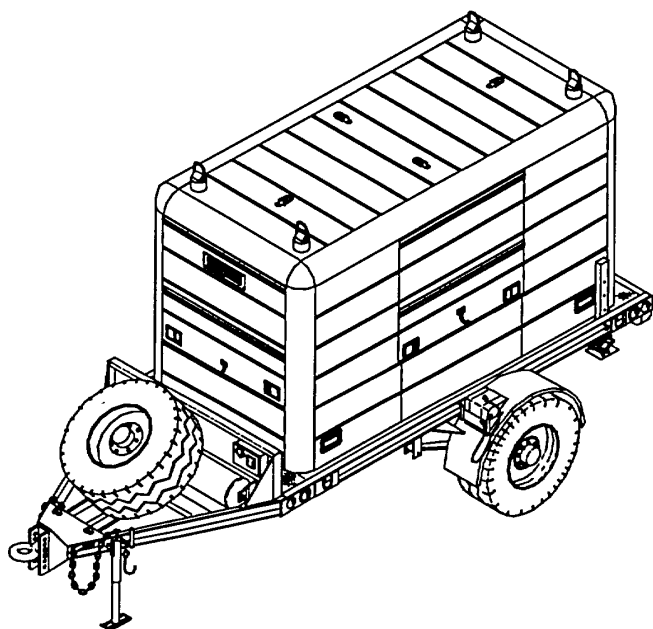


TECHNICAL MANUAL

**OPERATOR, UNIT, DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE MANUAL**

for
**LUBRICATING AND SERVICING UNIT,
DIESEL ENGINE DRIVEN,
TRAILER MOUNTED
MODEL PM92-133
NSN 4930-00-365-5725**



HOW TO USE THIS MANUAL	
EQUIPMENT DESCRIPTION	
OPERATION UNDER USUAL CONDITIONS	
OPERATOR TROUBLESHOOTING PROCEDURES	
UNIT MAINTENANCE INSTRUCTIONS	
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS	
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS	
MAINTENANCE ALLOCATION CHART	
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS	
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST	

Distribution Statement A: Approved for public release; distribution is unlimited.

WARNINGS

EXHAUST AND HEAT HAZARDS

- Do not operate the Lubricating and Servicing Unit in an enclosed area. Exhaust gases can kill.
- Do not touch hot exhaust system components with bare hands.
- Components become hot during operation. Allow them to cool before handling.

COMPRESSED AIR HAZARDS

- Compressed air can be dangerous if not used properly. Wear safety glasses and do not direct air source toward clothing or skin. Air entering body may cause severe injury or death.
- Periodically check all air receiver tank relief valves for correct operation. Failure of relief valves could result in tank explosion and serious injury or death to personnel.
- Do not disconnect air lines or components before first relieving the air tank of pressure.

FIRE AND ELECTRICAL HAZARDS

- Do not smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.
- Do not smoke when working with solvents.
- Do not smoke or use open flame around batteries. Batteries generate explosive hydrogen gas
- Do not perform troubleshooting checks or tests near open flame, sparks, or electricity. Diesel fuel is flammable.
- Dry-cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin
- Ignition switch should be OFF during fuel system troubleshooting checks.
- Use extreme caution when working with diesel fuel. It is flammable.
- Use caution when removing fuel cap and neck assembly: hoses may quickly give way and cause injury.
- Prevent electrical shocks or burns. Do not wear jewelry or dog tags when working on electrical components.

EQUIPMENT HAZARDS

- Do not wear loose clothing when working around moving parts. Serious injury or death may result.
- Clean up spills as soon as they occur. Spills may result in serious slip and fall injuries.
- Chock wheels when unit is not on a level surface. Unit could roll and cause injury.
- Do not over-inflate tires. The tire or wheel assembly could explode.

WARNINGS - CONTINUED

- Trailer wheels must be chocked even if parking brake is applied. The parking brake will release within 1 1/2 hours, and-if not correctly chocked-the trailer may roll, causing severe personal injury or death.
- Personnel must stand clear if unit is lifted. Chains could snap or the load could shift causing the unit to fall.
- Use extreme caution when jacking up the trailer. It could fall causing serious injury or death.
- Hearing protection is required when unit is operating. Prolonged loud noise can result in hearing loss.
- Replace all worn or damaged parts immediately.
- Wear safety glasses at all times whether operating or servicing the lube unit.
- Exercise caution when replacing the enclosure. Fingers can be damaged if wedged between A-Frame and rear jacks.
- Do not use a dry brush or compressed air to clean brake shoes. Asbestos dust on brake shoes is dangerous if inhaled. Brake shoe must be wet, and a soft bristle brush should be used.
- Do not use rope start or start engine without belt guards in place. Death or serious injury could result.

NBC HAZARDS

- If nuclear, biological, or chemical (NBC) exposure is suspected, contact an NBC officer or NBC NCO for appropriate handling or disposal instructions.
- IF NBC exposure is suspected, all air filter media should be handled by personnel wearing protective gear.
- NBC contaminated filters or equipment must be handled using adequate precautions (**See FM 21-40**).
- Use only authorized cleaning solvents and methods. Refer to **TM 9-247** for information.
- Prolonged exposure to decontamination spray can cause injury to personnel. Do not use decontamination spray on personnel unless it can be washed from exposed skin

SOLVENT HAZARD

- Clean all parts in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of the skin to the cleaning solvent. Failure to do so can cause severe injury or death. Do not use solvent near flame or excessive heat. Flash point of solvent is 1 000F to 1380F (380C to 590C).

BATTERY HAZARDS

- Battery acid is harmful. Wear safety glasses and rubber gloves. If acid touches eyes or skin, flush with running water for 60 seconds. Seek medical attention.
- Do not lay tools on top of batteries. A spark or short could cause battery explosion.
- Disconnect the negative battery cable before removing the alternator or belts.

**OPERATOR, UNIT, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL
for
LUBRICATING AND SERVICING UNIT,
DIESEL ENGINE DRIVEN,
TRAILER-MOUNTED**

**MODEL PM92-133
NSN 4930-01-365-5725**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

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TABLE OF CONTENTS

			Page
			vi
HOW TO USE THIS MANUAL			
CHAPTER 1.		INTRODUCTION	1-1
Section	I.	General Information	1-1
Section	II.	Equipment Description	1-3
Section	III.	Principles of Operation	1-7
CHAPTER 2.		OPERATING INSTRUCTIONS	2-1
Section	I.	Description and Use of Operator Controls and Indicators	2-1
Section	II.	Operator Preventive Maintenance Checks and Services (PMCS)	2-10
Section	III.	Operation Under Usual Conditions	2-26
Section	IV.	Operation Under Unusual Conditions	2-56

TABLE OF CONTENTS - CONTINUED

CHAPTER 3.		OPERATOR MAINTENANCE INSTRUCTIONS	3-1
Section	I.	Lubricating Instructions	3-1
Section	II.	Operator Troubleshooting Procedures	3-1
Section	III.	Operator Maintenance Procedures	3-8
CHAPTER 4.		UNIT MAINTENANCE INSTRUCTIONS	4-1
Section	I.	Repair Parts and Special Tools List	4-2
Section	II.	Service Upon Receipt	4-3
Section	III.	Unit Troubleshooting Procedures	4-4
Section	IV.	Unit Preventive Maintenance Checks and Services (PMCS)	4-8
Section	V.	Unit Maintenance Procedures	4-9
Section	VI.	Preparation For Storage Or Shipment	4-192
CHAPTER 5.		DIRECT SUPPORT MAINTENANCE INSTRUCTIONS	5-1
Section	I.	Direct Support Maintenance Instructions	5-1
CHAPTER 6.		GENERAL SUPPORT MAINTENANCE INSTRUCTIONS	6-1
Section	I.	General Support Maintenance Procedures	6-1
Appendix A.		References	A-1
Appendix B.		Maintenance Allocation Chart	B-1
Appendix C.		Components of End Item and Basic	C-1
		Issue Items List	
Appendix D.		Additional Authorization List	D-1
Appendix E.		Expendable/Durable Supplies	E-1
		and Materials List	
Appendix F.		Illustrated List of Manufactured Items	F-1
Appendix G.		Torque Limits	G-1
Appendix H.		Mandatory Replacement Parts	H-1
Appendix I.		Glossary	I-1
Alphabetical Index		Index-1

LIST OF ILLUSTRATIONS

Figure No.	Title	Page
1-1.	Lubricating And Servicing Unit, Diesel Engine Driven, Trailer Mounted	1-0
1-2.	Location of Major Components	1-4
1-3.	Theory of Operations	1-8
2-1.	Flush Mounted Door Latches	2-1
2-2.	Lube Tank Assembly Controls and Indicators	2-2
2-3.	Air Compressor Assembly Controls and Indicators	2-3
2-4.	Alcohol Injector Control Valve	2-4
2-5.	Fuel Tank Drain Line	2-4
2-6.	Engine Exhaust System	2-5
2-7.	Control Panel Assembly	2-5
2-8.	Safety Devices	2-6
2-9.	Automatic Idle Control	2-6
2-10.	Reel Stand Locking Device	2-7
2-11.	Metering Valves	2-7
2-12.	Heater and Fuel Pump Switches	2-8
2-13.	Trailer Assembly	2-8
2-14.	Control Panel, Air Compressor, Air Tank, Diesel Engine and Clutch	2-19
2-15.	Fuel Tank	2-20
2-16.	Fuel Cap and Neck	2-20
2-17.	Reel Cabinet Assembly and Accessories	2-21
2-18.	Trailer Lights and Reflectors	2-21
2-19.	A-Frame Assembly	2-22
2-20.	Winterization Assembly	2-22
2-21.	Transfer Pump	2-23
2-22.	Lube Tank Assembly	2-23
2-23.	Trailer Assembly	2-24
2-24.	Enclosure and Skid Assemblies	2-23
2-25.	Preparation For Use	2-26
2-26.	Starting and Stopping The Engine (Normal Weather)	2-30
2-27.	Starting The Engine With Rope Starter	2-31
2-28.	Pumping Lubricants	2-33
2-29.	Preparation For Movement	2-35
2-30.	Driving and Parking	2-38
2-31.	Filling The Lube Tank	2-41
2-32.	Decals and Instruction Plates	2-43
2-33.	Shutdown Procedures	2-54
2-34.	Unusual Environmental/Weather	2-57
2-35.	Winterization Assembly and Heater	2-60
2-36.	Partial Equipment Failure	2-62
3-1.	Air Moisture Separator	3-9
3-2.	Alcohol Injector	3-11
3-3.	Battery Box Assembly - Servicing	3-12
3-4.	Air Filter Replacement	3-13
3-5.	Air Cleaner	3-14
3-6.	Wheel and Tire Assembly	3-16
4-1.	Enclosure Assembly	4-12
4-2.	Doors	4-15
4-3.	Panels	4-19
4-4.	Air Filter/Moisture Separator	4-22
4-5.	Alcohol Injector	4-24
4-6.	Lube Supply Hoses	4-28
4-7.	Transfer Pump	4-31
4-8.	Fuel Cap and Neck Assembly	4-33

LIST OF ILLUSTRATIONS (Cont)

Figure No.	Title	Page
4-9.	Fuel Tank Assembly	4-36
4-10.	Fuel Tank Removal and Installation	4-38
4-11.	Tool Box Assembly	4-40
4-12.	Gear Lube and Oil Dispensers	4-43
4-13.	Grease Control Valves	4-45
4-14.	Reels and Hoses	4-47
4-15.	Reel Assembly.....	4-48
4-16.	Cabinet Assembly	4-51
4-17.	Battery Box Removal	4-59
4-18.	Battery Cable Repair	4-63
4-19.	Condensate Drain Assembly	4-66
4-20.	Control Panel and Throttle	4-70
4-21.	Compressor Belts	4-78
4-22.	Alternator Belt	4-84
4-23.	Alternator Assembly	4-87
4-24.	Plumbing	4-89
4-25.	Air Pump	4-92
4-26.	Shut-Off Valve	4-95
4-27.	Pressure Relief Valve	4-96
4-28.	Ball Valve	4-97
4-29.	Unloader Valve	4-99
4-30.	Diesel Engine	4-101
4-31.	Air Cleaner Assembly	4-105
4-32.	Heater Plug	4-107
4-33.	Starter Motor	4-110
4-34.	Oil Filter Assembly	4-113
4-35.	Oil Pressure Switch	4-115
4-36.	Exhaust System	4-117
4-37.	Rope Start Assembly	4-119
4-38.	Fuel Filter Assembly	4-121
4-39.	Flywheel Pulley and Shaft	4-124
4-40.	Clutch	4-126
4-41.	Air Regulator and Plumbing	4-129
4-42.	Low and High Pressure Pumps and Pump Mufflers	4-135
4-43.	Heater Assembly	4-137
4-44.	Fuel Pump and Fuel Line	4-140
4-45.	Control Box Assembly and Heater	4-142
4-46.	Heater Wiring Harness	4-145
4-47.	Exhaust Line/Hoses	4-149
4-48.	Heater Mounting Assembly.....	4-152
4-49.	Air Hose Assemblies and Gladhand Couplers	4-153
4-50.	Control Valve	4-155
4-51.	Emergency Relay Valve	4-158
4-52.	Quick Release and Limiting Valve	4-160
4-53.	Synchronizing Valve	4-163
4-54.	Air Tank Assembly	4-165
4-55.	Power Cluster and Master Cylinder	4-167
4-56.	Brake Lines	4-172
4-57.	Intervehicular Trailer Harnesses	4-174
4-58.	Voltage Reducer Box	4-176
4-59.	Front and Rear Jacks and Safety Chain Assembly	4-178
4-60.	Hub and Drum.....	4-182
4-61.	Brakes	4-189

LIST OF ILLUSTRATIONS (Cont)

Figure No.	Title	Page
5-1.	Skid Assembly	5-3
5-2.	Transfer Pump	5-6
5-3.	A-Frame	5-11
5-4.	Fuel Tank	5-13
5-5.	Gear-Lube and Oil Dispensers	5-16
5-6.	Battery Box	5-19
5-7.	Reel Cabinet Frame	5-21
5-8.	Crankshaft, Crankcase and Related Parts	5-23
5-9.	Pistons and Connecting Rods and Related Parts	5-25
5-10.	Air Tank	5-31
5-11.	Fuel Pipe-Pump and Leak-Off Pipe	5-34
5-12.	Fuel Injector	5-36
5-13.	Fuel Control Solenoid Valve	5-38
5-14.	Fuel Injector Pump	5-41
5-15.	Fuel Filter Head	5-43
5-16.	Fuel Lift Pump	5-45
5-17.	Crankcase Breather Assembly	5-47
5-18.	Variable Speed Control	5-50
5-19.	Stop/Run Lever	5-52
5-20.	Engine Air Cowling	5-54
5-21.	Lubricating Oil Pipe	5-56
5-22.	Oil Pan, Gasket and Strainer	5-58
5-23.	Cylinder Head and Cylinder Barrel	5-61
5-24.	Intake and Exhaust Valves and Decompression Lever Adjustment	5-64
5-25.	Low Pressure Pump	5-67
5-26.	High Pressure Pump	5-74
5-27.	Lube Tank	5-81
5-28.	Heater Wiring Diagram	5-86
5-29.	Intervehicular Wiring Harness	5-89
5-30.	Trailer Wiring Harness	5-91
5-31.	Axle Assembly	5-95
5-32.	Trailer Frame	5-98
6-1.	Cylinder Head Repair	6-4
6-2.	Cylinder, Piston and Connecting Rod Assembly	6-7
6-3.	Flywheel and Crankcase Replacement	6-16
6-4.	Camshaft Replacement	6-26
6-5.	Governor Replacement	6-32
6-6.	Governor Linkage Repair	6-35
6-7.	Governor Linkage Adjustment	6-38
6-8.	Oil Pump Replacement	6-40
6-9.	Crankcase Repair	6-42
6-10.	Engine Running-In	6-45

LIST OF TABLES

Table No.	Title	Page
1-1.	Equipment Data	1-5
2-1.	Operator Preventive Maintenance Checks and Services (PMCS) For: Lubricating and Servicing Unit, Model PM92-133	2-13
3-1	Operator Troubleshooting Table	3-2
4-1	Troubleshooting	4-1
4-11.	Unit PMCS	4-8

HOW TO USE THIS MANUAL

Be sure to read all Warnings before using your equipment.

This manual contains instructions for operation and maintenance of the Lubricating and Servicing Unit. Read the following brief descriptions in order to familiarize yourself with basic manual layout.

- **Front Cover** Provides you with basic information such as equipment name, model number, TM number, illustration of unit, and keyed index to major portions of the manual. The keyed index lists each major division of the TM that will be used most frequently by you the operator. The black tabs at the cover edge correspond to the first page of each of the major divisions in the manual.
- **Chapter 1** Introduces you to the equipment and gives you general information such as weight, height, length and other technical data. Provides you with simple functional descriptions of how the equipment works. Provides you with information for completing forms and records.
- **Chapter 2** Presents instructions needed by you in order to use or operate the equipment. Operating instructions in this chapter tell you how to use the equipment in both usual and unusual weather conditions. Preventive maintenance checks and services instructions (PMCS) provide information needed to inspect and service the Lubricating and Servicing Unit.
- **Chapter 3** Provides Operator troubleshooting procedures for Identifying equipment malfunctions and maintenance instructions for performing Operator maintenance tasks. For lubrication instructions refer to companion publication LO 5-4930-244-12. Lubrication Order.
- **Chapter 4** Provides Unit Maintenance personnel with troubleshooting procedures for identifying equipment malfunctions and maintenance instructions for repairing defective equipment as authorized by the maintenance allocation chart.
- **Chapter 5** Provides Direct Support Maintenance personnel with maintenance instructions for performing repairs on equipment as authorized by the maintenance allocation chart.
- **Chapter 6** Provides General Support Maintenance personnel with maintenance instructions for performing repairs on equipment as authorized by the maintenance allocation chart.
- **Appendix A** Provides a list of frequently used forms, manuals, and publications referenced in the manual and required by the operator to operate and maintain the equipment.
- **Appendix B** The Maintenance Allocation Chart identifies repairable components, length of time to repair, and the maintenance level authorized to perform the repairs.
- **Appendix C** Lists components that are not mounted on the equipment, but are required to make the unit functional. All components in the Components of End Item and Basic Issue Items Lists are illustrated for easy identification.
- **Appendix D** If applicable, lists additional equipment authorized for your unit for use with the Lubricating and Servicing Unit, but not supplied as part of the system. This equipment list may include items such as fire extinguishers, protective clothing, etc.

- Appendix E Provides you with information about expendable supplies such as sealants, lubricants, chemicals, etc. that are used when operating or maintaining the equipment.
- Appendix F This appendix includes complete instructions for making items to be manufactured or fabricated at unit maintenance.
- Appendix G Provides you with a tabular torque limit table.
- Appendix H Lists all mandatory replacement parts referenced in the task setups and procedures.
- Appendix I Includes all terms that are not adequately defined in the text or listed in the Army dictionary.
- Alphabetical Index Provides you with an alphabetical index of the manual.

AIDS TO FINDING INFORMATION. The following aids have been placed within this technical manual to help you quickly locate the information you may need.

Front Cover Index To provide you with a quick reference to the most used portions of this manual, an index has been placed on the cover of this manual.

Bleeder Edges On Pages On the right edge of the front cover index of this manual you will see a black box area that goes to the edge of the front cover page. If you hold this manual with your left hand and bend back the outer right edges of the pages with your right hand, you will find that there are pages inside the technical manual that also have black boxes on the right edges of the page and that these boxes line up with boxes on the front cover index. By turning to the page in the technical manual that lines up with the box on the front cover, you will be able to turn quickly to the topic shown in the front cover index.

Table of Contents and Boxed Titles In the event that the front cover has been removed from this manual, the items that appear in the front cover index have also been placed in a box where they appear in the Table of Contents of this manual.

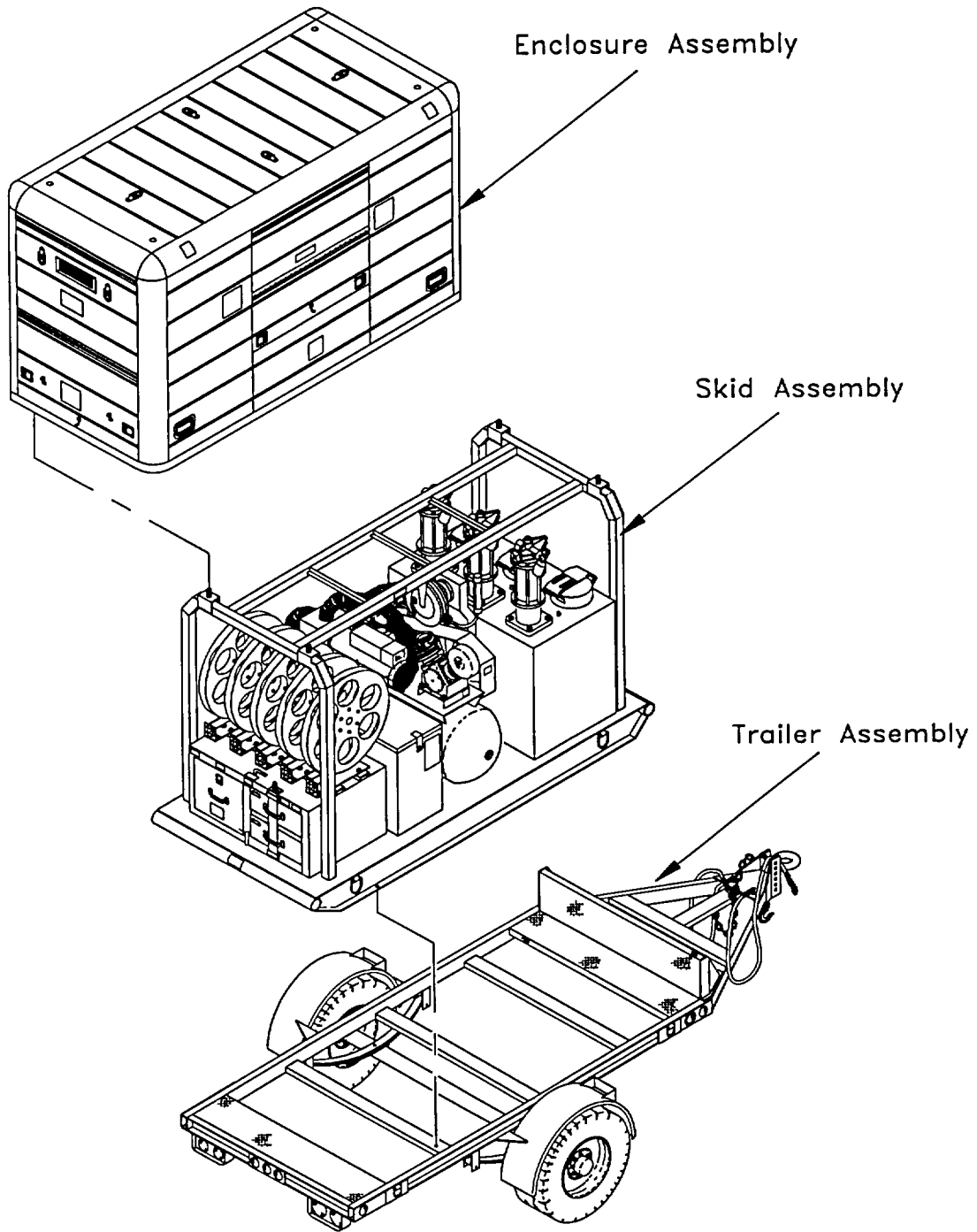


Figure 1-1. Lubricating and Servicing Unit, Diesel Engine Driven, Trailer Mounted

CHAPTER 1
INTRODUCTION

Paragraph		Page
Section I.	General Information	1-1
1-1.	Scope	1-1
1-2.	Maintenance Forms Records and Procedures	1-1
1-3.	Safety, Care and Handling	1-1
1-4.	Corrosion Prevention and Control	1-1
1-5.	Destruction of Army Materiel to Prevent Enemy Use	1-2
1-6.	Preparation For Storage or Shipment	1-2
1-7.	Reporting of Equipment Improvement Recommendations (EIR's)	1-2
1-8.	Nomenclature Cross-Reference List	1-2
1-9.	List of Abbreviations	1-2
Section II.	Equipment Description	1-3
1-10.	Equipment Characteristics, Capabilities, and Features	1-3
1-11.	Location and Description of Major Components	1-3
1-12.	Equipment Data	1-5
Section III.	Principles of Operation	1-7
1-13.	Theory of Operation	1-7

Section I. GENERAL INFORMATION

1-1. SCOPE.

This technical manual contains instructions for Operator, Unit, Direct Support and General Support maintenance procedures required to operate and maintain the Lubricating and Servicing Unit. The purpose of the unit is to lubricate various types of equipment in usual and unusual conditions and in remote locations. The unit model number is PM92-133.

1-2. MAINTENANCE FORMS, RECORDS AND PROCEDURES.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, The Army Maintenance Management System (TAMMS) (Maintenance Management Update).

1-3. SAFETY, CARE, AND HANDLING.

No special safety precautions are needed for the operation and repair of the lubrication and servicing unit. Standard warnings, cautions, and notes are provided when required.

1-4. CORROSION PREVENTION AND CONTROL.

Corrosion Prevention and Control (CPC) of Army Materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling or breaking of these materials may be a corrosion problem.

If a corrosion problem is identified, it can be reported using Standard Form 368, Product Quality Deficiency Report. Using key words such as "rust", "deterioration", or "cracking" will insure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 738-750.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Procedures for destruction of Army materiel to prevent enemy use are found in TM 750-244-3.

1-6. PREPARATION FOR STORAGE OR SHIPMENT.

Contact unit maintenance for preparation and storage or shipment. Refer to Section VI, Chapter 4.

1-7. REPORTING OF EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S).

If your Lubricating and Servicing Unit needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Tank-Automotive and Armaments Command, ATTN: AMSTA-TR-E/MPA, Warren, Mich. 483975000. We'll send you a reply.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Common Name

Lube Unit

Official Nomenclature

Lubricating and Servicing Unit

1-9. LIST OF ABBREVIATIONS.

Abbreviation

TM

PSI

°F

°C

BHP

PSIG

RPM

GAA

Official Nomenclature

Technical Manual

Pressure Per Square Inch

Degrees Fahrenheit

Degrees Celsius

Brake Horsepower

Pounds Per Square Inch Gauge

Revolutions Per Minute

General Artillery and Automotive

Section II. EQUIPMENT DESCRIPTION**1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.**

a. Characteristics.

- (1) The unit is self-contained. All components required to make the system operational are supplied.
- (2) Trailer mounting ensures transportability over many types of terrain.
- (3) The lube unit is diesel-powered; thus, electrical power is not required.
- (4) The skid mounted lube unit may be removed for operation or may be left on the trailer.

b. Capabilities and Features.

- (1) The winterization assembly heats the engine, battery, and lubricant tank. This allows the lube unit to operate in temperatures down to -40°F.
- (2) The lube unit dispenses air and three types of lubricant: grease, engine oil, and gear lube.
- (3) A transfer pump is included for use in dispensing lubricants from 55-gallon drums.
- (4) A trouble light is provided for illumination of obscured areas and for night missions.
- (5) Many accessories have been provided for specialized lube jobs.

1-11. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. (Refer to Figure 1-2).

- a. Aluminum Enclosure (1): Encloses major components, suppresses noise levels, and protects components from harsh weather.
- b. Engine Oil Pump (2): Pumps engine oil for desired use.
- c. Grease Pump (3): Pumps grease for desired use. Two hoses are included for this pump.
- d. Gear Lube Pump (4): Pumps gear lubricant for desired use.
- e. Transfer Pump (5): Pumps diesel fuel, engine oil, and gear lubricant from 55 gallon drums.
- f. Lubricant Tank (6): Houses three compartments: one grease, one gear lubricant, and one for engine oil.
- g. Air Compressor (7): Creates compressed air. Stores air in the air receiver tank for use as needed.
- h. Air Receiver Tank (8): Stores compressed air created by the compressor.
- i. Tool Box Assembly (9): Contains air repair hose, transfer pump discharge hose, and miscellaneous tools and accessories.
- j. Trailer Assembly (10): Allows for towing of the lube unit. Serves as mounting platform for the Unit.

- k. Steel Skid Assembly (11): Serves as a platform for the lube unit components. The skid assembly is removable from the trailer.
- l. Reel Cabinet Assembly (12): Consists of: Reels, lubricant hoses fitted with meters, a large drawer which houses two batteries and two small drawers which houses accessories.
- m. Diesel Engine (13): Drives the air compressor; is cranked automatically or manually.
- n. Winterization Assembly (14): Conducts heated air to engine crankcase, lubricant container, and cooling air intake. Keeps lube unit warm enough to dispense lubricants in temperatures to -40°F.

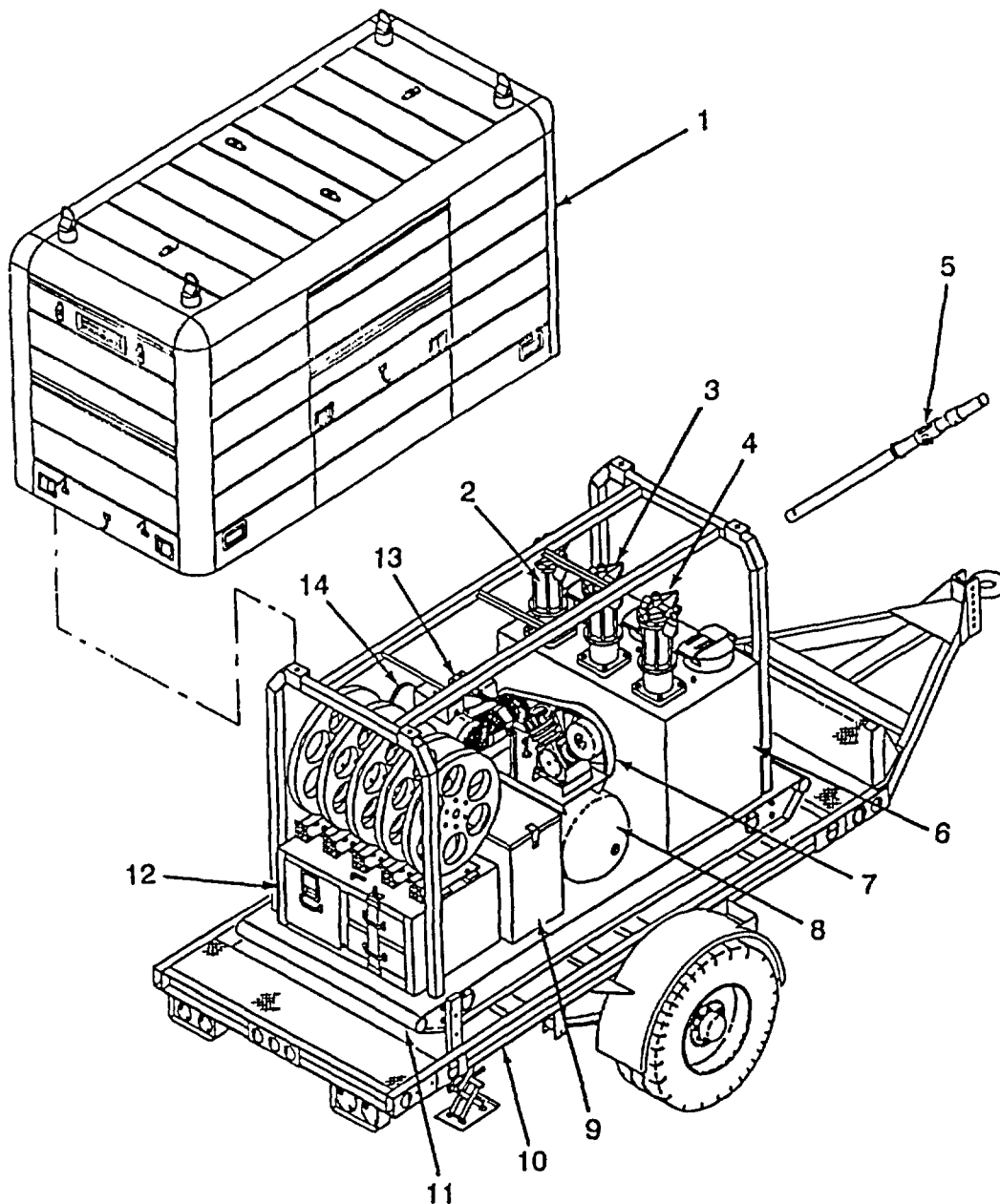


Figure 1-2. Location Of Major Components.

1-12. EQUIPMENT DATA.

TEMPERATURE LIMITS

Operational Temperature Parameters +120°F to -25°F or -40°F winterized

WEIGHT AND DIMENSIONS

Weight (Empty)..... 4100 lbs.
 Length..... 184"
 Width 84"
 Height 90"
 Clearance..... 14"
 Cubic Measure 805 Cu. Ft.

CAPACITIES

Engine Oil and Gear Lubricant Containers27 gallons
 Grease Pump Container.....23 gallons
 Fuel Tank.....10 gallons
 Alcohol Injector 8 oz
 Engine Crankcase..... 2.85 quarts

LUBRICANT TYPES

Engine Oil Compartment OE/HDO 15/30-40 (0-1236)
 Grease Compartment GAA (F) (G-403)
 Gear Lube Compartment GO-80/90 (0-226)
 Brake Fluid DOT 5

RATIOS

Air Pressure of Air-Powered Lubricant Pumps 120 psig to 200 psig
 Grease Pump Ratio..... 40 to 1
 Engine-Oil Pumps Ratio 8 to 1
 Gear-Lubricant Pump Ratio 8 to 1
 Transfer Pump Ratio 1 to 1

AIR COMPRESSOR

Manufacturer..... Dresser Industries, LeRoi Div.
 Model TRU-5N
 Motor Speed..... 1750 RPM
 Compressor Speed 930 RPM
 Maximum Operating Pressure..... 175 psi
 Type Two Stage, Single-Acting, Air Cooled
 Pulley, Drive 5 h.p., Diesel Engine Driven, 1 or 3 phase

ENGINE

Manufacturer..... Lister-Petter, Inc
 Model AD1 Build 02 rated 7.1 BHP @3000 RPM
 Technical Data..... 1500/3600 rev/min. Governing to
 BS 5514 class B1. 100% Load.
 Variable Speed. Clockwise Rotation.
 Type Air-Cooled Diesel
 Fuel Consumption..... 0.53 GPH

ELECTRICAL SYSTEM

BatteryTwo MS35000-3-6TL, 12v batteries
connected in series to provide 24v.

PUMPS

Manufacturer.....Alemite
Grease Pump Model Number 7785-B5
Engine Oil and Gear Lube Model No..... 7793-B1
Transfer Pump Model Number 7216-4

WINTERIZATION ASSEMBLY

Heater Manufacturer Hupp Heaters
Model..... MF60A, 24v

TIRES

Manufacturer..... Specialty Tire Co.
Model L LA4E7, 12 X 16.5 LT

TRAILER

Brake System TypeAir Over Hydraulic

Section III. PRINCIPLES OF OPERATION

1-13. THEORY OF OPERATION. (Refer to Figure 1-3).

a. Air Compressor Assembly.

- (1) The control panel holds (1) gauges, switches, and buttons necessary to operate and monitor the lube unit. For night missions, panel lamps (2) are included.
- (2) A run/stop toggle switch (3) prepares the unit to be started. Pushing the engine start button (4) opens the solenoid and allows the starter to receive power from the batteries. The starter cranks the diesel engine (5).
- (3) The diesel engine (5) turns the alternator (6) which recharges the batteries. The engine also turns the air compressor (7) which generates and sends compressed air to the air-receiver tank (8).
- (4) A system of valves, controls, and devices regulate air compression and ensure safe operating conditions. A spring-loaded pressure relief valve (9) "pops off" and relieves tank pressure if it exceeds 200 psi, preventing serious safety problems. A ball valve (10) shuts off air to all lubricant pumps. An adjustable pressure-actuated mechanical control/automatic idle control (11) maintains air pressure between 140 psig and 175 psig and reduces engine speed to recommended idle speed during the compressor unload period.
- (5) A spring-loaded interstage pressure relief valve (12) protects the low pressure cylinder of the air compressor if the high pressure cylinder fails. A shut-off valve (13) prevents air from entering the air-receiver tank (8). An automatic unloading device (14) prevents the engine from starting against either tank pressure or compression in air compressor cylinders. A condensate removal valve (15) drains the air-receiver tank (8) of moisture and air. A clutch handle (16) engages the clutch and compressor drive belts, thus allowing air compressor to start working.

b. Lube Tank Assembly.

The engine-oil, grease, and gear-lube pumps (17) pump lubricant from the lube tank assembly (18) and out through lubricant hoses (19). Each pump is driven by compressed air that is generated by the air compressor (7). The lube tank assembly (18) is divided into three compartments: one for engine-oil, one for grease, and one for gear lube.

c. Reel Cabinet Assembly.

- (1) Lubricant hoses are fitted with meters (20) for precisely adjusting the desired amount of lubricant.
- (2) Reels (21) provide a convenient way to store and retrieve hoses in mission situations.
- (3) The large drawer (22) houses two batteries mentioned earlier. The two smaller drawers (23) house accessories needed for missions.

d. Winterization Assembly.

The heater assembly (24) operates off of the batteries and circulates hot air to the diesel engine (5), lube tank (18), and batteries. The winterization assembly should be used for starting and operating the unit in cold weather.

e. Trailer Assembly.

The trailer assembly serves as a platform for the lube unit and allows towing of the unit from place to place.

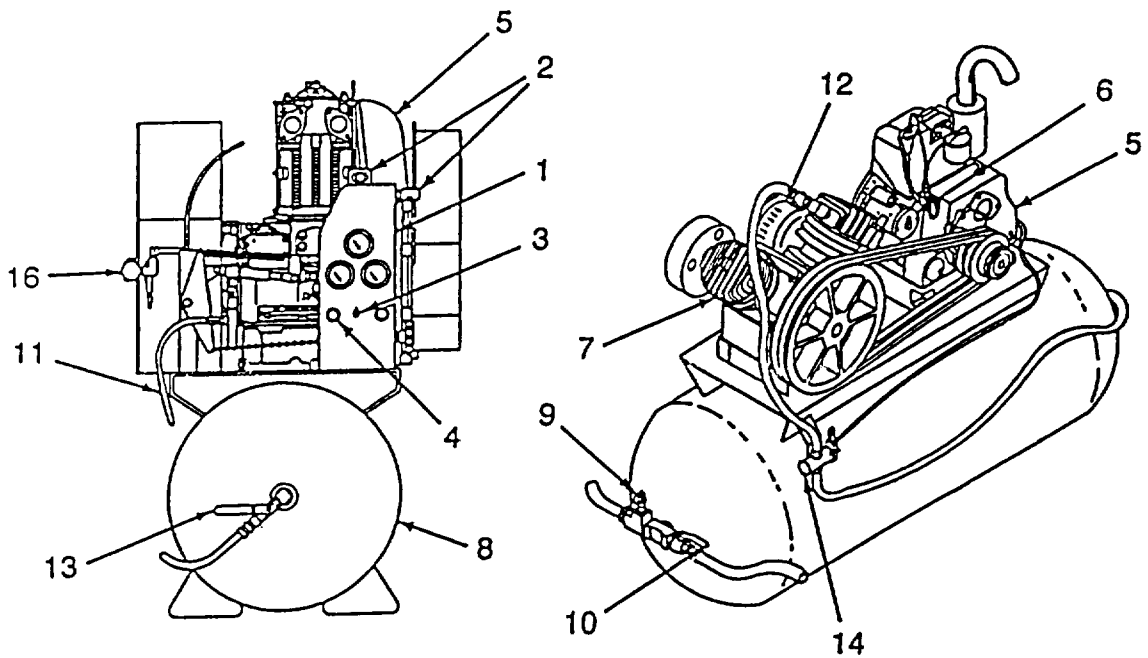
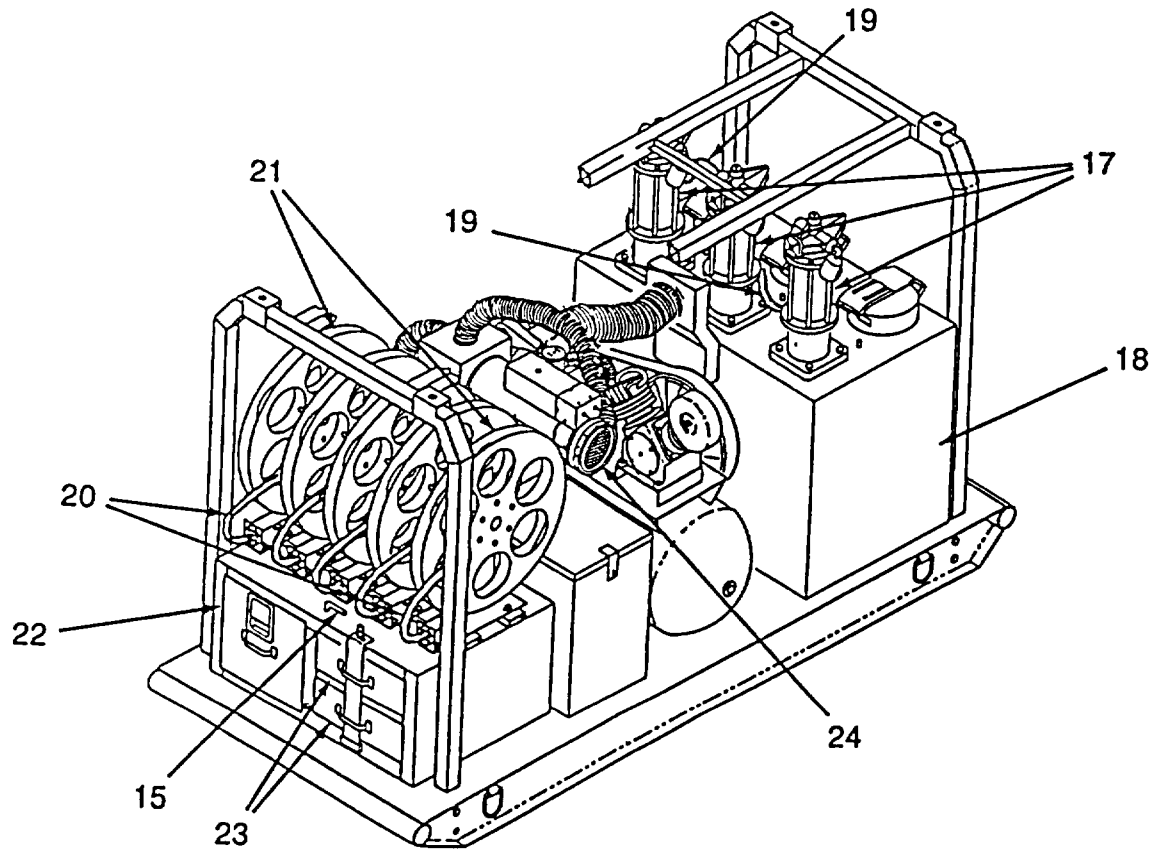


Figure 1-3. Theory Of Operations.

CHAPTER 2
OPERATING INSTRUCTIONS

Paragraph		Page
Section I.	Description and Use of Operator Controls and Indicators.....	2-1
2-1.	Introduction	2-1
2-2.	Operator Controls and Indicators	2-1
Section II.	Operator Preventive Maintenance Checks and Services (PMCS)	2-10
2-3.	General	2-10
2-4.	PMCS Procedures	2-10
2-5.	Leakage Definitions for Operator PMCS	2-11
2-6.	Operator Preventive Maintenance Checks and Services	2-12
Section III.	Operation Under Usual Conditions	2-26
2-7.	Assembly and Preparation for Use	2-26
2-8.	Initial Adjustments and Checks	2-28
2-9.	Operating Procedures	2-28
2-10.	Decals and Instruction Plates	2-43
2-11.	Shutdown Procedures	2-53
Section IV.	Operation Under Unusual Conditions	2-56
2-12.	Operation in Unusual Environment/Weather	2-56
2-13.	Emergency Procedures	2-61
2-14.	Nuclear, Biological, and Chemical (NBC) Decontamination Procedures	2-63

Section I. DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

2-1. INTRODUCTION.

This section provides the operator with information needed to locate, identify, and use the controls and indicators on the Lube Unit. The components and controls identified in this section are applicable to the entire system. Some of the controls are repeated throughout the system.

2-2. OPERATOR CONTROLS AND INDICATORS.

- a. Door Latches. (Refer to figure 2-1).

Located on the enclosure (1), these latches (2) are used to open and close front, rear and side doors.

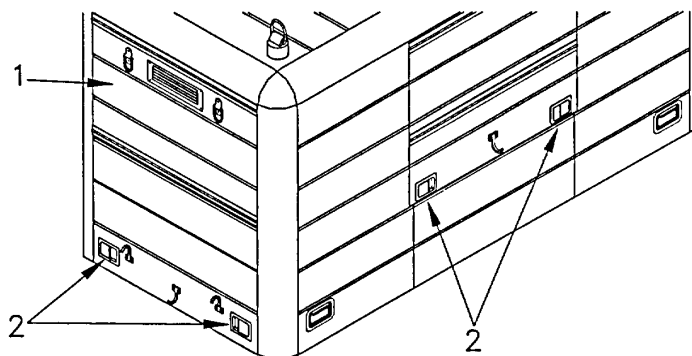


Figure 2-1. Flush-Mounted Door Latches

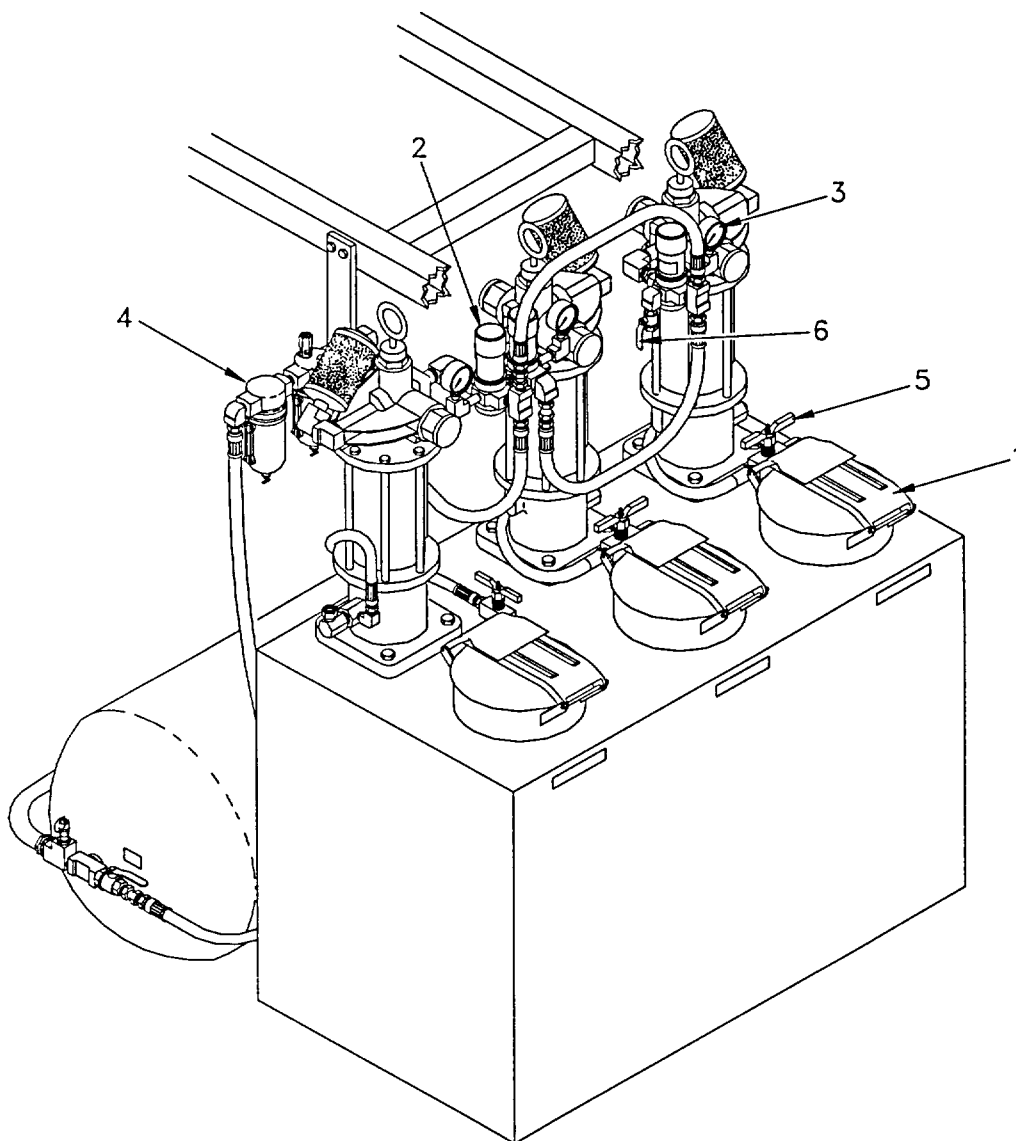


Figure 2-2. Lube Tank Assembly Controls and Indicators

b. Lube Tank Assembly. (Refer to Figure 2-2).

- (1) Manhole Cover Latch (1). Opens the cover to each lube compartment.
- (2) Air Pressure Regulator (2). Regulates pump speed. Adjusts air pressure to the pumps.
- (3) Air Pressure Gauge (3). Displays air pressure from 0-200 psi.
- (4) Air Moisture Separator (4). Removes moisture from the air coming from the air receiver tank to the air regulators (2).
- (5) Lube Recirculation Valve (5). Permits recirculation of lubricant from pump to compartment.
- (6) Air Pressure Relief Valve (6). Relieves air pressure in all pump lines.

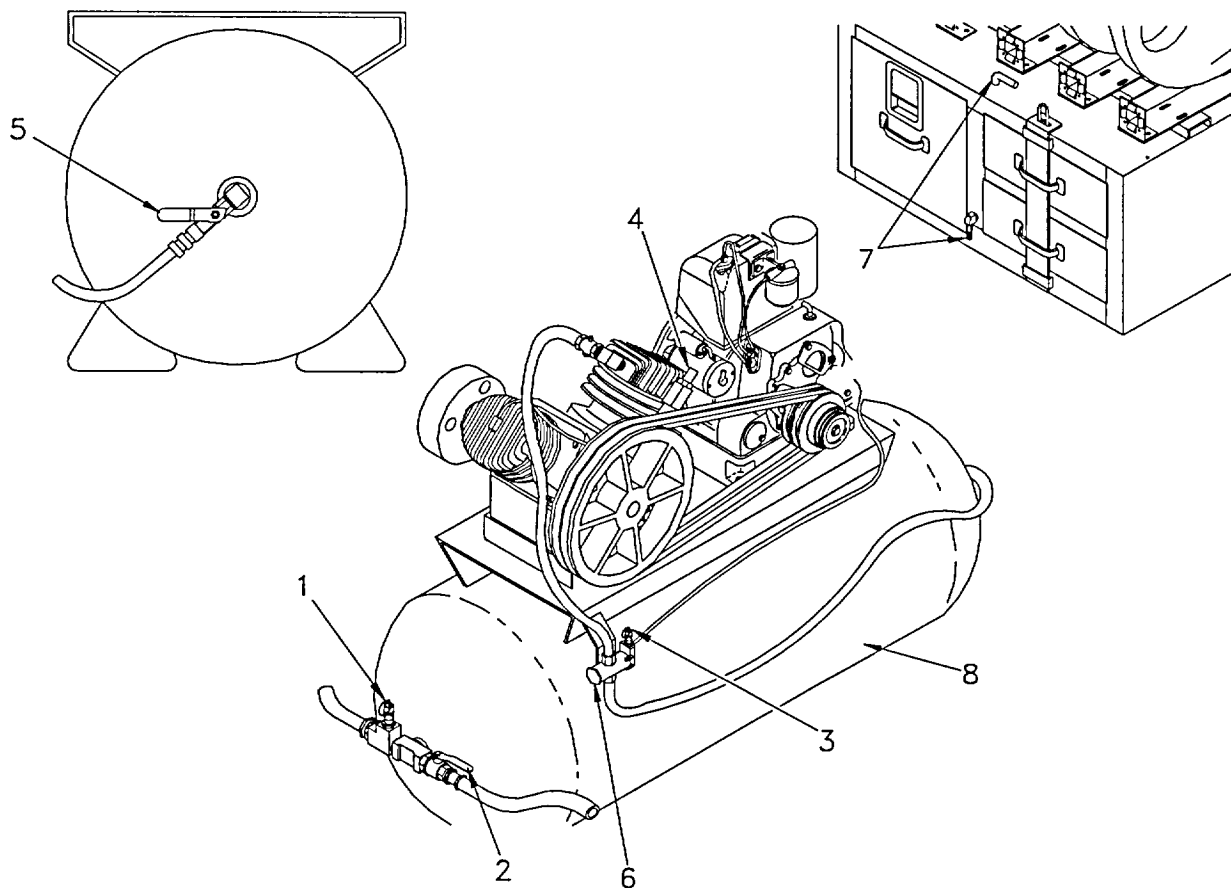


Figure 2-3. Air Compressor Assembly Controls and Indicators

c. Air Compressor Assembly. (Refer to Figure 2-3).

- (1) Spring-Loaded Pressure Relief Valve (1). An emergency device that relieves air pressure exceeding 200 psi. Without this device the tank could explode.
- (2) Ball Valve (2). Shuts off all air to pumps.
- (3) Adjustable Pressure-Actuated Mechanical Control (3). Stops the compression of air when the receiver tank pressure has reached 175 psig and starts the compression of air when the tank pressure has dropped to 140 psig. Air in excess of 175 psi is released into the atmosphere.
- (4) Spring-Loaded Interstage Pressure Relief Valve (4). Protects the low pressure cylinder of the air compressor in the event of failure of the high pressure cylinder.
- (5) Shut-off Valve (5). When closed, will shut off air to tank and isolate tank from the adjustable pressure-actuated mechanical control (6)
- (6) Automatic Unloading Device (6). Protects the engine from starting against either tank pressure or compression in the compressor cylinders by relieving cylinders of air.
- (7) Condensate Removal Valve (7). Completely drains the tank of all moisture. Drain daily.
- (8) Air Receiver Tank (8). Stores compressed air created by compressor.

d. Alcohol Injector. (Refer to Figure 2-4).

Alcohol Injector (1) regulates the flow of alcohol into the system.

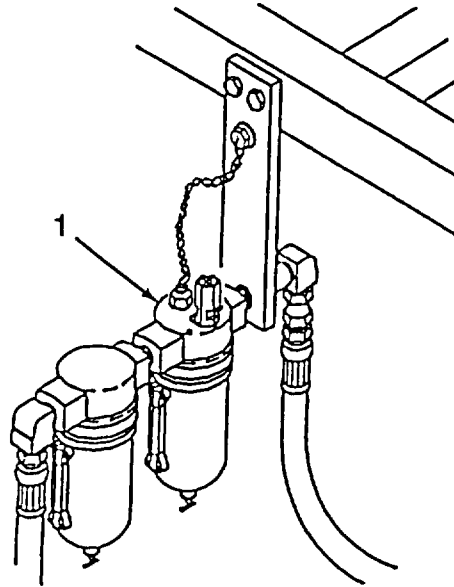


Figure 2-4. Alcohol Injector Control Valve

e. Fuel Tank. (Refer to Figure 2-5).

Fuel Tank. This line (1) drains fuel tank to outside of enclosure and into a suitable container.

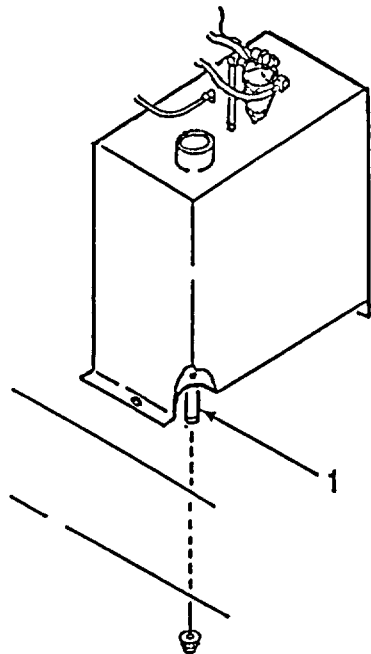


Figure 2-5. Fuel Tank Drain Line

f. Engine Exhaust. (Refer to Figure 2-6).

Engine Exhaust Diverter (1). Diverts exhaust gases either into the bottom heat chamber of the lubricant compartment or through the floor of the lubricator and out into the atmosphere.

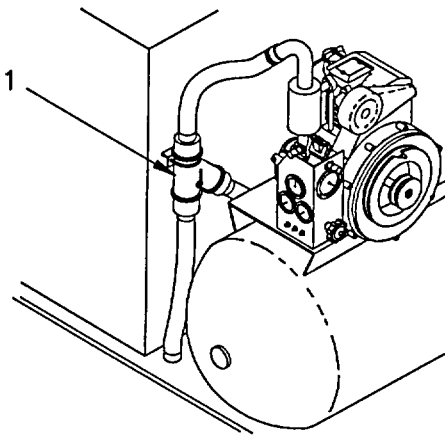


Figure 2-6. Engine Exhaust System

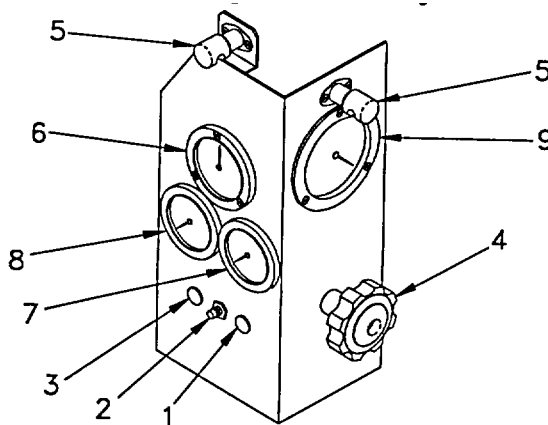


Figure 2-7. Control Panel Assembly

g. Control Panel. (Refer to Figure 2-7).

- (1) Engine Glow-Plug Button (1). Used in cold weather to ready the diesel engine for starting.
- (2) Power-On Button (2). Provides DC current to the lube unit.
- (3) Engine Start Button (3). Starts the engine.
- (4) Throttle Knob (4). Increases and decreases engine RPM.
- (5) Panel Lamps (5). Illuminates controls for night missions.
- (6) DC Amperage Gauge (6). Indicates amperes generated by the alternator.
- (7) Oil Pressure Gauge (7). Indicates engine oil pressure.
- (8) Fuel Gauge (8). Indicates tank fuel level.
- (9) Air Pressure PSI Gauge (9) Indicates air pressure in air-receiver tank.

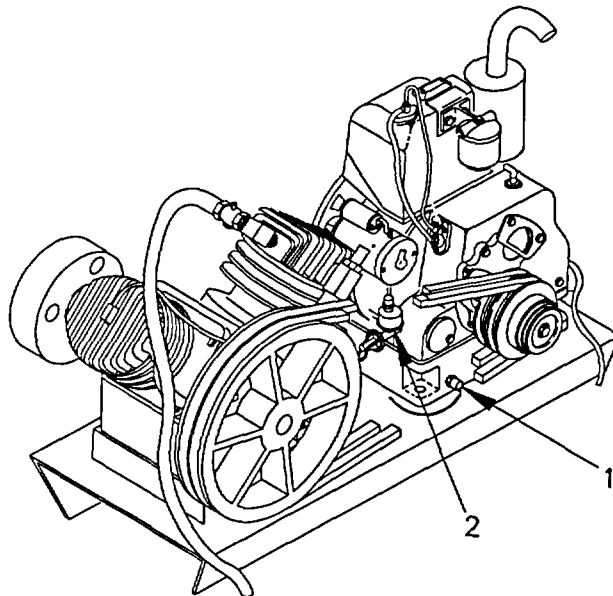


Figure 2-8. Safety Devices

h. Safety Devices. (Refer to Figure 2-8).

- (1) High Oil-Temperature Shutdown Switch (1). Shuts unit down when oil pressure reaches unsafe limits
- (2) Low Oil-Pressure Shutdown Switch (2). Shuts unit down when oil pressure reaches unusable limits.

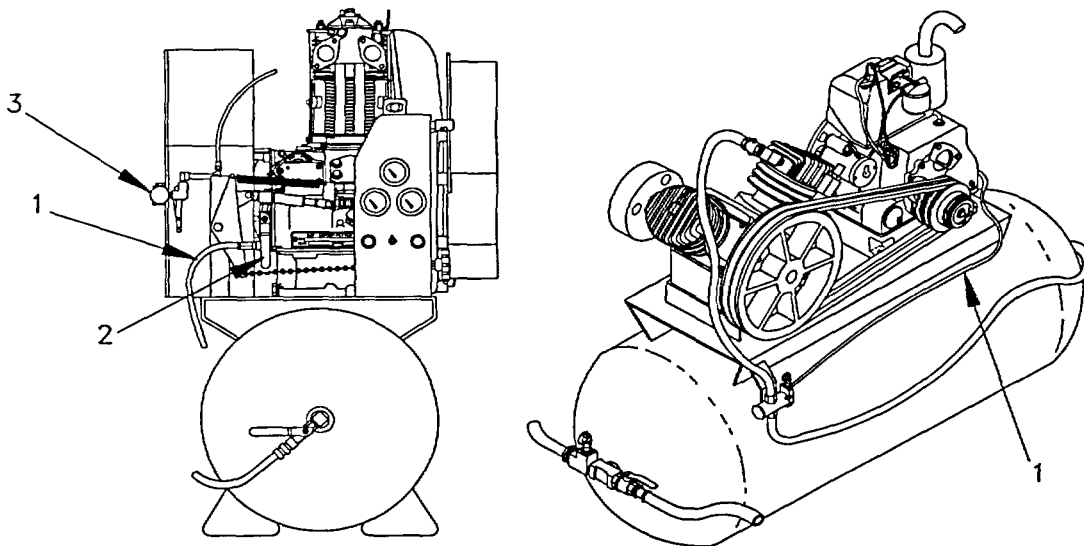


Figure 2-9. Automatic Idle Control

i. Diesel Engine. (Refer to Figure 2-9).

- (1) Auto Idle (1). Reduces engine speed to recommended idle speed during compressor unload period.
- (2) Manual Override Valve (2). Disables the idle device so that the engine doesn't go into the idle mode. Keeps engine operating at proper RPMs.
- (3) Clutch Engagement Control (3). Used to engage/disengage clutch to set air pump in motion.

j. Reel Stand Locking Device. (Refer to Figure 2-10).

- (1) Lock (1) prevents reel movement when reel is not in use.

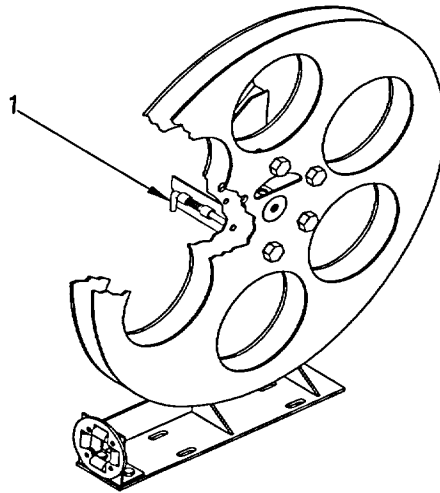


Figure 2-10. Reel Stand Locking Device

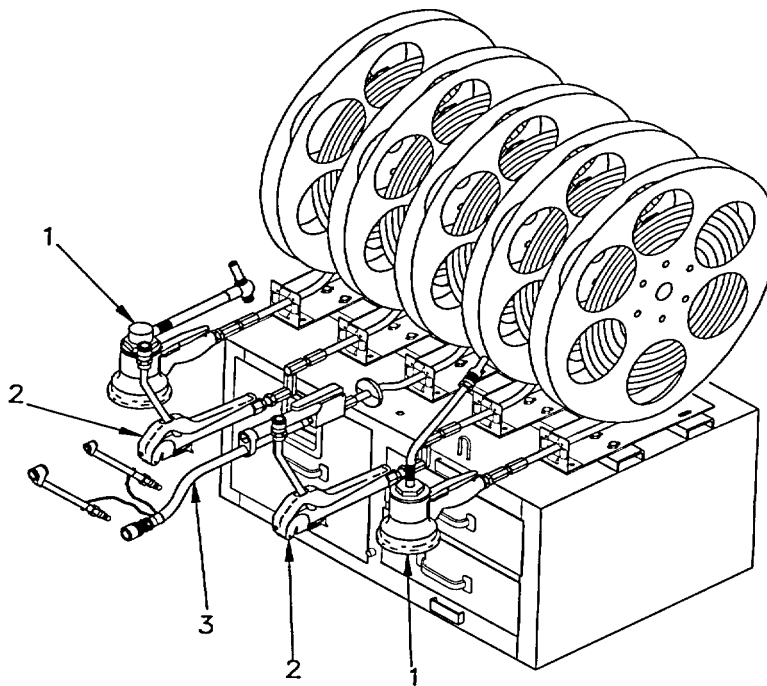


Figure 2-11. Metering Valves

k. Metering Valves. (Refer to Figure 2-11).

- (1) Metering Valves (1). Control lubricant flow.
- (2) Grease Control Valves (2). Control flow of grease.
- (3) Tire Inflator Gage (3). Inflates and measures air pressure.

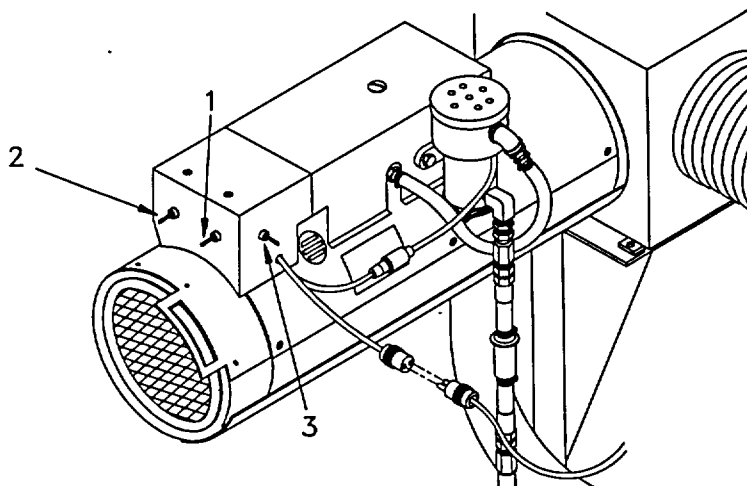


Figure 2-12. Heater And Fuel Pump Switches

I. Winterization Assembly. (Refer to Figure 2-12).

- (1) Heater Run-Off Start Switch (1). Turns the heater motor from "start" to "run".
- (2) Heater High-Low Switch (2). Adjusts heater for high or low heat settings.
- (3) Fuel Pump Switch (3). Turns the heater fuel pump on and off.

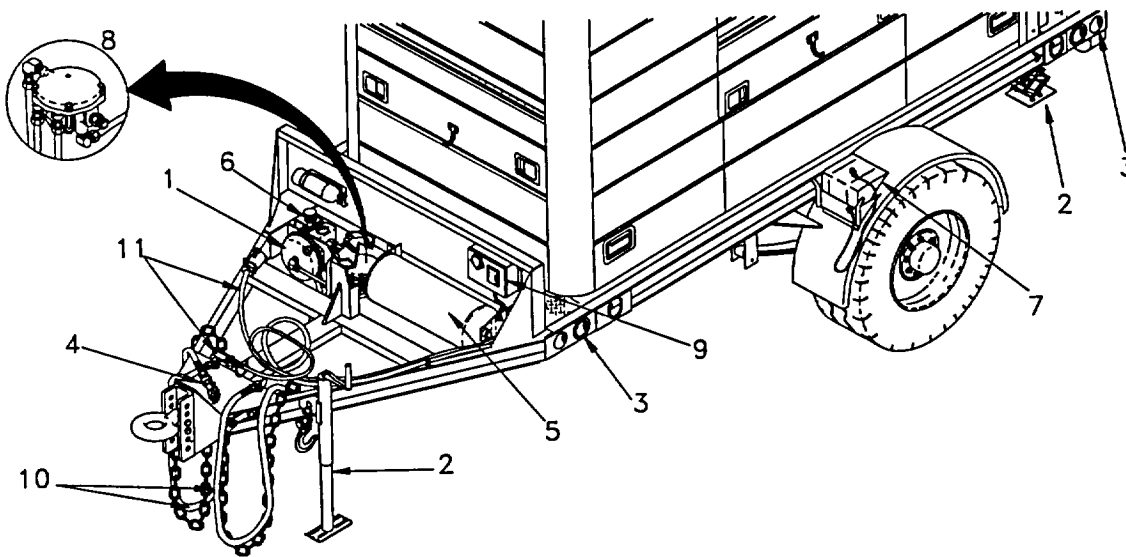


Figure 2-13. Trailer Assembly

m. Trailer Assembly. (Refer to Figure 2-13).

- (1) Power Cluster and Master Cylinder (1). Converts air pressure into hydraulic pressure by use of an air cylinder and a master brake cylinder.
- (2) Front & Rear Jacks (2). Stabilize the trailer and lube unit.

- (3) Reflectors (3). Safety devices that allow other vehicles to see the lube unit.
- (4) Emergency and Service Brake Couplers (4). Connects the braking system of the trailer to that of the towing vehicle.
- (5) Trailer Air Tank (5). Stores air for use with the trailer air brake system.
- (6) Parking Brake (6). Activates brakes for the parking unit. Use with wheel chocks (7).
- (7) Emergency Relay Valve (8). Receives air from the emergency and service brake couplers and sends it to the trailer air tank. This is used to apply the emergency brakes if a sudden pressure drop is sensed such as if the trailer broke away from the towing vehicle.
- (8) Junction Box (9). Connects towing vehicle wiring and power to trailer.
- (9) Brake Hose Assemblies (10). Connects trailer air brake system to towing vehicle.
- (10) 12 VDC and 24 VDC Intervehicle Electrical Cable Assemblies (11) Provides electrical power from towing vehicle to trailer junction box.

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

2-3. GENERAL.

Table 2-1 PMCS Table has been provided so you can maintain your equipment in good operating condition and ready for its primary mission. Preventive Maintenance Checks and Services (PMCS) means systematic caring, inspecting, and servicing of equipment to maintain good condition and to prevent breakdowns. As the operator of the Lubrication and Servicing Unit, your mission is to:

- a. Perform PMCS each time you operate the Lubrication and Servicing Unit. Always do PMCS in the same order, so it becomes a habit. After you've had some practice, you will quickly be able to spot anything wrong.
- b. **BEFORE** - Do PMCS right before you operate the equipment. Pay careful attention to WARNINGS, CAUTIONS and NOTES.
- c. **DURING** - Do PMCS while you operate the equipment. Pay careful attention to WARNINGS, CAUTIONS and NOTES.
- d. **AFTER** - Do PMCS after you operate the equipment. Pay careful attention to WARNINGS, CAUTIONS and NOTES.
- e. Use DA Form **2404** (Equipment Inspection and Maintenance Worksheet) to record any faults that you discover before, during, or after operation, unless you are able to fix them. DO NOT record faults that you fix.
- f. Assist unit maintenance when required.
- g. When a check and service procedure is required for both after and before intervals, it is not necessary to do the procedure twice if the equipment is operated during a weekly period.
- h. Always observe the WARNINGS and CAUTIONS appearing in your PMCS Table. Warnings and cautions appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or prevent your equipment from being damaged.

