22	150 ft/lbs.
8'	SP-24	250 ft/lbs.

2.) If valve shows signs of leakage in stem area due to normal stem packing wear, tighten gland nut until leakage stops and valve operates smoothly.

3.) After all adjustments are made on the seats and seals and valve is bolted metal to metal, a new repair kit is required. These parts come in kit form, each containing:

APPENDIX A

1/4", SP-12 through 4", SP-20	Quan.	(2) teflon seats (2) teflon body gaskets (1) Teflon stem packing
6", SP-22 and 8", SP-24	Quan.	(2) teflon seats (2) Viton o-ring body gaskets (1) teflon stem packing

4.) To replace the above parts, please adhere to the following instructions:

a. Loosen and remove body section from the line.

b. If valve is actuated, remove actuator, bracket and coupling.

c. Remove seats and body seals from end fittings.

d. Remove lock nut, handle, gland, stem, gland ring and stem packing.

e. Ball is now free, so remove it, being very careful not to scratch or nick the exterior surface.

f. Wash and clean all parts

*g. Replace ball in body, making certain not to scratch the exterior surface.

h. Place new stem packing, gland ring, stem and gland into valve. body in sequential order. Engage stem into ball (a rubber hammer may be used due to light press fit) and tighten gland to hand tight position.

* *i. Place seats and body seals into proper position in end fittings, lubricating both end fitting seat cavities and sealing surfaces on seats and seals.

j. Place end fittings into proper locations on valve body section and tighten body bolts hand tight, making certain ball port is centrally located with end fitting inside diameters.

k. Torque up the body bolts evenly alternating from body bolt to body bolt. Ball should be turned several times with torquing to assure smooth operation. The following should be noted with respect to torque on body bolts.

(1) There should always be a space between end fittings and body initially. This is the adjust-o-seal feature that allows for the external adjustments of seats and seals.

(2) Valve body bolts should only be tightened until you reach the breakaway torques off the valve stem listed on Page 1, Item 1 under b.

l. Rotate ball several times, then tighten down firmly on gland.

m. Place handle in position and secure with lock nut. (if valve is actuated, see actuator assembly instructions)

* See Engineering Data Form "F" in booklet to aid in assembly.

* * STP recommended lubricant.

PITTSBURGH BRASS MANUFACTURING COMPANY
SANDY HILL ROAD, BOX 387-A • R.D. 6, IRWIN, PA. 15642
Telephone: (412) 863-0550

BILL OF MATERIAL

ASSEMBLY SP-A-16-S SUB. ASSEMBLY

CAT NO.	DWG NO.	DWG SIZE	PATT NO.	DESCRIPTION	QTY	MAT'L
	SP-16-1			BODY	1	ANODIZED ALUM
	SP-16-2			BALL	1	"
	SP-16-3			END FITTING	2	"
	SP-17-4			HANDLE	1	ALUM BRNZ
	SP-17-5A			STEM	1	316 S/S
	SP-17-6			GLAND	1	300 SERIES S/S
	SP16-8B			SEAT	2	GLASS FILLED TEFLON
	SP-17-9			PACKING	1	"
	SP-17-10			GLAND RING	1	300 SERIES S/S
	SP-16-13			BODY GASKET	2	GLASS FILLED TEFLON
	SP-16-15			HEX BOLT (7/16-14x4"lg HEX HD)	4	18-8 S/S
	SP-16-16			HEX NUT (7/16-14)	4	"
	SP-16-20			LOCKWASHER (7/16)	4	"
	SP-16-17			STEM HEX NUT (7/16-14 JAM)	1	"
	SP16-44			STEM LOCKWASHER (7/16 EXTERNAL TOOTH LW)	1	"
	SP-16-21			STOP PIN (1/4" DIA x 3/4" lg ROLL PIN)	1	400 SERIES S/S
	SP-16-13F			CAVITY FILLER-OPTIONAL	2	GLASS FILLED TEFLON
				MODIFY BODY FOR FILLERS		
				PER DWG SP-13-1F		

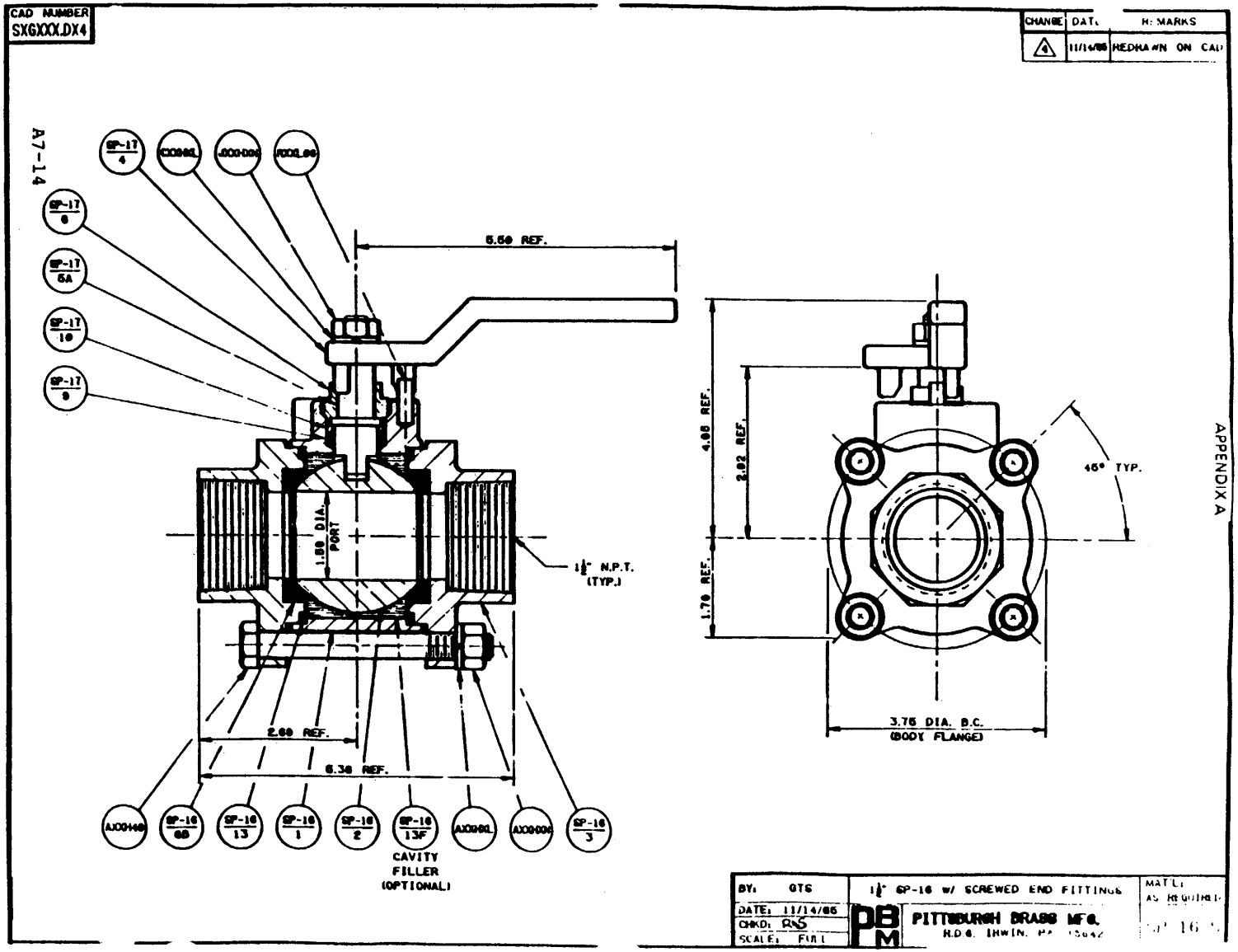
REVISIONS

DATE	2-16-80
BY	PBMFG
APP'D	GWF

REMARKS: SP-A-16-SCREWED ENDS ALUM BALL VALVE

PAGE 1 OF 1

A7-13


CAD NUMBER
SXGXXX.DX4
CHANGE
DATE
REMARKS
11/14/85
REDRAWN ON CAD
APPENDIX A
5.50 REF.
1.50 DIA. PORT
1½" N.P.T. (TYP.)
2.69 REF.
6.38 REF.
CAVITY FILLER (OPTIONAL)
4.68 REF.
2.82 REF.
1.70 REF.
45° TYP.
3.75 DIA. B.C. (BODY FLANGE)
BY: GTG
DATE: 11/14/85
CHKD: RNS
SCALE: FULL
1½" SP-16 w/ SCREWED END FITTINGS
PITTSBURGH BRASS MFG.
MATL: AS REQUIRED
SP 16 S

PITTSBURGH BRASS MANUFACTURING COMPANY

APPENDIX A

SANDY HILL ROAD, BOX 387-A R.D. 6, IRWIN, PA. 15642
Telephone: (412) 863-0550

BILL OF MATERIAL

ASSEMBLY: SPA-19-S2

CAD NO.	DWG NO.	DESCRIPTION	QTY.	MAT'L
SXJAAX	SP-19-1A	BODY	1	ALUMINUM
SXJBXX	SP-19-2	BALL	1	ALUMINUM
SXJCXX	SP-19-3	END FITTING	2	ALUMINUM
SXJDXX	SP-19-4D	HANDLE	1	WELDEX
SXJEXX	SP-19-5A	STEM	1	316 SST
SXJFAX	SP-19-6A	GLAND ASSEMBLY	1	300 SER SST
SXJGXX	SP-19-8B	SEAT	2	GL.FL.TFE
SXJHAX	SP-19-9A	PACKING	1	GL.FL.TFE
SXJIXX	SP-19-10	GLAND RING	1	303 SST
SXJJXX	SP-19-13	BODY GASKET	2	GL.FL.TFE
AXXM64	AHCM64	HEX. BOLT ($\frac{3}{4}$"-10 x $6\frac{1}{2}$" LG.)	6	18-8 SST
AXXMXN	AHCMXN	HEX. NUT ($\frac{3}{4}$"-10)	6	18-8 SST
AXXMXL	AHXMXL	LOCKWASHER ($\frac{3}{4}$")	6	18-8 SST
JXXKXN	JHCKXN	HEX. NUT ($\frac{5}{8}$"-11 JAM)	1	18-8 SST
AXXKXL	AHXKXL	LOCKWASHER ($\frac{5}{8}$")	1	18-8 SST
RXXN10	RHXN10	STOP PIN ($\frac{3}{8}$" DIA. x 1" LG. ROLL PIN)	1	400 SER SST

REVISIONS		DATE:	6-3-85
1	6-3-85 REDRAWN ON CAD	BY:	JMW
		APP'D:	RLS

3" SPA-19 w/ SCREWED END FITTINGS

PAGE 1 OF 1

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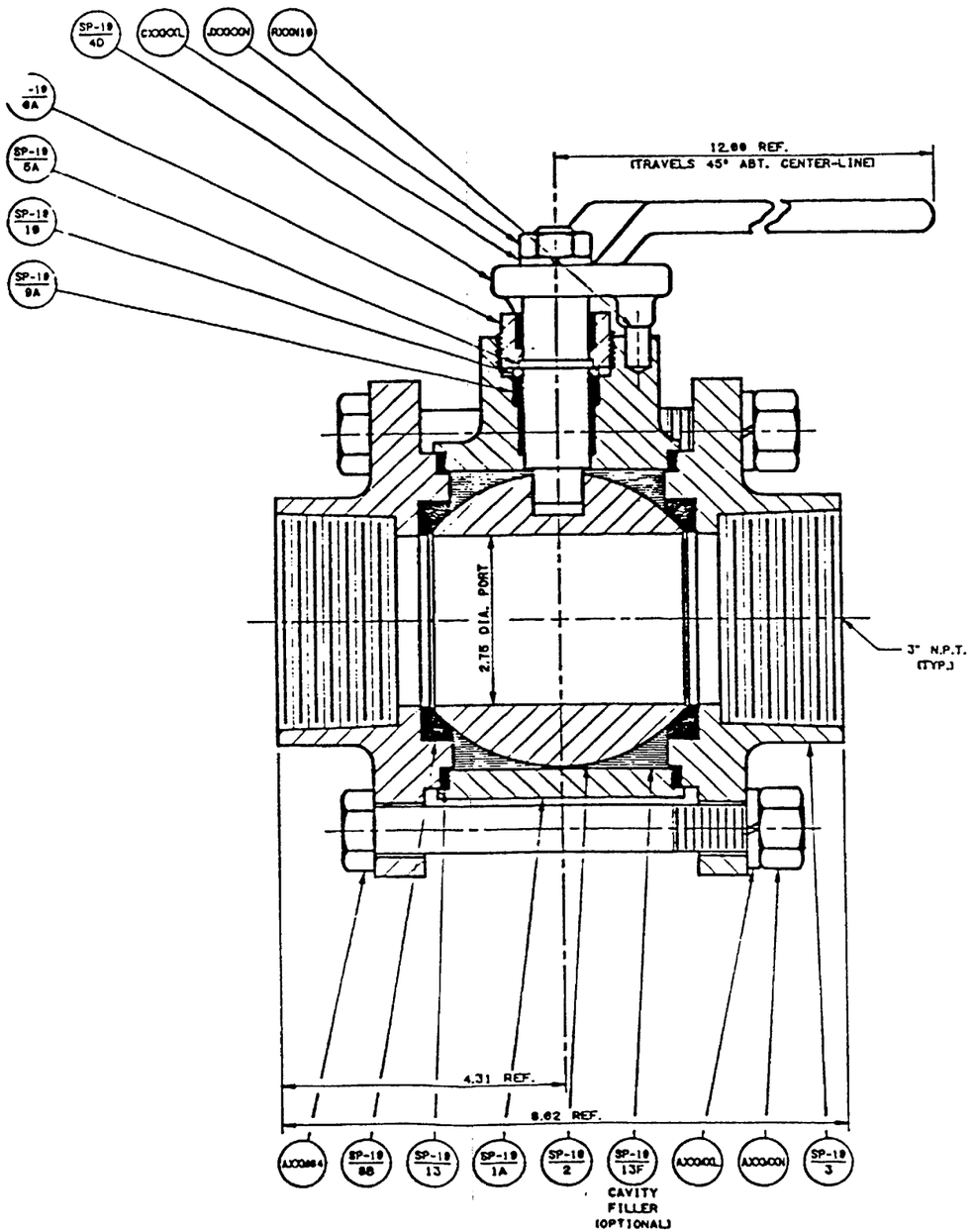
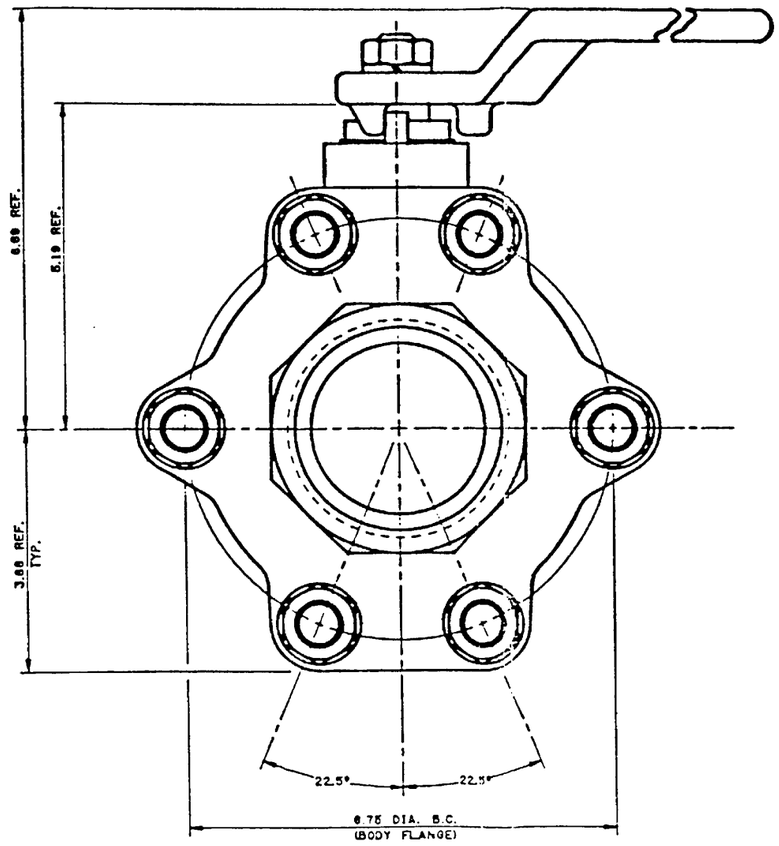
CHANGE!	DATE	REMARKS
4	5/10/85	REDRAWN ON CAD





BY: GTS	3" SP-19 w/ SCREWED END FITTINGS		MATL: AS REQUIRED
DATE: 5/10/85	PITTSBURGH BRASS MFG. CO.		SP-19-S
CHKD. R.S.	R.D.8. IRWIN, PA. 15642		
SCALE: FULL			

PITTSBURGH BRASS MANUFACTURING COMPANY
APPENDIX A
SANDY HILL ROAD, BOX 387-A • R.D. 6, IRWIN, PA. 15642
Telephone: (412) 863 0550

BILL OF MATERIAL

ASSEMBLY SP-A-20-S SUB. ASSEMBLY

CAT NO.	DWG NO.	DWG SIZE	PATT NO.	DESCRIPTION	QTY	MAT'L
	SP-20-1A			BODY	1	ALUM
	SP-20-2			BALL	1	"
	SP-20-3			END FITTING	2	"
	SP-19-4D			HANDLE	1	WELDEX
	SP-19-5A			STEM	1	316 SS
	SP-19-6A			GLAND	1	300 SERIES SS
	SP-20-8B			SEAT	2	GLASS FILLED TEFLON
	SP-20-9A			PACKING	1	"
	SP-19-10			GLAND RING	1	300 SERIES SS
	SP-20-13			BODY GASKET	2	GLASS FILLED TEFLON
	SP-20-15			HEX BOLT (3/4"-10X8"LG HEX HD)	8	18-8 SS
	SP-20-16			HEX NUT (3/4-10)	8	"
	SP-20-20			LOCKWASHER (3/4)	8	"
	SP-20-17			STEM HEX NUT (5/8-11 JAM)	1	"
	SP-20-4A			STEM LOCKWASHER (5/8")	1	"
	SP-20-21			STOP PIN (3/8" DIA. X 1" LG ROLL PIN)	1	400 SERIES SS
	SP-20-13F			CAVITY FILLER - OPTIONAL	2	GLASS FILLED TEFLON

REVISIONS

DATE	2-16-80
BY	D Davis
APP'D	GwF

REMARKS: SP-A-20 - SKEWED ENDS

PAGE 1 OF 1

A7-19/(A7-20 Blank)

APPENDIX A

PART II

VENDOR INFORMATION

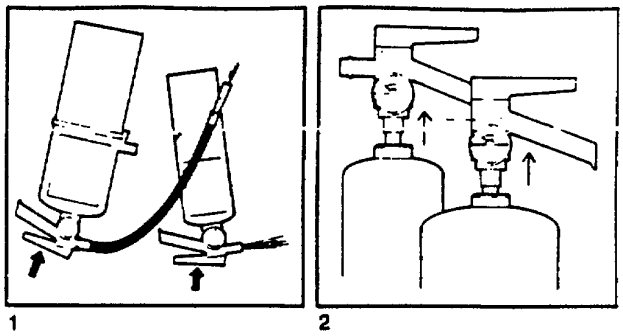
DRY CHEMICAL EXTINGUISHER
20 LB. HAND HELD

A-A-393
ANSUL SY-2024

To return the dry chemical extinguisher to service after use:

1. Invert the extinguisher and press the lever to release all pressure.

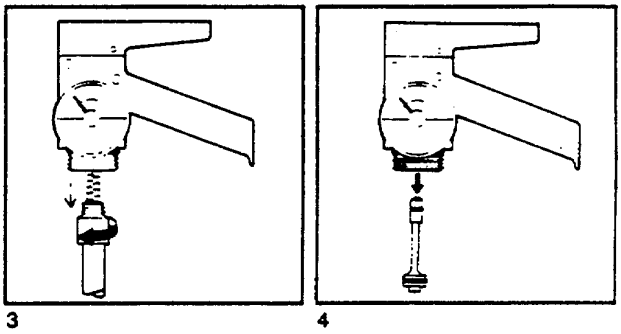
2. Remove the hose and/or nozzle from the valve assembly and then remove the valve assembly from the shell.



3. Remove the pick-up tube and spring from the valve assembly.

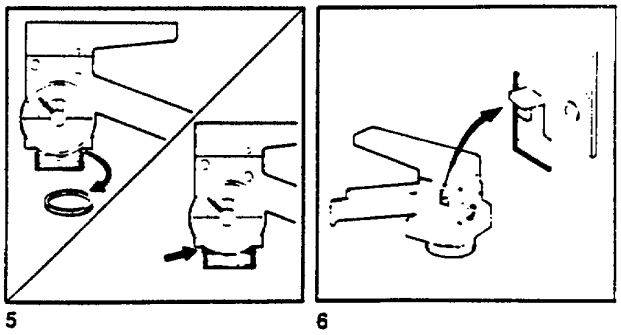
4. If the valve stem is plastic, remove by pushing down on the push lever and then withdrawing the stem using a needle nose pliers. Be careful not to scratch the seating area in the aluminum valve. Discard the plastic valve stem assembly. If the valve stem is metal, remove and clean it, taking care not to damage the O-ring or molded rubber. After either valve stem is removed, clean the internal valve body with a soft cloth.

   CAUTION: DO NOT SCRATCH INTERNAL VALVE SURFACES. SCRATCHING CAN RESULT IN VALVE LEAKAGE.



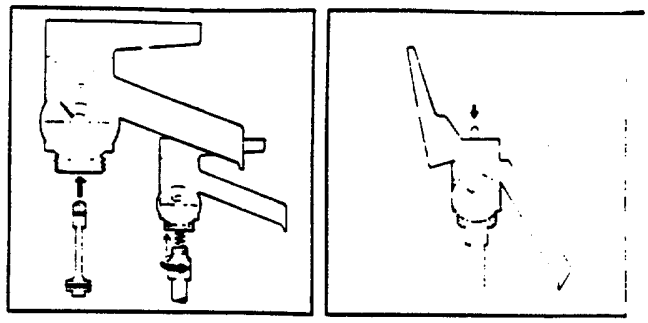
5. Remove quad ring. Clean dry chemical from the valve and quad ring groove. Lubricate the quad ring with a high quality silicone grease and return to valve assembly. Make certain quad ring is not twisted.

6. If there is a window in the back side of the carrying handle (as shown), a small metal tab should extend. This tab protects the plastic valve stem. It the push lever tab is bent or missing, replace the push lever.



7. Inspect the pick-up tube and verify that the tube is not blocked and is securely attached to the adaptor. Use a high quality grade grease of silicone grease to lubricate the metal valve stem O-ring and reassemble the valve body with the cleaned metal valve stem assembly, spring, and pick-up tube.

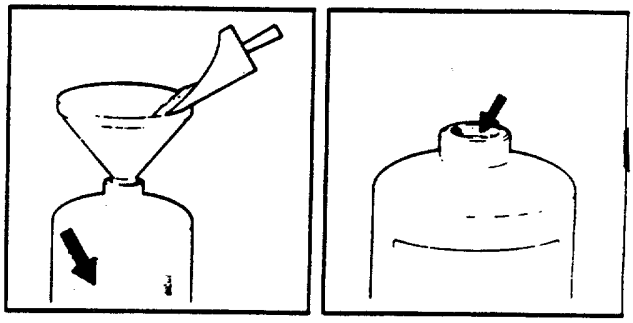
8. On 2 1/2 and 5 lb. models with aluminum handles, lift the operating lever and apply LUBRIPLATE grease or equivalent (not silicone) to the top of the valve stem.



7 8

9. Fill extinguisher to rated capacity using only the Ansul dry chemical specified on the nameplate.

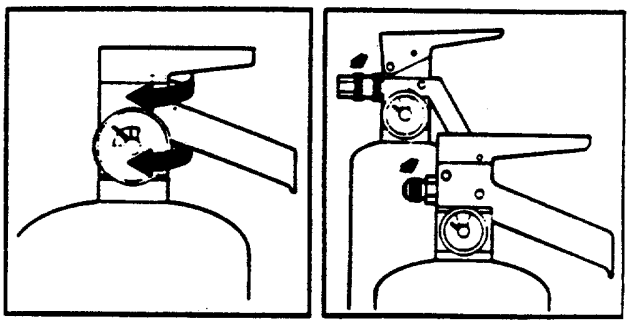
10. Clean the dry chemical from the quad ring seating surface and the threads of the shell.



9 10

11. Screw the valve assembly into the shell.

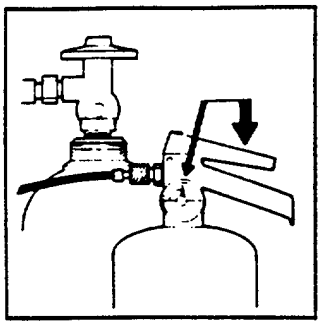
12. Install recharge system (Part No. 55793) using recharge adaptor, Part No. 25743 for 2 1/2 lb. and SY-0515 models; and Part No. 16246 for 6, 10, and 20 lb. as well as the SY-0514 and earlier 5 lb. models. (See Dry Chemical Recharge System on Page 10.)



11 12

13. Make certain nitrogen cylinder regulator Ii present at 210 psi (1448 kPa) or lower before opening nitrogen cylinder valve. Open nitrogen cylinder valve and set regulator pressure at 210 psi (1448 kPa). Press lever and pressurize with dry nitrogen. Release lever. Extinguisher gauge pointer should be in the GREEN operating range. If not, replace the gauge by referring to page 13 of the Appendix.

    CAUTION: The pressure gauge on the extinguisher should not be used to determine whether the intended charging pressure has been reached. Use the calibrated gauge on the Recharge System to determine if the correct pressure is being applied.



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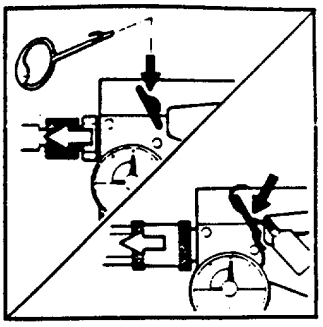
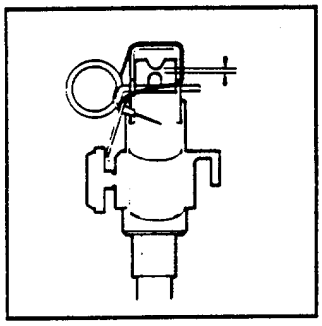


14

14. On models with plastic pull pins. insert a new pull pin until the barb locks it in place. On models with metal ring pins, reinsert the ring pin and install a new visual inspection seal. Then, remove the recharge adaptor.

15. Also. on metal ring pin models or when replacing plastic pull pins with metal, check that there is 1/16 in. (1.6 mm) minimum clearance between the top of the valve stem and the push lever. If there is not sufficient clearance, replace with plastic pull pin (see Parts List).

16. Test for leakage using LEAK-TEC FORMULA 177 or equivalent. Observe gauge 24 to 48 hours after recharge. There should be no loss of pressure. If gauge shows a pressure loss, raise the pressure and retest for leakage.



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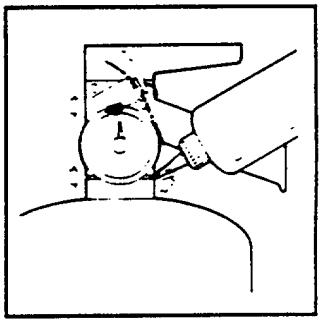
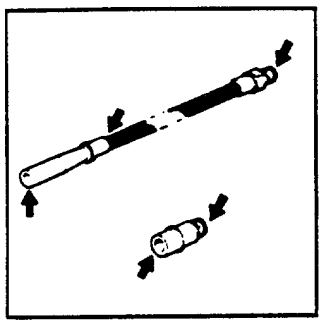


16

17. Inspect hose and nozzle for obstructions or other mechanical damage.

18. Reinstall hose and/or nozzle.



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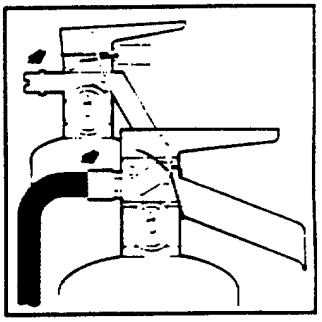
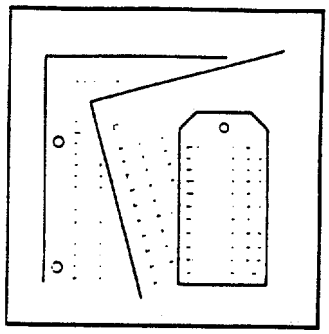


18

19. Record date of recharge and notify operating personnel that the extinguisher Is back in service.

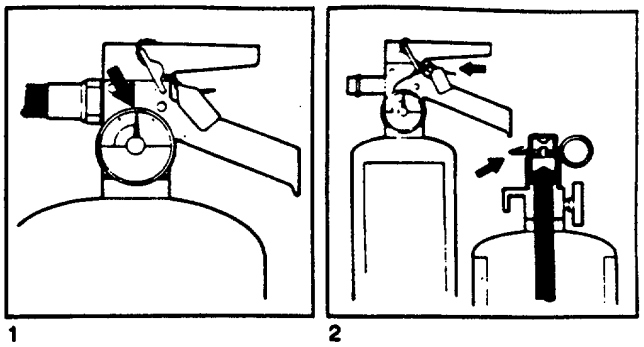


19

To Inspect/maintain the dry chemical and Halon 1211 extinguishers:

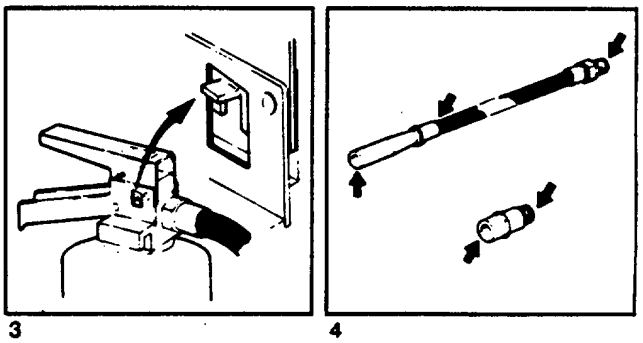
1. Check that pointer on extinguisher pressure gauge is in the GREEN operating range. (Upper and lower point of operating range reflects the operating temperature range of the extinguisher.)

   CAUTION: The operating pressure of the Halon 1211 extinguisher varies with temperature. A Halon 1211 stored pressure extinguisher shall be recharged if a loss in pressure occurs, adjusted for temperature, exceeding 10% of the charging pressure. If a pressure loss is suspected, condition the extinguisher at 70 OF (21 OC) for 12 hours and then recheck the pressure reading. If gauge still shows a 10% pressure loss, the extinguisher must be recharged.



2. Check the visual inspection seal on metal ring pin models. Check that the barb is intact on pull pin models.

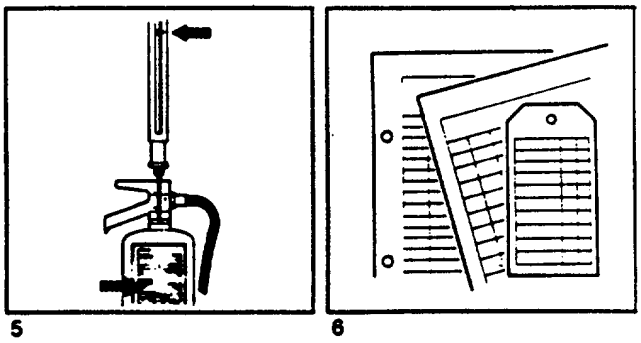
3. If the extinguisher has a window (as shown) a metal tab should extend through that window. The tab restricts operating movement to protect the valve stem. If the tab is bent or missing, visually inspect the valve stem (by lifting the operating lever) and repair or replace components as required.



4. Inspect the hose and/or nozzle for damage or obstructions.

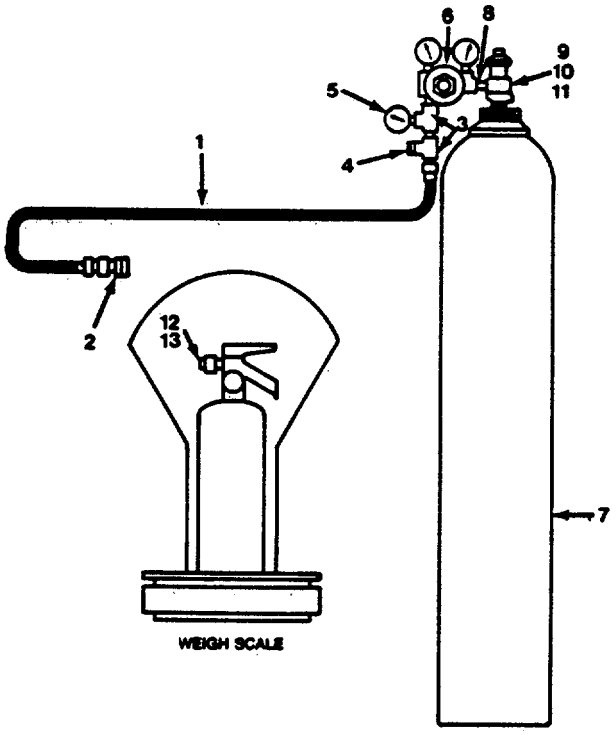
5. Weigh the extinguisher. The total charged weight is printed on the nameplate. The extinguisher shell should be checked for damage or corrosion and treated as outlined in NFPA 10.