2-4. PMCS PROCEDURES.

The PMCS table is arranged with the individual PMCS procedures listed in sequence under assigned intervals. The most logical time (before, during, or after operation) to perform each procedure determines the interval to which it is assigned.

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

- b. The "INTERVAL COLUMN." This column tells you when you must do the procedure in the procedure column. BEFORE procedures must be done before you operate or use the equipment for its intended mission. DURING procedures must be done during the time you are operating or using the equipment for its intended mission. AFTER procedures must be done immediately after you have operated or used the equipment.
- c. The "LOCATION, ITEM TO CHECK / SERVICE COLUMN." Tells you the name of the item to be checked or serviced and where the item is located.
- d. The "PROCEDURE COLUMN." This column gives the procedure you must do to check or service the item listed in the Check/Service column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.
- e. The "NOT FULLY MISSION CAPABLE." column of Table 2-1. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.
- f. The following are checks that are common to the entire lube unit system:
 - (1) Keep the equipment clean. Remove dirt, sand, and debris from quick disconnect couplings, hose ends, and valves to prevent excessive wear and system contamination.
 - (2) Check and tighten loose nuts, bolts, and screws.
 - (3) Look for wear, damage, and leaks on hoses and fuel lines. Make sure clamps and quick disconnect couplings are tight. Wet spots show leaks, and a stain around a fitting or connector may also indicate a leak. Tighten any loose fittings or couplings. Repair or report problems to unit maintenance.
 - (4) Check wiring and connectors for cracked or broken insulation, exposed wiring, and loose or broken connectors. Repair problems or inform unit maintenance (5) Check welds for gaps, cracks, and rust. Check paint for chipping. Report problems to unit maintenance.
 - (6) Look for leaking diesel fuel, oil, or lubricants. Report leaks to unit maintenance.
 - (7) Check trailer tires for tread wear, and cracking. Report problems to unit maintenance.
- g. Be sure to observe all special information and notes that appear in your table.

2-5. LEAKAGE DEFINITIONS FOR OPERATOR PMCS.

It is necessary for you to know how fluid leakage affects the status of the equipment. The following are classes and definitions of leakage an operator needs to know to be able to determine the status of the Lubrication and Servicing Unit. Be familiar with these leakage definitions. When in doubt, notify your supervisor.

- Class I Seepage of fluid (indicated by wetness or discoloration) not great enough to form drops.
- Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked.
- Class III Leakage of fluid great enough to cause drops to drip from item being checked.

NOTE

Fluid levels of items with Class I and Class II leaks must be checked often so proper levels can be kept.

Class III leaks must be reported to supervisors or to Unit Level Maintenance for corrective action.

2-6. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

NOTE

If the equipment must be kept in continuous operation, do only those procedures in the following table that do not disturb operation. Make complete checks and services when the equipment is shut down.

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
1	Before	Wheel & Tire Assembly	Check tires (4) for correct pressure of 60 psi. Inflate tires if needed. (Figure 2-23.) Inspect tires (4) for cuts or worn tread.	Tire low or flat. Tires cut or have excessive tread wear. Chocks blocks missing.
2	Before	Diesel Engine	Check diesel engine (12) for leaks or cracks. (Figure 2-14.)	Engine is leaking or cracked.
3	Before	Compressor & Alternator Belts	Check belts (3) for tension.	Belt is loose, damaged or broken.
4	Before	Shut-Off Valve	Inspect shut off valve (7) for damage or leaks.	Valve damaged or leaking.
5	Before	Fuel Tank	Inspect fuel tank (1), fuel strainer (2), and fuel lines (3) for cracks, leaks, or damage. (Figure 2-15.)	Tank cracked open or damaged, or fuel strainer or fuel lines leaking.
6	Before	Fuel Cap	Inspect fuel cap (1) for proper fit. Replace if needed. (Figure 2-16.)	Cap is missing or damaged.
7	Before	Fuel Neck Assembly	Inspect fuel hose (2) for cracks or deterioration.	Hose cracked or deteriorated.

WARNING

Battery acid is harmful Wear safety glasses and rubber gloves. If acid touches eyes or skin, flush with running water for 60 seconds. Seek medical attention.

8	Before	Battery Box	Check battery electrolyte (2), and fill to ring at bottom of fill hole. (Figure 2-17.) Check battery cables (3) in drawer for secure connections.	Electrolyte is too low to charge. Battery cables are loose.
9	Before	Air, Lube and Grease Hoses	Check hoses (8) for secure connections.	Hoses have loose
10	Before	Brake & Tail Lights	Check lamps (1) for broken bulbs and illumination. (Figure 2-18.) Check wire connections (2). damaged.	Lamps / bulbs broken or do not illuminate. Wires are exposed or

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:

Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
11	Before	Alcohol Injector	Check alcohol injector (1) fluid level. Check for leaks. (Figure 2-19.)	Alcohol level is low or alcohol is leaking.
12	Before	Lube Supply	Check hoses (3) for secure connections Hoses and tighten if needed.	Hoses connections are not tight.
13	Before	Unloader Valve	Inspect unloader valve (10) for damage. (Figure 2-14.)	Valve is damaged.
14	Before	Lube Tank	Check lube tank (4) for leaks or cracks. (Figure 2-22.)	Tank is leaking or is cracked.
			Check all hoses (5) for cuts, tears, and abrasions.	Hoses are damaged.
15	Before	Safety Chain	Inspect safety chain (18) for cracks or corrosion. (Figure 2-23.)	Chain cracked or corroded.
16	Before	Brake & Tail	Check light connection and switch on Lights towing vehicle.	Damage exists.
17	During	Shut off valve	Inspect shut off valve (7) for leaks. Valve leaking. (Figure 2-14.)	
18	During	Control Panel	Inspect control panel (1) gauges for correct operation and check for damage.	Gauges inoperable or damaged.
19	During	Fuel Tank	Check for contaminated fuel. erratic.	Engine operates rough or erratic.
20	During	Grease Valves	Check grease valves (9) for leaks. (Figure 2-17.)	Grease valves leaking.
21	During	Exhaust Hoses & Heat Ducts	Check heater exhaust hoses and heat ducts (4) for leaks. (Figure 2-20.)	Hoses or ducts are leaking or damaged.
22	During	Air Compressor Pump	Check air compressor pump (5) for leaks. (Figure 2-14.)	Air compressor pump leaking.
23	During	Pressure Relief Valve	Inspect pressure relief valve (8) for leaks.	Valve leaking.
24	During	Ball Valve	Inspect ball valve (9) for leaks.	Valve leaking.
25	During	Unloader Valve	Inspect unloader valve (10) for leaks.	Valve leaking.

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
26	During	Air Tank	Inspect air tank (11) for leaks. (Fig. 2-14.)	Tank leaking.
27	During	Transfer Pump	Inspect transfer pump (1) for leaks. (Figure 2-21.)	Transfer pump leaks or is inoperable.
28	During	Air Regulators	Check air regulator (1) for leaks and proper gauge operation. (Figure 2-22.) damaged.	Regulator leaking, or gauges inoperative or
29	During	Low Pressure Pumps	Check low pressure pumps (2) for leaks.	Pumps are leaking.
30	During	High Pressure Pump	Check high pressure pump (3) for leaks.	Pump is leaking.
31	During	Brake	Check brake assemblies (3) for proper Assembly operation. (Figure 2-23.)	Brakes squeak, grind, or pull.
32	After	Alternator	Inspect alternator (2) for damage. (Figure 2-14.) hardware broken.	Alternator is cracked or
33	After	Clutch	Check clutch (14) for binding or damage. binds.	Clutch is damaged or
34	After	Diesel Engine	Check diesel engine (12) oil and fill if needed.	Engine oil is empty or low.
35	After	Control Panel	Inspect control panel (1) gauges.	Gauges damaged.
36	After	Fuel Tank	Check fuel tank gauge (1) for fuel level. Fill if needed.	Fuel level is empty or low.
37	After	Diesel Engine Air Filter	Check engine air filter (13) for excessive dirt or damage.	Filter dirty, clogged, or damaged.
38	After	Wheel & Tire Assembly	Inspect wheel assembly (4) for bends or cracks. (Figure 2-23.)	Wheel assembly has cracks or bends.
39	After	Trailer Wiring Harness	Inspect trailer wiring harness (16) for exposed, broken, corroded, or loose wires.	Wires exposed, damaged, or loose.
40	After	Reel Cabinet	Inspect reel cabinet (1) for smooth operation of drawers. (Figure 2-17.) Inspect reel cabinet (1) for holes, dents, leaks, or damage.	Drawers inoperable or missing. Cabinet leaks.

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
41	After	Condensate Drain Assembly	Inspect drain tube (5) for cuts, tears or deep abrasions. Inspect clamp. (Figure 2-17.) loose or missing.	Hose cut or torn or has deep abrasions. Clamp
42	After	Gear Lube and Oil Dispensers	Check dispensers (6) for cracks, leaks, or Dis	Dispensers are cracked, leaking, or damaged.
43	After	Reel	Unroll each hose assembly (8) and check for smooth reel (7)operation. Inspect reel (7) for structural damage.	Hose does not unroll correctly. Reel is bent or cracked.
44	After	Air, Lube, and Grease Hoses	Inspect hoses (8) for cuts, tears, and deep abrasions. Check hoses (8) for leaks.	Hoses cut, torn or abraded. Hoses leak.
45	After	Grease Valves	Check grease valves (9) for cracks.	Parts cracked or damaged.
46	After	Condensate Drain Valve	Inspect and open condensate drain valve(10) to drain tank daily.	Not drained daily.
47	After	Front and Rear Jacks	Inspect jacks (17) for corrosion, cracks or warping. (Figure 2-23.)	Jacks cracked, badly corroded or warped.
48	After	Alcohol Injector	Inspect sight gauge (1) and service alcohol injector if needed. (Fig. 2-19.)	Alcohol injector is empty.
49	After	Air Filter/Mois- ture Separator	Inspect sight gauge (2) for moisture content and drain if needed.	Moisture separator is full.
50	After	Lube Supply Hoses	Inspect hoses (3) for cuts, tears, or deep abrasions.	Hoses cut, torn or deeply abraded.
51	After	Air Compressor Pump	Check oil level (4) in air compressor (5) and fill if needed.	Oil level is empty or low.
52	After	Air Compressor Air Filter	Check air filter (6) for excessive dirt or damage. Replace if needed.	Filter dirty, clogged or damaged.
53	After	Pressure Relief Valve	Inspect pressure relief valve (8) for damage.	Valve damaged.
54	After	Ball Valve	Inspect ball valve (9) for damage.	Valve damaged.
55	After	Heater Assembly	Check heater assembly (1) for cracks and damage. (Figure 2-20.)	Heater assembly is cracked or damaged.

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
56	After	Control Box Assembly	Inspect control box switches (2) for damage. (Fig. 2-20.)	Switches damaged
57	After	Fuel Lines	Check fuel lines (3) for cracks, leaks, and wear. Check clamps.	Hoses are cracked, leaking or worn. Clamps loose or missing.
58	After	Exhaust Hoses & Heat Ducts	Check heater exhaust hoses and heat ducts (4) for cracks and wear.	Hoses or ducts are worn.
59	After	Heater Mounting Assembly	Check heater mounting assembly (5) for cracks, corrosion, or warping.	Mounting is cracked, severely corroded, or warped.
60	After	Toolbox	Check toolbox (2) for contents listed on box. (Figure 2-24.)	Toolbox items missing or damaged.
61	After	Brake Lines	Inspect brake lines (13) for damage, cracks, leaks and wear. (Figure 2-23.)	Lines damaged.
62	After	Axle Assembly	Inspect axle assembly (2) for corrosion or cracks.	Axle is corroded or severely cracked.
63	After	Transfer Pump	Inspect transfer pump (1) for damage. (Figure 2-21.)	Transfer pump cracked, damaged, or missing.
64	After	Air Regulators	Check air regulators (1) for cracks. (Figure 2-22.)	Regulators cracked.
65	After	Low Pressure Pumps	Check low pressure pumps (2) for cracks or damage.	Pumps are cracked or damaged.
66	After	High Pressure Pump	Check high pressure pump (3) for cracks or damage.	Pump is cracked or damaged.
67	After	Lube Tank	Check compartments (4) for engine-oil, grease, and gear lube and fill as needed.	Compartments are empty or fluid levels low.
68	After	Air Brake Hose Assemblies	Check air hose assemblies (5) for cuts, tears and abrasions. (Figure 2-23.)	Hoses are damaged.
69	After	Gladhand Couplers	Inspect gladhand couplers (6) for damage and wear.	Couplers are damaged.
70	After	Control Valve	Inspect control valve (7) for damage.	Valve damaged.
71	After	Emergency Relay Valve	Inspect emergency relay valve (8) for damage.	Valve damaged.

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

Item No.	Interval	Location Item to Check/Service	Procedure	Not Fully Mission Capable if:
72	After	Quick Release & Limiting Valve	Inspect quick release and limiting valve (8) for damage. (Figure 2-23.)	Valve damaged.
73	After	Synchronizing Valve	Inspect quick synchronizing valve (10) for damage.	Valve damaged.
74	After	Air Tank Assembly	Inspect air tank assembly (11) for damage and drain daily. (Figure 2-23.)	Tank is damaged or not drained daily.
75	After	Power Cluster & Master Cylinder	Inspect power cluster & master cylinder (12) for damage. Check master cylinder (12) brake fluid level and fill as needed.	Power cylinder or master cylinder is damaged or leaking. Master cylinder is empty or fluid is low.
76	After	Intervehicular Trailer Harness	Check intervehicular trailer harness (14) for cuts and abrasions.	Cables damaged.
77	After	Voltage Reducer Box	Inspect voltage reducer box (15) for cracks and deteriorated seal.	Box cracked or seal leaks.
78	After	Air Tank	Inspect air tank (11) for cracks. (Figure 2-14.)	Tank cracked or damaged.
79	After	Reflectors	Inspect reflectors (3) for cracks or damage. (Figure 2-18.)	Cracks or damage exists.
80	After	Trailer Frame	Inspect trailer frame (1) and lunette for cracks, corrosion, dents, or warping. (Figure 2-23.)	Frame or lunette is cracked, badly corroded, or warped; or lunette is missing.
81	After	Platform Skid	Inspect platform skid (1) for cracks or dents. (Figure 2-24.)	Skid has cracks or dents.
82	After	Doors	Inspect doors (3) for smooth operation, holes, dents, leaks, or damage.	Doors are inoperable, expose inside assemblies, or leak.
83	After	Panels	Inspect panels (4) for holes or other damage and for leaks.	Panels expose inside assemblies, or leak.

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

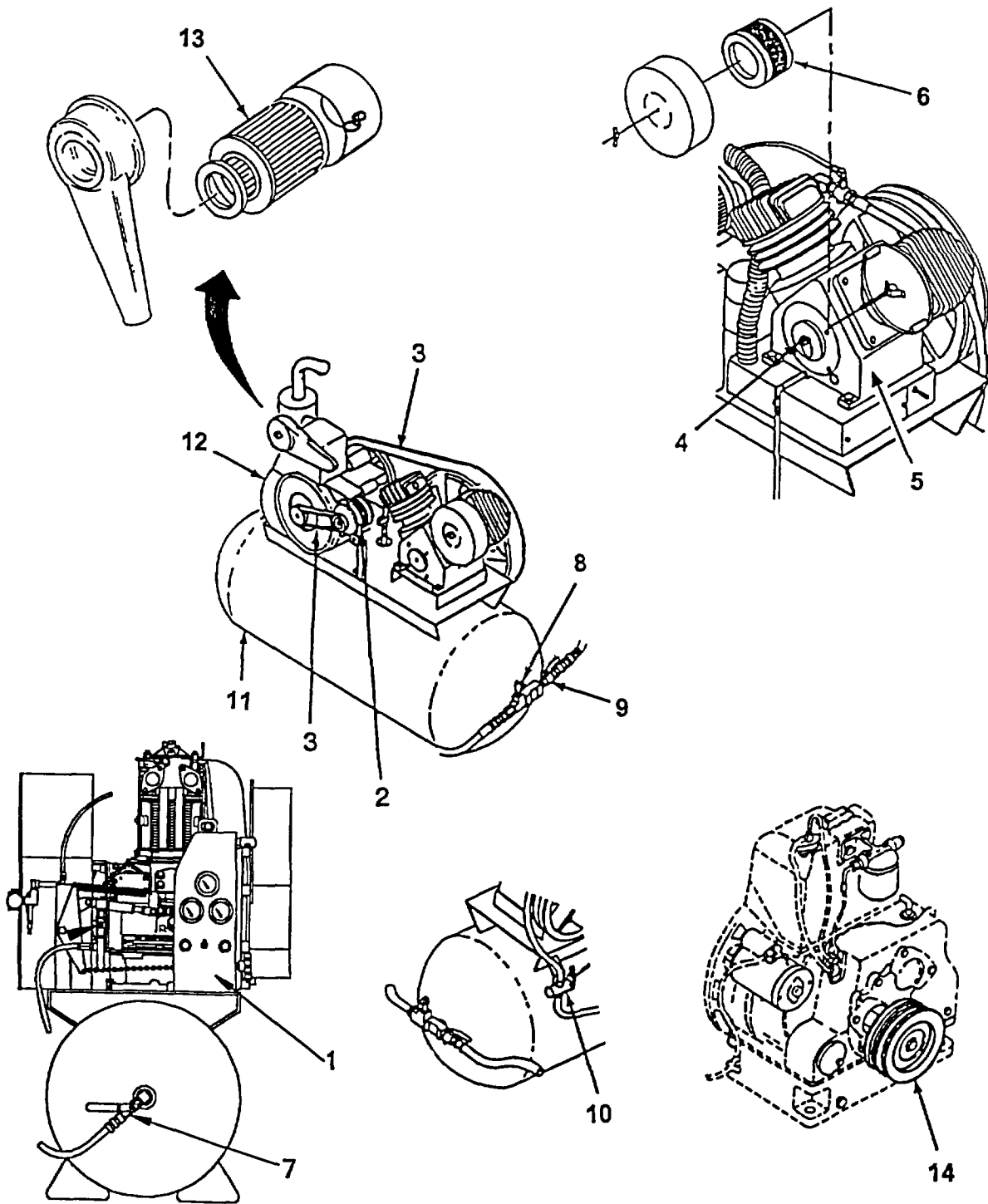


Figure 2-14. Control Panel, Air Compressor, Air Tank, Diesel Engine and Clutch

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

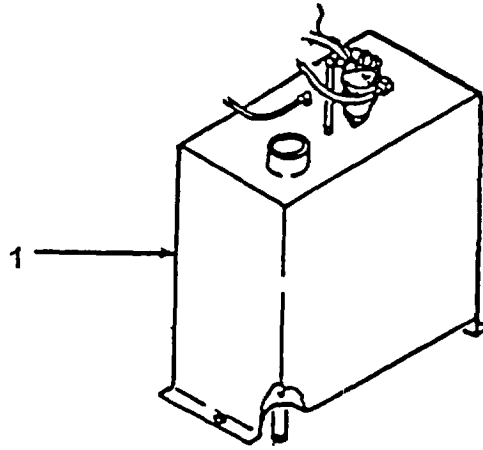


Figure 2-15. Fuel Tank

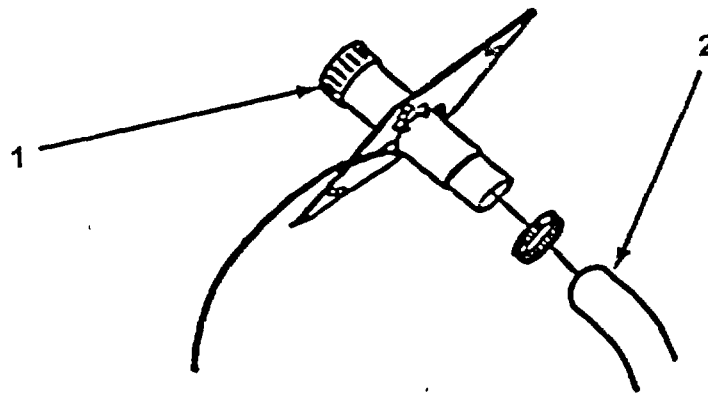


Figure 2-16. Fuel Cap and Neck

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

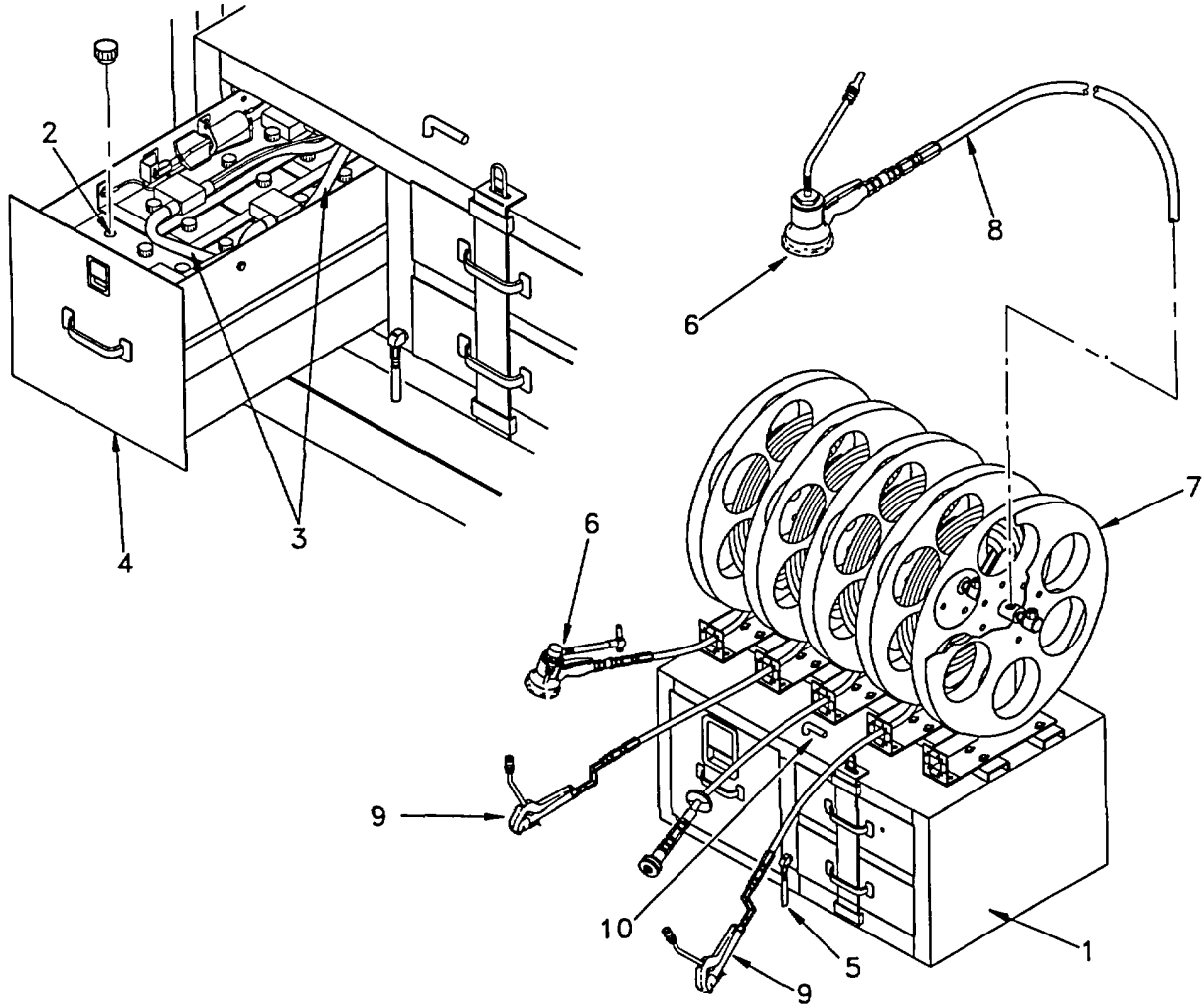


Figure 2-17. Reel Cabinet Assembly and Accessories

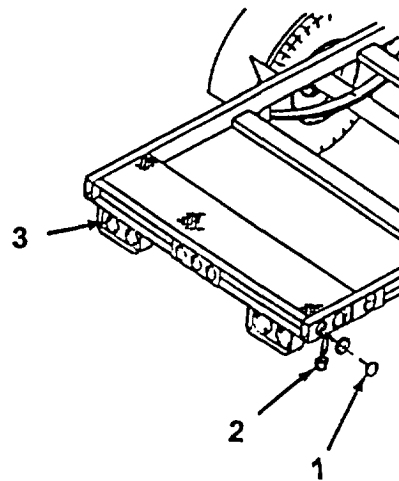


Figure 2-18. Trailer Lights and Reflectors

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

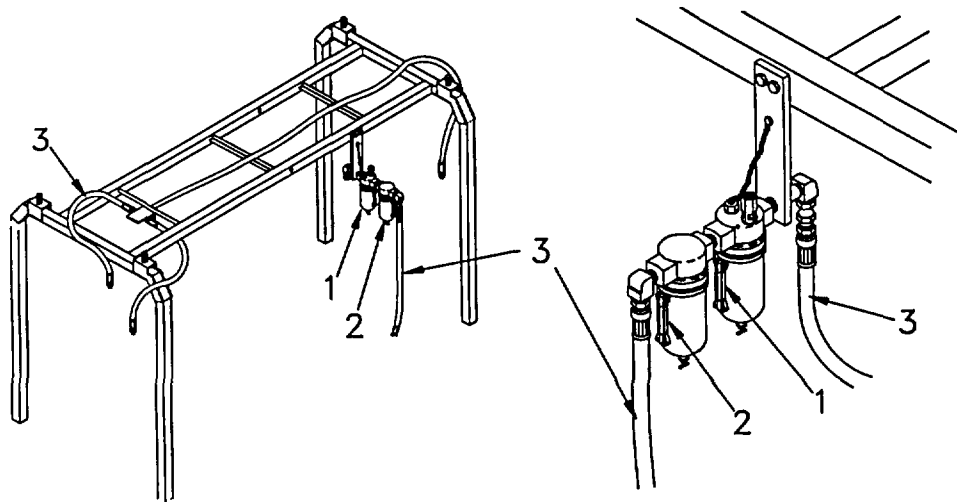


Figure 2-19. A-Frame Assembly

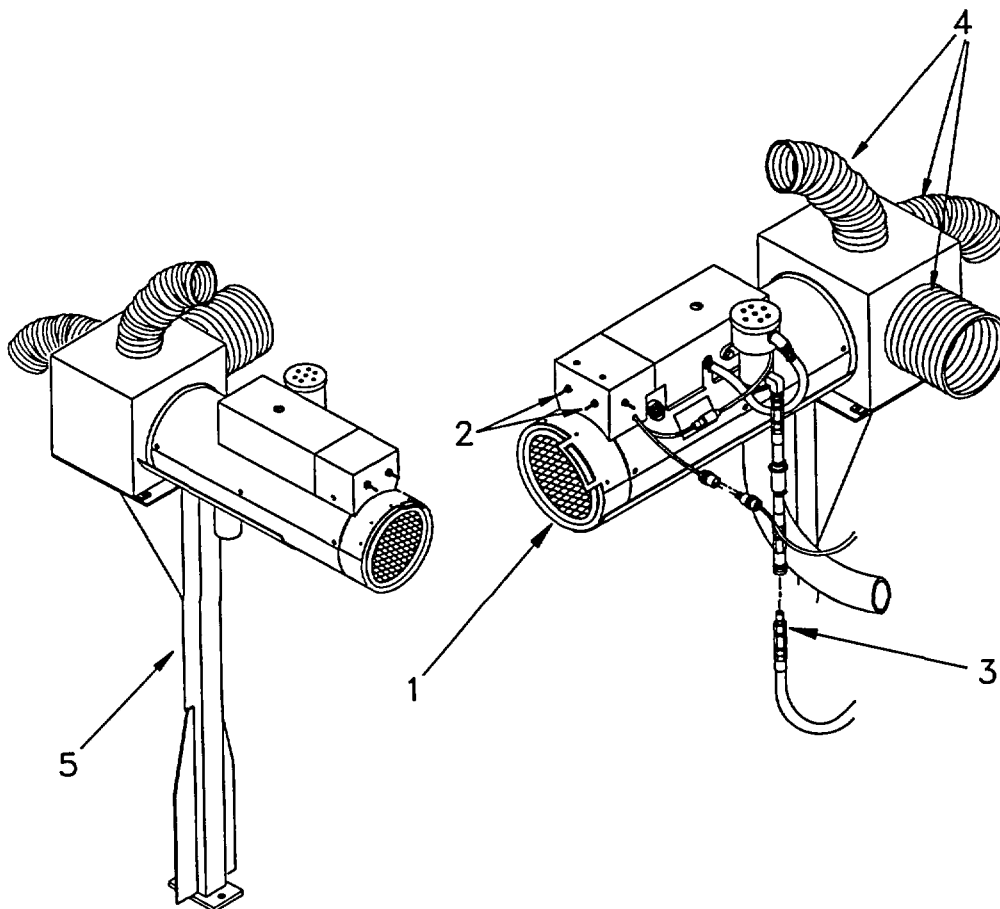


Figure 2-20. Winterization Assembly

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

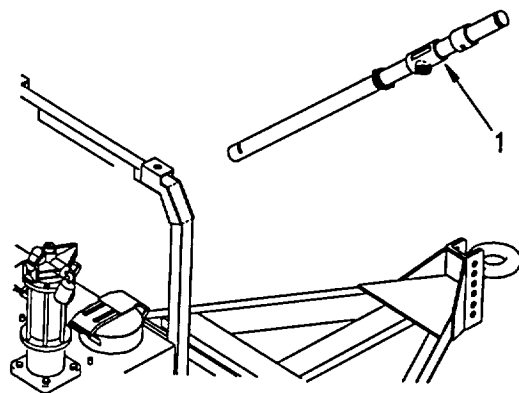


Figure 2-21. Transfer Pump

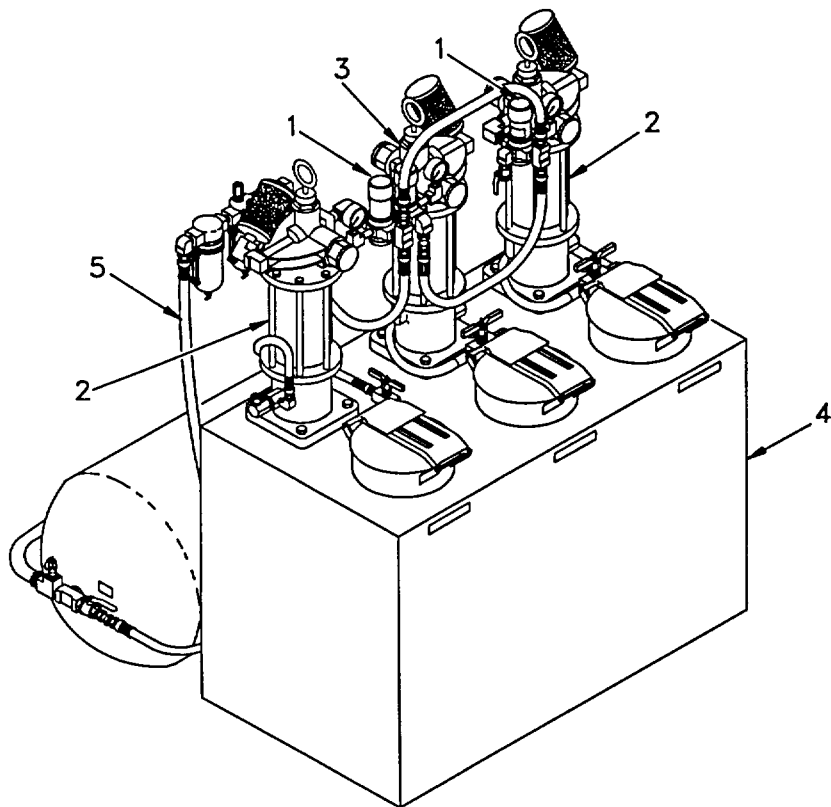


Figure 2-22. Lube Tank Assembly

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

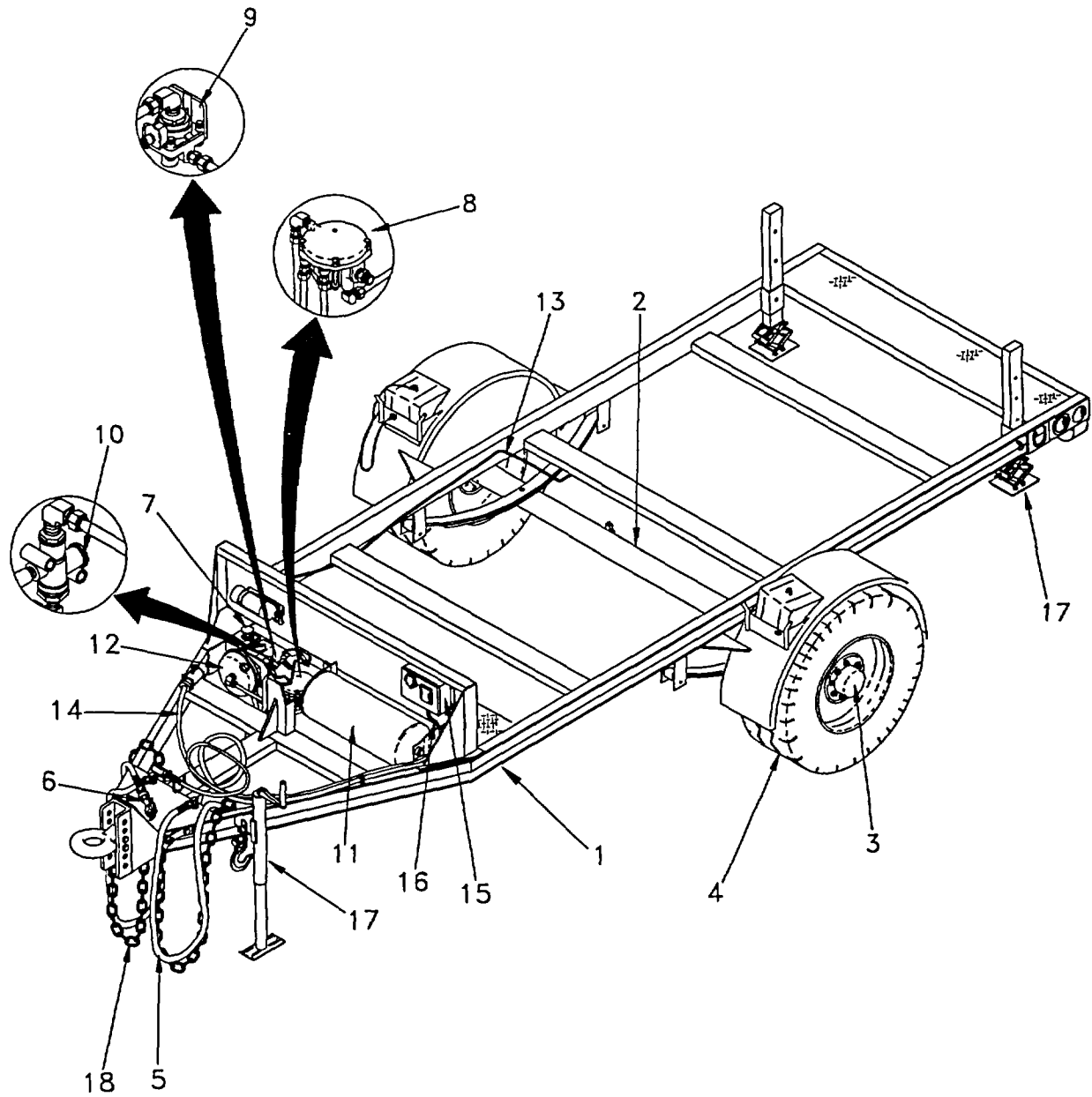


Figure 2-23. Trailer Assembly

TABLE 2-1. OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES FOR:
LUBRICATING AND SERVICING UNIT, MODEL PM92-133

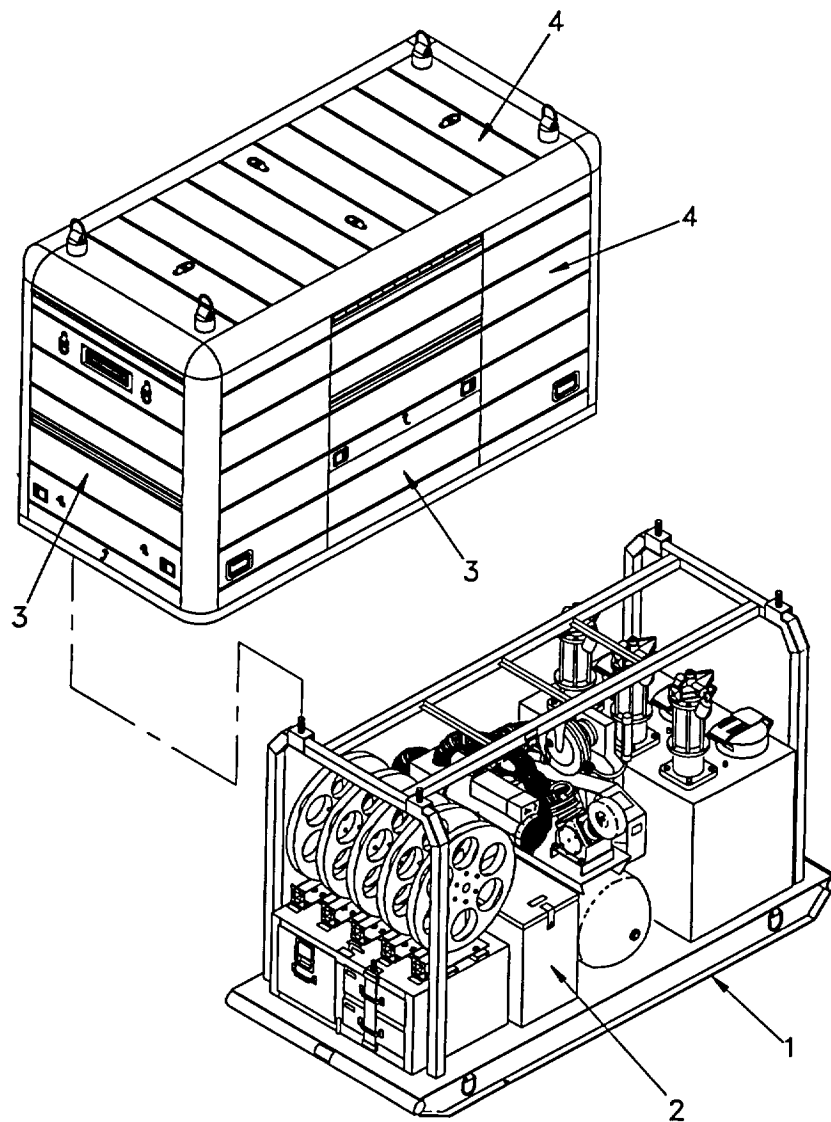


Figure 2-24. Enclosure and Skid Assemblies

Section III. OPERATION UNDER USUAL CONDITIONS

2-7. ASSEMBLY AND PREPARATION FOR USE.

- (1) No assembly or installation is required. Perform the "Initial Adjustments and Checks." Refer to paragraph 2-8 as well as Operator PMCS found in Table 2-1.
- (2) Preparation for use. (Refer to Figure 2-25).

NOTE

The following procedures apply to any of the four enclosure doors.

- (a) Open slam latches (1) on outside of door (2). Raise door up and fold.
- (b) Unlatch finger bolt latches (3) on inside of door (2). Let door hang freely.

CAUTION

- Hold door securely when raising and lowering.
- Keep fingers and hands away from hinges.

- (c) Raise door (2) up and attach hook (4) to ring (5) on top of enclosure (6).

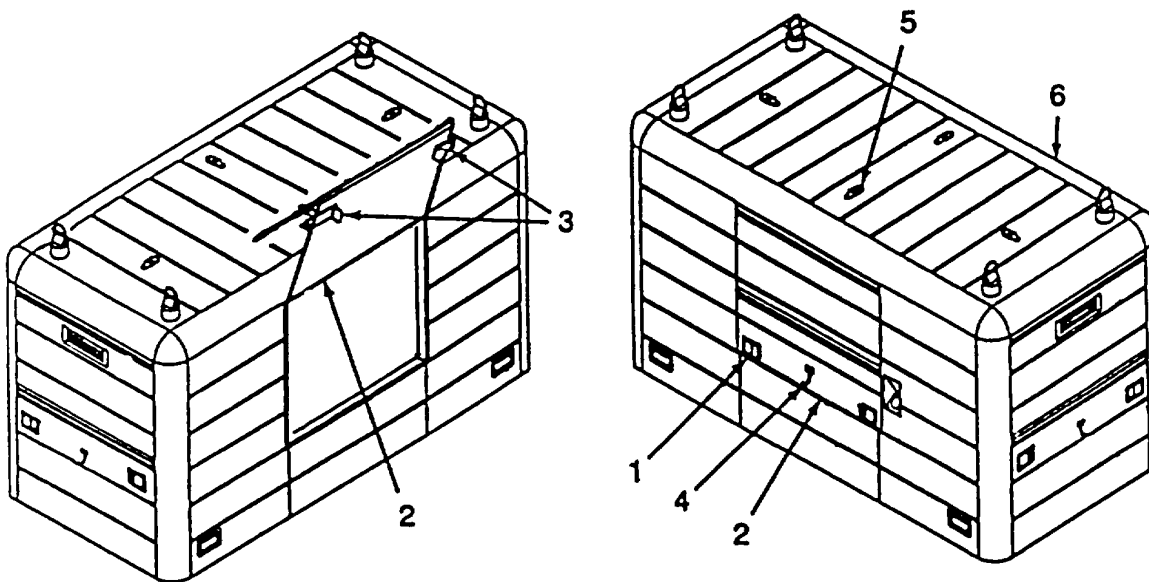


Figure 2-25. Preparation For Use (Sheet 1 of 2)

- (d) Turn condensate removal valve handle (7) to "close" position on reel cabinet assembly (8).
- (e) Close ball valve (9) on air-receiver tank (10).
- (f) Close ball valve (11) on gear lube pump (12).
- (g) Close shut-off valve (13) on air-receiver tank (10).

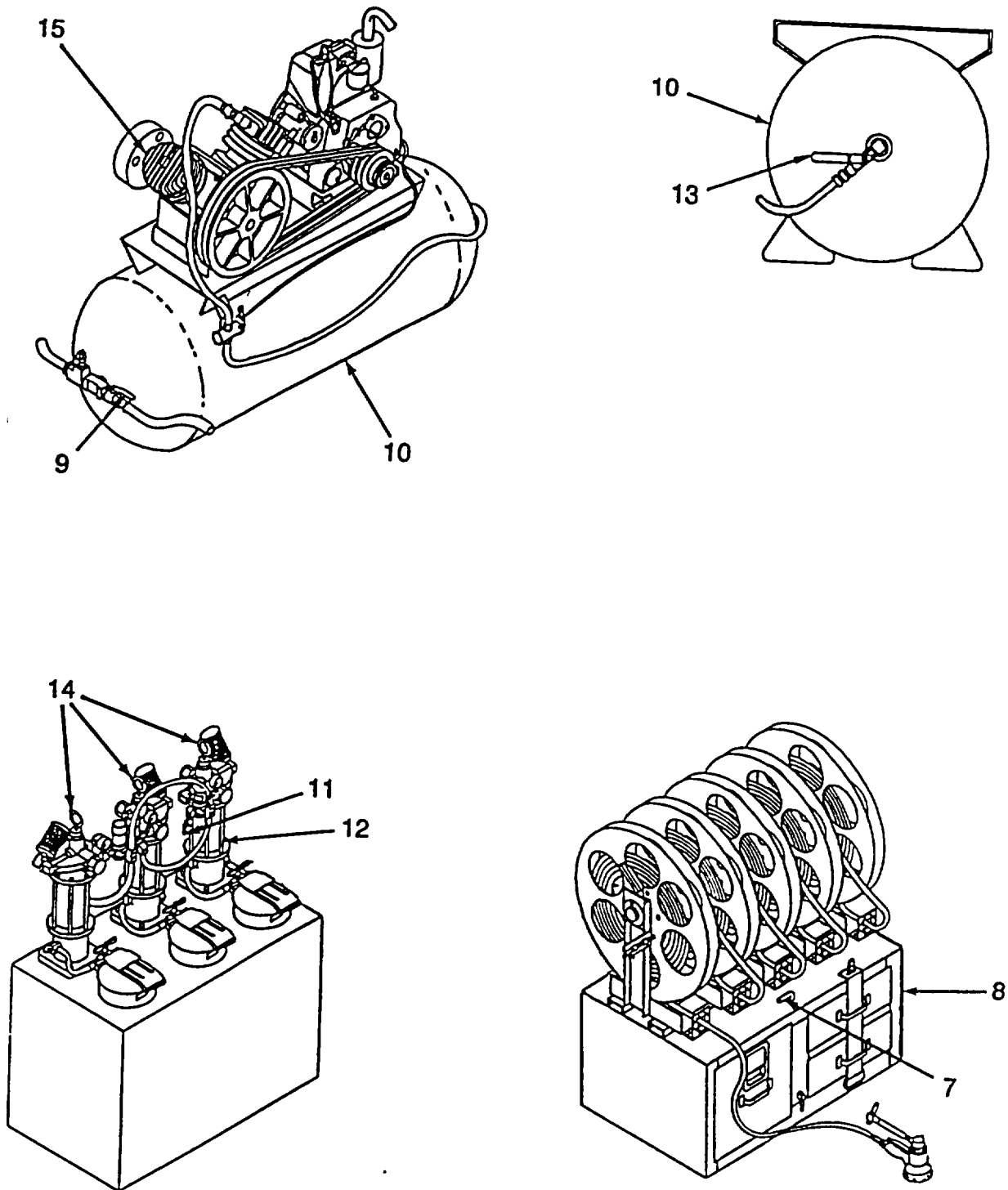


Figure 2-25. Preparation For Use (Sheet 2 of 2)

2-8. INITIAL ADJUSTMENTS AND CHECKS.

- a. Fill fuel tank with diesel fuel.
- b. Fill lube compartments with appropriate lubricants (see para. 2-9L).
- c. Check front and rear jacks to ensure unit stability (see para. 4-64).

2-9. OPERATING PROCEDURES.**WARNING**

Hearing protection is required when unit is operating. Prolonged loud noise can result in hearing loss.

- a. STARTING THE ENGINE

CAUTION

Do not crank engine for over 20 seconds. Extended cranking will drain batteries and overheat starter.

(1) NORMAL WEATHER (Refer to Figure 2-26).

- (a) Flip engine exhaust diverter valve (1) to the right, "summer" position.
 - (b) Or if clutch is engaged, disengage it by pushing handle (2) in.
 - (c) Move the engine run/stop lever (3) on engine to "run".
 - (d) Move the on/off toggle switch (4) on control panel to "on".
 - (e) Push and hold engine start button (5) on control panel until engine starts, then release.
 - (f) Open shut-off valve (13) on air-receiver tank (10) to allow air to flow from air compressor (15) to air-receiver tank (10.) **(Refer to Figure 2-25, Sheet 2).**
 - (g) Engage clutch (2), by pulling handle away from control panel.
 - (h) Allow pressure to build until the air pressure gage (6) shows a reading of between 140 and 175 psi.
 - (i) Open ball valve (9) on air-receiver tank (10) to allow air to flow to pumps (14). **(Refer to Figure 2-25, Sheet 2).**
- b. ENGINE SHUT DOWN NORMAL (Refer to Figure 2-26).
 - (1) Disengage clutch (2).
 - (2) Move the on/off toggle switch (4) to "off"
 - (3) Move the engine run/stop lever (3) on engine to "stop".

c. ENGINE SHUT DOWN EMERGENCY.

Move the engine run/stop lever (3) on engine to "stop". This will shut the engine down immediately.

d. STARTING THE ENGINE WITH ROPE STARTER (Refer to Figure 2-27).

WARNING

Do not use rope start or start engine without belt guards in place. Death or serious injury could result.

- (1) Remove three cap screws (1), three lockwashers (2), and three spacers (3) from alternator belt guard (4)
- (2) Remove alternator belt guard (4) from engine housing (5).
- (3) Flip the decompressor lever (6) all the way to the stop position (toward glow plug).

NOTE

Makes sure that the rope is threaded through the rope handle and that it is knotted at both ends.

- (4) Wind the rope (7) clockwise around the engine pulley (8) on the fly wheel end of the engine, making sure the knotted end of the rope catches the pulley (8) at the pulley slot.
- (5) Install alternator belt guard (4) to engine housing (5), placing three spacers (3) between engine housing (5) and alternator belt guard (4).
- (6) Install three cap screws (1), three lockwashers (2) into alternator belt guard (4), spacers (3) and engine housing (5), but do not tighten.
- (7) Disengage the clutch (9).
- (8) Move the engine run/stop lever (10) on engine to "run".
- (9) Move the on/off toggle switch (11) on control panel to "on".
- (10) Pull rope (7)
- (11) If the engine starts, tighten three cap screws (1).
- (12) If the engine fails to start, move on/off toggle switch (11) to "off," move engine run/stop lever to "stop," and repeat the above procedures.

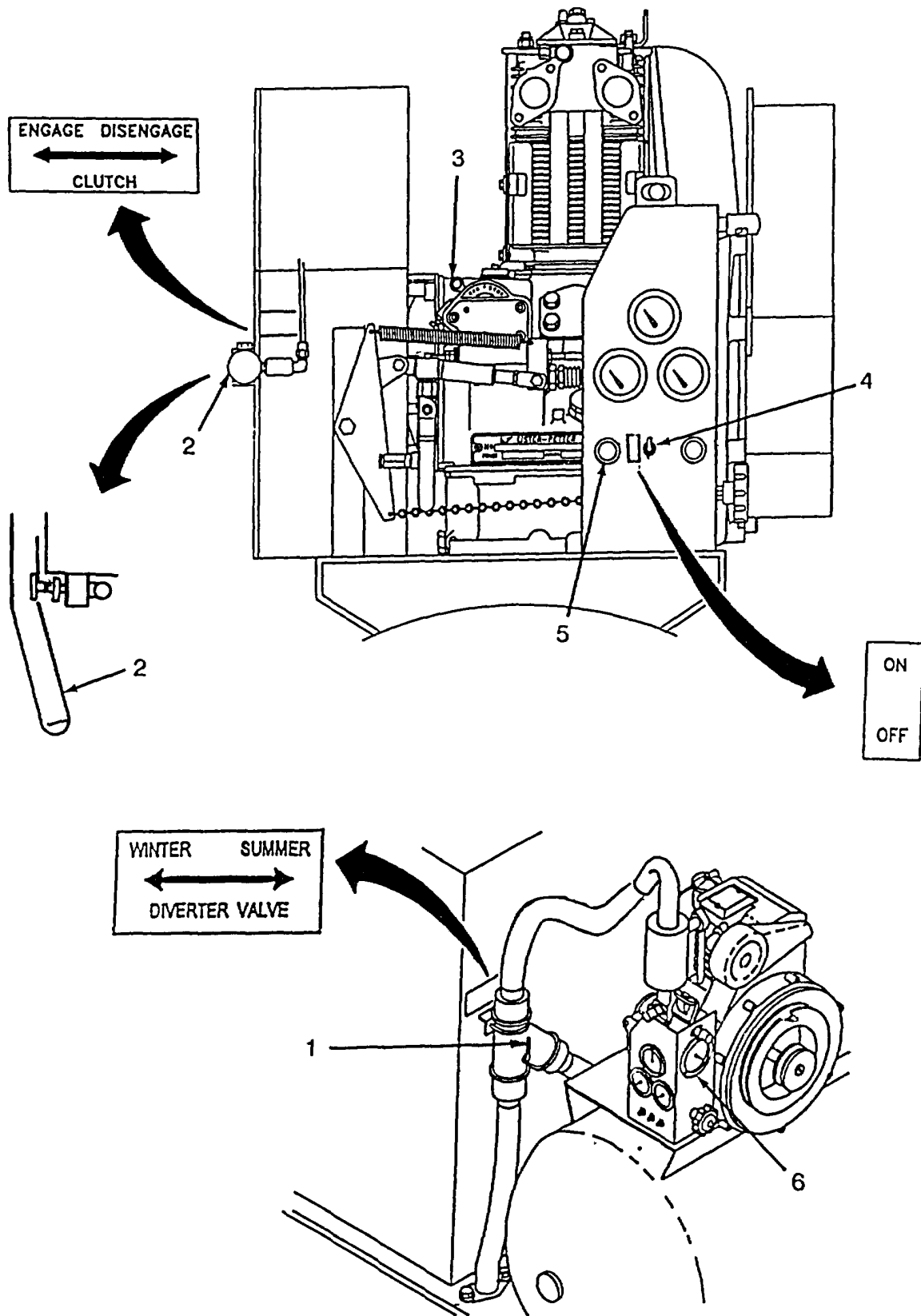


Figure 2-26. Starting and Stopping The Engine (Normal Weather)

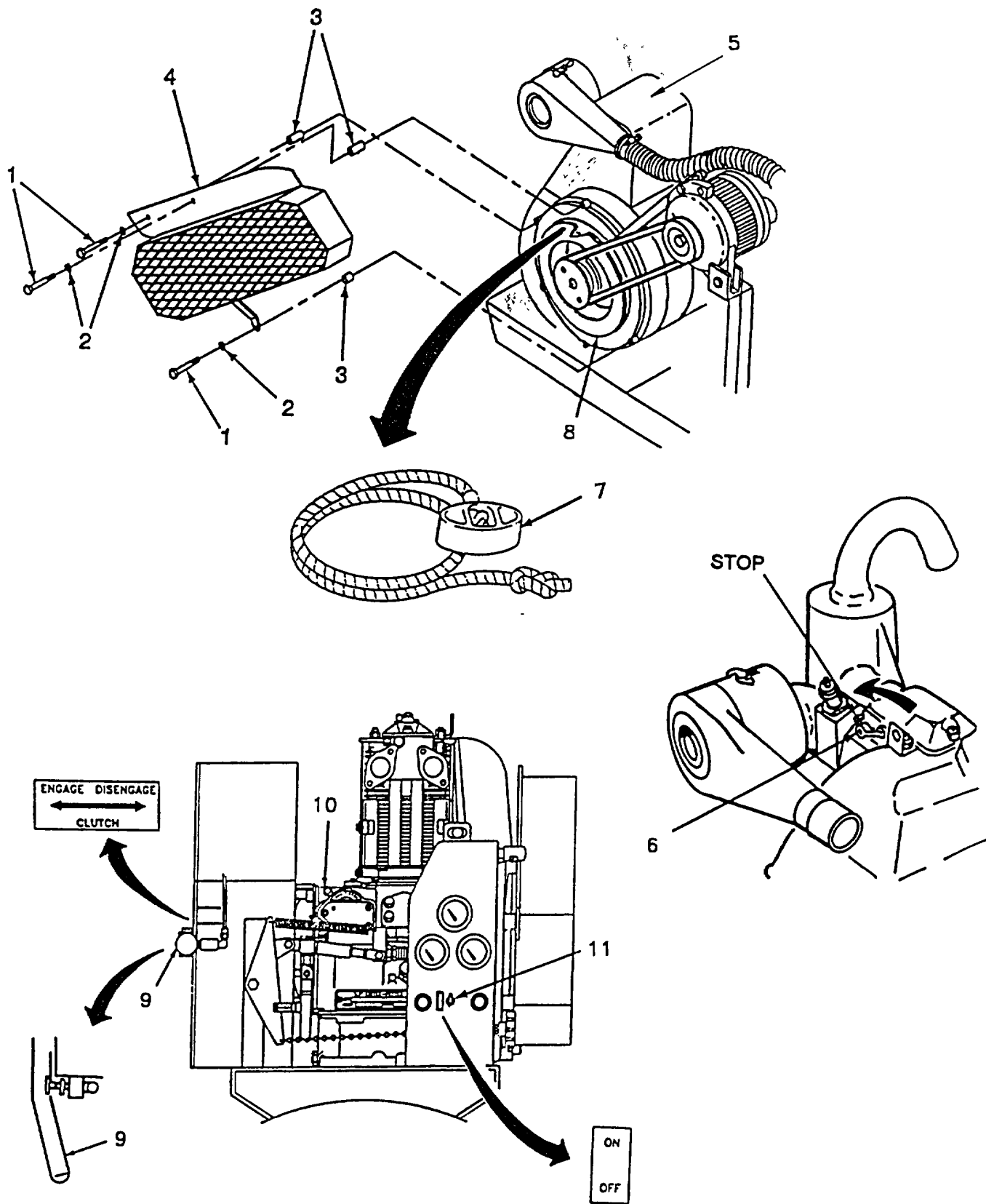


Figure 2-27. Starting The Engine With Rope Starter

e. PUMPING LUBRICANTS (Refer to Figure 2-28.)

NOTE

The engine-oil, grease and gear-lube pumps pump lubricants from the lube tank. The lube tank is divided into three compartments: one for engine-oil, one for grease, and one for gear-lube. Before dispensing any of these lubricants, you must first prime the lubricant pump(s).

- (1) To prime low pressure pumps (1) or high pressure pump (2), open the recirculation valve (3) that corresponds to the pump that you want to use.
- (2) Let the air pressure slowly increase until the pump starts cycling.
- (3) Allow the pump to cycle for a few minutes or until you know all air is expelled from the lube tank (4) and system, by opening the manhole cover (5). You can see the pumps cycling and expelling air.
- (4) Increase the air pressure as necessary. (Maximum of 100 psi for low pressure pumps (1) and maximum of 200 psi for high pressure pump (2).
- (5) As soon as pumps are primed, turn off the recirculation valve (3).

NOTE

To dispense lubricant, first determine which lubricant you need. The lubricant types are labeled on the front of the reel cabinet assembly from left to right as follows: gear lube, grease, air, grease, and engine-oil.

- (6) Pick up the control valve (6) that you need. It should be resting on control valve holder (7)
- (7) Allow the reel (8) to spin freely by releasing the hose reel lock (9).
- (8) Pull out the desired amount of hose, determine quantity of lubricant needed, and If dispensing gear lube or engine oil, set the meter on the control valve (6) accordingly.
- (9) Begin pumping by holding down the handle (10).
- (10) Finish lubricating; then roll up the hose, set the hose reel lock (9), and lay the control valve on control valve holder (7).

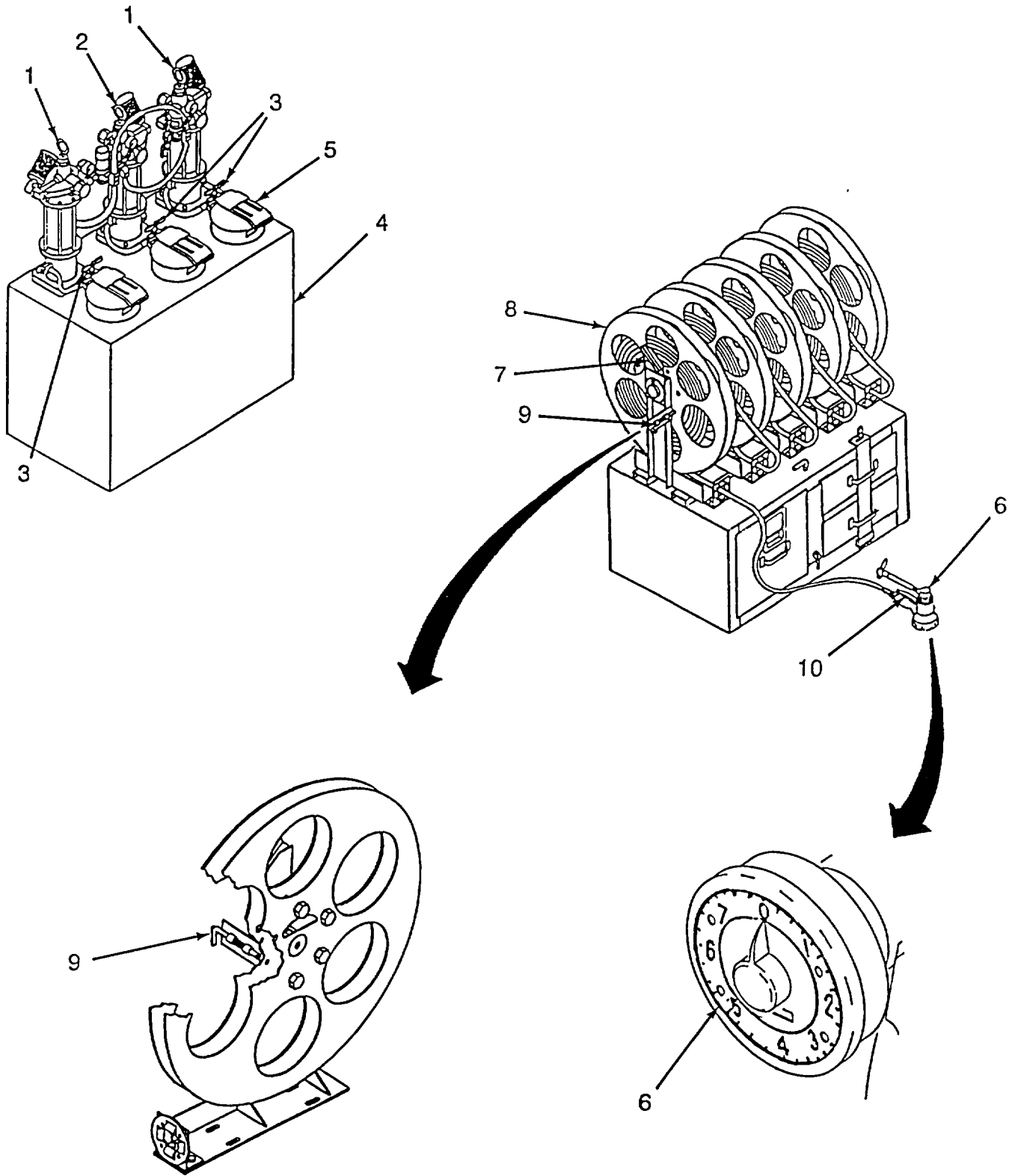


Figure 2-28. Pumping Lubricants

f. SHUT DOWN LUBE TANK OPERATIONS (Refer to Figure 2-25.)

- (1) Close ball valve (9) on air-receiver tank (10), which will stop air flow to pumps.
- (2) Open air pressure relieve valve (11), relieving air pressure in all pump lines.

g. PREPARATION FOR MOVEMENT (Refer to Figure 2-29.)

- (1) Hold scissor jack (1) with one hand and pull out pin (2) with other hand.
- (2) Slide scissor jack (1) up and into jack guide (3).
- (3) Align lowest hole in scissor jack (1) with hole in jack guide (3).
- (4) Install pin (2).
- (5) Remove safety pin (4) on towing vehicle and pull up on locking latch (5) to lift pintle hook (6).
- (6) Align towing vehicle with trailer lunette (7). If necessary, remove two locknuts (8) and two bolts (10) and move trailer lunette (7) to correct position. Install two bolts (10) and two locknuts (8) to secure trailer lunette (7).
- (7) Back towing vehicle in front of trailer lunette (7). Using the front jack leg (11), raise trailer lunette (7) and back towing vehicle until pintle hook (6) is directly under trailer lunette (7). Lower onto pintle hook (6).
- (8) Push down and close pintle hook (6). Check that locking latch (5) is locked by pulling up on hook upper jaw of pintle hook (6). Insert safety pin (4).

CAUTION

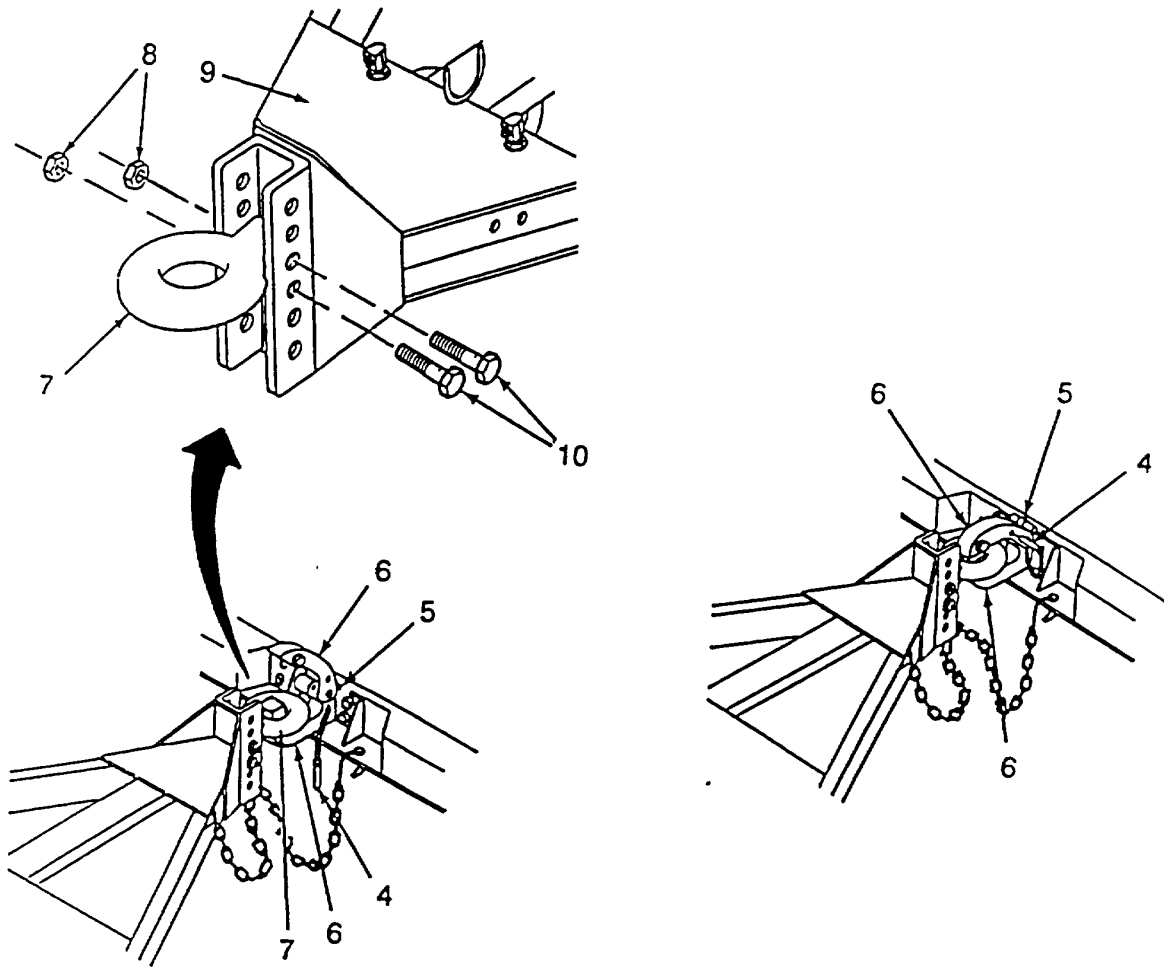
Safety chains should be crossed under lunette to support trailer (9) in the event that the trailer detaches from the towing vehicle. Be sure to have enough slack to allow trailer to make full turns.

- (9) Cross two safety chains (12) under trailer lunette (7) and hook on towing vehicle. Secure safety chains (12) to prevent dragging.
- (10) Connect both service brake (14, blue) and emergency brake (13, red) hose assemblies to the towing vehicle. Open towing vehicle shutoff valves (refer to towing vehicle operator manual). Apply towing vehicle air brakes to pressurize air brake system.

NOTE

Determine voltage of towing vehicle.

- (11) Connect one end of either 12 Vdc connector (15) or 24 Vdc connector (16) to towing vehicle electrical receptacle and other end to voltage reducer box receptacle (20).
- (12) Raise front jack leg (11) to stowed position.
- (13) Place both chock blocks (17) into stowage brackets (18). Secure cables out of the way.
- (14) Release parking brake by pushing knob (19) of parking brake control valve down.