6. Record date of inspection/maintenance.



DRY CHEMICAL RECHARGE SYSTEM

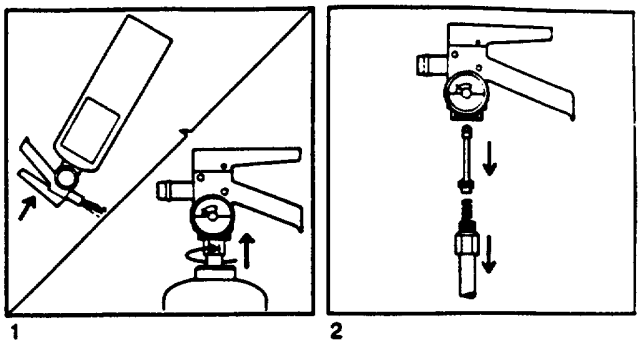
Item	Part No.	Qty.	Description
1	32633	1	Hose Assembly, 1/4"
2	32636	1	Coupler, Quick-Connect, Valved. 1/4"
3	27350	2	Tee, 1/4"
4	70452	1	Valve, Relief, 1/4" - 300 psi (2068 kPa)
5	29788	1	Gauge, Calibrated, 1000 psi (6894 kPa) with Restrictor
6	68819	1	Regulator, Adjustable, Inlet 0-3000 psi (0-20682 kPa), Outlet 0-1000 psi (0-6894 kPa), Self-Relieving with Gauges, 1/4" Inlet and Outlet Connections
7	7847	1	Cylinder, Nitrogen, Assembly, 400 cu. ft.
8	1778	1	Nipple, Schedule 80, 1/4"
9	12791	1	Tee, Schedule 80, 1/4"
10	3384	1	Nipple
11	3799	1	Nut
12	25743	1	Adaptor, Charging (For 2 1/2 lb. and SY-051S Models)
13	16246	I	Adaptor, Charging (For 6, 10, and 20 lb. and SY-0514 and Earlier 5 lb. Models)



GAUGE REPLACEMENT PROCEDURES

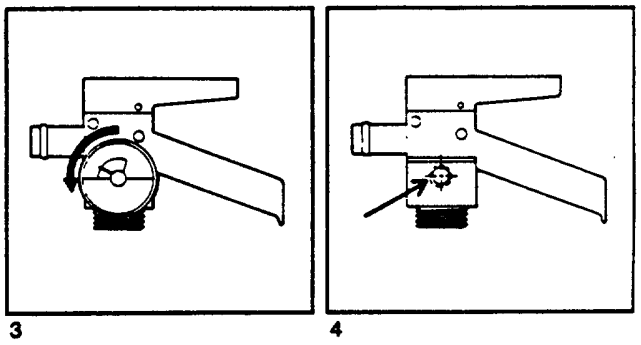
1. Invert the extinguisher and press the lever to release all pressure. (On Halon 1211 models, inverting is not necessary; also if agent reclaiming is desired, see page 12 of Appendix.) Remove valve assembly.

2. Disassemble the valve assembly, removing the pick-up tube, valve stem, and spring.



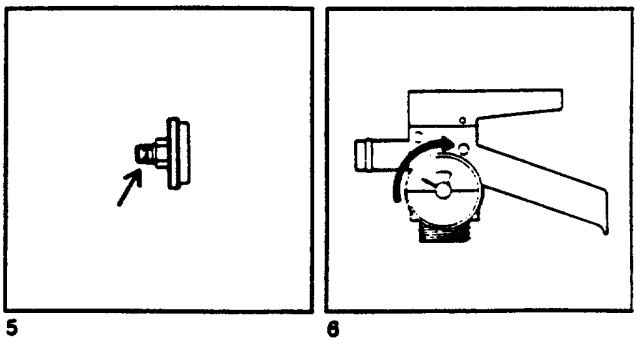
3. Remove damaged/defective gauge.

4. Clean the gauge port thread. Use 1/8 in. NPT pipe tap to chase threads, if necessary. Be careful not to tap too deep as gauge will not tighten properly and valve assembly will have to be replaced.

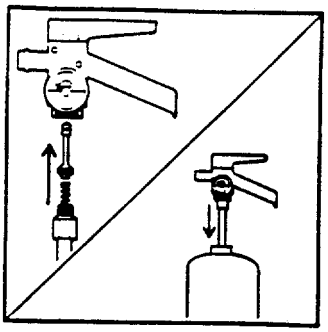


5. Apply plastic lead pipe sealant (ARMSTRONG C-4 w/Activator W or equivalent) to the thread of the new gauge. Be careful not to get any sealant into the hole in the face of the gauge socket. Ansul does not recommend the use of pipe tape.

6. Screw the new gauge into the valve body making certain that the GREEN operating range on the gauge face ia pointed to the top of the valve.



7. Clean valve body. lubricate. and reassemble. Recharge extinguisher and check or leakage fuse LEAK-TEC FORMULA 177 or equivalent. If there is leakage through gauge threads. relieve pressure from extinguisher and tighten gauge one more turn. If leakage cannot be stopped, discard valve assembly.



7

Sentry Dry Chemical Extinguishers

SENTRY 20

Model	SY-2024
Agent Capacity	20 lb. (9.1 kg) Purple-K
U.L. Rating	120-B:C
Discharge Time	30 seconds
Maximum Effective Range	22 ft. (6.7 m)
Agent Flow Rate	68 lb./sec. (.31 kg/sec.)
Charged Weight (with agent)	31 lb., 5 oz. (14.2 kg)
Dimensions (H)	23 3/4 in. (60.3 cm)
(W)	9 1/2 in. (24.1 cm)
(D)	7 in. (17.8 cm)
Fire Suppression Capability*	
Novice Operator	120 sq. ft.
Experienced Operator	300 sq. ft.

APPENDIX A

PART II

VENDOR INFORMATION

METER SKID ASSEMBLY (25608-100)
(METER STRAINER ASSY)
VENDOR COMPONENTS

METER REGISTER
VEEDER ROOT PETROLEUM PRODUCTS 7887

METER
SMITH METER INC. SF-6V-NF

STRAINER
WEAMCO 25606-1

AIR ELIMINATOR HEAD
WEAMCO MODEL RB

CALIBRATOR
SMITH METER, INC. MODELS AM-5, AT-5 AND ATS-5

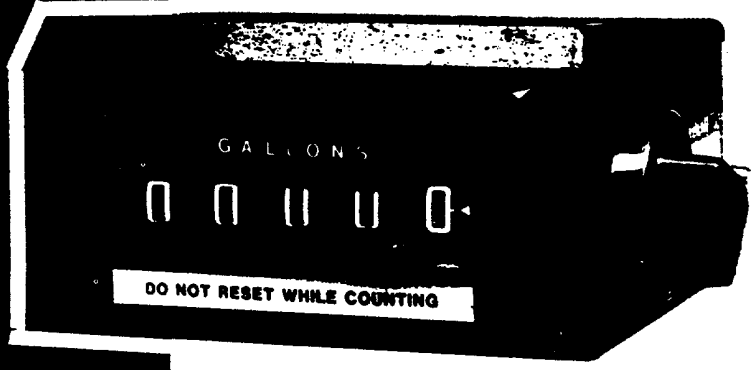
Parts List

Technical Manual
8-017
Issued: 6/85
Supersedes: 12/84

Manual No. 251292

METER REGISTER

SERIES 7887



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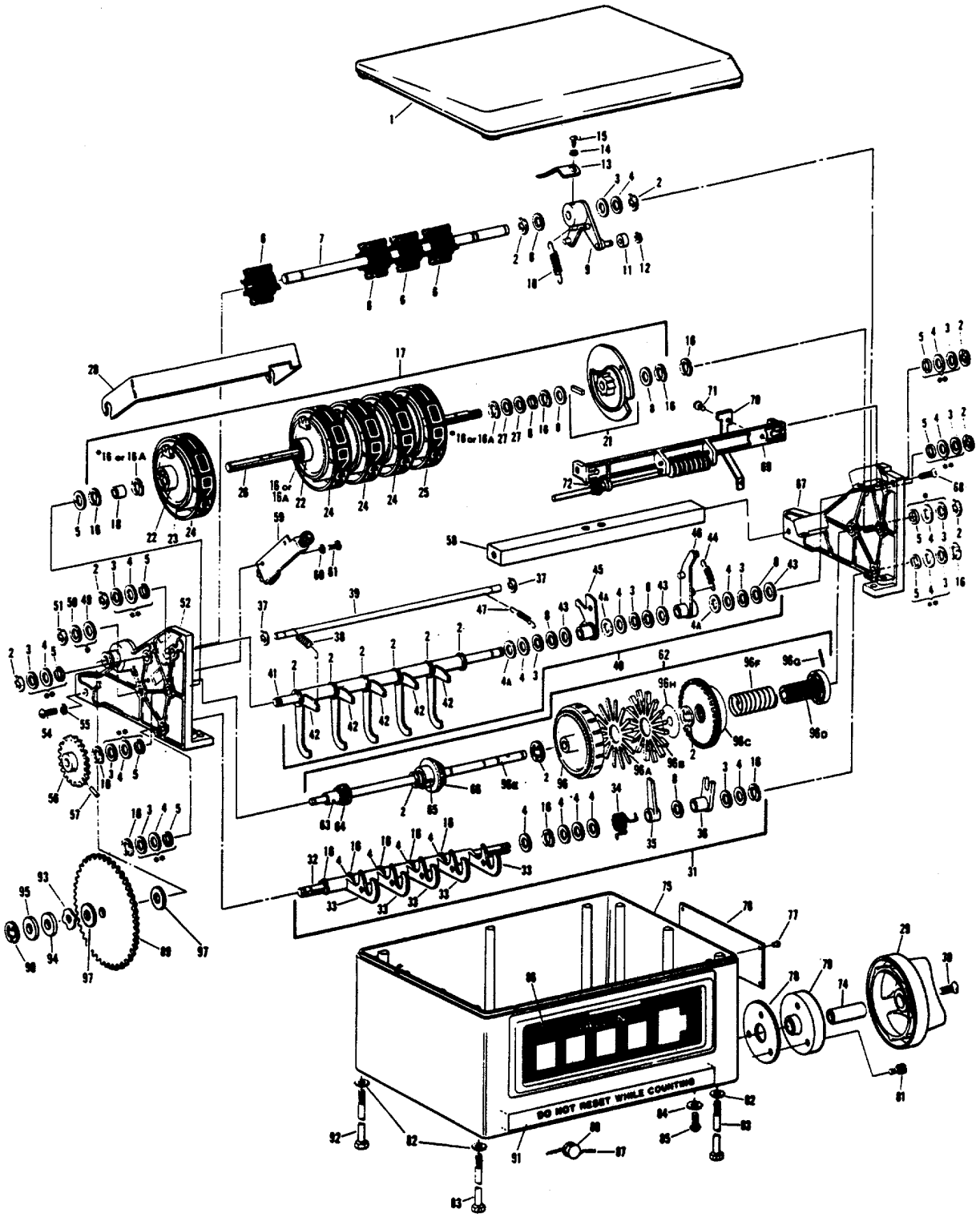
PETROLEUM PRODUCTS

Meter Register
Series 7887



Q:101

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
1	80602-009	Cover	1
2	511810-001	Retaining Ring	18
3	74800-360	Washer (.005)	As Req.
4	11071-208	Washer (.010)	As Req.
4a	885005-050	Washer (.003)	As Req.
5	11071-159	Washer (.031)	As Req.
6	324601-001	Pinion-Transfer	4
7	324687-002	Shaft-Pinion	1
8	11071-159	Washer (.031)	5
9	324744-001	Detent Lever Group	1
10	310300-331	Spring-Detent	1
11	324765-001	Roller	1
12	511807-001	Retaining Ring	1
13	324651-001	Brake	1
14	510055-030	Lockwasher (No. 2)	1
15	500740-001	Screw (2-64)	1
16	511805-324	Retaining Ring	21
16a	511805-329	Retaining Ring (.025)	As Req.
17	325046-001	Wheel Shaft Group	1
18	884010-019	Sleeve-Shutter	1
19	11071-905	Washer (.014)	As Req.
20	11071-869	Washer (.006)	As Req.
21	312020-872	Kit Cam-Multiple w/key	1
22	324602-001	Eccentric	5
23	324603-001	Locking Disc	5
24	324625-002	Middle and Left Wheel	4
25		Right Hand Wheel	1
	324625-001	0-9 and 10 Grads W/B	
	324625-006	0-9 and 100 Grads W/B	
	324625-005	00-95 and 100 Grads B/W	
26	324686-001	Shaft-Wheel	1
27	11071-965	Washer (.040)	As Req.
28	324645-001	Shutter	1
29	324757-001	Knob	1
30	503648-001	Screw	1
31	325045-001	Reset Shaft Group	1
32	324660-001	Shaft-Reset	1
33	324597-001	Finger-Reset	5
34	310340-587	Spring	1
35	324644-001	Pawl-No Back	1
36	324655-001	Arm-Reset	1
37	511807-001	Retaining Ring	3
38	310300-329	Spring-Anti-Topping	5
39	324693-001	Shaft-Stop	1
40	325044-001	Anti-Topping Finger Shaft Group	1
41	324682-001	Shaft-Anti-Topping	1
42	324596-001	Finger-Anti-Topping	5
43	11071-208	Washer (.010)	2
44	310300-330	Spring-Reset	1
45	324747-001	Clutch Lever Group	1
46	324743-001	Reset Lever Group	1
47	310300-268	Spring-Clutch	1
48	74800-291	Washer (.056)	As Req.
49	11071-485	Washer (.010)	As Req.
50	11071-833	Washer (.005)	As Req.
51	511807-001	Retaining Ring	1
52	324749-001	Left Hand Plate Group (includes 59, 60, 61)	1
53	Deleted		
54	502819-005	Screw (10-32)	2
55	510031-001	Lockwasher (No. 10)	2
56	403071-419	Gear-Register	1

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
57	510187-001	Pin, Groove	1
58	324647-001	Bar, Rear Mounting	1
59	324748-001	Bracket Group	1
60	510057-001	Lockwasher (No. 4)	2
61	501249-001	Screw (4-40)	2
62	325043-001	Clutch Shaft Group	1
63	510176-001	Pin	1
64	324662-001	Bevel Gear	1
65	512900-190	Pin-Spirol	1
66	324661-001	Bevel Gear	1
67	324754-001	Right Hand Plate Group	1
68	501700-137	Screw (6-32)	2
69		Totalizer Group	1
	324633-001	Right Wheel B/W	
	324633-002	All Wheels W/B	
70	324734-001	Pointer	1
71	510500-330	Screw-Self Tapping	1
72	324630-001	Bevel Gear	1
73	Deleted		
74	324756-001	Shaft-Knob	1
75	324610-001	Housing	1
76	325171-001	Name Plate	1
77	510506-001	Drive Screw	4
78	76124-005	Gasket	1
79	70718-025	Flange	1
80	Deleted		
81	511850-152	Screw	3
82	510003-006	Lockwasher	4
83	503344-032	Screw-Seal	2
84	510020-001	Lockwasher (.250)	3
85	503600-104	Screw (1/4-28 x 3/4)	3
86		Crystal	1
	324695-001	Gallons	
	324695-015	Gallons & Decimal	
	324695-002	Liters	
	324695-012	Liters & Decimal	
	324695-003	Pounds	
	324695-004	Imperial Gallons	
	324695-011	Imp. Gals. & Decimal	
	324695-005	Dekaliters	
	324695-006	Meter Units	
	324695-010	Barrels	
	324695-014	M^3	
87	11853-285	Seal Wire	1
88	44602-005	Lead Seal	1
89	403071-420	Gear-Idler	1
90	511800-106	Ring-Retaining	1
91	328065-001	Label-Warning	1
92	503300-111	Screw	2
93	885005-937	Washer-Wave Spring	1
94	885005-789	Washer	As Req.
95	885005-791	Washer	As Req.
96	324600-001	Disc-Clutch	1
96A	320279-001	Spring	1
96B	320255-001	Disc	1
96C	324598-001	Coupling	1
96D	324599-001	Driver	1
96E	324663-001	Shaft-Clutch	1
96F	310325-270	Spring	1
96G	512921-001	Pin-Spirol	1
96H	11071-905	Washer (.014)	1
97	885005-791	Washer	2

Note: Items indented under a Group are part of that Group and will be included with the Group when ordered. Individual items may be ordered as individual parts.

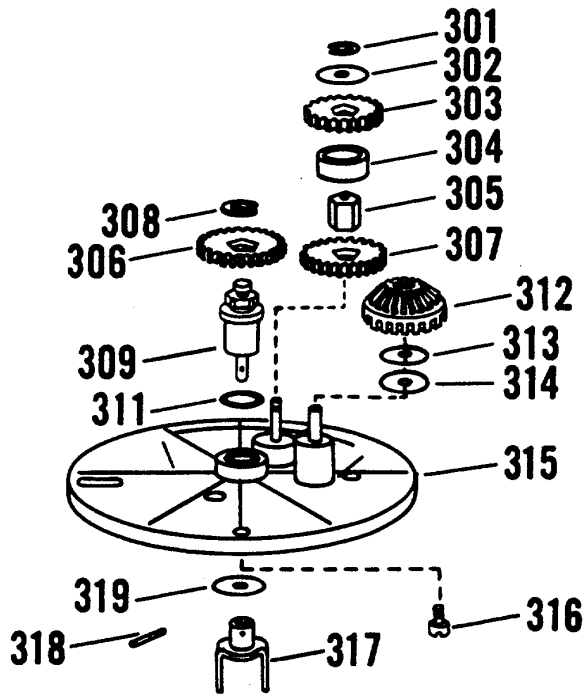
*After installing retaining ring (Item 16), pull wheel group against retaining ring. Manually rotate the wheel. If it does not spin freely, replace Item 16 with Item 16A.

**Use Items 3, 4 and 5 as required to obtain end play of between 0.005 and 0.012 inch.

•Use Items 49 and 50 on left side and Items 3, 4 and 5 on right side as required for proper totalizer bevel gear engagement while maintaining 0.007 inch maximum shaft end play.

••Use Items 3, 4 and 5 as required to adjust the clutch for proper operation with the input clutch while maintaining a maximum end play of 0.007 inch.

GEAR PLATE ASSEMBLY
(TYPE 1)



Q:102

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
301	511807-001	Retaining Ring	1
302	11071-135	Washer (.010)	1
303	70827-005	Gear (25T)	1
304	14571-792	Spacer	1
305	33534-050	Bushing	1
306	73296-195	39T Gear (For 1:1 ratio)	1
	73296-130	26T Gear (For 2:1 ratio)	1
307	73296-195	39T Gear (For 1:1 ratio)	1
	73296-260	52T Gear (For 2:1 ratio)	1
308	511810-001	Retaining Gear	1
309	70659-010	Drive Shaft	1
311	11071-929	Washer (.010)	1

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
312	70828-005	Gear Assembly	1
313	11071-479	Washer (.030)	1
314	11071-333	Washer (.020)	As Req.
	11071-325	Washer (.010)	As Req.
	11071-803	Washer (.005)	As Req.
315	70856-010	Gear Plate	1
316	502230-001	Flat Fil. Hd. Screw (8-32 x 1/4")	2
317	68845-005	Coupling	1
318	510107-002	Groove Pin (1/16" x 7/16")	1
319	11071-933	Washer (.010)	1

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251292 10220 Replaces 10010

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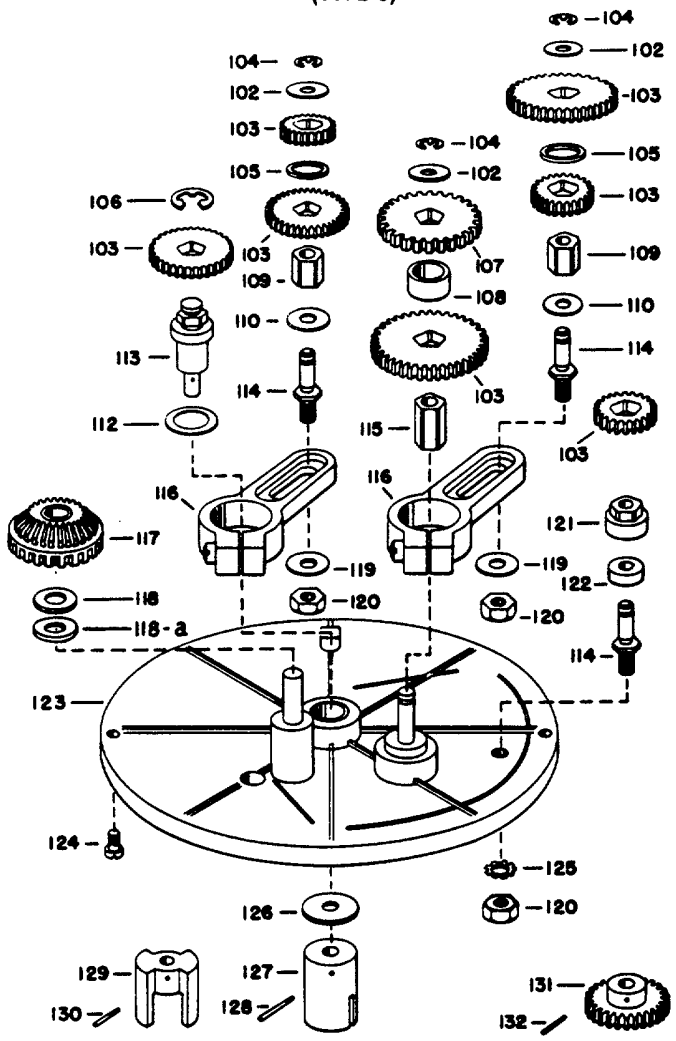
GEAR PLATE ASSEMBLY (TYPE 5)



GEAR LIST (Item 103)

PART NO.	NO. OF TEETH	PART NAME
77348-005	19	*Gear
32996-019	19	**Gear
311427-120	20	*Gear
311427-110	20	**Gear
311427-130	26	**Gear
32996-028	28	Gear
32996-029	29	Gear
32996-030	30	Gear
32996-031	31	Gear
32996-032	32	Gear
32996-033	33	Gear
32996-034	34	Gear
32996-035	35	Gear
32996-036	36	Gear
32996-037	37	Gear
32996-038	38	Gear
32996-039	39	Gear
32996-040	40	Gear
32996-041	41	Gear
32996-042	42	Gear
32996-043	43	Gear
32996-044	44	Gear
32996-045	45	Gear
32996-046	46	Gear
32996-047	47	Gear
32996-048	48	Gear
32996-049	49	Gear
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32996-062	62	Gear
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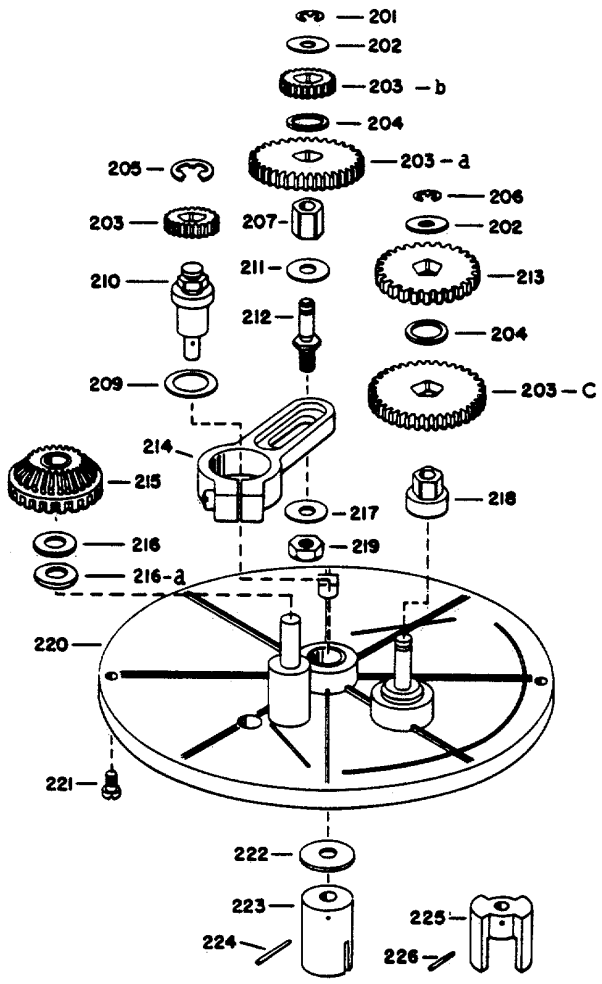
32996-065	65	Gear
32996-066	66	Gear
32996-067	67	Gear
32996-068	68	Gear
32996-069	69	Gear
32996-070	70	Gear
32996-071	72	Gear
32996-075	75	Gear
32996-076	76	Gear
32996-080	80	Gear
32996-084	84	Gear

*Round hub/round hole
**Pentagon hub/round hole

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
102	11071-135	Washer (0.010)	3
103	See List Above	Change Gears	
104	511807-001	Retaining Ring	3
105	11071-199	Washer (0.047)	2
106	511810-001	Retaining Ring	1
107	70827-005	Gear (25T)	1
108	14571-792	Spacer	1
109	33534-015	Bushing	2
110	11071-171	Washer (0.020)	2
112	11071-929	Washer (0.010)	1
113	70659-010	Drive Shaft	1
114	326586-001	Stud	3
115	33534-050	Bushing..	1
116	33534-005	Swing Arm Assembly	2
117	70828-005	Gear Assembly	1
118	11071-479	Washer (0.030)	1

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
118a	11071-333	Washer (0.020)	As Req.
	11071-325	Washer (0.010)	As Req.
	11071-803	Washer (0.005)	As Req.
119	11071-187	Washer (0.031)	2
120	511038-001	Hex Nut (10-32)	3
121	74843-005	Bushing	1
122	65009-005	Spacer	1
123	70856-010	Gear Plate	1
124	502230-001	Flat Fil. Hd. Screw (8-32 x 1/4")	2
125	510002-001	Lockwasher	1
126	11071-933	Washer (.010)	1
127	65004-005	Coupling	1
128	510105-177	Groove Pin (1/16" x 5/8")	1
129	33775-005	Coupling	
130	510107-002	Groove Pin (1/16" x 7/16")	
131	32948-015	24T Gear	
	65116-005	36T Gear	
132	510105-179	Groove Pin for 24T Gear	
	510108-001	Groove Pin for 36T Gear	

GEAR PLATE ASSEMBLY
(TYPE 7)



ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
201	511807-001	Retaining Ring	1
202	11071-135	Washer (.010)	2
203	32996-033	33T Gear (For 4:1 ratio)	1
	32996-028	28T Gear (For 8:1 ratio)	1
203a	32996-066	66T Gear (For 4:1 ratio)	1
	32996-084	84T Gear (For 8:1 ratio)	1
203b	32996-033	33T Gear (For 4:1 ratio)	1
	32996-030	30T Gear (For 8:1 ratio)	1
203c	32996-066	66T Gear (For 4:1 ratio)	1
	32996-080	80T Gear (For 8:1 ratio)	1
204	11071-199	Washer (.047)	2
205	511810-001	Retaining Ring	1
206	511807-001	Retaining Ring	1
207	33534-015	Bushing	1
209	11071-929	Washer (.010)	1
210	70659-010	Drive Shaft	1
211	11071-171	Washer (.020)	1

ITEM NO.	PART NO.	PART NAME	QUANTITY PER UNIT
212	326586-001	Stud	1
213	70827-005	Gear (25T)	1
214	33534-005	Swing Arm Assembly	1
215	70828-005	Gear Assembly	1
216	11071-479	Washer (.030)	1
216a	11071-333	Washer (.020)	As Req.
	11071-325	Washer (.010)	As Req.
	11071-803	Washer (.005)	As Req.
217	11071-187	Washer (.031)	1
218	76551-005	Bushing	1
219	511038-001	Hex. Nut (10-32)	1
220	70856-010	Gear Plate	1
221	502230-001	Flat Fil. Hd. Screw (8-32 x 1/4")	2
222	11071-933	Washer (.010)	1
223	65004-005	Coupling	1
224	510105-177	Groove Pin (1/16" x 5/8")	1
225	33775-005	Coupling	1
226	510107-002	Groove Pin	1

APPENDIX A

Smith Meters

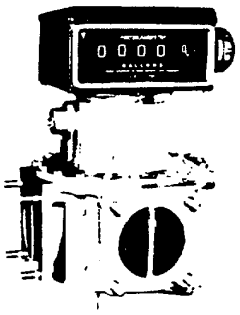
GEOSOURCE

an Operation of the Flow Measurement & Control Division

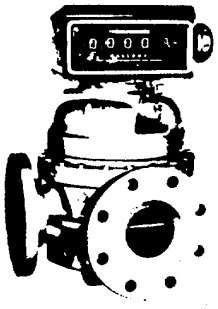
April 1976

Bulletin 1.2.9

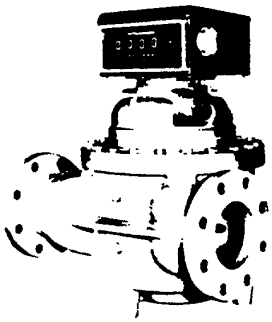
NON FERROUS AIRCRAFT FUELING METERS



3" T-20-NF



4" ASF-4-NF



4" SF-4-NF

THE SULTON COMPANY, INC.
4404 SOUTH MAYBELLE AVE.
TULSA, OKLAHOMA 74107
PHONE A/C 918 446-1611

AIRCRAFT FUELING

With the advent of modern jet powered commercial aircraft, Smith has pioneered and developed a family of highly specialized measurement and control equipment for handling turbine fuels. This equipment is oriented toward hydrant systems, refuelers and servicers.

The second generation of jet powered aircraft, the Jumbo Jet, has demanded increased capacity from existing measurement and control equipment. Many airport facilities throughout the world are being expanded to handle increased traffic of all types of jet powered aircraft. In addition to new airports, many existing airports are being expanded, some utilizing the same facilities for higher pumping rates and pressures required to handle this increasing demand, making equipment selection extremely important.

Fast, accurate, reliable . . . the Smith positive displacement meter is ideally suited for refueler service. Increased flow rate capacity and low pressure loss enable this meter to meet the required increased capacity. This meter meets all legal accuracy standards and holds its accuracy under severe operating conditions. It occupies a minimum of space and its flexibility permits it to be arranged to suit almost any piping layout.

DESCRIPTION

Smith Non-Ferrous Rotary Positive Displacement Meters meet high accuracy standards (±0.1%) and hold their accuracy under severe operating conditions. These meters occupy a minimum of space and their almost unlimited flexibility permits them to be arranged to suit any layout.

They are available for registration in U.S. Gallons, Imperial Gallons, Liters and Dekaliters with a wide variety of counters and accessories for efficient installation and operation.

ADJUSTMENTS

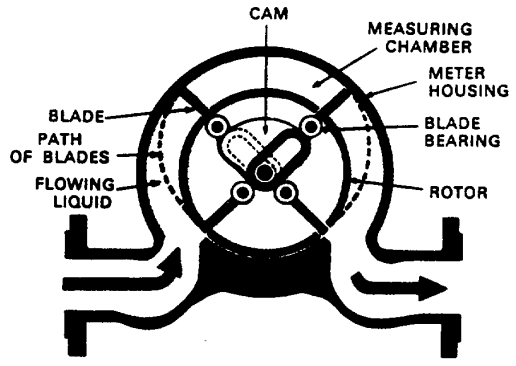
Dry accessible calibration is made in extremely fine increments with any Smith adjustment device. These adjustment devices are protected from dirt and foreign matter, and may be sealed against unauthorized tampering. Meters supplied with standard manual calibrators provide adjustment in increments of 1/20th of 1%. The following devices are optionally available for specific installation or operational requirements: ATC (Automatic Temperature Compensation), ATG (Automatic Temperature Compensation with gravity selection), "G" Calibrator (for reverse flow). Other standard accessories can be mounted on these meters to comprise the optimum system for the best measurement and control.

PRINCIPLE OF OPERATION

The rotor, which revolves on stainless steel bearings, has four evenly spaced slots. The slots control the position of two blades that are at right angles to each other. As liquid flows through the meter, the rotor and blades revolve around a fixed cam. Ball bearings fixed to the blades roll around the cam, causing the blades to move radially. The successive movement of the blades, outward toward the case wall, forms a measuring chamber of precise volume between the blades, rotor, case wall, and the bottom of the case. Four measuring chambers are produced for each revolution of the rotor, continuously and uninterrupted. Neither the blades nor the rotor contact the stationary walls of the measuring chamber.

Illustrated below is a straight-through meter.

Port location of angle meters do not change this basic principle of operation.



APPENDIX A

MODELS AND CAPACITIES AVAILABLE

All Meters designed for 150 psig (10.5 Kg/cm2) working pressure
Maximum Temperature 200 °F.

MODEL	CONNECTIONS	Maximum Capacity				Net Wt. LBS.
		USGPM	IGPM	LPM	M^3/H	
T-11-NF (Angle Type)	2" Smith FF Studded Flanges*	100	85	375	23	30
T-20-NF (Angle Type)	3" Smith FF Studded Flanges*	250	210	950	57	45
SD or ASD - 3 - NF	3" Class 125 FF Flanges	420	350	1600	95	75
SD or ASD - 3V - NF	3" Victaulic Flanges	420	350	1600	95	68
SD or ASD - 4 - NF	4" Class 125 FF Flanges	420	350	1600	95	80
SD or ASD - 4V - NF	4" Victaulic Flanges	420	350	1600	95	70
SF or ASF - 4 - NF	4" Class 125 FF Flanges	800	650	3000	180	115
SF or ASF - 4V- NF	4" Victaulic Flanges	800	650	3000	180	105
SF or ASF - 6 - NF	6" Class 125 FF Flanges	800	650	3000	180	120
SF or ASF - 6V - NF	6" Victaulic Flanges	800	650	3000	180	108
SG or ASG - 6 - NF	6" Class 125 FF Flanges	1200	1000	4600	270	160
SG or ASG - 6V - NF	6" Victaulic Flanges	1200	1000	4600	270	148

**Threaded Companion Flanges available.*

MATERIALS OF CONSTRUCTION

BODY AND COVER:
Hard Anodized Aluminum

BLOCIK.
Hard Anodized Aluminum

ROTOR:*
Aluminum

BEARINGS:
Stainless Steel

SHAFT AND CAM:
Stainless Steel

GEARS: (In contact with liquid) -
Stainless Steel

BLADES:
Hard Anodized Aluminum/Nylon Wear Strips

BUSHINGS:
Rulon (T-1 1, Bronze)

**T-1 1 has Manganese Bronze Rotor*

NOTE: All Meters with Aluminum Rotors must be used downstream of a fine mesh (e.g. 5 micron) filter.