TRAILER ENLARGE
FROM TOW VEHICLE

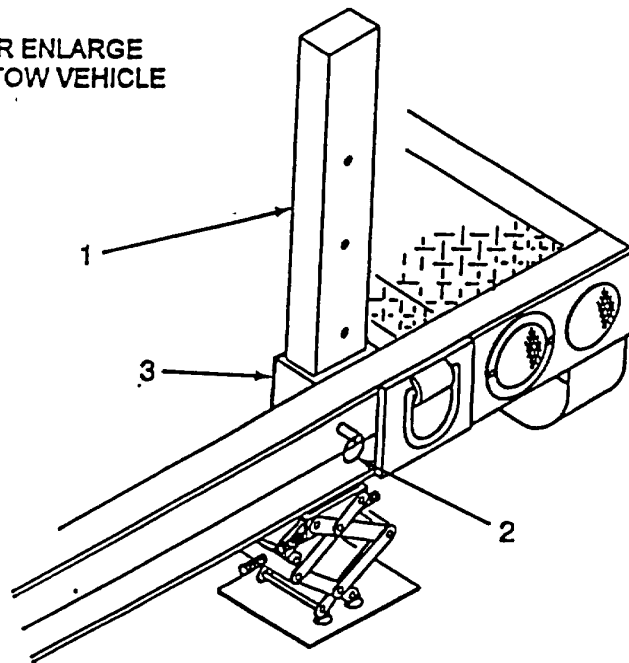


Figure 2-29. Preparation For Movement (Sheet 1 of 2)

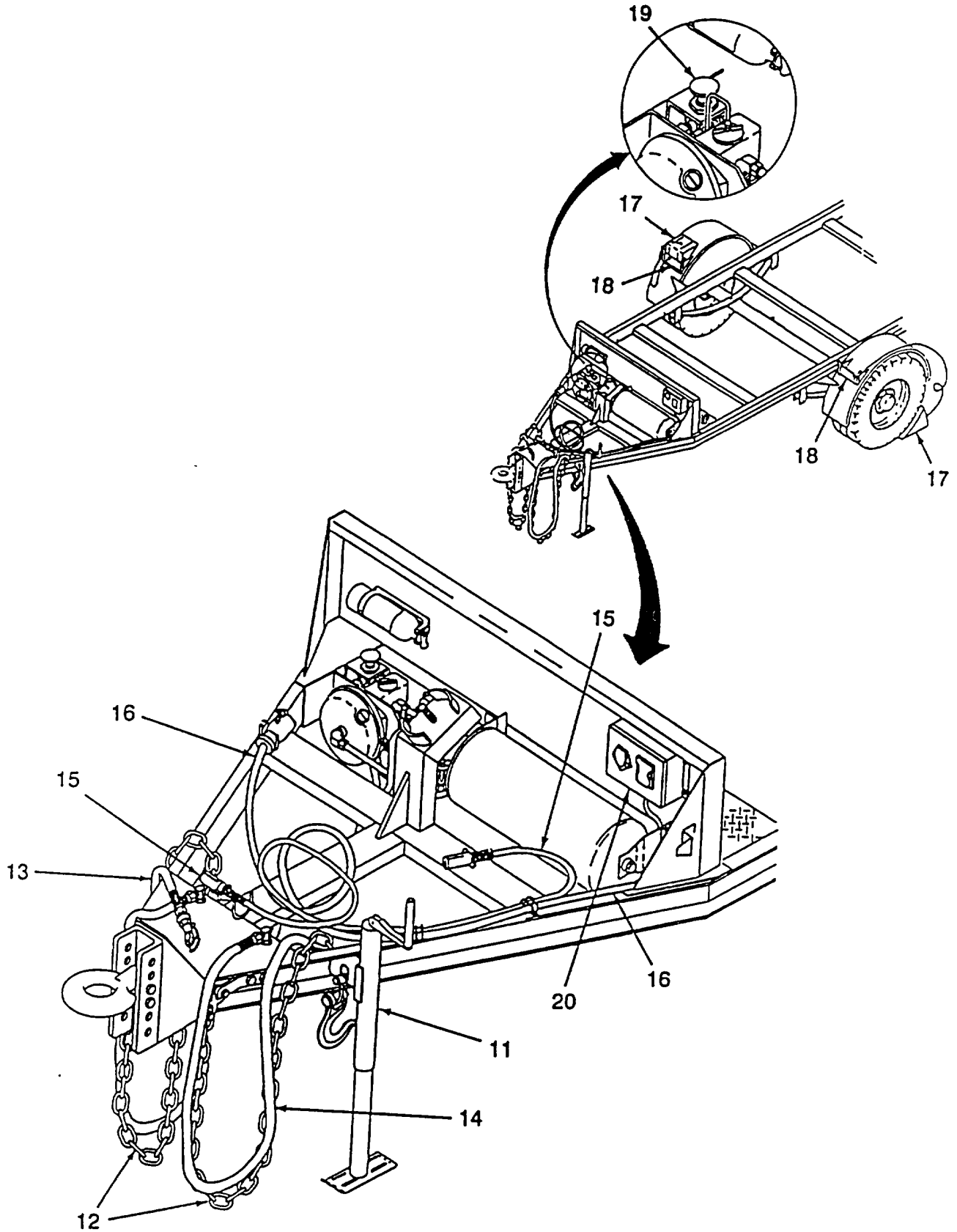


Figure 2-29. Preparation For Movement (Sheet 2 of 2)

h. DRIVING AND PARKING (Refer to Figure 2-30.)

CAUTION**Sudden stops may cause the drawbar to bend or buckle.**

- (1) When trailer is attached, always start and stop the towing vehicle slowly and gradually. Do this whether or not the trailer is loaded.
- (2) Never exceed maximum highway speeds or 10 mph (16 kph) for cross country driving
- (3) When driving the towing vehicle with trailer attached, overall length of the unit must be kept in mind when turning and passing other vehicles. Because the unit is hinged in the middle, turning and backing are also affected. Heavier payloads will increase stopping distance and decrease off road maneuverability.
- (4) When turning corners, allow for the fact that the trailer wheels turn Inside the turning radius of the towing vehicle To make a right turn at a road intersection, drive the towing vehicle part way into the intersection and then cut sharply to the right. This will allow for the turning radius of the trailer and keep it off the curb
- (5) Always back the towing vehicle slowly and gradually. Whenever possible, the assistant driver or another person will act as a ground guide to assist and direct the driver.
- (6) When backing, the rear of the trailer will move in the opposite direction In which the towing vehicle is turned. When the towing vehicle has turned and backing in a straight line required, turn the towing vehicle in the direction the trailer is moving. This will slowly bring the towing vehicle and trailer into a straight line.
- (7) In normal operation the brakes of the towing vehicle and trailer are applied at the same time when the driver steps on the brake pedal. Brake pressure must be applied gradually and smoothly. With some towing vehicles the trailer brakes can be applied separately by using a brake control (refer to towing vehicle operator manual). On steep grades or slippery surfaces, the trailer brakes should be applied before the towing vehicle brakes, if possible. This will reduce the possibility of jackknifing the trailer.
- (8) When the towing vehicle and trailer are to be left unattended, set the towing vehicle parking brake, turn off the engine and set the chock blocks.
- (9) After towing, lower the trailer front jack leg (1).
- (10) Position two chock blocks (2) behind or in front of wheels of trailer, dictated by direction of slope.
- (11) Disconnect either 12 Vdc connector (3) or 24 Vdc connector (4) from towing vehicle.

WARNING

Trailer wheels must be chocked even if parking brake is applied The parking brake will release within 1 1/2 hours and if not correctly chocked, the trailer may roll causing severe personal injury or death

- (12) Apply parking brake by pulling knob on parking brake control valve (5).
- (13) Disconnect both service brake (7) and emergency brake (6) hose assemblies from the towing vehicle.

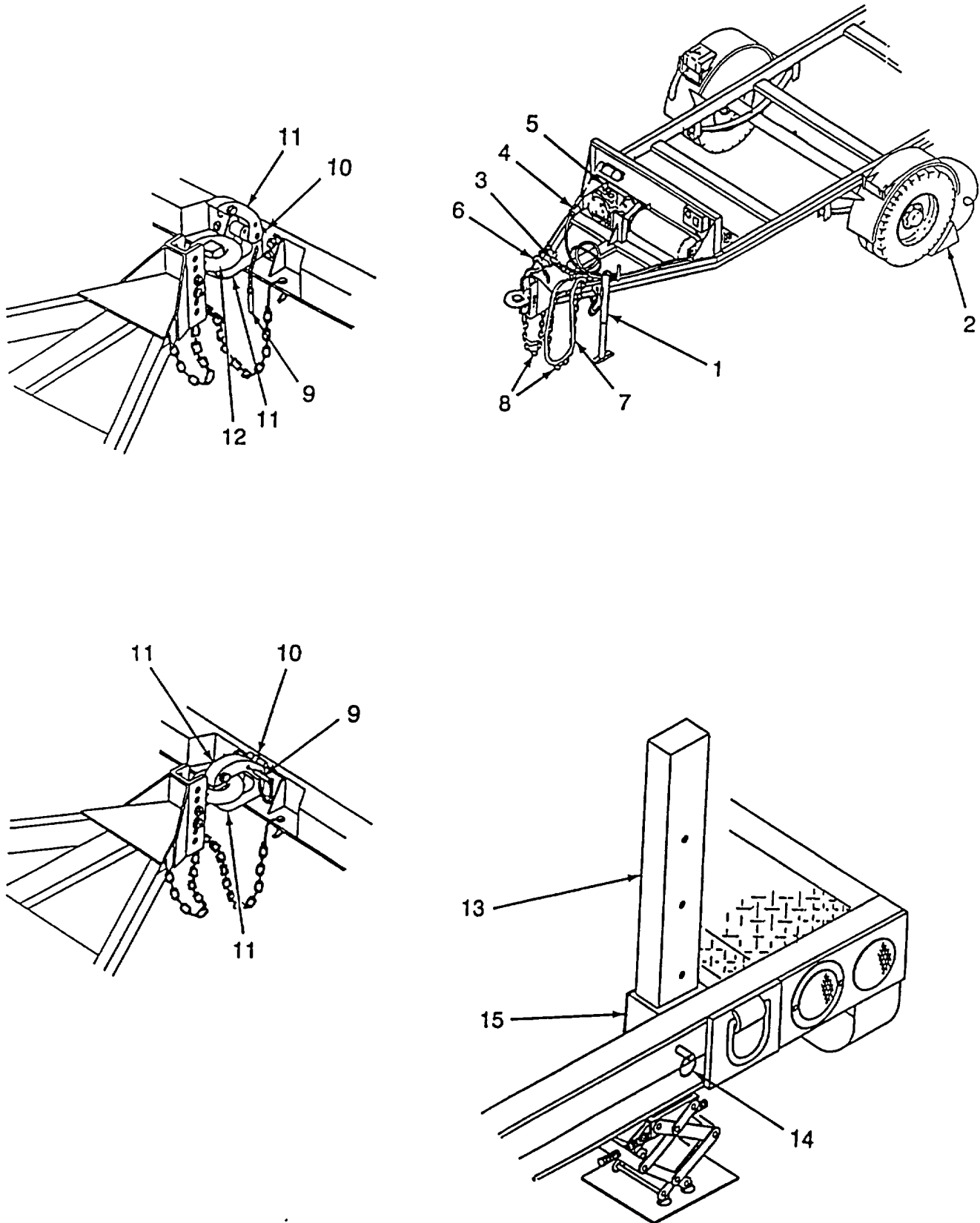


Figure 2-30. Driving and Parking

- (14) Unhook two safety chains (8) from towing vehicle.
- (15) Remove safety pin (9) on towing vehicle and pull up on locking latch (10) to lift pintle hook (11).
- (16) Using the front jack leg (1), raise trailer lunette (12) off of pintle hook (11). Slowly move towing vehicle forward to clear trailer lunette.
- (17) Push down and close pintle hook (11). Check that locking latch (10) is locked by pulling up on pintle hook. Insert safety pin (9)

NOTE

Repeat step (18) on both sides of trailer.

- (18) Hold rear scissor jack (13) with one hand and pull out pin (14) with other hand.
- (19) Slide rear scissor jack (13) down jack guide (15).
- (20) Align top hole in rear scissor jack (13) with hole in jack guide (15) and install pin (14)
- (21) Lower scissor jack (13) until it contacts surface.
- (22) The lube unit is now in operational position for use.

i. FILLING THE LUBE TANK. (Refer to Figure 2-31).

- (1) Make sure the condensate removal valve (1) is in the "closed" position.
- (2) Start the engine (Para. 2-9a).
- (3) Air pressure in air receiver tank (2) will automatically build up to 175 psi. A mechanical control shuts off the compressor at 175 psi and turns it back on if pressure falls below 140 psi. A safety valve is set to release air into atmosphere when pressure in tank exceeds 200 psi.
- (4) Allow pressure to build until the air pressure gage (3) shows a reading of between 140 and 175 psi, before using the transfer pump.

NOTE

Transfer pump cannot be used to pump grease.

- (5) Remove transfer pump (4) from front compartment of enclosure. Remove bung wrench (5) from lower drawer of reel cabinet assy (6). Using bung wrench (5) remove plug from drum. Install transfer pump (4) into drum of lubricant to be dispense.
- (6) Grease must be hand-packed into the grease compartment (7) of the lube tank (8).
- (7) Remove the transfer pump hose assembly (9) from the tool box assembly (10) and install onto transfer pump (4).
- (8) Pull out the air service hose (11) from the center reel assembly (12) and attach air service hose (11) to the transfer pump (4).
- (9) Open the lubricant manhole (13) of the lube tank (8) compartment to be filled and insert the transfer pump hose assembly (9).

NOTE

Always keep lubricant compartments at least 3/4 full.

LUBRICANT TABLE

LOCATION	CAPACITY	TYPE OF LUBRICANT
Engine Oil Compartment	27 Gallons	OE/HDO 15/30-40 (0-1236)
Grease Compartment	23 Gallons	GAA (F) (G-403)
Gear Lube Compartment	27 Gallons	GO-80/90 (0-226)

- (10) Open the ball valve (14) on transfer pump assembly to required air volume.
- (11) Fill lubricant compartments in lube tank (8) to capacity indicated in LUBRICANT TABLE above.
- (12) When compartment (8) is filled, close ball valve (14) on transfer pump assembly.
- (13) Disconnect air service hose (11) and reel it back onto center reel assembly (12).
- (14) Remove transfer pump hose assembly (9) from transfer pump (4), and drain any remaining lubricant back into drum. Remove transfer pump hose assembly (9) from drum; clean and store in tool box (10).
- (15) Clean and store transfer pump (4) in original position.
- (16) Using bung wrench (5) re-install plug into drum; clean and store bung wrench (5) in lower drawer of reel cabinet assy (6).
- (17) Shut down engine by turning power switch (15) on control panel (16) to "off" position.
- (18) Open the condensate removal valve (1) to drain moisture from the air receiver tank (2).

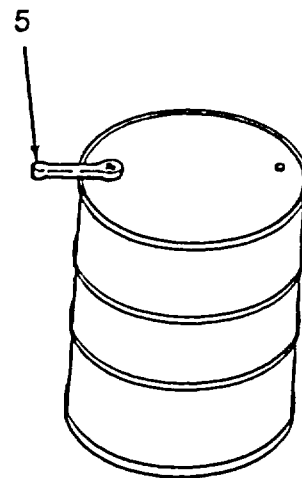
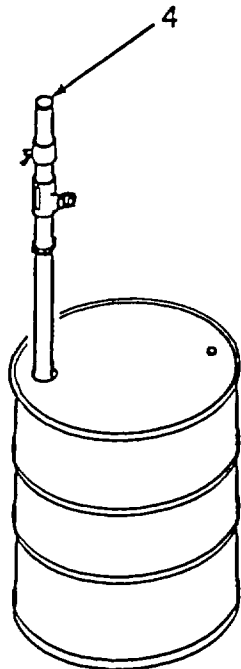
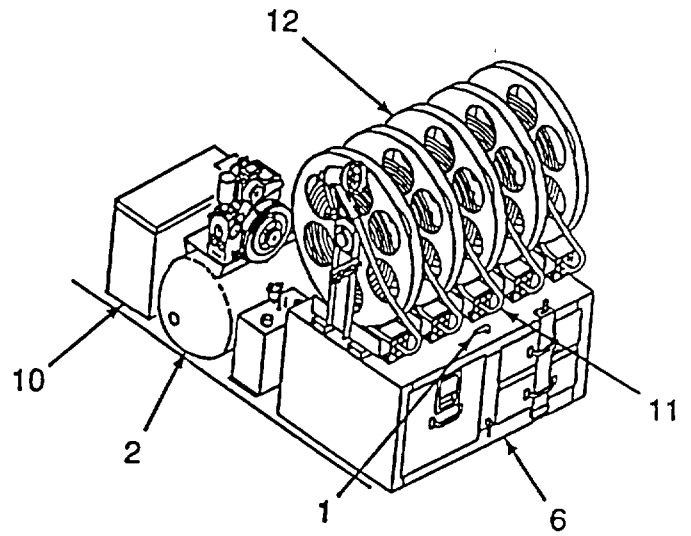
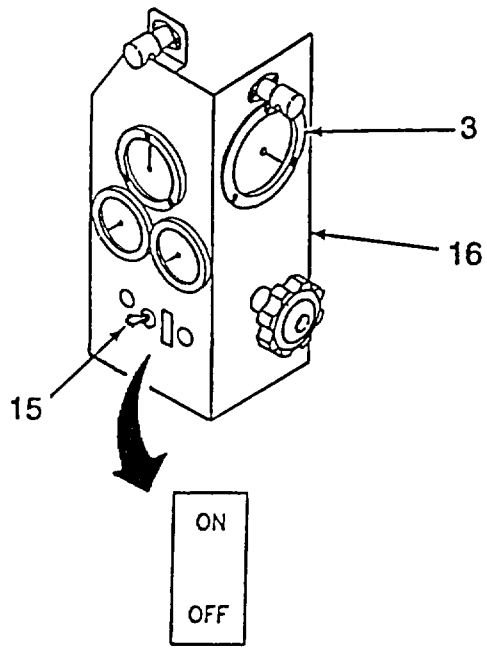


Figure 2-31. Filling The Lube Tank (Sheet 1 of 2)

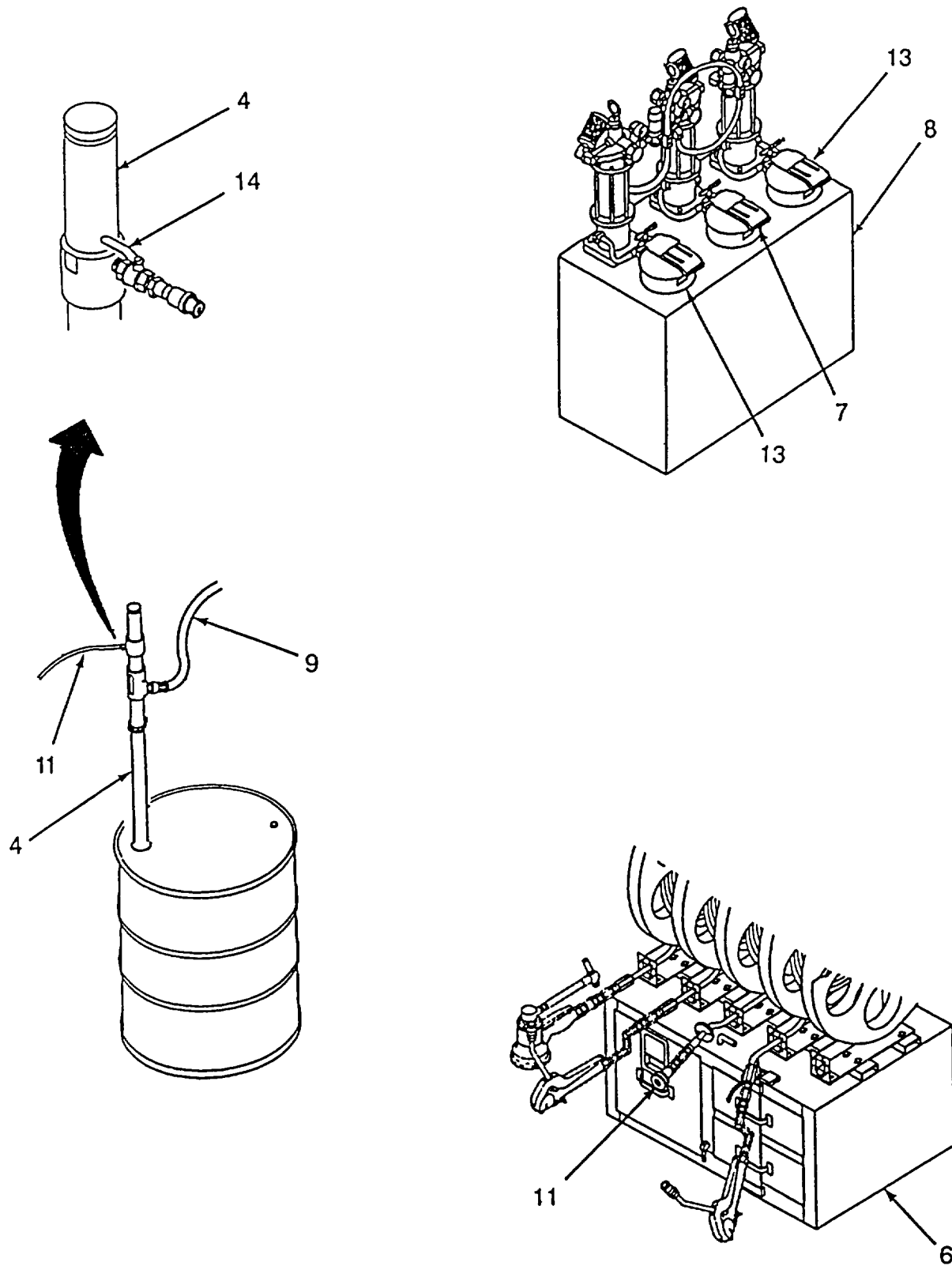


Figure 2-31. Filling The Lube Tank (Sheet 2 of 2)

2-10. DECALS AND INSTRUCTION PLATES. Refer to Figure 2-32 for location and description of decals and instruction plates used on the lubricating and servicing unit.

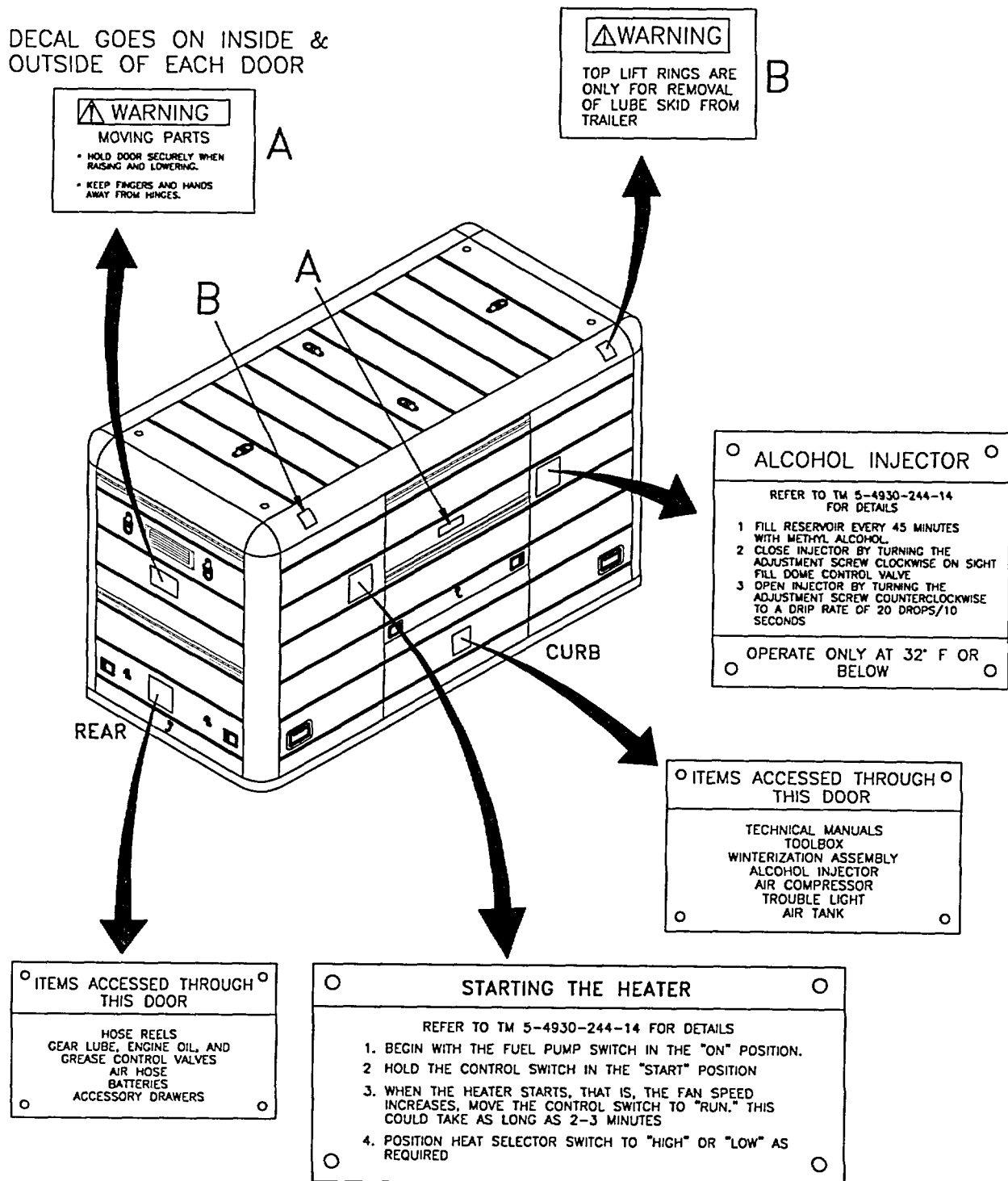


Figure 2-32. Decals and Instruction Plates (Sheet 1 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

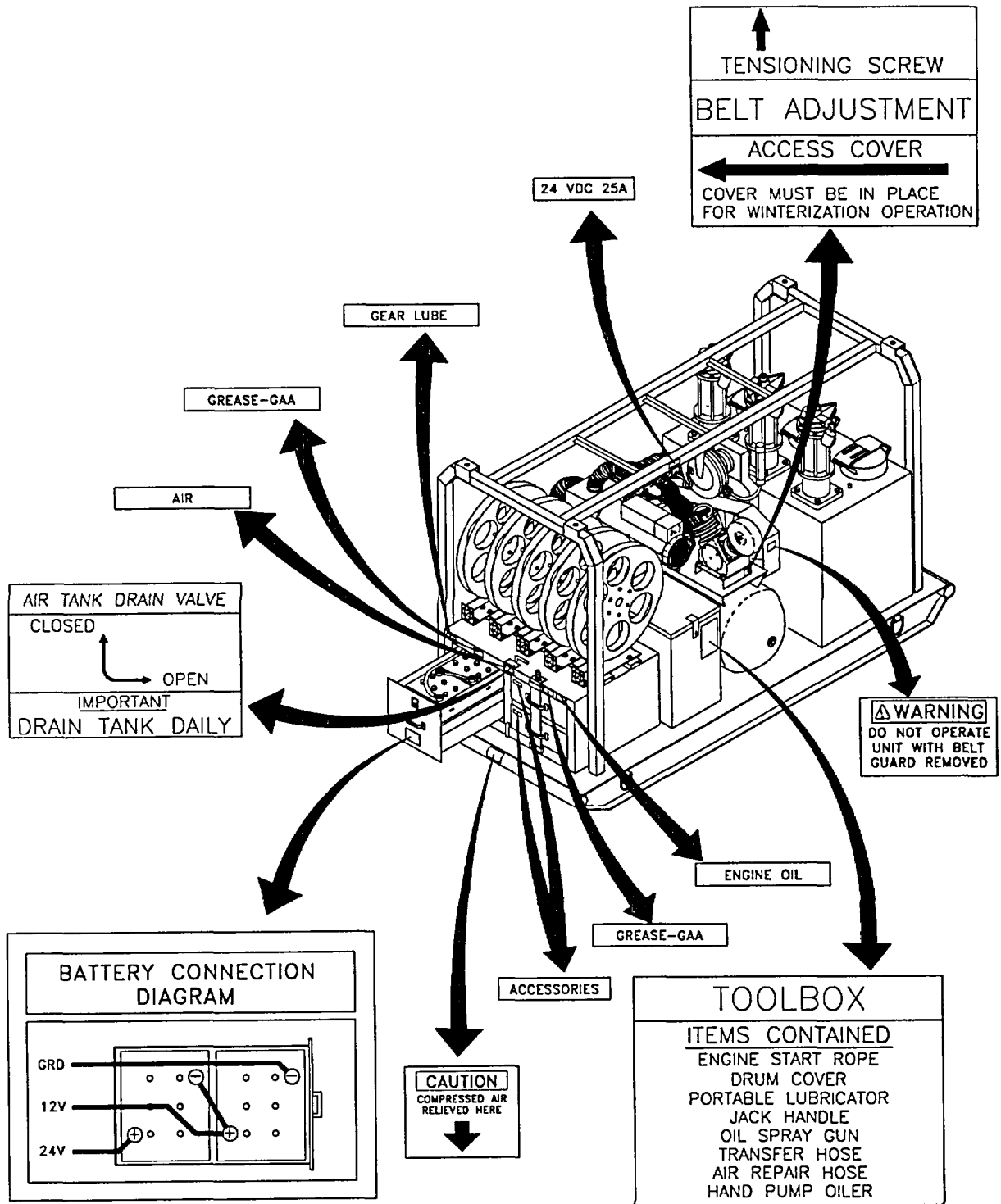


Figure 2-32. Decals and Instruction Plates (Sheet 2 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

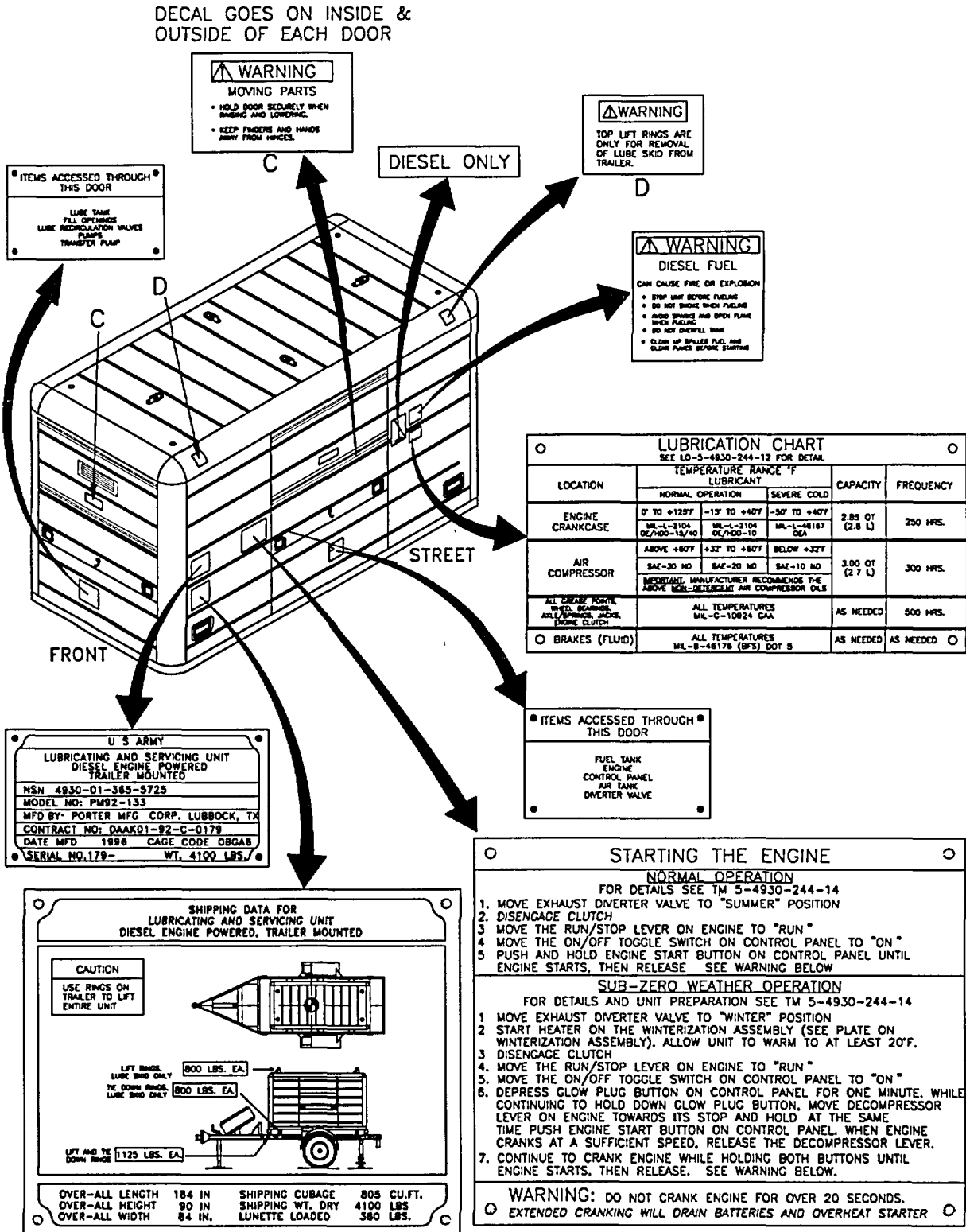


Figure 2-32. Decals and Instruction Plates (Sheet 3 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

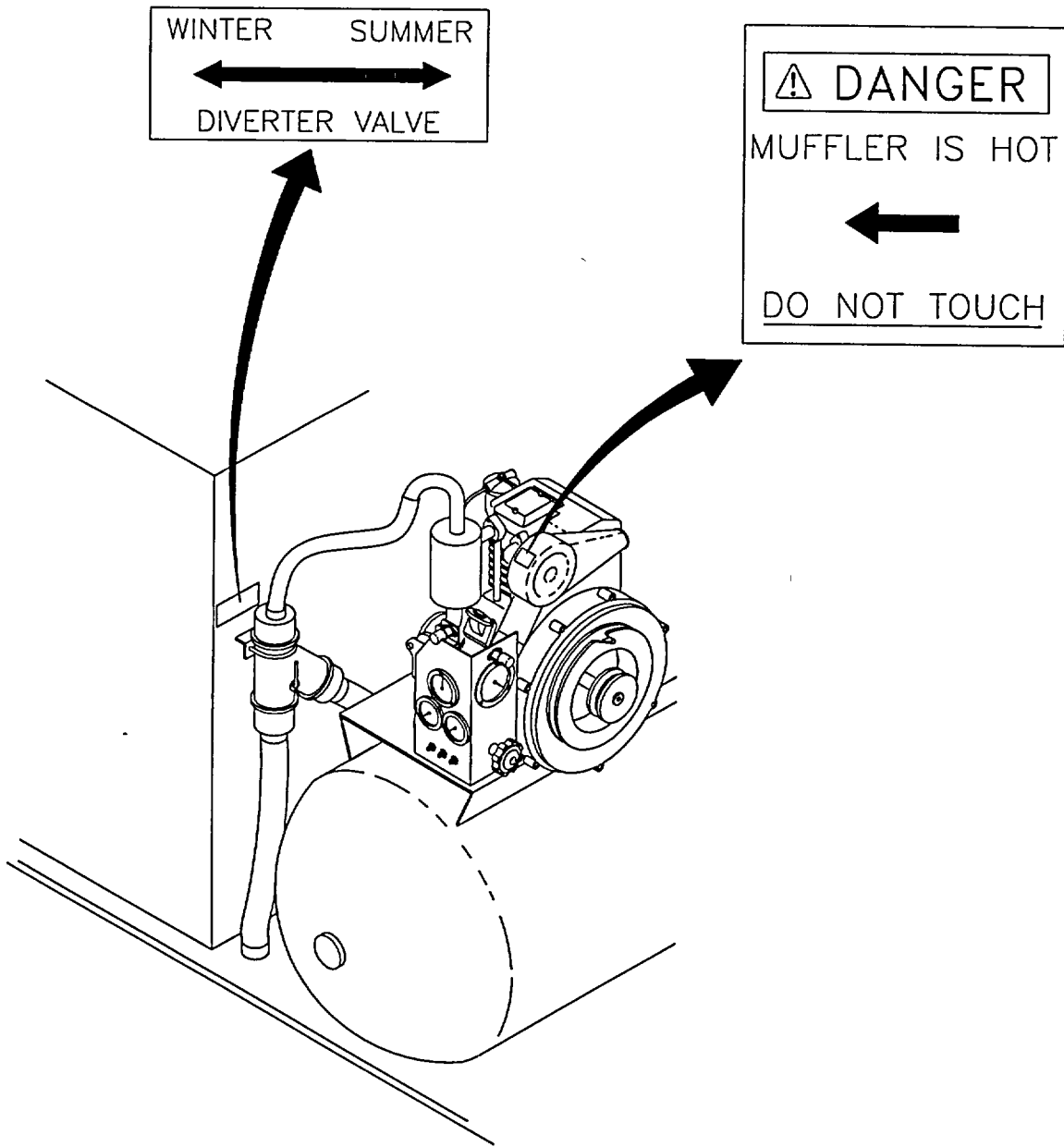


Figure 2-32. Decals and Instruction Plates (Sheet 4 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

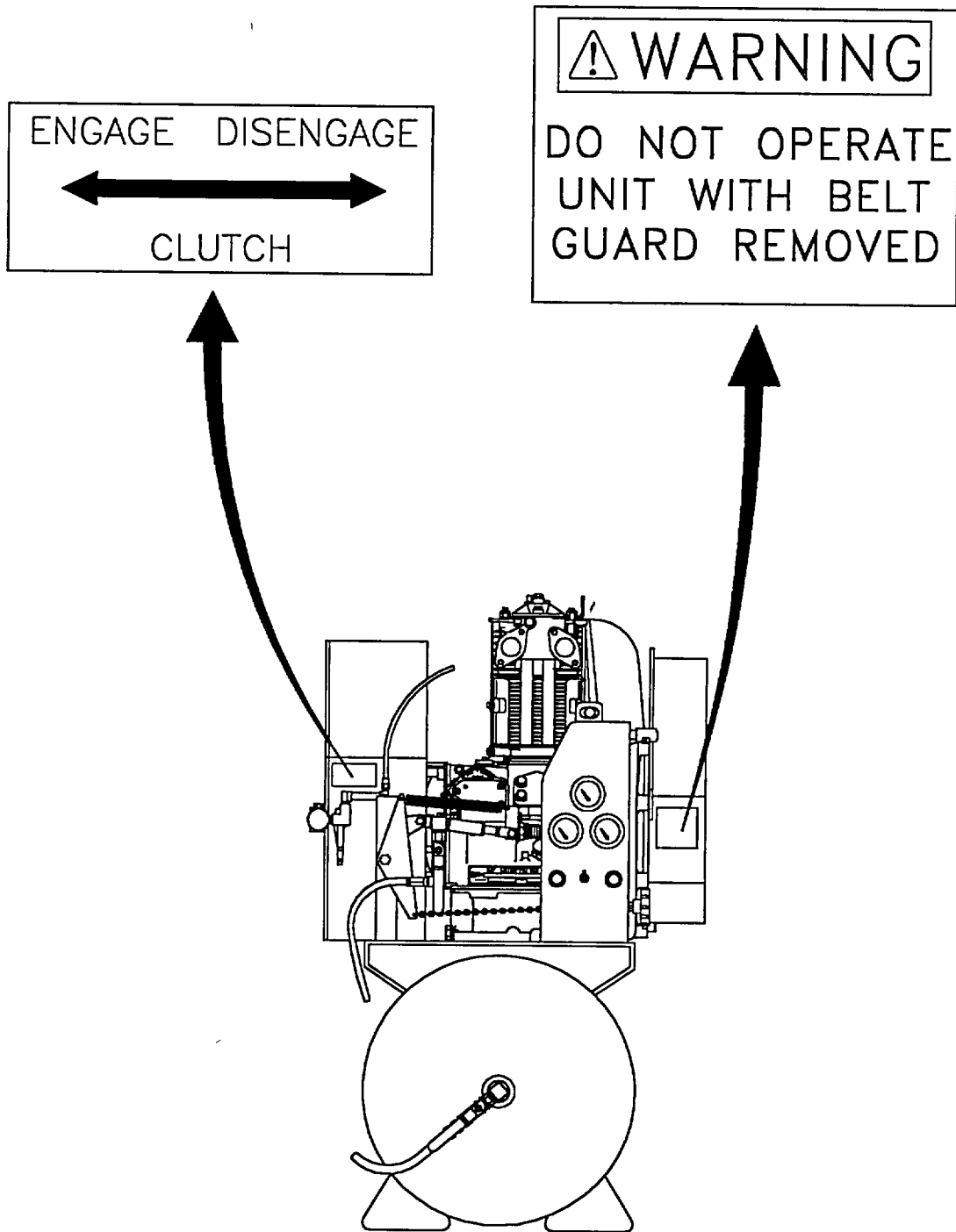


Figure 2-32. Decals and Instruction Plates (Sheet 5 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

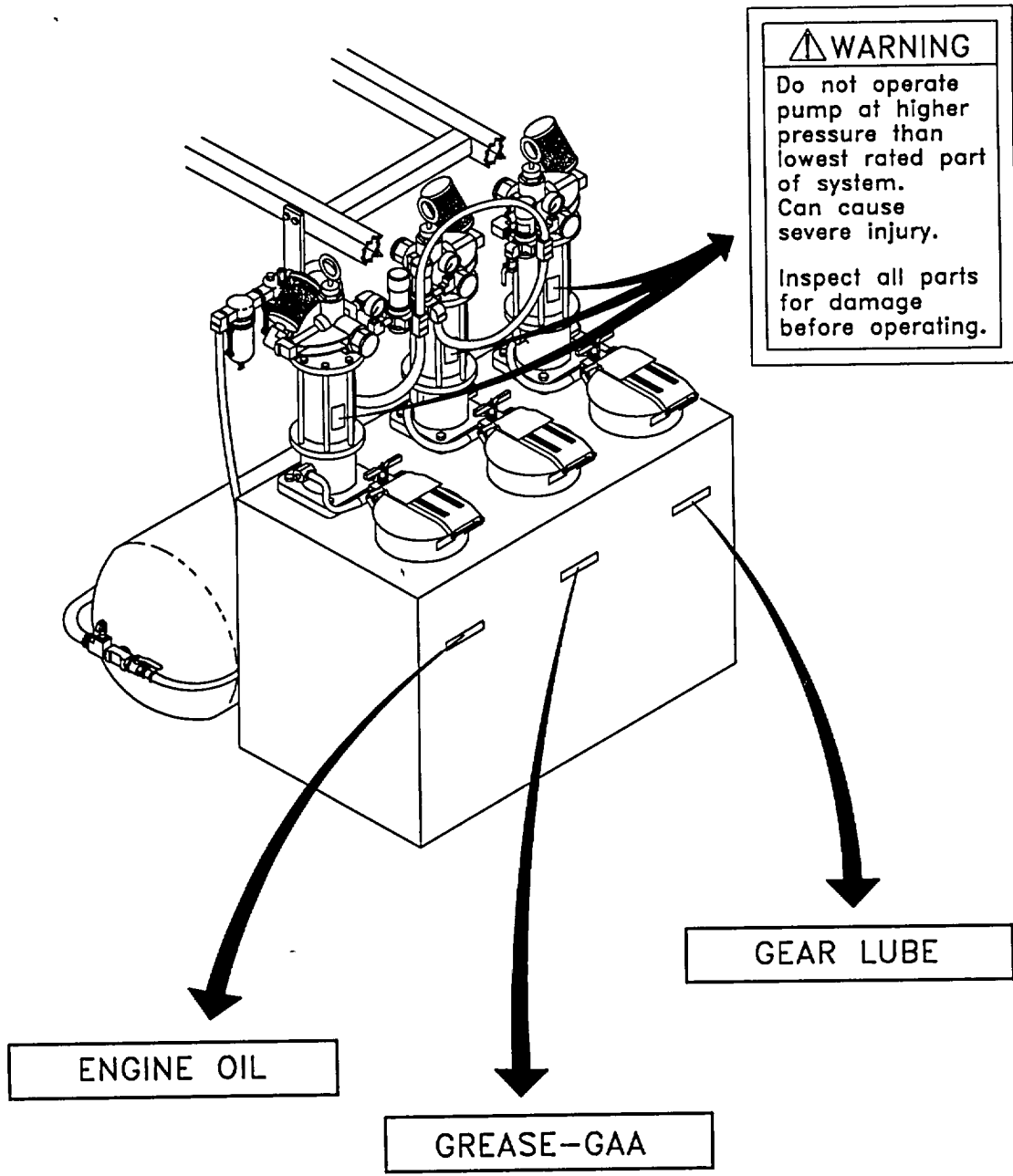


Figure 2-32. Decals and Instruction Plates (Sheet 6 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

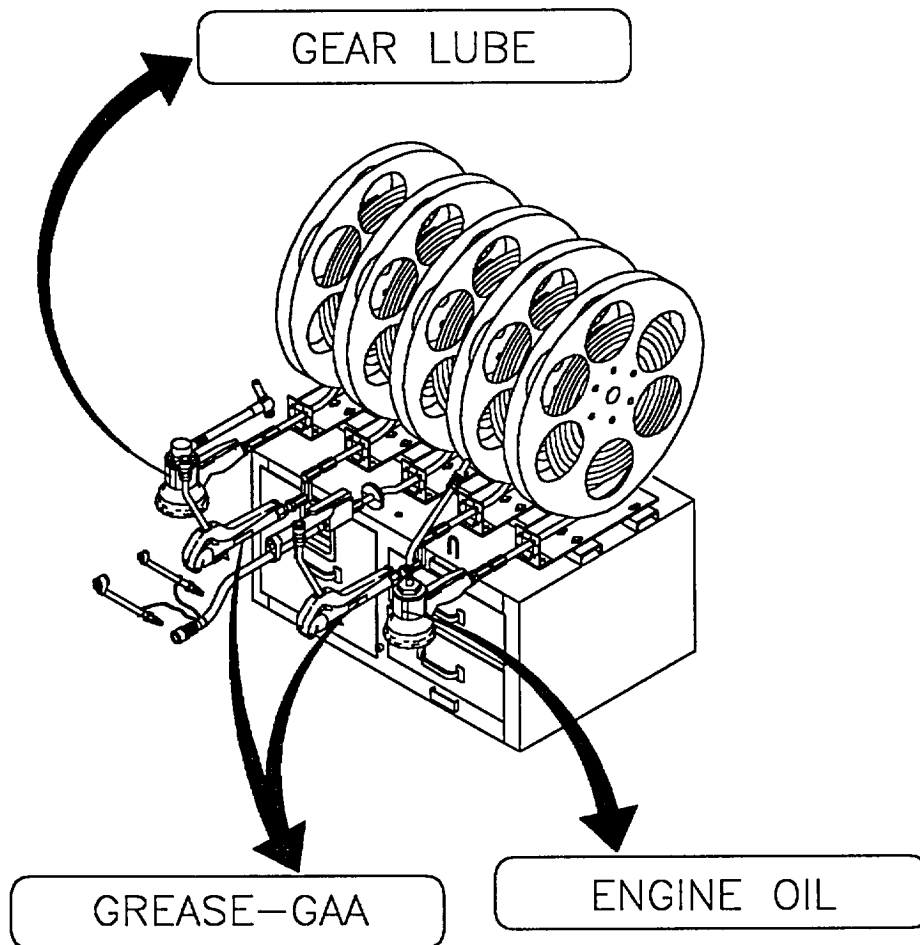


Figure 2-32. Decals and Instruction Plates (Sheet 7 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

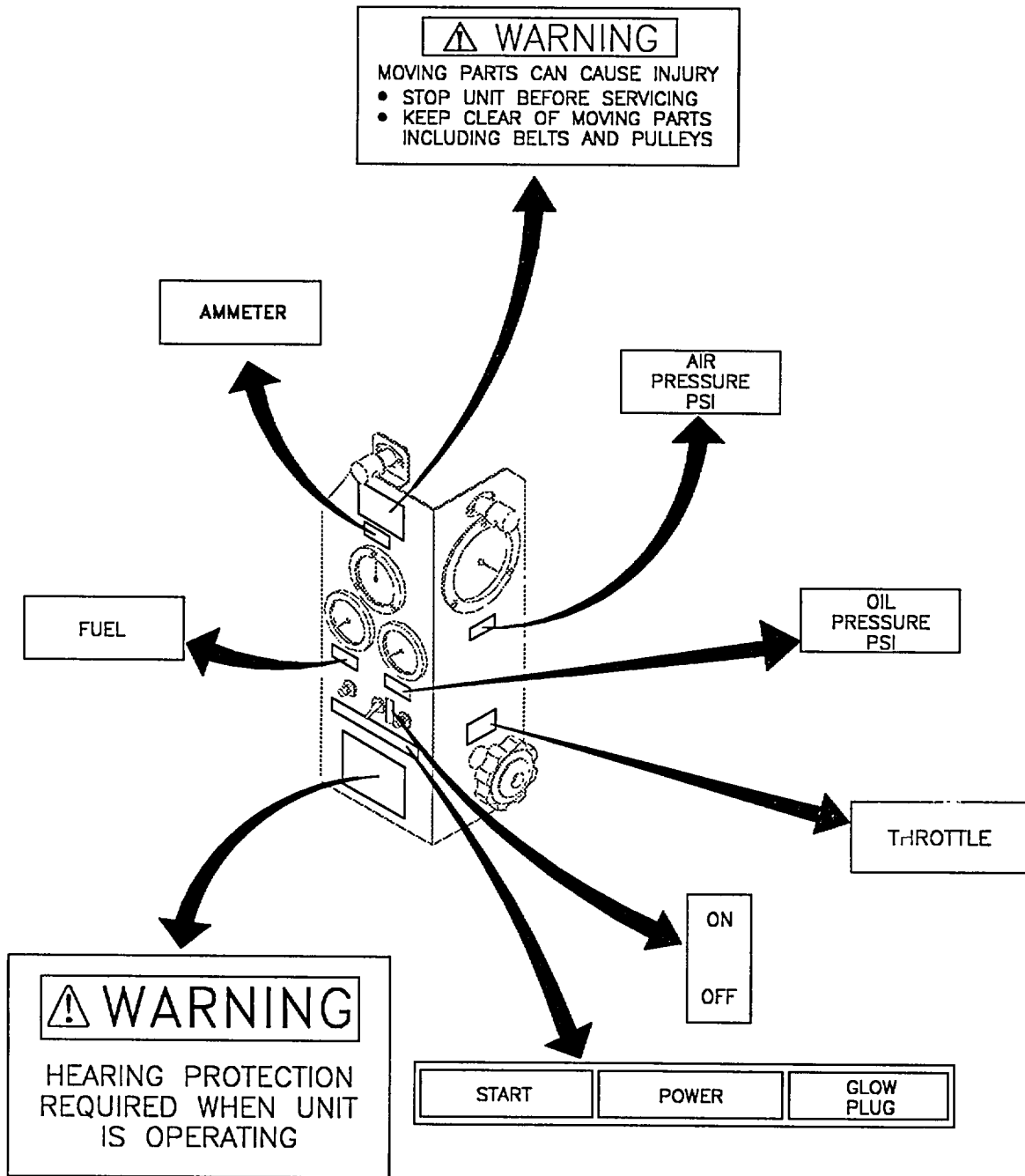


Figure 2-32. Decals and Instruction Plates (Sheet 8 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

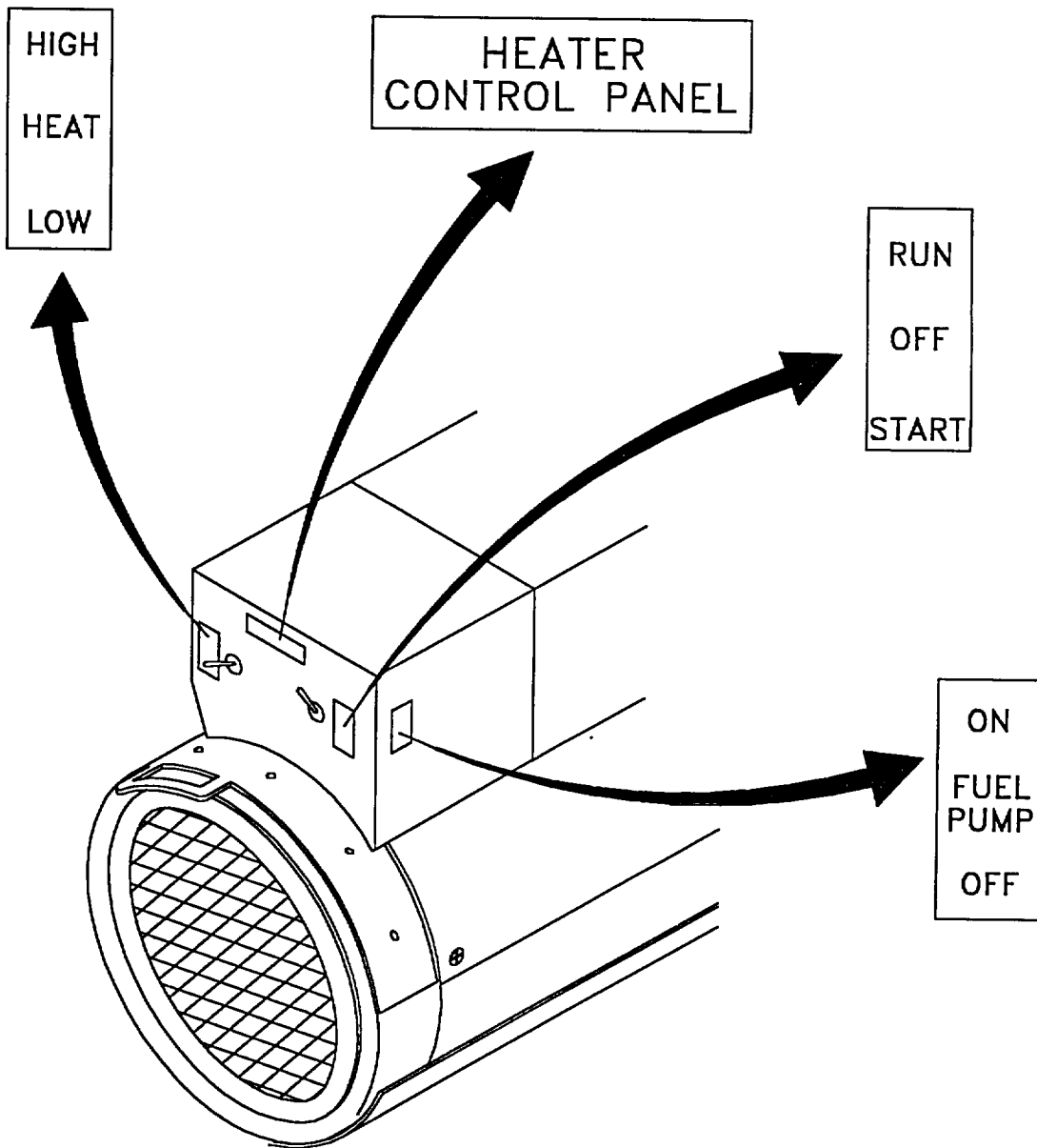


Figure 2-32. Decals and Instruction Plates (Sheet 9 of 10)

2-10. DECALS AND INSTRUCTION PLATES - Continued

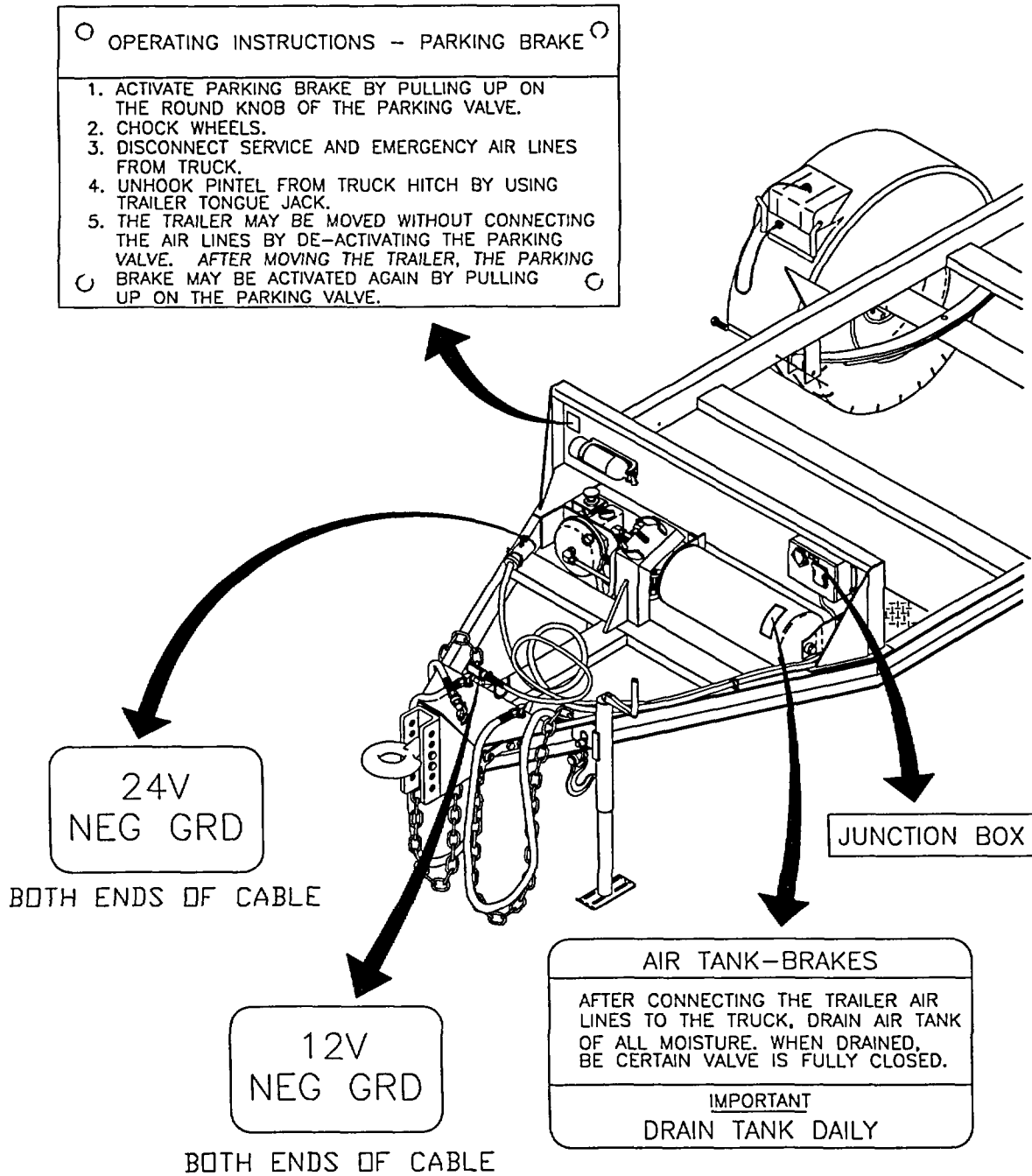


Figure 2-32. Decals and Instruction Plates (Sheet 10 of 10)

2-11. SHUTDOWN PROCEDURES

a. SHORT TERM SECURE (Refer to Figure 2-33.)

- (1) Disengage clutch (1).
- (2) Move the on/off toggle switch (2) on control panel to "off".
- (3) Move the engine run/stop lever (3) on engine to "stop".
- (4) Close ball valve (4) on air-receiver tank (5).
- (5) Open ball valve (6) on gear lube pump (7).

b. LONG TERM SECURE

- (1) Repeat procedures para. 2-11 (1) through (5).
- (2) Close shut-off valve (8) on air-receiver tank (5).
- (3) Open condensate removal valve handle (9) to "open" position on reel cabinet assembly (10).

NOTE

The following procedures apply to any of the four enclosure doors.

- (4) Holding door (11) securely, raise door (11) up and unlatch hook (12) from nng (13) on top of enclosure (14).
- (5) Let door (11) hang freely.
- (6) Latch finger bolt latches (15) to inside of enclosure (14).
- (7) Latch door (11) to enclosure (14) using slam latches (16).

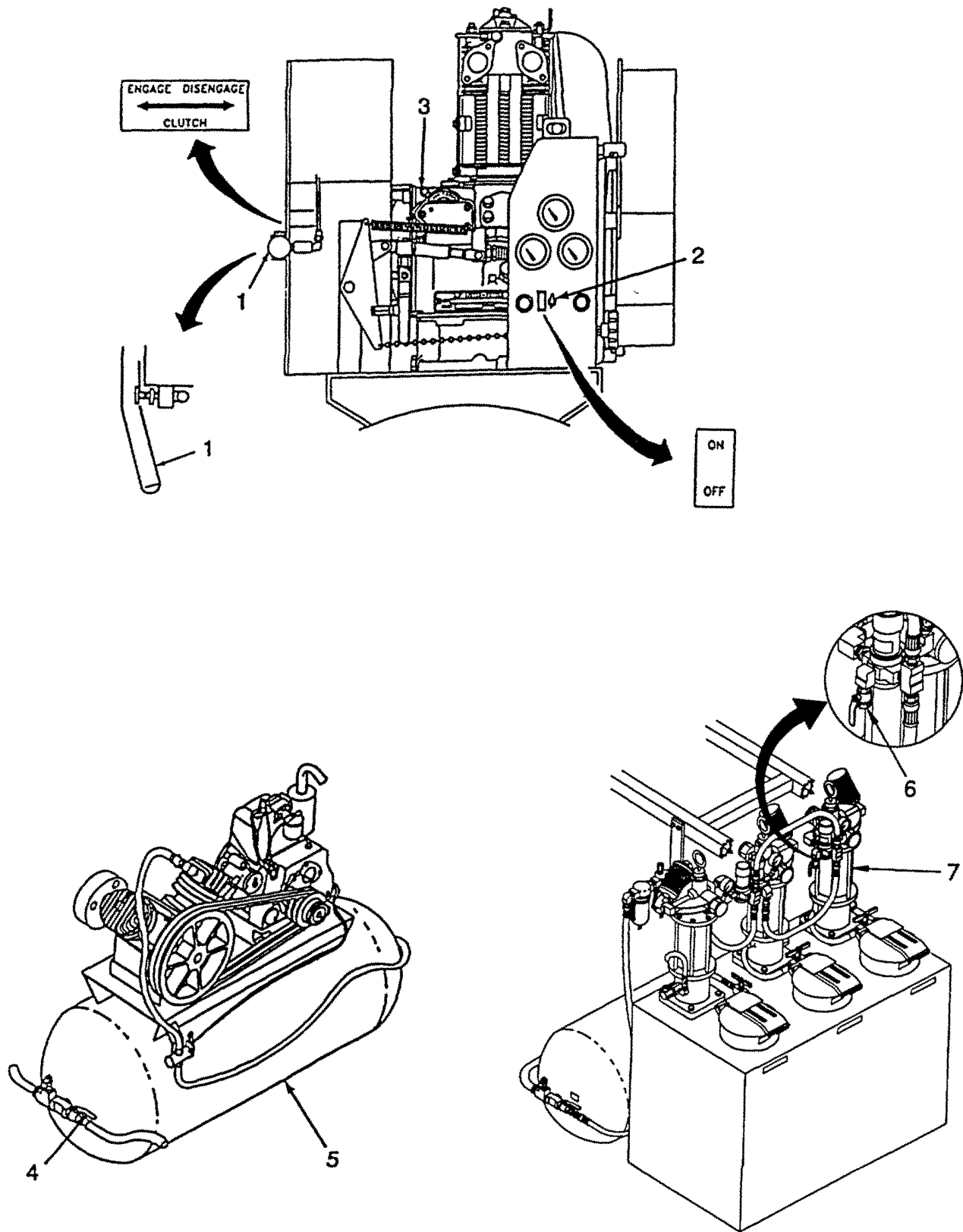


Figure 2-33. Shutdown Procedures (Sheet 1 of 2)

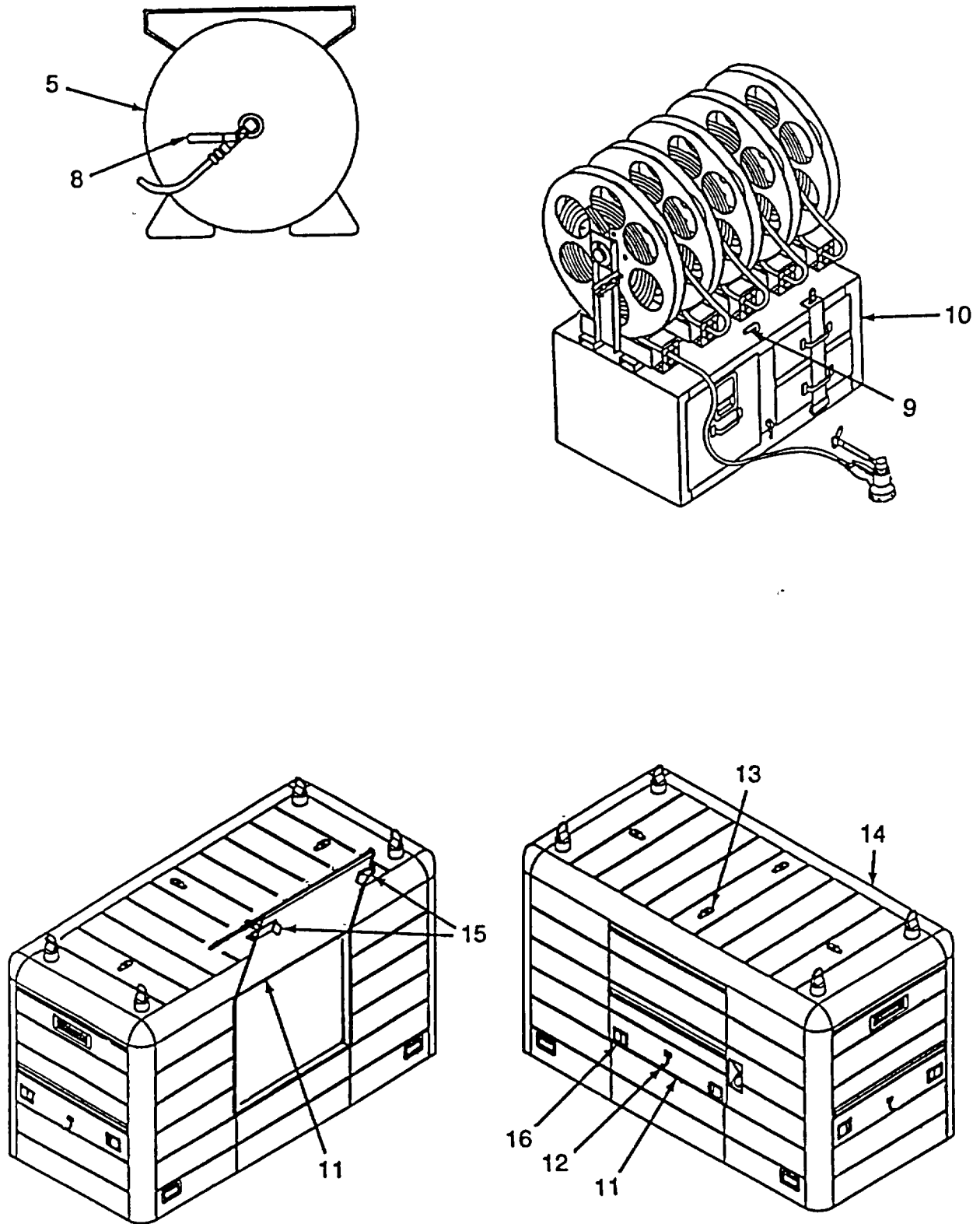


Figure 2-33. Shutdown Procedures (Sheet 2 of 2)

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-12. OPERATION IN UNUSUAL ENVIRONMENT/WEATHER. (See Figure 2-34.)

1. PREPARATION FOR USE.

a. Refer to para. 2-7(2) for procedures.

b. EXTREME HEAT "DRY":

- (1) Provide adequate shade or shelter if possible.
- (2) Check hoses and wires for cracking and brittleness. Replace if necessary.
- (3) The engine is air-cooled. Make sure nothing is blocking free air flow around the engine.

c. EXTREME HEAT "HUMIDITY":

- (1) See steps 1-3 under "b" above.
- (2) To prevent rusting, wipe visible moisture from unit.

d. EXTREME COLD:

- (1) If possible, shelter the unit from snow and ice.
- (2) Provide a heated shelter if possible.
- (3) Use the heater found in the winterization assembly (see para. 2-12.1.f.).

NOTE

Engine will need more time to warm and crank. Cool lubricants become thick and will slow down cranking.

- (4) Do not allow moisture to come in contact with lubricants or diesel fuel. Use a filter when filling lube tanks or diesel fuel tank to prevent contamination.
- (5) Carefully operate knobs and valves. They break easily in cold weather.
- (6) Prevent air line freezing by using the alcohol injector system (see para. 4-18).
- (7) Change engine oil and replace with light oil such as 5W-30, 5W-20, or OW-20. Do not try to start the engine with standard grade oil. Do not dilute the engine oil with any kind of fuel to "thin" it.
- (8) Make sure that fuel tank is filled with Mdl-Spec Arctic Diesel Fuel. Do not use a diesel fuel that will "wax" or "gel" in cold temperatures.
- (9) Replace standard heavy oil in air compressor with lighter oil (SAE-10 ND). If heavy oil is left in the compressor, the engine's performance will drag.
- (10) Before moving the lube unit to sub-zero mission areas, change the fuel filter and circulate new fuel and oil through the system with the engine at 50% - 70% throttle for 15 minutes.

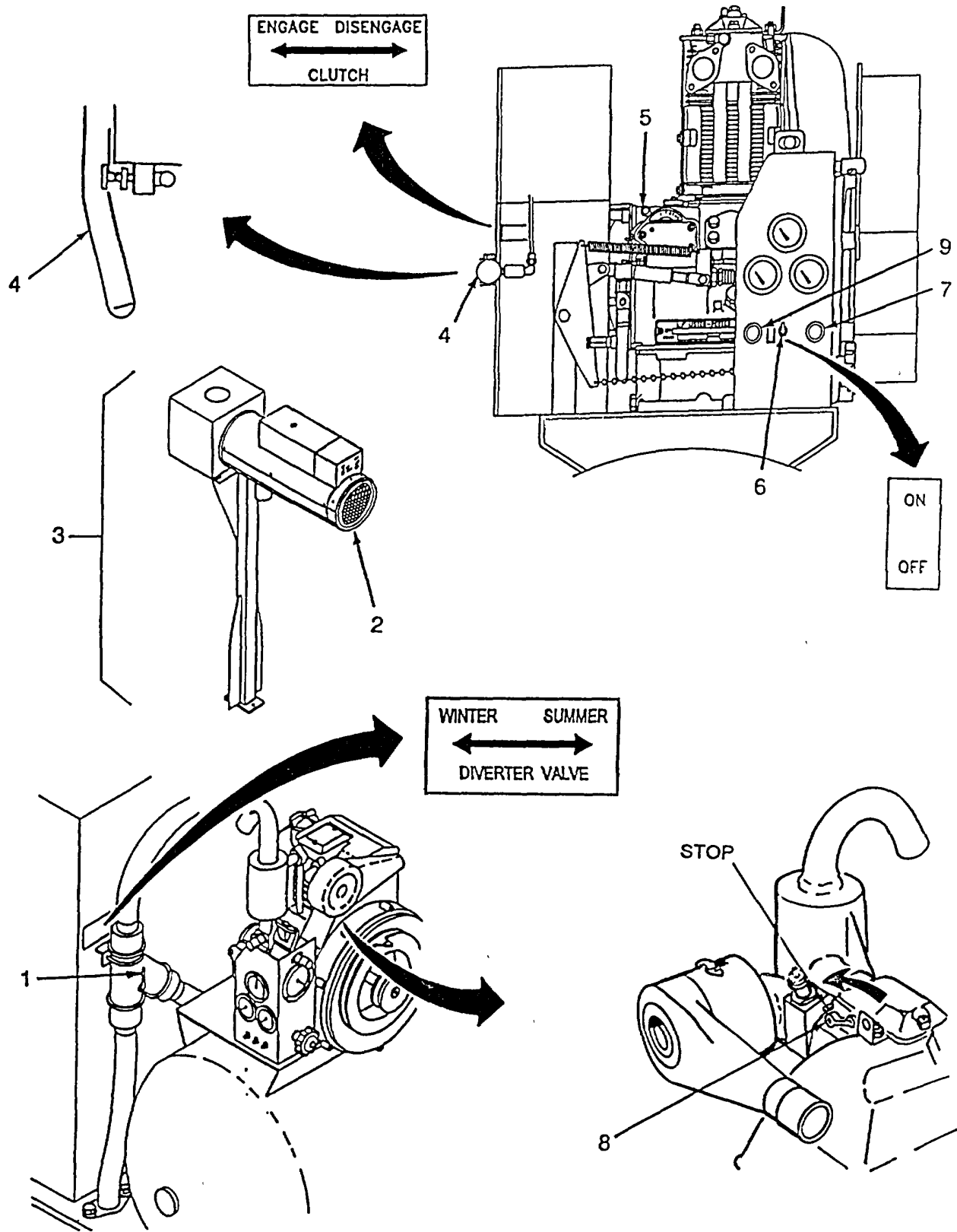


Figure 2-34. Unusual Environment/Weather

- (11) Make sure that the batteries are in new or almost new condition. It would even be a good idea to take two spare batteries along on the mission as well as a battery charger.

e. STARTING THE ENGINE (Refer to Figure 2-34.)