APPENDIX A

Figure	Model	Size	A	B	C	Anchor Bolt Circle D	E	F	G	Anchor Bolt Holes H	Flange Data J	K	L	M	N	O
I	T-11-NF	2" NPT	4 1/8	10 3/32	5 3/8	6 5/8	10 13/16	12 7/32	16 3/4	(3) 3/8-16	1 1/2	1 1/2	1 1/2	1 1/2	13/16	4
											Bronze Removable Threaded for 2" Pipe					
	T-20-NF	3" NPT	4 11/16	12 17/32	7	8 1/2	11 7/8	13 15/32	17 13/16	(3) 3/8-16	2	2	2	2	13/16	4 3/4
											Alum Removable Threaded for 3" Pipe					
II	SD-3-NF	3"	4 7/8	14 3/4	4 7/8	8 1/8	14	15 1/2	19 13/16	(3) 3/8-16	7 1/2	6	No of Holes and Dia (4) 3/4	Bolt Dia 5/8	7/8	5 1/4
	SD-3V-NF	3"		13 3/8							3 1/2	—	—	—		
	SD-4-NF	4"		14 15/16							9	7 1/2	(8) 3/4	5/8		
	SD-4V-NF	4"		13 3/8							4 1/2	—	—	—		
	SD-3R-NF	3"		14 3/4			14 3/4		20 1/4		7 1/2	6	(4) 3/4	5/8		
	SD-3VR-NF	3"		13 3/8							3 1/2	—	—	—		
	SD-4R-NF	4"		14 15/16							9	7 1/2	(8) 3/4	5/8		
	SD-4VR-NF	4"		13 3/8							4 1/2	—	—	—		
	SF-4-NF	4"	7 15/32	17 1/2	5 1/2	11 1/4	17 11/16	20	23 5/8	(3) 5/8-11	9	7 1/2	(8) 3/4	5/8	1 3/4	4 11/16
	SF-4V-NF	4"		16 1/2							4 1/2	—	—	—		
	SF-6-NF	6"		18 1/2							11	9 1/2	(8) 7/8	1/4		
	SF-6V-NF	6"		16 1/2							6 5/8	—	—	—		
	SF-4R-NF	4"		17 1/2			18		23 15/16		9	7 1/2	(8) 3/4	5/8		
	SF-4VR-NF	4"		16 1/2							4 1/2	—	—	—		
	SF-6R-NF	6"		18 1/2							11	9 1/2	(8) 7/8	3/4		
	SF-6VR-NF	6"		16 1/2							6 5/8	—	—	—		
	SG-6-NF	6"	9 1/4	20 1/8	5 13/16	12 3/4	20 7/8	23	26 3/8	(3) 3/4-10	11	9 1/2	(8) 7/8	3/4	2 3/8	5 7/8
	SG-6V-NF	6"		19 3/4							6 5/8	—	—	—		
	SG-6R-NF	6"		20 1/8			20 3/4		26 11/16		11	9 1/2	(8) 7/8	3/4		
	SG-6VR-NF	6"		19 3/4							6 5/8	—	—	—		
III	ASD-3-NF	3"	4 7/8	14 1/8	8 1/8	8 1/8	14	14 1/8	19 13/16	(3) 3/8-16	7 1/2	6	(4) 3/4	5/8	7/8	5 1/4
	ASD-3V-NF	3"									3 1/2	—	—	—		
	ASD-4-NF	4"									9	7 1/2	(8) 3/4	5/8		
	ASD-4V-NF	4"									4 1/2	—	—	—		
	ASD-3R-NF	3"					14 3/4		20 1/4		7 1/2	6	(4) 3/4	5/8		
	ASD-3VR-NF	3"									3 1/2	—	—	—		
	ASD-4R-NF	4"									9	7 1/2	(8) 3/4	5/8		
	ASD-4VR-NF	4"									4 1/2	—	—	—		
	ASF-4-NF	4"	7 15/32	17 1/2	10	11 1/4	17 11/16	17 1/2	23 5/8	(3) 5/8-11	9	7 1/2	(8) 3/4	5/8	1 3/4	4 11/16
	ASF-4V-NF	4"									4 1/2	—	—	—		
	ASF-6-NF	6"									11	9	(8) 7/8	3/4		
	ASF-6V-NF	6"									6 5/8	—	—	—		
	ASF-4R-NF	4"					18		23 15/16		9	7 1/2	(8) 3/4	5/8		
	ASF-4VR-NF	4"									4 1/2	—	—	—		
	ASF-6R-NF	6"									11	9	(8) 7/8	3/4		
	ASF-6VR-NF	6"									6 5/8	—	—	—		
	ASG-6-NF	6"	9 1/4	20 1/4	11 1/2	12 3/4	20 7/8	20 1/4	26 3/8	(3) 3/4-10	11	9	(8) 7/8	3/4	2 3/8	5 7/8
	ASG-6V-NF	6"									6 5/8	—	—	—		
	ASG-6R-NF	6"					20 3/4		26 11/16		11	9	(8) 7/8	3/4		
	ASG-6VR-NF	6"									6 5/8	—	—	—		

NON-FERROUS METER MODEL NUMBER DESCRIPTION

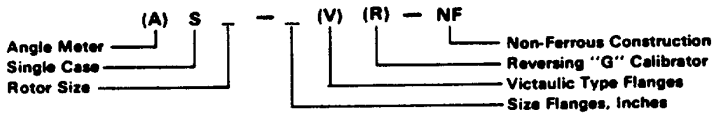


FIGURE I

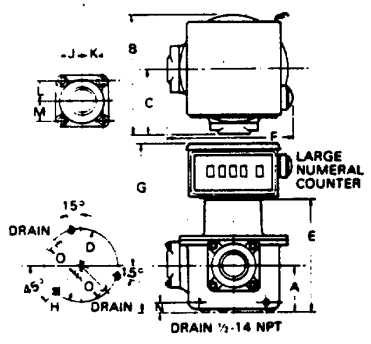


FIGURE II

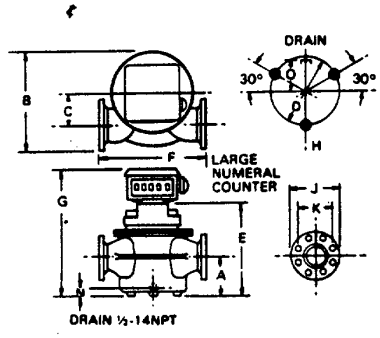
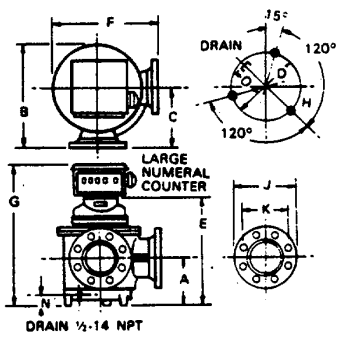
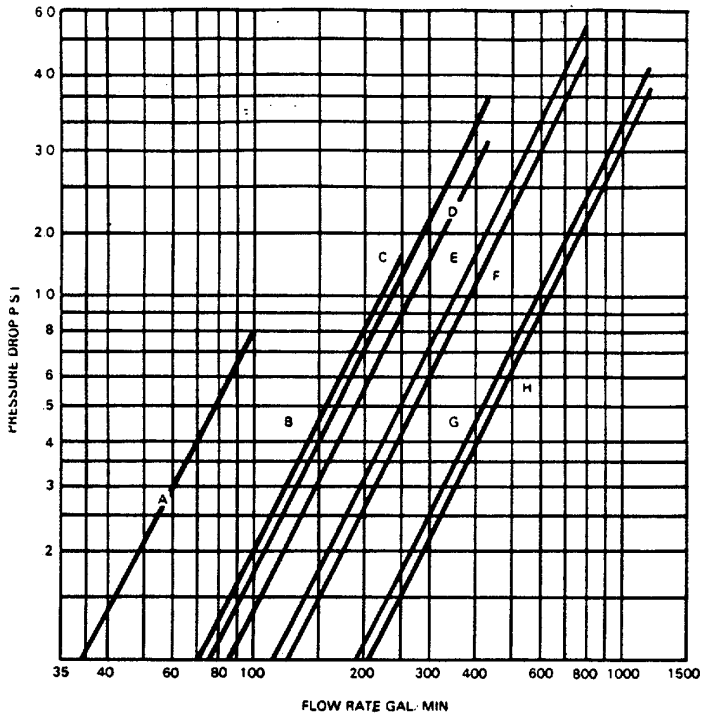


FIGURE III



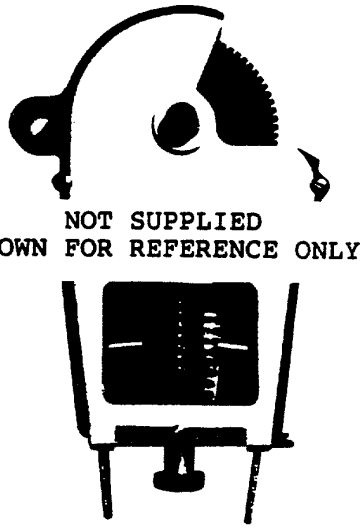
PRESSURE DROP CHART



A.	T-11-NF	E.	SF-4-NF	
B.	T-20-NF	F.	ASF-4-NF	FOR VICTAULIC OR ONE SIZE LARGER
C.	SD-3-NF	G.	SG-6-NF	FLANGES ON ABOVE METERS, ADD APPROX.
D	ASD-3-NF	H	ASG-6-NF	1 PSI TO CHART

"G" TYPE REVERSING CALIBRATOR

Available as a standard accessory is the G calibrator which not only allows easy and fine incremental adjustment but permits reverse flow thru the meter frequently required for defueling. Other standard accessories can be mounted on these meters to comprise the optimum system for the best measurement and control. Ask for bulletin 1.6.1.8 for specifications.



NOT SUPPLIED
SHOWN FOR REFERENCE ONLY

TEMPERATURE COMPENSATOR

Meters equipped with the ATC and ATG temperature compensator provide net volume or weight registration. This registration is based on continuous integration of gross metered volume and temperature regardless of flow rate and temperature fluctuations. It is also based on the coefficient of expansion of the particular liquid being metered.

NOTE: For specifications on ATC and ATG Temperature Compensators, ask for Bulletins 1.6.4.2 and 1.6.4.1 respectively.

Smith Meters

An Operation of the Flow Measurement & Control Division

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Houston, Texas 77056

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Erie, Pennsylvania 16512

PARTS DISTRIBUTION OPERATIONS AND SERVICE OPERATIONS
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Erie, Pennsylvania 16512

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Ellerbek, West Germany

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(212) 964-7093

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Houston, Texas 77055
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MID-WEST REGION
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Arlington Heights, Illinois 60006
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WEST COAST REGION
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Los Angeles, California 90040
(213) 685-6776

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Rms. 101-102, 1st Fl.,
M & G Centre
154/170 Clemenceau Avenue
Singapore 9
320655

A9-10
3M—MP—10/79

Smith Meter Inc.
A Moorco Company

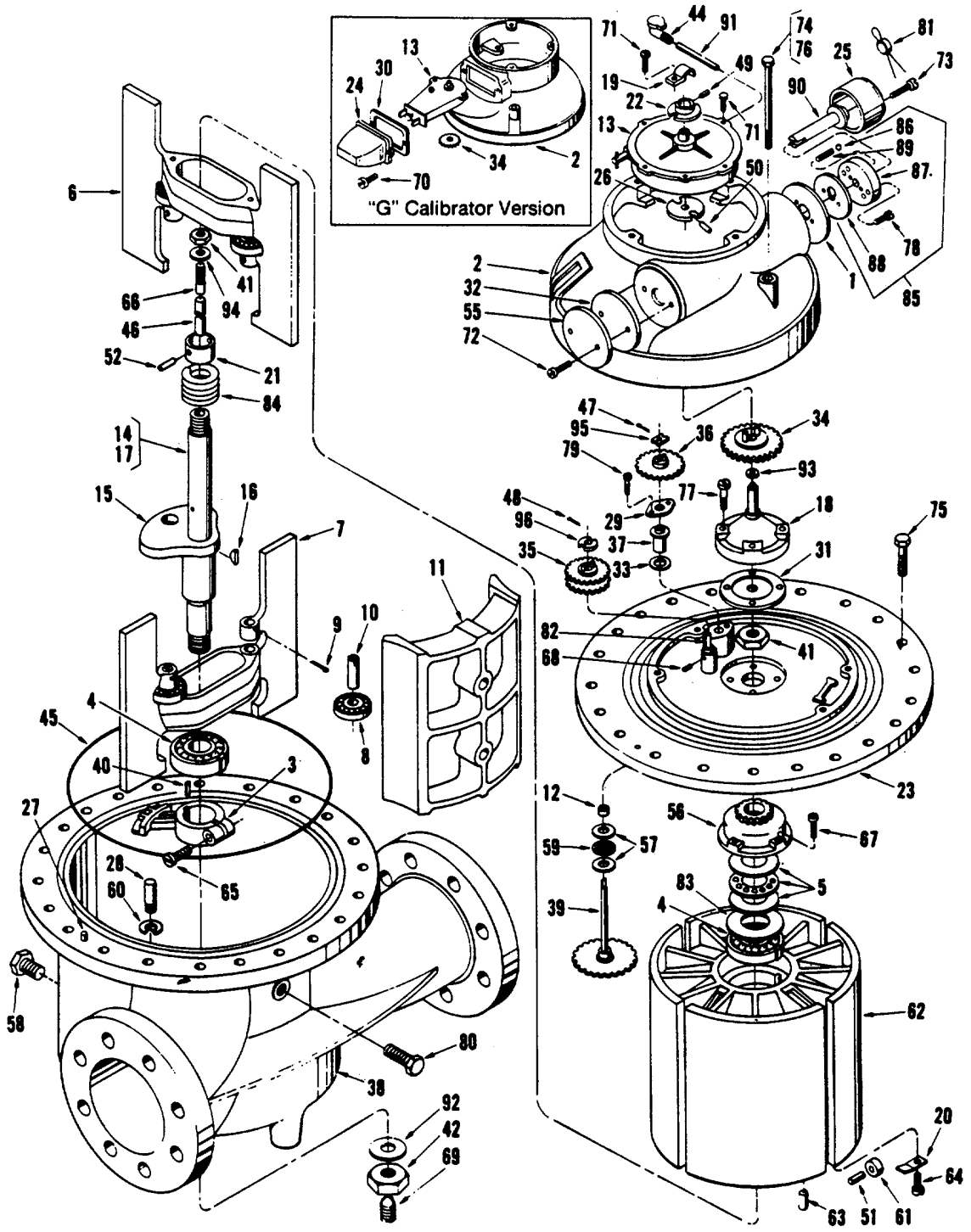
MOORCO

Form No. P0542.00

Meter, P.D. Model SF, SG, ASF or ASG-6, 6V, 6R or 6VR-NF

Parts List

Printed in U.S.A.



Item		Description	Qty	SF Or ASF Models	SG Or ASG Models
1		Adapter, Adjusting Stem (Manual Calibrator)	1	512372-1	512372-1
2		Adapter, Meter:			
		"G" Calibrator Version	1	502862-1	502862-1
		All Others	1	535148-1	535148-1
3		Arm, Locating	1	535100-1	535287-1
4	+	Bearing, Rotor	2	516109-1	516110-1
5	+	Bearing, Thrust	1	504658-1	505590-1
6		Blade, Upper.	1	535425-1	535271-1
7		Blade, Lower	1	535426-1	535272-1
8	@1+	Bearing, Blade	2	65109-1	644888-401
9		Pin, Cotter, 3/32 x 1"	2	6308-1	6308-1
10		Shaft, Bearing	2	3449-1	3458-1
11		Block	1	517085-5	516999-3
12	+	Bushing, Jackshaft	1	504666-1	504666-1
13	+	Calibrator:			
	@2	Manual	1	512059-1	512059-1
	@3	"G" Calibrator	1	501029-1	501029-1
	@2	Temperature Compensated (Standard)	1	512060-1	512060-1
	@2@4	Temperature Compensated (Special Temp or API)	1	516130-	516130-
14		Cam & Shaft Assembly	1	535107-1	535311-1
15	+	Cam	1	535106-1	535320-1
16		Key, Woodruff	1	643487-401	643487-402
17		Shaft, Rotor	1	575056-1	535310-1
18		Cap, Rotor Adjusting Stem	1	8159-2	501270,3-
19		Clamp, Oil Tube	1	3905-1	3905-1
20		Clamp, Rotor Cover Roller	8	11226-1	12502-1
21		Collar	1	535101-1	535309-1
22	+	Coupling, Drive	1	72103-1	72103-1
23		Cover	1	535079-1	535292-1
24		Cover, "G" Calibrator	1	14171-1	14171-1
25		Cover, Knob	1	3553-1	3553-1
26		Disc, Coupling	1	14356-1	14356-1
27		Dowel	1	1613-1	1613-1
28		Dowel, Locating Arm	1	535537-1	512115-1
29		Flange, Packing Gland	1	10171-1	10171-1
30	+	Gasket, "G" Calibrator Cover	1	14310-1	14310-1
31		Gasket, Cap	1	2033-1	1951-1
32		Gasket, Cover	1	3834-1	3834-1
33	+	Gasket, Packing Gland	1	10173-1	10173-1
34	+	Gear, Calibrator Drive:			
		"G" Calibrator Version:			
		Gallons	1	72308-1	517374-1
		Dekaliters	1	516490-1	518719-1
		Manual and ATC Versions:			
		Gallons	1	8248-1	8248-1
		Dekaliters.	1	515934-1	514779-1
35	+	Gear, Idler:			
		"G" Calibrator Version:			
		Gallons	1	72309-1	517373-1
		Dekaliters	1	539177-1	533007-1
		Manual and ATC Versions:			
		Gallons	1	8250-1	512313-1
		Dekaliters	1	534631-1	516539-1
36	+	Gear, Jackshaft Pinion	1	8249-1	512314-1
3	+	Gland, Packing	1	535160-1	535160-1

Item		Description	Qty	SF Or ASF Models	SG Or ASG Models
38		Housing:			
		Straight Thru Flanged	1	535077-3	535307-1
		Straight Thru Victaulic	1	535077-4	535307-2
		Angle Flanged	1	535078-3	535308-1
		Angle Victaulic	1	535078-4	535308-2
39	+	Jackshaft and Gear	1	535105-1	535295-1
40		Key, Locating Arm	1	512715-2	512715-2
41		Nut, Adjusting Screw	1	670044-402	670044-402
42		Nut, Cap	1	670035-402	670035-403
43		Nut, Lock	1	670044-403	670044-404
44		Oiler	1	6588-1	6588-1
45	+	O Ring	1	575054-1	641471-406
46		Pin, Adjusting Screw Extension	1	575057-1	575057-2
47		Pin, Cotter, 1/16 x 1/2"	1	1095-401	1095-401
48		Pin, Cotter, 1/16 x 3/8"	1	9825-400	9825-400
49		Pin, Groove, 1/16 x 5/8"	1	6028-2	6028-2
50		Pin, Groove, 5/64 x 1/2"	1	6053-2	6053-2
51		Pin, Rotor Cover Roller	4	1634-1	1939-1
52		Pin, Thrust Bearing Collar	1	8251-1	8121-1
53		Plate, Caution:			
		Manual Calibrator	1	6572-1	6572-1
		"G" Calibrator	1	503059-1	503059-1
54		Plate, Caution	1	6571-1	6571-1
55		Plate, Cover (Manual Calibrator)	1	3440-2	3440-2
56		Plate, Rotor G	1	512112-3	512318-3
57	+	Plate, Thrust Bearing	2	1111-1	1111-1
58		Plug, Pipe, 1/2" NPT	1	640820-1	640820-1
59	+	Retainer, Thrust Bearing	1	70360-1	70360-1
60		Ring, Retaining	1		65303-2
61	+	Roller, Rotor Cover	4	11681-1	12501-1
62		Rotor	1	535121-1	535288-1
63		Dowel	9	1636-1	1938-1
64		Screw	8	65224-1	643669-402
65		Screw, Locating Arm	1	643668-403	643668-404
66		Screw, Rotor Adjusting	1	670046-425	670046-425
67		Screw, Rotor Gear Plate:			
		SF or ASF Models, 1/4-20 x 7/8"	4	65224-1	
		SG or ASG Models, 1/4-20 x 5/8"	6		642017-403
68		Screw, Set, 1/4-20 x 1/4"	1	6538-1	6538-1
69		Screw, Set	1	670029-406	670029-406
70		Screw, 1/4-20 x 1/2" Drilled ("G" Calibrator)	4	6775-3	6775-3
71		Screw, 6-32 x 5/16"	2	6048-2	6Q48-2
72		Screw, 10-32 x 3/8"	2	6045-2	6045-2
73		Screw, 10-24 x 3/4" Drilled	2	6481-3	6481-3
74		Screw, 5/16-18 x 3 3/4"¢ Drilled	2	6422-3	6422-3
75		Screw:			
		SF or ASF Models, 1/2-13 x 1 1/2"	22	6097-2	
		SG or ASG Models, 5/8-11 x 1 3/4"	24		6156-2
76		Screw, 5/16-18 x 3 1/2" ("G" Calibrator)	2	6421-3	6421-3
77		Screw:			
		SF or ASF Models, 5/16-18 x 1 1/4"	4	6151-2	
		SG or ASG Models, 5/16-18 x 7/8"	5		9563-400
78		Screw, 10-32 x 5/8"	2	8338-400	8338-400

Item		Description	Qty	SF Or ASF Models	SG Or ASG Models
79		Screw, 10-32 x 1/2"	2	6764-2	6764-2
80		Screw, 1/2-13 x 1 1/4"	2	643166-403	643166-403
81	+	Seal, Lead & Wire	2	1627-400	1627-400
82		Shaft, Idler	1	70139-1	70139-1
83		Spacer, Bearing	1	512075-1	512271-1
84		Spring, Rotor	1	2198-2	3567-2
85		Stem, Adjusting	1	9838-1	9838-1
86		Ball	2	6427-1	6427-1
87		Plate, Base	1	3552-1	3552-1
88		Plate, Retaining	1	3556-1	3556-1
89		Spring, Knob.	2	3557-1	3557-1
90		Stem, Adjusting	1	3551-1	3551-1
91		Tube, Oil	1	3896-1	3896-1
92		Washer.	1	536520-1	536521-1
93		Washer	1	14012-200	14012-200
94		Washer, Adjusting Screw.	1	670045-403	670045-403
95	+	Washer, Drive	1	1125-1	1125-1
96		Washer, Jackshaft Pinion	1	3599-1	3599-1

\+ Recommended stock.

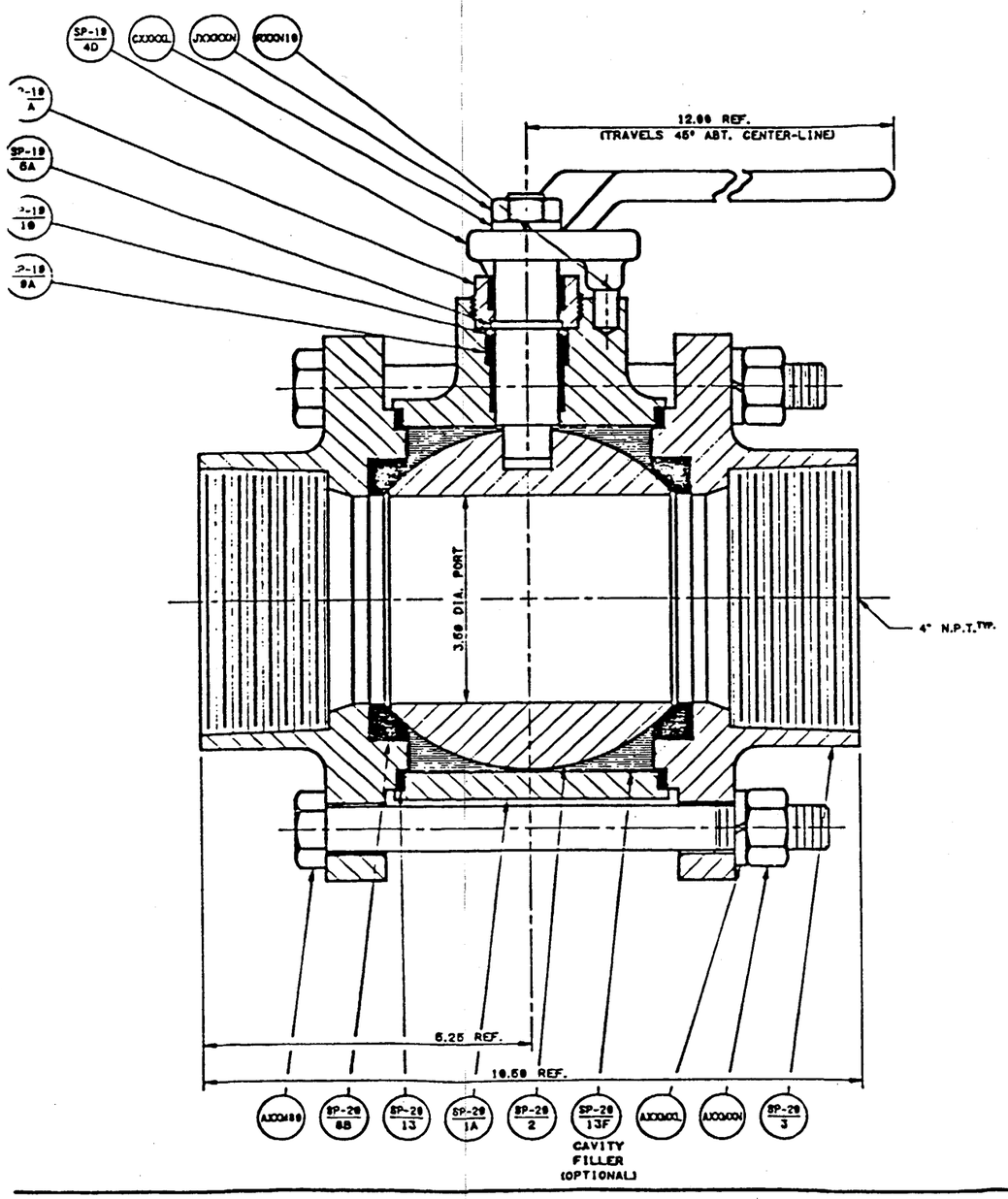
@1 Use of current style blade bearing eliminates the need to use a blade bearing bushing, part number 3457-1.
@2 See Form No. P0206.00 for component parts.
@3 See Form No. P0204.00 for component parts.
@4 Include temperature range and specific API gravity when ordering.

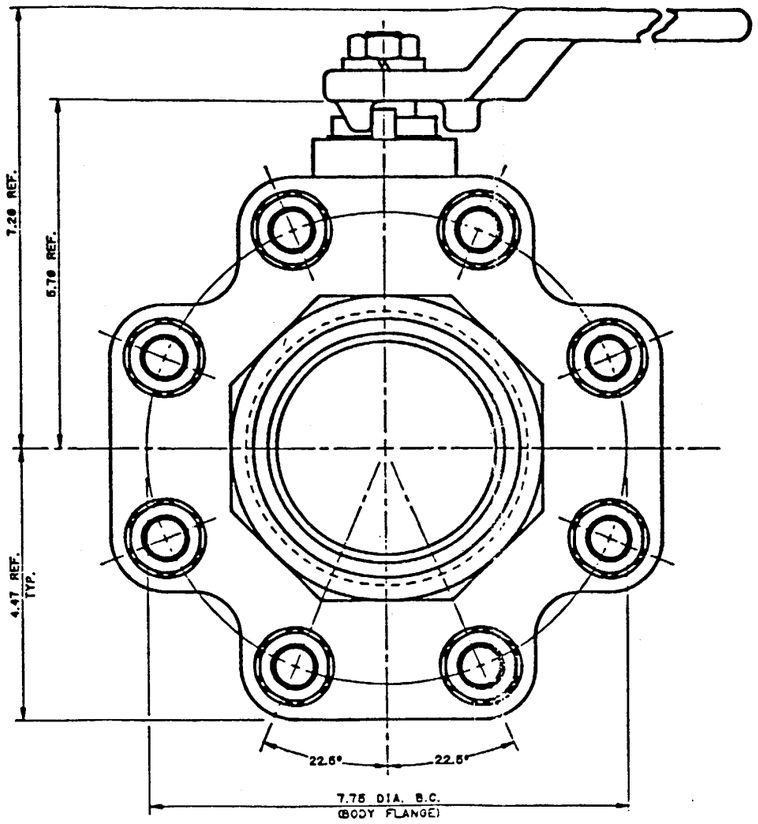
Form No. P0542.00 supersedes Parts Lists 1-J and 1-K.

Date Code EB

CHANGE	DATE	REMARKS
3	11/14/85	REDRAWN ON CAD

XX.D>.2





BY: GTS	4" SP-28 w/ SCREWED END FITTINGS	MAT'L: AS REQUIRED
DATE: 11/14/85	PITTSBURGH BRASS MFG. CO. R.D.6. IRWIN, PA. 15642	SP-20-S
CHKD: RWE		
SCALE: FULL		

A7-21/(A7-22 Blank)

ANSUL "SENTRY" DRY CHEMICAL EXTINGUISHERS

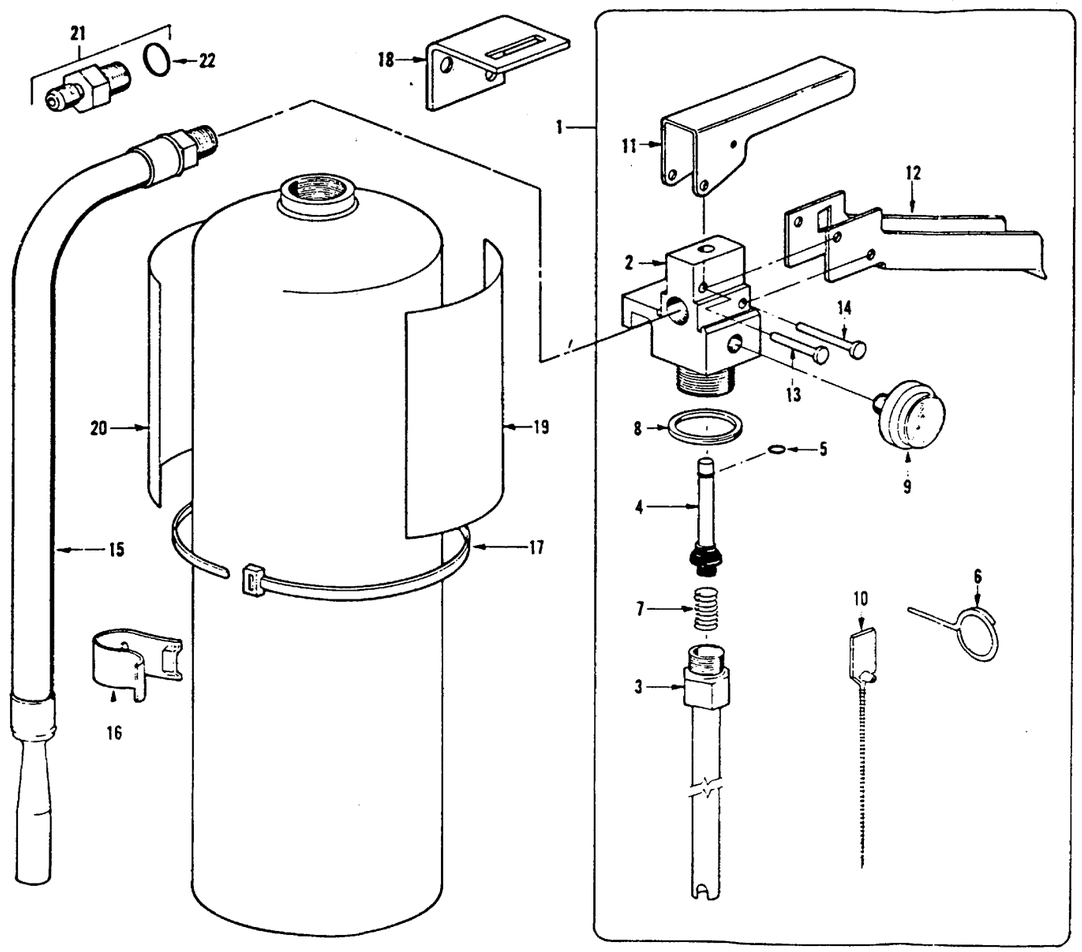


FIGURE NO.	DESCRIPTION	PART NUMBER								
		SY-0613 SY-0614	SY-0623 SY-0624	SY-0633 SY-0634	SY-1013 SY-1014	SY-1023 SY-1024	SY-1033 SY-1034	SY-2013 SY-2014	SY-2023 SY-2024	SY-2033 SY-2034
1	Valve Assembly	30604	30604	32967	30895	30895	32969	30896	30896	32970
2	Valve Body, Machined	28452	28452	28452	28452	28452	28452	28452	28452	28452
3	Tube, Pick-Up	31559	31559	31559	31556	31556	31556	31553	31553	31553
4	Valve Stem Assembly (Metal)	24489	24489	24489	24489	24489	24489	24489	24489	24489
5	"O" Ring	11873	11873	11873	11873	11873	11873	11873	11873	11873
6	Pull Pin (Ring Pin)	30279	30279	30279	30279	30279	30279	30279	30279	30279
7	Spring	29256	29256	29256	29256	29256	29256	29256	29256	29256
8	Quad Ring	16222	16222	16222	16222	16222	16222	16222	16222	16222
9	Gauge, Pressure	24498	24498	24498	24498	24498	24498	24498	24498	24498
10	Seal, Visual Inspection	25940	25940	25940	25940	25940	25940	25940	25940	25940
11	Lever, Operating	31793	31793	31793	31793	31793	31793	31793	31793	31793
12	Handle, Carrying	31794	31794	31794	31794	31794	31794	31794	31794	31794
13	Rivet, Operating Lever	17050	17050	17050	17050	17050	17050	17050	17050	17050
14	Rivet,Carrying Handle	17050	17050	17050	17050	17050	17050	17050	17050	17050
15	Hose and Nozzle Assembly	29819	29819	29819	29819	29819	29819	29819	29819	29819
16	Hose Clip	32422	32422	32422	32422	32422	32422	32422	32422	32422
17	Locking Cable	30636	30636	30636	30636	30636	30636	30935	30935	30935
18	Hanger Hook	16819	16819	16819	25298	25298	25298	30643	30643	30643
19	Nameplate (Operating)	24190	24192	24192	24195	24197	24197	24195	24197	24197
20	Nameplate (Maintenance, w/o U.L. Approval)	24191	24194	24193	24196	24199	24198	24196	24199	24198
21	Adaptor Assembly, Recharge	16246	16246	16246	16246	16246	16246	16246	16246	16246
22	"O" Ring	6263	6263	6263	6263	6263	6263	6263	6263	6263
23	Inspection Record Tag, (Not Shown)	16313	16313	16313	16313	16313	16313	16313	16313	16313

Smith Meter Inc.
A Moorco Company

MOORCO

Meter
Installation/Operation

June 1985 Bulletin 1.2.11

Caution

Read Instructions carefully before attempting to operate. Each meter Is thoroughly tested before leaving the factory. Smith Meter Inc. cannot accept claims for damage occurring during the fire 24 hours of operation.