- (1) Switch exhaust diverter valve (1) to the left "winter" position.
- (2) Start heater (2) on winterization assembly (3). (See para. 2-12.1.f. Winterization assembly and heater). Allow unit to warm to at least 200F.
- (3) To decrease starting load, start engine with clutch (4) disengaged.
- (4) Move the engine run/stop lever (5) on engine to "run".
- (5) Move the on/off toggle switch (6) on control panel to "on".
- (6) Depress glow plug button (7) on control panel for one minute - It warms the engine chamber air for easier combustion of diesel fuel.
- (7) While continuing to hold glow plug button (7) move decompressor lever (8) on top of engine towards its stop and hold.

CAUTION

Do not crank engine for over 20 seconds. Extended cranking will drain batteries and overheat starter.

- (8) While holding glow plug button (7) and decompressor lever (8), push engine start button (9) When engine cranks at a sufficient speed, release the decompressor lever (8).
- (9) Continue to crank engine by depressing the engine start button (9) and glow plug button (7) until engine starts; then release glow plug button (7) and engine start button (9).
- (10) Refer to paragraph 2-9.a.(1) (f) (i).

f. WINTERIZATION ASSEMBLY AND HEATER (See Figure 2-35.)

- (1) For cold weather missions, use the heater (1) located on the winterization assembly (2).
- (2) To operate the heater (1), first switch the exhaust diverter valve (3) to the left "winter" position.
- (3) Turn the fuel pump switch (4) to "on" position.

NOTE

Once you press the "run-off-start" switch down and hold it in the "start" position, do not allow it to return to the "off" position, as this will disrupt the start sequence of the heater. If this situation occurs, place the "run-off-start" switch in the "off" position and wait a minimum of 15 minutes before attempting a restart.

- (4) Flip the "run-off-start" switch (6) to "start" position and hold 2-4 minutes until heater combustion begins.
- (5) When the heater (1) starts, (that is, the fan speed increases), move the "run-off-start" switch (6) to "run" position.
- (6) Flip high-low heat selector switch (5) to position desired as determined by the temperature.
- (7) If the heater (1) fails to start after holding the "run-off-start" switch (6) in the "start" position for 4 minutes, move the "run-off-start" switch to the "off" position and wait a minimum of 15 minutes before attempting to restart the heater as outlined above.
- (8) If the heater (1) fails to start on the second attempt do not continue the starting procedure until unit maintenance has been notified of the problem.
- (9) After heater has started (Refer to para. 2-12.1.d. (3 through 9)).

g. WINTERIZATION ASSEMBLY AND HEATER SHUT DOWN NORMAL (Refer to figure 2-35.)

- (1) Turn the fuel pump switch (4) to "off" position.
- (2) Flip "run-off-start" switch (6) to "off" position. Blower will continue to run until the heater has purged itself of fuel.

h. WINTERIZATION ASSEMBLY AND HEATER SHUT DOWN EMERGENCY:

Turn the fuel pump switch (4) to "off" position. This will shut off fuel to the heater immediately.

i. SALT AIR AND SPRAY:

- (1) Prevent corrosion by frequently wiping the unit clean with non-abrasive towels or rags.
- (2) To prevent rusting, coat any exposed machine parts with light oil.
- (3) Provide adequate shelter from sea spray.

j. DUST STORMS AND SANDSTORMS:

- (1) Replace and check filters more frequently.
- (2) Shelter the unit from blowing sand and dust.
- (3) Do not allow sand or dust to enter components during repair, service, and use

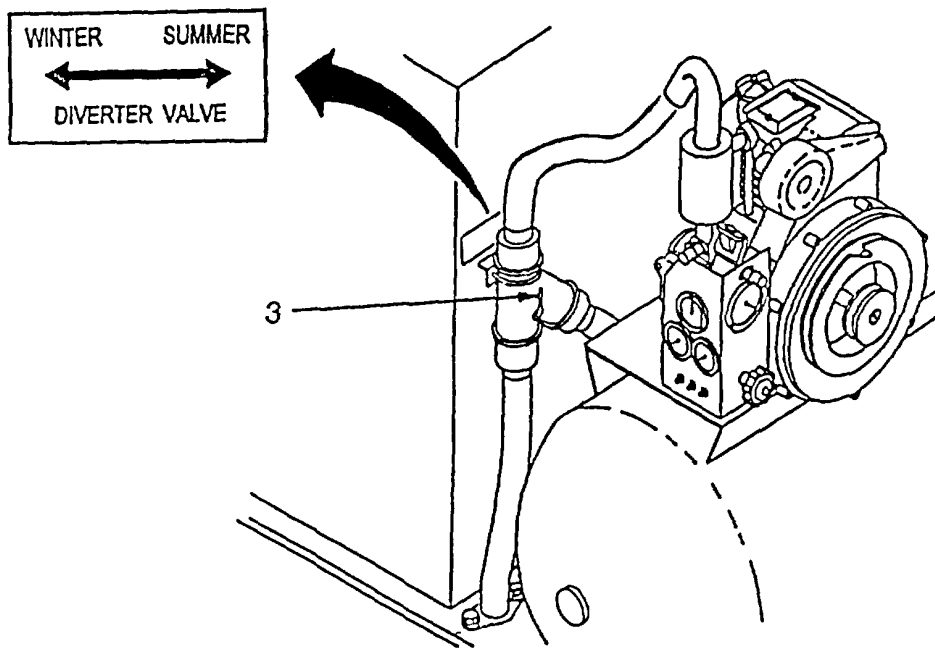
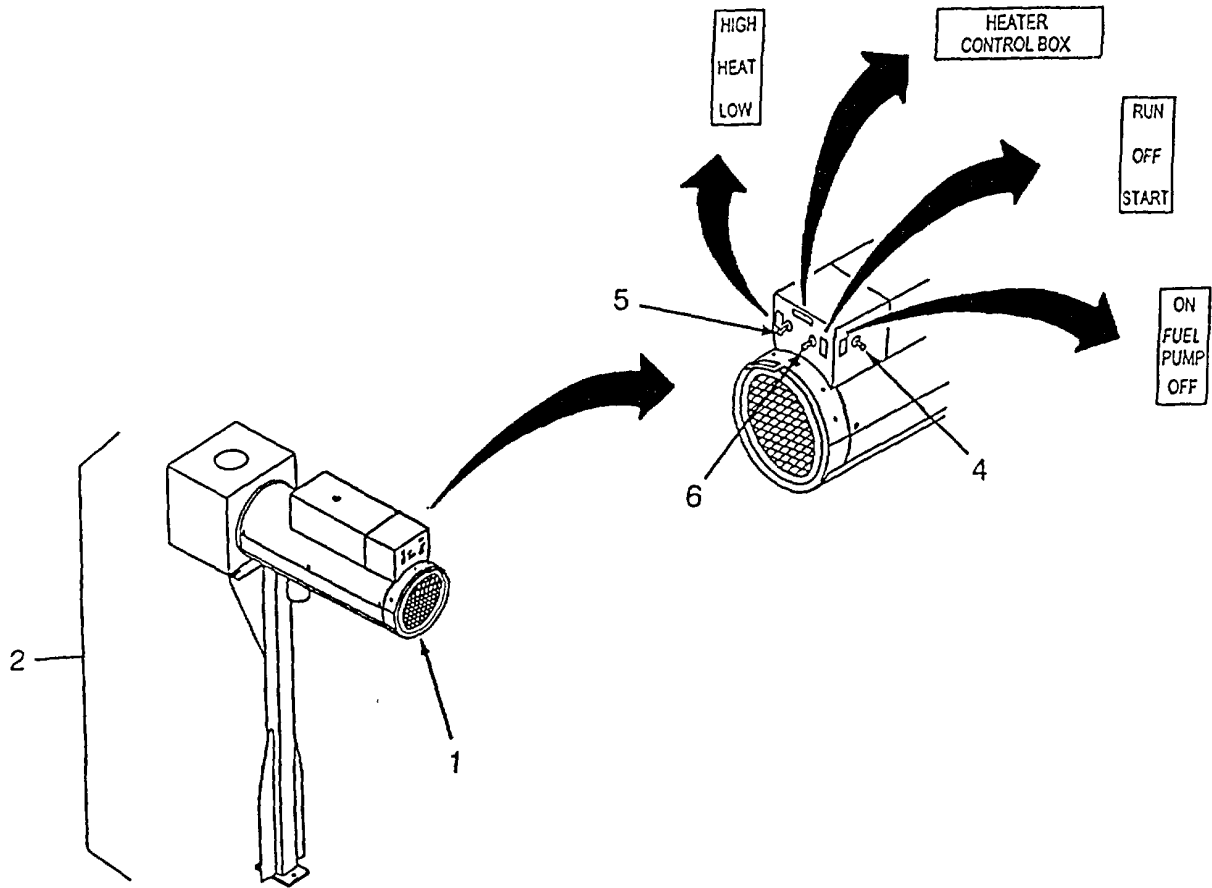


Figure 2-35. Winterization Assembly and Heater

k. HIGH ALTITUDE:

- (1) No adjustments are necessary but engine performance will decrease as altitude is increased.

l. MUD:

- (1) Avoid towing the unit through mud.
- (2) Wash mud off of unit and wipe clean with rags or towels.

m. RAINY CONDITIONS:

Prevent rain or moisture from coming in contact with electrical or fuel systems.

2-13. EMERGENCY PROCEDURES.

a. REDUCTION IN POWER:

NOTE

Because the lube unit is diesel-powered and not electric-powered, it is not susceptible to electrical brownouts or blackouts. On the other hand, if there is mechanical failure, such as the diesel engine failing, you may still be able to dispense some lubricants, see "Partial Equipment Failure" below.

b. PARTIAL EQUIPMENT FAILURE (See Figure 2-36.)

NOTE

In the event of engine or air compressor failure, lubricants can still be dispensed to some degree. The air-receiver tank (1), which is mounted below the engine (2) and air compressor (3), stores air generated by the air compressor. When the air compressor stops operating, air is still in the tank and will remain there until drained or used up. Once air in the air-receiver tank (1) is exhausted, you can no longer complete your mission until maintenance has repaired the unit.

- (1) Look at the control panel (4) and find the air pressure gauge (5). Determine how much air is stored in the air-receiver tank (1).
- (2) Begin dispensing lubricant; continue to dispense until finished or until air in the airreceiver tank (1) is exhausted.

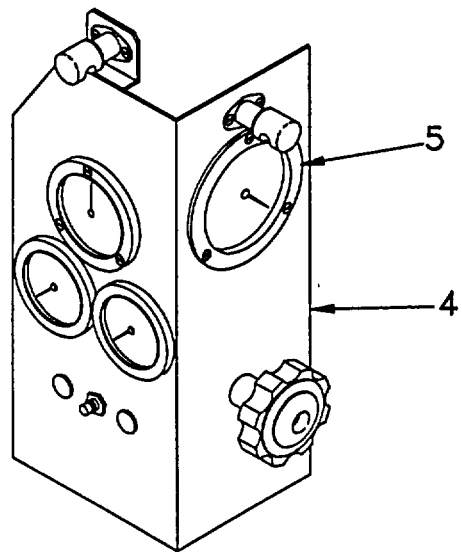
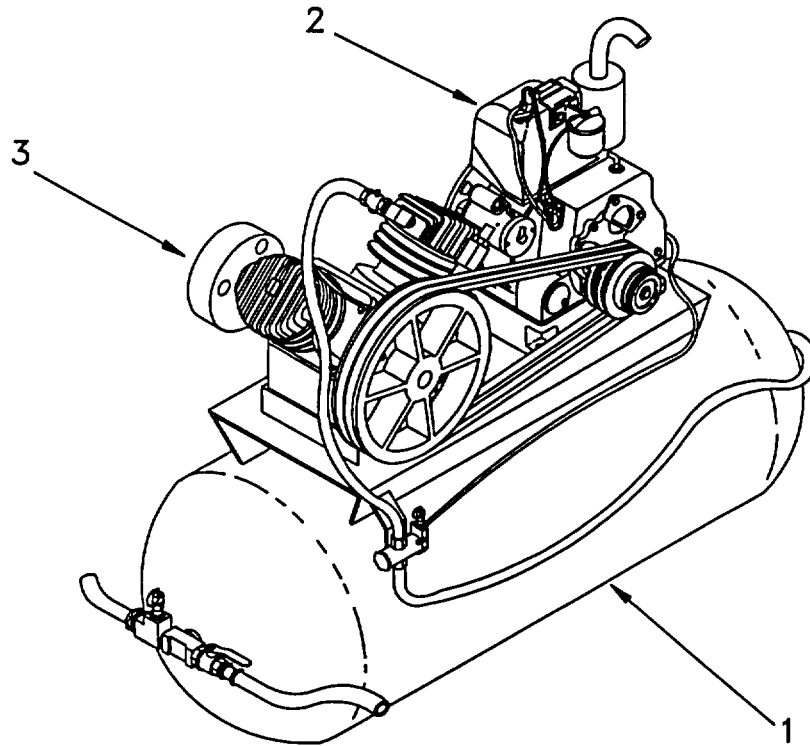


Figure 2-36. Partial Equipment Failure

2-14. NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES.

In the event that the Lubrication and Servicing Unit has been subjected to NBC contamination, the following emergency procedures can be performed until field NBC decon facilities are available

a. Emergency Procedures. If NBC attack is known or suspected, mask at once and continue mission. If outside, follow decontamination procedures below to avoid taking contamination into controlled area. Do not unmask until told to do so.

- (1) Nuclear Decontamination. Brush fallout from skin, clothing, and equipment with available brushes, rags, or tree branches Wash skin and have radiation check made as soon as tactical situation permits
- (2) Biological Decontamination. Remain masked and continue mission until told to unmask.
- (3) Chemical Detection and Decontamination.

WARNING

Prolonged exposure to decontamination spray can cause injury to personnel. Do not use decontamination spray on personnel unless it can be washed from exposed skin.

- (a) Use M8 paper from the M256 Chemical Agent Detector Kit or M9 paper to determine if liquid agent is present on the equipment.
 - (b) If exposure to liquid agent is known or suspected, clean exposed skin, clothing, personal gear, and equipment, in that order using M258A1 kit. Use the buddy system. Wash exposed skin and thoroughly decontaminate as soon as tactical situation permits.
 - (c) If the M8 or M9 paper indicates that liquid chemical agent is present on the equipment, use the NBC-M11 decon apparatus for decon of equipment.
- (4) Reference Material. For further detailed information on NBC decon procedures, refer to the information in FM 3-3, FM 3-4, and FM 3-5

Chapter 3

OPERATOR MAINTENANCE INSTRUCTIONS

Paragraph	Page
Section I. Lubrication Instructions	3-1
Section II. Operator Troubleshooting Procedures	3-1
3-1. Introduction	3-1
3-2. Malfunction Index	3-2
3-3. Troubleshooting Table	3-2
Section III. Operator Maintenance Procedures	3-8
3-4. General	3-8
3-5. Air Moisture Separator	3-8
3-6. Alcohol Injector	3-10
3-7. Battery Box Assembly	3-12
3-8. Air Compressor Assembly Air Filter	3-13
3-9. Engine Air Cleaner	3-14
3-10. Wheel and Tire Assembly	3-15

Section I. LUBRICATION INSTRUCTIONS

See companion publication LO 5-4930-244-12, Lubrication Order.

Section II. OPERATOR TROUBLESHOOTING PROCEDURES

3-1. INTRODUCTION

This section lists common malfunctions that you may find with your equipment. Perform the tests, inspections, and corrective actions in the order they appear in the table.

This manual cannot list all the malfunctions that may occur, all the tests and inspections needed to find the fault, or all the corrective actions needed to correct the fault. If the equipment malfunction is not listed or actions listed do not correct the fault, notify your supervisor.

Table 3-1 lists the common malfunctions which you may find during the operation or maintenance of the lubrication and servicing unit, or its components. You should perform the tests/inspections and corrective actions in the order listed.

3-2. MALFUNCTION INDEX

Malfunction No.	Malfunction	Page
1.	Engine Falls to Turn Over When Starter Switch is Pushed.....	3-2
2.	Engine Turns Over But Falls To Start	3-3
3.	Engine Starts But Then Stops	3-3
4.	Engine Overheats	3-3
5.	Engine Runs But Lacks Power	3-3
6.	Engine Misfires During Operation.....	3-3
7.	Excessive Engine Oil Consumption	3-4
8.	Engine Oil Pressure Is Too Low (Below 12 lbf.) or High (Above 60 lbf.) At Normal Operation Conditions	3-4
9.	Excessive Fuel Consumption	3-4
10.	Air Compressor Malfunctions	3-4
11.	Compressor Pumps Too Slowly	3-5
12.	Heater Will Not Start During Cold Weather Operations	3-5
13.	Lube Dispensers/Pumps Are Not Operating Properly	3-5
14.	Hose Reel Assemblies Are Not Working Properly	3-6
15.	Trailer Taillights Are Not Working.....	3-6
16.	Trailer Electrical	3-6
	a. All Lamps Do Not Light	3-6
	b. One or More (But Not All) Lights Will Not Light	3-6
17.	Tires Have Unusual Or Uneven Wear	3-7
18.	Brakes Are Malfunctioning.....	3-7

3-3. TROUBLESHOOTING TABLE (Refer to Table 3-1 for operator troubleshooting procedures.)

Table 3-1. Operator Troubleshooting Table.

WARNING

· **Read ALL Warnings at the front of the manual before you begin troubleshooting.**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
--------------------	---------------------------	--------------------------

1. ENGINE FAILS TO TURN OVER WHEN STARTER SWITCH IS PUSHED:

- Step (1) Check to see if battery electrolyte level is over plates.
Add distilled water until level is correct.
- Step (2) Inspect for loose, corroded or broken battery cables.
Clean corroded cables. Tighten loose connections. If cables are broken or damaged, notify unit maintenance.
- Step (3) Inspect air compressor wiring harness for damage or loose connections.
Tighten loose connections. If wiring harness is damaged or broken, notify unit maintenance.

Table 3-1. Operator Troubleshooting Table (Cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step (4)	Inspect control panel switches for damage. Notify unit maintenance if switches are damaged.
	Step (5)	Inspect starter for damage. Notify unit maintenance if starter is damaged.
2. ENGINE TURNS OVER BUT FAILS TO START:		
	Step (1)	Ensure that control panel switches are in correct position for starting. Place switches in correct positions.
	Step (2)	Check for empty fuel tank. Fill empty fuel tank.
	Step (3)	Check for damaged or leaking fuel lines. Notify unit maintenance if fuel lines are damaged or leaking.
3. ENGINE STARTS BUT THEN STOPS:		
	Step (1)	Check for insufficient fuel supply. Fill fuel tank.
	Step (2)	Check for correct engine oil level. Service engine as required. If oil level is correct, notify unit maintenance.
4. ENGINE OVERHEATS:		
	Step (1)	Check engine oil level. Service engine as required. Notify unit maintenance if engine continues to operate in an overheated condition.
5. ENGINE RUNS BUT LACKS POWER:		
		Check that throttle control is in full speed condition. Pull throttle control into full speed condition.
6. ENGINE MISFIRES DURING OPERATION:		
		Check for water in the fuel system by looking at fuel strainer bowl. Notify unit maintenance if engine continues to misfire during operation.

Table 3-1. Operator Troubleshooting Table (Cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

7. EXCESSIVE ENGINE OIL CONSUMPTION:

Step (1) Check engine oil level. See companion publication LO 5-4930-244-12.
 Fill if level is low. Notify unit maintenance if level is too high.

Step (2) Check for leaks at the oil pan, oil filter, housing, dipstick, etc.
 Report any leaks to unit maintenance.

8. ENGINE OIL PRESSURE IS TOO LOW (BELOW 12 lbf.) OR HIGH (ABOVE 60 lbf.) AT NORMAL OPERATING CONDITIONS:

CAUTION

· **DO NOT operate engine when oil pressure is low. Serious damage could occur to engine components.**

Check engine oil level.

Fill if low.

If high, notify unit level maintenance.

9. EXCESSIVE FUEL CONSUMPTION:

Check fuel lines, hoses, and connections for leaks or damage.
 Notify unit maintenance of deficiencies.

10. AIR COMPRESSOR MALFUNCTIONS:

Step (1) Check compressor oil level (par. 4-40a).
 Fill if needed.

Step (2) Check air compressor filter for dirt and debris.
 Replace air filter if excessively dirty.

Step (3) Check for loose or slipping belts.
 If belts are loose or badly worn, notify unit maintenance.

Step (4) Check intercooler and cylinder fins for dirt and debris.
 Clean fins and intercooler.

Table 3-1. Operator Troubleshooting Table (Cont.)

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION**

11. COMPRESSOR PUMPS TOO SLOWLY

Step (1) Check for loose or slipping drive belts.

Notify unit maintenance if drive belts are slipping or worn.

Step (2) Check for dirty air filter.

Replace air filter.

Step (3) Check compressor oil level.

Fill if level is low. Notify unit maintenance if level too high.

12. HEATER WILL NOT START DURING COLD WEATHER OPERATIONS:

Step (1) If heater fails to start on second attempt, do not continue the starting procedure.

Report the problem to unit maintenance

Step (2) Check wiring for loose connections, cracks, and brittleness.

Report any problems to unit maintenance.

Step (3) Check for broken or leaking fuel lines.

Report deficiencies to unit maintenance.

13. LUBE DISPENSERS/PUMPS ARE NOT OPERATING PROPERLY:

Step (1) Check to see if air compressor is running.

Step (2) Check for air pressure gauge reading of approximately 120 psi minimum

If pressure is lower than 120 psi or higher than 180 psi, notify unit maintenance.

Step (3) In cold weather, check lubricant thickness due to cold.

Use the wintenzation assembly supplied with your unit.

Check fluid level of the alcohol injector and fill if necessary.

Step (4) Check for adequate levels in lubricant container tanks.

Fill to the correct levels.

Step (5) Check the lubricant recirculation valve. It should be closed.

Close the lubricant recirculation valve.

Table 3-1. Operator Troubleshooting Table (Cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

Step (6) Check air and lubricant lines for leakage, bends, or cracking.
Report any problems to unit maintenance.

14. HOSE REEL ASSEMBLIES ARE NOT WORKING PROPERLY:

Step (1) Check reel for cracks and other damage.
Report any problems to unit maintenance.

Step (2) Check hose reel lock for wear or damage.
Report any problems to unit maintenance.

15. TRAILER TAILLIGHTS ARE NOT WORKING:

Check for faulty cable connection.
Report faulty cable to unit maintenance.

16. TRAILER ELECTRICAL:

a. ALL LAMPS DO NOT LIGHT

Step (1) Check light switch position on towing vehicle.)
Place switch in correct position (see towing vehicle technical manual).

Step (2) Check electrical connectors on the trailer and towing vehicle.
Reconnect intervehicular harness.

Step (3) Inspect trailer wiring harness for damage.
Notify unit maintenance of damaged wiring harness.

b. ONE OR MORE (BUT NOT ALL) LIGHTS WILL NOT LIGHT

Step (1) Check for damaged or broken electrical leads.
Notify unit maintenance.

Step (2) Check for loose or damaged electrical connections.
Tighten loose connections. If damaged notify unit maintenance.

Table 3-1. Operator Troubleshooting Table (Cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

Step (3) Check for broken or damaged lights. Notify unit maintenance.

17. TIRES HAVE UNUSUAL OR UNEVEN WEAR:

WARNING

- **DO NOT over-inflate tires. The tire or wheel assembly could explode causing serious injury or death.**
- **Chock wheels when unit is not on a level surface. Unit could roll and cause injury.**

Step (1) Check for loose lug nuts or bolts.
Tighten if needed.

Step (2) Check tire pressure.
Inflate or deflate to correct pressure.

Step (3) Check suspension, axle, and wheels for cracks and other damage.
Report any problems to unit maintenance.

18. BRAKES ARE MALFUNCTIONING:

WARNING

- **Replace all worn or damaged parts immediately.**
- **Do not use a dry brush or compressed air to clean brake shoes. Asbestos dust on brake shoes is dangerous if inhaled. Brake shoes must be wet, and a soft bristle brush should be used.**

Step (1) Check air brake glad-hand couplers for dirt, wear, and loose connections.
Clean or retighten as necessary.

Step (2) Check brake lines for loose connections.
Retighten as necessary.

Step (3) Check parking brake control valve knob position.
Reposition.

Step (4) Check for moisture in air tank.
Drain moisture from tank.

Section III. Operator Maintenance Procedures

3-4. GENERAL.

This section contains the maintenance procedures which the Maintenance Allocation Chart authorizes the operator to perform. If the pump assembly still does not operate properly after performing these maintenance procedures, contact unit maintenance for assistance.

3-5. AIR MOISTURE SEPARATOR - SERVICE (Refer to Figure 3-1.)

- (1) Shut off air flow by turning ball valve handle (1) to off position.
- (2) Vent air pressure completely by turning lever (2).
- (3) Open petcock drain (3) on air moisture separator (4) and drain moisture from the system.
- (4) Check sight gage (5) while draining the system.
- (5) Close petcock drain (3).
- (6) Close valve (2).

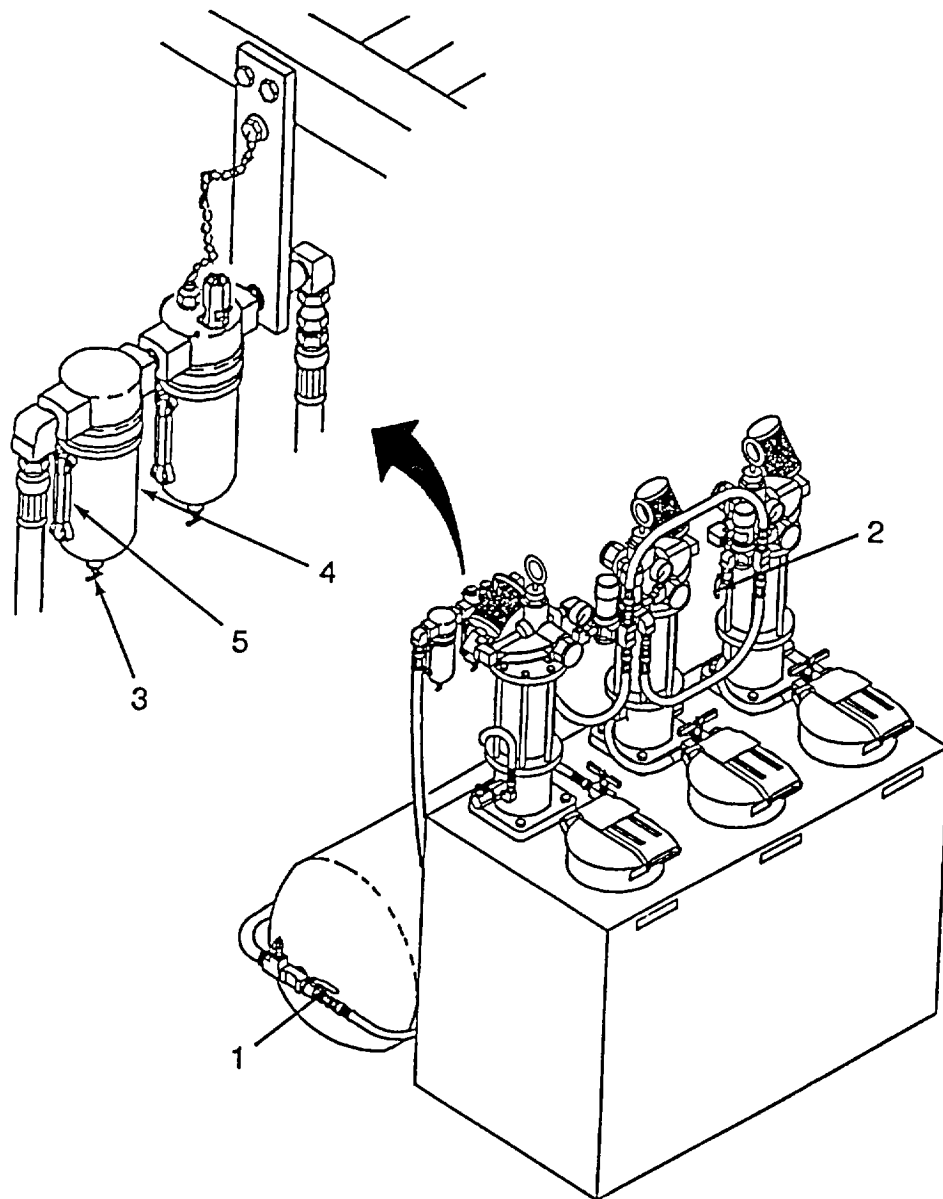


Figure 3-1. Air Moisture Separator

3-6. ALCOHOL INJECTOR - ADJUSTISERVICE.**NOTE**

- **Only use the alcohol injector in temperatures below 32°F (0°C).**
- **Fill reservoir every 45 minutes with methyl alcohol.**

a. Adjustment. (Refer to Figure 3-2.)

- (1) Remove reservoir (1) of alcohol injector (2) by grasping reservoir (1) firmly and turning counter-clockwise. Fill with methyl alcohol. Reinstall reservoir (1) by pushing it up into alcohol injector (2) top and turning it clockwise.
- (2) Start engine. (Refer to Section 2-9).
- (3) Close alcohol Injector (2) by turning adjusting screw (3) fully clockwise.
- (4) Open adjusting screw (3) approximately one quarter turn counterclockwise to establish drip rate of 20 drops/10 seconds.
- (5) During operation, inspect sight gage (4) frequently and fill alcohol injector (2) as needed.

b. Service.

CAUTION

Before servicing, relieve air pressure by closing ball valve (5) and opening ball valve (7), to prevent damage to alcohol injector (2).

- (1) Open petcock drain (6) and drain methyl alcohol into suitable container.
- (2) Close petcock drain (6).
- (3) Remove reservoir (1) of alcohol injector (2) by grasping reservoir (1) firmly and turning counter-clockwise. Fill with methyl alcohol. Reinstall reservoir (1) by pushing it up into alcohol injector (2) top and turning it clockwise.

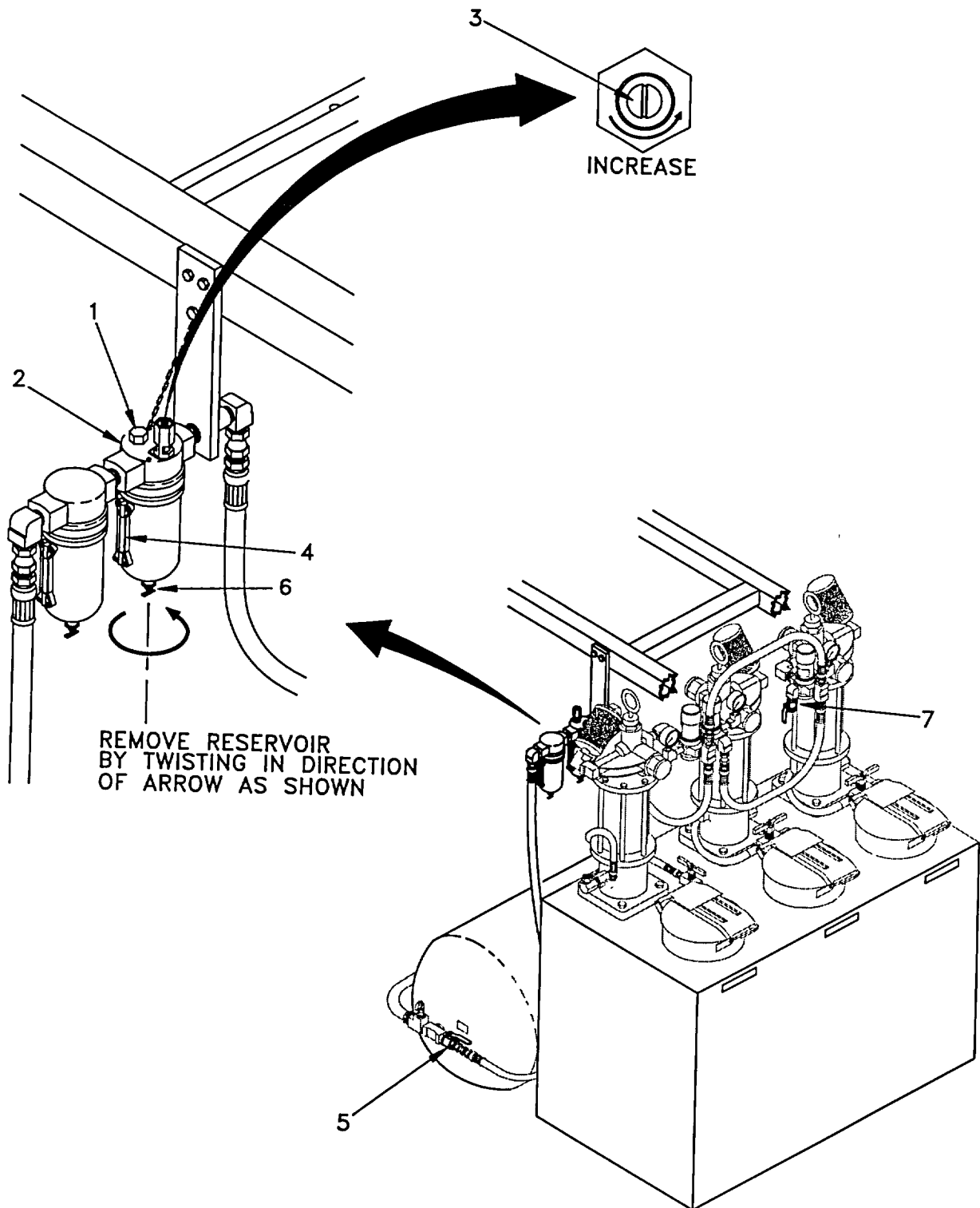


Figure 3-2. Alcohol Injector

3-7. BATTERY BOX ASSEMBLY - SERVICE (Refer to Fig 3-3).**WARNING**

Battery acid is harmful. Wear safety glasses and rubber gloves. If acid touches eyes or skin, flush with running water for 60 seconds. Seek medical attention.

- (1) Open and pull out battery box (1).
- (2) Identify date of service by removing proper tabs from permanent labels on batteries.
- (3) Remove twelve filler caps (2) from battery (3).
- (4) Fill all twelve chambers (4) to ring at bottom of fill holes on battery (3) with electrolyte.
- (5) Reinstall twelve filler caps (2).
- (6) Wash off spilled electrolyte with water.
- (7) Close battery box (1).

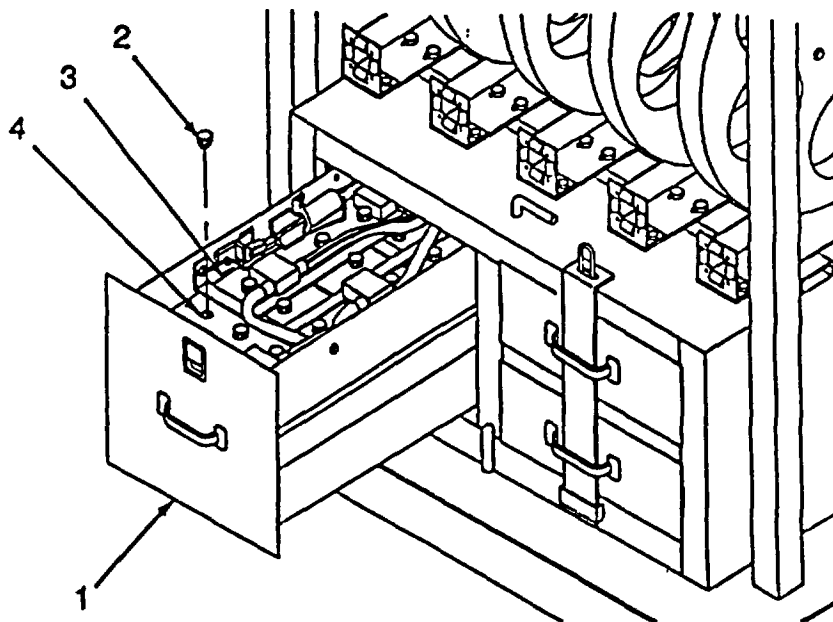


Figure 3-3. Battery Box Assembly - Servicing

3-8. AIR COMPRESSOR AIR FILTER - REPLACE.

This Task Covers: **a. Removal** **b. Cleaning** **c. Installation**

a. Removal. (Refer to Figure 3-4.)

- (1) Remove wing nut (1) from threaded stud.
- (2) Remove cover (2) and air cleaner element (3). Discard old air cleaner element if dirty.

b. Cleaning.

Locate air cleaner base (4). Wipe air cleaner base (4) clean with rags, before installing new air cleaner element (3).

c. Installation.

CAUTION

Do not overtighten wing nut; it will warp or break.

- (1) Install new air cleaner element (3), cover (2), and wing nut (1) onto air cleaner base (4).
- (2) Tighten wing nut (1) onto threaded stud.

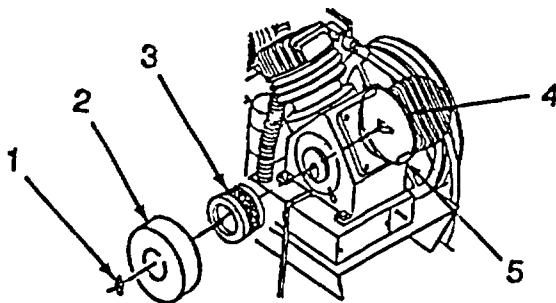


Figure 3-4. Air Filter Replacement

3-9. ENGINE AIR CLEANER - REPLACE.

This Task Covers: **a. Removal** **b. Cleaning** **c. Installation**

a. Removal. (Refer to Figure 3-5.)

- (1) Release toggle clips (1).
- (2) Remove cover (2) from air cleaner housing (3).
- (3) Remove old air cleaner element (4).

b. Cleaning.

Wipe air cleaner housing (3) with rags before installing new air cleaner (4).

c. Installation.

- (1) Install new air cleaner element (4) into air cleaner housing (3).
- (2) Install cover (2) to air cleaner housing (3), securing it using toggle clips (1).

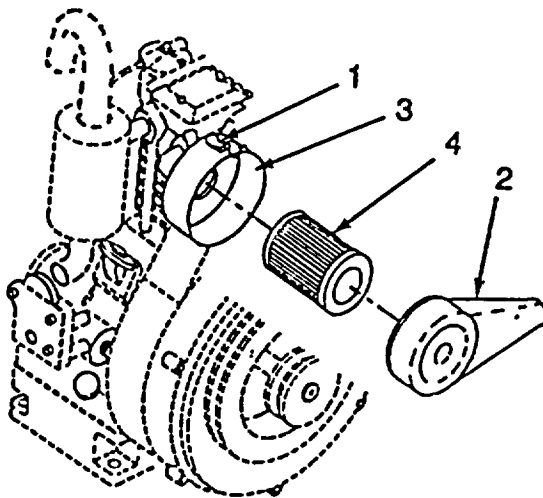


Figure 3-5. Air Cleaner

3-10. WHEEL AND TIRE ASSEMBLY - REPLACE

This Task Covers: **a. Removal** **b. Installation**

WARNING

- **Ensure that trailer is on level surface. Chock wheels for safety. Unit could roll and cause injury.**
- **Use extreme caution when jacking up the trailer. It could fall causing serious injury or death.**

a. Removal. (Refer to Figure 3-6.)

- (1) Position chock block (1) behind or in front of the trailer wheel (2) that is not defective, depending on direction of slope.
- (2) Loosen spare tire by removing brace nut (3), washer (4) and retaining bracket (5). Then remove spare tire (6).
- (3) Use towing vehicle's jack and lug wrench to remove eight lug nuts (7) and defective tire (8) from axle assembly (9).

b. Installation.

- (1) Slide spare tire (6) onto axle assembly (9) and install eight lug nuts (7).
- (2) Place defective tire (8) onto the spare tire position on the trailer (10). Put retainer (5) and washer (4) over defective tire (8).
- (3) Tighten brace nut (3) until defective tire (8) is secured.
- (4) Return tools to truck.

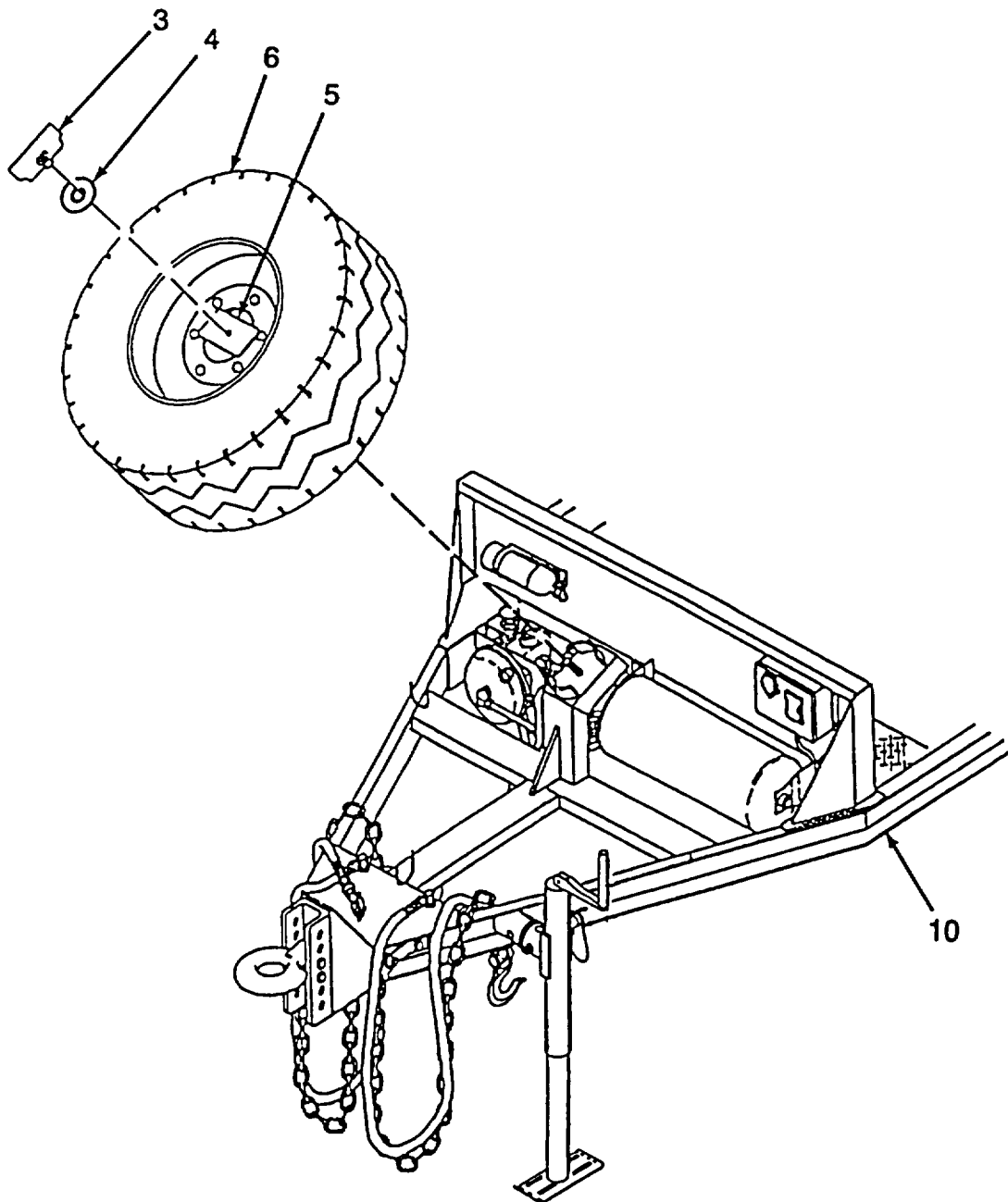


Figure 3-6. Wheel and Tire Assembly (Sheet 1 of 2)

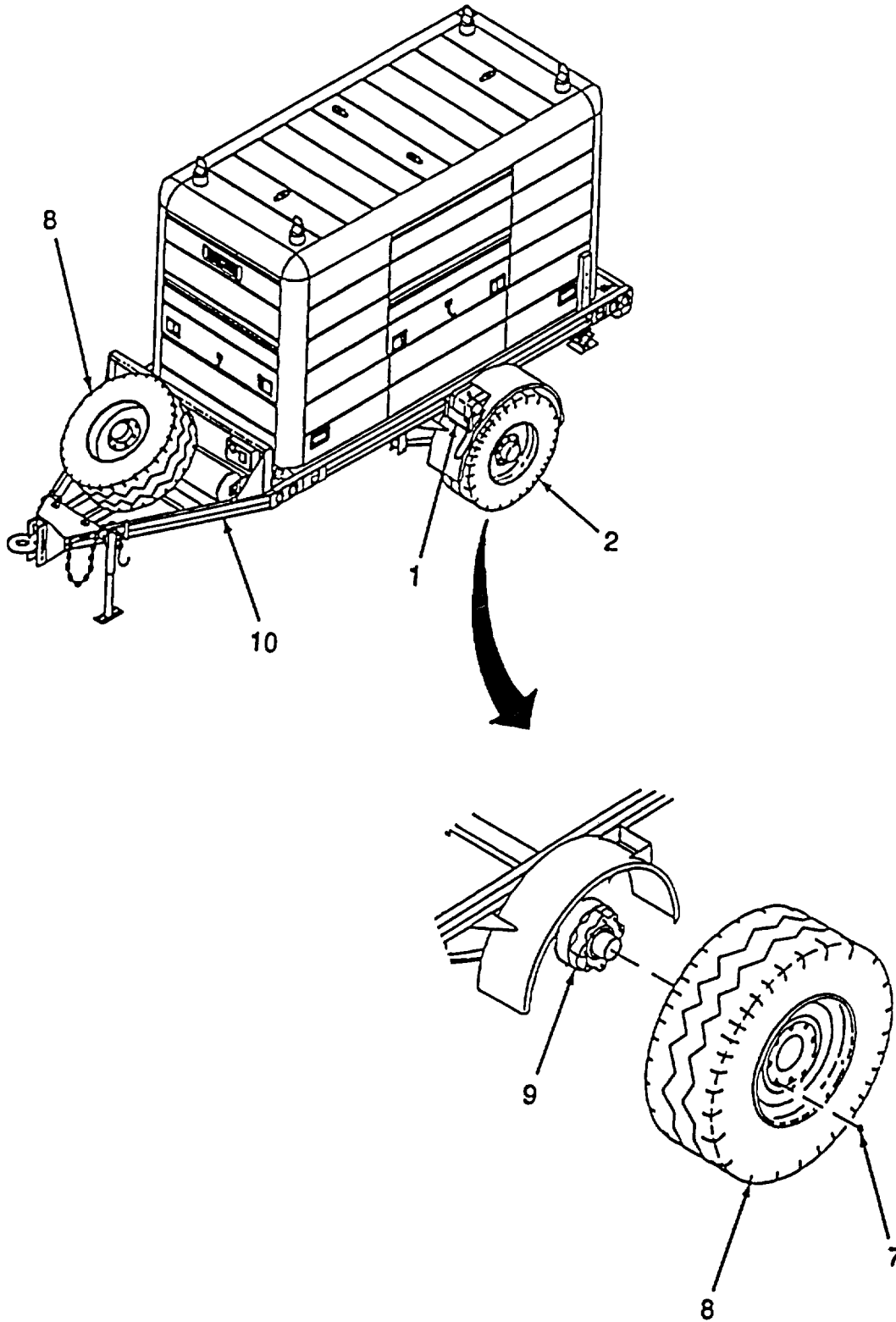


Figure 3-6. Wheel and Tire Assembly (Sheet 2 of 2)

**CHAPTER 4
UNIT MAINTENANCE INSTRUCTIONS**

Paragraph	Page
Section I. Repair Parts and Special Tools List	4-2
4-1. Common Tools and Equipment	4-2
4-2. Special Tools, Test, Measurement and Diagnostic Equipment (TMDE) and Support Equipment	4-2
4-3. Repair Parts	4-2
Section II. Service Upon Receipt	4-3
4-4. Siting	4-3
4-5. Shelter Requirements	4-3
4-6. Checking Unpacked Equipment	4-3
Section III. Unit Troubleshooting Procedures	4-4
4-7. Introduction	4-4
4-8. Malfunction Index.....	4-4
4-9. Troubleshooting Table	4-5
Section IV. Unit Prevention Maintenance Checks and Services (PMCS)	4-8
4-10. Introduction	4-8
4-11. Unit PMCS Table	4-8
Section V. Unit Maintenance Procedures	4-9
4-12. General Instructions	4-9
4-13. Enclosure Assembly.....	4-11
4-14. Doors	4-14
4-15. Panels	4-18
4-16. Air Filter/Moisture Separator	4-21
4-17. Alcohol Injector	4-23
4-18. Lube Supply Hoses	4-26
4-19. Transfer Pump.....	4-30
4-20. Fuel Cap and Neck Assembly.....	4-32
4-21. Fuel Tank Assembly	4-34
4-22. Tool Box Assembly	4-39
4-23. Gear-Lube and Oil Dispensers.....	4-41
4-24. Grease Control Valves	4-44
4-25. Reels and Hoses	4-46
4-26. Cabinet Assembly	4-50
4-27. Battery Box Assembly	4-57
4-28. Condensate Drain Assembly	4-65
4-29. Air Compressor Assembly	4-68
4-30. Control Panel and Throttle.....	4-69
4-31. Belts	4-77
4-32. Alternator Assembly.....	4-85
4-33. Plumbing.....	4-88
4-34. Air Pump.....	4-91
4-35. Shut-Off Valve	4-95
4-36. Pressure Relief Valve.....	4-96
4-37. Ball Valve	4-97
4-38. Unloader Valve	4-98
4-39. Diesel Engine	4-100

4-40.	Clutch	4-125
4-41.	Air Regulator and Plumbing	4-127
4-42.	Low and High Pressure Pumps and Pump Mufflers	4-133
4-43.	Heater Assembly	4-136
4-44.	Fuel Pump and Fuel Lines	4-138
4-45.	Control Box Assembly and Heater.....	4-141
4-46.	Heater Wiring Harness	4-143
4-47.	Exhaust Line/Hoses	4-147
4-48.	Heater Mounting Assembly	4-151
4-49.	Air Hose Assemblies and Gladhand Couplers	4-153
4-50.	Control Valve	4-154
4-51.	Emergency Relay Valve	4-157
4-52.	Quick Release and Limiting Valve	4-159
4-53.	Synchronizing Valve.....	4-162
4-54.	Air Tank Assembly	4-164
4-55.	Power Cluster and Master Cylinder.....	4-166
4-56.	Brake Lines	4-169
4-57.	Intervehicular Trailer Harnesses	4-173
4-58.	Voltage Reducer Box	4-175
4-59.	Front, Rear Jack and Safety Chain Assembly	4-177
4-60.	Hub and Drum	4-181
4-61.	Brakes	4-187
Section VI.	Preparation For Storage Or Shipment	4-192
4-62.	Scope	4-192
4-63.	Cleaning.....	4-192
4-64.	Lubrication.....	4-192
4-65.	Preservation and Packing/Preparation For Shipment.....	4-192
4-66.	Special Instructions For Administrative Storage	4-192

Section I. REPAIR PARTS AND SPECIAL TOOLS LIST

See companion publication **TM 5-4930-244-24P**

4-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970 or CTA 8-100, applicable to your unit. Also refer to SC 5180-90-N26, General Mechanic's Tool Kit.

4-2. SPECIAL TOOLS, TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) AND SUPPORT EQUIPMENT

Refer to the Maintenance Allocation Chart contained in Appendix B for maintenance tasks authorized at unit level maintenance and the TMDE and support equipment required to perform these tasks. No special tools or equipment are required to maintain the lube unit.

4-3. REPAIR PARTS

Repair parts are listed and illustrated in the Repair Parts and Special Tools list, **TM 5-4930-244-24P**, covering unit, direct support, and general support maintenance of the equipment.

Section II. SERVICE UPON RECEIPT**4-4. SITING.**

- a. Transport the lube unit by towing
- b. Lube unit design permits operation in remote locations
- c. Operate the unit on a level surface and avoid towing through deep mud or water.

4-5. SHELTER REQUIREMENTS.

In extremely hot, cold, or wet conditions shelter is helpful but not necessary

4-6. CHECKING UNPACKED EQUIPMENT.

- a. Remove and discard packing materials
- b. Inspect the equipment for damage Incurred during shipment If the equipment has been damaged, report the damage on SF 364, Report of Discrepancy.
- c. Check equipment against the packing slip to see if the shipment is complete. Report all discrepancies In accordance with the instructions of DA Pam 738-750.

Section III. UNIT TROUBLESHOOTING PROCEDURES

4-7. INTRODUCTION

- a. This table lists common malfunctions that you may find with your equipment. Perform the tests, inspections, and corrective actions in the order they appear in the table.
- b. This table cannot list all the malfunctions that may occur, all the tests and inspections needed to find the fault, or all the corrective actions needed to correct the fault. If the equipment malfunction is not listed or actions listed do not correct the fault, notify your supervisor.

NOTE

Before you use this table, be sure you have performed your PMCS (Chapter 2, Section II) Prior to performing unit troubleshooting procedures, be sure that Operator Troubleshooting Procedures have been performed

4-8. MALFUNCTION INDEX

Malfunction No.	Malfunction	Page
1.	Engine Will Not Start	4-5
2.	Engine Stops During Normal Operation	4-6
3.	Engine Misfires During Operation	4-6
4.	Engine Oil Pressure is Too Low or High At Normal Operating Conditions	4-6
5.	Diesel Fuel Is Used Too Quickly	4-7
6.	Lube Dispensers And Pumps Are Not Operating Properly	4-7

4-9. TROUBLESHOOTING TABLE

TABLE 4-1. TROUBLESHOOTING

WARNING

Read ALL warnings at the front of the manual before you begin troubleshooting.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. ENGINE WILL NOT START:

- Step (1) Check battery cables for corrosion (para 4-26).
Clean posts with wire brush. Reattach or replace the cables.
- Step (2) Check for clogged fuel filter (para 4-39).
Replace the filter element.
- Step (3) Check starter for proper operation (para 4-39).
Replace starter.
- Step (4) Check wiring for loose connections, cracks, and brittleness (para 4-30).
Repair or replace wire.
- Step (5) Check ignition switch for damage (para 4-30).
Repair or replace.
- Step (6) If above steps do not fix the problem, notify Direct Support maintenance.

TABLE 4-1 TROUBLESHOOTING - CONT.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

2. ENGINE STOPS DURING NORMAL OPERATION:

- Step (1) Check for clogged fuel filter.
Replace the filter.
- Step (2) Check for air or water in the fuel.
Drain fuel tank until fuel is clean and uncontaminated (para. 4-21). Refill fuel tank as required.

3. ENGINE MISFIRES DURING OPERATION:

- Step (1) Check for clogged fuel filter.
Replace the filter.
- Step (2) Check for air or water in the fuel system.
Drain and refill tank.

4. ENGINE OIL PRESSURE IS TOO LOW (BELOW 12 lb-ft) OR HIGH (ABOVE 60 lb-ft) AT NORMAL OPERATING CONDITIONS:**CAUTION**

DO NOT operate engine when oil pressure is low. Serious damage could occur to engine components.

- Step (1) Check engine oil for correct grade. See companion publication LO 5-4930-244-12.
Replace oil with correct grade.
- Step (2) Check oil pressure gauge for proper operation.
Repair or replace the gauge.
- Step (3) Check external fuel lines for leakage or restrictions.
Clear restrictions or replace lines.

TABLE 4-1 TROUBLESHOOTING - CONT.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

5. DIESEL FUEL USED TOO QUICKLY:**WARNING**

- **Fuel pressure may be sufficient to penetrate skin. Wear gloves when working with the fuel system.**
- **DO NOT perform troubleshooting checks or tests near open flame, sparks, or electricity. Diesel fuel is flammable**

Check for clogged fuel filter (para 4-39).

Replace the filter (para 4-39)

6. LUBE DISPENSERS AND PUMPS ARE NOT OPERATING PROPERLY:

- Step (1) Check for air pressure gauge reading of approximately 120 psi.
If pressure is significantly lower than 120 psi or higher than 170 psi
Repair or notify Direct Support maintenance

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

4-10. INTRODUCTION.

Table 4-2 lists preventive maintenance checks and services which shall be performed at specified intervals by unit maintenance personnel (operator and organizational). It expands on preventive maintenance performed by the operator. The columns, codes, and location designations used in the table are as follows:

- a. Item No. Column. Item numbers are assigned to each check or service task in the PMCS. Tasks are numbered in logical order of performance regardless of the interval. The numbers are to be used as a source of time numbers for the TM Number Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.
- b. Interval Column. This column will read either "Weekly", "Monthly", "Quarterly", or "Semiannually".
- c. Item To Be Inspected Column This column provides the name of the item to be checked or serviced.
- d. Procedure Column. This column describes the procedures by which the check or service is to be performed. It includes all the information required to perform the checks or services. Illustrations are included to assist in locating that part of the equipment requiring the check or service.

4-11. UNIT PMCS TABLE.

For Unit PMCS information, refer to Table 4-2.

Table 4-2. Unit PMCS

Item No.	Interval	Item to be Inspected	Procedure	Not Fully Mission Capable If
1	Quarterly	Lubrication Points	Refer to LO 5-4930-244-12.	Scheduled maintenance not performed.
2	Quarterly	Brake Assembly	Inspect brakes for correct operation and adjustment (para 4-61).	Brakes don't work
3	Semi-Annually	Air Compressor Assy	Inspect alternator and compressor belts for wear, cuts, or damage.	Belts are damaged.

Section V. UNIT MAINTENANCE PROCEDURES

4-12. GENERAL INSTRUCTIONS.

This section contains instructions for performing unit level maintenance on the Lubricating and Servicing Unit.

a. Safety.

WARNING

**Chock wheels when unit is not on a level surface or during maintenance
Unit could roll and cause injury.**

- (1) To ensure safety of personnel, proper care should be used when handling assemblies and parts. Many assemblies are heavy. The assistance of another person, lifting device, or other support equipment may be required to move or position heavy items.
- (2) Personnel must remove all items of jewelry (rings, bracelets, watches, necklaces etc.) and loose clothing before working on the equipment. Jewelry and loose clothing can get caught in moving parts and result in injury to personnel. Jewelry can cause electrical shorts or severe injury when working around electrical equipment.

b. Proper Equipment.

Obtain proper equipment before beginning maintenance. This includes hand tools and/or special tools, receptacles for storing small parts, and expendable materials required by the maintenance task.

c. Preparation For Disassembly.

WARNING

Dry cleaning solvent is flammable and toxic. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin.

Unit, tools, work area, and hands should be clean before maintenance is started. Dry solvent will clean most items encountered. A steam cleaner will clean caked on mud and grease. Use suitable soap or hand cleaner for your hands. Dirt and debris on parts can cause premature aging, breakdown or failure of equipment.

d. Disassembly.

- (1) Identify all parts that you remove with numbered or lettered tags. This procedure will allow you to quickly and correctly reassemble the equipment you are working on.
- (2) Protect yourself and your equipment. Get help when working with heavy items.

e. Assembly.

Before reassembling equipment, coat all bare metal surfaces with light oil. Oil will prevent rust, corrosion, and ensure easy removal in the future.

f. Finishing Up.

- (1) Bolts, nuts, and other hardware should be tight. Fill fluid reservoirs.
- (2) Clean up the work area and return all tools to their storage location.

4-13. ENCLOSURE ASSEMBLY - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

None

Equipment Condition

Engine shut down and cool.

Personnel Required

4

WARNING

- **Lift enclosure properly; it is heavy. Unit could shift causing it to fall and cause injury.**
- **Watch for hand and finger injuries when lowering the enclosure onto the skid Jacks can get in the way.**

CAUTION

- **Be certain that all controls are pushed in. Do not damage lights on control panel during removal.**
- **Be sure that all doors are closed on the enclosure**

NOTE

It is easier to remove the enclosure when the skid assembly is not on the trailer.

a. Removal. (Refer to Figure 4-1.)

- (1) Remove four thumb screws (1) to release fuel cap (2) and neck assembly (3) from enclosure (4).
- (2) Remove four lifting rings (5) and four washers (6) from enclosure (4).
- (3) Position one person at each corner of enclosure (4)
- (4) Locate and grasp lifting handles (7)
- (5) Lift enclosure (4) straight up and over skid assembly (8), making sure neck assembly (3) clears opening in enclosure.
- (6) Place enclosure (4) onto firm level ground.

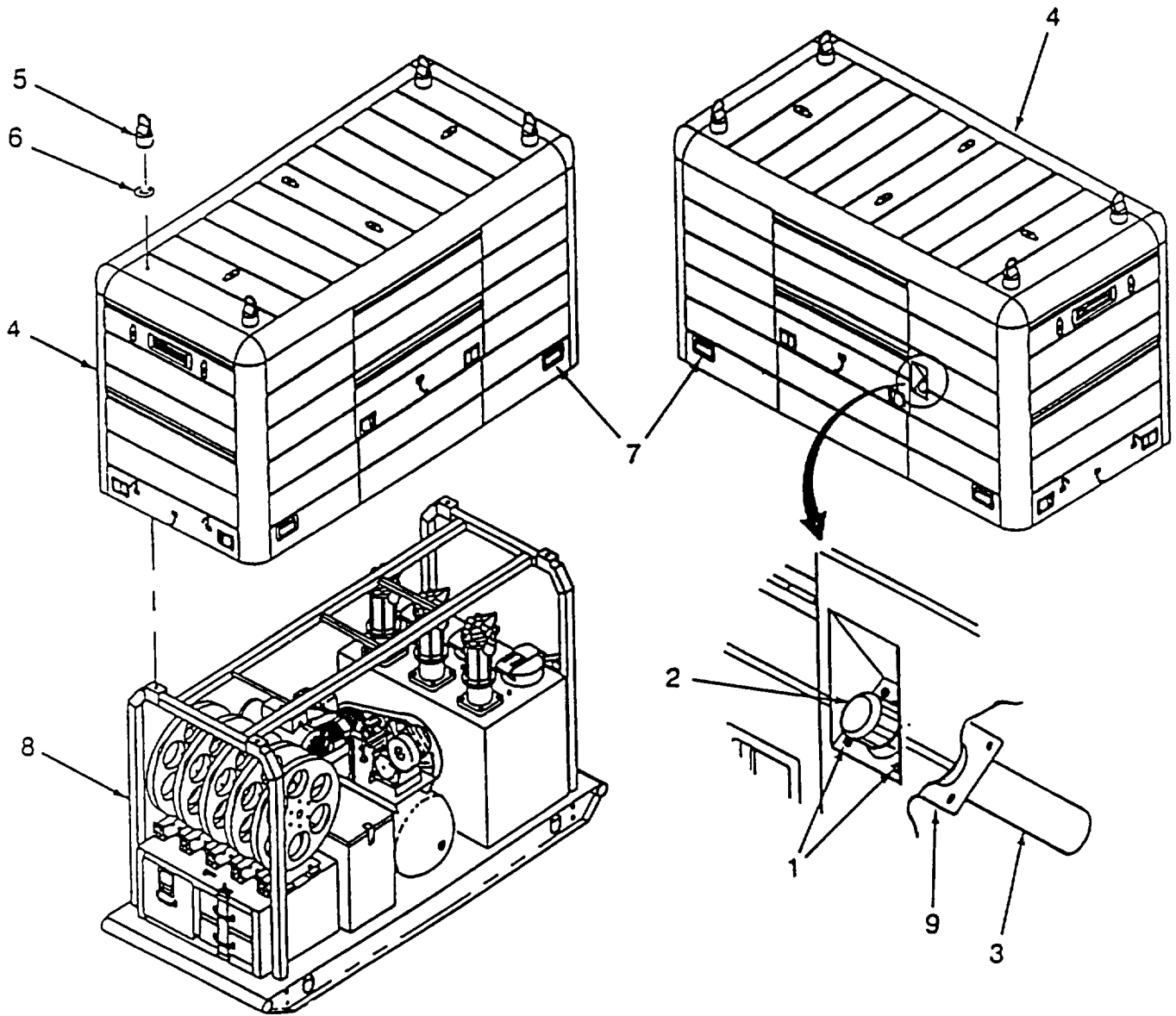


Figure 4-1. Enclosure Assembly

b. Installation.

- (1) Position one person at each corner of enclosure (4), locate and grasp lifting handles (7).
- (2) Lift enclosure (4) up and onto the skid assembly (8).
- (3) Attach four lifting rings (5) and washers (6) to enclosure (4)
- (4) Slide fuel cap (2) and neck assembly (3) through hole opening in enclosure (4), until cap housing (9) is flush with opening in enclosure.
- (5) Install four thumb screws (1) into cap housing (9) locking assembly in place

4-14. DOORS - REPLACE/REPAIR.

This Task Covers:	a. Removal	b. Disassembly	c. Repair
	d. Assembly	e. Installation	

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Riveter, Blind, Hand (Appendix B, Section III, Item 2).
 Electric Drill, 3/16" drill bit (Appendix B, Section III, Item 2).

Materials/Parts Required

Rivets (Appendix H, Section II, Items 1 and 2).
 Locknut (Appendix H, Section II, Item 77).

Equipment Condition

Engine shut down and cool.

Personnel Required

2

NOTE

The following procedures apply to any of the four enclosure doors.

- a. Removal. (Refer to Figure 4-2.)
 - (1) Open slam latches (1) on outside of doors (2). Raise door up and fold.
 - (2) Unlatch finger bolt latches (3) on inside of doors (2). Let doors hang freely.
 - (3) Drill out rivets (4) at top hinge (5) of doors (2), using electric drill with a 3/16" drill bit.
 - (4) Remove doors (2) from enclosure (6).

- b. Disassembly.
 - (1) Lay door (2) flat on work table. Drill out rivets (4) on lower portion of top hinge (5), removing hinge (5) from door (2).
 - (2) Remove rivets (7) from lower hinge (8), and remove hinge (8) from door (2).
 - (3) Drill out door latch rivets (9) and remove door latches (10) from typical two places.
 - (4) Remove machine screws (11), washers (23) and locknuts (24) from hooks (12) and remove hooks (12) from door (2).
 - (5) Drill out rivets (13) securing two inner door latches (3) to door (2) and remove from door (2).
 - (6) Drill out shutter rivets (21), removing shutter (22) from door (20).

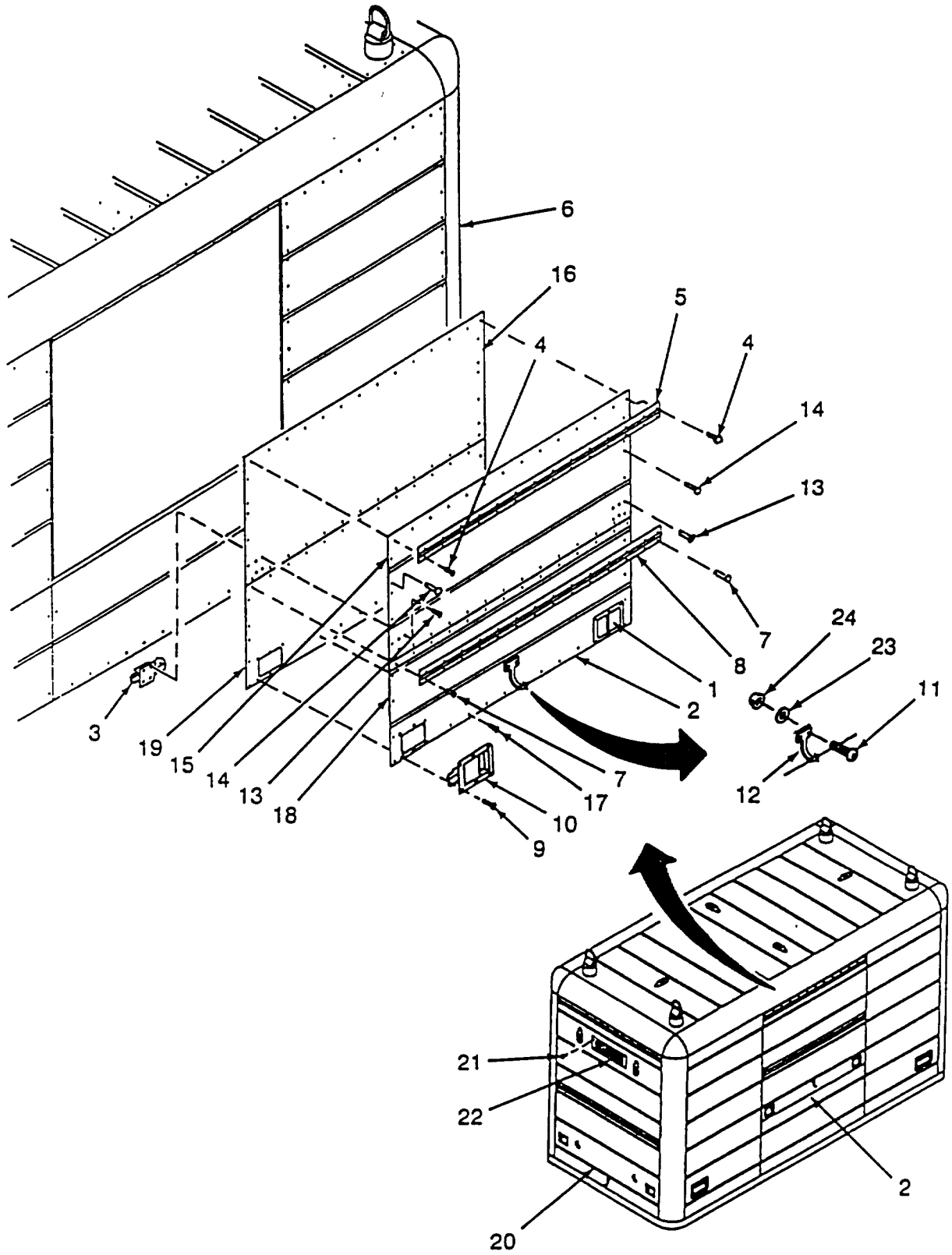


Figure 4-2. Doors (Sheet 1 of 2)

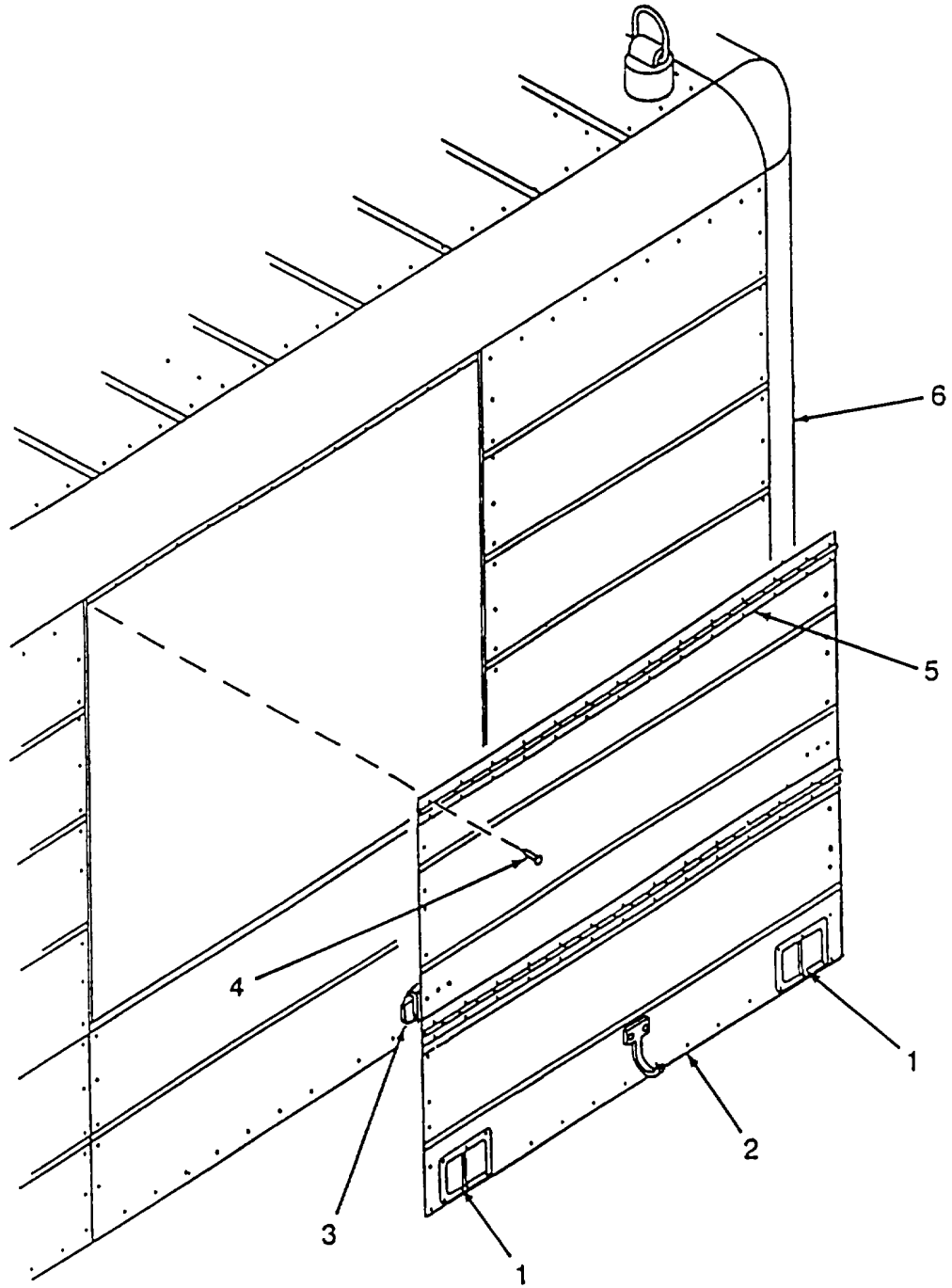


Figure 4-2. Doors (Sheet 2 of 2)

- (7) Drill out the remaining rivets (14) securing the upper door panel (15) to upper door plate (16).
- (8) Drill out the remaining rivets (17) securing the lower door panel (18) to lower door plate (19).

c. Repair.

- (1) Inspect all parts for damage, such as bends, holes, or cracks
- (2) Repair or replace as necessary.

d. Assembly.

NOTE

All items must be placed on door panels with holes aligned before installing rivets.

- (1) Match upper door panel (15) to upper door plate (16), securing it with rivets (14).
- (2) Match hinge (5) to upper door panel (15), securing lower portion of hinge (5) with rivets (4).
- (3) Match lower door panel (18) to lower door plate (19), securing it with rivets (17)
- (4) Match hinge (8) to lower door panel (18), securing it with rivets (7).
- (5) Match inner door latch (3) to inside of door (2), securing it with rivets (13).
- (6) Install door latches (10) into lower door panel (18), securing it with rivets (9)
- (7) Match hook (12) to lower door panel (18), securing it with machine screws (11), washers (23) and locknuts (24)
- (8) Install shutters (22) into front and rear doors (20), securing it with rivets (21).

e. Installation.

- (1) Place new doors (2) against enclosure (6) frame Install two rivets (4) - one in each corner.
- (2) Install all other rivets (4)
- (3) With door (2) folded, relatch finger bolt latches (3).
- (4) Relatch door (2) using slam latches (1)

4-15. PANELS - REPLACE/REPAIR.

This Task Covers:	a. Removal	b. Repair	c. Installation
--------------------------	-------------------	------------------	------------------------

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Caulking Gun (Appendix B, Section III, Item 5).
 Primer Brush (Appendix B, Section III, Item 6).
 Electric Drill, 3/16" drill bit (Appendix B, Section II, Item 2).
 Riveter, Blind, Hand (Appendix B, Section III, Item 2).

Materials Required

Synthetic Rubber Caulk Compound (Appendix E, Section II, Item 5).
 Rivets, Blind (Appendix H, Section II, Item 1).
 Rubber Caulking (Appendix E, Section II, Item 12).

Bulk Items

Aluminum Sheet, sized to fit hole (Appendix F, Figure 6).

Equipment Condition

Engine shut down and cool.

NOTE

Step a (2) applies to all panels, for other steps, proceed only as needed.

- a. Removal. (Refer to Figure 4-3).
- (1) Remove top panel (1) from enclosure frame (2) by drilling out all rivets (3) using electric drill with 3/16" drill bit.
 - (2) Remove four latch retainer D-rings (4) by drilling out rivets (5).
 - (3) Remove all other panels (6) by drilling out rivets (7) around outside edges of panels.
 - (4) Remove storage pocket (8) by drilling out rivets (7)..

NOTE

The following procedures apply to all panels.

- b. Repair.
- (1) Straighten dents and flatten area to be patched on panel.
 - (2) Cut aluminum sheet patch (9), and shape to fit hole in panel.
 - (3) Drill holes around perimeter of patch (9).
 - (4) Lay patch (9) over damaged area and transfer holes to panel.
 - (5) Coat inside of patch (9) with synthetic rubber caulking compound just inside the perimeter of drilled holes.
 - (6) Position patch (9) over damaged area and install rivets (10) as needed.

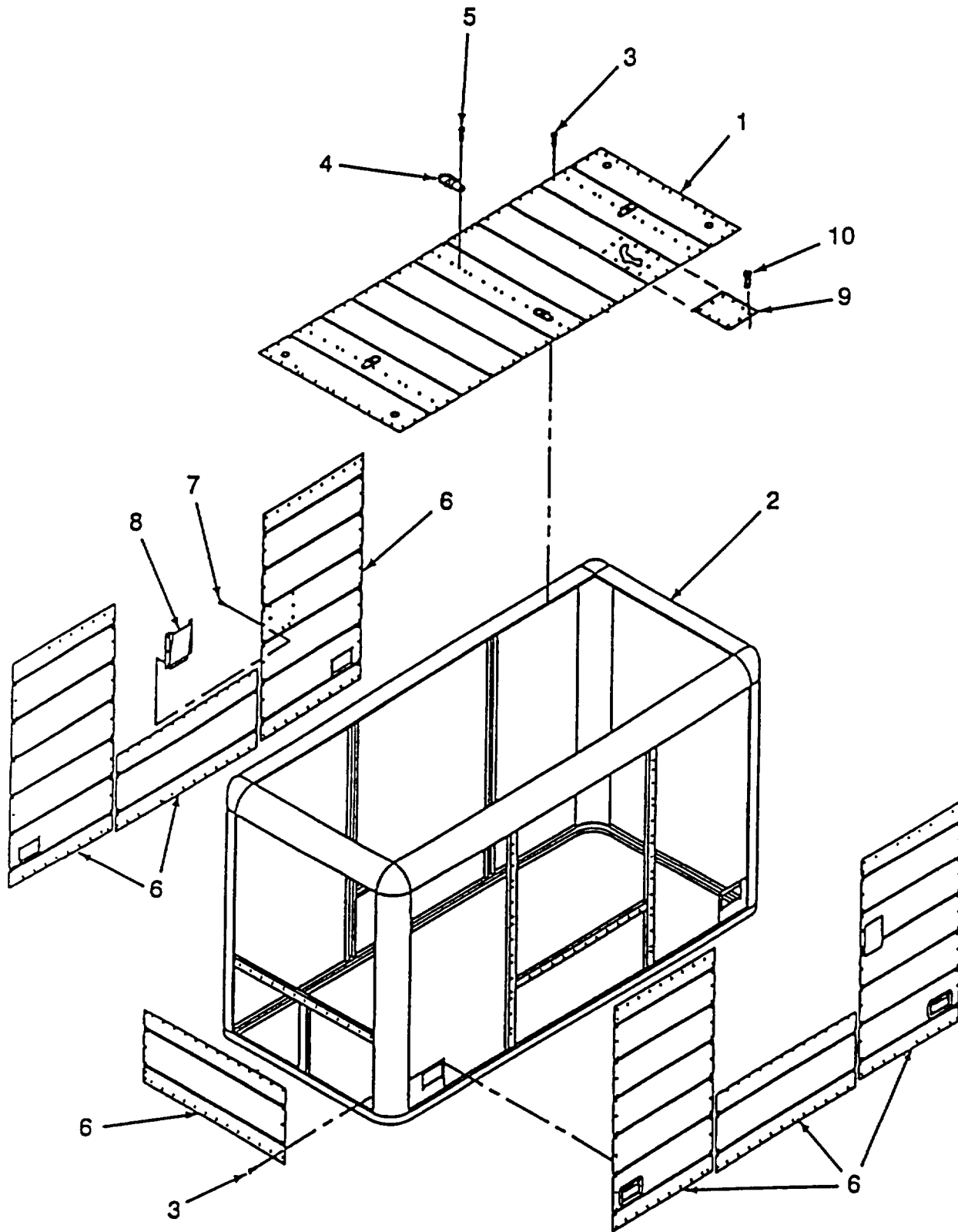


Figure 4-3. Panels

c. Installation.

NOTE

All items must be placed on panels with holes aligned before installing rivets.

- (1) Align holes in storage pocket (8) to holes in side panel (6), securing it with rivets (7).
- (2) Install four latch retainer D-rings (4) with rivets (5) to top panel (1).
- (3) For all other side panels, position panels (6) and fasten with rivets (3).

NOTE

Seal along all outside edges of top panel (1) with synthetic rubber caulking compound.

- (4) Install top panel (1) with rivets (3).

4-16. AIR FILTER/MOISTURE SEPARATOR - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts

Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Unit shut down and cool.

a. Removal. (Refer to Figure 4-4.)

- (1) Shut off air flow by turning ball valve handle (1) to "off" position.
- (2) Vent air pressure completely by turning lever (2) to "open" position.
- (3) Open petcock drain (3) and drain moisture.
- (4) Unscrew air filter reservoir bowl (10).
- (5) Disconnect hose (4) at swivel adapters (5 and 6).
- (6) Remove swivel adapter (6) and street elbow (7) from air moisture separator (8)
- (7) Remove air moisture separator (8) from nipple (9).

NOTE

Before installation, wrap nipple (8) threads with Teflon Tape.

b. Installation.

- (1) Tape free end of nipple (9) with Teflon tape.
- (2) Install air moisture separator (8) to nipple (9).
- (3) Tape male end of street elbow (7) and reconnect it and swivel adapter (6) to air moisture separator (8)
- (4) Connect hose (4) to swivel adapter (5).
- (5) Screw on air filter reservoir bowl (10) and close petcock drain (3).
- (6) Close air pressure vent by turning lever (2) to "closed" position.
- (7) Open ball valve handle (1).
- (8) Check for leaks

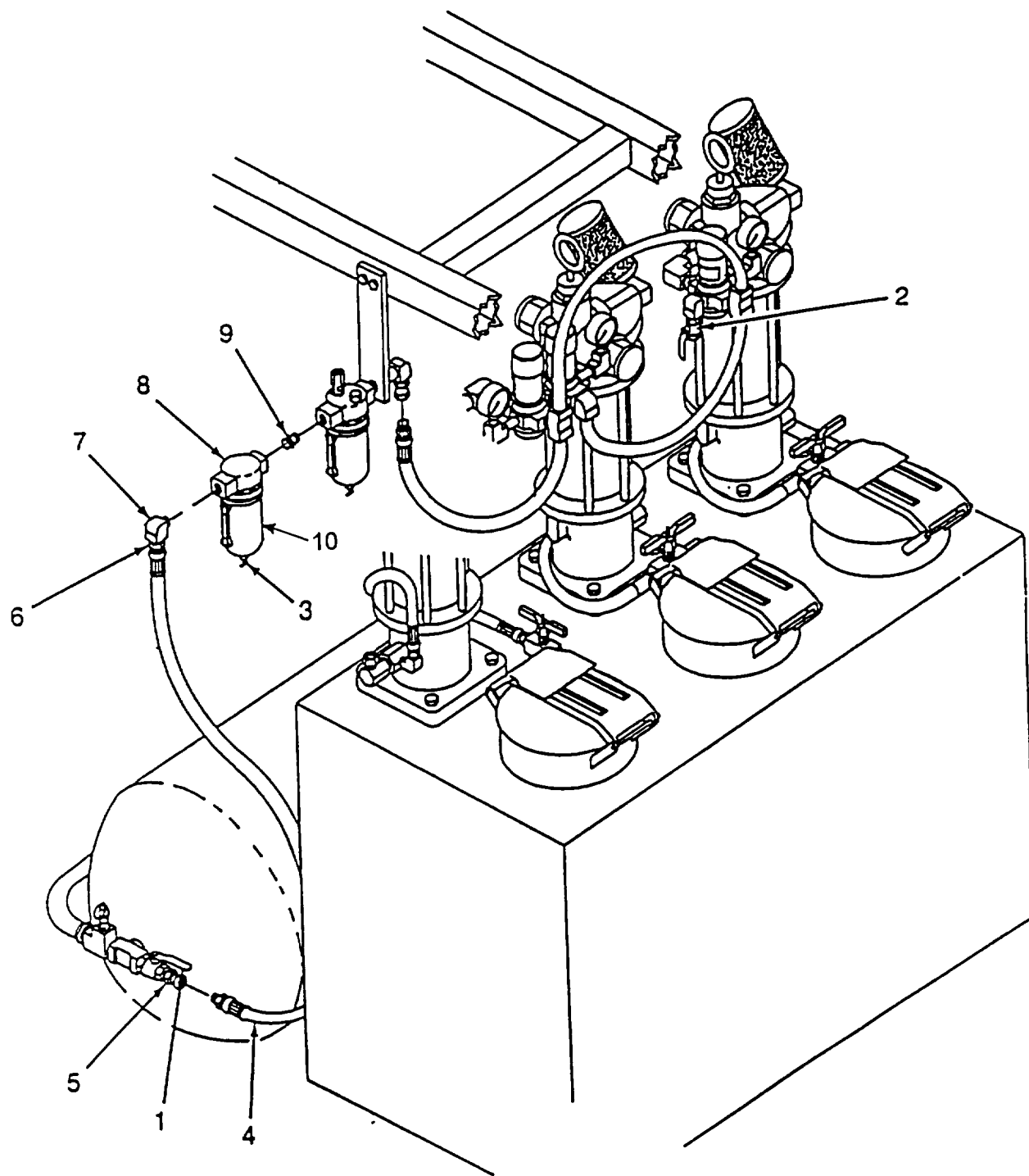


Figure 4-4. Air Filter/Moisture Separator

4-17. ALCOHOL INJECTOR - REPLACE/REPAIR.

This Task Covers: a. Removal b. Repair c. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7).

Nut, self-locking (Appendix H, Section II, Item 9).

Nut, self-locking (Appendix H, Section II, Item 10).

Equipment Condition

Air Filter/Moisture Separator Removal (para 4-16).

a. Removal. (Refer to Figure 4-5.)

- (1) Shut off air flow by turning ball valve handle (1) to "off" position.
- (2) Vent air pressure completely by turning lever (2) to "open" position.
- (3) Open petcock drain (3) and drain methyl alcohol into suitable container.
- (4) Disconnect hose (10) from swivel adapter (11).
- (5) Remove cap screw (12), washer (13), chain assy hook (14), and self-locking nut (15) from bracket (16). Discard self-locking nut (15).
- (6) Remove two bolts (17), two washers (18), and two self-locking nuts (19) from bracket (16), and remove bracket (16) and alcohol injector (9) from A-frame (22) Discard two self-locking nuts (19).
- (7) Remove alcohol injector (9) from nipple (20).

b. Repair.

- (1) Inspect for cracks or deterioration. Replace if necessary.
- (2) Replace any parts that show obvious wear or damage.

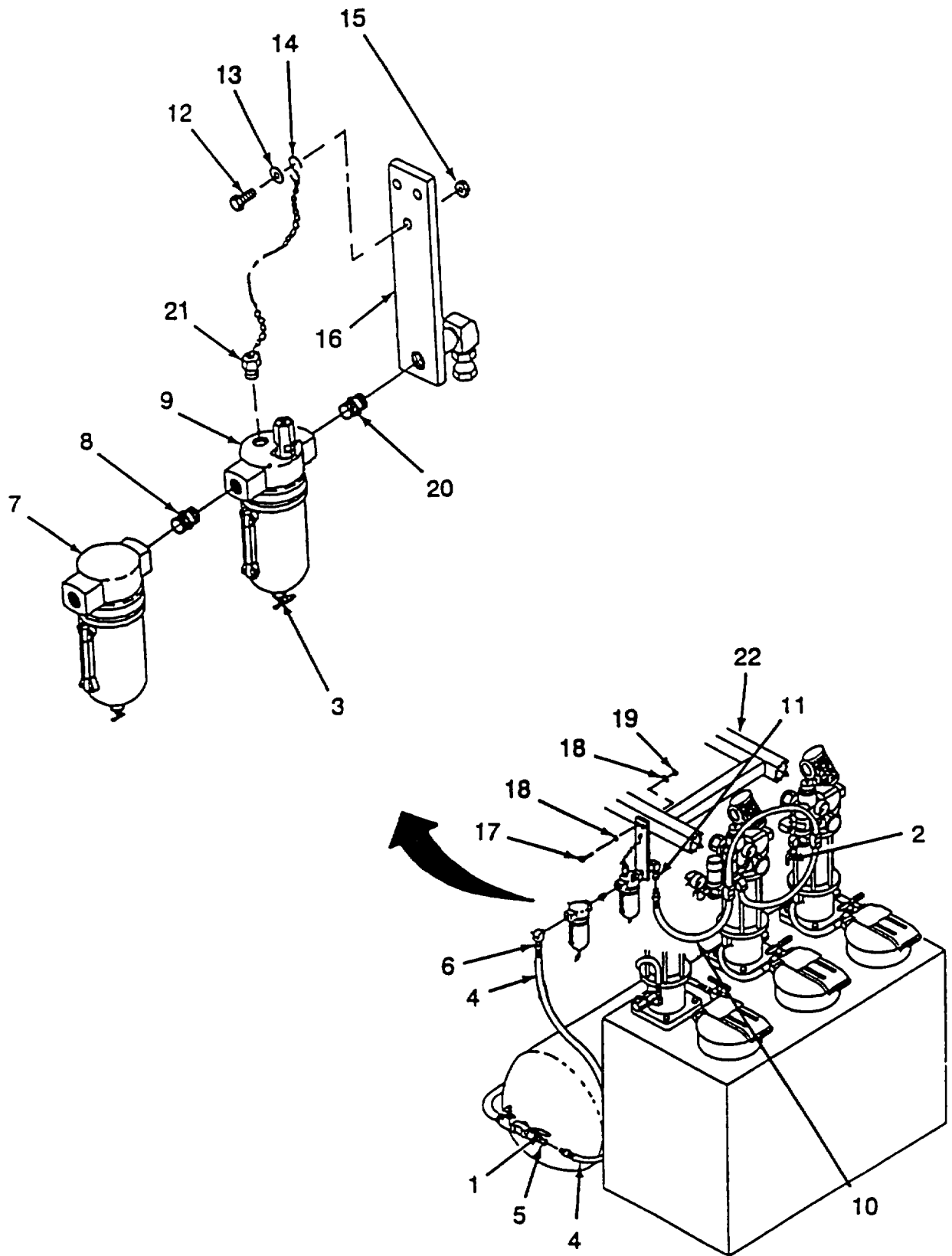


Figure 4-5. Alcohol Injector

c. Installation.

CAUTION

- **Unit components can be damaged by over tightening. Do not over tighten nipples attaching to alcohol injector.**

- (1) Before installation, wrap nipples in opposite direction of threads with Teflon Tape
- (2) Install alcohol injector (9) onto nipple (20) and tighten.
- (3) Attach cap screw (12), washer (13), chain assy hook (14), and new self-locking nut (15) onto bracket (16)
- (4) Attach bracket (16) onto frame using two bolts (17), two washers (18), and two new self-locking nuts (19)
- (5) Close petcock drain (3) Fill container with methyl alcohol
- (6) Put fill plug (21) back on alcohol injector (9) and tighten
- (7) Close vent by turning lever (2)
- (8) Open ball valve by turning ball valve handle (1). Check for leaks
- (9) Adjust flow alcohol injector (9). (Refer to para 3-5).

4-18. LUBE SUPPLY HOSES - REPLACE/REPAIR.

This Task Covers: **a. Removal** **b. Repair** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Nut, self-locking (Appendix H, Section II, Item 9).

Nut, self-locking (Appendix H, Section II, Item 10).

Equipment Condition

Engine shut down and cool.

Enclosure Removed (para. 4-13)

a. Removal. (Refer to Figure 4-6.)

- (1) Loosen and remove self-locking nut (1), washer (2), bolt (3) and clamp (4) securing hose (5) to A-frame (6). Discard self-locking nut (1).
- (2) Remove self-tapping screw (7) securing hose (5) to A-frame (6). Remove clamps (4 and 8) from hose (5).
- (3) Disconnect coupling (9) from swivel adapter (10) on low pressure pump (11).
- (4) Disconnect hose (5) from swivel adapter (12).
- (5) Remove two bolts (13) four washers (14), two self-locking nuts (15) and two clamps (16) securing hose (17) to A-frame (6). Discard self-locking nuts (15).
- (6) Unscrew swivel adapter (18) from nipple (19) and bracket (20).
- (7) Disconnect coupling (21) from swivel adapter (22) on high pressure pump (23).
- (8) Remove two self-tapping screws (24) securing hose (26) to A-frame (6). Remove clamps (25) from hose (26).
- (9) Disconnect coupling (27) from swivel adapter (28) on low pressure pump (29).
- (10) Disconnect hose (26) from swivel adapter (30).
- (11) Disconnect two swivel adapters (31) from connector (32).
- (12) Disconnect hose (34) from female swivel (33) at reel cabinet assembly, and remove hose (34).
- (13) Disconnect hose (36) from female swivel (35) at reel cabinet assembly, and remove hose (36).
- (14) Remove two self-locking nuts (37), four washers (38), two bolts (39) securing bracket (20). Discard self-locking nuts (37).
- (15) Tag and disconnect trouble light assembly (40) wires.

- (16) Loosen and remove cap screw (41), two washers (42), and self-locking nut (43) securing trouble light assembly (40) to A-frame (6). Discard self-locking nut (43).
- (17) Loosen and remove cap screw (44), two washers (45), and self-locking nut (46) securing strap (47) to A-frame (6) Discard self-locking nut (46)

b. Repair.

Replace any part that shows obvious wear or damage.

c. Installation.

- (1) Position and align hole in securing strap (47) with hole in A-frame (6) Install cap screw (44), two washers (45), and new self-locking nut (46) to A-frame (6).
- (2) Position trouble light assembly (40) with A-frame (6). Install cap screw (41), two washers (42), and new self-locking nut (43), securing trouble light assembly (40) to A-frame (6)
- (3) Reconnect trouble light assembly (40) wires White wire connects to black and black wire connects to white.
- (4) Align holes in bracket (20) up with holes in A-frame (6) Install two bolts (39), four washers (38), and two new self-locking nuts (37) securing bracket (20) to A-frame (6)
- (5) Connect hose (36) to swivel (35) at reel cabinet assembly.
- (6) Connect hose (34) to swivel (33) at reel cabinet assembly
- (7) Connect two swivel adapters (31) to connector (32).
- (8) Put clamps (16) on hose (17)
- (9) Align two clamps (16) up with holes in A-frame (6) Install two bolts (13), four washers (14) and two new self-locking nuts (15), securing clamps (16) to A-frame (6)
- (10) Connect coupling (21) to swivel adapter (22) on high pressure pump (23).
- (11) Screw swivel adapter (18) onto nipple (19) and hose (17).
- (12) Connect hose (26) to swivel adapter (30)
- (13) Put clamps (25) on hose (26)
- (14) Align two clamps (25) up with holes in A-frame (6) Install two self-tapping screws (24), securing clamps (25) to A-frame (6)
- (15) Connect coupling (27) to low pressure pump swivel adapter (28) on low pressure pump (29).
- (16) Put clamps (4 and 8) on hose (5).
- (17) Align clamp (4) up with hole in A-frame (6). Install bolt (3), two washers (2) through A-frame (6) and clamp (4) Install new self-locking nut (1), securing clamp (4) to A-frame (6).
- (18) Align clamp (8) up with hole in A-frame (6) Install self-tapping screw (7) into A-frame (6), securing clamp to A-frame (6).
- (19) Connect hose (5) to swivel adapter (12).

(20) Connect coupling (9) to swivel adapter (10) on low pressure pump (11).

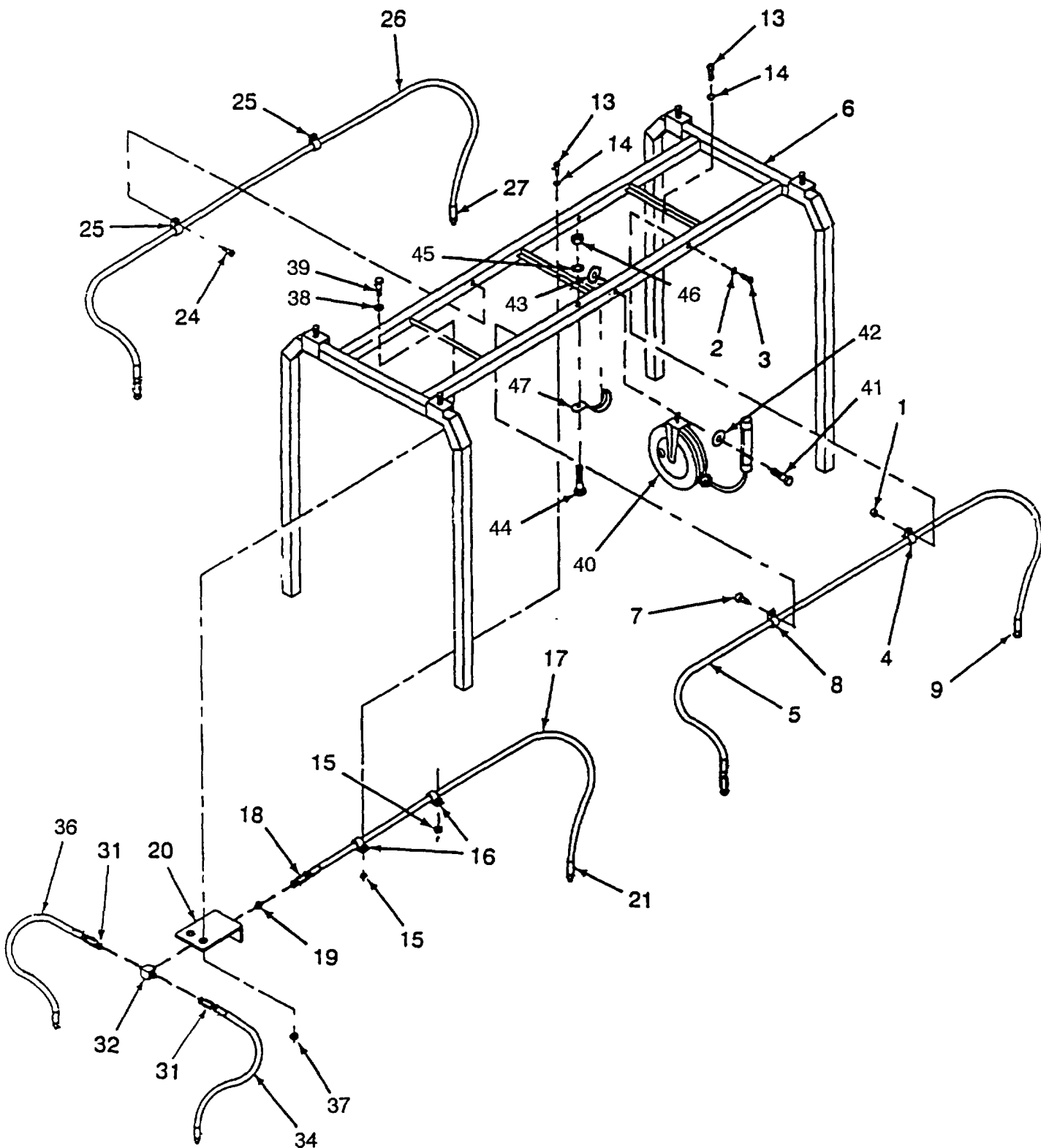


Figure 4-6. Lube Supply Hose (Sheet 1 of 2)

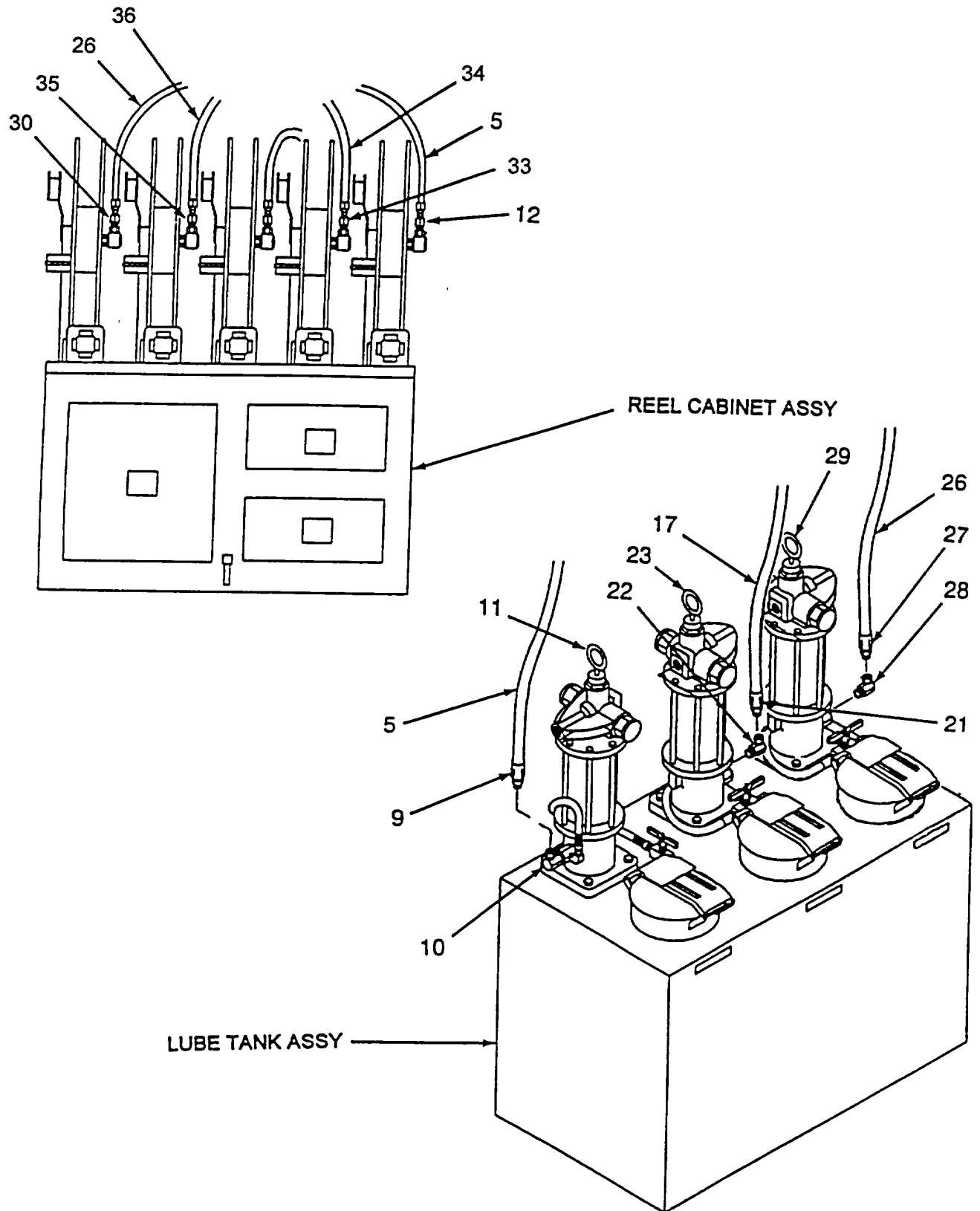


Figure 4-6. Lube Supply Hoses (Sheet 2 of 2)

4-19. TRANSFER PUMP - ADJUST.

This Task Covers: a. **Adjust**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1).

Materials RequiredNone

NOTE

This adjustment can also be made to correct leaking that occurs around packing adjustment slot.

CAUTION

Do not overtighten bushing as this will cause piston assembly to bind.

- a. Adjust. (Refer to Figure 4-7).
 - (1) Run pump for approximately five minute.
 - (2) Allow cylinder and plunger to cool.
 - (3) Apply a maximum of 30 psi air pressure. If pump does not start or if leakage occurs, adjustment is required.
 - (4) Loosen power head assembly (1) from pump casing (2) until its holes line up.
 - (5) Place hole punch through holes. Hand tighten power head assembly (1) into pump casing (2). This will tighten Teflon packings.
 - (6) Operate the transfer pump. If pump still leaks, notify next higher level of maintenance.

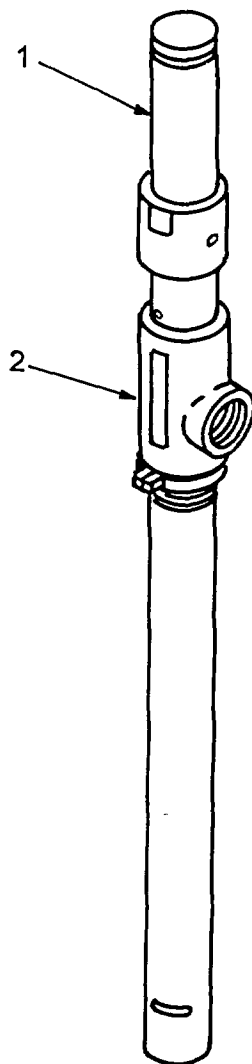


Figure 4-7. Transfer Pump

4-20. FUEL CAP AND NECK ASSEMBLY - REPLACE/REPAIR.

This Task Covers: **a. Removal** **b. Disassembly** **c. Repair**
 d. Assembly **e. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Lockwasher (Appendix H, Section II, Item 7).

Equipment Condition

Unit shut down and cool.
 Enclosure removed (para. 4-13)

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Use extreme caution when working with fuel.**
- **Use caution when removing fuel, cap, and neck assembly; hoses may quickly give way and cause injury.**

a. Removal. (Refer to Figure 4-8.)

- (1) Remove pan head screw (1) and lockwasher (2) from fuel level sending unit (3), holding ground wire (4). Discard lockwasher (2).
- (2) Loosen clamp (7) and slide down on hose (9). Loosen clamp (9 from fuel tank (10) sliding it up on hose (8).

NOTE

When removing the hose it is necessary to break the seal first. Use channel locks and twist slightly to break seal. Take caution not to collapse the neck on the fuel tank by gripping too tightly.

- (3) Remove hose (8) from fuel tank (10).

b. Disassembly.

- (1) Remove clamps (7 and 9) from hose (8) and hose (8) from cap and strainer assembly (5).
- (2) Remove six pan head screws (11), locknuts (12) and ground wire (4) from cap and strainer assembly (5) and flange (6).

c. Repair.

- (1) Inspect fuel hose for cracks or deterioration. Replace if necessary.
- (2) Replace any part that shows obvious wear or damage.

d. Assembly.

- (1) Slide cap and strainer assembly (5) through flange (6) until flange is flush on cap housing.
- (2) Install six pan head screws (11), ground wire (4) and nuts (12) to attach cap and strainer assembly (5) to flange (6).
- (3) Slide clamps (7 and 9) onto hose (8).
- (4) Install hose (8) onto cap and strainer assembly (5) and tighten clamp (7).

e. Installation.

- (1) Slide hose (8) onto fuel tank (10) neck, slide down clamp (9) and tighten clamp.
- (2) Install pan head screw (1), lockwasher (2) and ground wire (4) onto fuel level sending unit (3).

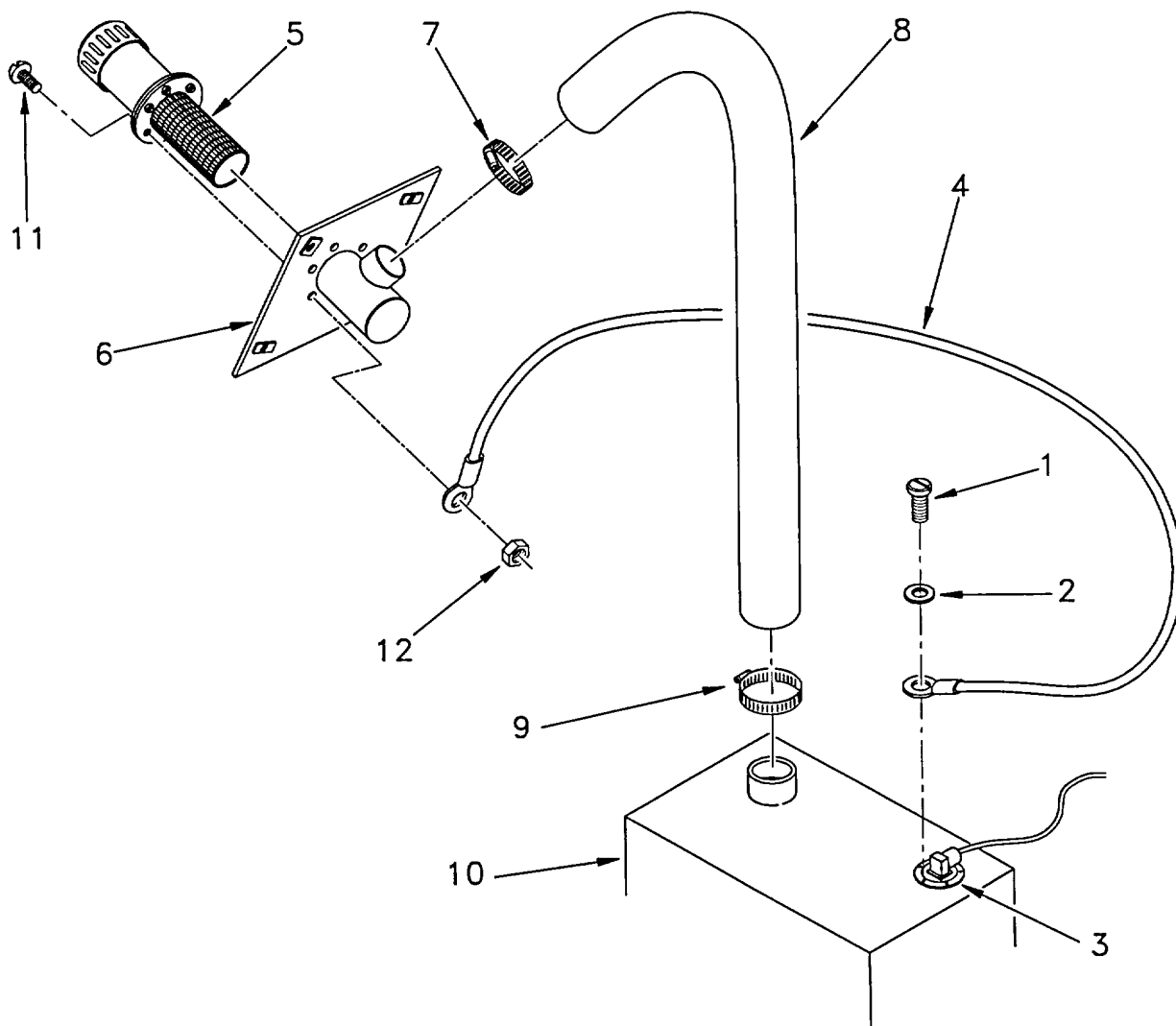


Figure 4-8. Fuel Cap and Neck Assembly

4-21. FUEL TANK ASSEMBLY - SERVICE/REPLACE.

This Task Covers: a. **Service** b. **Removal** c. **Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).

Plastic Ties (Appendix E, Section II, Item 9).

Teflon Tape (Appendix E, Section II, Item 7).

15 GAL Bucket (Appendix E, Section II, Item 14).

Nut, self-locking (Appendix H, Section II, Item 11).

Lockwasher (Appendix H, Section II, Item 7).

Equipment Condition

Engine shut down and cool.

Enclosure Removed (para. 4-13).

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Use extreme caution when working with fuel.**
- **Clean up spills immediately.**

a. Service. (Refer to Figure 4-9.)

(1) Drain diesel fuel into suitable container by removing cap (1).

(2) If diesel fuel appears contaminated or contains water, or if rough or erratic engine operation has been noticed, clean system thoroughly.

NOTE

If cleaning the fuel tank is not necessary, proceed to step 9.

(3) Loosen clamp (2) and slide hose (3) off of fuel tank inlet (4).

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**
 - **DO NOT smoke when working with solvent**
- (4) Thoroughly flush out fuel tank inlet (4) with dry-cleaning solvent.
- (5) Loosen knob (5) on bottom of fuel strainer (6) and remove glass bowl (7), gasket (8) and screen (9). Check for loose sediments, or water. Empty glass bowl into appropriate container and clean inside of glass bowl with dry-cleaning solvent

NOTE

Make sure that gasket lies flat around rim of glass bowl and inside lip of fuel strainer.

- (6) Place screen (9) and gasket (8) around rim of glass bowl (7) and install into bottom of fuel strainer (6).
- (7) Tighten knob (5) until a snug fit between knob and glass bowl (7) is accomplished.
- (8) Install fuel hose (3) and clamp (2) onto fuel tank inlet (4) Tighten clamp (2).
- (9) Check for leaks; repeat procedures if necessary
- (10) Replace pipe cap (1) onto bottom of fuel tank.

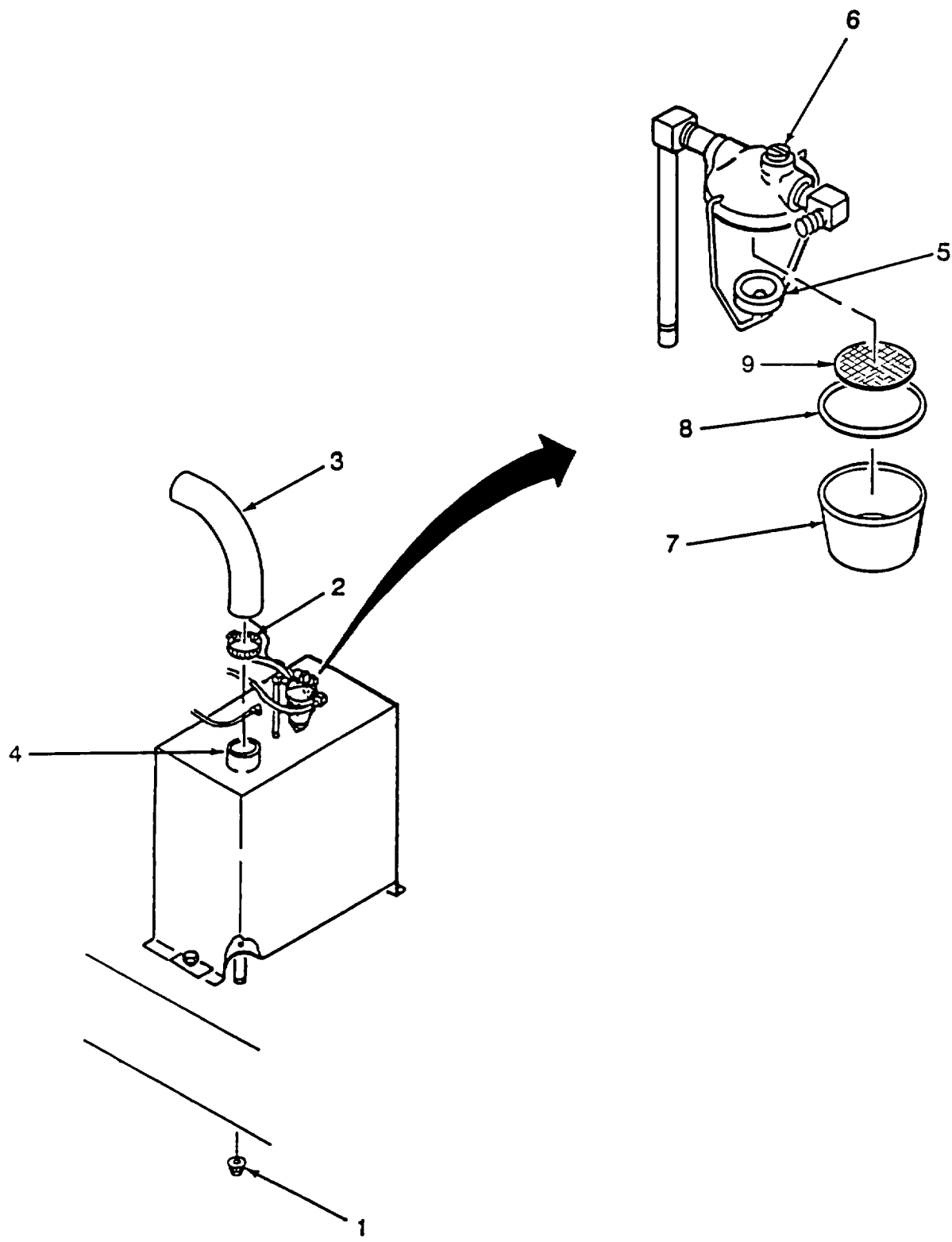


Figure 4-9. Fuel Tank Assembly

4-21. FUEL TANK ASSEMBLY - SERVICE/REPLACE (CONT.).

b. Removal. (Refer to Figure 4-10.)

- (1) Remove pan head screw (1) and lockwasher (2) from fuel level sending unit (3), holding ground wire (4)
Discard lockwasher (2).
- (2) Drain fuel tank (5) (refer to paragraph 4-21 a).
- (3) Disconnect quick-disconnect (6) at heater assembly (7)
- (4) Loosen clamp (8) and disconnect engine fuel line (9) from hose barb (10).

NOTE

When removing the hose it is necessary to break the seal first. Use channel locks and twist slightly to break seal. Take caution not to collapse the neck on the fuel tank by gripping too tightly.

- (5) Loosen clamp (11) and slide hose (12) off of fuel tank inlet (13)
- (6) Disconnect fuel gauge wire (14) from level sending unit (3)
- (7) Remove two self-locking nuts (15), two rectangular washers (16), two hex head cap screws (17) from skid (18) Discard two self-locking nuts (15)
- (8) Remove fuel tank assembly (5).

c. Installation.

- (1) Position fuel tank (5) onto skid (18), making sure that drain nipple (19) aligns with hole in skid.
- (2) Install two rectangular washers (16) and two hex head, cap screws (17) through flange on fuel tank (5) and skid (18). Install two self-locking nuts (15) onto cap screws (17)
- (3) Connect fuel gauge wire (14) to level sending unit (3). Check to make sure it is snug.
- (4) Slide clamp (11) onto hose (12)
- (5) Slide hose (12) and clamp (11) onto fuel tank inlet (13).
- (6) Tighten clamp (11)
- (7) Connect engine fuel line (9) to hose barb (10) Tighten clamp (8).
- (8) Connect quick-disconnect (6) at heater assembly (7).
- (9) Refuel the fuel tank (5) with diesel fuel, observing all warnings.

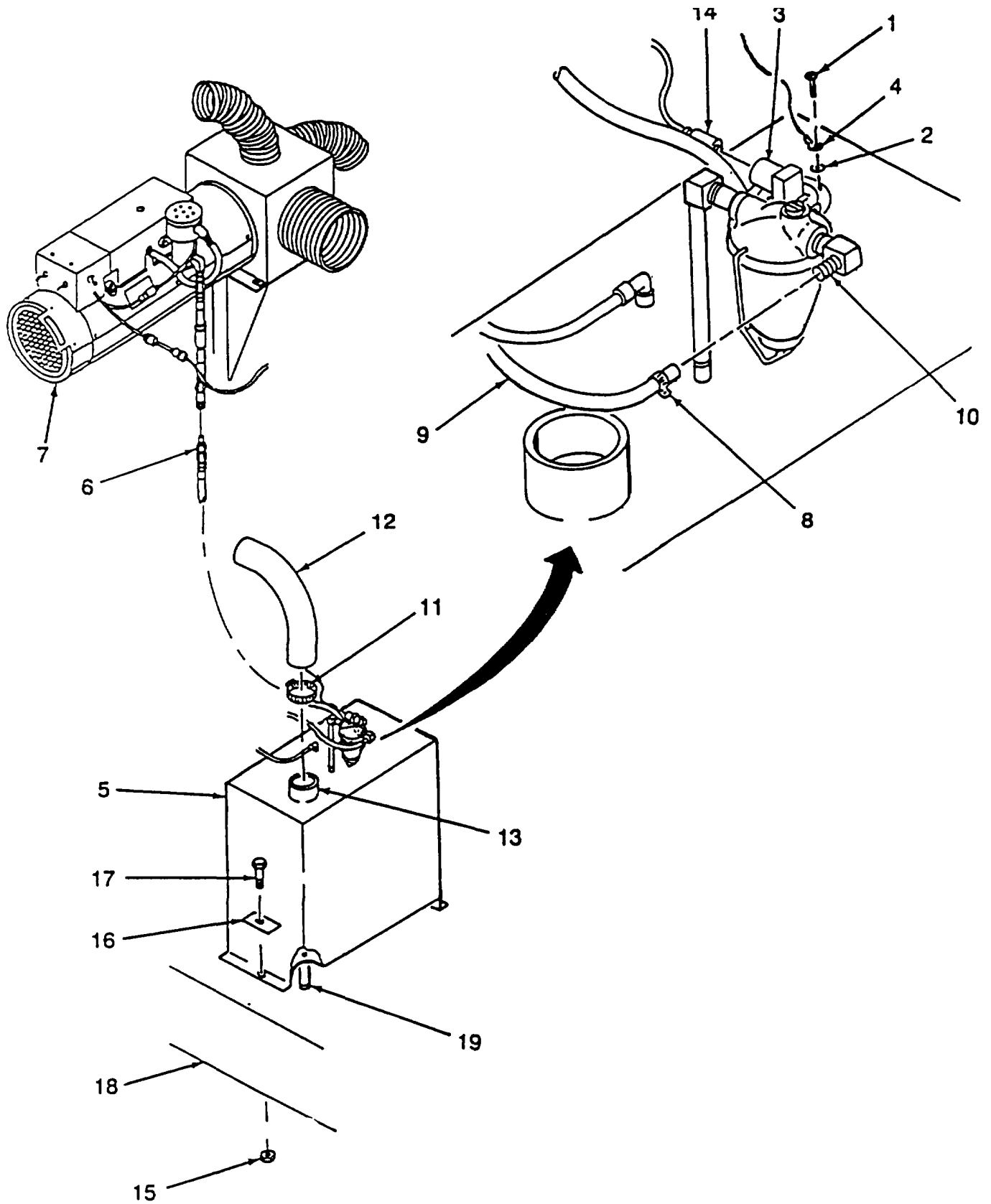


Figure 4-10. Fuel Tank Removal and Installation

4-22. TOOL BOX ASSEMBLY - REPLACE/REPAIR.

This Task Covers: **a. Removal** **b. Repair** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1).
Tool Kit, Common Number 1 (Appendix B, Section II, Item 2).
Electric Drill, 3/16" drill bit (Appendix B, Section III, Item 2).

Materials Required

Rivets (Appendix H, Section II, Item 1).

Equipment Condition

Enclosure Assembly Removed (para. 4-13)
Unit shut down and cool.
Tool Box empty.

Personnel Required

2

a. Removal. (Refer to Figure 4-11.)

- (1) Remove four nuts (5), from bottom of skid (6) and four bolts (7) and four washers (8) from bottom of tool box assembly(4).
- (2) Remove bolt (9), washer (10) from inside of tool box assembly (4) and remove negative wire (11) and nut (12) from tab on heater stand (13).
- (3) Remove tool box assembly (4) from skid (6).

b. Repair.

- (1) Inspect tool box for dents, cracked welds, or any deterioration. Repair as needed.
- (2) Drill out rivet (14) from tool box assembly (4) using electric drill and 3/16" drill bit. Remove pad lock with chain (1). Discard rivet (14).
- (3) Install rivet (14) through padlock chain into tool box assembly (4).

c. Installation.

- (1) Align holes in tool box assembly (4) with holes in skid (6).
- (2) Install four bolts (7) and washers (8) through bottom of tool box assembly (4) through skid (6) and attach four nuts (5).
- (3) Install bolt (9), washer (10) through back of tool box assembly (4), tab on heater stand (13), and negative wire (11). Securing it with nut (12).

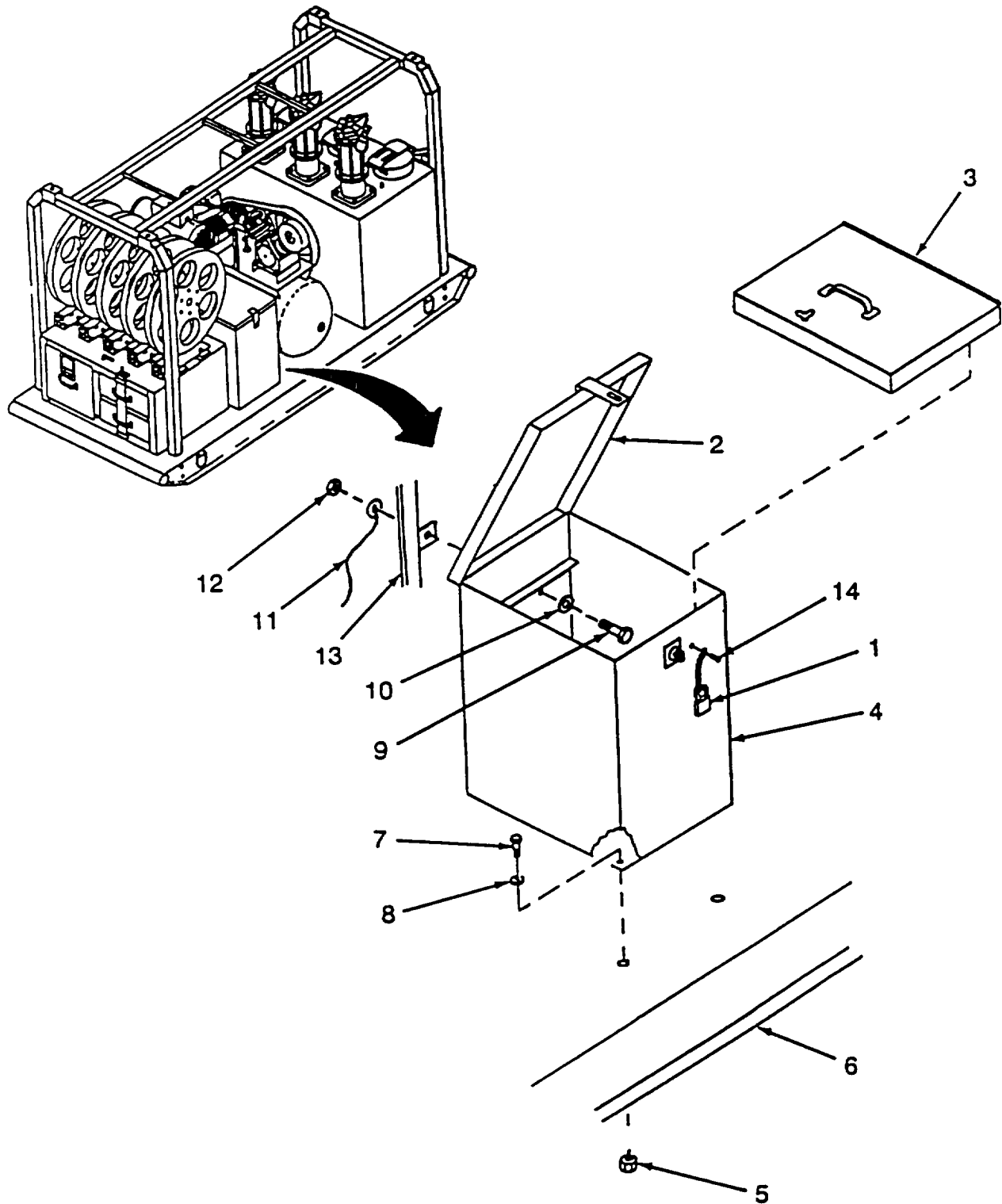


Figure 4-11. Tool Box Assembly

4-23. GEAR-LUBE AND OIL DISPENSERS - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1)

Materials Required

Rags, wiping (Appendix E, Section II, Item 1).

Equipment ConditionUnit shut down and cool

- a. Removal. (Refer to Figure 4-12.)

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Do not disconnect air lines or components before first relieving the air-receiver tank**

- (1) Close ball valve (1) at end of air-receiver tank (2).
- (2) Vent air pressure by opening valve (3) on reel cabinet assembly (4).
- (3) Vent air pressure by opening ball valve on gear lube pump (Reference para. 2-9.f.).

NOTE

Care is needed when removing female swivels from gear lube meter and engine oil meter, because lubricant and/or grease will come out of female swivels. A container and wiping rags will be required.

- (4) Loosen female swivel (5) and remove gear lube meter (6)
- (5) Loosen female swivel (7) and remove engine oil meter (8) with reducing connector (9).
- (6) Remove reducing connector (9) from engine oil meter (8)

- b. Installation.

- (1) Join reducing connector (9) to engine oil meter (8).
- (2) Install engine oil meter (8) with reducing connector (9) onto female swivel (7) and tighten female swivel

- (3) Install gear lube meter (6) onto female swivel (5) and tighten female swivel.
- (4) Close valve (3) on reel cabinet assembly (4).
- (5) Close ball valve on gear lube pump (Reference para. 2-7.f).
- (6) Open ball valve (1) at end of air-receiver tank (2).

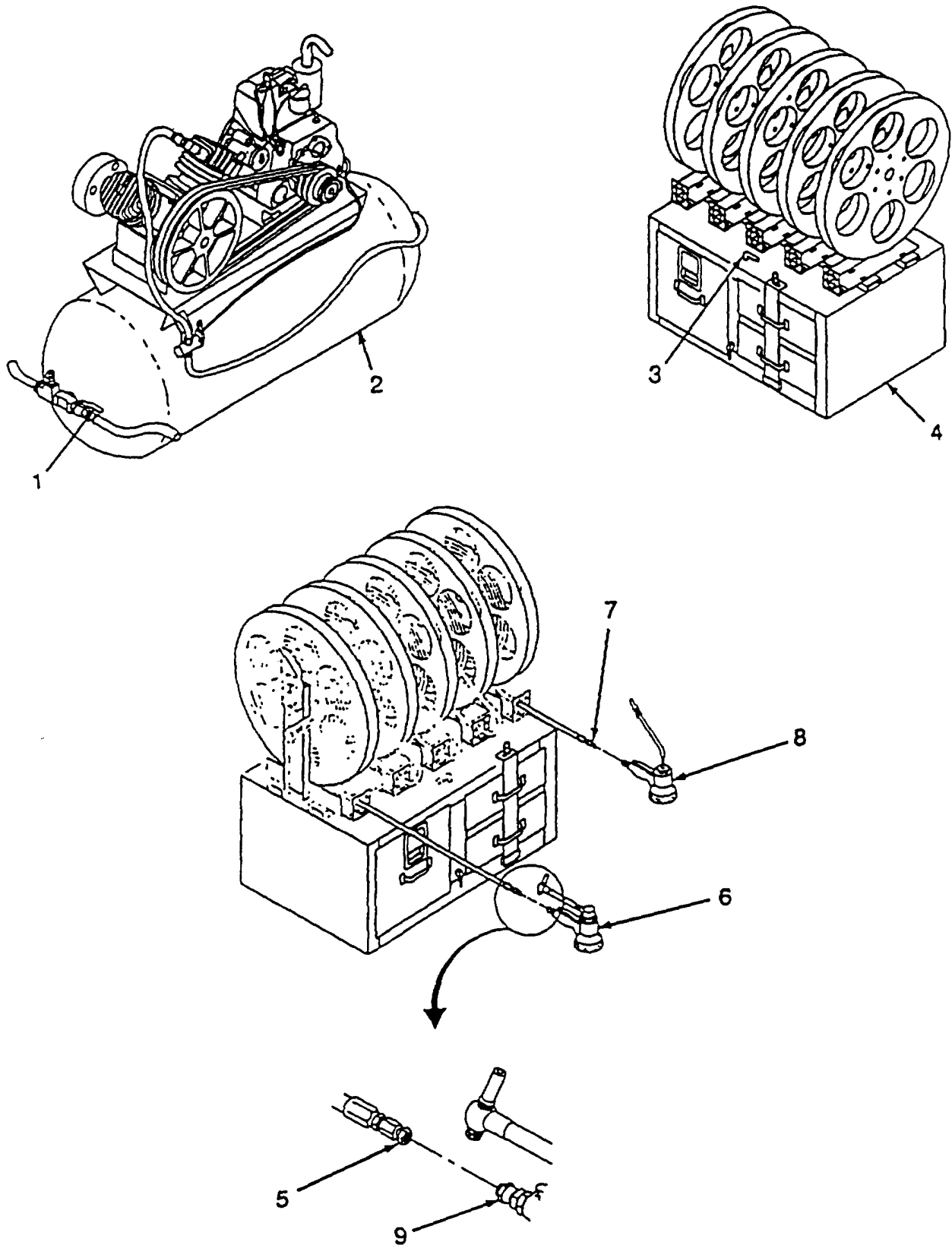


Figure 4-12. Gear Lube and Oil Dispensers

4-24. GREASE CONTROL VALVES - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

Rags, wiping (Appendix E, Section II, Item 1).

Equipment Condition

Unit shut down and cool.

- a. Removal. (Refer to Figure 4-13).

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Do not disconnect air lines or components before first relieving the air-receiver tank.**

- (1) Close ball valve (1) at end of air-receiver tank (2).
- (2) Vent pressure by opening valve (3) on reel cabinet assembly (4).
- (3) Vent pressure in lube pumps by opening ball valve on gear lube pump (Reference para. 2-9 f.).

NOTE

Care is needed when removing female swivels from grease valves, because grease will come out from female swivels. A container and wiping rags will be required.

- (4) Loosen female swivel (5) and remove grease valve (6) with z-swivel (7) and bushing (8).
- (5) Remove z-swivel (7) and bushing (8) from grease valve (6). Repeat for other grease valve.

- b. Installation.

- (1) Connect z-swivel (7) and bushing (8) to grease valve (6).
- (2) Install grease valve (6) with z-swivel (7) and bushing (8) onto female swivel (5). Repeat for other grease valve.
- (3) Close valve (3) on reel cabinet assembly (4).
- (4) Open ball valve (1) at end of air-receiver tank (2).
- (5) Close ball valve on gear lube pump. (Reference para. 2-7.f.).

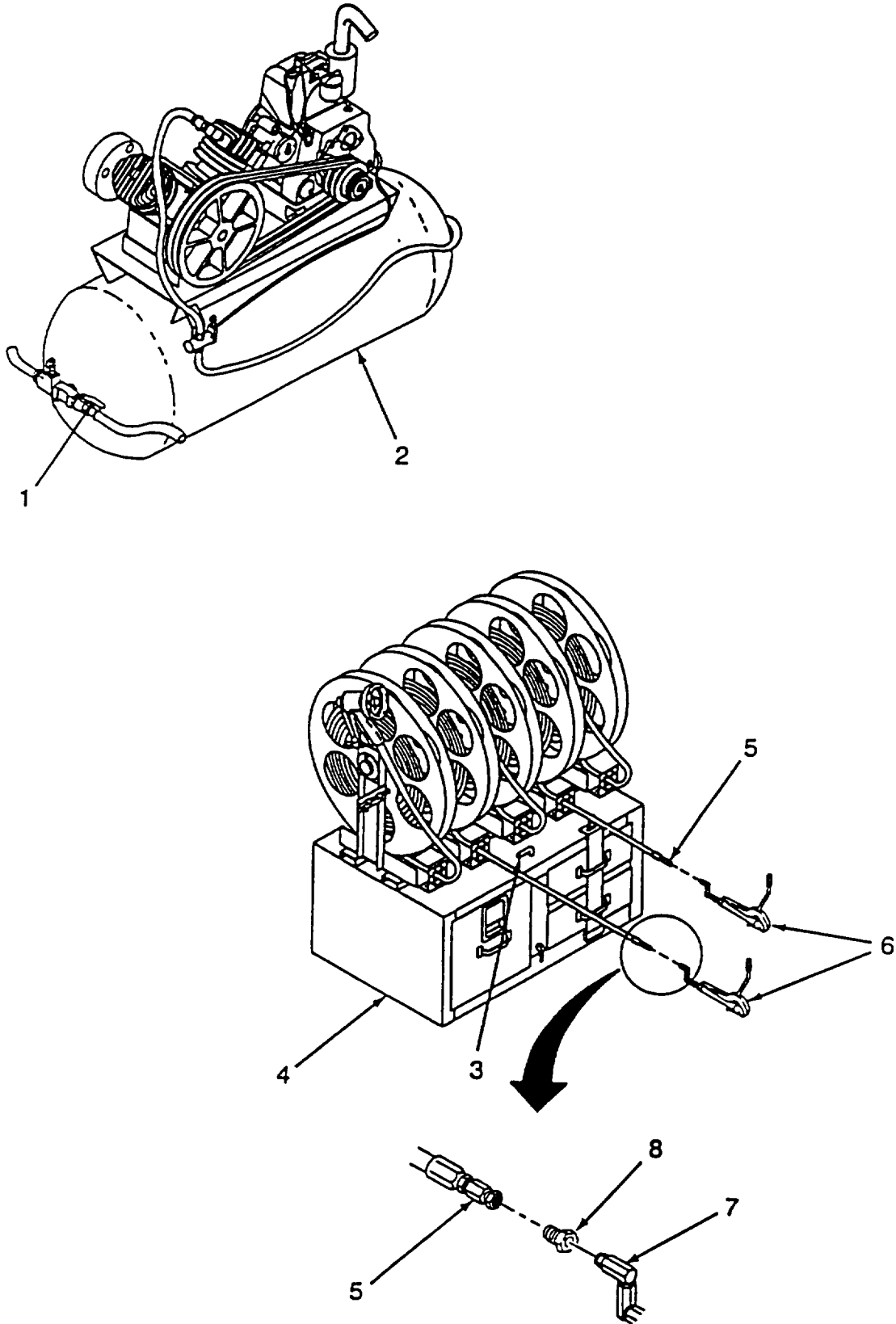


Figure 4-13. Grease Control Valves

4-25. REELS AND HOSES - REPLACE/REPAIR.

This Task Covers: **a. Removal** **b. Disassembly** **c. Repair**
 d. Assembly **e. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

Rags, wiping (Appendix E, Section II, Item 1).

Teflon Tape (Appendix E, Section II, Item 7).

Lockwasher (Appendix H, Section II, Item 7).

Equipment Condition

Unit shut down and cool.

Gear Lube and Oil Dispenser Removal (para. 4-23).

Grease Control Valves Removal (para. 4-24).

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Do not disconnect air lines or components before first relieving the air tank of pressure.**

a. Removal. (Refer to Figure 4-14).

- (1) Unspool hose assembly (1) from reel assembly (2). This makes reel lighter.

NOTE

Care is needed when removing male fittings from hose assemblies, because grease will come out of male fittings and/or hose assemblies. A container and wiping rags will be required.

- (2) Remove four bolts (3), four lockwashers (4), four flat washers (5) from reel cabinet assembly (6). Remove reel assembly (2). Discard four lockwashers (4).
- (3) Remove hose assembly (1) from reel assembly (2) by loosening male fitting (7).
- (4) Remove male fitting (7) on both ends of hose.

b. Disassembly. (Refer to Figure 4-15.)

- (1) Remove capscrew (1), washer (2) and locking nut (3) to remove complete roller assembly. Disassemble roller assembly by removing screw (4), locknut (5) and roller (6) from bracket (7).
- (2) Remove cotter pin (8) and washers (9) to separate the reel from bracket (16).
- (3) Remove locking nuts (10), capscrews (11) and spacers (12).
- (4) Remove swivel (13) and separate reel halves (14 and 15).