Installation Instructions

1. The meter and its accessories are precision instruments and should be treated accordingly. Prior to installation the equipment should be protected from adverse weather conditions and accidental abuse.
2. The installation should provide protection from sand, dust, rain, sleet, etc., where extreme adverse weather conditions are encountered.
3. Except for vertical meter installations the meter should be mounted on a suitable base or platform so it will not be supported by the piping.
    a. Dimensional outline drawings showing size and location of anchor holes are available for all meters.
4. Install the meter so that it cannot be accidentally drained of product; however, it is advisable to drain the meter of water and sediment periodically.
    a. When installing a meter, be sure drain plug is accessible.
5. Piping should not produce an undue strain on the meter.
6. Protect the meter and system against the effects of thermal expansion with a relief valve.
7. Where necessary, a deaerator or air eliminator should be installed to keep air and vapor out of the meter.
8. All piping should be internally cleaned before the meter is put into operation.
    a. Rust, dirt, welding shot, and other foreign material should be removed completely.
    b. Remove the inner mechanism and flush the lines to prevent damage to the metering element.
    c. The meter should be protected by a strainer.
9. Where necessary, a flow limiting valve should be installed downstream of the meter to protect it from excessive flow rates.
10. Remove the inner mechanism if the system is to be pressure tested with water or if debris is to be flushed from system.
11. Do not calibrate with water or allow water to stand in the meter.
    a. Flush meter with a light lubricating oil if it is left idle or stored.
12. Unless otherwise specified, meters normally flow from left to right when viewed from the flanged side of the housing.
    a. Most meters can be changed to flow from right to left. See the appropriate manual.
13. A counter may be located in any one of four 90° positions. Large numeral counters may be located in any of eight 45° positions.

Operation Instructions

Start-Up

It is best to fill the meter by gravity. However, where hydraulic conditions require that the pump(s) be operated, extreme care should be used in opening the valves at the meter.

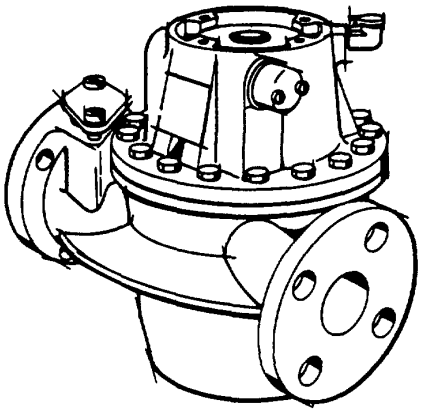
In all instances, the air should be evacuated slowly from the meter and system.

1. Establish product flow through meter.
    a. With outlet valve closed, slowly open inlet valve.
    b. Slowly open outlet valve until counter begins to turn. Leave outlet valve in throttled position until air is evacuated from meter.
    This is necessary to protect the meter from excessive speed due to air in the lines of system.
2. Loosen vent plug of double case meters (except for vertical meters) when meter is filled with liquid.
    a. Permit the air trapped in the meter cover to escape through the threads. Close plug when product begins to seep through threads.
3. Fully open inlet and outlet valves.
    a. Open valves slowly, pausing if register operation is rough. Continue opening when operation becomes smooth.
4. Inlet and outlet valves should be operated slowly to avoid line shock. Abrupt closure can create forces in excess of normal line pressure. This could result in damage to the meter and other equipment.
5. Do not set a reset type counter when the meter is operating.
6. The ticket securing pin in a printer head must be in the down or locked position when the meter is operating.
7. Meters equipped with G, ATG, AMR, or Dummy calibrators can be operated in either direction.
8. Calibration adjustment has been made at the factory for zero error at maximum nameplate capacity on 33 SSU solvent. Due to variations in operating conditions it is recommended that the meter be calibrated and adjusted after installation.
9. Meter calibration is accomplished by adjusting the calibrator dial or knobs. Calibration may be changed in increments of 1/20 of 1%. The adjustment is concealed under a cover on the calibrator adapter.
10. To obtain maximum service from Smith meters, it is suggested that detailed records be maintained. Data such as model, serial number, operating rate, type of product, meter clearances, totalizer readings and other pertinent information should be recorded. Such information is an excellent guide in scheduling a preventive maintenance program. Refer to manuals for meter maintenance.

Note

For further information on meter installation, meter proving, and operation the following publication is recommended: API Standard 1101, Measurement of Petroleum Liquid Hydrocarbons by Positive Displacement Meter.

ROTARY METER and ACCESSORIES



Smith Meter Inc.
A Moorco Company

MOORCO

SERVICE MANUAL

APPENDIX A

PRINCIPLE OF OPERATION
TYPES OF METERS

PRINCIPLE OF OPERATION

The Smith Meter is of the Rotary Positive Displacement Type. The accurately machined housing contains a rotor which revolves on ball bearings and carries four evenly spaced blades. As liquid flows through the Meter, the Rotor and blades revolve about a fixed cam, causing the blades to move outward. The successive movement of the blades forms a measuring chamber of precise volume between two of the blades, the rotor, the housing, the bottom and top covers. A continuous series of these closed chambers is produced, four for each rotor revolution. Neither blades nor Rotor contact the stationary walls of the measuring chamber.

One of the outstanding features of the Smith Meter principle is that the flow is literally undisturbed while it is being metered. Energy is not wasted by arresting liquid velocity; consequently high accuracy and efficiency are commonplace with Smith Meters.

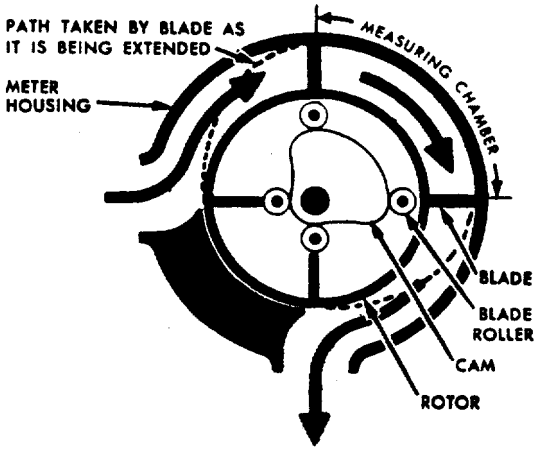


FIG. 1. DRAWING SHOWS PRINCIPLE OF A.O.SMITH ROTARY METER.

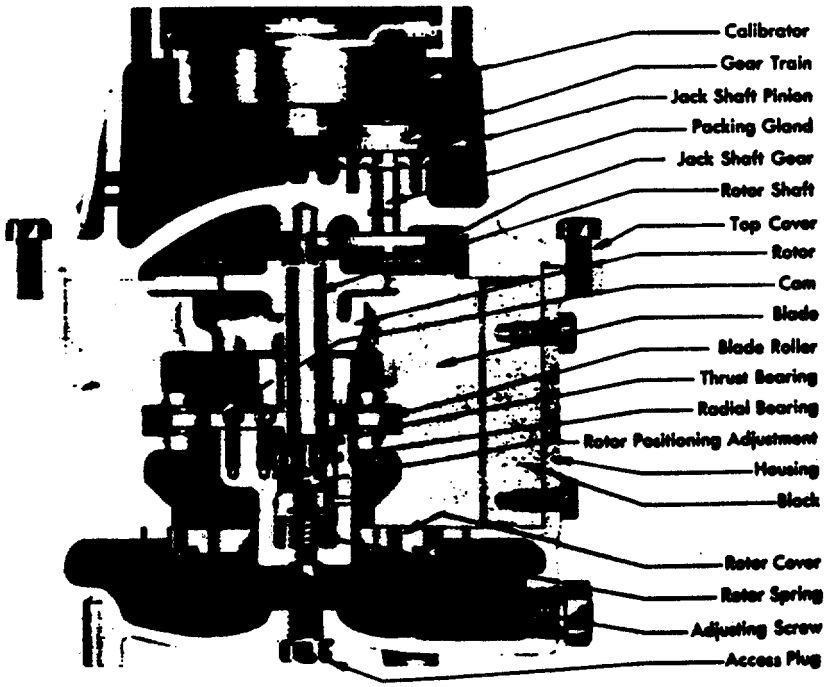


FIG. 2. CONSTRUCTIONH OF 6 AND 10 SERIES METERS.

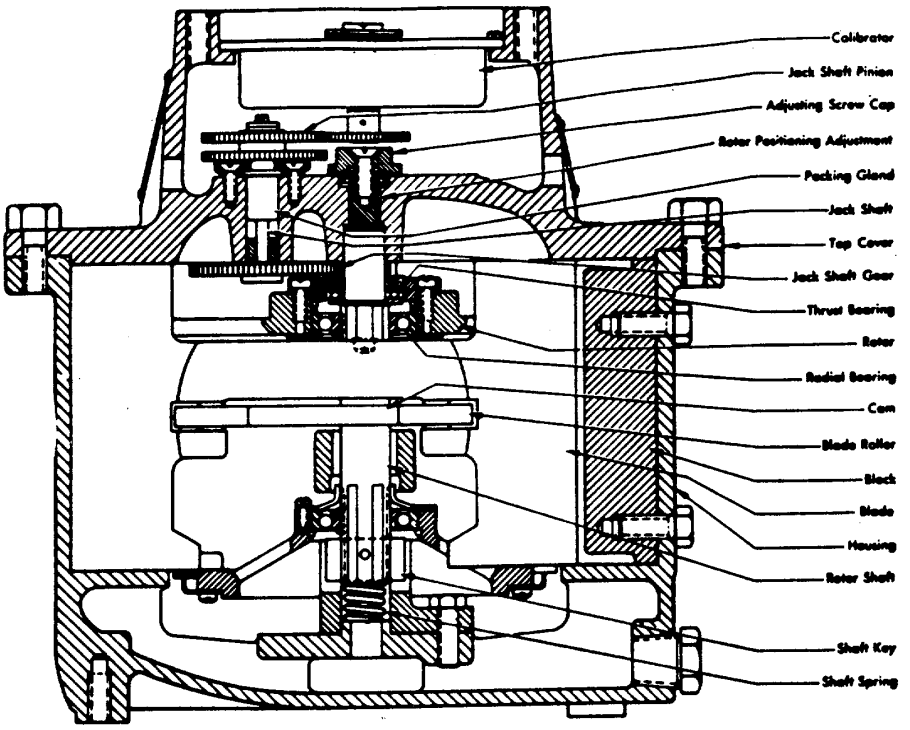


FIG. 3. CONSTRUCTION OF 18 SERIES T-15 AND T-30 METERS

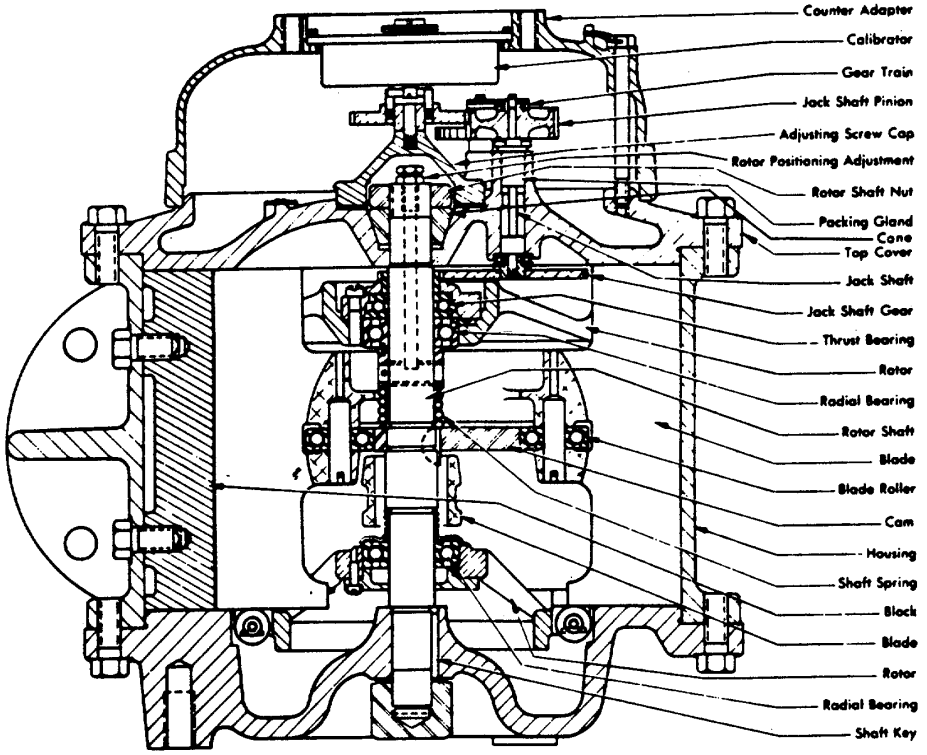


FIG. 4. CONSTRUCTION OF 28, 42, 60, 90, 170 AND 250 SERIES METERS.

APPENDIX A

While Smith meters are basically the same in principle, some differences exist in the design of the various models. Figure 1 shows the principle of Rotary Positive Displacement Meters. Figures 2, 3 and 4 show differences in design.

It will be seen from the illustrations that the rotor positioning adjustment of the Meters in Figure 2 is made at the bottom of the meter. In Figures 3 and 4 the rotor positioning adjustment is made at the top of the meters. It is to be noted that the rotor shaft in Figure 4 extends through the meter base. This is not the case in Figure 3.

Double Case Meter construction differs from Single Case construction in that the measuring unit is encased in a high pressure outer housing.

To obtain maximum service from Smith Meters, it is suggested that detailed records be maintained on each. Data such as meter model, capacity, serial number, meter clearances, progressive totalizer readings, meter factor or adjustment and other pertinent data should be recorded.

Such information is an excellent guide in scheduling a preventive maintenance program.

OPERATING INSTRUCTIONS

1. Large volumes of air capable of extensive destruction can be unknowingly compressed in a dry line by the pump at the first attempt to flood a -new system, therefore, valves must be opened very slowly to avoid damaging the meter by over-speeding. Always have an up stream valve closed before operating a set stop valve the first time.
2. Valves should be handled in a cautious manner after a meter has been put into service to avoid unnecessary abrupt stops. Sudden valve closure causes severe line shock creating pressures many times the normal operating pressure. This may result in damage to the meter and other equipment.
3. Reset Type Counters must not be reset when the meter is operating.
4. The "ticket securing pin" in a printer head must be in the down or locked position when the meter is operating.
5. The normal flow range of a meter is from its maximum rated capacity to 20% of its maximum rated capacity, example: 100 GPM maximum 20 GPM minimum.
6. Meter calibration is effected by adjusting the calibrator dial or knobs whichever the case may be. Calibration may be changed in increments of 1/20 of 1%. The calibrator adjuster is concealed under a small cover fitted to the register adapter.
7. Only meters equipped with "G " calibrators can be operated in either direction. Standard meters are assembled for right hand flow direction unless otherwise requested by the customer. Refer to Pages.8 & 9 for reversing instructions.
8. If a meter has been idle for a considerable time, it is considered good practice to drain it of possible water and sediment before restoring it to service.

SINGLE CASE METERS

SINGLE CASE METER: DISMANTLING AND INSPECTION

First remove the counter and the counter adapter. This exposes the gear train. (Important Note: For Temperature Corrected Meters, see Page 12.) Visual inspection of the gears and gear shafts will determine the need for replacement. On S-13 and "T" meters the calibrator must be removed to reveal the gear train.

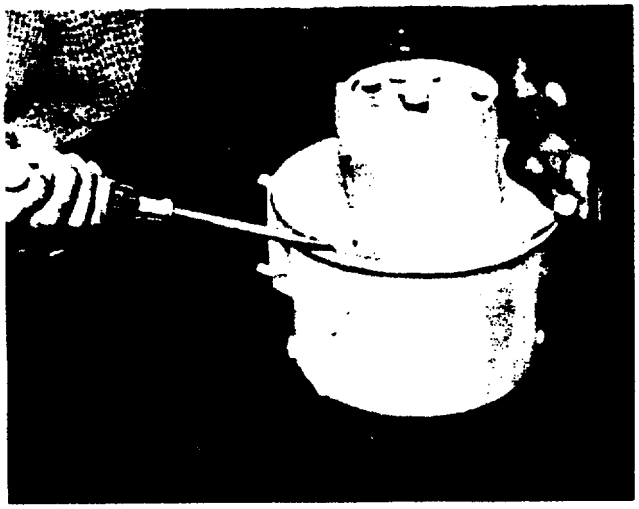


FIG. 5. COVER OF SMALLER METERS IS REMOVED BY PRYING WITH A SCREWDRIVER.

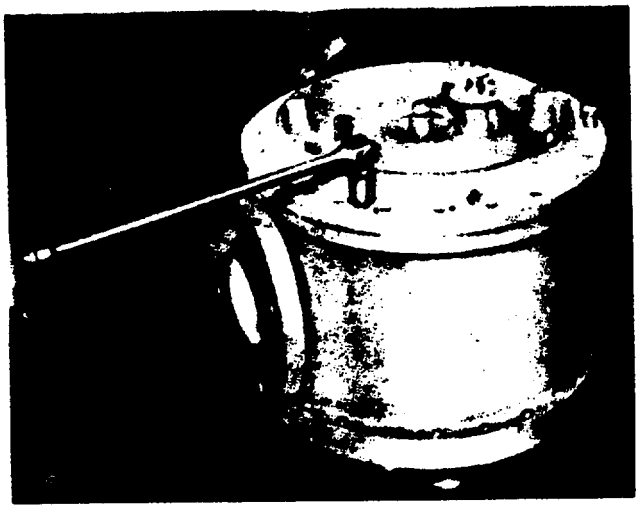


FIG. 6. JACKSCREWS (COVER SCREWS) ARE USED TO BREAK SEAL AND LIFT COVER OF LARGER METERS.

Next, remove the adjusting screw cap on meters so equipped. IMPORTANT: Do not attempt to remove the meter housing cover before removing the adjusting screw cap, the rotor shaft nut and shaft collar. Failure to remove the upper shaft nut at this point will result in breakage of the meter cover or base. To remove the meter cover, pry evenly around its perimeter using the slots provided for this purpose. Covers on larger meters are provided with three tapped holes. Three cover bolts may be screwed into these holes to raise the cover evenly. (See Figures 5 & 6).

After the meter cover is removed, any liquid still remaining in the meter should be drained or otherwise eliminated. If the meter is in service on crude oil or any other viscous liquid, a solvent should be used to dissolve the residue.

Bottoming of rotor assemblies is done to provide a firm support for the assembly in order to determine whether clearances in the meter are within the proper tolerances. There is a clearance chart on the bottom of Page 7 showing maximum and minimum allowable tolerances for meters operating up to 150°F and viscosities less than 5,000 SSU. (For clearances above 150°F., consult your nearest Smith Meter Sales Office.)

In the case of meters shown in Figure.2, on Page 2, the rotor is bottomed in the meter housing by turning the adjusting screw located in the base of the meter. For meters shown in Figure 3, on Page 3, the rotor is bottomed by first removing the complete rotor assembly, then removing the shaft spring which is located in the shaft socket in the base of the meter. When the rotor assembly is reinstalled without the spring it will rest on the bottom of the housing. For meters shown in Figure 4, on Page 3, the rotor assembly may be bottomed by turning the adjusting screw in the top of the rotor shaft.

Clearances should be checked with a leaf type feeler gage. Any average of clearances that are outside of the tolerance should be noted with a view toward replacing the worn parts. It is well to call attention to the fact that although certain parts may be at or over the borderline of the maximum allowable tolerance, consideration should be given to the condition of the part and the accuracies being obtained in calibrating the meter. By this it is meant that certain major parts such as the rotor and blades need not be replaced if no difficulty is experienced in proving the meter and records show that there is no appreciable change in accuracy from one meter proving to another.

With the rotor assembly still in the meter housing, blade roller and/or cam clearances can be checked by moving the blades back and forth against the cam. Each blade should be checked in two positions, one position at right angles to the first position. This determination can usually be made visually.

It is recommended that a support be used to disassemble the rotor. A simple and inexpensive work plate can be fabricated from pipe and steel plate.

Before attempting further disassembling, turn the rotor and shaft assembly upside down on the support plate. On the T-15 Meter, drive out the pin that holds the shaft key and remove the key. The S13 sump plate is fastened to the shaft with Allen head set screws, 90 degrees apart, with two set screws at each location. Be sure to remove the first one completely, 'then loosen the other screws that hold the rotor cover to the rotor and carefully pry off the Rotor Cover. This should be done in such a manner so as not to damage the edge of the rotor. (See Figure 10.) Remove the lower bearing and bearing cover from the shaft. Mark position of blades using a punch or file with relation to rotor slots. This will permit replacement in their respective slots and in the same positions.

Next, carefully lift out the lower blade and then withdraw the shaft. The upper blade can then be removed. Turn the Rotor over and remove the Rotor Gear Plate, making the Upper Radial Bearing and the Thrust Bearing accessible. Clean all parts thoroughly. Fine emery cloth may be used to remove scale, etc., after

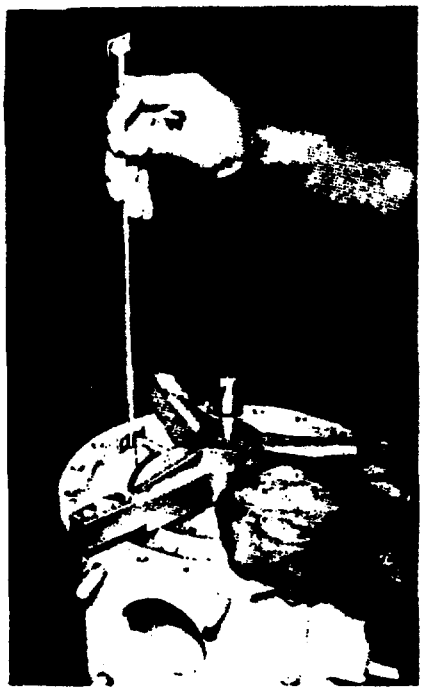


FIG. 7. USING FEELER GAUGE TO CHECK BLADE TO HOUSING CLEARANCES.

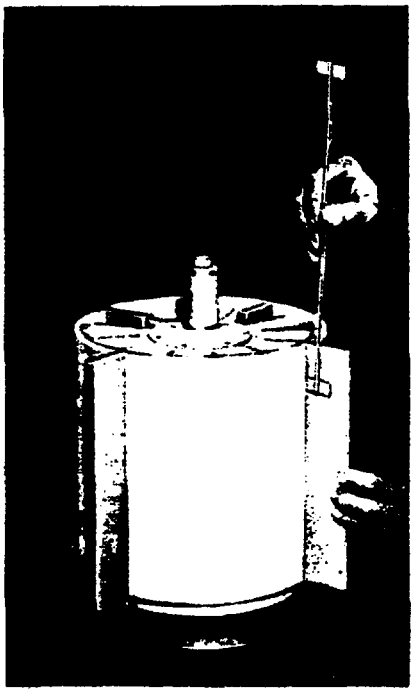


FIG. 8. CHECKING BLADE SLOT CLEARNCE WITH FEELER GAUGE. CLEARANCES MAY BE CHECKED WITH BLADES POSITIONED INSIDE OF OR OUTSIDE OF ROTOR, BUT ROTOR COVER MUST BE ON.

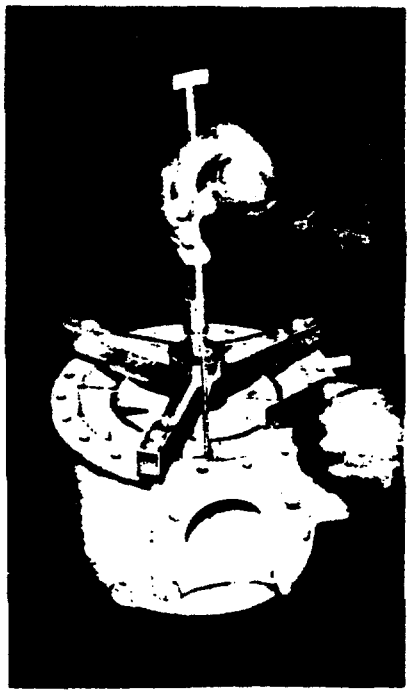


FIG. 9. CHECKING CLEARANCES BETWEEN ROTOR AND BLOCK.

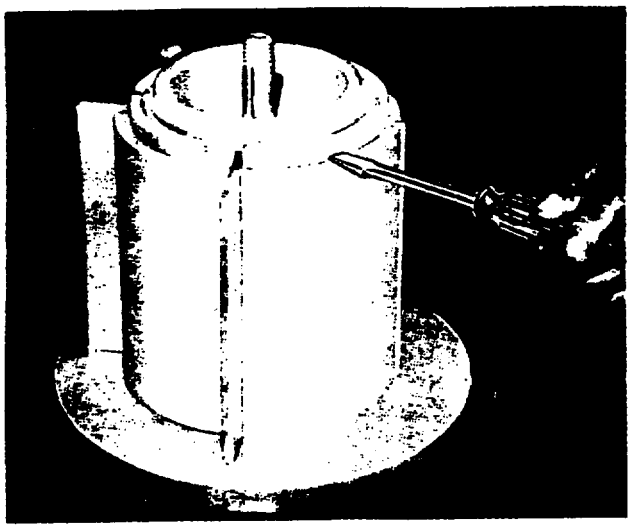


FIG. 10. REMOVING ROTOR COVER, TOP OF SCREW-DRIVER IS PLACED IN SLOT AND PRIED UPWARD TO PREVENT DAMAGE TO TOP EDGE OF ROTOR.

to remove scale, etc., after which all parts should be thoroughly washed in solvent or kerosene. The Blade Rollers or bearings must revolve freely on their shafts without excessive looseness. If the Blade Rollers (bearings) are worn, they must be replaced. Blade Roller or bearing replacement is not normally attempted in the field but can be accomplished with proper equipment and care.

If any burrs are apparent on the blades, they should be removed. Sharp, clean cut edges should be maintained on the blades. Blade blocks should be flat and clean, if grooved they maybe turned over and used on the opposite side, otherwise they should be replaced. If the Rotor is equipped with rotor cover rollers and pins, these should also be replaced if they show wear or roughness. Reassemble in reverse order from disassembly, being sure that al l bearing locks are properly positioned.

The jackshaft extends through a replaceable cartridge type Packing Gland in the single case meters. Remove Jack Shaft Pinion and draw the Shaft from the Gland. If the Jack shaft is worn or corroded, it should be replaced, otherwise it may be cleaned and polished with a fine crocus cloth. Polish with a rotary motion so as not to cut vertical grooves or scratches in the Shaft. Coat the Shaft with light grease before inserting in the gland. If the Packing Gland is worn, replace with a new Gland cartridge and gasket. Check Jack Shaft Bushing and replace if worn.

TABLE 1 - CLEARANCE GUIDE

THIS CLEARANCE GUIDE LISTS THE RECOMMENDED MINIMUM AND MAXIMUM FITTING CLEARANCES FOR NEW AND REPAIRED METERS. CLEARANCES MAY EXCEED THE MAXIMUM SHOWN PROVIDED THE METER PROVES WITHIN ACCEPTABLE ACCURACY.

METER MODEL OR RATING	ROTOR TO BLOCK	ROTOR ADJUSTMENT TOTAL END CLEARANCE DIVIDED EQUALLY EACH END	BLADE SLOT TOTAL CLEARANCE*	BLADE ENDS TOP END CLEARANCE BELOW ROTOR**	BLADE ROLLER OVER RADIUS PORTION OF CAM***	BLADE TIP TOWARD HOUSING****
T-6 & T-10	.002-.004	.005-.008	Free-.003	.000-.001	.001-.003	.003-.0045
T-15	.002-.004	.007-.010	Free-.003	.000-.001	.001-.003	.004-.005
T-25, T-30	.002-.004	.007-.010	Free-.003	.000-.001	.001-.003	.004-.005
12, 13	.002-.004	.006-.009	Free-.003	.000-.001	.001-.003	.003-.005
20, 24, 28	.003-.005	.007-.011	Free-.003	.000-.001	.001-.003	.004-.006
30, 35, 42	.004-.006	.008-.012	Free-.004	.000-.002	.001-.003	.004-.006
45, 50, 60	.004-.006	.008-.012	Free-.004	.000-.002	.001-.003	.005-.007
65, 75, 90, 100	.004-.006	.008-.012	Free-.004	.000-.002	.001-.003	.006-.008
150,170,200,250	.005-.007	.010-.016	Free-.004	.000-.002	.001-.003	.011-.013

THE ABOVE CLEARANCES APPLY ONLY TO METERS OPERATING AT STANDARD OPERATING TEMPERATURES OF 20° TO 150°F. AND VISCOSITIES LESS THAN 5,000 SSU. FOR HIGHER TEMPERATURES AND VISCOSITIES CONSULT FACTORY.

*BLADES SHOULD MOVE FREELY IN ROTOR SLOTS AND THE AVERAGE CLEARANCE IN EACH SLOT SHOULD NOT EXCEED THE LISTED CLEARANCES. NOR SHOULD ANY SINGLE POINT BE MORE THAN 50% ABOVE THE MAXIMUM LISTED.

**THE BLADE SHOULD BE SHORTER THAN THE ROTOR BY THE AMOUNT SPECIFIED TO ALLOW FOR DIFFERENCE IN COEFFICIENT OF EXPANSION BETWEEN THE ALUMINUM BLADES AND IRON ROTOR. (LOWER EDGE OF BLADE SHOULD NOT PROJECT BELOW BOTTOM SURFACE OF ROTOR.)

***WITH THE BLADE IN THE MEASURING CHAMBER. THIS TOTAL CLEARANCE SHOULD BE MAINTAINED BETWEEN THE RADIUS OF THE CAM AND ONE ROLLER ONLY.

****WITH THE BLADE HELD TOWARD (AWAY ON T-6 AND T-10) THE HOUSING, THESE CLEARANCES SHOULD BE MAINTAINED BETWEEN THE MEASURING CHAMBER AND THE FULL LENGTH OF THE EDGE OF THE BLADE.

ASSEMBLY

If new blades are installed, they may need to be fitted to the meter housing, refer to clearance chart in Table I. After assembling the rotor, it should be installed in the meter housing and the clearances determined with a leaf feeler gage. Usually the blade edges of new blades require dressing down to bring the blade ends within the proper clearance. Figure 11 shows the proper manner in which to accomplish this filing operation. Caution: Use a vise with soft jaws, or otherwise properly protect the blade held by the vise. A Vixen (babbit metal) file is recommended for aluminum blades and a Mill coarse file is recommended for cast iron blades.

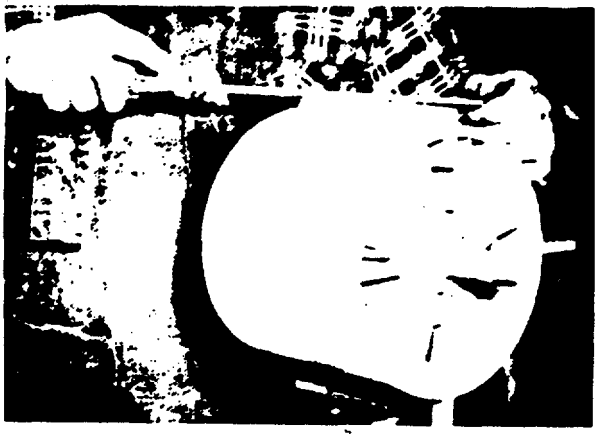


FIG. 11. PROPER METHOD OR FILING ALUMINUM BLADES.

Care should be exercised in replacing the Meter Cover to insure that the lower Jack Shaft Gear engages the Rotor Gear before pressing the cover into final position. It is recommended that the rotor assembly be bottomed when installing the meter cover. Insert three or four of the cover cap screws, the shaft cone, and shaft upper nut, and test rotor operation before installing all screws for final tightening.

The Rotor and Blades should not touch the top, side, or bottom of the Meter Body. Top and bottom clearances can be adjusted by the adjusting screw. If a Meter is clean, properly adjusted, and in good condition, the Rotor can be turned by hand by applying slow, even torque to the Jack Shaft Pinion. Some force is required to turn the pinion. If Rotor drag exists, it can be detected. Never use pliers to turn the Pinion or Shaft.
To adjust Rotor top and bottom clearance, loosen Adjusting Locking Screw. Then, while applying torque to Jack Shaft Pinion, turn adjusting screw until a position is found where the rotor turns freely. The Meter tends to act as a pump when the Rotor is turned, accordingly the Rotor cannot be turned by hand unless all liquid is drained from the Meter. If the Meter is not taken out of the piping system, the inlet and outlet connections should be freed to allow air to enter and discharge. When the free turning position has been found, and with the Rotor still being turned, the Adjusting Screw should be backed off slightly until the Rotor can be felt rubbing the Top Cover. Mark the Adjusting Screw position and reverse the operation, turning the adjusting screw down until the Rotor rubs the Bottom Cover, then mark the Adjusting Screw at this position. Next set the Adjusting Screw half way between the two marks to obtain equal clearance between the Rotor and Top and Bottom Covers.

If the Rotor cannot be adjusted properly, indications are that the Rotor and Blades, etc. , have not been properly assembled, and the complete assembly must be removed and the cause of the difficulty located and eliminated.

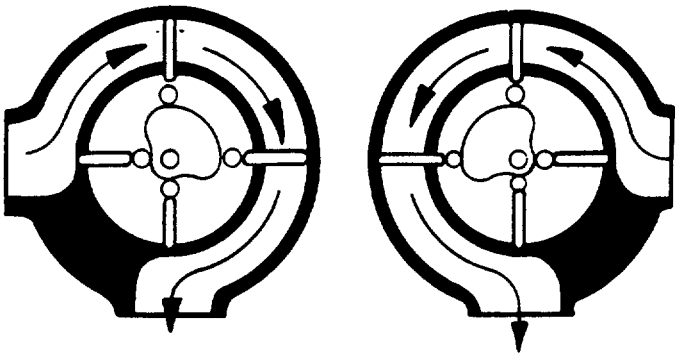
REVERSING INSTRUCTIONS

All Meters except the Double Case Type can be reversed with regard to direction of flow. Unless otherwise specified, a Meter is assembled at the factory to flow left to right, when viewing the Meter from the flanged side. If it is desired that the Meter flow from right to left, it may be changed as follows:

a. Remove the screws holding the counter adapter to the Meter Cover, and lift the entire assembly from the Meter Cover. This will expose the gears to be reversed on S-13 and "T" meters, where the counter adapter is incorporated in the cover, the calibrator must be removed to expose the gears to be reversed.

b. See Reversing Diagram, Figure 13.

c. Remove the cotter pins from the Intermediate and Jack Shafts.



Right Hand Meter

Liquid flows from left to right. Rotor turns clockwise.

Left Hand Meter

Liquid flows from right to left. Rotor turns counter-clockwise.