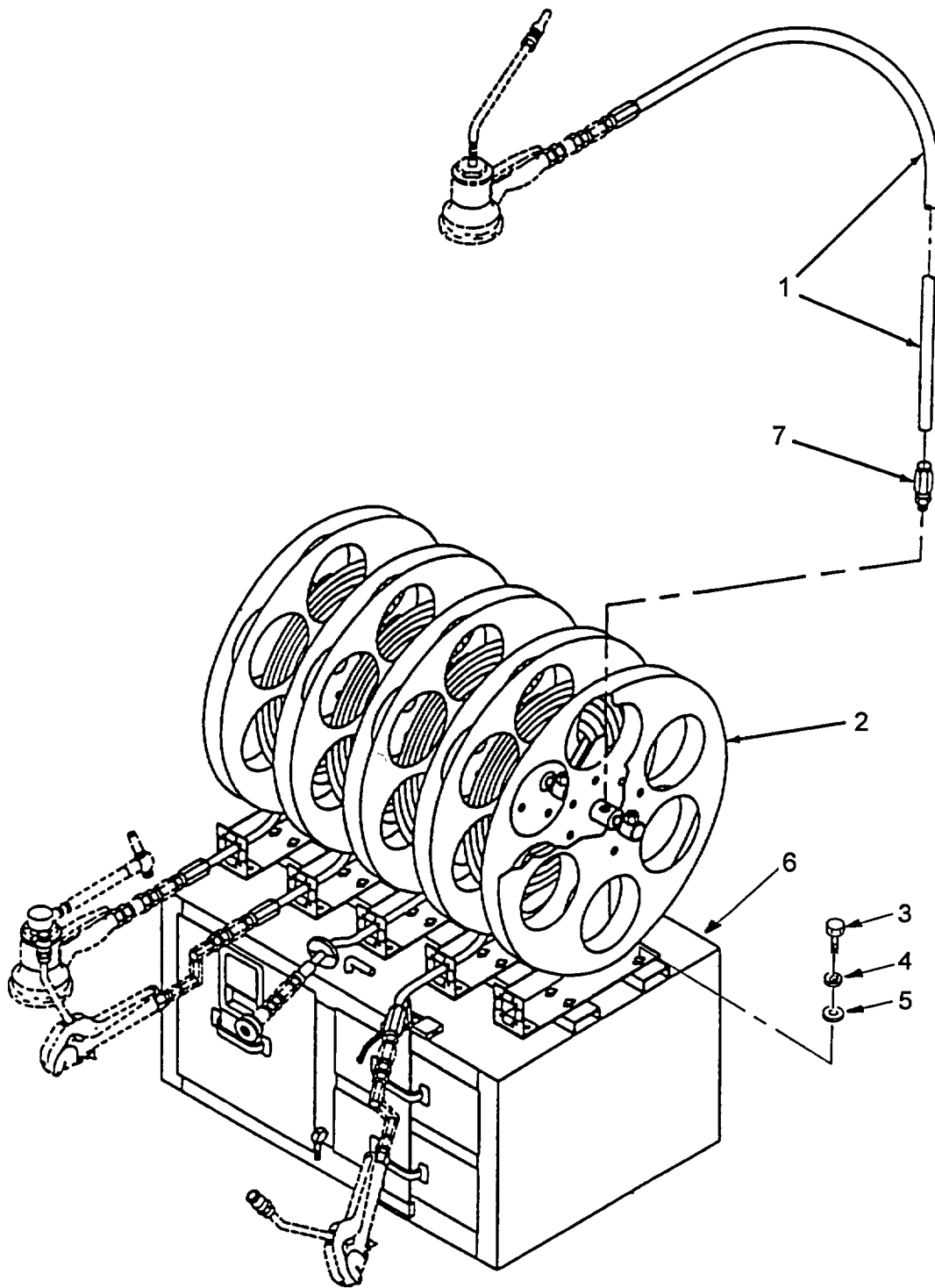


Figure 4-14. Reels and Hoses

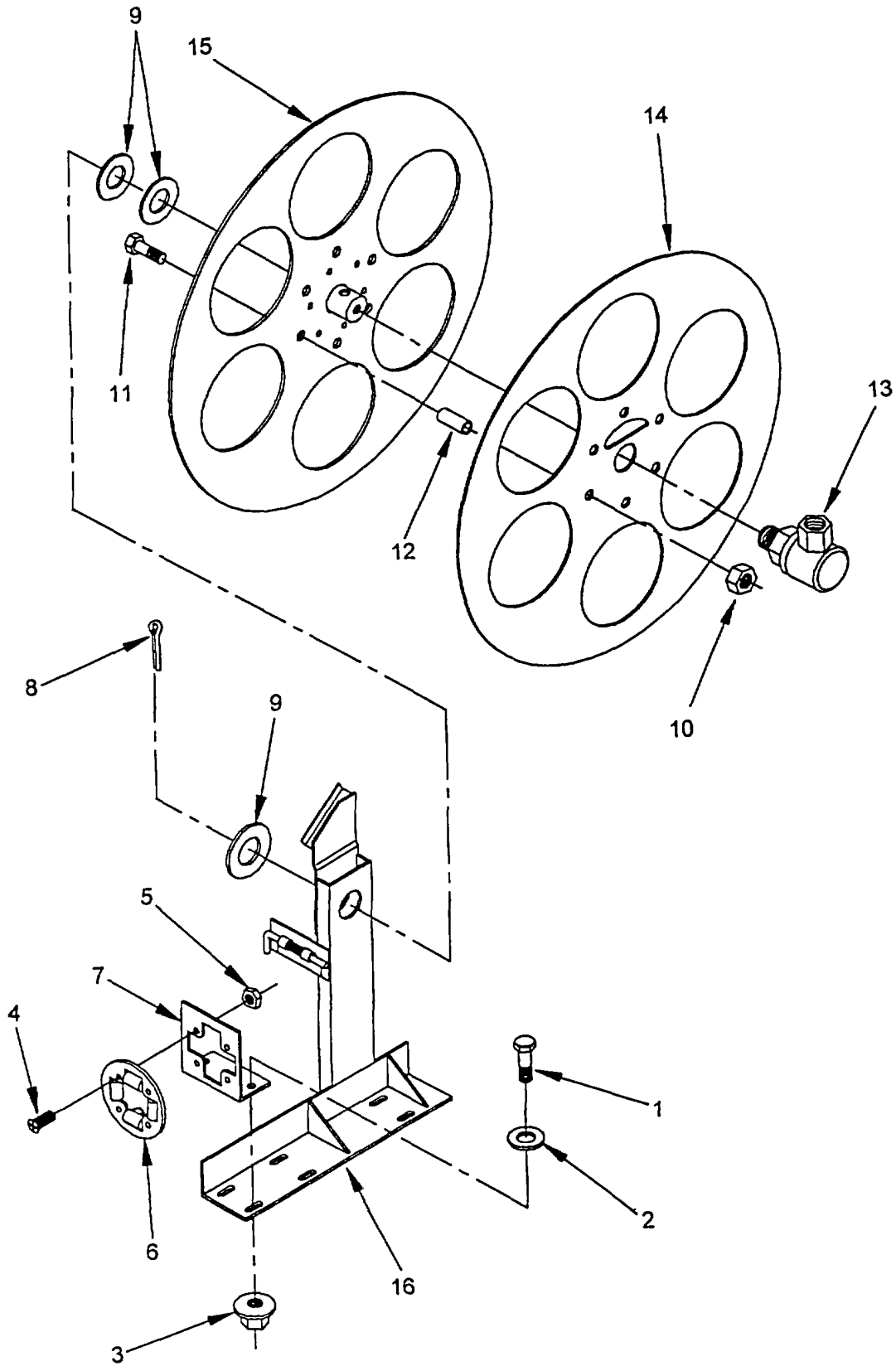


Figure 4-15. Reel Assembly

c. Repair.

Inspect all parts for damaged threads, cracks, distortion and other damage. Replace any part that shows obvious wear or damage.

d. Assembly. (Refer to Figure 4-15.)

- (1) Install capscrews (11) in reel half (15) and place spacers (12) on capscrews.
- (2) Assemble reel half (14) to reel half (15) and install locking nuts (10).
- (3) Wrap threads of swivel (13) with teflon tape and install swivel in reel.
- (4) Place two washers (9) on reel and install on bracket (16). Install other washer (9) and cotter pin (8).
- (5) Assemble roller (6) to bracket (7) and secure with screws (4) and locking nuts (5).
- (6) Place roller assembly bracket (7) on reel bracket (16) and install capscrews (1), washers (2) and locking nuts (3)

e. Installation. (Refer to Figure 4-14.)

- (1) Clean and wrap Teflon tape around threads of male fittings (7).
- (2) Connect male fittings (7) to ends of hose (1).
- (3) Screw male fitting (7) into reel assembly (2).
- (4) Place hose reel assembly (2) onto reel cabinet assembly (6).
- (5) Install four bolts (3), lockwashers (4), and flat washers (5) into top of reel cabinet assembly (2).

NOTE

Do not remove hex reducing nipple from hose assembly.

- (6) Roll hose assembly (1) onto reel assembly (2).

4-26. CABINET ASSEMBLY - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1).

Materials Required

Rags, wiping (Appendix E, Section II, Item 1).

Nut, self-locking (Appendix H, Section II, Item 11).

Equipment Condition

Enclosure Removed (para. 4-13).

Unit shut down and cool.

Lube Supply Hoses Disconnected (para. 4-18).

Personnel Required2

- a. Removal. (Refer to Figure 4-16.)

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Completely vent air pressure by turning drain levers as indicated below.**

- (1) Relieve air from air-receiver tank (1) by turning condensate removal valve handle (2) to "open" position.
- (2) Open ball valve (3) on air-receiver tank (1).
- (3) Open ball valve (4) on gear lube pump.
- (4) Open shut-off valve (5) on air-receiver tank (1).
- (5) Remove lockbar (6) Remove two screws (7), two lockwashers (8) and drawer stop (9) from accessories/tray drawers (10).
- (6) Pull accessories/tray drawers (10) completely out of reel cabinet assembly (11) and set them aside.

CAUTION

- **Before servicing, disconnect ground cable to prevent damage to the batteries.**
 - **Do not let ground cable come in contact with positive battery terminal or cable.**
- (7) Open battery drawer (12) and disconnect ground cable (13) from battery (14) using a 1/2" box end wrench.

- (8) Disconnect wire (15) from the thermostat (16) located on left rear side of battery drawer (12). Pull wire (15) through hole in back of reel cabinet assembly (11).
- (9) Disconnect wire #5 (17) from positive battery terminal (18) Pull wire #5 through larger grommet (21) in back of reel cabinet assembly (11).
- (10) Remove positive cable (19) from power distribution block on heater stand (Reference para 4-48a (4)).
- (11) Disconnect other end of ground wire (13) from diesel engine (Reference para. 4-39a.(2)(h)).

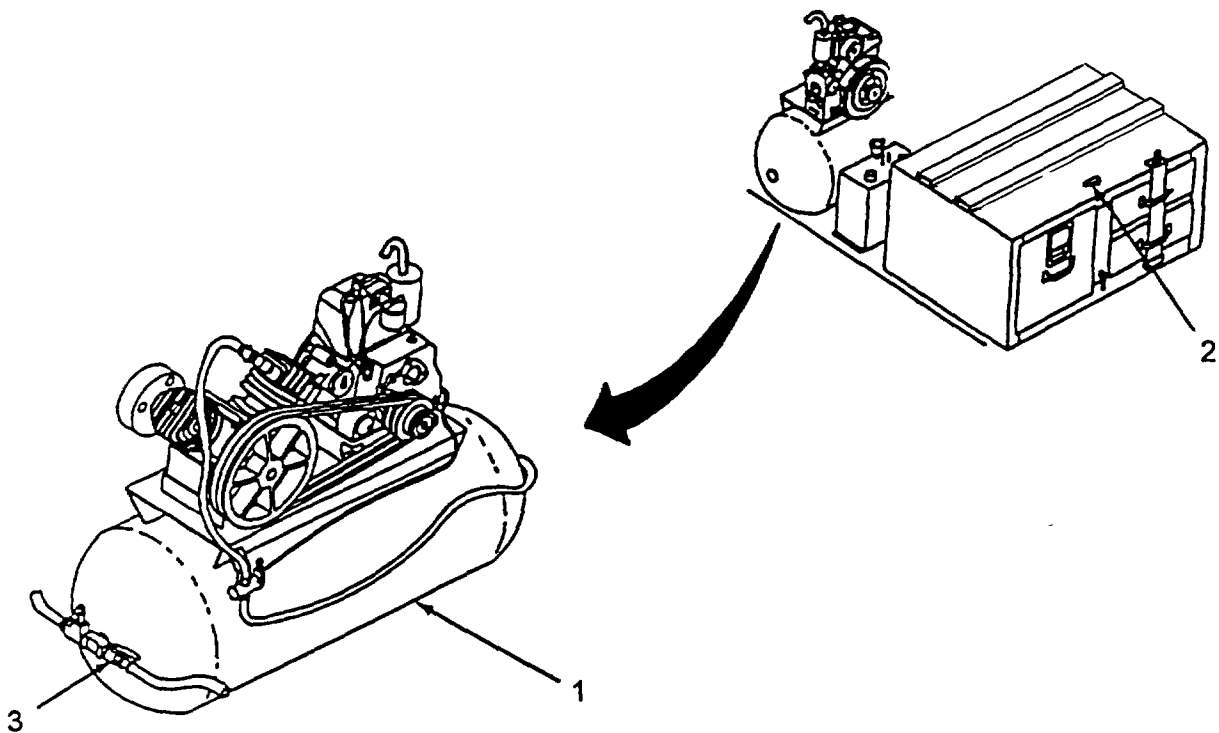


Figure 4-16. Cabinet Assembly (Sheet 1 of 4)

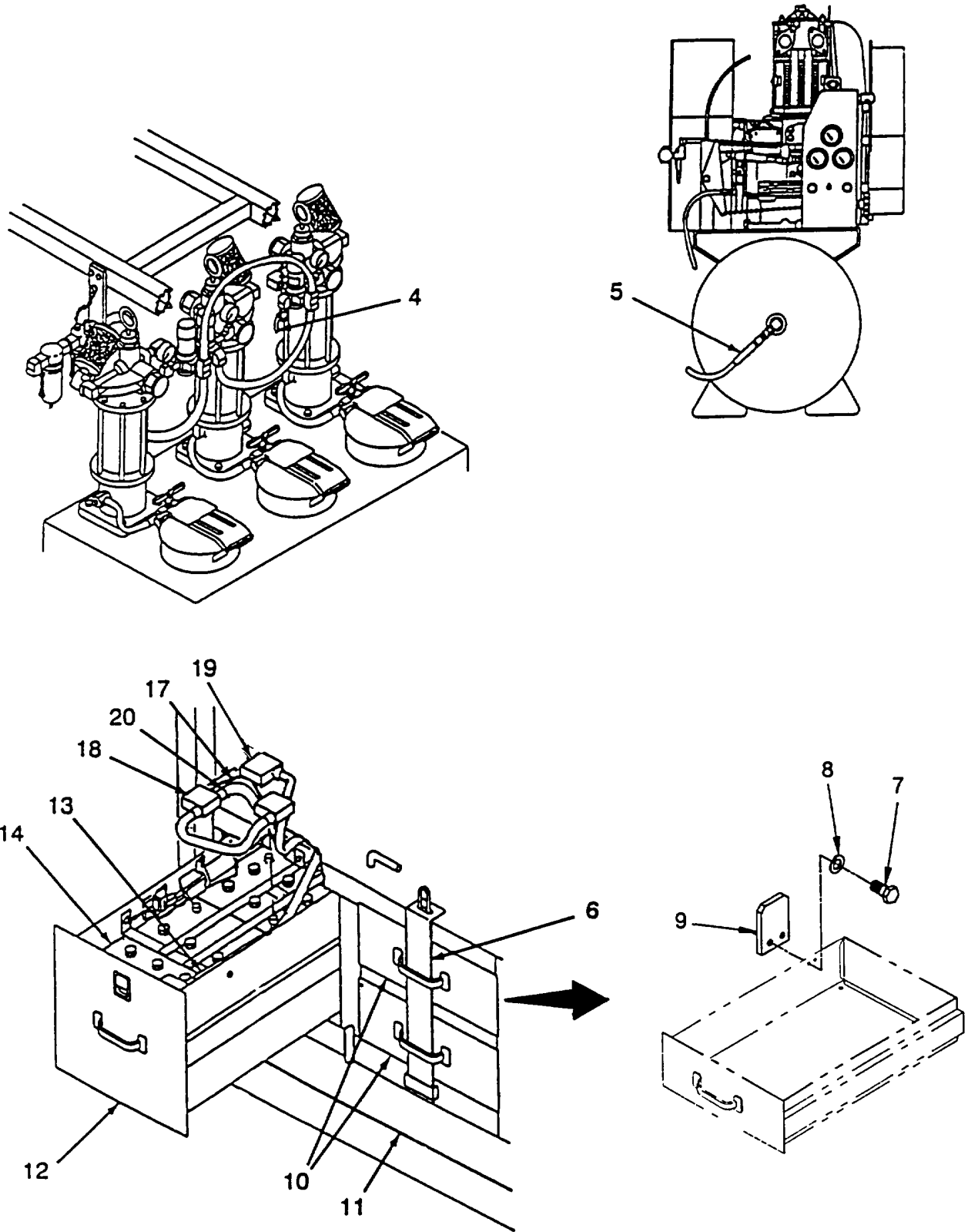


Figure 4-16. Cabinet Assembly (Sheet 2 of 4)

- (12) Remove positive cable (20) from starter motor, located on air compressor. (Reference para. 4-39.d (2)(h)).
 - (13) Pull the three cables (13, 19, 20) forward through the larger grommet (21) at rear of reel cabinet assembly (11)
(14) Remove two screws (22), two lockwashers (23) and drawer stop (24) from battery drawer (12).
 - (15) Pull battery drawer (12) completely out of reel cabinet assembly (11) and set it aside.
 - (16) Disconnect air-receiver tank drain hose (25) from side of air-receiver tank.
 - (17) Disconnect air supply hose (26) from end of air receiver tank (1).
 - (18) Remove heater duct at side of reel cabinet by removing two clamps and swinging duct out of the way.
 - (19) Remove four self-locking nuts (27), four washers (28) and four bolts (29) from reel cabinet assembly (11) Discard four self-locking nuts (27).
 - (20) Remove reel cabinet assembly (11) from skid (30).
- b. Installation.
- (1) Place reel cabinet assembly (11) onto skid (30).
 - (2) Fasten reel cabinet assembly (11) to skid (30) using four new self-locking nuts (27), four bolts (29), and four washers (28).
 - (3) Attach five supply hoses (31) to reel assembly. (Reference para. 4-18).
 - (4) Attach drain hose (25) to side of air-receiver tank and tighten Attach air supply hose (26) at end of receiver tank.
 - (5) Place battery drawer (12) Into reel cabinet assembly (11).
 - (6) Push wire assembly (15) onto thermostat (16) located on left rear side of battery drawer (12).
 - (7) Pull wire #5 (17) through larger grommet (21) on back of reel cabinet assembly (11), and connect wire #5 (17) to positive battery terminal (18).
 - (8) Push cable assemblies (13, 19, 20) back through larger grommet (21) at rear of reel cabinet assembly (11).
 - (9) Reconnect cable terminal (13) to battery (14) Close battery drawer (12).
 - (10) Install drawer stop (24) on right side of battery drawer (12) by installing two screws (22) and two washers (23) onto battery drawer (12).
 - (11) Place accessory/tray drawers (10) into reel cabinet assembly (11).
 - (12) Install drawer stop (9) on right side of accessory/tray (10) by installing two screws (7) and two washers (8) onto accessory/tray (10).

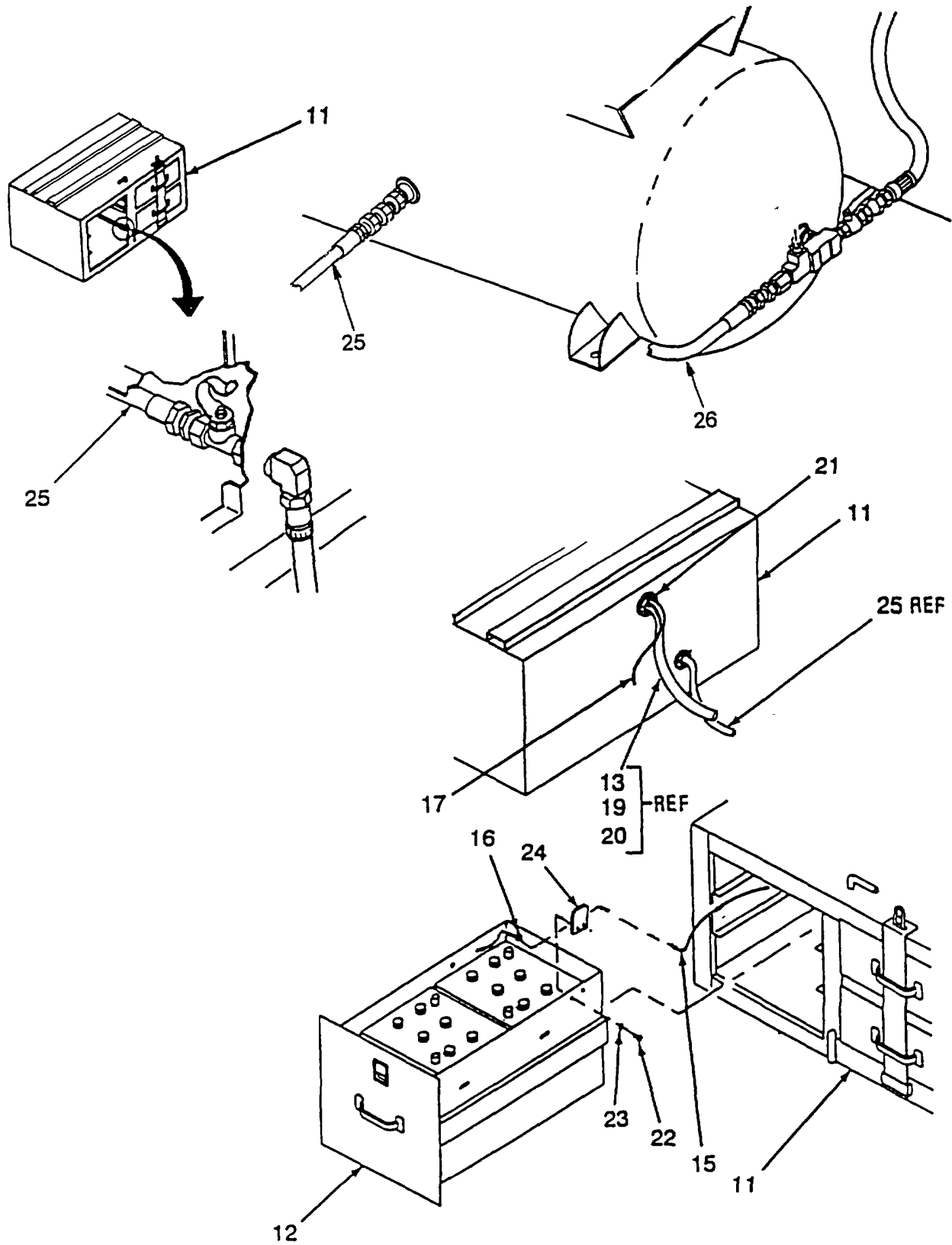


Figure 4-16. Cabinet Assembly (Sheet 3 of 4)

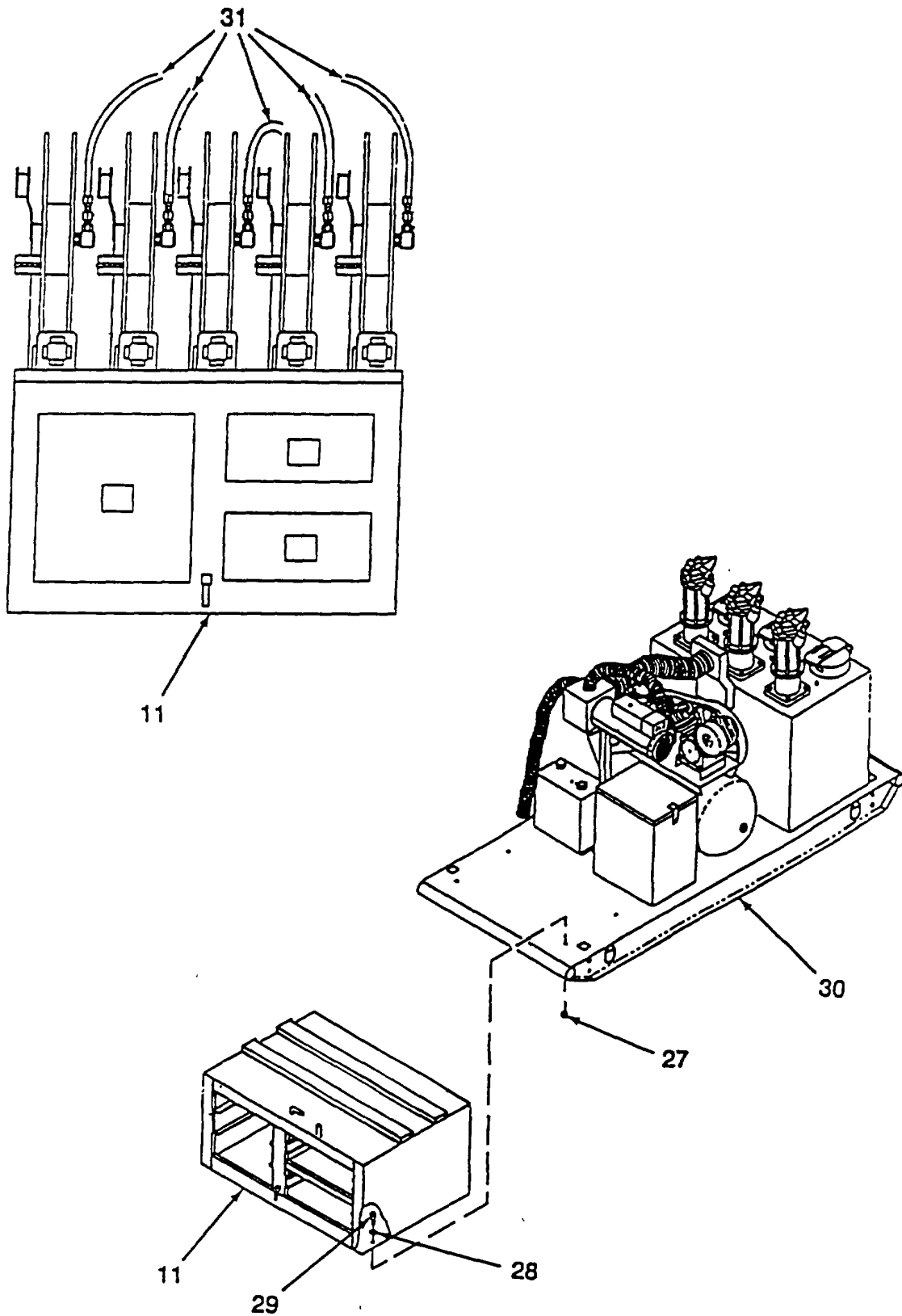


Figure 4-16. Cabinet Assembly (Sheet 4 of 4)

- (13) Install accessory/tray drawers (10) into reel cabinet assembly (11).
- (14) Re-install negative cable (13) to diesel engine (Reference para. 4-39).
- (15) Re-install positive cable (19) to power distribution block on heater stand. (Reference para. 4-48).
- (16) Re-install positive cable (20) to starter motor, located on air compressor. (Reference para. 4-39.d). (17) Close ball valve (4) on gear lube pump.
- (18) Close ball valve (3) on air-receiver tank (1).
- (19) Close condensate removal valve, turning handle (2) to "closed" position.

4-27. BATTERY BOX ASSEMBLY - REPLACE/REPAIR.

This Task Covers: a. Disassembly b. Repair c. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1)
Multimeter (Appendix B, Section II, Item 2)

Materials/Parts Required

Dry-cleaning Solvent (Appendix E, Section II, Item 3)
Battery Electrolyte (Appendix E, Section II, Item 10)
Apron (Appendix B, Section III, Item 2).
Rubber gloves (Appendix B, Section III, Item 2).
Distilled water (Appendix E, Section II, Item 29).
Rags, wiping (Appendix E, Section II, Item 1).
Locknut (Appendix H, Section II, Item 47).
Nut, self-locking (Appendix H, Section II, Item 10).

Equipment Condition

Unit shut down and cool
Battery Box Removed (para. 4-26).

WARNING

- **Do not smoke or use open flame around batteries. Batteries generate explosive hydrogen gas.**
- **Battery acid is harmful. Wear safety glasses and rubber gloves when performing battery maintenance.**
- **If battery acid touches your skin or eyes, flush with running water for at least 60 seconds. Seek medical help immediately.**
- **Do not lay tools on top of batteries. A spark or short could cause battery explosion.**
- **Protect your face by not standing directly over the top of batteries.**
- **Do not remove sealing device on electrolyte until ready to fill batteries.**

CAUTION

- **Before servicing, disconnect ground cable to prevent damage to the batteries.**

NOTES

- **Batteries shall be charged full at a constant 15 volts before being put into service. A specific gravity reading should be taken at 30 minute intervals until batteries remain at a constant 15 volts.**
- **Charging current should not exceed 6 amps.**

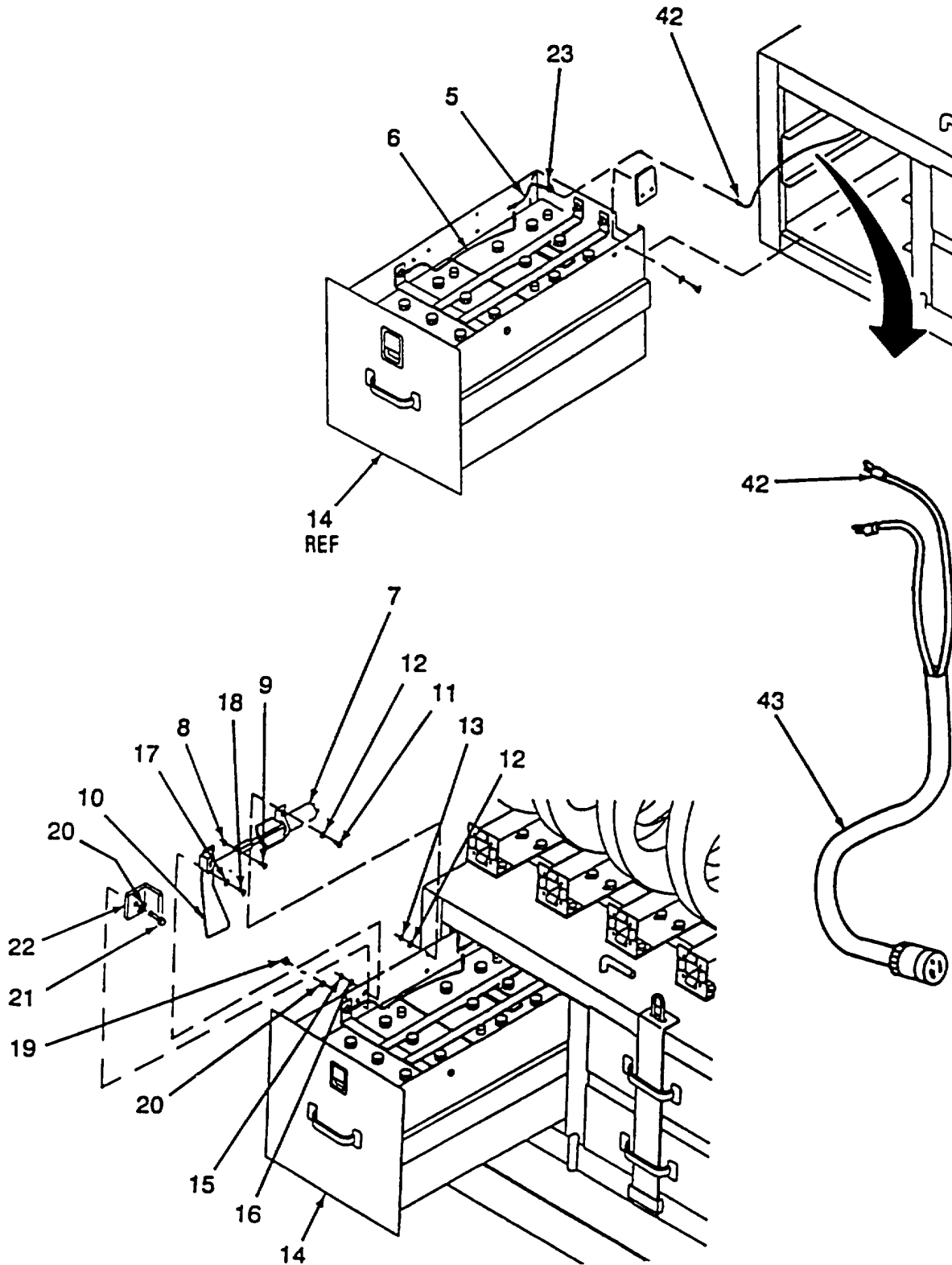
- **Battery and electrolyte temperature must be above 60° F but preferably not above 100° F.**
- **Electrolyte temperature should not be allowed to exceed 120° F (48.9° C) during or after charging.**
- **Batteries should be charged every six months or when specific gravity of any cell falls below 1.250.**
- **Electrolyte volume of each battery is 8 quarts.**
- **After initial charge, use only distilled water to maintain proper levels.**
- **Keep the top and sides of the battery clean and dry.**
- **Make sure vent filler plugs are clean. When cleaning is required, wash with water.**

a. Disassembly. (Refer to Figure 4-17.)

NOTE

To pull battery box assembly from reel cabinet assembly, reference para. 4-26.

- (1) Using a 1/2" box end wrench, loosen terminals of battery cables (1), (2) and (3). Pull them from battery posts (4) using a puller tool.
- (2) Disconnect wire (5) from thermostat (23). Disconnect wire (6) from solenoid (7).
- (3) Remove cotter pin (8) and clevis pin (9) from solenoid (7) and damper (10).
- (4) Remove two bolts (11), four washers (12) two nuts (13) holding solenoid (7) to battery drawer (14).
- (5) Remove solenoid (7) from battery drawer (14).
- (6) Remove self-locking nut (15), washer (16), washer (17) and shoulder screw (18) from damper (10). Remove damper (10) from side of battery drawer (14). Discard self-locking nut (15).
- (7) Remove locknut (19), washers (20) and cap screw (21) from stop angle (22). Remove stop angle (22) from side of battery drawer (14). Discard locknut (19).
- (8) Remove thermostat (23) by removing two hex nuts (24), two washers (25) and two pan head machine screws (26).
- (9) Remove four self-locking nuts (27), eight washers (28) and four cap screws (29) from battery retainer (30). Remove wire assembly (6). Discard four self-locking nuts (27).
- (10) Slide battery retainer (30) forward from the two socket head cap screws (31) and lift out of battery drawer (14).



Battery 4-17. Battery Box Assembly - Removal and Installation (Sheet 1 of 3)

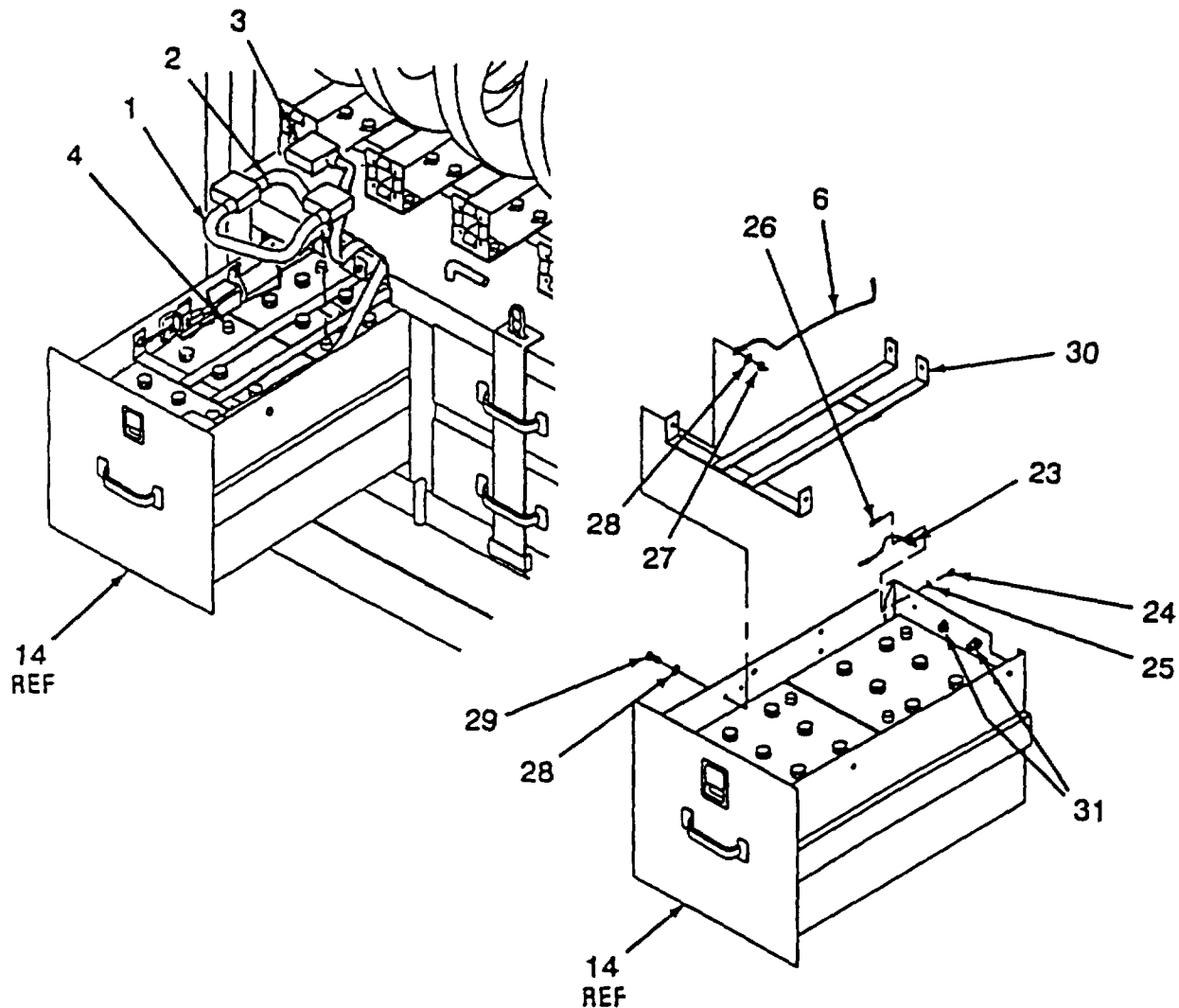
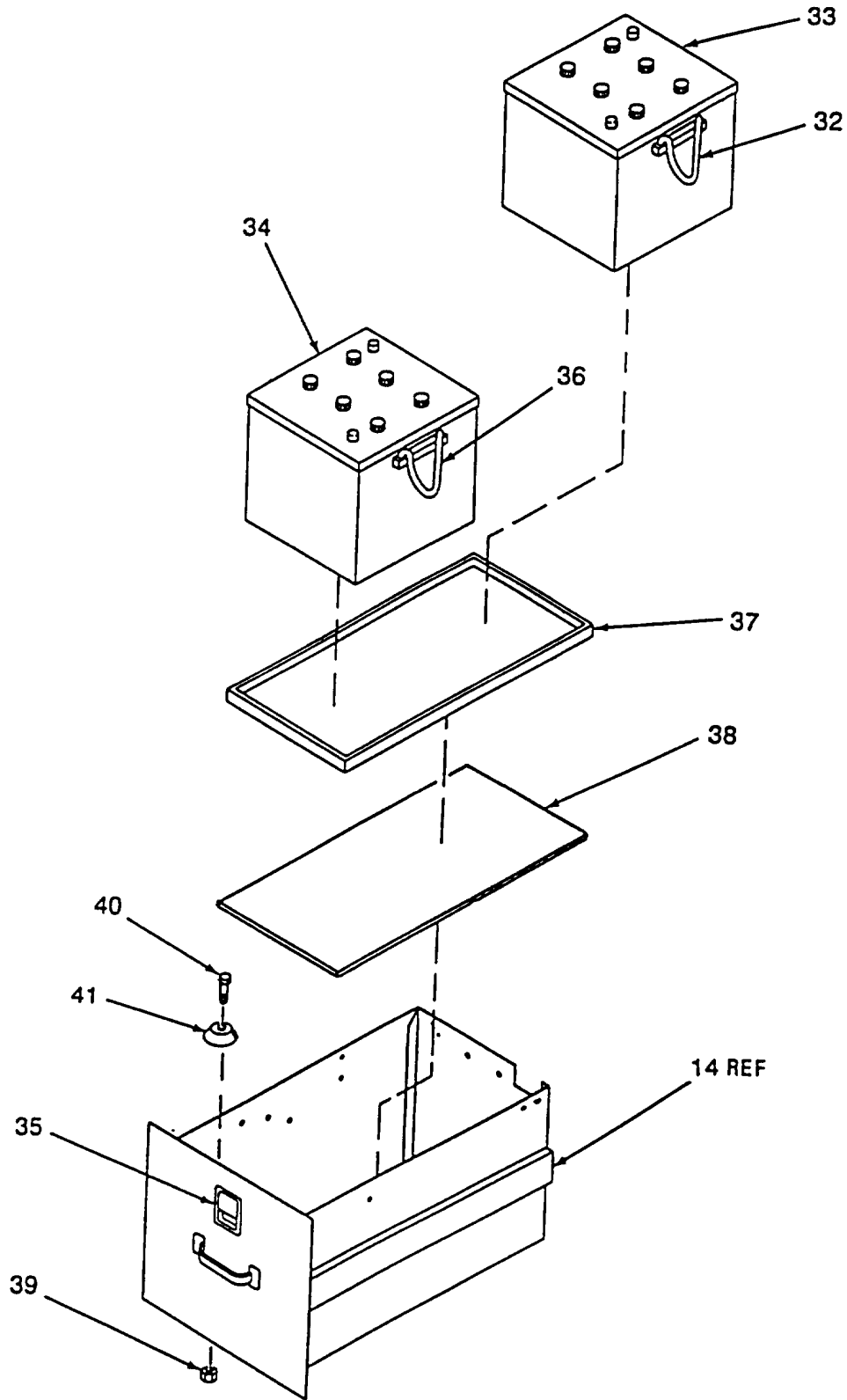


Figure 4-17. Battery Box Assembly - Removal and Installation (Sheet 2 of 3)

NOTE

Rear battery must be removed prior to removing front battery.

- (11) Using rope handles (32), lift and remove rear battery (33) from battery drawer (14).
- (12) Slide front battery (34) back, to clear drawer latch (35). Remove front battery (34) using rope handles (36).
- (13) Remove rubber battery tray (37) and check for defects prior to reinstalling batteries (33 and 34).
- (14) Remove battery tray plate (38) from battery drawer (14) (15) Remove self-locking nut (39) and pan head screw (40) from battery tray support (41). Discard self-locking nut (39).
- (16) Check all ten battery tray supports (41) for defects.



Battery 4-17. Battery Box Assembly - Removal and Installation (Sheet 3 of 3)

- b. Repair. (Refer to Figure 4-18).

CAUTION

- **DO NOT allow baking soda solution to enter batteries; batteries would be damaged.**

- (1) Flush metallic parts and battery cable ends with a solution of baking soda and water to neutralize any acid on these parts.
- (2) Clean battery tops with baking soda and water solution.

WARNING

- **Clean all parts in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of the skin to the cleaning solvent. Failure to do so can cause severe injury or death. Do not use near flame or excessive heat. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**

- (3) Remove any grease or gummy deposits with dry cleaning solvent.
- (4) Inspect batteries for cracks, loose posts or other damage. Replace if needed.
- (5) Inspect battery cables for corrosion, breaks or deteriorated insulation. Replace if damaged.
- (6) Inspect all sheet metal parts for cracked or broken weldments, dents or distortion. Replace as required.
- (7) Perform continuity test on all wires, until continuity is indicated.
- (8) Inspect all parts for obvious wear or damage. Replace as required.
- (9) If cables are damaged, first lift up terminal cover (1) from battery terminal lug (2), remove damaged cable (3) from battery terminal lug (2) by removing nut (4) and bolt (5).
- (10) Attach new cable (3) to terminal lugs (2) by installing bolts (5) and nuts (4) onto terminal lugs (2).

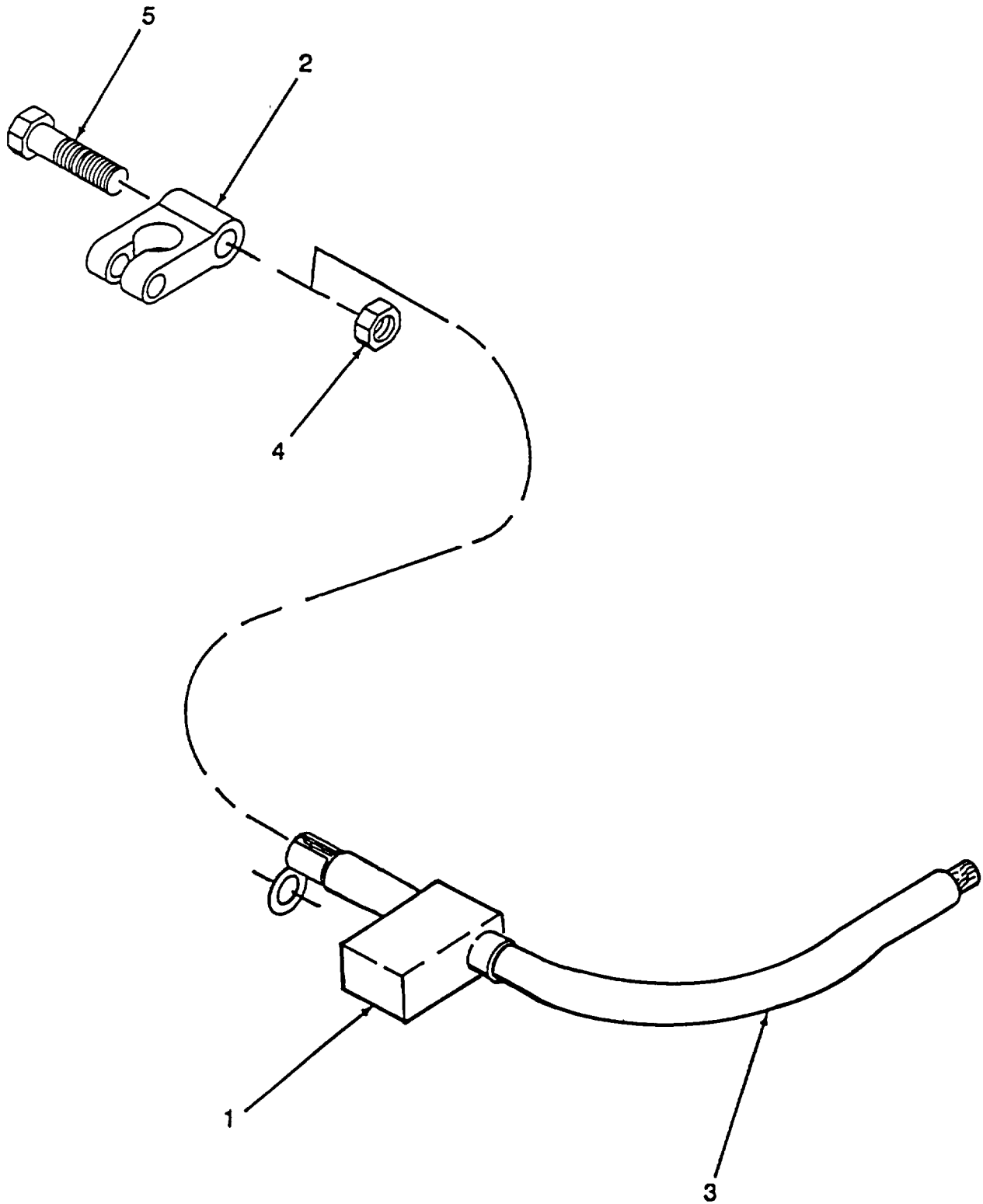


Figure 4-18. Battery Cable Repair

c. Installation. (Refer to Figure 4-17).

- (1) Install battery tray supports (41) by installing pan head screws (40) and new self-locking nuts (39).
- (2) Install battery tray plate (38) into battery box (14).
- (3) Install rubber battery tray (37) onto battery tray plate (38), in battery box (14).
- (4) Using rope handles (36) install front battery (34) into battery box (14); fold down rope handles (36) and slide battery forward until it is against front of battery box (14).
- (5) Using rope handles (32) install rear battery (33) making sure that it clears front battery (34) and rear of battery box (14) (6) Slide battery retainer (30) onto the two socket head, cap screws (31) in the rear of the battery box (14).

NOTE

Perform next step on both sides of battery retainer.

- (7) Install wire assembly (6) to left side of battery box (14), by installing hex head cap screw (29) and washer (28) through outside of battery box (14) through battery retainer (31) and wire assembly. Install other washer (28) and new self-locking nut (27).
- (8) Replace thermostat (23) to rear of battery box (14), by installing two pan head machine screws (26) two washers (25) and two hex nuts (24).
- (9) Install solenoid (7) to left side of battery box (14), using two bolts (11), four washers (12) and two nuts (13).
- (10) Install damper (10) to left side of battery box (14), by installing shoulder screw (18), washer (17), washer (16) and self-locking nut (15).
- (11) Install pins (8 and 9) through end of solenoid (7) and damper (10).
- (12) Install angle stop (22) on left side of battery box (14), by installing hex head cap screw (21), washer (20) and locknut (19).
- (13) Attach wire (6) and wire (5) onto solenoid (7). Attach wire (5) to thermostat (23).
- (14) Connect quick-slide connector (42) of cord assembly (43) to thermostat electrical connector.

NOTE

For installing battery box into reel cabinet assembly, reference para. 4-26.

4-28. CONDENSATE DRAIN ASSEMBLY - REPLACE/REPAIR.

This Task Covers: **a. Removal** **b. Repair** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Nut, self-locking (Appendix H, Section II, Item 10).

Equipment Condition

Unit shut down and cool.

Battery Box Removed (para. 4-26).

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Completely vent air pressure by turning drain lever.**

a. Removal. (Refer to Figure 4-19.)

- (1) Unscrew outer drain assembly (1) from condensate drain bracket (2).
- (2) Detach condensate drain bracket (2) from reel cabinet assembly (3) by removing hex head cap screw (4), washer (5), and self-locking nut (6) Discard self-locking nut.
- (3) Disconnect drain hose assembly (7) from side of air-receiver tank Remove grommet (11) and pull drain hose assembly (7) forward through hole in back of reel cabinet (3).
- (4) Remove lever (8) from condensate drain valve (9) by removing cotter pin (10).
- (5) Remove lever (8) from cabinet by pulling it down through hole in top of reel cabinet (3).
- (6) Unscrew and remove condensate drain bracket (2) from condensate drain valve (9).
- (7) Remove condensate hose assembly (7) from condensate drain valve (9).

b. Repair.

Repair is limited to replacing defective components.

c. Installation.

- (1) Install condensate drain bracket (2) to condensate drain valve (9).
- (2) Install condensate hose assembly (7) into condensate drain valve (9) Push drain hose assembly (7) through smaller hole in back of reel cabinet (3), and attach it to side of air-receiver tank Install grommet (11).

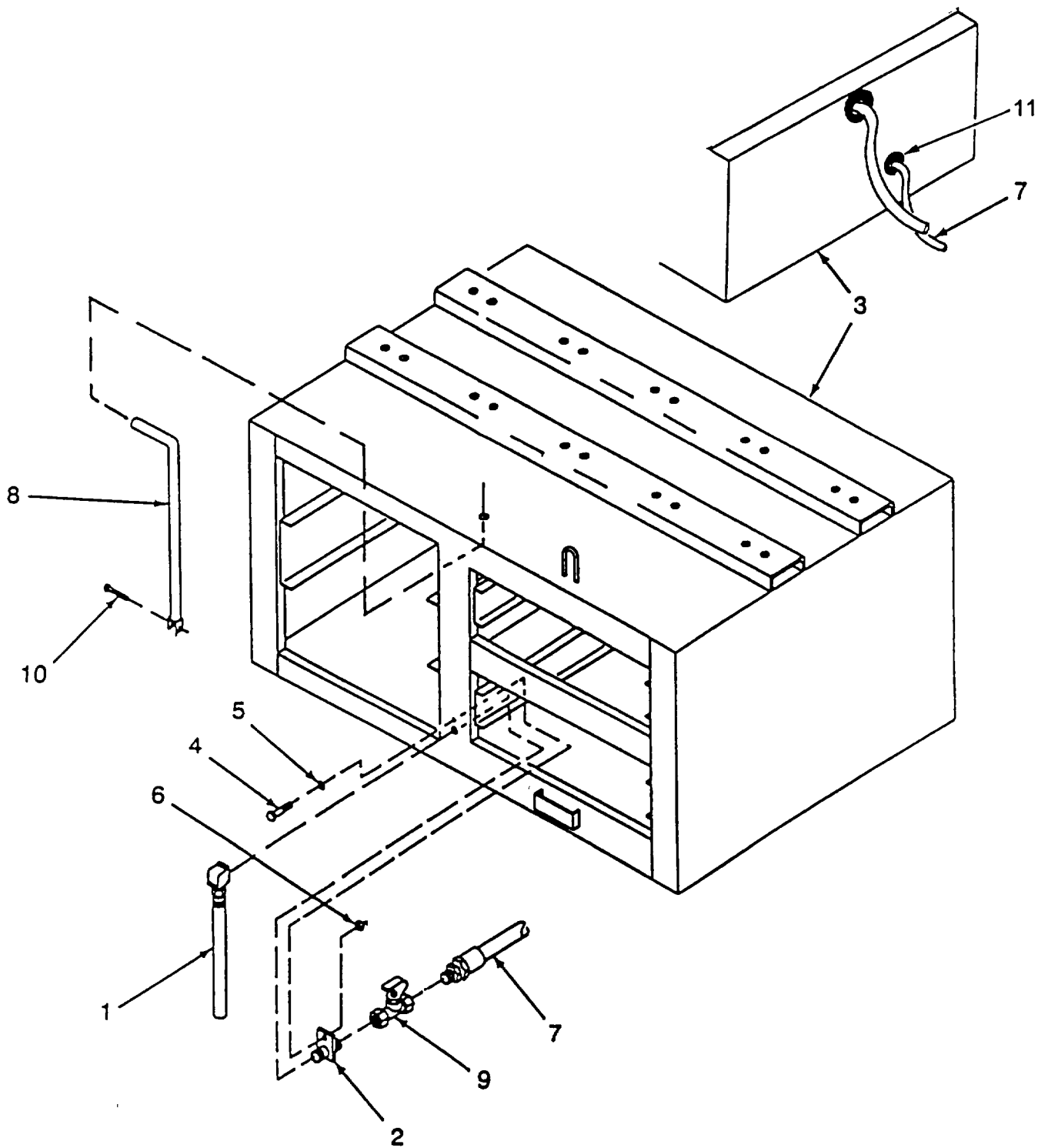


Figure 4-19. Condensate Drain Assembly

- (3) Insert lever (8) up through hole in top of cabinet (3).
- (4) Set lever (8) onto top of handle on condensate drain valve (9). Slide cotter pin (10) through holes in fork of lever (8) and under handle on condensate drain valve (9). Spread cotter pin (10) apart (5). Slide lever (8), drain valve (9), drain bracket (2) and drain hose assembly (7), as a unit, up through hole in top of reel cabinet (3).
- (6) Install condensate drain bracket (2) to reel cabinet assembly (3), by fastening hex head cap screw (4), washer (5), and self-locking nut (6).
- (7) Screw outer drain assembly (1) onto condensate drain (2).

4-29. AIR COMPRESSOR ASSEMBLY - TEST.

This Task Covers: a. Test

Initial Setup:

References

TB 43-0151, Inspection and test of air and other compressors.

Tools Required

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Equipment Condition

Unit shut down and cool.

- a. Test. Perform tests as required by TB 43-0151. Refer to TB 43-0151 for required test intervals.

4-30. CONTROL PANEL AND THROTTLE - TEST/REPLACE/REPAIR.

This Task Covers:	a. Test	b. Removal	c. Disassembly
	d. Repair	e. Assembly	f. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section III, Item 1).
Multimeter (Appendix B, Section III, Item 1)

Materials/Parts Required

Nut, self-locking (Appendix H, Section II, Item 48).
Tags (Appendix E, Section II, Item 17)
Tape, Electrical (Appendix E, Section II, Item 18).

a. Test. (Refer to Figure 4-20).

- (1) Start the lube unit (para 2-9a)
- (2) Ensure that all gauges are working properly.
- (3) Observe throttle assembly and linkage (1) Check that throttle assembly properly changes engine speed.

WARNING

- **Prevent electrical shocks or burns. Do not wear jewelry or dog tags when working on electrical components.**

- (4) With multimeter, perform continuity tests on each control panel wire on back side of control panel (2) Replace or repair wires with no continuity.

b. Removal.

- (1) Shut down the lube unit (para. 2-11a.) and allow to cool

WARNING

- **Exhaust muffler may be hot Use caution to prevent burn injury.**

CAUTION

- **Disconnect negative battery cable to prevent electrical short or damage to components.**

- (2) Close ball valve (3) on air-receiver tank (4)

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Drain air tank prior to disconnecting air line on air pressure gauge**

- (3) Open condensate removal valve handle (5) to "open" position on reel cabinet assembly (6)

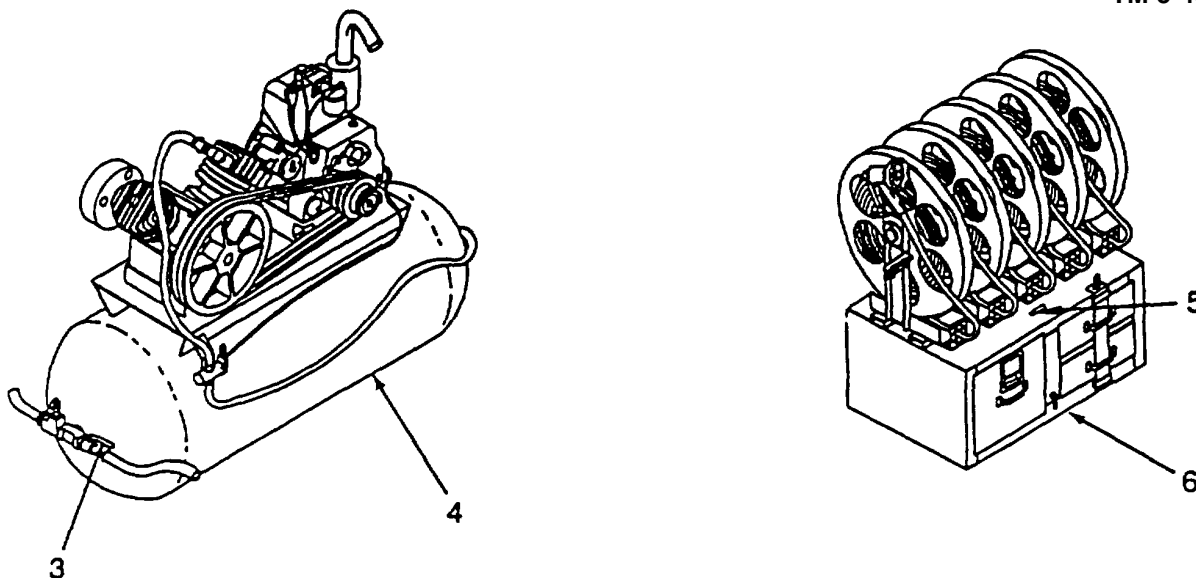


Figure 4-20. Control Panel and Throttle (Sheet 1 of 3)

NOTE

- Wires are already tagged and numbered. In the procedures below, tag numbers are preceded by a "#" symbol. Illustration numbers are in parentheses.
- Lines and wire will be removed from back side of control panel.

- (4) Disconnect air line (7) from air pressure gauge (8).
- (5) Loosen throttle rod (9) by turning throttle adjustment knob (10) on side of control panel (2) counter clockwise, until throttle bracket (11) is removed.
- (6) Remove throttle chain (12), throttle bracket (11), and throttle spring (13).
- (7) Remove tension spring (14) from air cylinder support bracket (15) and from upper throttle bracket (16).
- (8) Remove cotter pin (17) from clevis pin (18) holding throttle assembly (1) to air cylinder support bracket (15). Remove pin (18).
- (9) Remove cotter pin (19) from pin (20) holding throttle assembly (1) to upper throttle bracket (16) which is attached to diesel engine. Remove pin (20).
- (10) Remove five cap screws (21), five washers (22) and five self-locking nuts (23). Discard five self-locking nuts (23). Turn control panel around in place to make wires accessible.
- (11) Disconnect wires #27 and #28 (24) from glow plug switch (25).
- (12) Disconnect wires #5, #10, #23 (26) from run/stop switch (27). If wire #22 is attached to #23, disconnect and replace #22 on control panel.
- (13) Disconnect wire #26 (28) from crank switch (29).

NOTE

- **Rotate oil pressure gauge to clear block, if necessary.**

- (14) Disconnect oil pressure wire #20 (30) from oil pressure gauge (31).
 - (15) Disconnect fuel level wire #21 (32) from fuel gauge (33).
 - (16) Disconnect wires #8 and #13 (34) from shunt (35) by removing shunt terminal screws. Reinstall screws.
 - (17) Remove thumb screw from side of each panel light housing (36). Disconnect wire #6 (37) from one panel light (36) and wire #7 (37) from the other panel light (36). Replace light fixture into light housing (36) and replace thumb screw.
 - (18) Remove control panel (2) from air-receiver tank mounting base (38).
- c. Disassembly.
- (1) Disconnect wires #14 and #15 (39) from the ammeter (40) and the shunt (35).
 - (2) Remove wire #18 (41) connecting oil pressure gauge (31) and run/stop switch (27). Remove wire #19 (42) connecting fuel gauge (33) and run/stop switch (27). Remove wire #22 (43) connecting crank (29) and run/stop switch (27).
 - (3) Remove four nuts (44) and four machine screws (45) holding two panel lights (36) in control panel (2). Remove two panel lights (36) with ground wires (46) attached.
 - (4) Remove three machine screws (47) and three nuts (48) and air pressure gauge (8) from control panel (2).
 - (5) Remove four nuts (49), four lockwashers (64) and brackets (50) holding oil pressure gauge (31) and fuel gauge (33) to back of control panel (2).
 - (6) Remove three machine screws (51) and nuts (52) and ammeter (40) from control panel (2).
 - (7) Unscrew two covers (53) from start button (29) and glow plug button (25). Remove start button and glow plug button.
 - (8) Remove two nuts (54) and washer (55) from throttle rod (9) at rear of control panel (2).
 - (9) Remove nut (56), washer (57), throttle rod (9) and throttle adjustment knob (10) from control panel (2).
 - (10) Remove throttle rod (9) from throttle adjustment knob (10).
 - (11) Remove two machine screws (58) washers (59) and nuts (60) and shunt bar (61) from control panel (2).
 - (12) Remove jam nut (62) holding on/off switch (27) and on/off plate (63) on control panel (2)

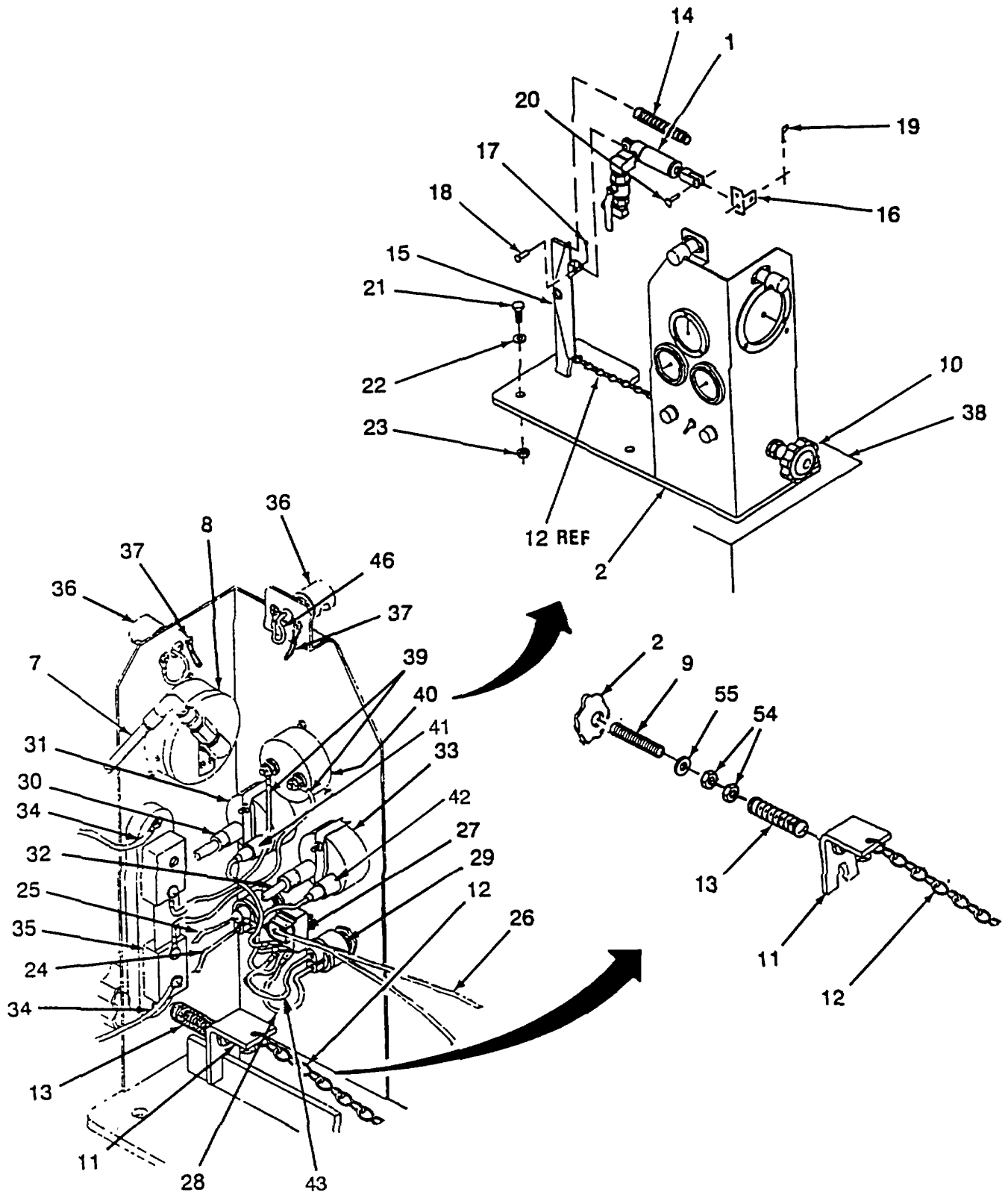


Figure 4-20. Control Panel and Throttle (Sheet 2 of 3)

d. Repair.

- (1) Inspect gauges for discolored or illegible markings, bent or sticking dial pointers and loose, damaged or corroded connectors Replace defective gauges.
- (2) Check operation of switches The toggle switch must operate positively to each of its positions. Replace defective toggle switch.
- (3) Inspect all electrical connections Replace components that have loose, corroded or damaged connectors.
- (4) Inspect wiring for defectives. Repair wiring (5) Inspect control panel for cracks, illegible markings and damage. Replace or repair as needed.

e. Assembly.

- (1) Install on/off switch (27) and on/off plate (63) through rear of control panel (2) and then install jam nut (62) onto on/off switch (27) and tighten.
- (2) Mount shunt bar (61) to rear of control panel (2) with two machine screws (58) washers (59) and nuts (60), then tighten.
- (3) Install throttle adjustment knob (10) onto throttle rod (9) Install nut (56) and washer (57) onto throttle rod (9).
- (4) Install throttle rod (9) into side of control panel (2) Install washer (55) and two nuts (54) onto throttle rod.
- (5) Install throttle spring (13) onto throttle rod (9), over washer (55) and two nuts (54) against rear of control panel (2).
- (6) Thread throttle rod (9) into throttle bracket (11).
- (7) Tighten the two rear nuts (54), and front nut (56) on throttle rod (9) until snug against front and rear of control panel.
- (8) Turn throttle adjustment knob (10) on throttle rod (9) until slack in chain (12) is taken up a little. It is not necessary to tighten chain (12) much, until installation.
- (9) Install start button (29) and jam nut into back side of control panel (2).
- (10) Install glow plug button (25) and jam nut into back side of control panel (2).
- (11) Install covers (53) onto start button (29) and glow plug button (25).
- (12) Install ammeter (40) into control panel (2) with three screws (51) and three nuts (52).
- (13) Install oil pressure gauge (31) into control panel (2) and onto bracket (50). Secure with two lockwashers (64) and two nuts (49).
- (14) Install fuel gauge (33) into control panel (2) and onto bracket (50). Secure with lockwashers (64) and two nuts (49)

- (15) Install air pressure gauge (8) into control panel (2) with three screws (47). Secure with three locknuts (48).
- (16) Install panel lights (36) to front and side of control panel (2) using two screws (45) and two locknuts (44) on each panel light. Be sure to connect ground wires #6 and #7 (19) beneath their respective nuts.
- (17) Connect wires #14 and #15 (39) to the ammeter (40) and the shunt (35).
- (18) Attach wire #18 (41), connecting oil pressure gauge (31) and run/stop switch (27). Attach wire #19 (42), connecting fuel gauge (33) and run/stop switch (27). Attach wire #22 (43), connecting crank (29) and run/stop switch (27).

f. Installation.

NOTE

Wires are already tagged and numbered In the procedures below, tag numbers are precede by a "#" symbol Illustration numbers are in parenthesis.

- (1) Place control panel (2) onto air-receiver tank mounting base (38) Position panel (2) in such a way as to make the connecting of wires easiest.
- (2) Connect wires #27 and #28 (24) to glow plug switch (25).
- (3) Connect wires #5, #10, #23 (9) to run/stop switch (27).
- (4) Connect wire #26 (7) to crank switch (29).
- (5) Connect oil pressure wire #20 (30) to oil pressure gauge (31).
- (6) Connect fuel level wire #21 (32) to fuel gauge (33).
- (7) Connect wires #8 and #13 (39) to shunt (35).
- (8) Remove thumb screw from side of each panel light housing (36) Connect wire #6 (37) to fixture of light (36) above the ammeter (40). Connect wire #7 (37) to fixture of light (36) above the air pressure gauge (8). Replace light fixtures into light housings (36) and replace thumb screws (45).
- (9) Install pin (18) holding throttle assembly (1) to air cylinder support bracket (15) Insert cotter pin (17) into pin (18) Spread cotter pin (17) apart to secure It against pin (18).
- (10) Insert pin (20) holding throttle assembly (1) to upper throttle bracket (16), which is attached to diesel engine. Insert and spread cotter pin (19).
- (11) Install throttle chain (12) onto throttle bracket (11).
- (12) Install tension spring (14) to air cylinder support bracket (15) and upper throttle bracket (16).
- (13) Tighten throttle adjustment knob (10) until throttle chain (12) is tight.
- (14) Connect air line (7) to air pressure gauge (8) (15) Reconnect negative (ground) battery cable (para 4-26).