FIG. 12.

d. The Meter is reversed simply by interchanging the Jack Shaft Gear "B", and the Intermediate Gear "A". It will be observed that the washers on these gears are not the same type and consequently must remain on their respective shafts.

e. After the gears are interchanged, replace the washers and cotter pins. It may be necessary to lift up the Jack Shaft with pliers before the cotter pin can be inserted, as this Shaft drops slightly when the cotter pin is removed.

f. When replacing the Counter Adapter Assembly, line up the drive gears between the calibrator and the Meter Gear so that they engage properly, before tightening the Counter Adapter Screws.

MAINTENANCE

The Smith Rotary Positive Displacement Meter requires a minimum of maintenance.

The calibrator should be kept well lubricated by applying S.A.E. 10 oil or lighter, such as ordinary household oil, through the oil cup directly below the counter.

Meters should be drained of sediment periodically.

If meter is to be stored or idle for any length of time, flush with light lubricating oil.

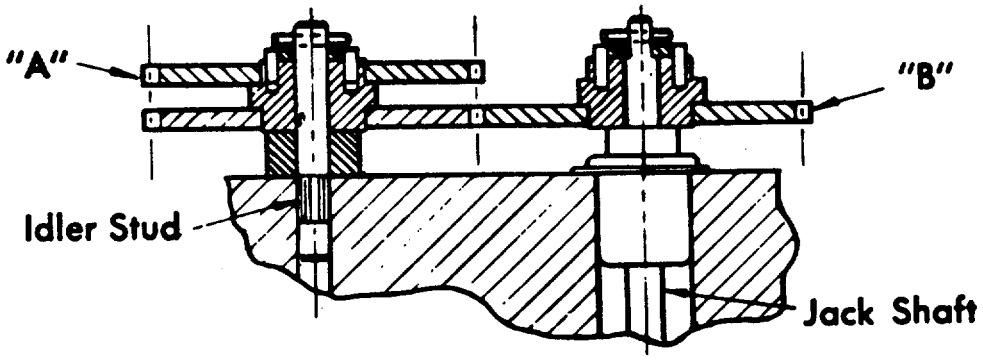


FIG. 13.

DOUBLE CASE METERS

NOTE
DOUBLE CASE METERS NOTE SUPPLIED. MAINTENENANCE PROCEDURES INCLUDED FOR REFERENCE ONLY.

DISASSEMBLY

First remove the counter and counter adapter. Next remove the outer cover, this exposes the inner mechanism.

The inner mechanism of the Double Case Meter is held in position by Allen Head Set Screws which are under the two Bull Plugs shown in Figure 14.

Each hole contains two Allen Head Set Screws and it is recommended that both be completely re

moved from the outer housing. The purpose of this is to enable the inner mechanism to be properly positioned when reinstalled. The inner mechanism will be found to show the marks of these set screws and these marks can be used to line up the inner mechanism properly when being replaced in the outer housing.

After removing inner mechanism from outer housing proceed with disassembly, inspection and reassembly as outlined in Section on Single Case Meters.

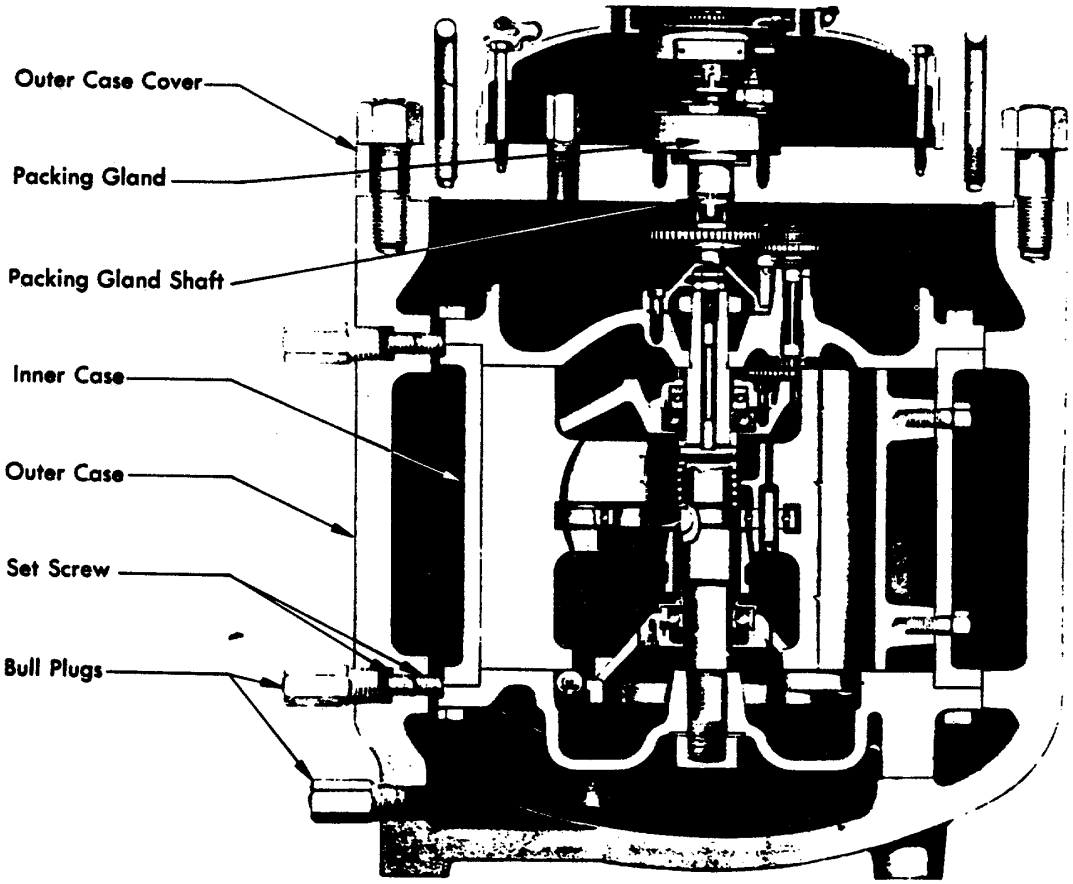


FIG. 14. CONSTRUCTION OR TYPICAL HIGH PRESSURE METER.

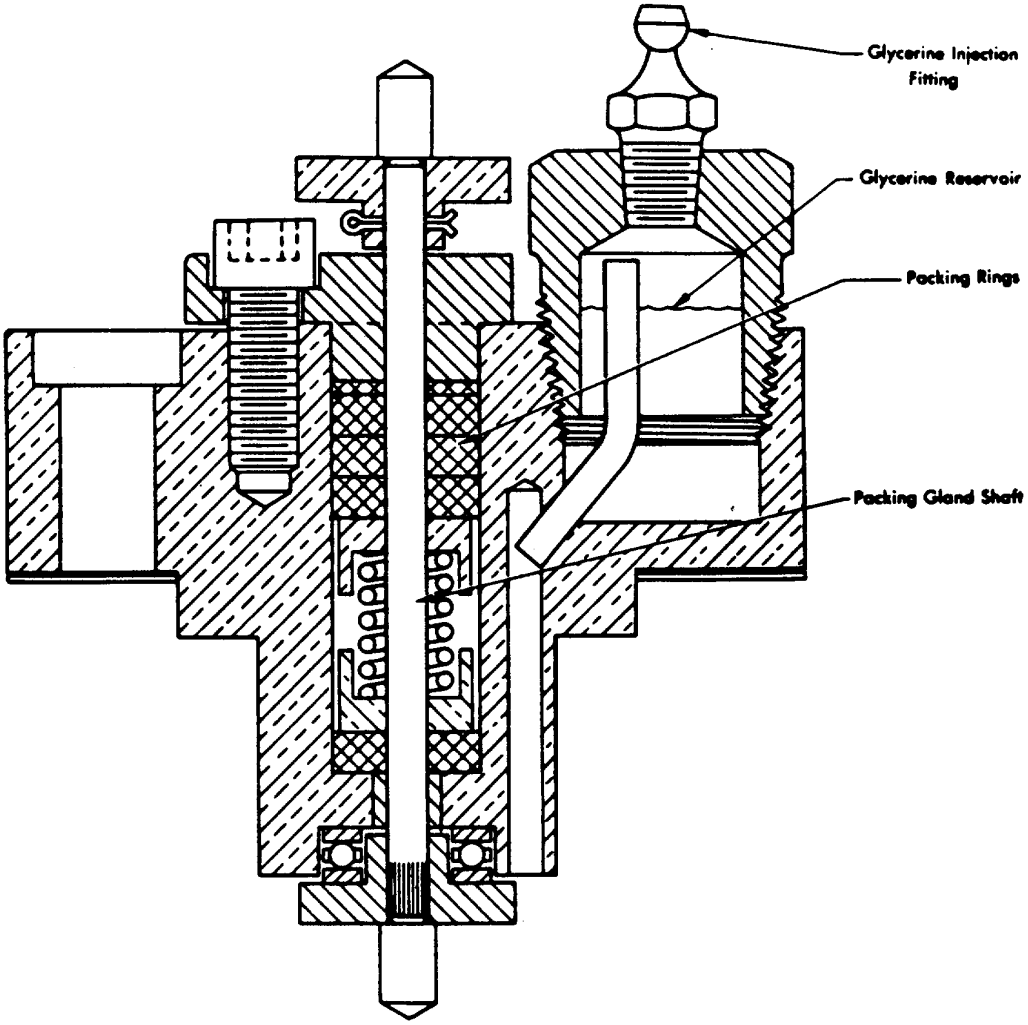


FIG. 15.

Double Case Meters are equipped with a liquid sealed type packing gland as shown in Figure 15.

Glycerine is used as a sealing and lubricating medium and should be injected into the gland at regular intervals. Meters in-different services will require more or less servicing of the packing gland, and the interval can best be determined from experience. However, it is recommended that the injection interval not exceed 60 days.

Packing rings may be replaced when necessary by using the same care that would be used in packing any liquid sealing device. The shaft should be replaced if worn, or otherwise cleaned with crocus cloth, using a rotary motion.

Care should be exercised in replacing the cover of the outer housing of the Double Case Meter to insure that the packing gland shaft is properly centered. The cover is located to the housing with a dowel and by centering the studs visually in all of the holes in the cover, proper centering can be accomplished.

Reassemble in reverse order from disassembly, making sure to apply sealing compound to outlet flange of inner unit.

CALIBRATORS

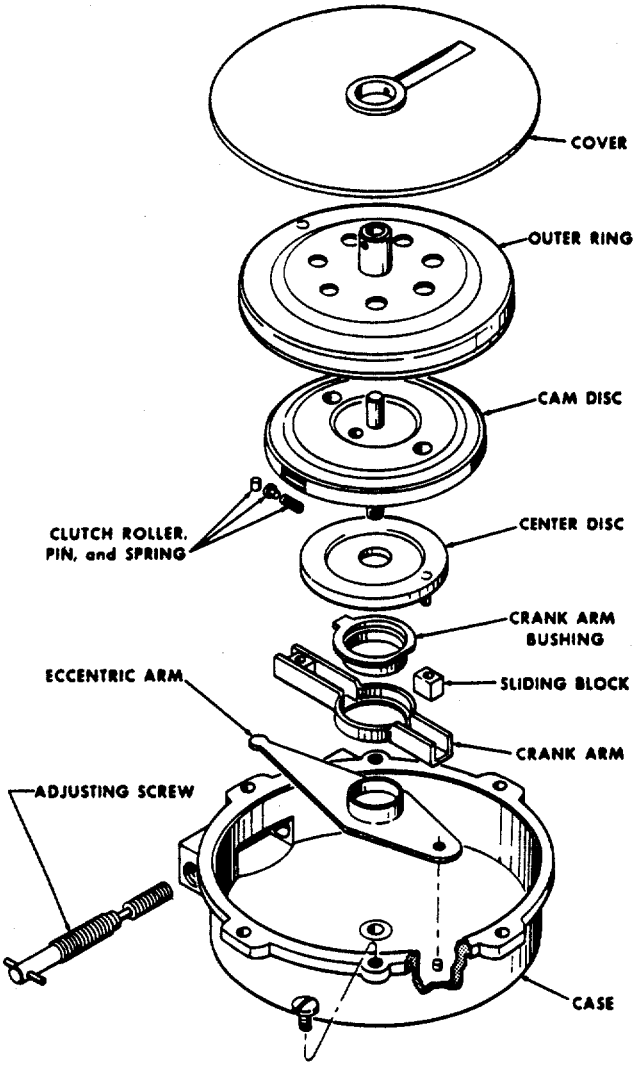


FIG. 16. CLUTCH TYPE CALIBRATOR.

For the purpose of adjustment, A.O. Smith meters are equipped with a calibrator. Calibrators are of two designs, the Clutch Type and the type G or Gear Type.

CLUTCH TYPE

The clutch type calibrator, Figure 16, utilizes two overriding clutches and an eccentric. By adjusting the amount of eccentricity the calibrator can be made to vary any drive ratio between the meter and the register by a maximum total of 11 percent.

This calibrating means is used for adjusting for variations in operating conditions, differences in viscosity of product metered, as well as for providing automatic temperature compensation.

OPERATION

The nature of the device is such that a correction impulse is imparted to the calibrator output shaft once during each revolution. This means that on a standard Model "S" Meter which is geared to register 5 gallons for each revolution of the calibrating or output shaft, there will be one correction impulse for each five gal Ions. To reduce wear to a minimum and to obtain maximum accuracy in frequency of operation of the correction device, the cycle has been reduced to one impulse per barrel on the large capacity, continuous service meters, hence a standard Model W, D or M-60 Meter which is geared to one 42 gallon barrel per revolution of the output shaft will have a correction cycle for each barrel.

Small capacity meters such as the Model T-10 Truck Meters are geared one revolution per gallon and consequently receive one correction impulse per gallon.

TEMPERATURE COMPENSATION

Temperature compensation is accomplished by adjusting the amount of eccentricity of the calibrator eccentric arm automatically by utilizing a thermostatic bulb and bellows assembly (see Figure 17).

The Smith meter accurately measures the actual volume of the liquid passing through it, regardless of temperature.

The Smith Temperature Compensator consists of a thermostatic bulb connected by a capillary tube to a metal sylphon bellows.

The bulb and bellows assembly is completely filled with a liquid having the proper expansion characteristics.

The bulb is immersed in the metered liquid and the bellows is attached to the controlling arm of the calibrator. Temperature changes in the liquid being measured act upon the liquid in the temperature compensating bulb causing expansion or contraction of the metal bellows which actuates the calibrator arm, automatically correcting meter measurement to 60° F.

While the liquid contained in the temperature correcting bulb is affected solely by the temperature of the product being metered, the small amount of the same liquid contained in the metal bellows is affected by the ambient temperature. To correct for any error due to movement of the bellows as a result of a change in ambient temperature, the bellows is built into an assembly including a second bellows containing a volume of liquid equal to the first.

The bellows assembly is arranged in such a manner that while a rise in ambient temperature will cause both bellows to expand, the lengthening of one bellows tends to lengthen the whole bellows assembly while the lengthening of the other tends to shorten the assembly by the same amount, nullifying the effect of ambient temperature on the bellows. This makes the temperature correcting device responsive only to the effect of the temperature of the product being measured, acting on the liquid in the temperature correcting bulb.

METER CALIBRATION

Meter calibration can be made by use of the calibrator dial which is revealed by removing the calibrator access cover, Figure 18, located immediately below the register. The amount of product delivered through the meter increases when the calibrating dial is turned in a clockwise direction and diminishes if the dial is turned in a counterclockwise direction. The dial is graduated to provide increments of adjustment approximately 1/20 of 1%. (4 ounce in 50 gallons or 6 cubic inches in 50 gallons to each notch.)

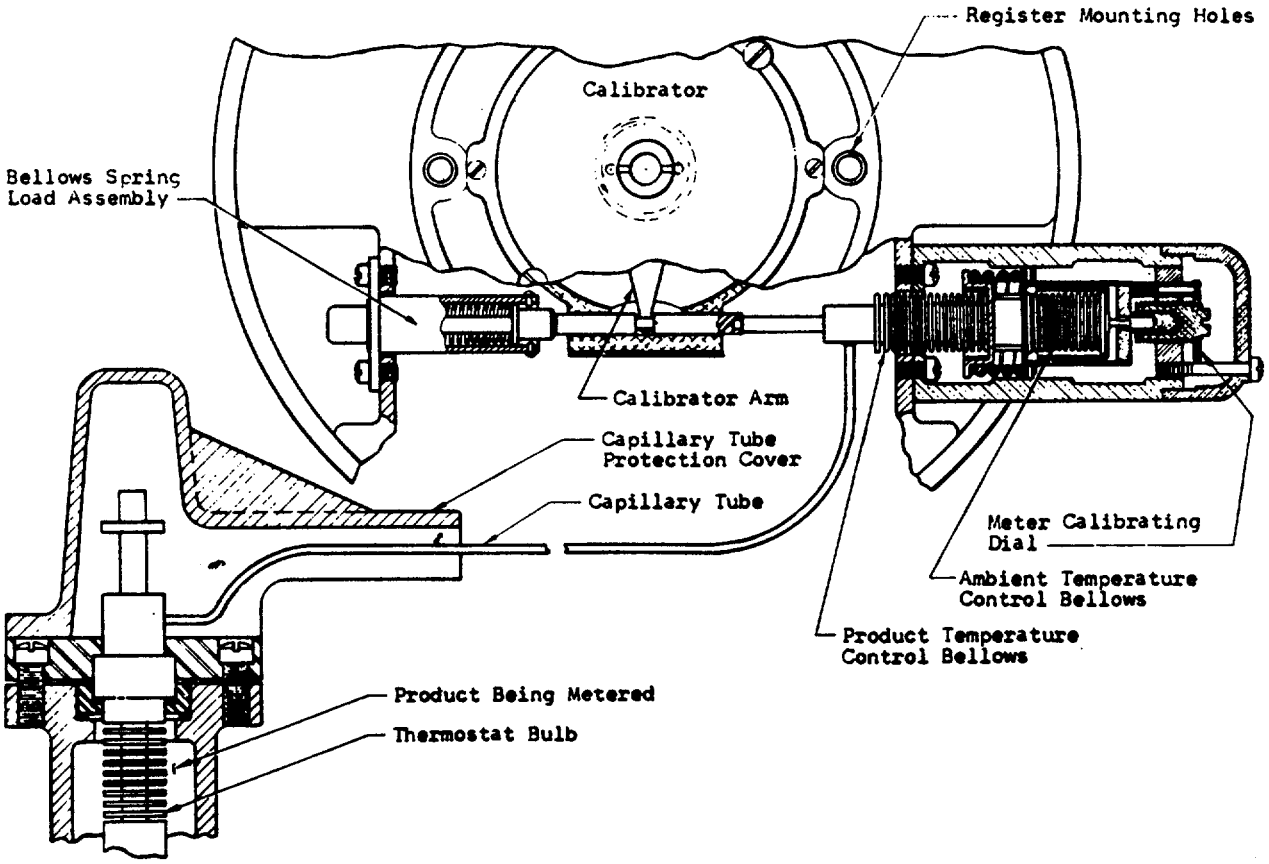


FIG. 17.

After adjustment is made and the access cover is replaced it should be sealed to prevent unauthorized persons from changing the final adjustment.

The correction impulse causes a momentary acceleration of the register which will result in errors and erratic tests if not taken into account.

FIG. 18.

It is important when calibrating a meter that the volume of the calibrated prover be a multiple of the increment of correction of the meter. For example, a prover for Model "S" Meters which are geared to calibrate in five gallon increments should be 200, 205 or 210 gallon capacity and not 203 or 207. For a Model W, D or M-60 which is normally geared to give a correction impulse for each barrel it is essential that the prover be calibrated in even 42 gallon barrels.

The reason for the above is evident as each test run must contain the same number of correction impulses in order to be absolutely accurate. If the test is started with the meter register at zero, the register at the end of the test run should show a quantity divisible by the number of gallons or barrels delivered for each revolution of the calibrator, or each correction impulse.

The magnitude of the meter correction is in the order of 4 or 5 per cent of the volume of meter thruput per correction input cycle. On a standard "S" Meter this would be 4 or 5 per cent of 5 gallons and on a barrel geared meter it would amount to 4 or 5 per cent of 42 gallons. The type of register used is not necessarily an indication of meter correction frequency, as a gallon geared meter maybe equipped with a register geared to read in barrels.

It is therefore desirable to have the prover tank of a volume which conforms to even increments of full barrels as well as increments of 5 gallons, as for example, 30 barrels or 1260 gallons. A prover of this size makes it possible to test either a gallon geared meter or a barrel geared meter. By starting and stopping the meter' on an even barrel or five gallon increment as the case may be and reading the error on the prover scale, the error due to meter correction impulse is entirely eliminated.

Many meters with gallon gearing are equipped with barrel registers and it may be necessary to test these meters into a barrel calibrated prover. Further, the prover may be of an odd size, barrels and fractions of barrels.

Take as an example a prover of 29.3 barrel capacity being used to test a meter with gallon gearing (5 gallons per revolution) with a register reading in barrels. The register will be assembled with 8.4 - 1 gear ratio.

In a case of this kind the meter calibrator impulse error can be avoided by the following procedure:

Determine the number of gallons contained in the prover 29.3 = 1230.6 gallons. Reduce this to the nearest number divisible by 5 or 1230. Now consider the volume of the prover 1230 gallons or 29.285 barrels instead of 29.3 barrels. Make a test run stopping the meter at exactly 29.285 barrels thereby completing the full number of correction cycles. Read the error on the prover scale.

Since it is not possible to stop the register exactly at 29.285 barrels, the next test run should be made to stop the meter register at 58.570 barrels (29.285 plus 29.285). Each successive test run should be made to stop the meter register at 29.285 barrels added to the last counter registration at which the meter register should have been stopped. Do not add the 29.285 barrels to the actual counter registration except on the first test run. Do not reset the register for each test run

REPAIRS

Clutch type calibrators are of standard and heavy duty construction. Heavy duty calibrators utilize ball bearings. Standard calibrators use bronze bushings. It is not recommended that the case and cover bushings be replaced unless facilities are available to ream when cover is assembled to case assuring concentricity. If worn, the case and cover should be replaced.

DISASSEMBLY

After removing the counter drive gear or coupling, remove the cover screws. Turn the calibrator upside down in your hand. This will allow the cover and the inner mechanism to fall out of the case. Remove the crank arm and the two sliding blocks.

Next lift out the center disc assembly by grasping the block pin and turning in a clockwise direction. The cam disc assembly can then be removed by lifting and turning in a counter clockwise direction. Remove the six clutch springs and rollers.

Remove the eccentric arm from the calibrator case by lifting it off the pin.

All parts should be inspected for wear. The inner surface of the outer ring and the outer surface of the cam disc should be free of scratches. Any parts showing excessive wear should be replaced. See Parts List 3-B for replacement part numbers.

Reassemble in reverse order of disassembly, with the following precautions:

1. When assembling clutch springs and rollers, be sure all rollers, both inner and outer, are facing in a counter clock wise direction.
2. The sliding blocks must not be on the same side of the shaft. Turn center disc until the blocks are 1800 apart, before replacing crank arm.
3. Do not allow the eccentric arm to fall off the pin when reassembling the case and the inner mechanism.

All moving parts should be well oiled with S.A.E. 10 oil or lighter.

"G" OR GREATER TYPE

The "G" type calibrator, Figure 19, is used when ever it is desirable to operate a meter in either direction. Normal flow through the meter will increase counter registration, whereas reverse flow will decrease counter registration.

The calibrator is so designed that gear ratios can be varied to permit final corrections of any inaccuracies due to operating conditions or viscosity of product.

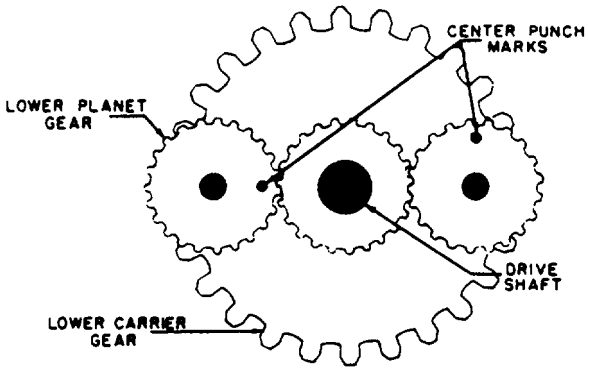


FIG. 19. 'G' TYPE CALIBRATOR.

Meter Calibration can be made by removing the Calibrator access cover located immediately below the counter. Two small notched shifters and a knurled rotating knob are thereby exposed (Figure 20).

The right hand shifter is for coarse adjustment of variations and the left shifter is for fine adjustments. The knurled knob is provided for manual rotation of gears to facilitate meshing of gears moved by the shifters with other gears within the calibrator.

Shifters are released for movement by sliding the instruction plate to right or left to free the desired shifter.

Pulling the shifters out adds to the level of liquid in the prover tank by slowing down the counter while pushing the shifters in lowers the liquid level in the can by speeding up the counter. Each notch on the coarse shifter equals 6/10 of one per cent or 138.8 cubic inches in 100 gallons while each notch on the fine shifter equals 1/20 of one per cent or 11.5 cubic inches in 100 gallons.

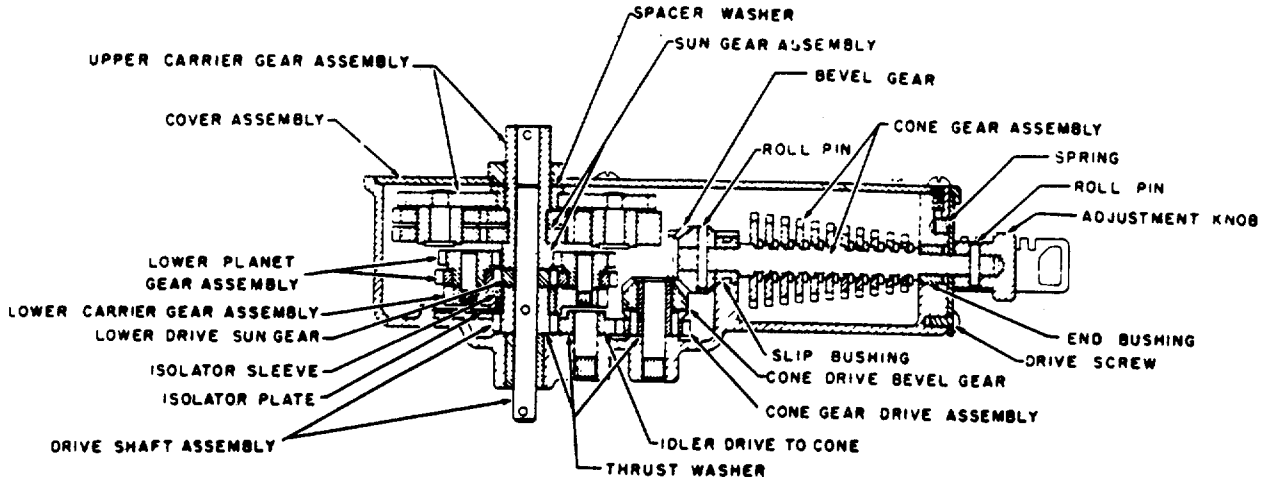


FIG. 20.

After adjustment is completed and the access cover replaced, it should be sealed to prevent tampering or unauthorized changing of the adjustment.

DISASSEMBLY

First remove the cover. Lift off the upper carrier gear, sungear assembly, two lower planet gear assemblies, lower driving sun gear, lower carrier gear assembly, isolator sleeve, isolator plate and drive shaft assembly.

Next, drive out the roll pin and remove the adjustment knob. Remove the adjustment plate drive screw, adjustment plate and spring. This will allow the three end bushings to be removed.

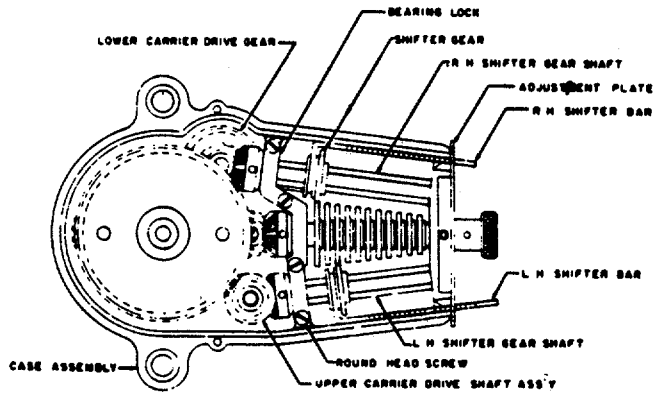


FIG. 21.

Next, remove the bearing lock and lift out the right and left hand shifter assemblies and the cone drive gear assembly. Remove the upper carrier drive shaft assembly, lower carrier drive gear, cone drive bevel gear, cone drive gear assembly and idler gear.

All parts showing excessive wear should be replaced. If the case bushing is worn it is recommended that the case assembly be replaced, rather " than the bushing, as it is necessary to machine finish the bushings after assembly to the case. See Parts List 3-C for replacement part numbers.

Reassemble in reverse order of disassembly, with the following precautions:

1. Add 14312 - 1 washers behind bevel gears until ends of teeth line up and minimum backlash is obtained.

2. Be sure the isolator plate key is engaged in the keyway of the isolator sleeve and that the slot engages the stop pin.

3. When assembling the two lower plane gears to the lower carrier gear, note that each gear has a center punch mark at one of the teeth. Point the marked tooth of one gear at the drive shaft and the other at a 900 angle to the drive shaft, Figure 21. This is necessary to allow the sun gear assembly to mesh with the planet gears.

The "G" calibrator requires only a light coat of oil as all gears have an electro-film coating which is self-lubricating. Use S. A. E. 10 or lighter oil,.

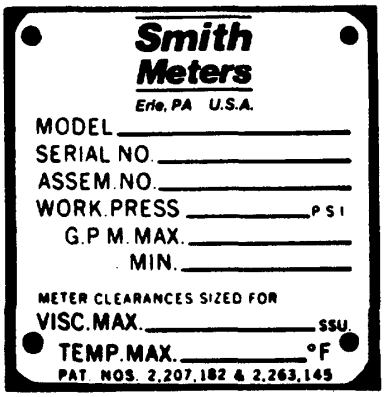


FIGURE 1 - MODEL AND RATING PLATE

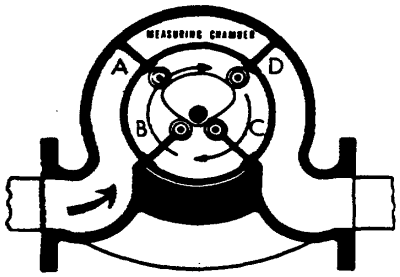
When ordering parts or inquiring about a unit be sure to provide complete model and serial number information as shown on the plate in Figure 1.

Order parts from your Smith Meter representative or from the Parts Distribution Operations, address below.

APPENDIX A
PRINCIPLE OF OPERATION

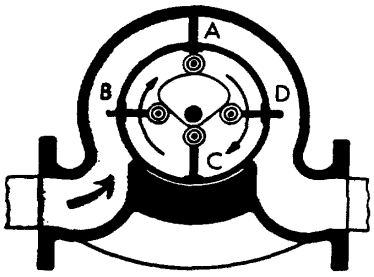
The Smith Meter is of the Rotary Positive Displacement Type. The accurately machined housing contains a rotor which revolves on ball bearings and carries evenly spaced blades. As liquid flows through the Meter, the Rotor and blades revolve about a fixed cam, causing the blades to move outward. The successive movement of the blades forms a measuring chamber of precise volume between two of the blades, the rotor, the housing, the bottom and top covers. A continuous series of these closed chambers is produced, for each rotor revolution. Neither blades nor Rotor contact the stationary walls of the measuring chamber.

One of the outstanding features of the Smith Meter principle is that the flow is literally undisturbed while it is being metered. Energy is not wasted by arresting liquid velocity; consequently high accuracy and efficiency are commonplace with Smith Meters.



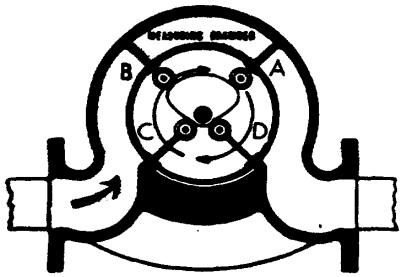
1

Unmeasured liquid (dark area) is shown entering meter. Rotor and vanes are turning clockwise. Vanes A and D are fully extended forming the measuring chamber; Vanes B and C retracted.



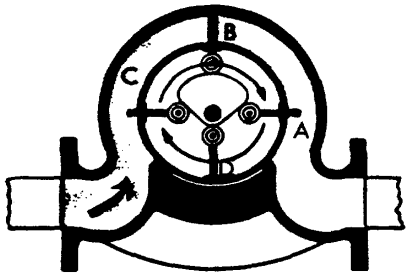
2

The rotor and vanes have made one-eighth revolution. Vane A is fully extended. Vane D is being drawn back; Vane C is fully recessed; Vane B is being extended.



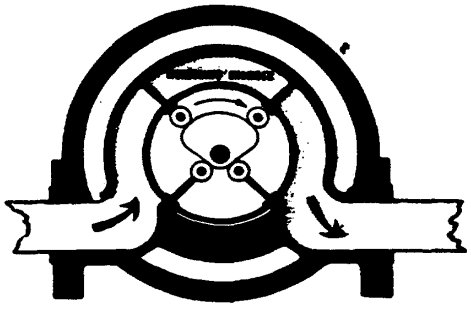
3

A quarter revolution has been made. Vane A is still extended and Vane B is now fully moved out. An exact and known volume of new liquid is now in the measuring chamber.



4

One-eighth revolution later, the measured liquid is moving out. A second measuring chamber is beginning to form between Vanes C and B. Vane A is being drawn back.



5

Fig. 1 thru 4 illustrates Single Case construction.

Fig. 5 illustrates Double Case construction.

Principle of operation is the same regardless of construction.

In one-half revolution, two measuring chambers have formed and the third is forming. This cycle is repeated as long as liquid flows.

APPENDIX A
INSTALLATION

The following information is general in nature and is presented as a guide to the installer and serviceman.

1. The meter should be mounted on a suitable base or platform so it will not be supported by the piping, except vertical meters which are supported directly by the piping. Dimensional outline drawings showing size and location of anchor holes are available for all meters.
2. When possible, install the meter so that it cannot be accidentally drained of product, however, it is advisable to drain the meter of water and sediment periodically. When installing a meter, be sure drain plug is accessible.
3. Piping should not produce an undue strain on the meter.
4. Protect the meter and system against the effects of thermal expansion with an adequate relief valve.
5. Where necessary, a deaerator or air eliminator should be installed to keep air and vapor out of the meter.
6. **Remove the inner mechanism if the system is to be pressure tested with water**.
7. All piping should be internally clean before meter is put into operation. Rust, dirt, welding shot and other foreign material should not be present. It is best to remove the inner mechanism and flush the lines. This will prevent damaging the metering element. The meter should be protected by a strainer.
8. Do not calibrate with water or allow water to stand in the meter. Flush meter with a light lubricating oil if it is left idle or stored.
9. Unless otherwise specified, meters normally flow from left to right when viewing from the flanged side of the housing. Most meters can be changed to flow from right to left, see REVERSING SECTION.
10. A counter may be located in any one of four 90° positions. Large numeral counters may be located in any of eight 45° positions.