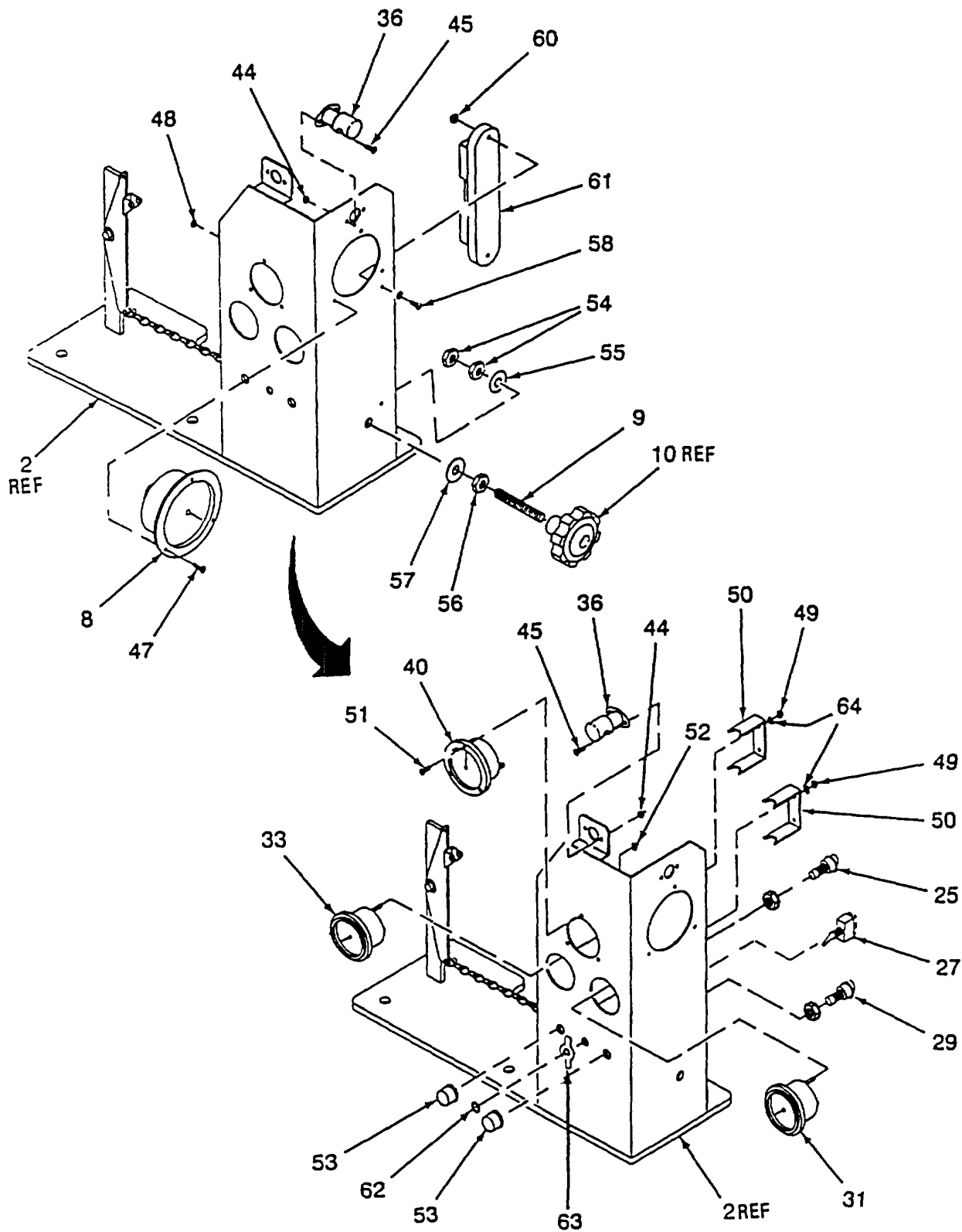


Figure 4-20. Control Panel And Throttle (Sheet 3 of 3)

4-31. BELTS- ADJUST/REPLACE.

This Task Covers: a. **Air Compressor** b. **Alternator****Initial Setup:****Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Lockwasher (Appendix H, Section II, Item 7)

Nut, self-locking (Appendix H, Section II, Item 10).

Nut, self-locking (Appendix H, Section II, Item 47).

Nut, self-locking (Appendix H, Section II, Item 48)

Equipment Condition

Enclosure removed (para. 4-13).

Alcohol injector removed (para 4-16).

Unit shut down and cool.

a. Air Compressor.

(1) Removal. (Refer to Figure 4-21).

WARNING

- **Clothing may get caught in moving machinery and cause serious injury or death DO NOT wear loose clothing around moving parts**

CAUTION

- **Disconnect negative battery cable before removing belts to prevent electrical short or damage to components**

- (a) Open battery drawer and disconnect ground wire #1 from battery (para 4-26).
- (b) Remove lube tank duct (1) from heater plenum (2) and heat inlet (11) by loosening two clamps (4) Pull lube tank duct (1) off and set aside.
- (c) Remove two nuts (5) and two lockwashers (6) from muffler (7) at engine exhaust. Remove gasket (8) Bend muffler (7) and exhaust hose (9) down and away from diesel engine (10).
- (d) Remove heat inlet (11) from lube tank (12) by removing two hex head cap screws (13) and two lockwashers (14) Slide heat inlet (11) out Discard two lockwashers (14).
- (e) Remove cap screw (15), washer (16), and self-locking nut (17) from clutch arm (18) on belt guard (19) Discard self-locking nut.
- (f) Remove cap screw (20), washer (21), and self-locking nut (22) from clutch fork (23). Move clutch arm (18) out of the way Discard self-locking nut.
- (g) Remove clutch fork (23) by spreading its end apart and pulling it away from pins (24) on clutch assembly (25).
- (h) Detach nylon air tubing (42) from quick disconnect at side of belt guard (19).

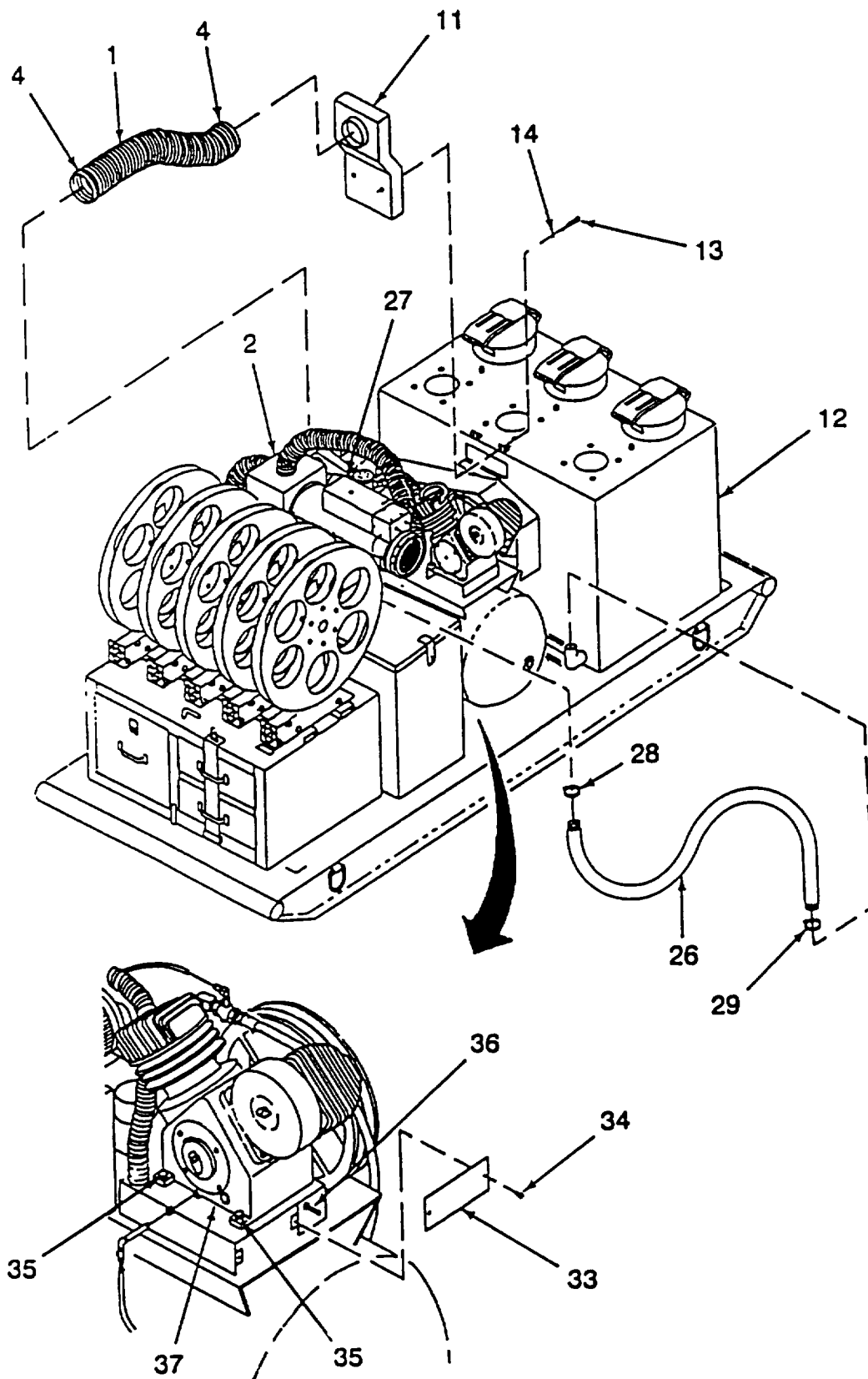


Figure 4-21. Compressor Belts (Sheet 1 of 4)

- (i) Remove hose assembly (26) from winterization assembly heater exhaust (27) by loosening clamp (28).
- (j) Loosen clamp (29) from lube tank (12) and remove hose assembly (26).
- (k) Remove six cap screws (30), six washers (31) and six self-locking nuts (32) from belt guard (19). Discard six self-locking nuts.
- (l) Remove belt guard (19).
- (m) Remove access plate (33) by loosening two thumb screws (34).
- (n) Loosen four bolts (35), one adjustment nut (36) and slide air compressor (37) forward until air compressor belts (38) can be taken off of flywheel (39) and clutch assembly (25).
- (o) Remove air compressor belts (38).

(2) Installation.

NOTE

Before tightening air compressor belts, make sure that air compressor flywheel and clutch assembly are in line with each other. If they are not, see section (3) below.

- (a) Install new air compressor belts (38) onto clutch assembly (25) and flywheel (39).
- (b) Slide air compressor (37) back until air compressor belts (38) can be depressed about one inch or 1 1/4 inch. Tighten adjustment nuts (36).
- (c) Tighten four air compressor bolts (35).
- (d) Replace access plate (33) by tightening thumb screws (34).
- (e) Install belt guard (19) by installing six cap screws (30), six washers (31), and six self-locking nuts (32).
- (f) Install hose (26) to winterization assembly heater exhaust (27) by tightening clamps (28) and to lube tank (12) by tightening clamp (29).
- (g) Install clutch fork (23) onto clutch assembly (25) by spreading its ends and pushing it onto pins (24).
- (h) Install clutch arm (18) to clutch fork (23) with cap screw (20), washer (21), and self-locking nut (22).
- (i) Install clutch arm (18) to belt guard (19) using cap screw (15), washer (16), and self-locking nut (17).
- (j) Install heat inlet (3) to lube tank (12) using two hex head cap screws (13) and two lock washers (14). Attach air tubing (42) to quick disconnect at side of belt guard (19).
- (k) Install muffler (7) and gasket (8) to diesel engine exhaust (10) using two lockwashers (6) and two nuts (5).
- (l) Install lube tank duct (1) to winterization assembly heater plenum (27) and heat inlet (11) by tightening two clamps (4).

NOTE

- Refer to Section (1) above for removal of belt guard and other obstructions.
- If clutch does not need alignment with compressor flywheel, proceed to step (e).

(3) Adjust.

- (a) Loosen bolt (40) on clutch assembly (25) and slide the clutch assembly (25) into position on the engine shaft to correctly align the air compressor belts (38).
- (b) Use a straight-edge to align clutch assembly with compressor flywheel. Make sure the distance from straight edge to belt edge is uniform (see detail B).
- (c) Make sure that clutch assembly and air compressor are square with bed plate (see detail A).
- (d) Tighten bolt (40) on clutch assembly (25).
- (e) Remove access plate (33) by loosening two thumb screws (34). Loosen four compressor bolts (35) and slide the compressor (41) to where compressor belts have about 1" to 1.25" slack.

NOTE

Do not overtighten air compressor belts.

- (f) Tighten adjustment nut (36).
- (g) Tighten four air compressor bolts (34).

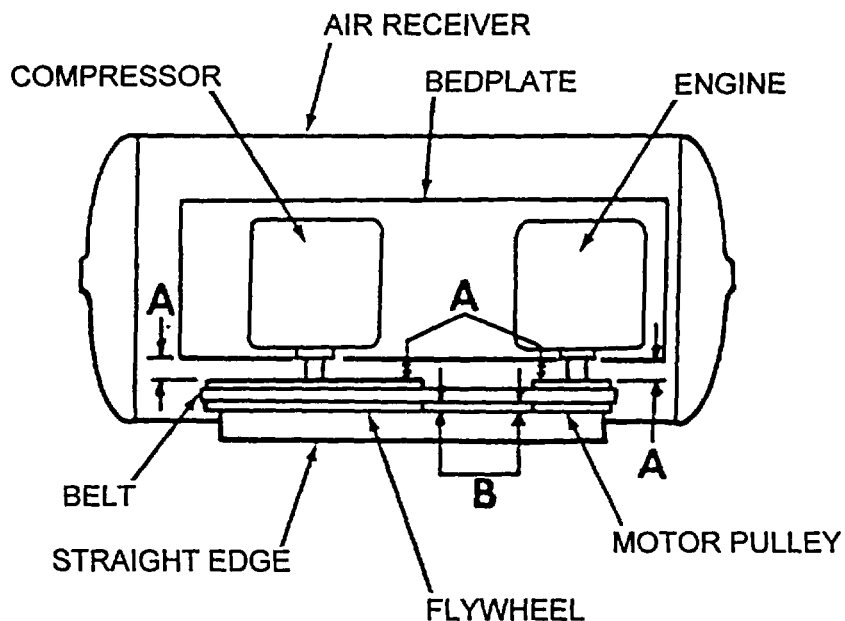


Figure 4-21. Compressor Belts (Sheet 2 of 4)

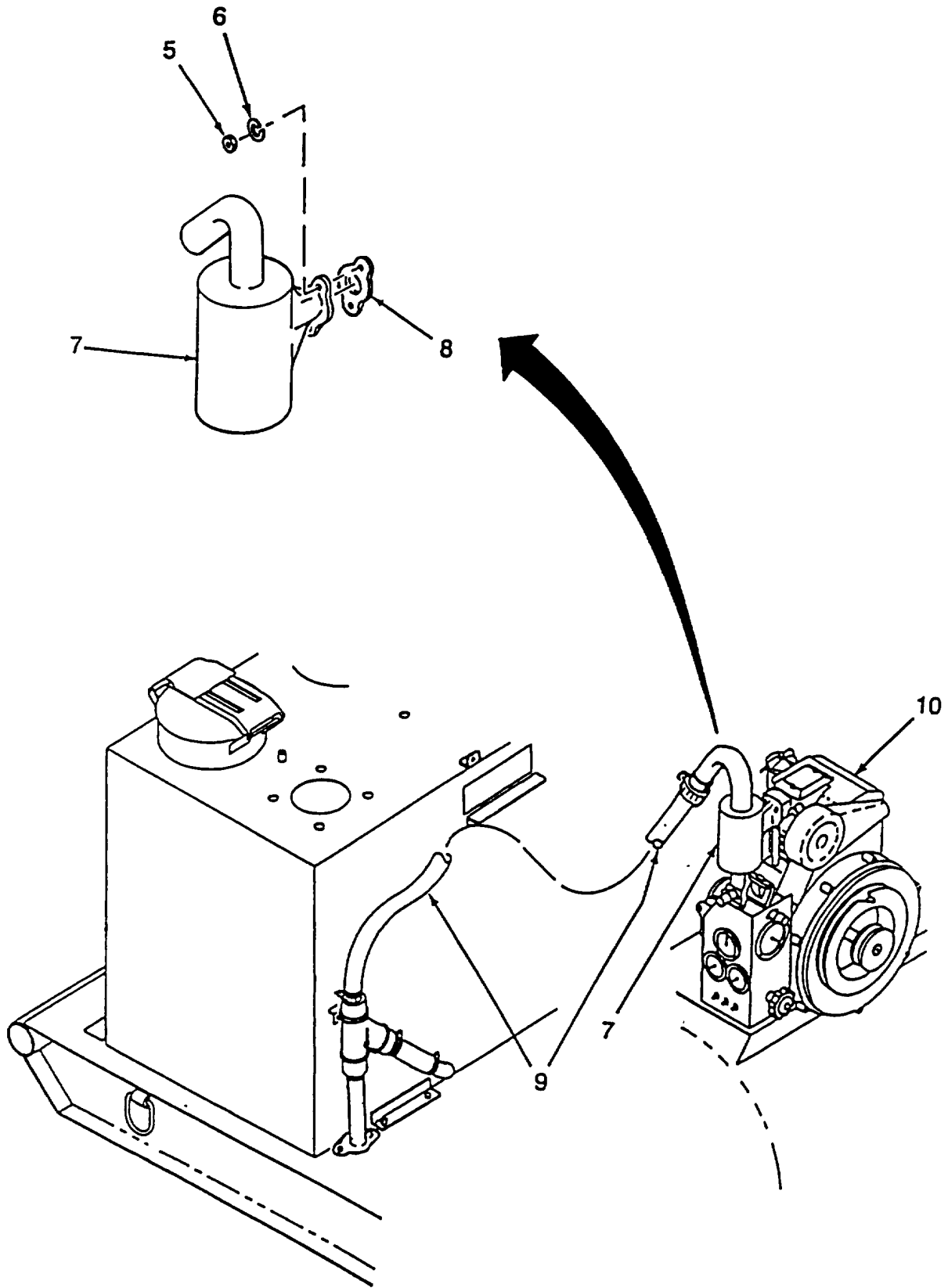


Figure 4-21. Compressor Belts (Sheet 3 of 4)

b. Alternator.

(1) Removal. (Refer to Figure 4-22).

- (a) Remove three cap screws (1), three lockwashers (2), and three spacers (3) from alternator belt guard (4). Discard three lockwashers (2).
- (b) Remove alternator belt guard (4) from engine housing (5).
- (c) Loosen two cap screws (6) from alternator (7).
- (d) Slide alternator (7) forward to loosen alternator belt (8).
- (e) Remove alternator belt (8) from alternator pulley (9) and engine pulley (10).

(2) Installation.

- (a) Install alternator belt (8) onto alternator pulley (9) and engine pulley (10).
- (b) Slide alternator (7) back so that alternator belt (8) is tight.
- (c) Tighten two cap screws (6) while holding back on alternator (7).
- (d) Install alternator belt guard (4) to engine housing (5), placing three spacers (3) between engine housing (5) and alternator belt guard (4).
- (e) Install three cap screws (1), three lockwashers (2) into alternator belt guard (4), spacers (3) and engine housing (5).

(3) Adjust.

NOTE

Before tightening alternator belt (8), make sure that alternator pulley (9) and engine pulley (10) are in line with each other.

- (a) Loosen cap screw (6) on top portion of alternator (7).
- (b) Lift upon alternator (7) until alternator belt (8) has about 1/2" of slack.
- (c) Tighten cap screw (6).

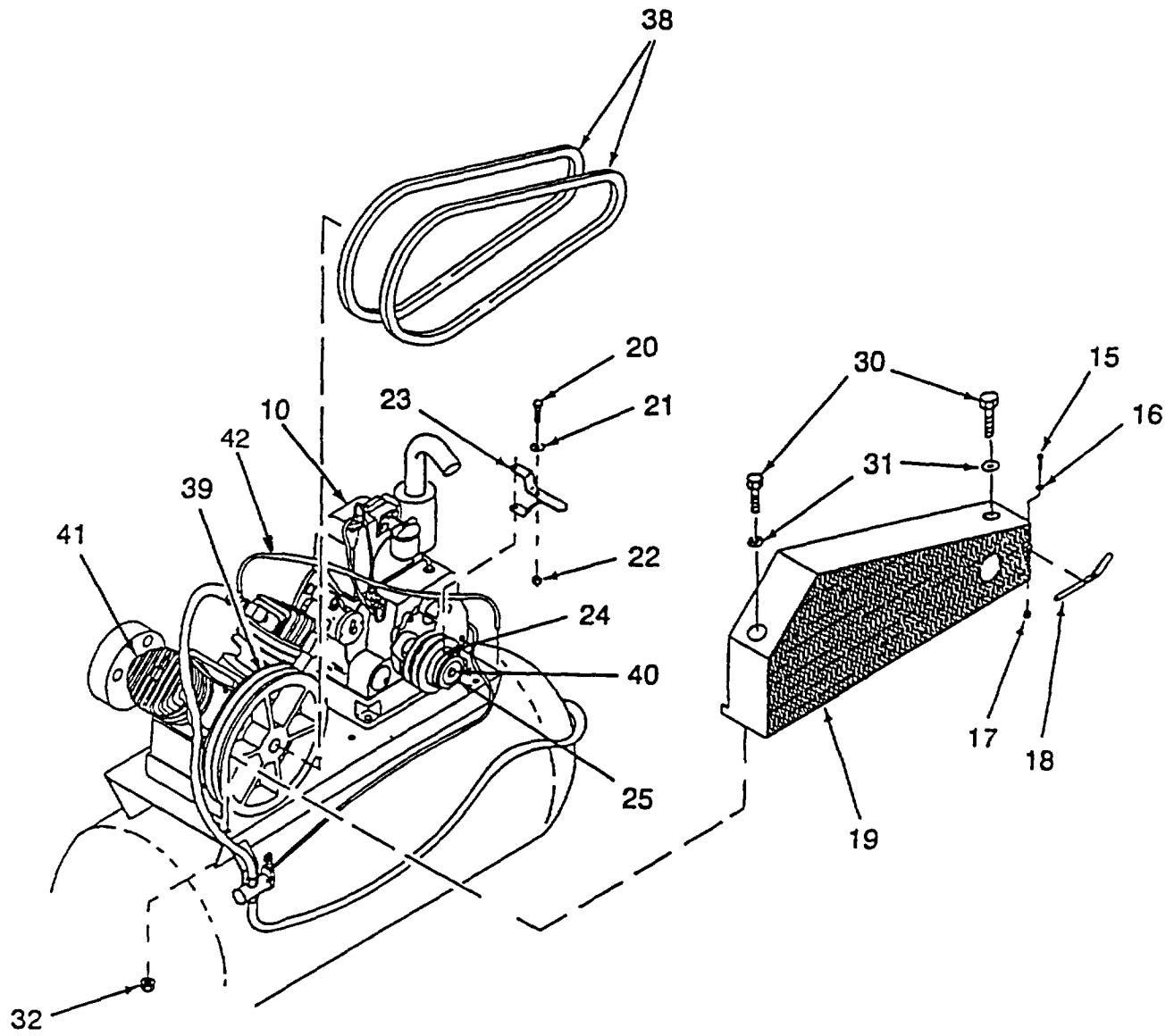


Figure 4-21. Compressor Belts (Sheet 4 of 4)

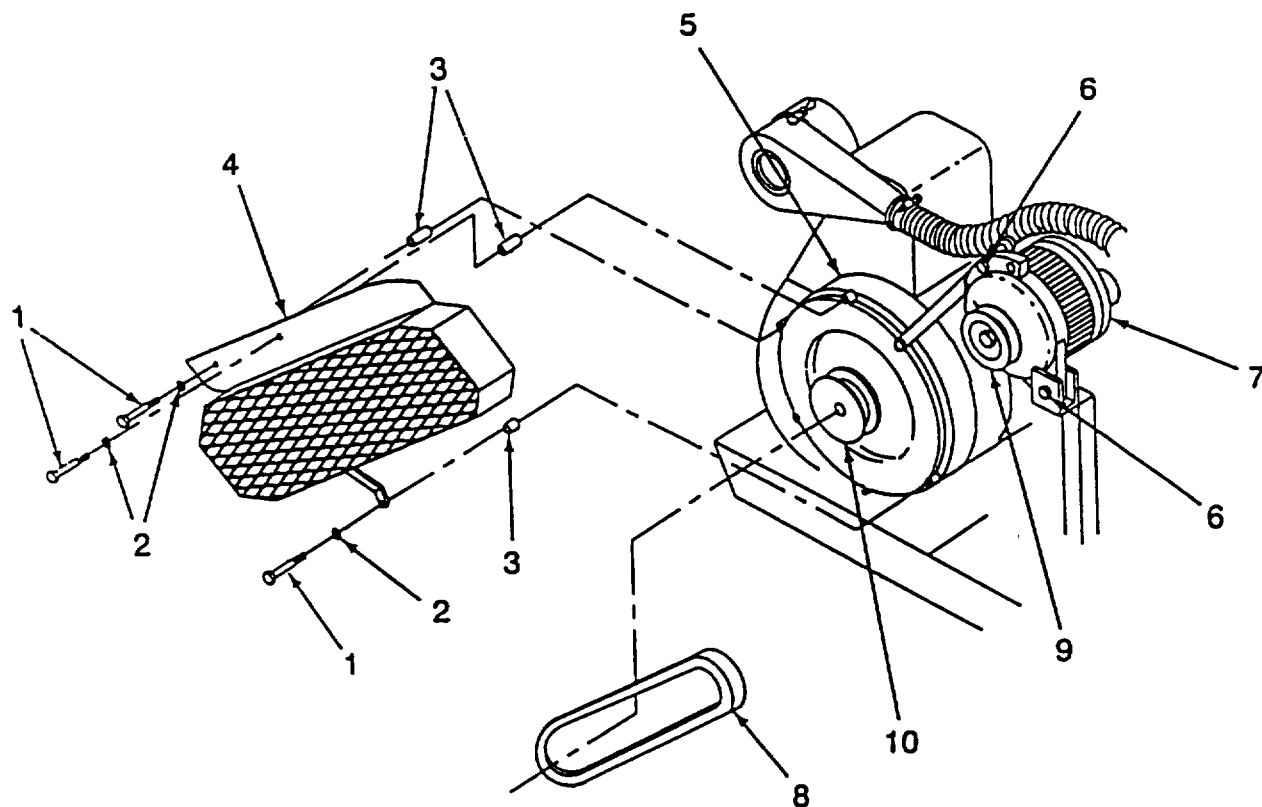


Figure 4-22. Alternator Belt

b. Removal.

- (1) Remove wire #13 (4) on back portion of alternator (2), by removing nut (5).
- (2) Remove top mount cap screw (6), lockwasher (7), and flat washer (8) connecting alternator (2) to upper alternator support bracket (12). Discard lockwasher (7).
- (3) Remove lower bolt (9) and nut (10) from alternator support bracket (11).
- (4) Remove alternator (2) from support bracket (11).

c. Installation.

- (1) Install alternator (2) into lower alternator support bracket (11) and align alternator to upper alternator support bracket (12).
- (2) Install bolt (9) and nut (10) into lower alternator support bracket (11).
- (3) Install cap screw (6), lockwasher (7) and flat washer (8) through upper alternator support bracket (12) into alternator (2).
- (4) Attach alternator wire #13 (4) to alternator (2) and secure with nut (5).
- (5) Install alternator belt (para 4-31).

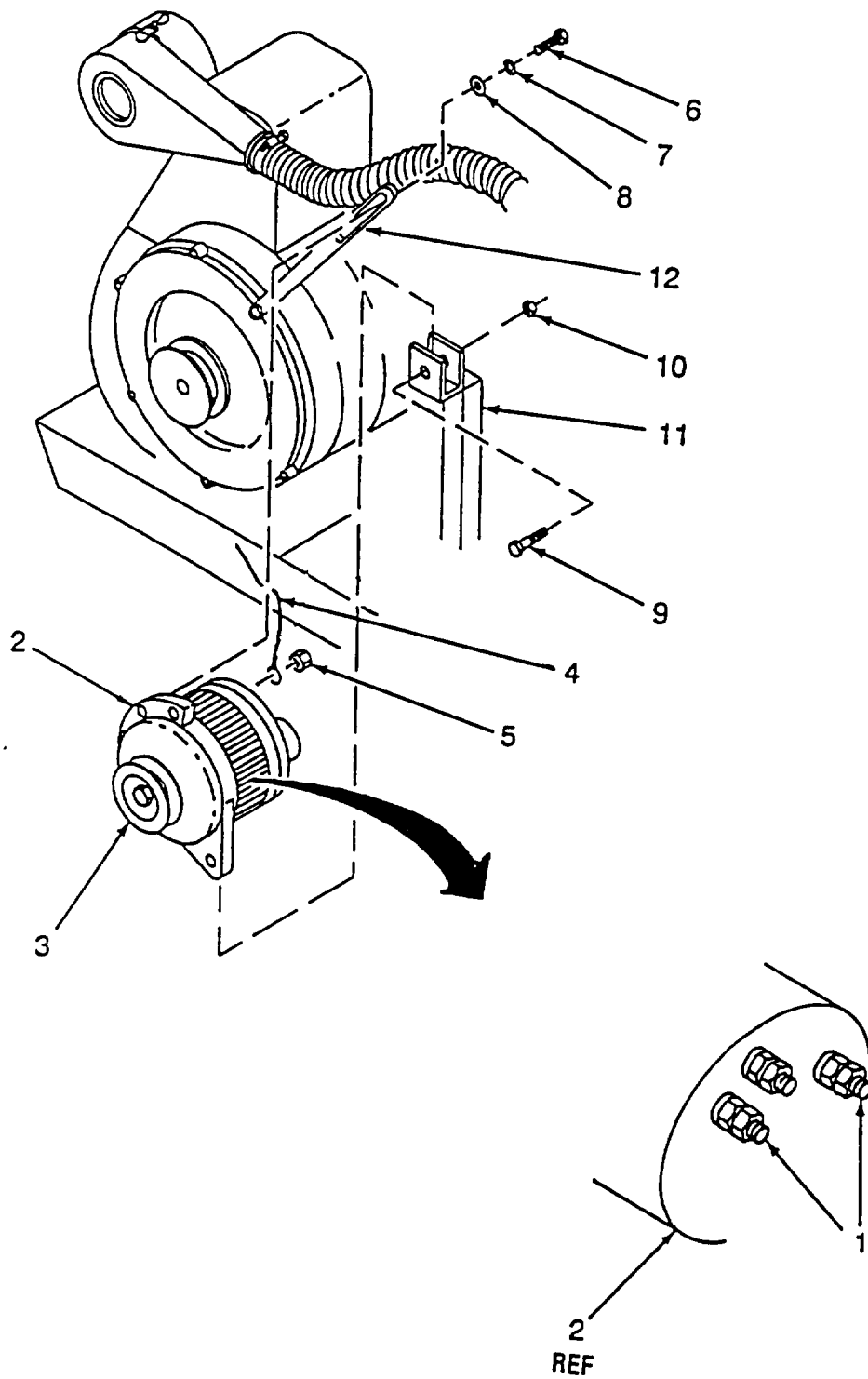


Figure 4-23. Alternator - Assembly

4-33. PLUMBING- REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts

Teflon Tape (Appendix E, Section II, Item 7).

Dry Cleaning Solvent (Appendix E, Section II, Item 3).

Rag, wiping (Appendix E, Section II, Item 1).

Equipment Condition

Unit shut down and cool.

Enclosure Removed (para. 4-13).

Compressor Belt Removed (para. 4-31).

a. Removal. (Refer to Figure 4-24).

CAUTION

- **Before removal, clean all grease, oil, and dirt from air line fittings to help prevent system contamination.**

NOTE

The following procedure is typical of all air compressor assembly hoses, lines, valves, and fittings.

- (1) Open condensate drain valve on reel cabinet to relieve tank pressure.
- (2) Verify that pressure has been relieved by reading the air pressure gauge. It should read zero.
- (3) Remove air tubing (1), elbow fitting (2), and adapter/extender (3) from check valve (4).
- (4) Remove braided steel hose (5) from check valve (4).
- (5) Remove street elbow (6), nipple (7) and check valve (4) from air compressor (8).
- (6) Remove nipple (7) from street elbow (6) and check valve (4).
- (7) Remove tee male branch (9), bushing (10) and relief valve (11) from air compressor (8).

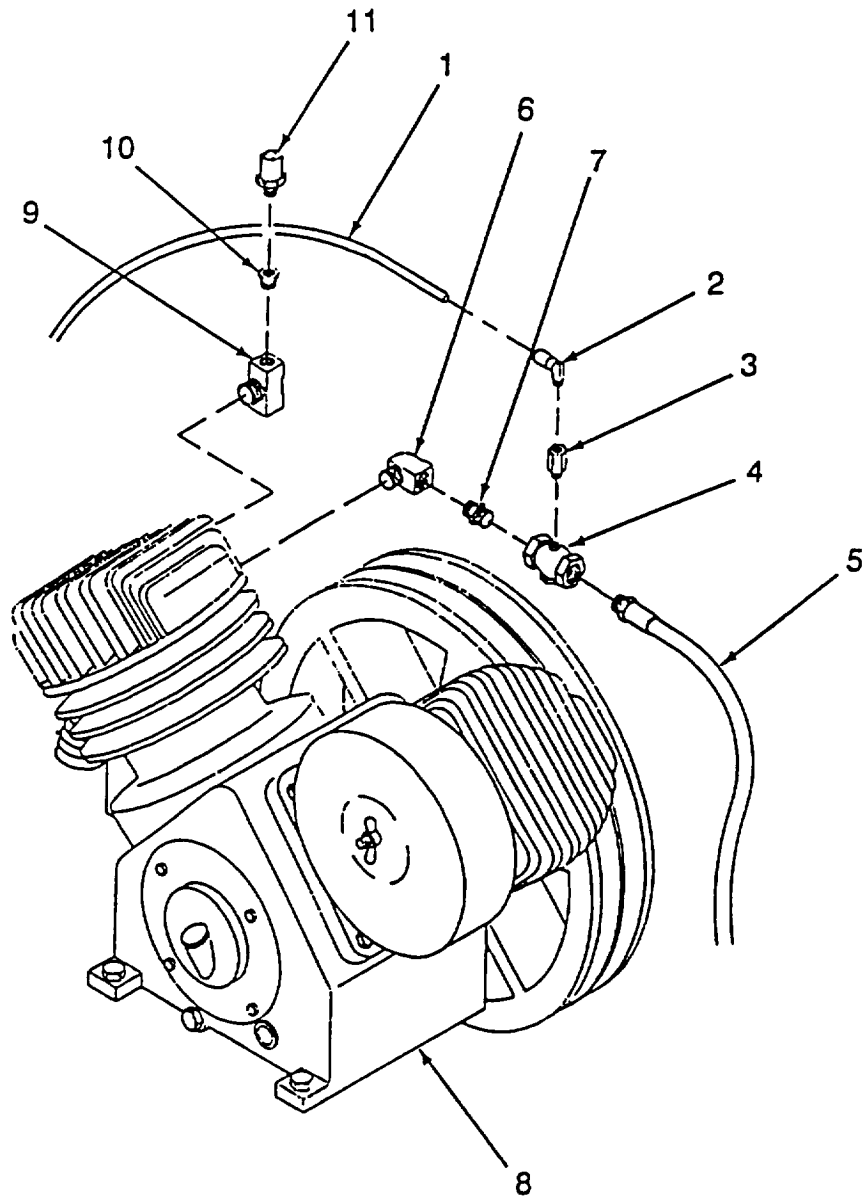


Figure 4-24. Plumbing

b. Installation.

NOTE

Wrap all male threads with Teflon Tape.

- (1) Install male branch tee (9) into air compressor (8).
- (2) Install bushing (10) into male branch tee (9).
- (3) Install relief valve (11) into bushing (10).
- (4) Install street elbow (6) into air compressor (8).
- (5) Install nipple (7) into street elbow(6).
- (6) Install check valve (4) onto nipple (7); tighten check valve until male elbow port is pointing towards compressor belt wheel.
- (7) Install adapter/extender (3) and elbow fitting (2) into check valve (4).
- (8) Push air tubing (1) into elbow fitting (2). Install braided steel hose (5) into check valve (4).

4-34. AIR PUMP - SERVICE/REPLACE.

This Task Covers: **a. Servicing** **b. Removal** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Drain Pan (Appendix B, Item 2)

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7)

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para. 4-13).
Compressor Belts Removed (para. 4-31)

Personnel

2

WARNING

- **Compressed air can be dangerous if not used properly. DO NOT disconnect air lines or components before first relieving the air-receiver tank of all pressure.**
- **Use caution when removing the air compressor. It is bulky and heavy.**

a. Servicing. (Refer to Figure 4-25).

- (1) Remove dipstick (1) from side of air compressor (2).
- (2) Drain air compressor oil by opening drain valve (3), and drain it into a suitable container.
- (3) Close drain valve (3).
- (4) Refill oil reservoir on air compressor (2) to proper level (Refer to LO 5-4930-244-12)

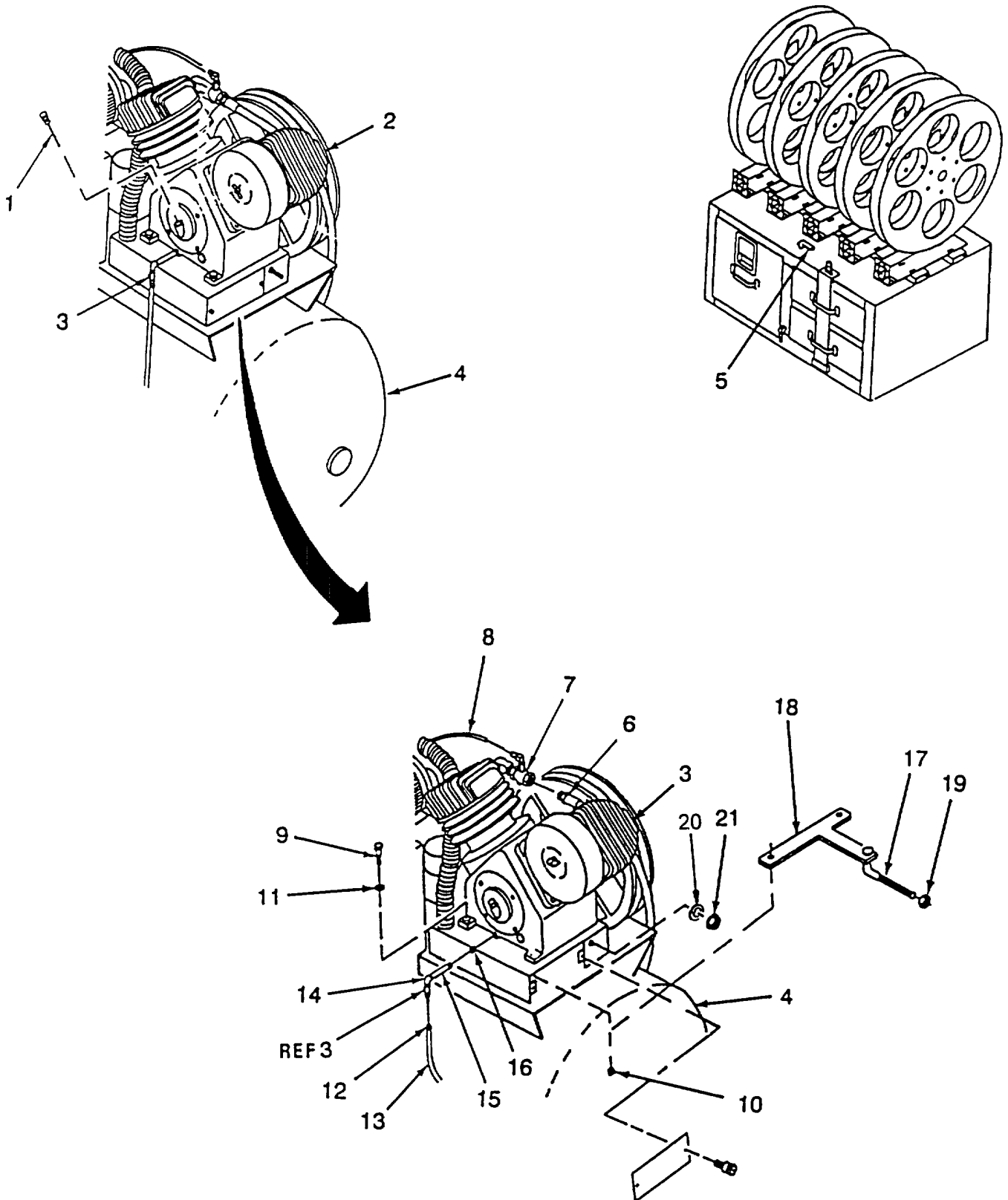


Figure 4-25. Air Pump

b. Removal.

- (1) Relieve air from air-receiver tank (4) by turning condensate removal valve handle (5) to "open".

NOTE

Be sure all air pressure has been released before proceeding. Check this by reading the air pressure gauge on the control panel.

- (2) Remove braided steel hose (6) at check valve (7).
- (3) Disconnect air tubing (8) at elbow fitting on the check valve (7)
- (4) Remove four bolts (9), four nuts (10), and eight washers (11) at base of air compressor (2).

NOTE

Drain air compressor oil before unscrewing the drain valve.

- (5) Loosen hose clamp (12) and slide down on hose (13).
- (6) Remove hose (13) from drain valve (3)
- (7) Unscrew drain valve (3) from elbow (14)
- (8) Remove elbow (14), nipple (15) and bushing (16) from air compressor (2)

WARNING

Use caution when removing the air compressor It is bulky and heavy Two people are needed to remove air compressor.

- (9) Lift air compressor (2) from air-receiver tank (4).

c. Installation.

NOTE

Before installation wrap threads on drain valve, nipple and bushing with Teflon Tape.

- (1) Clean mounting surface of air-receiver tank (4) area before replacing air compressor (2)
- (2) Carefully place air compressor (2) onto mount area, on air-receiver tank (4)
- (3) Align holes on base of air compressor (2) with mount area of air-receiver tank (4). Install two nearest bolts (9), that is two bolts on the side of compressor farthest from engine, with two washers (11) and two nuts (10). Slightly tighten bolts
- (4) Install J-bolt (17) onto belt adjustment bracket (18)
- (5) Install nut (19), onto J-bolt (17).
- (6) Slide J-bolt (17) with belt adjustment bracket (18) attached through hole in platform on air-receiver tank (4).

- (7) Install two innermost bolts (9) and two washers (11), and raise belt adjustment bracket (18) with J-bolt (17) up and onto these two innermost bolts (9). Fasten with two locknuts (10). Slightly tighten bolts.
- (8) Install washer (20) and flanged nut (21) onto J-bolt (17) and tighten.
- (9) Install air compressor belts. (Refer to para. 4-31).
- (10) Adjust air compressor belts. (Refer to para. 4-31).
- (11) Install belt guard. (Refer to para. 4-31).
- (12) Connect braided steel hose (6) to check valve (7).
- (13) Connect air tubing (8) at elbow fitting on check valve (7).
- (14) Clean male threads on drain valve (3), elbow (14), nipple (15), and bushing (16). Tape threads with Teflon tape.
- (15) Install nipple (15) into bushing (16), then install both into lower side of air compressor (2).
- (16) Install elbow (14) onto nipple (15).
- (17) Insert drain valve (3) into elbow (14) and tighten, making sure handle on drain valve is pointing away from base of air compressor (2).
- (18) Install hose (13) onto drain valve (3), tighten hose clamp (12) upon hose and drain valve.
- (19) Fill oil reservoir on air compressor (2) with oil. (Refer to para. 4-34.a.).

4-35. SHUT OFF VALVE - REPLACE.

This Task Covers: a. Removal b. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Unit shut down and cool.

Enclosure Removed (para. 4-13)

a. Removal. (Refer to Figure 4-26).

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Completely vent air pressure by turning drain lever on reel cabinet**

- (1) Open condensate drain valve on reel cabinet to relieve tank pressure.
- (2) Verify that pressure has been relieved by reading the air pressure gauge (1) It should read zero.
- (3) Disconnect elbow swivel (2) and hose (3) from shut-off valve (4).
- (4) Disconnect shut-off valve (4) from hex nipple (5).

b. Installation.

- (1) Apply Teflon tape to hex nipple (5) and swivel (2) threads.
- (2) Connect shut-off valve (4) to hex nipple (5).
- (3) Connect elbow swivel assembly (2) and hose (3) to shut-off valve (4).

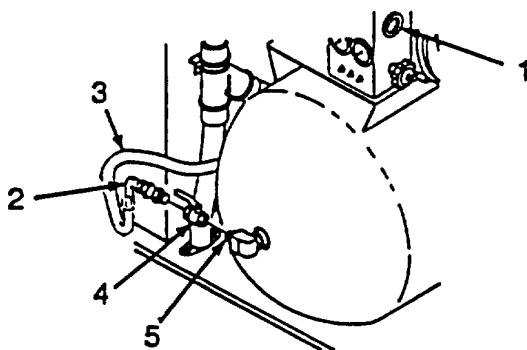


Figure 4-26. Shut-Off Valve

4-36. PRESSURE RELIEF VALVE - REPLACE.

This Task Covers: a. Removal b. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Unit shut down and cool.

Enclosure Removed (para. 4-13).

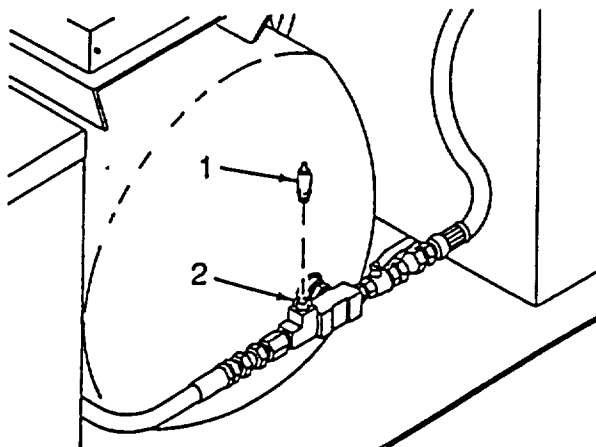
a. Removal. (Refer to Figure 4-27).

WARNING**Compressed air may cause severe injury or death, if not used properly.
Completely vent air pressure by turning drain lever on reel cabinet.**

- (1) Open condensate drain valve on reel cabinet to relieve tank pressure.
- (2) Verify that pressure has been relieved by reading the air pressure gauge. It should read zero.
- (3) Remove pressure relief valve (1) from reducer bushing (2).

b. Installation.

- (1) Apply Teflon tape to threads of relief valve (1).
- (2) Install pressure relief valve (1) into reducer bushing (2).

*Figure 4-27. Pressure Relief Valve*

4-37. BALL VALVE - REPLACE.

This Task Covers: a. Removal b. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's' Automotive (Appendix B, Section III, Item 1)

Materials Required

Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Enclosure Removed (para. 4-13).
Unit shut down and cool

a. Removal. (Refer to Figure 4-28).

WARNING

- **Compressed air may cause severe injury or death, if not used properly. Completely vent air pressure by turning drain lever on reel cabinet.**

- (1) Open condensate drain valve on reel cabinet to relieve tank pressure.
- (2) Verify that pressure has been relieved by reading the air pressure gauge. It should read zero.
- (3) Disconnect swivel assembly (1) and hose (2) from ball valve (3).
- (4) Disconnect ball valve (3) from hex nipple (4)

b. Installation.

- (1) Connect ball valve (3) to hex nipple (4).
- (2) Connect swivel assembly (1) and hose (2) to ball valve (3).

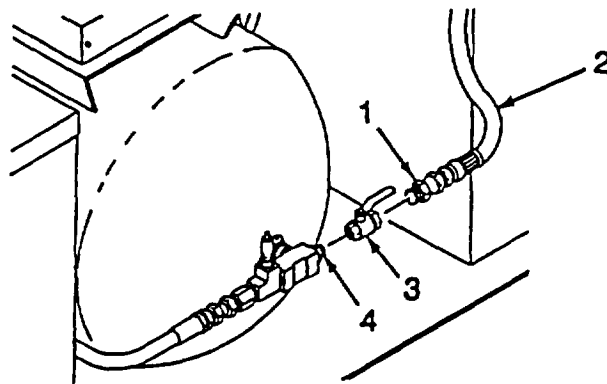


Figure 4-28. Ball Valve

4-38. UNLOADER VALVE - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Engine shut down and cool.

Enclosure Removed (para. 4-13).

a. Removal. (Refer to Figure 4-29).

WARNING

Compressed air can be dangerous if not used properly, It can cause severe injury or death. DO NOT disconnect hose assembly or components before first relieving the air-receiver tank of all pressure.

- (1) Open condensate drain valve on reel cabinet to relieve tank pressure.
- (2) Verify that pressure has been relieved by reading the air pressure gauge. It should read zero.
- (3) Disconnect braided hose assembly (1), braided hose assembly (2), nylon tube (3) from unloader valve (4). Braided hose assembly (2) must be disconnected from both ends.
- (4) Remove unloader valve (4) and nipple (5) from tank assembly (6).
- (5) Remove nipple (5), swivel adapter (7), push-in fitting elbow (8) from unloader valve (4).

b. Installation.

- (1) Clean threads of the following fittings and tape: nipple (5), swivel adapter (7), push-in fitting elbow (8), and fitting on hose assembly (2).
- (2) Install nipple (5), swivel adapter (7), push-in fitting elbow (8) into unloader valve (4).
- (3) Install nipple (5) and unloader valve (4) into tank assembly (6).
- (4) Connect braided hose assemblies (1 and 2), nylon tube (3) to unloader valve (4).
- (5) To check correct operation of the unloader valve, check air pressure gauge (9) and control panel (10) to see when the engine kicks in and when it idles down.
- (6) The cut-in pressure should be about 145 psi, the cut-out pressure should be about 175 psi.

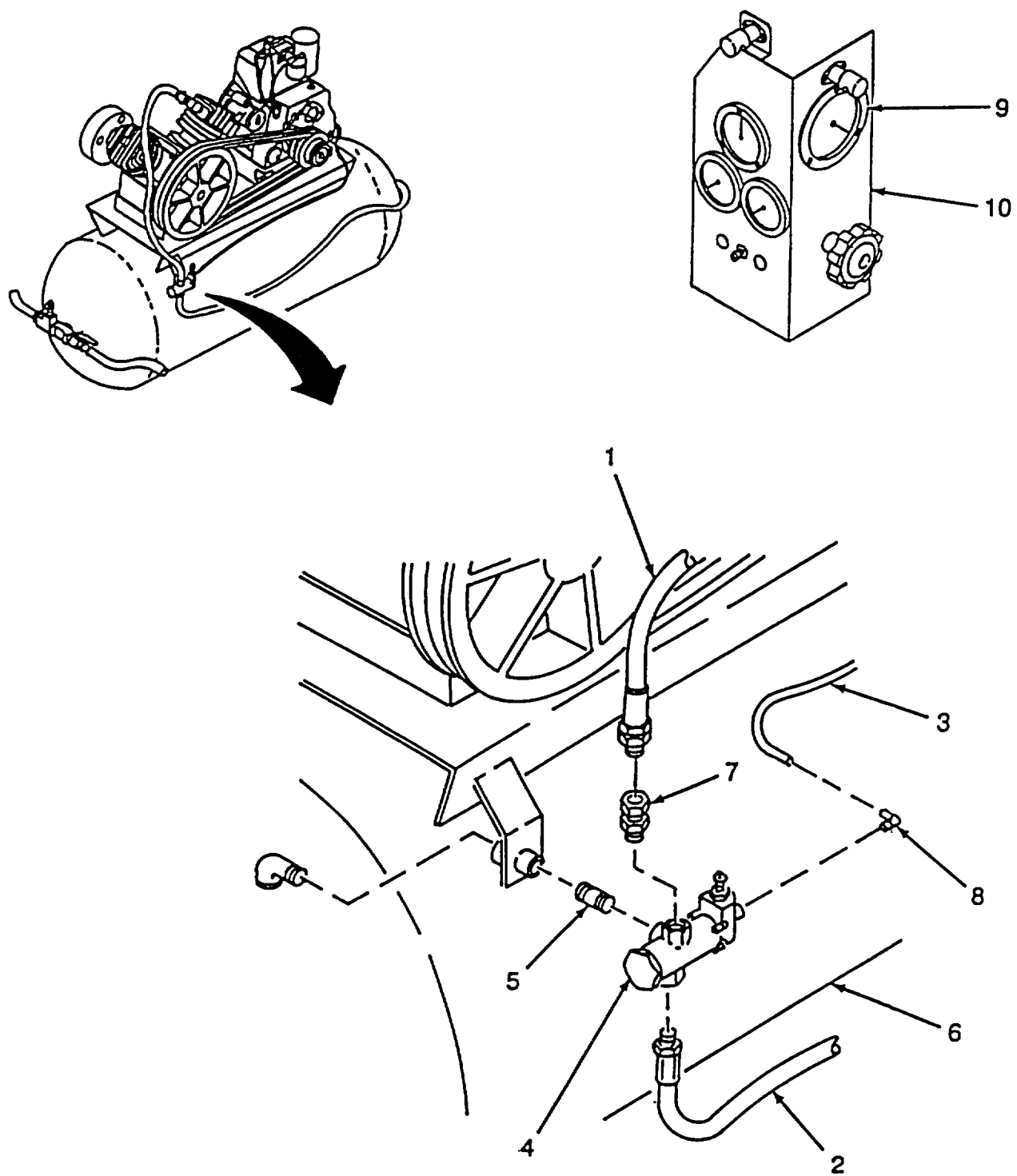


Figure 4-29. Unloader Valve

4-39. DIESEL ENGINE - REPLACE/REPAIR.

This Task Covers:

a. Diesel Engine	b. Air Cleaner Assembly	c. Heater Plug
d. Starter Motor	e. Oil Filter Assembly	f. Oil Pressure Switch
g. Exhaust System	h. Rope Start Assembly	i. Fuel Filter
j. Flywheel Pulley and Shaft		

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Multimeter (Appendix B, Section III, Item 2).

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7).
Dry Cleaning Solvent (Appendix E, Section II, Item 3).
Rags, wiping (Appendix E, Section II, Item 1)
Drain pan (Appendix B, Section III, Item 2).
Lockwasher (Appendix H, Section II, Item 7).
O-Ring (Appendix H, Section II, Item 49).

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para. 4-13).
Compressor Belts Removed (para. 4-31).
Control Panel Removed (para. 4-30).

Personnel2

a. Diesel Engine.

WARNING

- **Components become hot during operation. Allow them to cool before handling.**
- **Chock wheels when working on the unit. Unit could roll and cause injury.**
- **Stand clear when the engine is being lifted. Engine could fall and cause serious injury.**
- **Clean up spills as soon as they occur. Spills may result in serious slip and fall injuries.**
- **Do not smoke when handling fuel system components.**
- **Prevent electrical shock or burns. Do not wear jewelry or dog tags when working on electrical components.**

(1) Service.

- (a) Drain diesel engine oil by opening drain valve (1), and drain it into suitable container.
- (b) Lift out the dipstick (2) from the engine crank case (3).
- (c) Fill the engine crankcase (3) to the top of the narrow section on the dipstick (2) to the "H" mark.
- (d) Install the dipstick (2) into the engine crank case (3).
- (e) Check all components parts on diesel engine for leaks. Repair or replace as necessary.
- (f) Inspect diesel engine for damaged threads, cracks, distortion or wear.

(2) Removal. (Refer to Figure 4-30).

NOTE

Drain engine oil before removing engine. For procedure, see (1) Service, above.

- (a) Disconnect negative battery cable from the battery post (para. 4-26).
- (b) Turn off air valves on both ends of air-receiver tank (para. 4-26). Open condensate removal valve handle to "open" (para. 4-27).
- (c) Loosen clamp (4), and slide upon fuel line (5).
- (d) Disconnect fuel line (5) on suction side of fuel pump (6).
- (e) Remove oil temperature switch (7) from diesel engine (3).
- (f) Remove nut (9) and disconnect electrical lead (8) from glow plug (10).
- (g) Loosen clamp (11) and remove hose (12) from air filter housing (13).
- (h) Remove bolt (14), lockwasher (15), and two ground wires (16) from diesel engine (3). Disconnect 24v battery cable from starter solenoid.
- (i) Remove wires #20, 23, and 26.
- (j) Remove four nuts (17), washers (18), and bolts (19) from air-receiver tank mount (20).

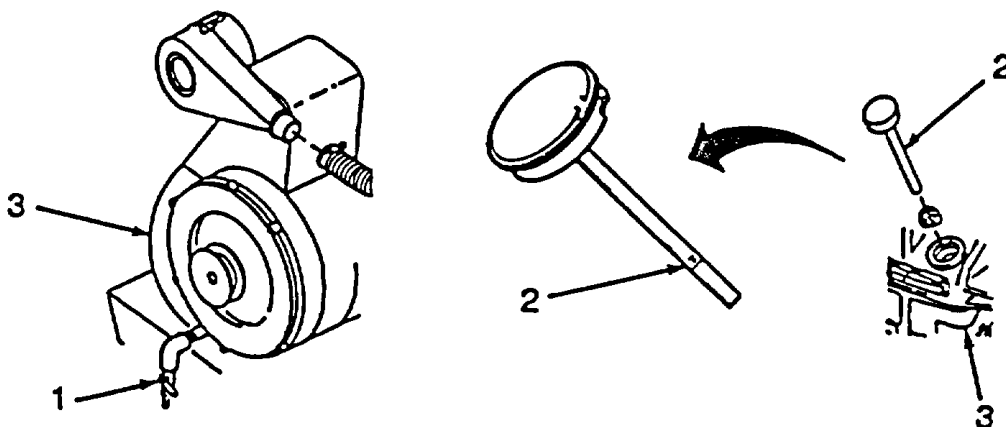


Figure 4-30. Diesel Engine (Sheet 1 of 2)

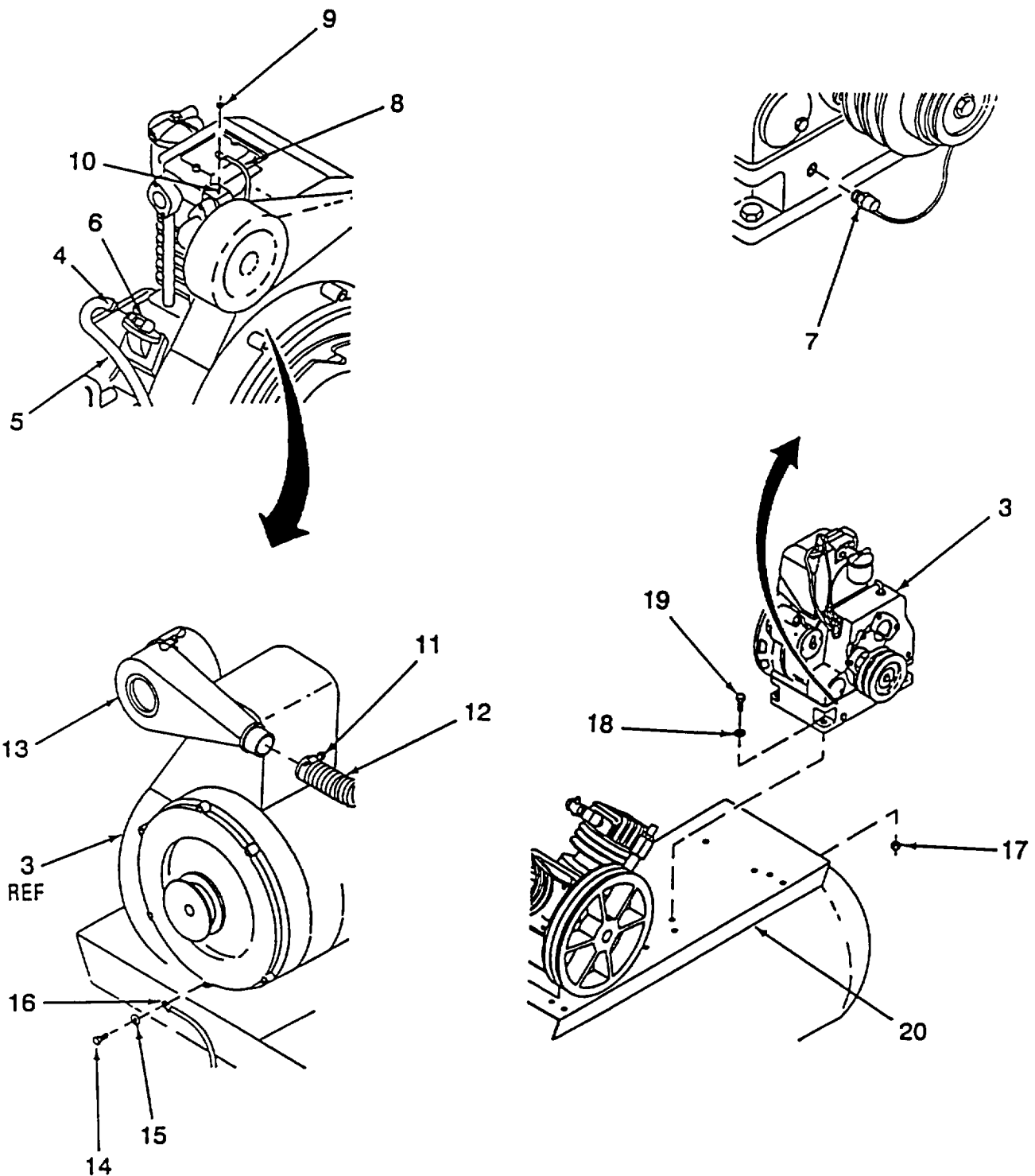


Figure 4-30. Diesel Engine (Sheet 2 of 2)

WARNING

- **Diesel engine is heavy. Exercise caution when lifting or moving the diesel engine. Injury could occur. Use two people to lift.**

(j) Remove diesel engine (3) and set it on blocks or other suitable surface. Diesel engine (3) must be moved by two personnel.

(3) Installation.

- (a) Set diesel engine (3) onto air-receiver tank mount (20), aligning up holes.
- (b) Install four nuts (17) under air-receiver tank mount (20), four washers (18), and bolts (19), through diesel engine (3) mount.
- (c) Install bolt (14), washer (15), and two ground wires (16) to diesel engine (3).
- (d) Position hose (12) on air cleaner (13), securing with clamp (11).
- (e) Connect electrical lead (8) to glow plug (10), securing with nut (9)
- (f) Install oil temperature switch (7) into diesel engine (3)
- (g) Connect fuel line (5) to suction side of fuel pump (6) and tighten clamp (4).
- (h) Reconnect negative (ground) battery cable (para 4-26).

b. Air Cleaner Assembly.**(1) Removal. (Refer to Figure4-31).**

- (a) Remove hose from air cleaner (para 4-39.a.). Remove breather tube (7) from valve (9)
- (b) Remove two nuts (1) and two washers (2) from studs (3)
- (c) Remove air cleaner assembly (4) and gasket (5) from cylinder head.

(2) Disassembly.**NOTE**

For Removal, see para. 4-39.b.(1).

- (a) Slide clip (6) down on breather tube (7). Remove breather tube (7) from breather (8). Remove breather (8) from manifold (10).
- (b) Loosen clamp (11) on end of air cleaner housing (12) and grommet (13). Slide air cleaner housing (12) and grommet (13) off of manifold (10)
- (c) Release toggle clips (14) on both sides of air cleaner housing (12) and remove air cleaner cap (15), seal (16), and element (17).

(3) Repair.

- (a) Inspect air cleaner element (17), if dirty, install new air cleaner element.
- (b) Clean inside of air cleaner housing (12) and air cleaner cap (15) with dry cleaning solvent
- (c) Completely dry inside of air cleaner housing (12) and air cleaner cap (15) with wiping rags.

(4) Installation.

- (a) Slide grommet (13) into clamp (11). Slide clamp (11) and grommet (13) onto end of air cleaner housing (12). Tighten clamp (11) down.
- (b) Slide air cleaner housing (12) along with grommet (13) onto manifold (10).
- (c) Install air cleaner element (17) and seal (16) into air cleaner housing (12). Install air cleaner cap (15) onto air cleaner housing (12), securing it using two toggle clips (14).
- (d) Install breather (8) into bottom of manifold (10). Install breather tube (7) onto breather (8) and valve (9). Slide clips (6) upon breather tube (7), breather (8) and valve (9), securing both.

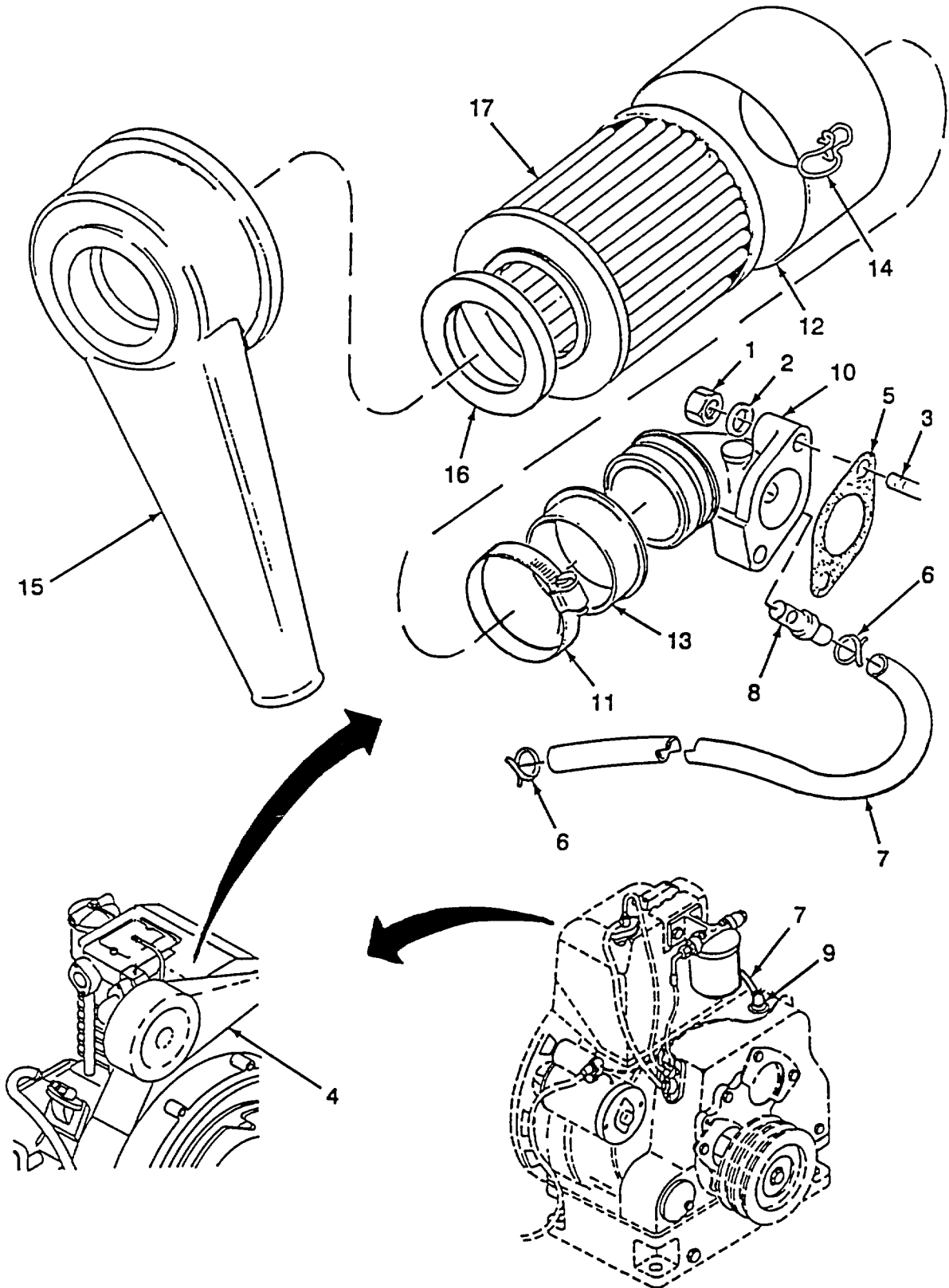


Figure 4-31. Air Cleaner Assembly

c. Heater Plug.

(1) Removal. (Refer to Figure 432).

- (a) Remove nut (1) and disconnect wire #27 from glow plug (2).
- (b) Remove air cleaner assembly (3) (para. 4-39 b.).
- (c) Unscrew extension studs (7). Remove adapter (4) and gasket (5) from diesel engine (6).
- (d) Remove glow plug (2) from top of adapter (4). Remove plug (8) from the bottom of adapter (4).

(2) Repair.

- (a) Inspect all parts for damage, cracks, distortion and other damage. Replace parts as needed.
- (b) Remove all gasket material from front and rear face of adapter (4).
- (c) Replace gasket.

(3) Installation.

- (a) Align holes in gasket (5) with holes in adapter (4). Fasten gasket (5) and adapter (4) to engine (6) with extension studs (7).
- (b) Slide gasket (5) and air cleaner assembly (3) onto extension studs (7) (para. 4-39b.).
- (c) Install plug (8) into bottom of adapter (4). Screw glow plug (2) into top of adapter (4).
- (d) Install wire #27 and nut (1) onto glow plug (2).

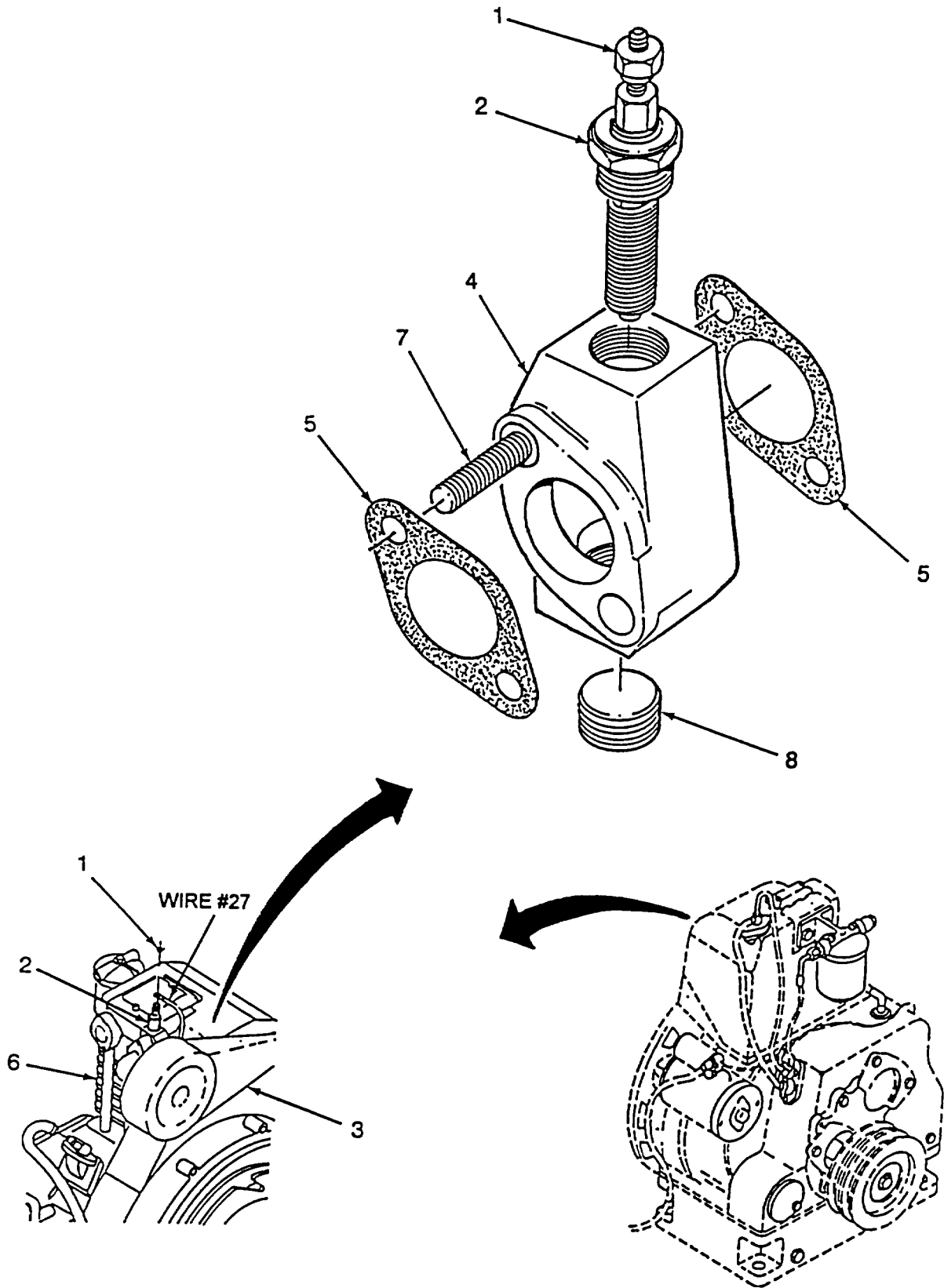


Figure 4-32. Heater Plug

d. Starter Motor.