OPERATION

START-UP

It is best to fill the meter by gravity. However, where hydraulic conditions require that the pump(s) be operated, extreme care should be used in opening the valves at the meter. In all instances, the air should be evacuated slowly from the meter and system.

1. **Establish product flow through meter**.

   With outlet valve closed, slowly open inlet valve. Slowly open outlet valve until counter begins to turn. Leave outlet valve in throttled position until air is evacuated from meter. This is necessary to protect meter from excessive speeds due to air in lines of system.

2. Loosen vent plug when meter is filled with liquid, Fig. 3 (On meters so equipped).

   Permit the air trapped in the meter cover to escape through the threads. Close plug when product begins to seep through the threads.

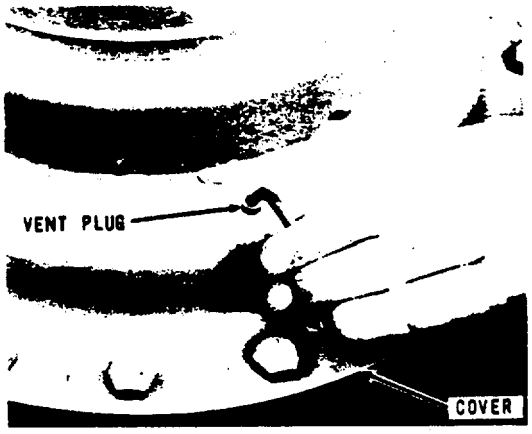


FIGURE 3 - LOOSENING VENT PLUG

3. To fully open inlet and outlet valves, open valves slowly, pausing if register operation is rough. Continue opening when operation becomes smooth.

APPENDIX A
GENERAL OPERATION INFORMATION

Abrupt closure of valves in a system can create forces in excess of normal line pressure. This could result in damage to the meter and other equipment.

Counters or printers must not be reset when the meter is operating.

The ticket securing pin in a printer head must be in the down or locked position when the meter is operating.

Meter calibration is accomplished by adjusting the calibrator dial or knobs. See calibration section.

Meters equipped with G, ATG or AMR calibrators can be operated in either direction.

If accuracy or repeatability cannot be obtained, or if excessive noise is present, it is an indication that meter should be disassembled for inspection and/or repair.

Probable causes for inaccuracy and non repeatability are:

1. Excess clearances allowing slippage.
2. Rotor not turning freely.

If rotor does not turn freely, adjust for end clearance after removal of outer cover and before disassembly of meter. See Rotor Adjustment End Clearance.

Excessive noise may be an indication of worn parts.

Before any disassembly of meter:

1. Be sure that the meter is being operated within the proper flow rate (refer to the name plate).
2. Remove and check calibrator to be sure that it is operating properly.

Calibrator should turn smoothly when top coupling is held and bottom coupling is turned counter-clockwise. Uneven or rough operation indicates presence of burrs or foreign material.

Lack of torque or too much side-play in shaft is indication of worn bearings.

ACCESSORIES AND PROTECTIVE DEVICES

Air Eliminators

The presence of air or vapor in a liquid stream being measured by a positive displacement meter will cause inaccurate measurement. And under some conditions damage to the meter. If there is a possibility of air entering the stream, an air eliminator or deaerator of adequate size should be installed upstream of the meter. In some cases, it may be necessary to install a back pressure valve between meter and air eliminator to permit the air eliminator to operate efficiently.

Flow Control

In any system where there is a possibility of flow exceeding the maximum rated capacity of the meter, a flow limiting valve or device should be installed upstream of the meter.

Strainers

A strainer of adequate size and with proper mesh basket, should be installed upstream of the meter to protect it from foreign material.

APPENDIX A
Calibration of Meters with Manual and ATC Calibrators

For the purpose of adjustment, some Smith meters are equipped with a calibrator utilizing two overriding clutches and an eccentric. By adjusting the amount of eccentricity the calibrator can be made to vary the drive ratio between the meter and the register by a maximum total of 11 per cent.

This calibrating means is used for adjusting for manufacturing variations, variations in operating conditions, differences in viscosity of product metered, variations in testing methods and testing equipment as well as for providing automatic temperature compensation.

The nature of the device is such that a correction impulse is imparted to the calibrator output shaft once during each revolution. The correction impulse causes a momentary acceleration of the register which will result in errors and erratic tests if not taken into account.

It is important when calibrating a meter that the volume of the calibrated prover be a multiple of the increment of correction of the meter. For example, a prover for 5:1 gallon geared meters should be 200, 205 or 210 gallon capacity and not 203 or 207. For 1:1 barrel geared meters it is essential that the prover be calibrated in even 42 gallon barrels.

The reason for the above is evident as each test run must contain the same number of correction impulses in order to be absolutely accurate. If the test is started with the meter register at zero, the register at the end of the test run should show a quantity divisible by the number of gallons or barrels delivered for each revolution of the calibrator, or each correction impulse.

The magnitude of the meter correction is in the order of 5 or 6 per cent of the volume of meter thruput per correction input cycle. On a standard 5:1 gallon geared meter this would be S or 6 per cent of 5 gallons and on a 1:1 barrel geared meter it would amount to 5 or 6 per cent of 42 gallons. The type of register used is not necessarily an indication of meter correction frequency, as a gallon geared meter may be equipped with a register geared to read in barrels.

It is therefore desirable to have the prover tank of a volume which conforms to even increments of full barrels as well as increments of 5 gallons, as for example, 30 barrels or 1260 gallons. A prover of this size makes it possible to test either a gallon geared meter or a barrel geared meter. By starting and stopping the meter on an even barrel or five gallon increment as the case may be and reading the error on the prover scale, the error due to meter correction impulse is entirely eliminated.

Many meters with gallon gearing are equipped with barrel registers and it may be necessary to test these meters into a barrel calibrated prover. Further, the prover may be of an odd size, barrels and fractions of barrels.

Take as an example a prover of 29.3 barrel capacity being used to test a meter with gallon gearing (5 gallons per revolution) with a register reading in barrels. The register will be assembled with 8.4:1 gear ratio.

In a case of this kind the meter calibrator impulse error can be avoided by following the procedure outlined below.

Determine the number of gallons contained in the prover 29.3 x 42 = 1230.6 gallons. Reduce this to the nearest number divisible by 5 or 1230. Now consider the volume of the prover 1230 gallons or 29.285 barrels instead of 29.3 barrels. Make a test run stopping the meter at exactly 29.285 barrels thereby completing the full number of correction cycles. Read the error on the prover scale.

METER GEARING--Metered throughput per revolution of meter output shaft.

	Gallon Gearing		Barrel Gearing	Dekaliter Gearing		Gallon Gearing		Barrel Gearing	Dekaliter Gearing
METER MODEL	U. S. Gallons per rev.	Imperial Gallons per rev.	Barrels per rev.	Dekaliters per rev.	METER MODEL	U. S. Gallons per rev.	Imperial Gallons per rev.	Barrels per rev.	Dekaliters per rev.
1" APM-2, WPM-3	1:1	1:1		1:1	4" 150 PSI	5:1	5:1	*(1:1)	1:1
1½" T-6	1:1	1:1	*(1:1)	1:1	4" 275 PSI & higher	*(5:1)	*(5:1)	1:1	1:1
2" T-10	1:1	1:1	*(1:1)	1:1	6" 150 PSI	5:1	5:1	*(1:1)	5:1
3" T-15	1:1	1:1		1:1	6" 275 PSI & higher	*(5:1)	*(5:1)	1:1	5:1
4" T-30	5:1	5:1		1:1	8" All pressure ratings		*(5:1)	1:1	10:1
2" 150 PSI	5:1	5:1		1:1	10" All pressure ratings		10:1	1:1	10:1
2½" 150 PSI	5:1	5:1		1:1	16" All pressure ratings		10:1	1:1	10:1
3" 150 PSI	5:1	5:1	*(1:1)	1:1					

*Non-standard gearing available when specified.

APPENDIX A
METER REVERSING PROCEDURE

To reverse meter rotation with gear trains illustrated in Figure E and Figure F, the Jack Shaft Pinion must have the same number of teeth as the lower gear of the Idler Pinion. Thus, for the arrangement shown in Figure E, the ratio between the Jack Shaft Pinion and the lower gear of the Idler is 1:1. In a few gear trains it is not possible to obtain the desired gear ratio by having 1:1 between these two gears and they must have a different number of teeth to obtain the desired ratio. It is not possible to reverse these meters (provide Left Hand Rotation) but such gear trains are usually of a special nature.

In standard meters where it is not possible to obtain the desired gear ratio with a 1:1 ratio between Jack Shaft Pinion and lower gear of the Idler, a Reversing Pinion is added to the gear train to provide the reversing feature. Figure A illustrates this type of gear train for clockwise rotor rotation. Note that for this arrangement the Reversing Pinion is not part of the gear train. When Counter-Clockwise Rotor Rotation is desired, the Reversing Pinion and Jack Shaft Pinion positions are interchanged (See Figure B).

FIGURE A

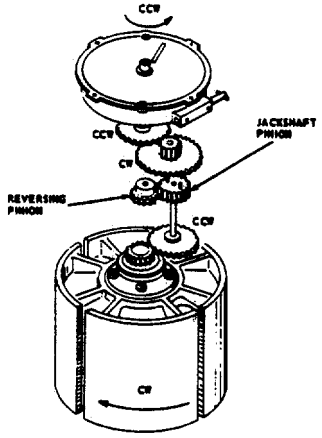


FIGURE B

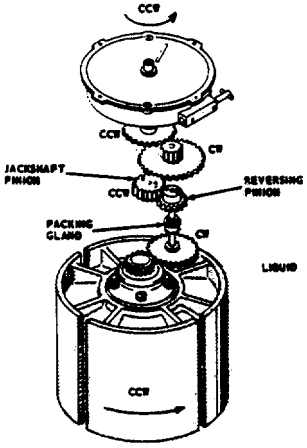
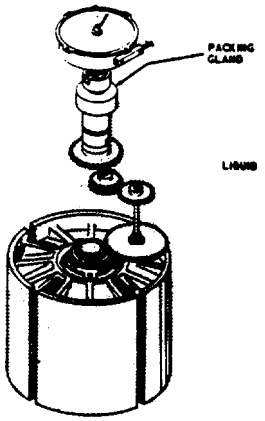


FIGURE C



Meters with 150 PSI working pressure or led up to and including 8" in size have only the Rotor Gear and Jack Shaft Gear in the metered fluid as per Figure B. Meters with 275 PSI word pressure or greater and 10" meters and larger (regardless of pressure ratings have the complete gear train in the metered liquid as per Figure C.

FIGURE D

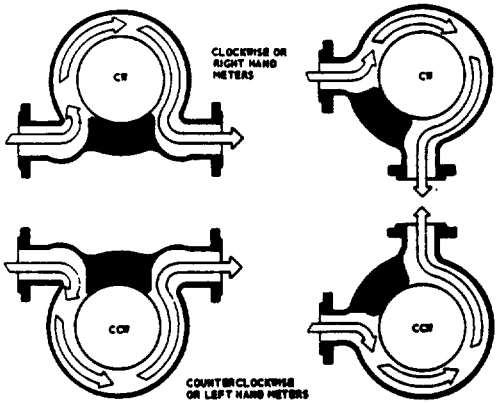


FIGURE E

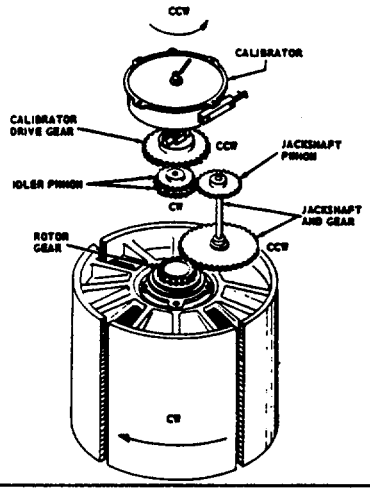


FIGURE F

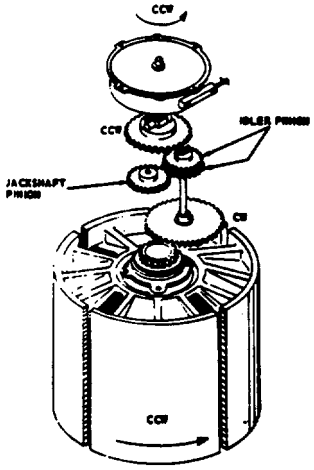


Figure F illustrates the same gear train but the position of the Jack Shaft Pinion and Idler Pinion have been reversed. This provides the desired counter-clockwise rotation of Calibrator Drive Gear and Adjusting Device for a Left Hand Meter or meter with Counter-Clockwise Rotor Rotation.

Note that in this arrangement the Jack Shaft Pinion is no longer part of the gear train and could actually be discarded.

APPENDIX A
METER CLEARANCE GUIDE
CLEARANCE GUIDE

The clearances listed herein should be used as a **guide** in determining whether or not components need to be repaired or replaced. Also, they should be considered as **average**. This means for instance, that if a nominal clearance is .004, for manufacturing tolerances a spread from .003 to .005 is permissible. Because of this, it is possible when checking with feeler gauges, to find at one point .003 clearance, while at another point along the same surface, the clearance may be .005 or even .006. However, from a performance standpoint, that portion which is .003 will generally cancel out the effect of the .005 or .006 ant average out at the nominal .004 desired. At **no** point should a clearance exceed 50% of the listed maximum.

From this it should be clear that a part need not be replaced or repaired just because clearances at some point may slightly exceed the listed maximum.

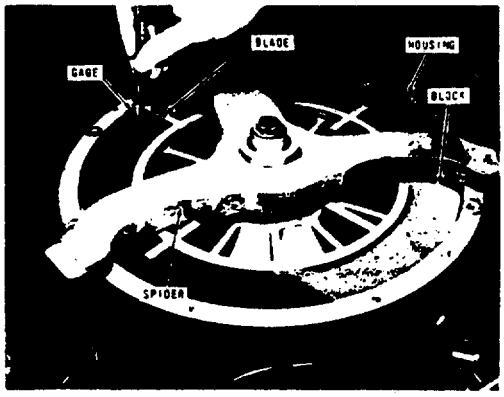
The ability of the meter to obtain acceptable repeatability and linearity for the particular operating conditions, such as flow rate, viscosity, lubricity, abrasive contaminants, and intermittent or continuous duty, should be considered a better guide rather than clearances alone.

For viscosities above 1000 SSU and/or temperatures above 150° F., consult the factory.

BLADE TO HOUSING CLEIRINCE

SPECIAL TOOLS REQUIRED
1. SPIDER 2. FEELER GAUGE

METER MODEL OR RATING	BLADE TIP TOWARD HOUSING	METER MODEL NUMBER	BLADE TIP TOWARD HOUSING
T6 & T-10 T-15	.003-.0045 .004-.005	REFERENCE ILLUSTRATION	FIG. 27
T-25, T-30 12, 13	.004-.005 .003-.005	C2	.003-.005
		E3	.004-.006
20, 24, 28 30, 35, 42	.004-.006 .004-.006	F4	.005-.007
		G6	.006-.008
45, 50, 60 65, 75, 90,100 150,170,200,250	.005-.007 .006-.008 .011 -.013	H8	.008-.010
		J10	.012-.015

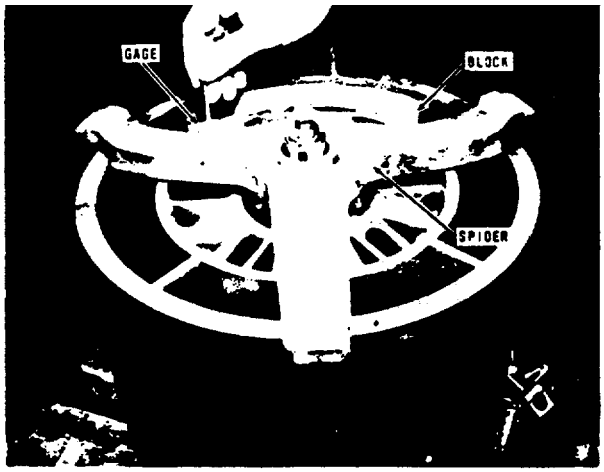


With the Blade held toward the Housing, these clearances should be maintained between the Measuring Chamber and the full length of the edge of the Blade.

ROTOR TO BLOCK CLEARANCE

SPECIAL TOOLS REQUIRED
1. SPIDER 2. FEELER GAUGE

METER MODEL OR RATING	ROTOR TO BLOCK	METER MODEL NUMBER	ROTOR TO BLOCK
T-6 & T-10 T-15	.002 - .004 .002 - .004	REFERENCE ILLUSTRATION	FIG. 27
T-25, T-30 12, 13	.002-.004 .002-.004	C2	.002-.004
		E3	.004-.006
20, 24, 28 30, 35, 42	.003-.005 .004-.006	F4	.004-.006
		G6	.004-.006
45, 50, 60 65.75, 90,100 150, 170, 200,250	.004-.006 .004-.006 .005-.007	H8	.005-.007
		J10	.005-.007



These clearances between Rotor and Block should be maintained the full length of the Rotor.

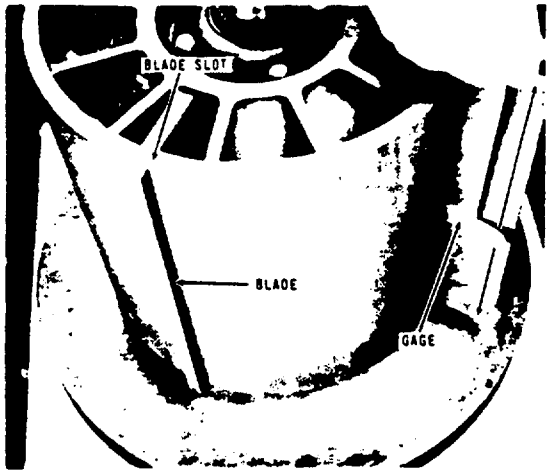
APPENDIX A
BLADE SLOT CLEARANCE

SPECIAL TOOLS REQUIRED

1. **FEELER GAUGES**
2. **FLATMETAL SURFACE WITH OPENING TO RECEIVE SHAFT**

METER MODEL OR RATING	BLADE SLOT TOTAL CLEARANCE
T-6 & T-10 T-15	FREE - .003 FREE - .003
T-25, T-30 12, 13	FREE - .003 FREE - .003
20, 24, 28 30, 35, 42	FREE - .003 FREE - .004
45, 50, 60 65, 75, 90, 100 150, 170, 200, 250	FREE - .004 FREE - .004 FREE - .004

METER MODEL NUMBER	BLADE SLOT TOTAL CLEARANCE
REFERENCE ILLUSTRATION	FIG. 31
C2	FREE .004
E3	FREE .004
F4	FREE .005
G6	FREE .005
H8	FREE .006
J10	FREE .007



Blades should move freely in Rotor slots and the average clearance in each slot should not exceed the listed clearances.

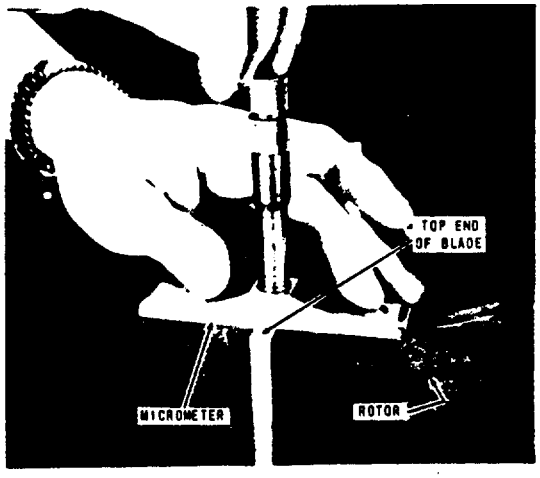
BLADE END CLEARANCE

SPECIAL TOOL REQUIRED

1. **DEPTH MICROMETER OR FEELER GAUGE**

METER MODEL OR RATING	BLADE ENDS TOP END CLEARANCE BELOW ROTOR
T-6 & T-10 T-15	.000 - .001 .000 - .001
T-25, T-30 12, 13	.000 - .001 .000 - .001
20, 24, 28 30, 35, 42	.000 - .001 .000 - .002
45, 50, 60 65, 75, 90, 100 150, 170, 200, 250	.000 - .002 .000 - .002 .000 - .002

METER MODEL NUMBER	BLADE ENDS TOP END CLEARANCE BELOW ROTOR
REFERENCE ILLUSTRATION	FIG. 32
C2	.000 .001
E3	.000 .002
F4	.000 .002
G6	.000 .002
H8	.000 .002
J10	.000 .002



Place a Depth Micrometer on the Rotor over the Blade End as shown. If a Depth Micrometer is not available, a Feeler Gauge may be used. Lower edge of Blade should not project below bottom surface of Rotor.

APPENDIX A

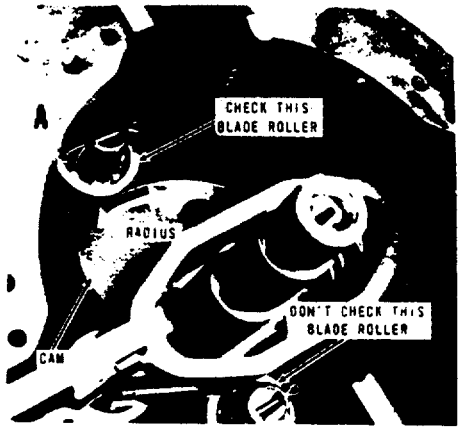
BLADE ROLLER TO CAM RADIUS CLEARANCE

SPECIAL TOOL REQUIRED

1. FEELER GAUGE

METER MODEL OR RATING	BLADE ROLLER OVER RADIUS PORTION OF CAM
T-6 & T-10 T-15	.001 - .003 .001 - .003
T-25, T-30 12, 13	.001 - .003 .001 - .003
20, 24, 28 30, 35, 42	.001 - .003 .001 - .003
45, 50, 60 65, 75, 90, 100 150, 170, 200, 250	.001 - .003 .001 - .003 .001 - .003

METER MODEL NUMBER	BLADE ROLLER OVER RADIUS PORTION OF CAM
REFERENCE ILLUSTRATION	FIG 35
C-2	.001-.004
E 3	.001-.004
F4	001-004
G6	001-004
H8	001-004
J10	001-004



With the Blade in the Measuring Chamber, this total clearance should be maintained between the Radius of the Cam, and one roller only.

To measure Blade Roller clearance over Radius portion of Cam, insert Feeler and check through Radius. Compare measurement with Clearance Guide.

*Check only one Blade Roller on each Blade.

ILLUSTRATION SHOWN WITH BOTTOM COVER REMOVED FOR BETTER VISIBILITY.

BOTTOM COVER AND LOWER BEARING SOULD BE IN PLACE ON SHAFT FOR ACCURATE CHECK.

ROTOR ADJUSTMENT END CLEARANCE

METER MODEL OR RATING	MOTOR ADJUSTMENT TOTAL END CLEARANCE
T6 & T-10 T-15	.005-.008 .007-.010
T-25, T-30 12, 13	.007-.010 .006-.009
20, 24, 28 30, 35, 42	.007-.011 .008-.012
45, 50, 60 65, 75, 90, 100 150, 170, 200, 250	.008-.012 .008-.012 .010-.016

METER MODEL NUMBER	ROTOR ADJUSTMENT TOTAL END CLEARANCE
REFERENCE ILLUSTRATION	FIG. 41
C 2	.006-.009
E 3	.006-.009
F4	.008-.012
G6	.008-.012
H8	.009-.015
J10	.010 - .016

Apply torque to Jack Shaft Coupling and turn Adjusting Screw clockwise to bottom, counterclockwise to raise against cover. Mark both positions and adjust Rotor approximately 1/3 down.

APPENDIX A

VERTICAL METER

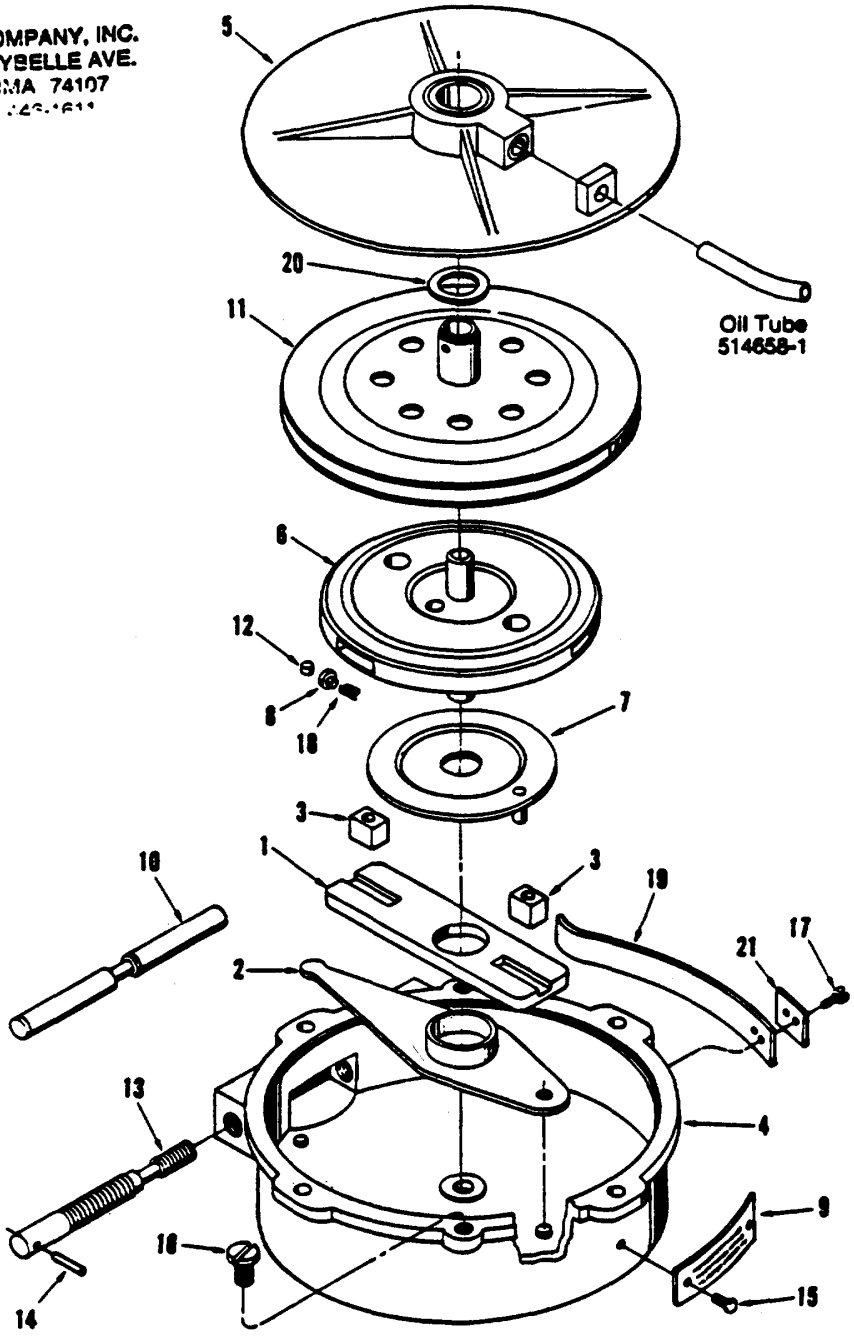
Meter Model Number	Rotor to Block	Rotor Adjustment Total End Clearance Divide Equally	Blade Slot Clearance	Blade End Clearance	Blade Roller to Cam Radius Clearance	Blade to Housing Clearance
F4-VI	.004-.006	.004-.008	Free-.006	.000-.002	.001-.004	.005-.007
G6-V1	.004-.006	.005-.009	Free-.006	.000-.002	.001-.004	.006-.008

GUARANTEE

Smith meters are guaranteed to meet accuracy requirements of Federal, State, County and Municipal authorities. Smith meters are fully guaranteed against defects in material and workmanship for a period of one year. Parts found defective within one year from date of shipment will be replaced free of charge, F.O.B. Factory, providing the original parts are returned and Factory inspection validates the claim.

The responsibility of Smith Meter Operations is limited to the repairing or replacement of defective material manufactured by them. Smith will not be responsible for loss of liquid or for damage of any kind, or from any cause, to the person or property of others.

SMITH METER INC. 1602 Wagner Avenue, P.O. Box 10428, Erie, Pennsylvania 16514, Telephone: 814/899-0661, Telex: 19-9902 • **SALES OFFICES: Northeast** 825 Lehigh Avenue, Union, New Jersey 07083, Telephone: 201/686-9070, Telex: 13-8771 • **Great Lakes & Eastern Canada** 1602 Wagner Avenue, P.O. Box 10428, Erie, Pennsylvania 16514, Telephone: 814/899-0661, Telex: 19-9902 • **Southeast** 6520 Powers Ferry Road, Atlanta, Georgia 30339, Telephone: 404/955-7759 • **Southwest** 1 Memorial Place, 7633 E. 63rd Place, Suite 342, Tulsa, Oklahoma 74133, Telephone: 918/250-9808 • **West & Western Canada** 2253 South Saybrook Avenue, Los Angeles, California 90040, Telephone: 213/685-6778, Telex: 67-4797 • **Houston Branch** 9800 Town Park, Suite 205, Houston, Texas 77036, Telephone: 713/777-9942, U.S.A. Telex: 791836, Int'l Telex: 6868229 • **Smith Parts Operation** 1813 McClelland Avenue, P.O. Box 10368, Erie, Pennsylvania, Telephone: 814/899-0661, Telex: 19-9902 • **Smith Systems Operation** 737 North Padre Island Drive, P.O. Box 4658, Corpus Christi, Texas 78469, Telephone: 512/289-1100, Telex: 778-432 • **Bay Area** 1633 Old Bayshore Highway, Suite 265, Burlingame, California 94010, Telephone: 415/697-5898, 415/697-5899, Telex: 278614 • **Eastern Hemisphere** Smith Meter Inc., Ambassador House, 181 Farnham Road, Slough SL1 4XP, Berkshire, England, Telephone: (0753) 71515, Telefax: (0753) 29966, Telex: 846765 • Smith Meter G.m.b.H., Regent Strasse, 2087 Ellerbek, West Germany, Telephone: 4101-3040, Telex: 841-2189003 • **America Latina** Calle 3C-Con Calle 67, Unicentro Virginia, Oficina 1-14, Maracaibo, Venezuela, S.A., Telephone: 011-58-61-915140, Tlx.: 62439 OCIO-VC • **Far East** Smith Meter Inc., A Moorco Co., Shaw Centre, 1 Scotts Road, #20-01, Singapore 0922, Republic of Singapore, Telephone: 732-3822, Telex: RS23460 AQSING



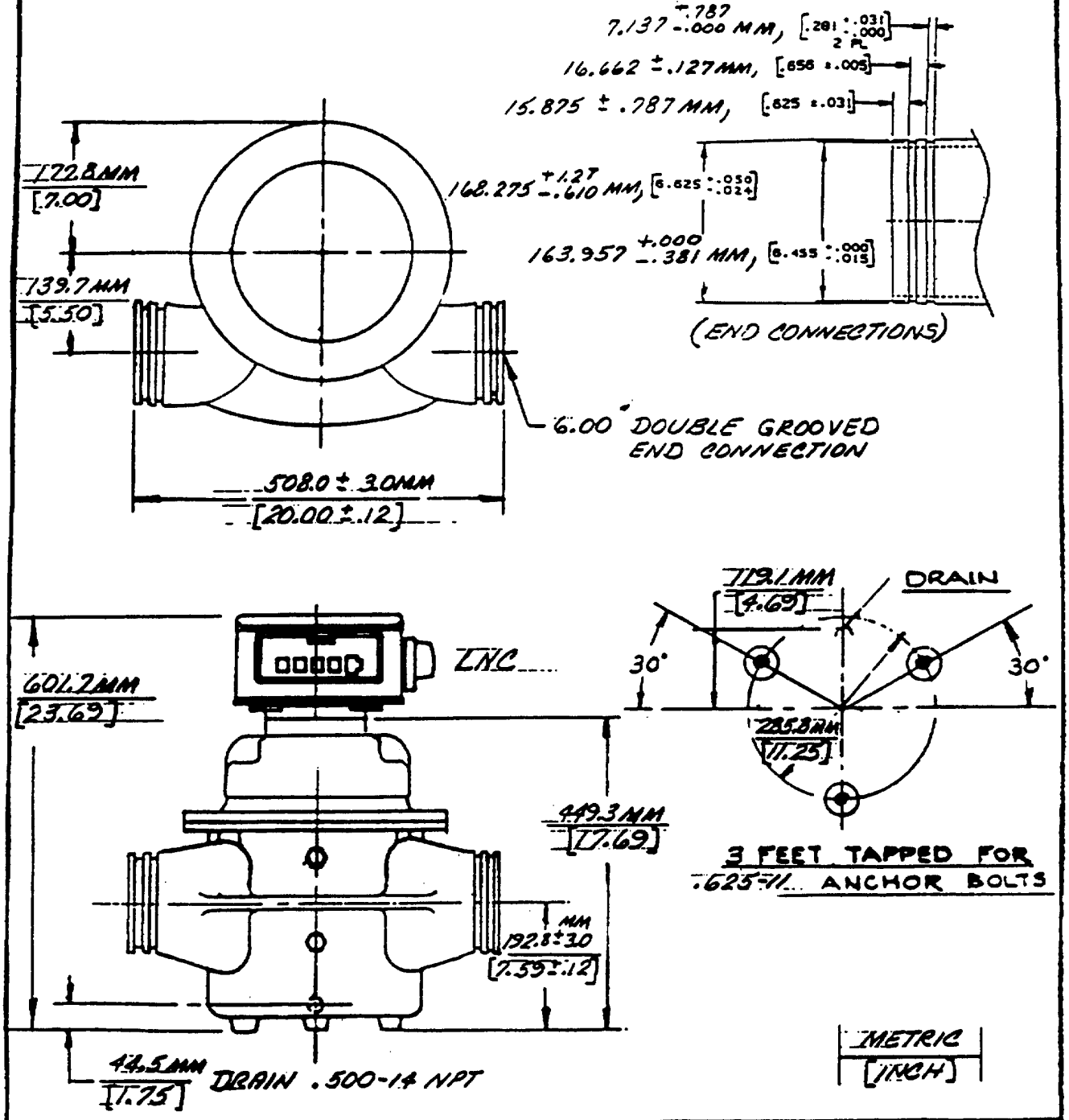
Item		Description	Qty	Part No..
1		Arm, Crank.	1	70595-1
2		Arm, Eccentric:		
		Manual and Standard Temperature Corrected	1	3472-1
	@1	Temperature Corrected, Special A.P.I. or Temp	1	3472-2
3		Block, Sliding	2	3474-1
4		Case:		
		Manual	1	512063-1
		Standard Temperature Corrected:		
		Single and Double Case Meters	1	512063-1
		T-Meters	1	519735-1
	@1	Temperature Corrected, Special A.P.I. or Temp.:		
		Single and Double Case Meters	1	516131-1
		T-Meters	1	533927-1
5		Cover	1	512025-1
6		Disc, Cam,	1	512046-1
7		Disc, Center	1	5934-1
8	+	Pin, Spring	6	3492-1
9		Plate, Name:		
		Manual and Special Temperature Corrected.	2	13367-1
		Standard Temperature Corrected	2	13367-2
10		Plunger, Temperature Corrected	1	515599-1
11		Ring, Outer	1	512058-1
12	+	Roller	6	4526-1
13		Screw, Adjusting, Manual Models	1	5856-1
14		Pin, Roll, 3/32 X 1/2".e	1	65435-1
15		Screw, Name Plate.	4	6869-2
16		Screw, 8-32 X 3/16".	2	6449-1
17		Screw, 6-32 X 1/4", T-Meters	2	6145-2
18	+	Spring, Clutch.	6	3500-1
19		Spring, Compensator, T-Meters.	1	550998-1
20		Washer	4	10466-1
21		Washer, Compensator Spring, Meters	1	550999-1
	+	Recommended Stock		
	@1	When ordering, provide A.P.I. gravity, A.P.I. Table and Temperature Range		

General Assemblies

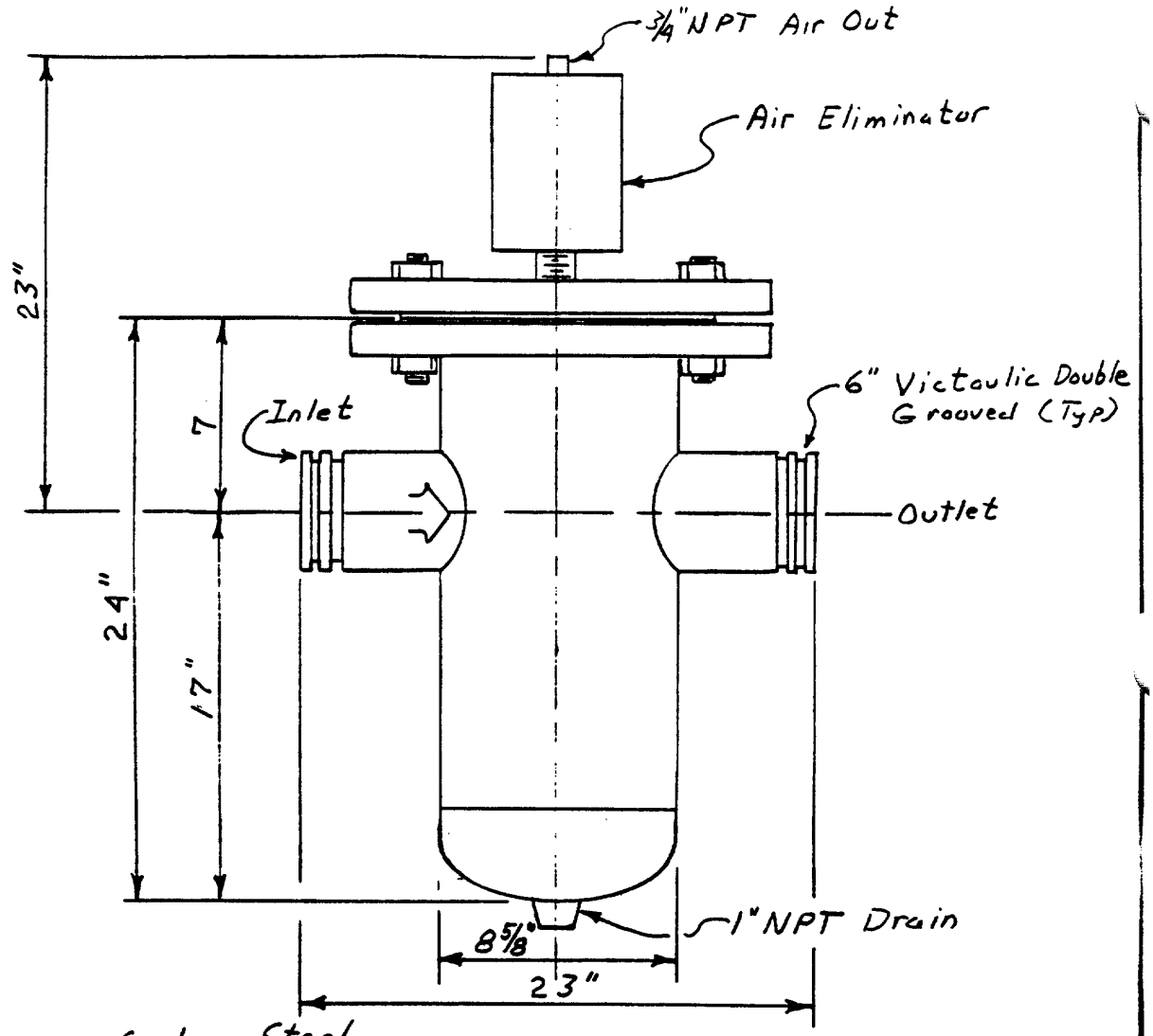
Manual calibrator		512059-1
Temperature, Corrected, Standards		
44° A.P.I., Temp. Range 0° to 139° F, Table 6		
39.9° A.P.I., Temp. Range 0° to 139° F, Table -6A		
42.5° A.P.I Temp Range 0°to 139° F, Table 6B		
500 A.P.I. Temp Range 0° to 139° F, Table 6C		
Single and Double Case and Oval Gear Meters		512060-1
T-Meters and Duraflow Meters		519734-1
Temperature Corrected, Special Temp. or A.P.I.		
Single and Double Case and Oval Gear.		516130
T-Meters and Duraflow Meters		533926

Form No P0206.00 Supersedes Parts List 3-B/1.

Date Code DK



CERTIFIED Smith Meter	ALL TOLERANCED DIMENSIONS ARE FOR INSTALLATION PURPOSES. ALL OTHER DIMENSIONS ARE FOR REFERENCE ONLY.
DE02 0198	**DIMENSIONAL OUTLINE**
John C. Skaue AUTHORIZED SIGNATURE	MADE FOR SE-6V-NF METER w/ DOUBLE GROOVED END CONNECTIONS & LNC
REVISION / DATE	Smith Meter Inc. A Mooreo Company, Erie, PA 16514 — DR. BY WCK, CH. BY FOTEK, APPVD, DATE 12-85 / 12-20-85 / DATE 12/20/85, SCALE, REV., DRAWING NUMBER MOL-760



Housing - Carbon Steel
Basket - Perforated C.S., 1/8" Dia Holes w/ 40 x 40 304 SS Mesh Liner
Design: 150 PSIG @ 100°F
Hydrotest: 225 PSIG
Finish: One Coat Shop Primer

WEAMCO
P. O. BOX 7731 TULSA, OKLAHOMA 74105

FV STRAINER WITH RB AIR ELIMINATOR

DRAWN BY: RA	CERTIFIED CORRECT BY: HP	DATE 11-22-85

CUSTOMER: THE SULTON CO.
P. O. NO. 7592
WEAMCO W. O. NO. 8601-23
QUANTITY 44 TYPE
TAG. NO.

DWG. NO. 8601-23 REV.

Model RB
Air Eliminator Head
Installation, Operation & Service

May 1982 Bulletin 1 6 3 4

Disassembly

1. Remove the air eliminator head assembly by disconnecting the vent line and removing the 8 mounting bolts.
2. Remove the 3 screws and nuts holding the float guard to the 3 brackets. Remove the float guard.
3. Remove the retaining ring from the float pin. then remove the float from the rocker spring.
4. In order to remove the valve assembly from the cover, the rocker spring will have to be positioned to provide access to the 3 1/4" 20 by 1/2" screws with lock washers. Caution: The valve assembly is spring loaded and has a tendency to 'snap' open by itself, as going from the position shown in Figure 1 to the position shown in Figure 2. Therefore, when the third screw is removed, be sure to hold the valve assembly so it will remain in the position shown in Figure 1. Remove the valve assembly from the head.

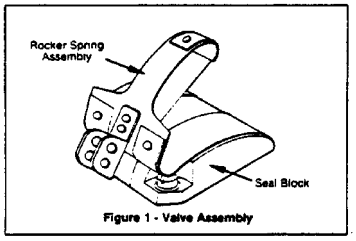


Figure 1 - Valve Assembly

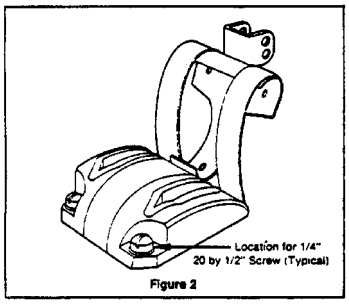


Figure 2

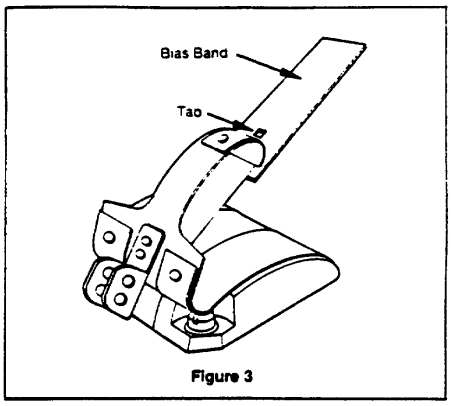


Figure 3

5. Tip the rocker spring as shown in Figure 3. The bias band may now be removed by working the band back and forth while exerting a pulling pressure to displace holding tab in seal block. When replacing the bias strip, the same colored strip must be used.

Inspection

1. Examine the molded seals on the seal block. The raised portion should be above the metal surface of the seal block and uniform in height. No foreign material should be imbedded in the molded seal. Such condition could prevent the valve bands from making a tight seal, and allowing the valve to leak.
2. Examine the valve bands. They should be free of any kinks or dents that would prevent them from making complete contact with the entire raised portion of the molded seal.
3. Any parts that prevent the raised portion of the molded seal and valve bands from making continuous contact around both valve openings will cause the valve to leak, and therefore. should be replaced.

Assembly

1 When the bands are fastened to the seal block. They should be inline with the seal block's edge (reference Figure. This allows the bands to "rock" square with the seal block by lying completely flat against it. If the bands are not in line with the edge of the seal block, they will tend to rock at an angle, will

APPENDIX A

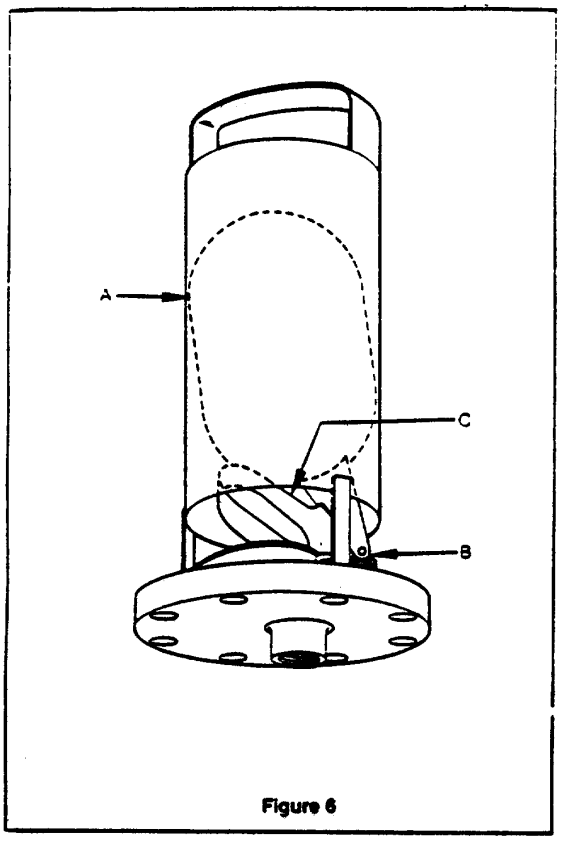


Figure 6

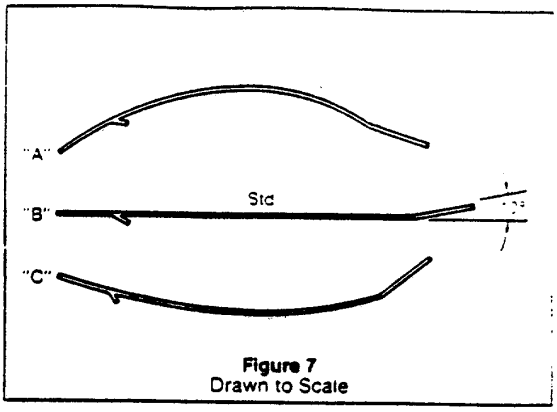


Figure 7
Drawn to Scale

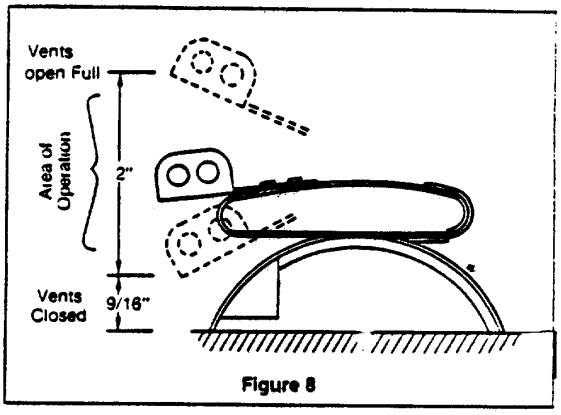


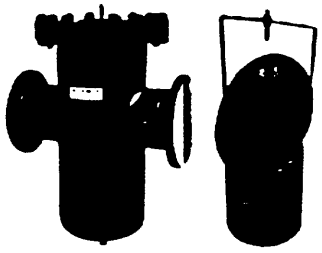
Figure 8

APPENDIX A

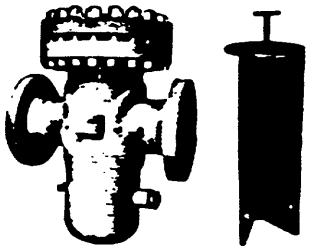
WEAMCO

MAKES FABRICATED VERTICAL BASKET STRAINERS FOR LIQUID OR GAS SERVICE

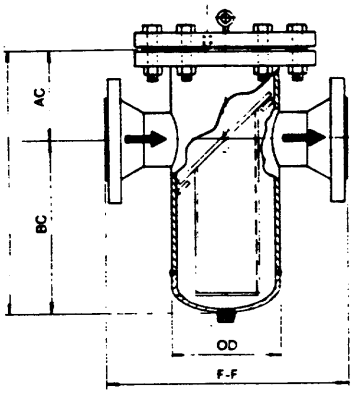
FACH STRAINER BASKET
4½ x AREA of PIPE
x 2 = 9 x Area of PIPE



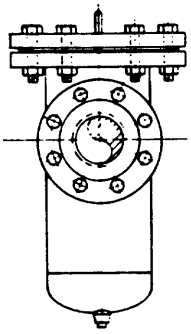
TYPE FV With Slope Top Basket For Horizontal Pipe Run

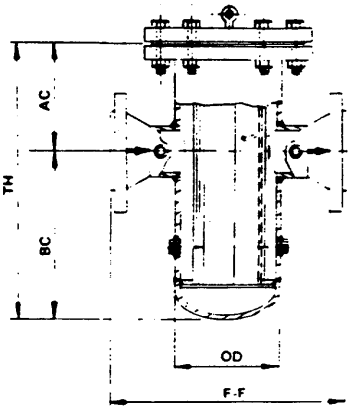


TYPE FT With Angle Basket For Horizontal or Vertical Pipe Run



TYPE FV





TYPE FT

LINE SIZE	COMMON DIMENSIONS						BASKET SURFACE AREA (SQ. IN.)		BASKET OPEN AREA (SQ. IN.)		OPEN AREA RATIO*		LINE SIZE
	O.D.	F.F.	TH	BC**	AC**	DRAIN	FV	FT	FV	FT	FV	FT	
2	4½	17	16	9	7	1	44	66	17.6	26.4	524%	787%	2
3	6⅝	20	20	11	9	1	99	140	39.6	56.0	536%	758%	3
4	8⅝	23	24	14	10	1½	207	245	82.8	98.0	650%	770%	4
6	10¾	26	29	17	12	1½	330	366	132	146	457%	505%	6
8	12¾	30	35	21	14	1½	509	550	204	220	408%	440%	8
10	16	34	42	25	17	1½	792	813	317	325	402%	412%	10
12	18	37	46	28	18	2	1034	1037	414	415	366%	367%	12
14	18	37	53	33	20	2	1232	1247	493	499	358%	362%	14
16	24	44	60	36	24	2	1885	2019	754	808	413%	442%	16
18	24	45	65	39	26	2	2073	2170	829	868	355%	387%	18
20	26	48	71	45	26	2	2512	2569	1005	1028	345%	369%	20
24	30	56	95	64	31	2	4310	4055	1724	1622	406%	403%	24
30	36	62	108	71	37	2	5938	5561	2375	2224	353%	342%	30

* Based on Standard Basket perforated 1/8" diameter holes on 3/16" centers. Open Area and Open Area Ratio also applicable to perforated patterns 1/4" diameter holes on 3/8" centers and 3/8" diameter holes on 9/16" centers. Other patterns and wire mesh liners available. See Bulletin AC676.
** Dimensions BC and AC for the Type FT Strainer are not firm and can be located at purchasers option within the shell length or can be offset without changing the Basket Area.
All dimensions are in inches.

– OVER –

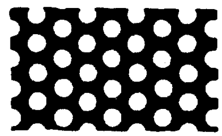
A9-51

WEAMCO PERFORATED AND WIRE CLOTH DATA

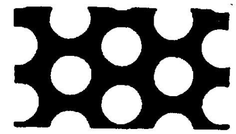
PERFORATED PATTERNS NORMALLY STOCKED

PATTERN DIA	PATTERN CENTERS	% OPEN AREA	*HOLES PSI	MATERIAL/GAUGE C.S.	304SS	316SS
1/16	1/8	23	74.	16	22	-
1/8	3/16	40	33	14.11	14	14*
3/16	1/4	51	18	14	16	-
1/4	3/8	40	8	11	11	14.11
3/8	9/16	40	3.7	11	11	-
1/2	11/16	48	2.4	11	11	-

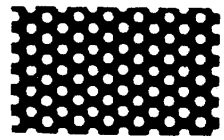
* Also in Monel



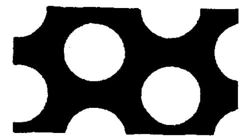
1/8" DIA. on 3/16" CTR



1/4" DIA on 3/8" CTR



1/16" DIA on 1/8" CTR

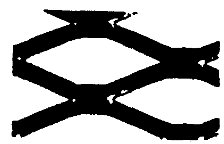


3/8" DIA. on 9/16" CTR

EXPANDED METAL NORMALLY STOCKED

For Straining or Fine Mesh Wire Cloth Support

SIZE	GAUGE	% OPEN AREA	MATERIAL
1/2	16	62	C.S. 304SS
3/4	13	72	C.S. 304SS

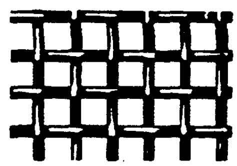


1/2" EXPANDED

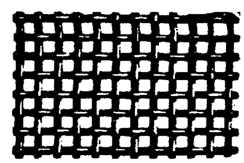
WIRE CLOTH NORMALLY STOCKED

Coarse mesh for straining or support

MESH*	WIRE DIA	OPENING	% OPEN AREA
3 x 3	.080	.2533	57.6
4 x 4	.063	.1870	56.0
8 x 8	.035	.0900	51.8
8 x 8	.047	.0780	38.9
10 x 10	.035	.0650	42.3



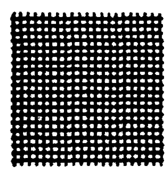
4 x 4 Mesh



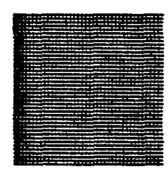
8 x 8 Mesh

Fine mesh requiring support

MESH*	WIRE DIA.	OPENING	% OPEN AREA
20 x 20	.016	.0340	46.2
30 x 30	.013	.0203	37.1
40 x 40	.010	.0150	36.0
60 x 60	.0075	.0092	30.5
80 x 80	.0055	.0070	31.4
100 x 100	.0045	.0055	30.3



20 x 20 Mesh



40 x 40 Mesh

60 x 60 Mesh

REPRESENTED BY

* Number of openings per linear inch. All meshes shown are available in carbon steel, 304 S.S. and 316 S.S. Many other meshes and materials are available.
All dimensions in inches. C.S.= Carbon Steel.

MICRON = 39.37×10^{-6} in
= $.03937 \times 10^{-3}$ in

IF YOU DON'T SEE WHAT YOU ARE LOOKING FOR, PLEASE CONTACT:

BULLETIN AC 283

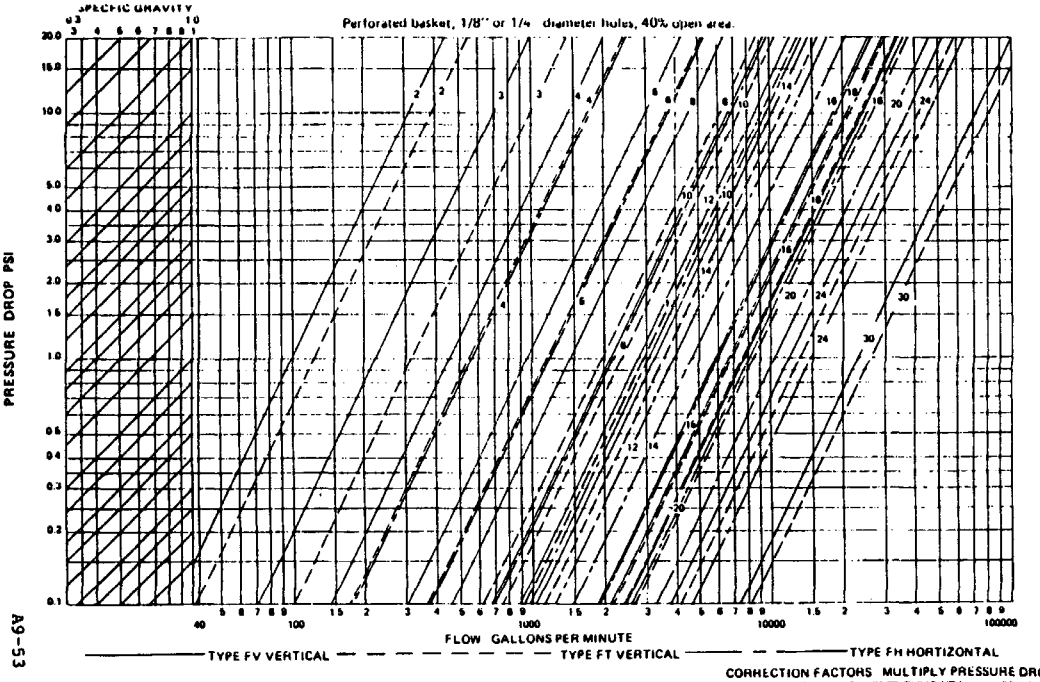
PHONE:
WATS (800) 331 3790
(918) 445 1141

WEAMCO

MAILING ADDRESS:
P.O. BOX 7731
TULSA, OKLAHOMA 74170

A9-52

ESTIMATED PRESSURE DROP FOR WEAMCO FABRICATED STRAINERS



Example: A 6" line flowing 1,000 G.P.M. liquid with a specific gravity of 0.6. To find the pressure drop, enter the chart at 1,000 G.P.M. and intersect the line representing a 6" FH, FT, and FV strainer. Read to the left for each type of fabricated strainer to intersection of S.G. = 1.0. Follow diagonal guide lines down to S.G. = 0.6. Read straight to the left for the corrected pressure drop. In the example the FV strainer would have a pressure drop of 0.65 P.S.I., the FT 0.45 P.S.I. and the FH 0.41 P.S.I. The strainer selection would depend upon piping configuration and allowable pressure drop.

CORRECTION FACTORS MULTIPLY PRESSURE DROP BY.

VISCOSITY SSU	PERFORATED 1/8" or 1/4" DIA	WITH WIRE MESH LINER			
		40 Mesh	60 Mesh	80 Mesh	100 Mesh
30 (Water)	Use Chart	13	15	16	17
500	16	19	21	24	26
1,000	17	22	24	26	28
2,000	19	24	27	29	32

WHEN YOU NEED A STRAINER THINK

BULLETIN AC 676

PHONE: (918) 445-1141 WEAMCO MAILING ADDRESS: P.O. BOX 7731

A9-53

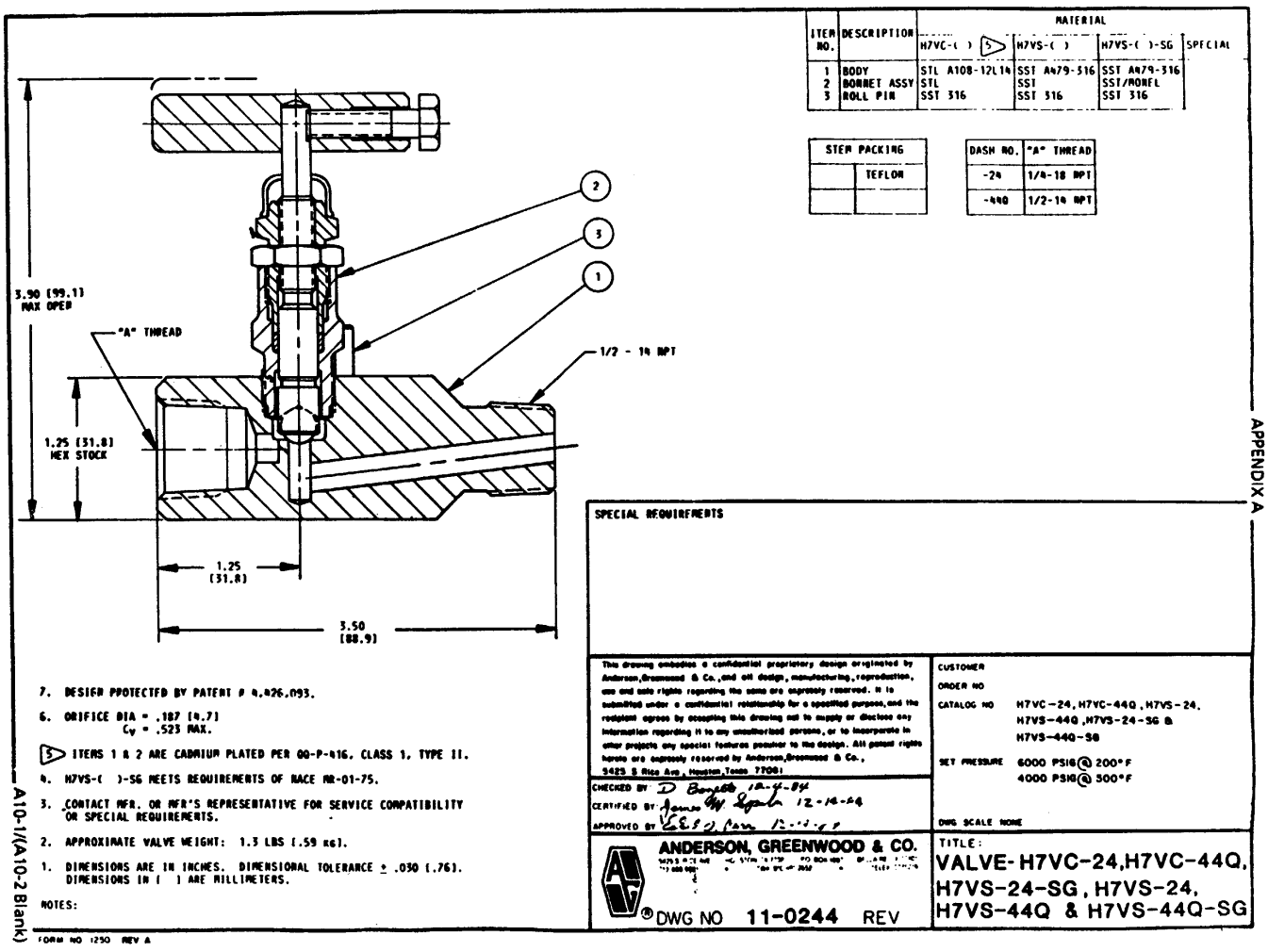
APPENDIX A

PART II

VENDOR INFORMATION

NEEDLE VALVE

25600-1 .50 INCH
ANDERSON, GREENWOOD & CO. H7VS-(4)-4Q



ITEM NO.	DESCRIPTION	MATERIAL H7VC-( ) ▷5	H7VS-( )	H7VS-( )-SG	SPECIAL
1	BODY	STL A108-12L14	SST A479-316	SST A479-316	
2	BONNET ASSY	STL	SST	SST/MONEL	
3	ROLL PIN	SST 316	SST 316	SST 316	

STEM PACKING
TEFLON

DASH NO.	"A" THREAD
-24	1/4-18 NPT
-44Q	1/2-14 NPT

APPENDIX A

SPECIAL REQUIREMENTS

7. DESIGN PROTECTED BY PATENT # 4,426,093.
6. ORIFICE DIA = .187 [4.7]
   C_V = .523 MAX.
5. ITEMS 1 & 2 ARE CADMIUM PLATED PER QQ-P-416, CLASS 1, TYPE II.
4. H7VS-( )-SG MEETS REQUIREMENTS OF NACE MR-01-75.
3. CONTACT MFR. OR MFR'S REPRESENTATIVE FOR SERVICE COMPATIBILITY OR SPECIAL REQUIREMENTS.
2. APPROXIMATE VALVE WEIGHT: 1.3 LBS [.59 Kg].
1. DIMENSIONS ARE IN INCHES. DIMENSIONAL TOLERANCE ± .030 [.76]. DIMENSIONS IN [ ] ARE MILLIMETERS.

NOTES:

CHECKED BY: D Bowers 12-9-84
CERTIFIED BY: [signature] 12-14-84
APPROVED BY: [signature] 12-17-84

CUSTOMER
ORDER NO
CATALOG NO: H7VC-24, H7VC-44Q, H7VS-24, H7VS-44Q, H7VS-24-SG & H7VS-44Q-SG
SET PRESSURE: 6000 PSIG @ 200°F
4000 PSIG @ 500°F
DWG SCALE NONE

ANDERSON, GREENWOOD & CO.

® DWG NO 11-0244 REV

TITLE:
VALVE-H7VC-24,H7VC-44Q, H7VS-24-SG, H7VS-24, H7VS-44Q & H7VS-44Q-SG

FORM NO 1250 REV A

A10-1/(A10-2 Blank)

APPENDIX B

TPT PACKING PLAN

OVERVIEW

A TPT is packed and marked in modular form to allow ease and flexibility in deployment.
Each shipping container is marked to indicate specific content and use (see Chapter 3, Section III for complete explanation of marking format).

The listing of the modules, containers, sizes, weights and contents follow.

APPENDIX B

GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(3) Tank Farm Primary Module 11 Boxes each
3835-01-210-5611

Box 1 of 11 WBEI
(2) Cross Assy, 6"
3835-01-210-5595

63"x63"x40' 11641

Box 2 of 11 WBEI
(2) Hose Assy, Disch, 6"x50'
3835-01-210-5618
(1) Cross Assy, 6"
3235-01-210-5595
(2) Cplg Half, Nipple Adptr, 6”
4730-01-222-6704
(2) Cplg Adptr Assy, 6"
4730-01-210-4559

63"x63"x52" 1267#

Box 3 of 11 WBEI
(4) Hose Assy, Disch, 6”x50'
3835-01-210-5618

57”x57"x48" 1507#

Box 4 of 11 WBEI
(10) Hose Assy, Suct, 6"x12'
4720-01-210-5596

48"x168"x28" 2065#

Box 5 of 11 WBEI
(10) Hose Assy, Suct, 6"x12'
4720-01-210-5596

48"x168"x28" 2065#

Box 6 of 11 WBEI
(4) Hose Assy, Disch, 6"x50'
3835-01-210-5618

57"x57"x48" 1507#

Box 7 of 11 WBEI
(4) Hose Assy, Disch, 6"x5O'
3835-01-210-5618

57*x57"x48" 1507#

Box 8 of 11 GFE
(1) Tank Fabric, 5000 Bbl
5430-01-160-3528
(2) Pole, Range
6685-00-514-5575

230"x72"x48" 6000#

Box 9 of 11 GFE
(1) Tank Fabric, 5000 Bbls
5430-01-160-3528
(2) Pole, Range
6685-00-514-5575

230x72"x48" 6000#

Box 10 of 11 GFE
(1) Pump, 600 GPM, Wheel Mtd.
4320-01-193-3429

156”x90"x90 5530#

Box 11 of 11 GFE
(1) Pump, 600 GPM, Wheel Mtd.
4320-01-193-3429

156"x90"x90" 5530#

APPENDIX B

GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DMAJ10-84-D-A006

(6) Tank Farm Secondary Module 12 boxes each
3835-01-210-5612

Box 1 of 12 WBEI
(4) Hose Disch. Flex, 6"x50'
3835-01-210-5618

57"x57"x48m 1507#

Box 2 of 12 WBEI
(4) Hose Disch. Flex, 6"x50'
3835-01-210-5618

57"x57"x48" 1507#

Box 3 of 12 WBEI
(4) Hose Disch. Flex, 6"x50'
3835-01-210-5618

57"x57"x48" 1507#

Box 4 of 12 WBEI
(4) Hose Disch. Flex, 6"x50'
3825-01-210-5618

57"x57”x48" 1507#

Box 5 of 12 WBEI
(4) Hose Disch. Flex, 6"x50'
3825-01-210-5618

57"x57"x48" 1507#

Box 6 of 12 WBEI
(1) Hose Disch, Flex, 6"x50'
3835-01-210-5618
(1) Cross Assy, 6"
3835-01-210-5595
(2) Cplg Adptr, F&M, 6"
4730-01-210-4559
(2) Cplg Half, Nipple Adpt, M, 6"
NSN

57"x57"x48" 1183#

Box 7 of 12 WBEI
(1) Hose Disch, Flex, 6"x50'
3835-01-210-5618
(2) “Y” Assy, 6w
3835-01-210-5592
(1) Tee, 6W, Grv, Cplg
4730-01-210-5628

57"x57"x48" 1176#

Box 8 of 12 WBEI
(10) Hose, Suct, Rgd, 6"x50'
4720-01-210-5596

168"x48"x28" 2065#

Box 9 of 12 WBEI
(9) Hose, Suct, Rgd, 6"x50'
4720-01-210-5596

168"x48"x28" 2065#

Box 10 of 12 GFE
(1) Tank, Fabric, 5000 Bbl
5430-01-160-3528
(2) Pole, Range
6685-00-514-5575

230"x72”x48" 6000#

Box 11 of 12 GFE
(1) Tank, Fabric, 5000 Bbl
5430-01-160-3528
(2) Pole, Range
6685-00-514-5575

230"x72"x48" 6000#

Box 12 of 12 GFE
(1) Pump, 600 GPM, Wheel Mtd.
4320-01-193-3429

156"x90"x90" 5530#

APPENDIX B

GENERAL- PACKING PLAN
TACTICAL PETROLEU TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(1) Switching Manifold, 6" 4 Boxes each
3835-01-210-5593

Box 1 of 4 WBEI
(7) Valve Assy, 6", Gate, w/Gaskt
NSN
(7) Tee, 6" Dbl Grv.
4730-01-210-5628

63"x63"x40" 1114#

Box 2 of 4 WBEI
(6) Valve Assy, 6', Gate, w/Gaskt
NSN
(2) Tee, 6' Dbl Grv.
4730-01-210-5628
(1) Fuel Sampling Assy
NSN

63"x63"x40" 1000#

Box 3 of 4 GFE
(1 Bd) Pipe, Alum, 6"xl9'
25 pcs per bundle
4710-01-181-3967 ea.

230'x42"x41" 2460#

Box 4 of 4 GFE
(1 set) Cplg Clamp, 6' Dbl Grv
w/gaskets
NSN

27"x24"x25 425#

APPENDIX B
GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(3) Transfer Hose Line Assy, 3835-01-210-5613 boxes each

Box 1 of 5 WBEI
(1) Y Assy, 6", Dbl Grv 383501-210-5592
(2) Cross Assy, 6" 3835-01-210-5595

63"x63"x48" 1507#

Box 2 of 5 WBEI
(8) Hose Disch, Flex, 6"x250' NSN
(4) Flaking Box Assy

Box 3 of 5 WBEI
(8) Hose Disch, Flex, 6"x250' NSN
(4) Flaking Box Assy

106"x84"x87" 8430#

Box 4 of 5 WBEI
(8) Hose Disch, Flex, 6"x250' NSN
(4) Flaking Box Assy NSN

Box 5 of 5 WBEI
(8) Hose Disch, Flex 6"x250' NSN
(4) Flaking Box Assy NSN
106"x84"x87" 8430#

NOTE: Adapters, caps and swivels are attached to the hose assembly by using the clamps and couplings.

APPENDIX B

GENBRAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(3) Fuel Dispensing Assy. 10 Boxes each
4930-01-211-6835

Box 1 of 10 WBEI
(6) Bose Assy, Disp., 4"x25'
4720-00-083-0047

57"x57"x48' 1155#

Box 2 of 10 WBEI
(1) Hose Assy, Disch, 6"x50'
3835-01-210-5618
(6) Hose Assy, Disp, 1"x25'
4720-00-083-0049
(5) Hose Assy, Disp, 2"x25'
4720-01-226-4824
(2) Hose Assy, Disp, 1.5'x25'
4720-00-901-7624
(2) Hose Assy, Disp., 4"x25'
4720-00-083-0047
(3) Hose Assy, Disp, 3"x50'
4720-00-083-0048

63"x63"x52" 1660#

Box 3 of 10 WBEI
(4) Hose Assy, Disch, 6"x50'
3835-01-210-5618

57"x57"x48" 1510#

Box 4 of 10 WBEI
(4) Hose Assy, Disch, 6"x50'
3835-01-210-5618

57"x57"x48" 1510#

Box 5 of 10 WBEI
(4) Hose Assy, Disch, 6"x50'
3835-01-210-5618

57"x57"x48' 1510#

Box 6 of 10 WBEI
(1) Valve Assy, Red, 3"
4820-01-214-9128
(2) Valve Assy, Ball, 1.5"
4820-01-210-5615
(6) Valve Assy, Ball, 4"
4820-01-211-9547

Box 6 of 10 (cont'd) WBEI
(2) Hose Assy, Disp., 4"x25'
4720-00-083-0047
(10) Coupling Clamp, 4"
4730-00-873-3864
(10) Gasket, 4"
NSN
(2) Reducer, 6" F x 4" M
4730-01-079-8234
(2) Valve Assy, 4"
4820-01-210-5605

63"x63"x36" 1175#

Box 7 of 10 WBEI
(2) Tee Assy, Flg. Red., 3"
4730-01-209-9209
(6) Tee Assy., Red. 2"x2"x1"
4730-01-210-5627
(6) Tee Fitting, 6"x6"x4"
4730-01-210-5625
(1) Y Assy, Fig. 4", 1MX2F
4730-01-210-5626
(1) Y Assy, Fig., 4", 2Mx1F
3835-01-210-5630
(8) Cplg Half, Npl. Adptr, 4"
NSN
(1) Cplg Adptr Assy, 6"
4730-01-210-4559
(2) Cplg half, Npl Adptr, 6"
4703-01-222-6704
(2) Cplg, Adptr, Assy, 4'
NSN
(6) Red., 4"F x 3"M
4730-00-951-3293
(1) Red., 4"F x 6"M
4730-00-068-0393
(2) Adptr Assy, Water Det. Kit
4930-01-013-7590
(6) Nozzle Assy, Fuel
4930-00-902-4642
(1) Valve Assy, Red., 4"
4820-01-210-5624
(8) Valve Assy, 4"
4820-01-210-5605
(1) Valve Assy, Gate, 6"
NSN
63"x63"x48" 1260#

APPENDIX B

GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAWJ10-84-D-A006

Box 8 of 10 WBEI
(14) Ground Rod Sets
NSN

114"x24"x24" 400#

Box 9 of 10 GFE
(1) Filter Separator, 350 GPM
4330-00-177-8485

48"x36"x48" 480t

Box 10 of 10 GFE
(1) Filter Separator, 350 GPM
4330-00-177-8485

48"x36”x48” 4801

APPENDIX B

GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(1) Contaminated Fuel Module 6 boxes ea.
3825-01-210-4556

Box 1 of 6 WBEI
(4) Hose Assy Flex, 6” x 50’
3835-01-210-5618

57”x57”x48” 1510#

Box 2 of 6 WBEI
(1) Hose Assy, Flex, 6"x50'
3835-01-210-5618
(1) Y Assy, 6" Dbl Grv
3835-01-210-5592
(2) Cplg half, Nip Adptr, 6”M
NSN
(2) Red, 6" Fx4"M
4730-01-079-8234
(1) Red, 4-Fx3"M
4730-00-951-3293
(1) Valve Assy, 35 Ball
NSN

57”x57"x48" 1210#

Box 3 of 6 WBEI
(8) Hose Assy, Rgd, 4"x12'
4720-00-727-1339
(2) Hose Assy, Flex, 4”x12'
4720-01-210-4560

168x48”x28" 1610#

Box 4 of 6 WBEI
(1) Tank, Fabric, 50,000 gal.
5430-00-181-8181

144"x42"x42" 1770#

Box 5 of 6 WBEI
(1) Tank, Fabric, 50,000 gal.
5430-00-181-8181

144"*x42x42" 1770#

Box 6 of 6 GFE
(1) Pump Assy, 350 GPM, Mtd.
4320-01-092-3551

96"x72”x60" 1500#

APPENDIX B

GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(1) 50 M Tank Configuration 12 boxes each
NSN

Box 1 of 12 WBEI
(2) Tee, 6" Dbl Grv
4730-01-210-5628
(2) Tee Assy, Flg, 4", 1Mx2F
NSN
(2) Tee Assy, Flg, 4", 3F
NSN
(1) Tee Assy, Flg, 4", 3M
NSN
(6) Valve Assy, 4", Gate
4820-01-210-5605
(12) Red, 6"Fx4"M
4730-01-079-8234
(12) Cplg half, MxD.G. Adptr, 6"
4730-01-222-6704
(14) Cplg Clamp, 6" w/Gask.
4730-01-209-4413
(3) Y Assy, Flg, 4", 1Mx2F
4730-01-210-5626
(3) Y Assy, Flg, 4", 3M
3835-01-210-5630

63"x63"x52" 1338#

Box 2 of 12 WBEI
(20) Hose Assy, Rgd, 4"x12'
4720-00-727-1339

168"x48"x28" 1880#

Box 3 of 12 WBEI
(20) Hose Assy, Rgd, 4"x12'
4720-00-727-1339

168"x48"x28" 1880#

Box 4 of 12 WBEI
(2) Hose Assy, Flex, 4"x25'
4720-00-083-0047
(4) Hose Assy, Flex, 4"x50'
4720-00-083-0046

57"x57"x48" 1400#

Box 5 of 12 WBEI
(5) Hose Assy, Flex, 4"x12'
4720-01-210-4560
(2) Hose Assy, Flex, 4"x25'
4720-00-083-0047

57"x57"x48" 1045#

Box 6 of 12 WBEI
(6) Hose Assy, Flex, 4'x25'
4720-00-083-0047

57"x57"x48" 1155#

Box 7 of 12 WBEI
(1) Tank Fabric, 50 M gal
5430-00-182-8181

144"x42"x42" 1770#

Box 8 of 12 WBEI
(1) Tank Fabric, 50 M gal.
5430-00-182-8181

144"x42"x42" 1770#

Box 9 of 12 WBEI
(1) Tank Fabric, 50 K gal.
5430-00-182-8181

144"x42"x42" 1770#

Box 10 of 12 WBEI
(1) Tank Fabric, 50 M gal.
5430-00-182-8181

144"x42"x42" 1770#

Box 11 of 12 WBEI
(1) Tank, Fabric, 50 M, gal.
5430-00-182-8181

144"x42"x42" 1770#

Box 12 of 12 WBEI
(1) Tank Fabric, 50 M, gal.
5430-00-182-8181

144"x42"x42" 1770#

APPENDIX B

GENERAL PACKING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006

(3) Tanker-Truck Receipt Manifold 6 boxes each
3835-01-210-5617

Box 1 of 6 WBEI
(9) Bose Suct., Rgd, 6"x12'
4720-01-210-5596

168"x42"x24" 1945#

Box 2 of 6 WBEI
(9) Bose Suct., Rgd, 6"x12'
4720-01-210-5596

Box 3 of 6 WBEI
(16) Bose Assy, Rgd, 6"x12'
4720-01-727-1339
(4) Cplg Adptr Assy, F, 4"
NSN
(4) Red, MxF and FxM, 3"Fx4"M
4730-00-951-3296

168"x42"x24" 1830#

Box 4 of 6 WBEI
(2) Tee Assy, 6"
4730-01-211-9548
(1) Bose Assy, Flex, 6"x50'
3835-01-210-5618

57"x57"x48" 1165#

Box 5 of 6 WBEI
(1) Tee Assy, 6"
4730-01-211-9548
(1) Hose Assy, Flex, 6"x50'
3835-01-210-5618
(4) Tee Fitting, 6"x6"x4"
4730-01-210-5625
(4) Cplg Clamp, 4"
NSN
(4) Gasket, Pre-lube, 4"
NSN
(4) Valve Assy, 4" Ball
4820-01-211-9547
(2) Cplg Clamp, 6"
4730-01-209-4413
(2) Gasket, Pre-lube, 6"
NSN
(2) Cap, 6" Dbl Grv
NSN

57"x57"x48" 1295#

Box 6 of 6 WBEI
(4) Ground Rod Brass, 9' w/Cable
5975-01-050-5707

114"x24"x24" 400#

(19) Fire Suppression Equipment 6 boxes ea.
4210-01-210-8728

Box 1 of 6 WBEI
(1) Trl Mtd Extinguisher
4210-01-210-6466
(1) Wheel Mtd Hose Cart
NSN

168”x87”x86” 6272#

Box 2 of 6 WBEI
(8) N2 Cylinder, 300 cu. ft.
3835-01-210-5594

68"x37”x38" 1550#

Box 3 of 6 WBEI
(1 Set) Protective Clothing
NSN

48"x36”x32" 345#

Box 4 of 6 WBEI
(5) Foam Liq, Aqueous, 5 gal. ea.
4210-01-056-8343
(5) Extng Washers, Dry, 201, ea.
NSN

48"x29"x33" 645#

Box 5 of 6 WBEI
(18) Purple "K” Dry Chem, 501 cans
4210-00-752-9343

38"x38"x37” 1300#

Box 6 of 6 WBEI
(18) Purple "Ku Dry Chem, 50# cans
4210-00-752-9343

38"x38-x37" 1300#

APPENDIX B
GENERAL PACXING PLAN
TACTICAL PETROLEUM TERMINAL/NSN 3835-01-182-1976
CONTRACT DAAJ10-84-D-A006
MISCELLANEOUS

Box 1 of 18 WBEI
(1) Meter Strainer Assy, 6”
NSN

66”x42”X55” 1375#

Box 2 of 18 WBEI
(1) Meter Strainer Assy, 6"
NSN

66"x42”x55” 1375#

Box 3 of 18 WBEI
(1) Meter Strainer Assy, 6"
NSN

66"x42"x55" 1375#

Box 4 of 18 WBEI
(1) Meter Strainer Assy, 6"
NSN

66”x42”x55" 1375#

Box 5 of 18 WBEI
(1) Meter Strainer Assy, 6"
NSN

66"x42"x55" 1375#

Box 6 of 18 WBEI
(1) Meter Strainer Assy, 6-
NSN

66"x42”x55" 1375#

Box 7 of 18 WBEI
(1) Meter Strainer Assy, 60
NSN

66"x42"x55" 1375#

Box 8 of 18 WBEI
(1) Test Kit, Aviation Fuel, Port.
6630-01-008-5524

Box 9 of 18 WBEI
(20) Roadway Guard Set, 6"
3835-01-187-1556

63”X63”X51” 1296#

Box 10 of 18 GFE
(1) Pump, 600 GPM, Wheel Mtd.
4320-01-193-3429

156"x90"x90” 5530#

Box 11 of 18 GFE
(1) Pump, 600 GPM, Wheel Mtd.
4320-01-193-3429

156”x90”x90" 5530#

Box 12 of 18 GFE
(1) Pump, 600 GPM, Wheel Mtd.
4320-01-193-3429

156"x90”x90” 5530#

Box 13 of 18 GFE
(1) Flood Light Set, Wheel Mtd.
6230-01-056-5238

156”x90"x90" 4800#

Box 14 of 18 GFE
(1) Flood Light Set, Wheel Mtd.
6230-01-056-5238

156-x90"x90" 4800#

Box 15 of 18 GFE
(1) Flood Light Set, Wheel Mtd.
6230-01-056-5238

156”x90"x90" 4800#

Box 16 of 18 GFE
(1) Flood Light Set, Wheel Mtd.
6230-01-056-5238

156"x90”x90” 4800#

Box 17 of 18 GFE
(1) Flood Light Set, Wheel Mtd.
6230-01-056-5238

156"x90"x90” 4800#

Box 18 of 18 GFE
(1) Flood Light Set, Wheel Mtd.
6230-01-056-5238

156”x90”x90" 4800#

APPENDIX C

OVERVIEW

The following list deliniates the manuals handbooks and pamphlets that are referenced in this manual and provide additional information necessary to install, operate and maintain the TPT.

APPENDIX C

REFERENCE LIST

NO.	TITLE	DATE	SOURCE
Commercial Technical Manual	Installation, Operation, and Maintenance Instructions with Parts Breakdown. Pump Unit, 600 Gpm Diesel Engine Driven Model US612ACD-1 NSN 4320-01 - 193-3429	April 1985	Peabody Barnes, Inc.
Commercial Technical Manual	Installation, Operation, and Instructions for Maintenance Pump Unit, Centrifugal, Hoseline, 1250 Gpm, Diesel Engine Driven Model US612ACD, NSN 4320-01-194-5601	April 1985	Peabody Barnes, Inc.
TM 5-4320-226-14	Operators', Organizational, Direct Support, and General Support Maintenance Manual Pumping Assembly, Diesel Engine driven, Wheel Mtd. 350 Gpm, 275 Ft. Head Model 13220E 1070 (97403) Fuel Use Only NSN 4320-01-092-3551	Aug.	1984 U.S. Army
Commercial Manual with Parts List	Installation, Operation and Maintenance Instructions Tank, Fabric, Collapsible, 5000 Bbl Petroleum NSN 5430-01-160-3528.	6 June 1986	ILC Dover
TM 5-5430-210-12	Operator and Organizational Maintenance Manual 3000 Gallon NSN 5430-00-268-8187 50000 Gallon NSN 5430-00-182-8181	Nov.	1978 U.S. Army

APPENDIX C

REFERENCE LIST

NO.	TITLE	DATE	SOURCE
TM 5-4330-211-12	Operator and Organizational Maintenance Manual Including Repair Parts and Special Tools List for Filter-Separator, 350-GPM Optimum Performance NSN 4330-00-177-8485	Oct. 1971	U.S. Army
TM 5-6320-210-13&P	Operators' Organizational, and Direct Support Maintenance Manual Including Repair Parts and Special Tool List for Floodlight Set High-Lite Corp. HLT-3K-5K-MIL Serial No.s 6301A thru 6909A NSN 6230-01-056-5238	15Sept. 1982	U.S. Army
TM0766B-14/1	Operation Instructions and Maintenance Instructions for Extinguisher, Fire, Dry Chemical and Aqueous Film Forming Foam Self-Contained Model No. 450PKP/1 OOAFFF03638MC	Oct. 1985	U.S. Marine Corps.
TM 5-343	Military Pipeline Systems	Feb. 1969	U. S. Army
TM 10-18	Petroleum Terminal and Pipeline Operations	Apr. 1975 w/Change 1	U.S. Army
FM 10-20	Organizational Maintenance of Military Petroleum Pipelines, Tanks, and Related Equipment	Feb. 1984	U.S. Army
FM 10-67	Petroleum Supply in Theaters of Operations	Feb. 1983	U.S. Army
FM 10-69	Petroleum Supply Point Equipment and Operations	Apr. 1982 w/Change 1	U.S. Army

APPENDIX C

REFERENCE LIST

NO.	TITLE	DATE	SOURCE
FM 10-70	Inspection and Testing Petroleum Products	May 1983	U.S. Army
FM 10-70-1	Petroleum Ref. Data	Dec. 83	U.S. Army
FM 10-72	Petroleum Testing Facilities Laboratories and Kits	Feb. 1979	U.S. Army
FM 10-76W	Soldier's Manual, Petroleum Supply Specialist	Aug. 82	U.S. Army
FM 10-207	Petroleum Pipeline and Terminal Operations Company	Apr. 1981	U.S. Army
FM 10-227	Petroleum Supply Company	28 Sep. 79	U.S. Army
AR 703-1	Coal and Petroleum Products - Supply and Management Activities	------	U.S. Army
MIL-HDBK-200F	Military Standardization Handbook Quality Surveillance Handbook for Fuels, Lubricants and Related Products	15 Sep. 80	DOD
MIL-HDBK-201B	Military Standardization Handbook Petroleum Operations	23 Sep. 71	DOD
Commercial Technical Manual	Installation, Operation, and Maintenance Instructions with Parts List for Petroleum Distribution System Inland Portion Area 8 Model WBE1-10001 NSN 3835-01-182-1977	TBD	Wilbros Butler Engineers, Inc.

APPENDIX D

MAINTENANCE ALLOCATION CHART

Inclusion of the Maintenance
Allocation Chart waived by Government
Letter dated 8 June 1986.

D-1/(D-2 Blank)

GLOSSARY

-a-

Absolute Pressure (Psia). Pressure measure with respect to zero pressure. Absolute pressure is one atmosphere greater than gage pressure (psig). For example, 30 psig equals 44.7 psia.

Adapter. A fitting or device used to change from one type or size of connection to another.

Air Test. A method used to test a pipeline or terminal when a water or fuel test is not possible or desirable. The line is sectionalized by block valves and tested in lengths that depend upon the capacity of available compressors. The air/vapor mixture could create a hazardous condition in lines that have been used for volatile products.

ANSI. American National Standards Institute Atmospheric Pressure. 1. The pressure of the atmosphere. 2. As a standard, the atmospheric pressure at sea level is a mercury barometer reading of 760 milliliters or 29.92 inches (equivalent to approximately 14.7 pounds per square inch).

-b-

Ball Valve. A valve in which the line closing part is a revolving ball with an opening drilled through it, allowing the passage of liquid when the opening is aligned with the pipe bore. Ball valves are quick acting requiring only 1/4 turn to actuate.

Barrel (Bbl). A common unit of measurement of liquids in the petroleum industry. A barrel equals 42 US gallons.

Batch. A quantity of product pumped into a pipeline.

Batch Change. Change or transition from one product to another in a pipeline, evidenced by a change in product color or product gravity or both.

Berm. An embankment or firewall erected around a storage tank to contain the product if tank leakage or rupture should occur.

Bonding. Electrically connecting units or containers before operations begin in order to equalize any static potential that might exist and to provide a continuous path for any static potential that might be generated after operations begin. (See Grounding.) Bottom Sediment and Water (BS&W). Amount of sediment and water measured in the bottom of the tank. Also known as basic sediment and water.

GLOSSARY

Break. When used in relation to hose or piping systems, means to open a flange or coupling. When used in relation to damage, means that the material has physically parted.

Bypass. A means of diverting flow of fluid in a system past some part of the system through which the fluid normally flows, as in conducting the stream around a pump station.

-C-

Carbon Dioxide. A heavy, colorless gas, C02, which will not support combustion (therefore, useful as a fire-extinguishing agent). It is exhaled as a waste gas by animals with lungs and absorbed by certain plants, which then release oxygen as a waste gas.

Carbon Monoxide. A colorless, odorless, and poisonous gas, CO, resulting from the incomplete combustion of carbon.

Cavitation. Formation of a partial vacuum next to a rotating pump impeller. Due to the lack of pressure at this point, the fluid being pumped will vaporize, forming a cavity of gas. This causes a loss of pump efficiency and, if allowed to continue, can damage the pump. The most common cause of cavation is inadequate suction pressure.

Centigrade Scale. A thermometer scale on which the interval between the freezing point and boiling point of water is divided into 100 parts or degrees centigrade, O°C corresponding to 32°F, and 1 00°C to 212°F.

Check Valve. A one-way or nonreturn valve that permits fluids to pass in one direction only. The valve closes when the pressure causing flow stops.

Class of Fires. Class A, fires of ordinary combustibles, such as paper, wood, textiles, or rubbish, and extinguished by water. 2. Class B, fires of flammable liquids like gasoline, oil, grease, and extinguished by smothering. 3. Class C, fires involving electrical equipment, and extinguished by nonconducting agents. 4. Class D, fires involving burning metal.

Coalesce. Separation of finely divided or suspended water from a petroleum product by passing the product through a filter separator.

Contaminated Product. A product in which one or more grades or types of products have been inadvertently mixed; or a product containing foreign matter such as dust, rust, water, or emulsions.

GLOSSARY

Contamination. The addition to a petroleum product of some material not normally present. Common contaminants are water, dirt, sand, rust, mill scale, and other petroleum products.

Cut. (1) Product withdrawn from a pipeline and routed into tankage. Product from the middle of a batch is a "heart cut" (2) As pertains to earthwork, removal of high spots to level an area (3) Also the act (to cut) of promptly changing the flow of fluid from one path to another.

-d-

Design Operating Pressure The pressure used as a parameter in the design of a piece of equipment or a system. See Operating Pressure.

Deterioration. Any undesirable chemical or physical change that takes place in a product during storage or use. Some of the more common forms of deterioration are weathering, gum formation, weakening of additives, and change in color.

Diesel Fuel. A hydrocarbon fuel used in diesel engines. Diesel fuels used by the Armed Forces are manufactured under two specifications: VV-F-800, which provides for three grades (DF-1 -2, and -A); and MIL-F-16884, which provides for one grade (Marine).

Differential Pressure. The difference between suction pressure and discharge pressure of a pump; increment of pressure added by each pump operating in series in a pump station; pressure drop or loss between the inlet and outlet of a filter, meter, or other accessory offering resistance to flow.

Differential Pressure Gage. A pressure gage which measures differential pressure. See Differential Pressure.

Discharge Head. The pressure in feet of liquid or psig at the discharge or outlet side of a pump.

-e-

Elevation Head. See Hydrostatic Pressure

-f-

Feet of Head. The measure of pressure in terms of the height in feet of a column of a given fuel. This measurement is convenient for use in hydraulic design of pipelines, since it can be applied directly to terrain elevations.

Fills. As pertains to earthwork, to level an area by filling low spots with soil. Fills should always be compacted before equipment is placed there.

GLOSSARY

Firewall. See Berm

Fittings. Miscellaneous items of piping such as elbows, tees, couplings, nipples, etc.

Flame Arrester. An assembly of perforated plates or screens enclosed in a case and attached to the breather vent on a petroleum storage tank. The device prevents a flame from entering the tank through the vent.

Friction Loss. Loss of pressure, in terms of feet of head or psi per unit of pipe length, from internal resistance to flow in the product itself (viscosity) and from resistance offered by pipe walls, pipe fittings, and reductions in pipe diameter.

Fuel Test. A method used to test a pipeline or terminal when a water or air test is not possible or desirable. The lines are tested section it a time at the system operating pressure. Extreme caution must be used due to the fire hazard associated with this test method.

-g-

Gage Pressure (psia). The pressure as shown by a pressure-registering instrument (gage). The gage pressure, in pounds per square inch, is approximately equal to the absolute pressure minus 14.7.

Gasket. The sealing element of a flange, coupling, or other mating surface designed to hold liquid or gas.

Gasoline (Mogas). A hydrocarbon fuel in the approximate composition range CsH12 to C9H20 for use in internal combustion engines and procured by the military Under three specifications. Federal specification VV-G-76 provides for two grades (regular and premium) and for three classes (A, 8, and C). Another specification for leaded and unleaded gasoline is VV-G-001690. Specification MIL-G-3056 specifies combat grade types I and II.

Gate Valve. A valve in which a disk or wedge is raised to permit flow and lowered to stop flow.

Gravity. See Specific Gravity Grounding. Electrically connecting single or bonded units to a ground rod so that any static potential that might exist or that might be generated will be discharged into the earth. If two or more units are bonded and one is grounded, the whole system is effectively grounded. (See Bonding.)

-h-

GLOSSARY

Head. An expression of pressure, usually stated in terms of inches or feet.

Hydrostatic Pressure. Pressure due only to the weight of the liquid itself. Hydrostatic pressure goes from zero at the top of a column of liquid to a maximum at the bottom of the column.

Hydrostatic Qualified. A method of approving equipment for use at a specified working pressure by subjecting the equipment to 1-1/2 to 2 times the working pressure required.

-i-

Interface. A mixture, or commingling, between adjacent products in a multiproduct pipeline; found between batches.

-j-

Jet Fuel (JP). Fuel meeting the required properties for use in jet engines and aircraft turbine engines. Jet fuels are procured for the Armed Forces in several grades. The most important grades are JP-4 (low vapor pressure) and JP-5 (high flashpoint), both produced under Specification MIL-T-5624 and designed for use in aircraft turbine engines. JP-6, produced under Specification MIL-J-25656, is designed for use in aircraft turbine and jet engines of land-based supersonic aircraft. RJ-1, produced under Specification MIL-F25558, is designed for use in ramjet aircraft engines. Jet fuel is usually called JP (jet propulsion) fuel.

-k-

Kevlar. A Dupont trade name for a synthetic, tough, fire resistant fabric.

Line Fill. See Line Pack Line Loss. See Friction Loss Line Pack. The liquid or gas inside a pipeline or hoseline.

Line Loss See Friction Loss

Line Pack The liquid or gas inside a pipeline or hoseline.

-m-

Manifold. A piping arrangement which permits a stream of liquid or gas to be divided into two or more streams, or which permits several streams to be collected into one. See Header.

Module. An identifiable section of a facility that can be installed as a unit and, under certain circumstances, be operated as a unit.

-o-

Off-Specification Product. A product which fails to meet one or more of the physical, chemical, or performance requirements of the specification.

Operating Pressure. The pressure at which a system is designed to operate safely. Equipment is normally pre-tested to 1-1/2 to 2 times the operating pressure to ensure adequate safety margins.

-p-

Packed Line. A petroleum hose line or pipeline filled with product under pressure from the pump station against a closed line valve.

Pad. The earth or concrete foundation on which equipment is placed.

Petcock. A small drain for releasing air or fluid.

Pipeline Batch. The quantity of product pumped into the pipeline in one continuous operation.

Plot Plan. A dimensioned layout of major equipment involved in a system.

POL. Petroleum, Oil and Lubricants.

Pressure Drop. The decrease of pressure in pounds per square inch, or head in feet, of a fluid flowing in a piping system from one point to another point downstream from the first point. Pressure drop may be caused by friction, increase of elevation, or increase of velocity.

Priming. Displacement of air on the suction side of a centrifugal pump between the source of supply and the point of intake in the pump. Priming can be done by filling the pump casing with product to be pumped or by removing the air with a vacuum pump. A foot

valve or check valve can be installed on the suction line to hold product when pumping stops.

Pump Power. Hydraulic power.

-r-

Rising Stem. Refers to the type of gate valve in which the stem and disk rise together when the valve is opened.

-s-

Slop. Any liquid petroleum product known to be off specification; storage tanks may be reserved for such products while waiting for analysis, reclamation, or other disposition; interfaces not disposed of in the adjacent products, or not fit for such disposition, should be taken off in slop tanks pending disposition.

Slop Tanks. Tanks regularly containing products which are not up to quality, or those products which are to be treated or degraded and transferred to selected tanks.

Sludge. A heavy sedimentation or deposit on the bottom of storage tanks consisting of water, dirt, and other settlings.

Spill. An issue of liquid outside its intended conduit or container.

Static Liquid Head See Head and Hydrostatic Pressure.

Suction Head. The pressure in feet of liquid or psig at the suction or inlet side of a pump.

-u-

Upstream. Opposite to the direction of pipeline flow; contrasted with downstream or the direction of pipeline flow.

-v-

Vapor Rich Mixture. Air-vapor mixture with a high level of fuel vapor in it.

Velocity (of flow). Rate of flow measured usually in feet per second. Equal to volume of flow in cubic feet per second divided by the cross sectional area of the pipe in square feet.

GLOSSARY

-w-

Water Test. A method of testing a newly completed pipeline or hose line. The line should be blocked off in sections and clean, fresh water pumped until the maximum working pressure is reached.

Working Pressure. The maximum pressure at which a system or piece of equipment is designed to operate safely.

LIST OF ABBREVIATIONS

The following abbreviations are used in this manual. When used in all capitalized titles or script, the abbreviation is all capitals. When used in lower case script, generally all lower case.

Adpt	Adapter
Alum.	Aluminum
Aslt	Assault
Assy	Assembly
Bbl	Barrel (42 U.S. Gallons)
Bd	Bundle
BS&W	Bottom Sediment and Water, Basic Sediment & Water
Cad	Cadmium
Cplg	Coupling
Dbl	Double
D.G.	Double Grooved
Dia.	Diameter
Disch	Discharge
F	Female
Flex.	Flexible
Ft.	Foot, feet
Gal	U.S. Gallon
Grv.	Grooved
Hex	Hexagonal
Hd	Head
Ht.	Height
ID	Inside Diameter
In.	Inch
In.3	Cubic inches
IPDS	Inland Petroleum Distribution System
Lbs.	Pounds
Lg.	Long, length
M	Male

LIST OF ABBREVIATIONS (cont'd)

Mod	Module
Mogas	Motor gasoline
Mtd	Mounted
N2	Nitrogen
Nom	Nominal
OD	Outside Diameter
Petro	Petroleum
Pl	Plated
Pres	Pressure
Psi	Pounds per square inch
Psig	Pounds per square inch - gage
Qts.	Quarts
Rbr	Rubber
Reg	Regulator
Rgd	Rigid
Rpm	Revolutions per minute
Suct	Suction
TPT	Tactical Petroleum Terminal
Wp	Working pressure

INDEX

INDEX - CONT'D.

INDEX - CONT'D.

INDEX - CONT'D.

INDEX - CONT'D.

INDEX - CONT'D.

INDEX - CONT'D.

INDEX

Index 15(Index 16 Blank)

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Official:

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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 = 3.2808.8 feet

Weights

1 *centigram = 10 milligrams = .15 grain*
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .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

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu in.
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Square measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. in.
1 sq. decimeter = 100 sq. centimeters = 15.5 inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 feet
1 sq. dekameter (are) = 100 sq. meters = 1.076.4 sq. ft.
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 hectometers = .386 sq. miles

Liquid Measure

1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons
1 liter = 10 deciliters = 33.81 fl. ounces
1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3 38 fl. ounces
1 metric ton = 10 quintals = 1.1 short tons

Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce inches	newton-meters	.0070062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	*yards*	1.094
sq. inches	sq. centimeters	6.451	kilometers	miles	.621
sq. feet	sq. meters	.093	sq. centimeters	sq. inches	.155
sq. yards	sq. meters	.836	sq. meters	sq. yards	10.764
sq. miles	sq. kilometers	2.590	sq. kilometers	sq. miles	1.196
acres	sq. hectometers	.405	sq. hectometers	acres	2.471
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
cubic yards	cubic meters	.765	milliliters	fluid ounces	.034
fluid ounces	milliliters	29.573	liters	pints	2.113
pints	liters	.472	liters	quarts	1.057
quarts	liters	.946	grams	ounces	.035
gallons	liters	3.785	kilograms	pounds	2.205
ounces	grams	28.349	metric tons	short tons	1.102
pounds	kilograms	.454	pound-feet	newton-meters	1.356
short tons	metric tons	.907			
pound inches	newton-meters	.11296			

Temperature (Exact)

°F Fahrenheit temperature — 5/9 (after subtracting 32) — Celsius Temperature °C

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