WARNING

When working on electrical components, remove all jewelry, dog tags, and metal items to avoid electrical shock and burns.

(1) Test. (Refer to Figure 4-33).

- (a) Set multimeter to DC volts; place red multimeter lead on positive terminal (1) and black to ground with ignition switch on and starter button pushed in. The multimeter should indicate 24-volts.
- (b) If voltage is not present at starter terminal (1), troubleshoot starting circuitry.
- (c) Place red multimeter lead on starter switch terminal (2). Multimeter should indicate 24 volts.
- (d) If voltage is below 24 volts, test battery and battery cables.
- (e) Place red multimeter lead on starter switch terminal (3). With ignition switch ON and starter button pushed in, multimeter should indicate 24 volts.
- (f) If voltage is present at both points and starter (4) fails to rotate engine (5), replace starter (4).
- (g) If voltage is present at starter terminal (1) and starter switch terminal (2), but not (3), replace starter solenoid (6).

(2) Removal.

- (a) Disconnect negative battery lead from batteries (para. 4-26).
- (b) Loosen two hose clamps (7) and remove engine air intake hose (8).
- (c) Remove alternator belt guard (para. 4-31).
- (d) Remove alternator (para. 4-32).
- (e) Loosen two hose clamps (9) and remove hose (10).
- (f) Remove lube tank duct (11) from heater plenum (12) and heat inlet (13) by loosening two clamps (14). Pull lube tank duct off and set aside.
- (g) Unplug starter switch lead (15), which has wire tag #26, from starter terminal (1).
- (h) Remove positive battery lead (16) and wire #28 from starter terminal (2) by removing nut (17) and washer (18).
- (i) Remove three cap screws (19) and three lockwashers (20) holding starter (4). Discard three lockwashers.
- (j) Pull starter (4) straight off from engine (5).

NOTE

Rotation of oil pressure switch may be necessary.

- (k) Remove lead from terminal (3) on solenoid (6).
- (l) Remove two screws (21) and two lockwashers (22) holding starter solenoid (6) Discard two lockwashers.
- (m) Pull starter solenoid (6) off of starter (4).

(3) Installation.

- (a) Install starter solenoid (6) into position on starter (4).
- (b) Install two new lockwashers (22) and two screws (21) onto starter (4) to hold starter solenoid (6) in place
- (c) Install starter (4) into position on engine (5).
- (d) Install three cap screws (19), and three lockwashers (20) onto engine (5), to hold starter (4) in place.
- (e) Place positive battery lead (16) and wire #28 onto starter terminal (2).
- (f) Install and tighten nut (17) and washer (18) onto battery terminal (2).
- (g) Plug starter switch lead (15), which has wire #26, onto starter terminal (1).
- (h) Install hose (10), and tighten two clamps (9)
- (i) Install alternator (para 4-32)
- (j) Install alternator belt guard (para. 4-31).
- (k) Install engine air intake hose (8) and tighten two hose clamps (7)
- (l) Install lube tank duct (11) to heat inlet (13) and heater plenum (12), and tighten two clamps (14)
- (m) Reconnect negative battery lead to battery post (para 4-26).

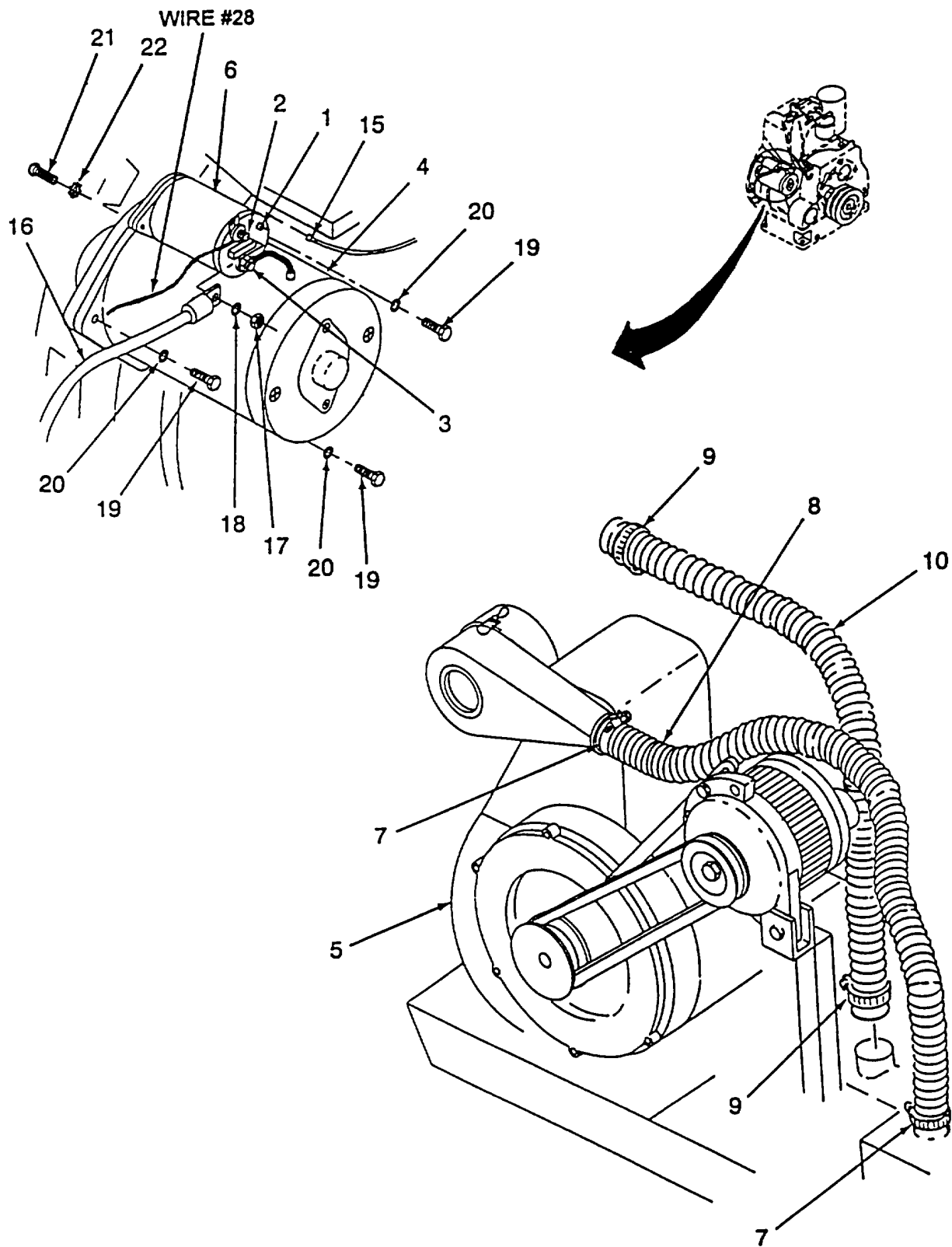


Figure 4-33. Starter Motor (Sheet 1 of 2)

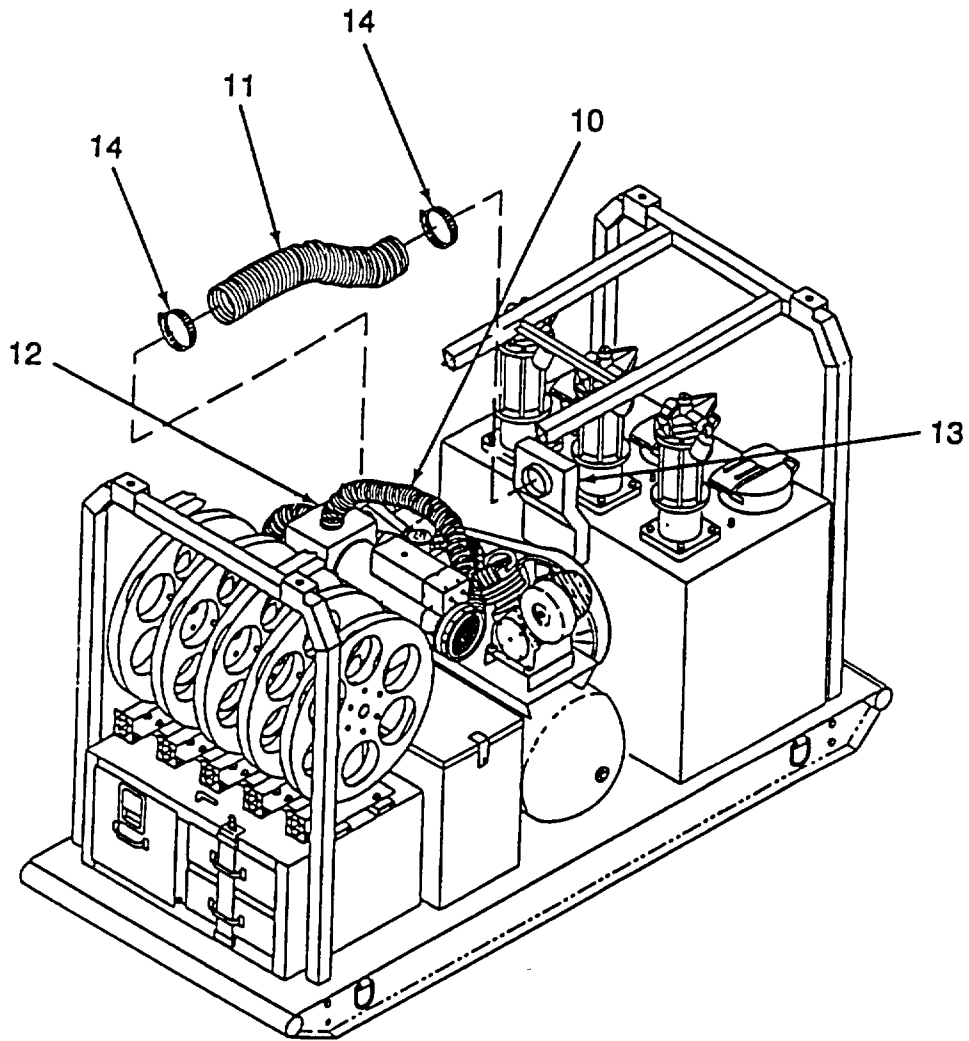


Figure 4-33. Starter Motor (Sheet 2 of 2)

e. Oil Filter Assembly.

- (1) Servicing. (Refer to Figure 4-34).

NOTE

If possible run the engine until it has reached operating temperature, Immediately before draining the oil.

- (a) Place a suitable container under the drain valve (1).
- (b) Drain the diesel engine oil by opening drain valve (1) and drain it into a suitable container.

- (2) Removal.

NOTE

No attempt must be made to clean the oil filter element.

- (a) Unscrew the center bolt (3) and withdraw the filter cover (4), with bolt (3), and filter element (2) from the engine crankcase (5).
- (b) Remove the o-ring (6) from the chamber of the engine crankcase (5). Discard ring (6).
- (c) Clean the filter cover (4) and chamber of the engine crankcase (5).

- (3) Installation.

- (a) Using your finger, smear a small amount of bil around a new o-ring (6).
- (b) Fit a new o-ring (6) into the chamber of the engine crankcase (5).
- (c) Fit a new filter element (2) into the chamber of the engine crankcase (5).
- (d) Insert the center bolt (3) and filter cover (4) through the new filter element (2) into the chamber of the engine crankcase (5).
- (e) Tighten the center bolt (3) to a maximum torque loading of 10.0 lb-ft.
- (f) Lift out the dipstick (7) from the engine crankcase (5).
- (g) Fill the engine crankcase (5) to the top of the narrow section on the dipstick (7) to the "H" mark (about 2 1/4 quarts).
- (h) Install the dipstick (7) into the engine crankcase (5).
- (i) Start the engine and run it a few minutes to circulate the oil and check the oil filter assembly for leaks.
- (j) Stop the engine and allow time for the oil to settle and re-check the level on the dipstick (7).
- (k) Add more oil if necessary.

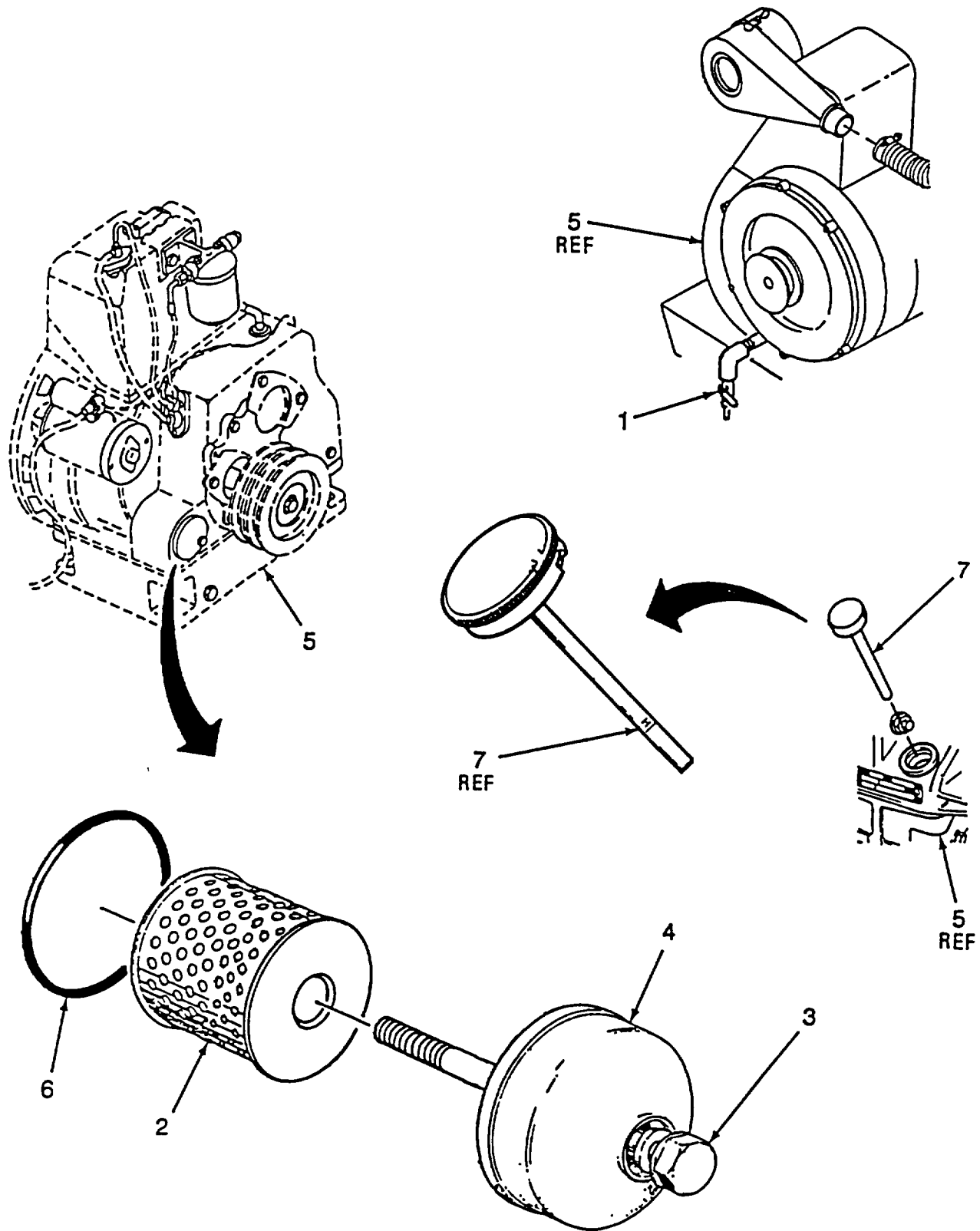


Figure 4-34. Oil Filter Assembly

f. Oil Pressure Switch. (Refer to Figure 4-35).

(1) Removal.

- (a) Refer to e. (1) above and drain engine oil.
- (b) Unscrew pressure switch (1) and pressure transmitter (2) from tee (3).
- (c) Remove tee (3), nipple (4) and straight adapter (5) from engine crankcase.

(2) Repair.

Inspect all parts for damage. Replace parts as needed.

(3) Installation.

- (a) Wrap all pipe threads with Teflon tape before installation.
- (b) Assemble straight adapter (5), nipple (4) and tee (3) Install assembled parts in engine crankcase. Branch on tee (3) should be pointing up.
- (c) Install pressure transmitter (2) and pressure switch (1) in tee (3).
- (d) Refer to Figure 4-38 and lift out the dipstick (7) from the engine crankcase (5).
- (e) Fill the engine crankcase (5) to the top of the narrow section on the dipstick (7) to the 'H' mark (about 2 1/4 quarts).
- (f) Install the dipstick (7) into the engine crankcase (5).
- (g) Start the engine and run it a few minutes to circulate the oil and check for leaks.
- (h) Stop the engine and allow time for the oil to settle and re-check the level on the dipstick (7).
- (i) Add more oil if necessary.

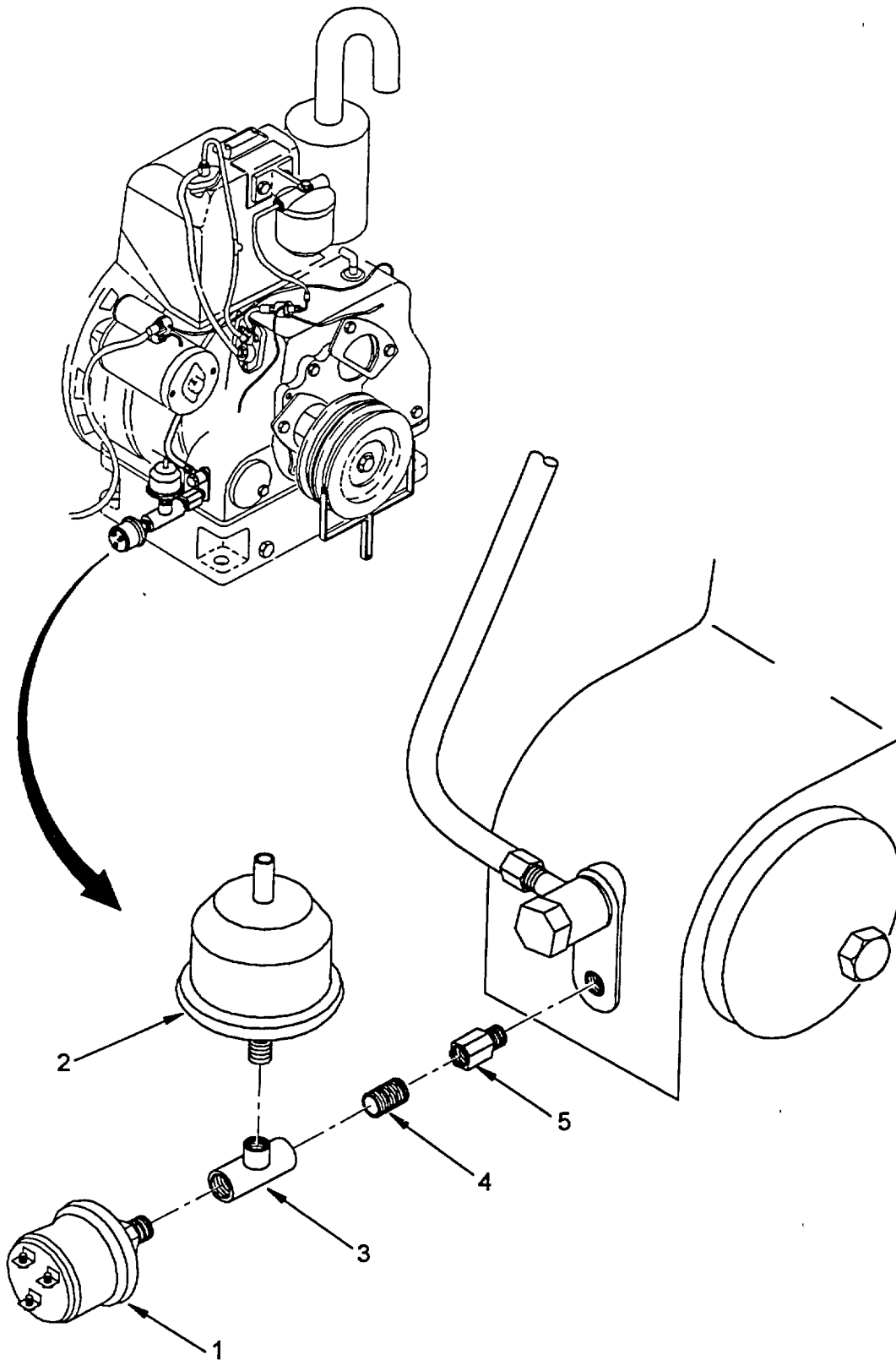


Figure 4-35. Oil Pressure Switch

g. Exhaust System.

WARNING

- **Hot Components can injure personnel. Do not touch hot exhaust system components with bare hands.**
- **Components become hot during operation. Allow them to cool before handling.**

(1) Removal. (Refer to Figure 4-36).

- (a) Remove two nuts (1), muffler bracket (2) and U-clamp (3) from muffler (4).
- (b) Remove interflex hoses (5) and fiberglass sleeving (6) from muffler (4).
- (c) Remove two nuts (7) and two lockwashers (8) from engine exhaust studs (9) holding muffler assembly (4) and gasket (10).
- (d) Remove muffler (4) and gasket (10). Discard gasket (10).

(2) Repair.

Inspect all parts, such as the muffler (4), interflex hose (5), fiberglass sleeving (6), and sleeving for any deterioration or damage. Replace if necessary.

(3) Installation.

- (a) Align new gasket (10) and muffler (4) with engine exhaust studs (9).
- (b) Secure muffler (4) and new gasket (10) by installing two nuts (7) and two lockwashers (8). Tighten securely.
- (c) Slide interflex hose (5) onto muffler (4).
- (d) Slide U-clamp (3) over interflex hose (5). Slide muffler bracket (2) onto U-clamp (3). Install two nuts (1) onto U-clamp (3) securing muffler bracket (2) onto interflex hose (5).

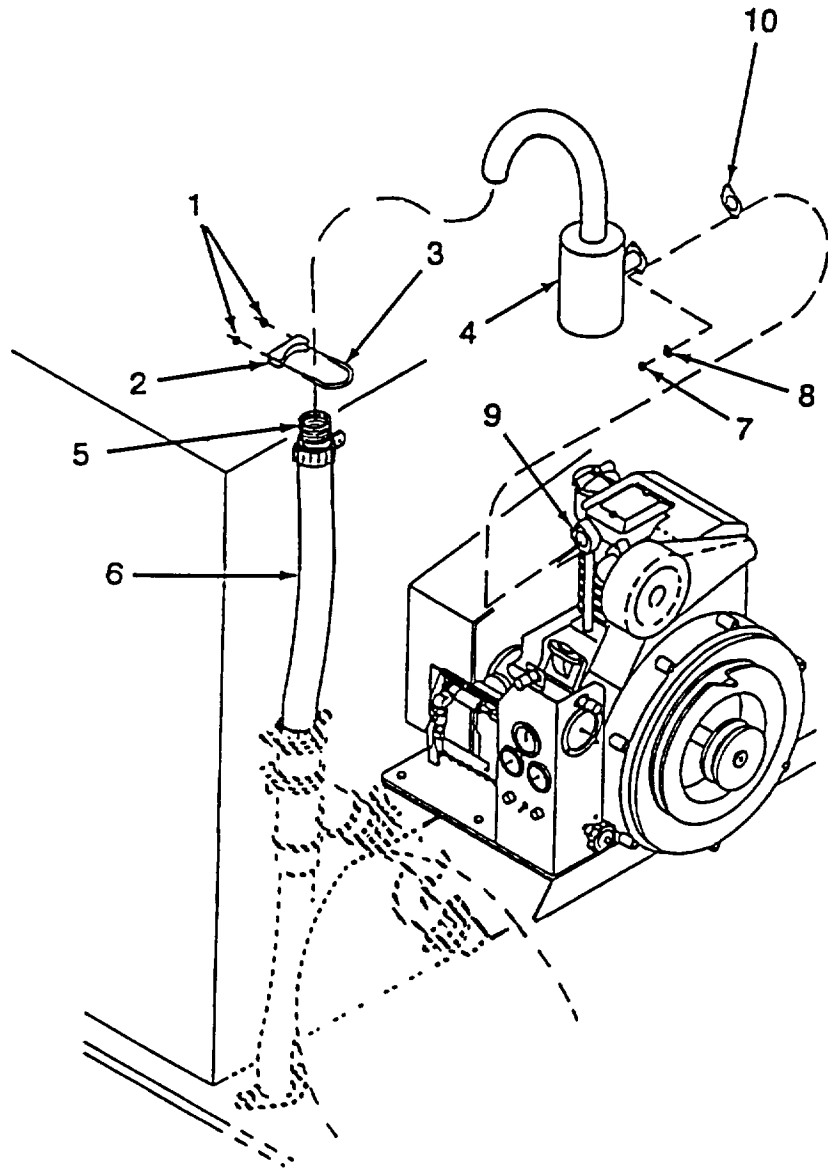


Figure 4-36. Exhaust System

h. Rope Start Assembly.

(1) Removal. (Refer to Figure 4-37).

(a) Remove three cap screws (1) securing pulley (2) to side of engine (3).

(b) Remove dowel (4) from engine (3) if replacement is necessary.

(2) Repair.

Inspect all parts for damage, cracks, distortion and other damage. Replace parts as needed.

(3) Installation.

(a) Install dowel (4) into engine (3).

(b) Align pulley (2) with dowel (4) and slide on.

(c) Install three cap screws (1) through pulley (2) into engine (3). Tighten.

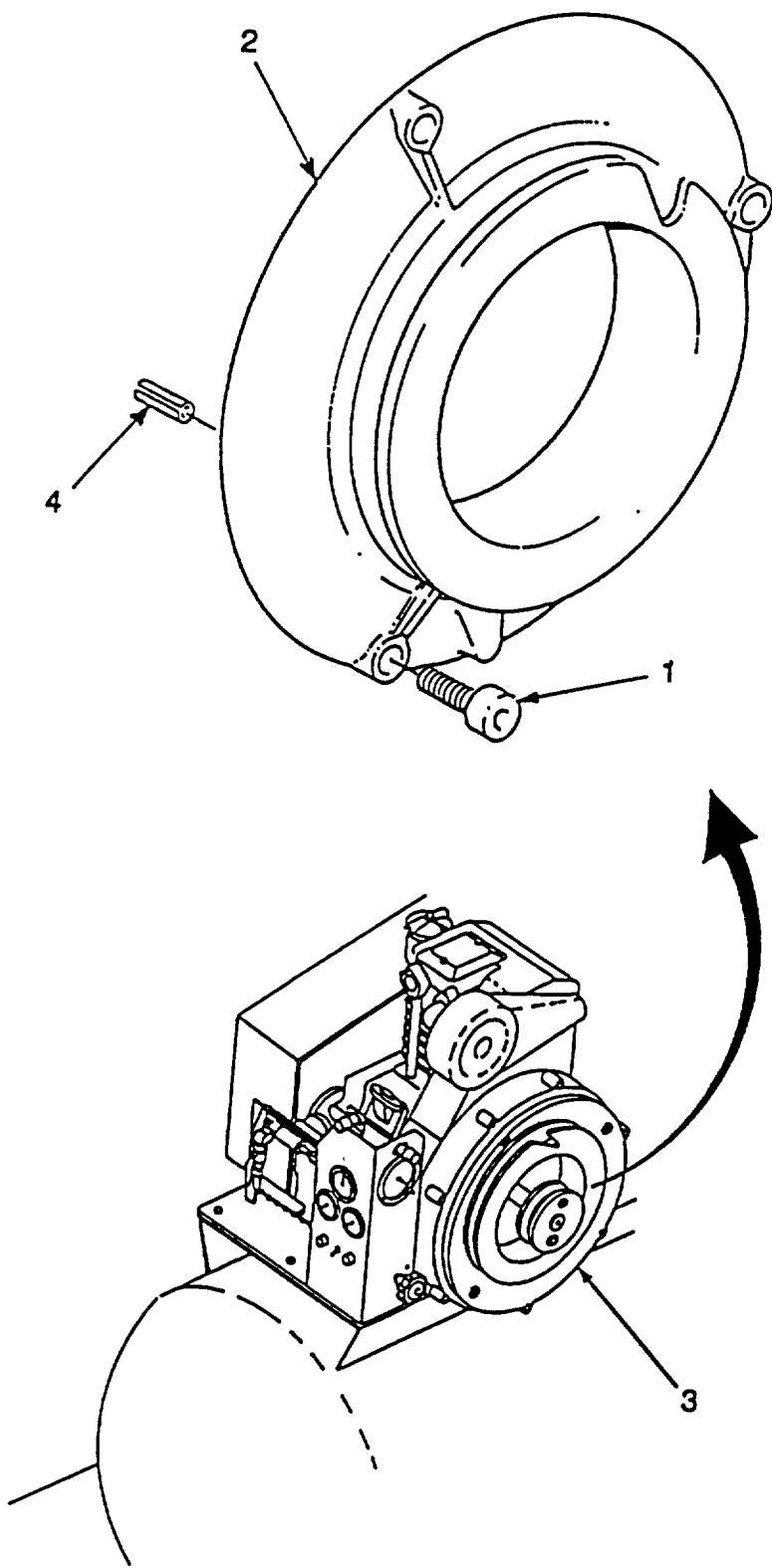


Figure 4-37. Rope Start Assembly

i. Fuel Filter Assembly.

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Clean up spills as soon as they occur. Spills may result in serious slip and fall injuries.**
- **Keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Fuel is very flammable and can explode easily.**

(1) Removal. (Refer to Figure 4-38.)

- (a) Loosen center bolt (1) from fuel filter head (2) and drain diesel fuel into drain pan.
- (b) Unscrew the center bolt (1) and remove fuel filter bowl (3), with center bolt. Remove filter element (4), element washer (5) and bowl seal (6) from filter head (2).
- (c) Remove upper seal (7) and lower seal (8) from filter bowl (3).

(2) Repair.

- (a) Inspect all parts for cracks, distortion and other damage. Replace parts as needed.

WARNING

Dry cleaning solvent is flammable. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes or contact with skin.

- (b) Thoroughly clean fuel filter bowl (3) with dry cleaning solvent. Dry inside with wiping rags.

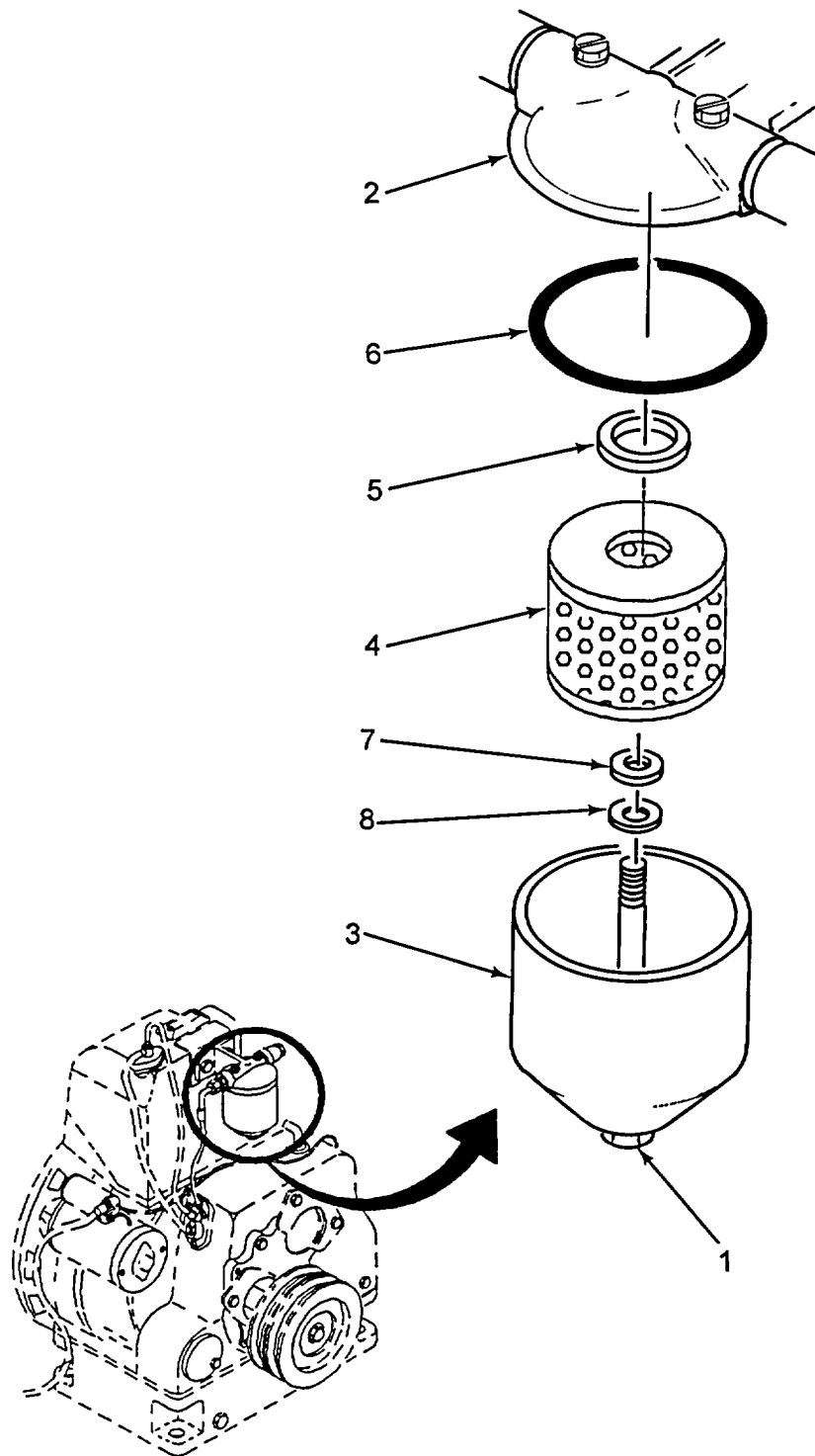


Figure 4-38. Fuel Filter Assembly

(3) Installation.

- (a) Install lower seal (8) and upper seal (7) over center bolt (1) in filter bowl (3).
- (b) Install bowl seal (6), element washer (5) and filter element (4) on filter head (2).
- (c) Install filter bowl (3) on filter head (2) and tighten center bolt (1).
- (d) Fill the fuel tank and prime the filter by loosening both vent screws (22) on filter head (2).
- (e) When no further air bubbles are escaping, close both vent screws (22) starting with the one nearest the fuel tank.

J. Flywheel Pulley and Shaft.

(1) Removal. (Refer to Figure 4-39.)

(a) Using a wheel puller, pull the flywheel pulley (1) from extension shaft (4). Remove key (2) from shaft.

(b) Remove bolts (3) to remove extension shaft (4) from flywheel (5)

(2) Repair.

Inspect all parts for cracks, distortion or other damage. Replace parts as needed.

(3) Installation.

(a) Place extension shaft (4) on flywheel (5) and install bolts (3). Torque bolts to 27 lb-ft (36 Nm).

(b) Install key in keyway of extension shaft (4).

(c) Press flywheel pulley (1) onto extension shaft (4).

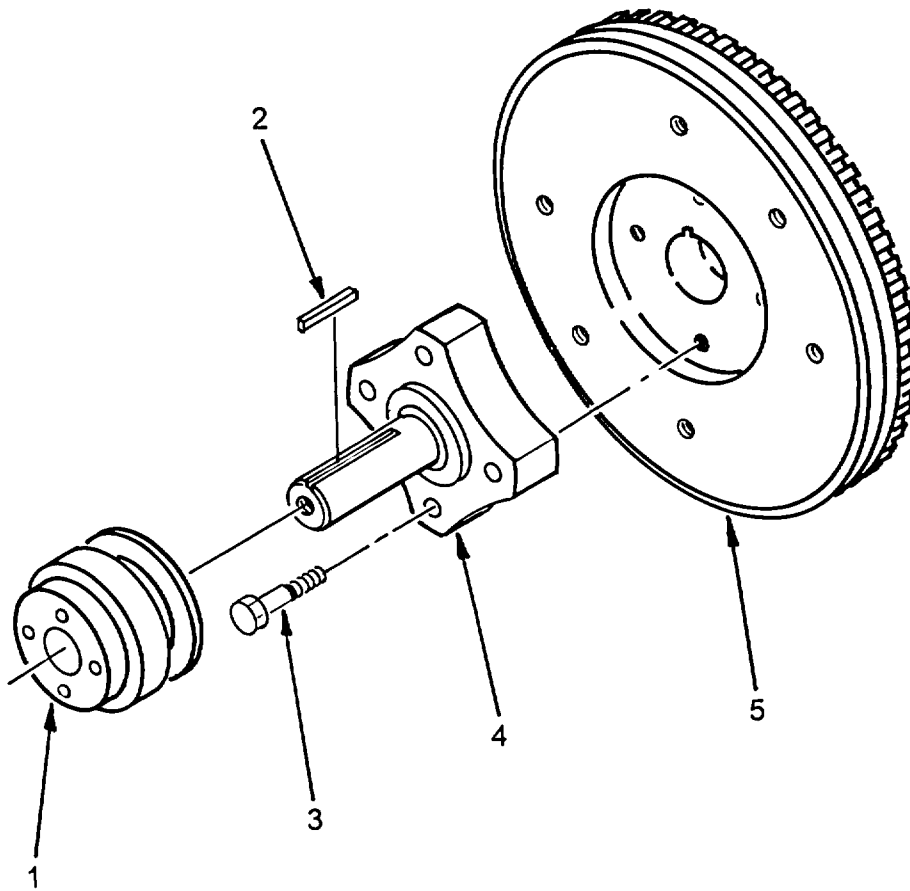


Figure 4-39. Flywheel Pulley and Shaft

4-40. CLUTCH AND CRANKSHAFT EXTENSION SHAFT.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

None.

Equipment Condition

Engine shut down and cool.

Enclosure Removed (para. 4-13).

Compressor Belts Removed (para 4-31)

a. Removal. (Refer to Figure 4-40).

- (1) Remove socket head-cap screw (1), lockwashers (2), and washer (3) from clutch (4). (3) Slide clutch (4) off of extension shaft (6).
- (2) Remove shaft key (5) from extension shaft (6).
- (3) Remove screws (7) and guard (8).
- (4) Remove screws (9) and extension shaft (6)

b. Installation.

- (1) Position extension shaft (6) and install screws (9). Torque screws to 14 lb-ft (19 Nm)
- (2) Install guard (8) over shaft (6) and install screws (7)
- (3) Slide clutch (4) onto extension shaft (6).
- (4) Install shaft key (5) into extension shaft (6).
- (5) Install custom washer (3), tight lock washers (2) and socket head-cap screw (1) into end of extension shaft (6).
- (6) Torque socket head-cap screw (1) to 40 lb-ft (53 Nm).

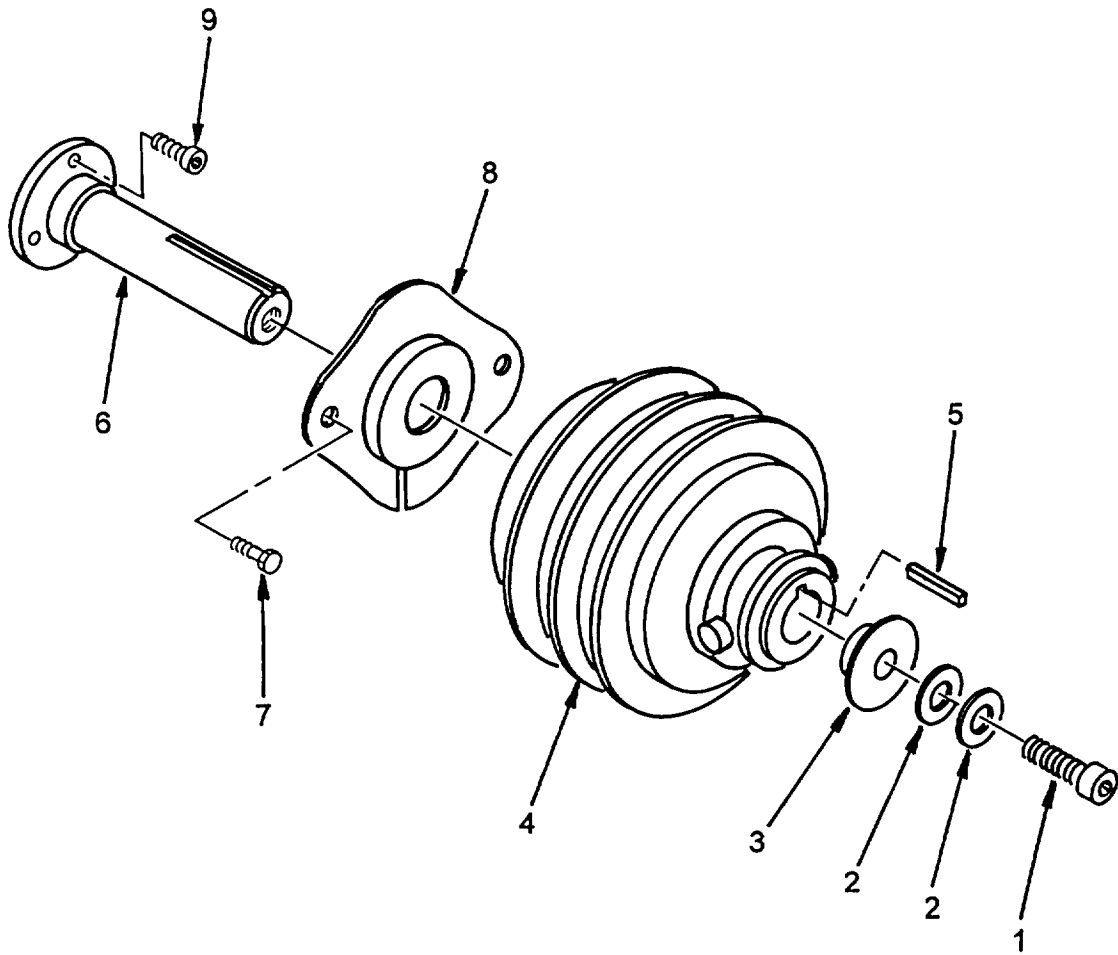


Figure 4-40. Clutch

4-41. AIR REGULATOR AND PLUMBING - REPLACE REPAIR.

This Task Covers: **a. Removal** **b. Repair** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7)

Equipment ConditionUnit shut down and cool

WARNING

Compressed air can be dangerous if not used properly. DO NOT disconnect air lines or components before first relieving the air-receiver tank of all pressure.

a. Removal. (Refer to Figure 4-41).

- (1) Remove hose assembly (1) from filter-injector assembly (2) and male tee (3).
- (2) Remove hose assembly (4) from swivel adapter (5) and male tee (6).
- (3) Remove four socket head cap screws (7) holding adapter (8) onto low pressure pump (9), along with air regulator and attached parts (10)
- (4) Remove adapter (8) from nipple (11). Replace adapter (8) to low pressure pump (9), using four socket head cap screws (7)
- (5) Remove male tee (3) from air regulator (12).
- (6) Remove nipple (11) from elbow (13). Remove reducing nipple (14) from air regulator (12) and elbow (13)
- (7) Remove air pressure gauge (15) from elbow (16). Remove nipple (17) from air regulator (12) and elbow (16).
- (8) Remove hose assembly (18) from male tee (6) and swivel adapter (19).
- (9) Remove four socket head cap screws (20) holding adapter (21) onto high pressure pump (22), air regulator and attached parts (23).
- (10) Remove adapter (21) from nipple (24) Replace adapter (8) to high pressure pump (22), using four socket head cap screws (20).
- (11) Remove swivel adapter (19) from street elbow (25). Remove street elbow (25) from air regulator (26).

- (12) Remove brass nipple (24) from elbow (27). Remove reducing nipple (28) from air regulator (26) and elbow (27).
- (13) Remove air pressure gauge (29) from elbow (30). Remove nipple (31) from air regulator (26) and elbow (30).
- (14) Remove four socket head cap screws (32) holding adapter (33) onto low pressure pump (34), along with air regulator and attached parts (35).
- (15) Remove adapter (33) from nipple (37). Replace adapter (33) to low pressure pump (34), using four socket head cap screws (32).
- (16) Remove brass nipple (37) from elbow (38). Remove reducing nipple (39) from air regulator (36) and elbow (38).
- (17) Remove air pressure gauge (40) from elbow (41). Remove nipple (42) from air regulator (36) and elbow (41).
- (18) Remove ball valve (43) from street elbow (44). Remove hex nipple (45) from air regulator (36) and street elbow (44).

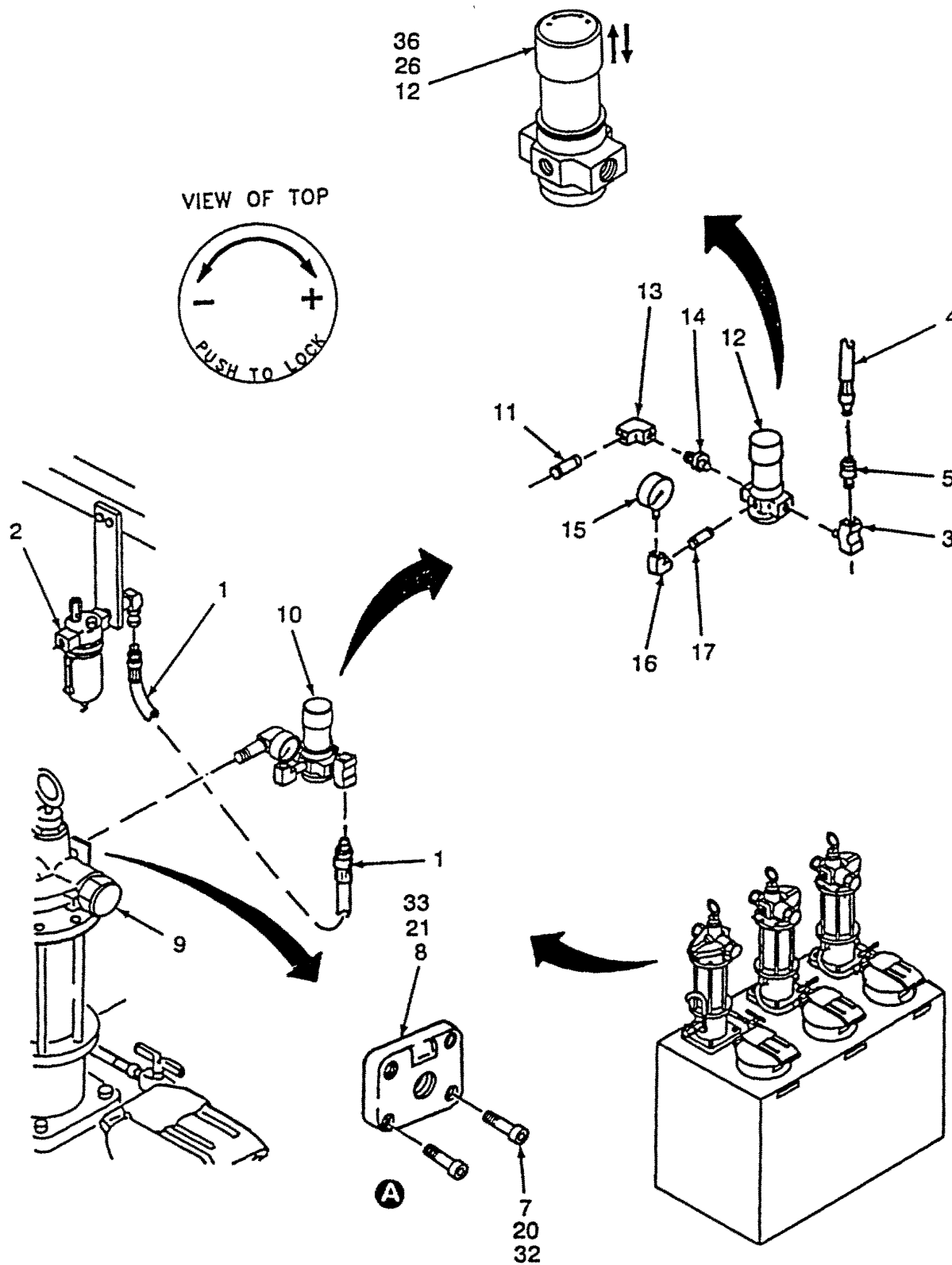


Figure 4-41. Air Regulator and Plumbing (Sheet 1 of 3)

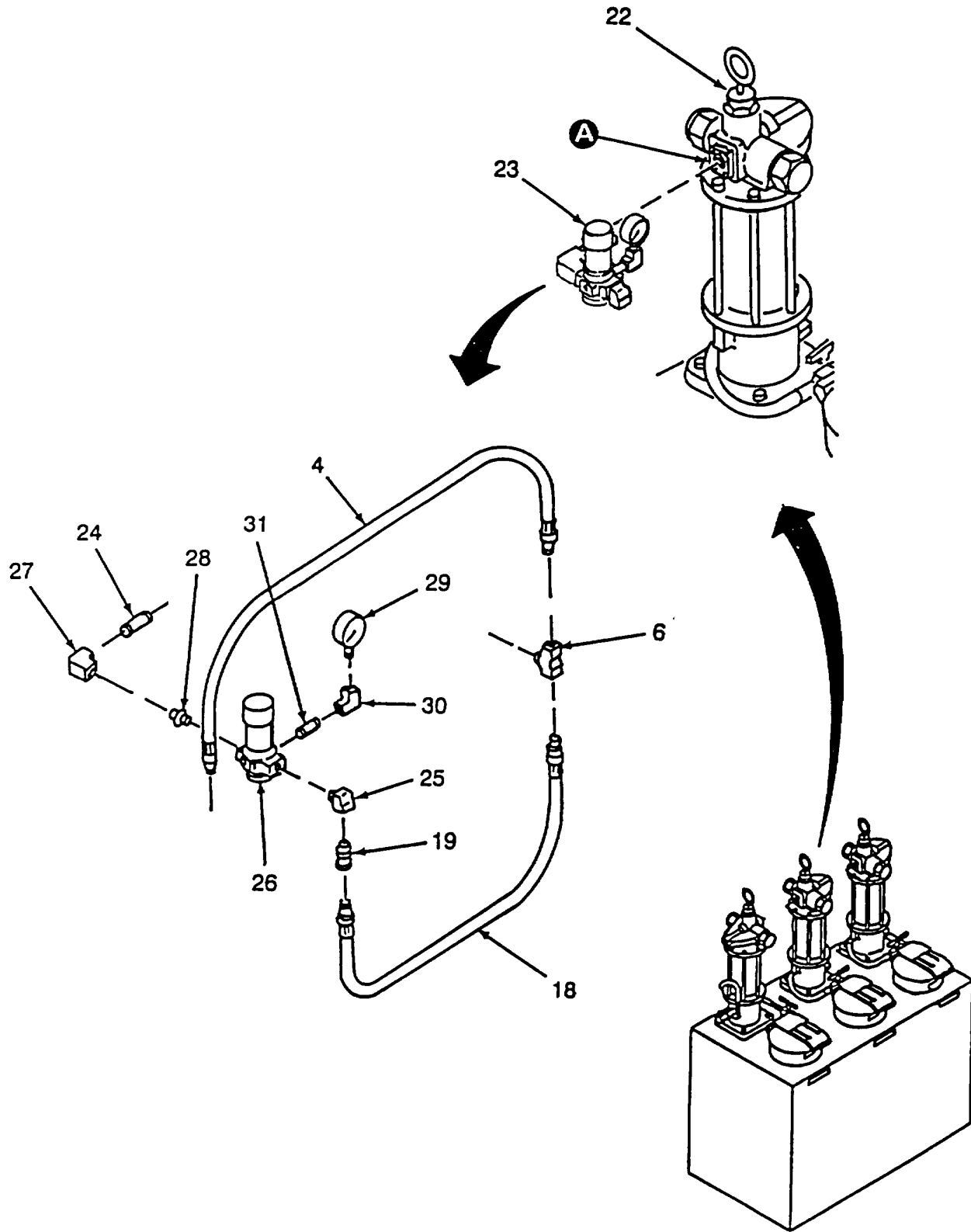


Figure 4-41. Air Regulator and Plumbing (Sheet 2 of 3)

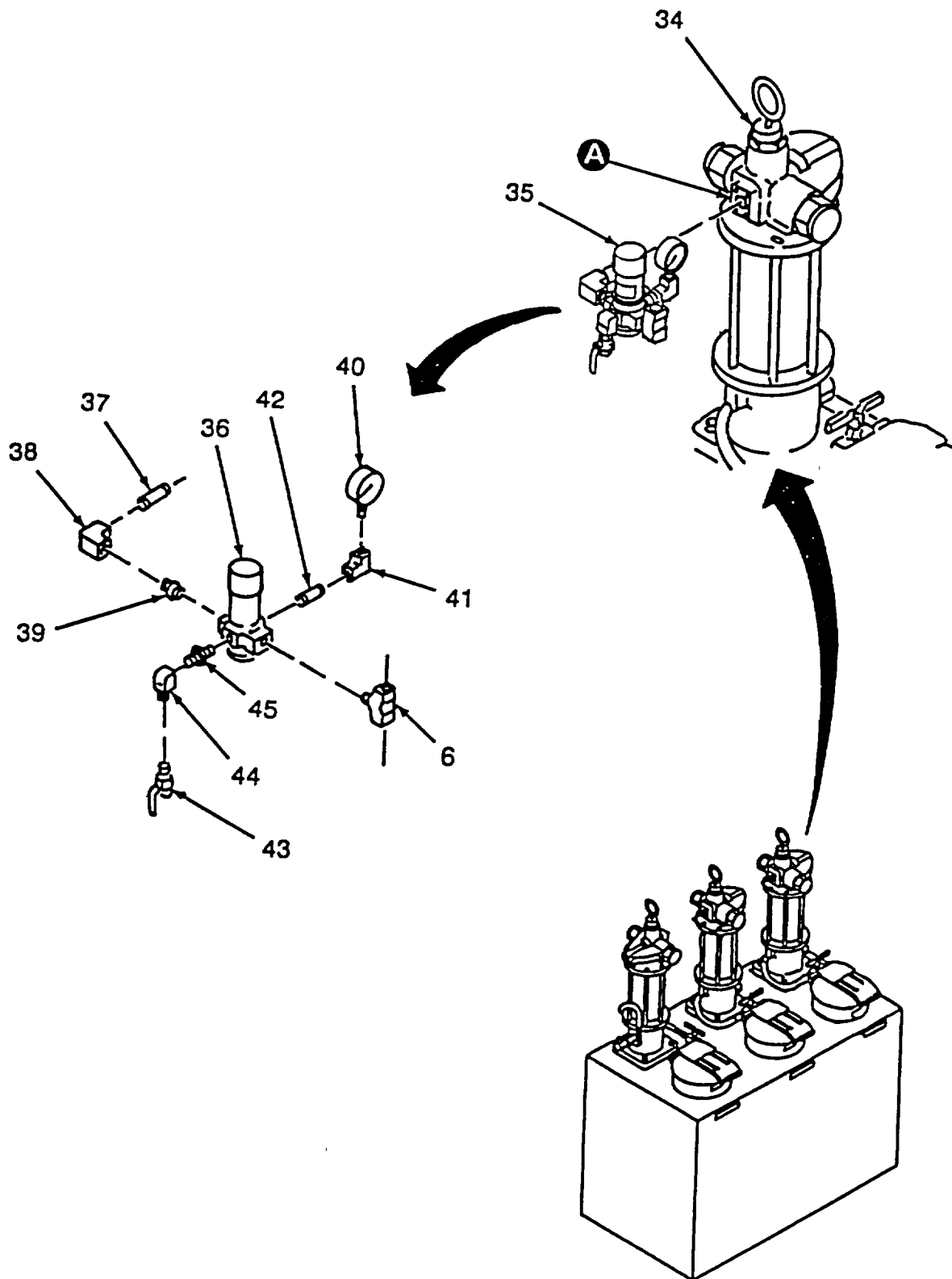


Figure 4-41. Air Regulator and Plumbing (Sheet 3 of 3)

b. Repair.

- (1) Inspect hoses for cracks, deterioration, abrasion, cuts, or fraying. Replace if damaged.
- (2) Inspect all other parts for damaged threads, cracks, distortion or wear. Replace any part that shows obvious wear or damage.
- (3) Instructions for adjusting the air regulators (12, 26, and 36) are written on the top of the air regulators. Raise the top of the regulator (12, 26, or 36); turn clockwise to increase the pressure; turn counterclockwise to decrease the pressure; push down to lock.

c. Installation.

NOTE

Before installation, wrap the male threads of all fittings with Teflon Tape.

Make sure that handle on air pressure relief valve (43) is pointing to front of unit.

- (1) Install hex nipple (45) into air regulator (36) and street elbow (44). Install ball valve (43) onto street elbow (44).
- (2) Install nipple (42) into air regulator (36) and elbow (41). Install air pressure gauge (40) into elbow (41).
- (3) Install reducing nipple (39) into air regulator (36) and elbow (38). Install brass nipple (37) into elbow (38).
- (4) Install air regulator and attached parts (35) into adapter (33).
- (5) Install nipple (31) into air regulator (26) and elbow (30). Install air pressure gauge (29) into elbow (30).
- (6) Install reducing nipple (28) into air regulator (26) and elbow (27). Install brass nipple (24) into elbow (27).
- (7) Install street elbow (25) into air regulator (26). Install swivel adapter (19) into street elbow (25).
- (8) Install air regulator and attached parts (23) into adapter (21).
- (9) Install hose assembly (18) into male tee (6) and swivel adapter (19).
- (10) Install nipple (17) into air regulator (12) and elbow (16). Install air pressure gauge (15) into elbow (16).
- (11) Install reducing nipple (14) into air regulator (12) and elbow (13).
- (12) Install male tee (3) into air regulator (12). Install air regulator and attached parts (10) into low pressure pump (9).
- (13) Install hose assembly (4) into swivel adapter (5) and male tee (6).
- (14) Install hose assembly (1) into male tee (3) and onto filter-injector assembly (2).

4-42. LOW AND HIGH PRESSURE PUMPS AND PUMP MUFFLERS - SERVICE/REPLACE.

This Task Covers: **a. Removal** **b. Service** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1)

Materials/Parts

Teflon Tape (Appendix E, Section II, Item 7).

Silicon Sealant (Appendix E, Section II, Item 6).

Equipment Condition

Unit shut down and cool

Air Regulator Removed (para. 4-41).

a. Removal. (Refer to Figure 4-42).

NOTE**The following procedures will be the same for all pumps except as noted.**

- (1) Remove pump mufflers (1) from elbows (2). Remove elbows (2) from pumps (3)
- (2) Disconnect hose assemblies (4) from elbow swivel adapters (5) Remove elbow swivel adapters (5) from pumps (3).
- (3) Remove hose assemblies (6) from needle valves (7) and elbows (8) Remove elbows (8)
- (4) Open manhole cover (9) to gain access to attaching hardware on pumps (3).
- (5) Remove four hex head - cap screw (10), and four washers (11) and four hex, lock nuts (12), holding pumps (3) onto lube tank (13). For high pressure pump only, loosen two set screws (14) on baffle (15). Remove baffle from high pressure pump (3) tube.
- (6) Lift out pumps (3) and allow excess lubricant to drip into lube tank (13) wipe tube clean.

NOTE**Do not let any pieces of old silicone sealant fall into the lube tank chamber.**

b. Service.

- (1) Remove two locknuts (16) from two threaded bolts (17) on muffler (1). Discard two locknuts (16).
- (2) Remove upper cap (18), circular screen (19) and base (20) from screen (21)

- (3) Slide paper element (22) from screen (21). If dirty, discard old paper element (22).
- (4) Install new paper element (22) into screen (21).
- (5) Install upper cap (18), circular screen (19) and base (20) onto screen (21).
- (6) Install two threaded bolts (17) through upper cap (18), paper element (22) and base (20). Secure using two new locknuts (16).

c. Installation.

NOTE

- **The following procedures will be the same for all pumps except as noted.**
- **Before installation, wrap muffler and elbows threads with Teflon Tape.**

- (1) Apply silicon sealant around pump openings.
- (2) Insert pumps (3) into lube tank (12).
- (3) For high pressure pump only, install baffle (15) onto high pressure pump (3) tube, 7 1/2 inches from the bottom of the tube. Tighten two set screws (14) on baffle (15).
- (4) Install four hex head - cap screws (10), four washers (11) through pressure pumps (3) into lube tank (13). Install four flanged locknuts (12) onto the four hex head - cap screws (10) inside lube tank (13). Tighten.
- (5) Install hoses assemblies (6) with attached needle valves (7) into street elbows (8), and lube tank (13).
- (6) Install elbow swivel adapters (5) into pumps (3). Reconnect hose assemblies (4) to elbows swivel adapters (5).
- (7) Install elbows (2) into pressure pumps (3). Screw pump mufflers (1) into elbows (2). Hand tighten.

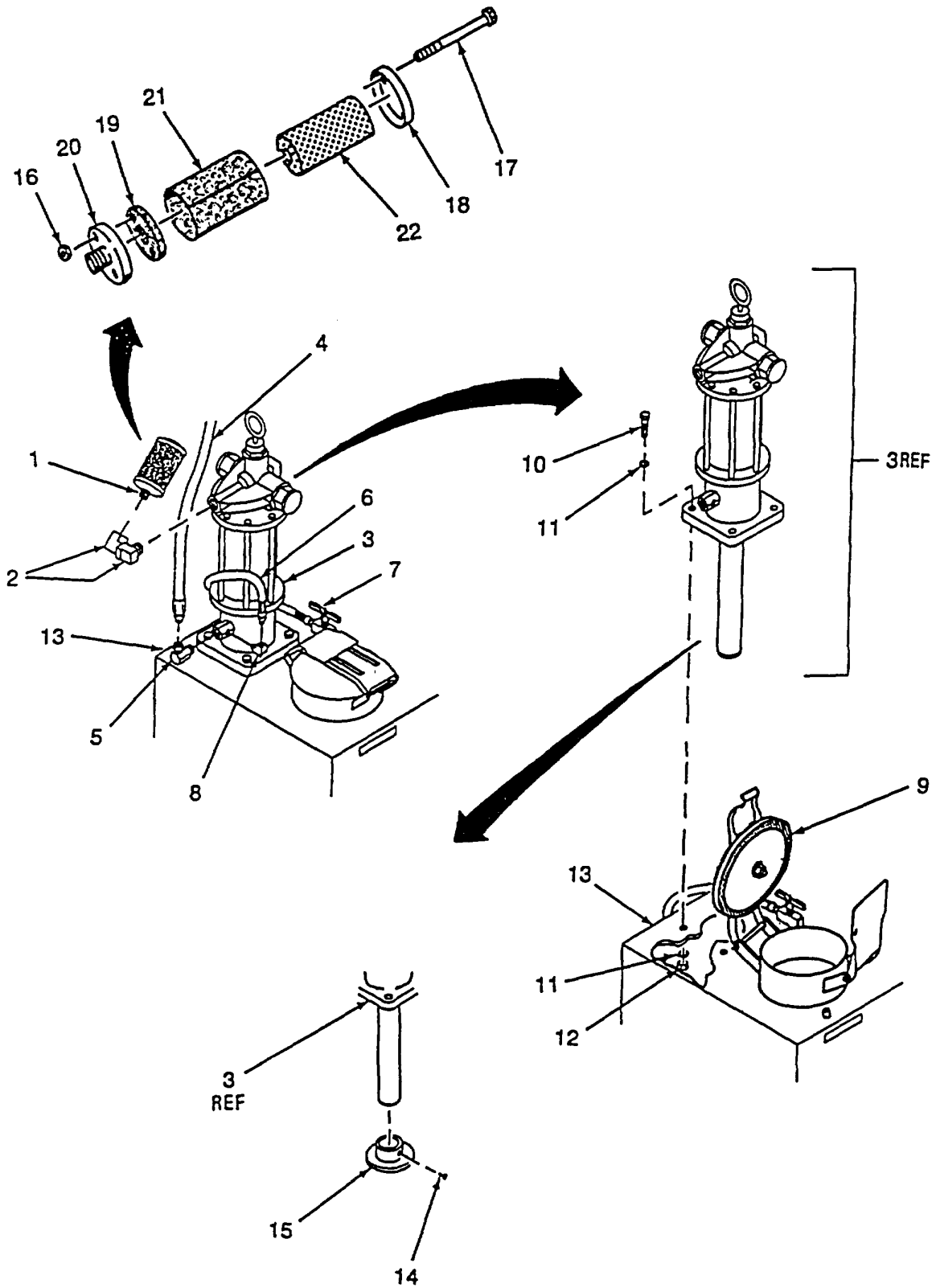


Figure 4-42. Low and High Pressure Pumps and Pump Mufflers

4-43. HEATER ASSEMBLY - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Equipment ConditionUnit shut down and cool.

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Prevent electrical shocks or burns. Do not wear jewelry or dog tags when working on electrical components.**
- **Clean up spills as soon as they occur. Spills may cause falls and serious injuries.**

a. Removal. (Refer to Figure 4-43).

- (1) Disconnect heater male plug (1), from female connector (2).
- (2) Disconnect fuel line (3) from heater fuel line (4) using quick disconnect (5).
- (3) To remove exhaust hose (6) on bottom of heater assembly (7), loosen T-clamp (8) and slide down on exhaust hose (6). Remove exhaust hose (6).
- (4) Remove clamp (9) holding heater assembly (7) to heater plenum (10). Remove heater assembly (7) from heater plenum (10).

b. Installation.

- (1) Place heater assembly (7) on heater plenum (10) and fasten with clamp (9).
- (2) Install exhaust hose (6) on bottom of heater assembly (7) and fasten with T-clamp (8).
- (3) Connect fuel line (3) to heater fuel line (4) using quick disconnect (5). (4) Connect heater male plug (1) to female connector (2).

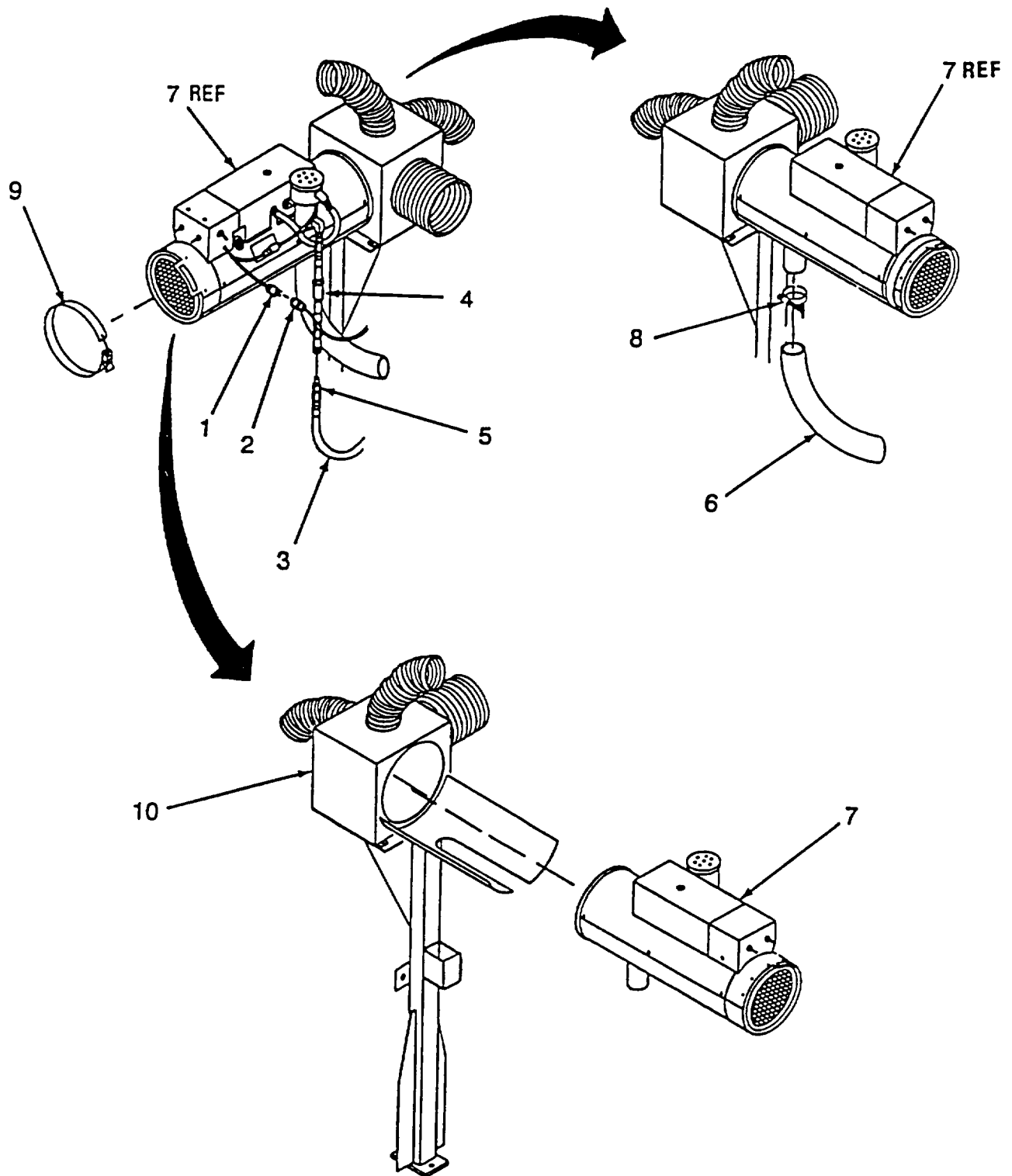


Figure 4-43. Heater Assembly

4-44. FUEL PUMP AND FUEL LINES - INSPECT REPLACE.

This Task Covers: **a. Inspection** **b. Removal** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials Required

Teflon Tape (Appendix E, Section II, Item 7).

Equipment ConditionUnit shut down and cool.

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Clean up spills as soon as they occur. Spills may cause falls and serious injuries.**

a. Inspection. (Refer to Figure 4-44).

- (1) Inspect fuel pump (1) for cracks, damage or leakage. Make sure fuel tank has enough fuel.
- (2) Inspect to make sure that there are no obstructions in the fuel lines leading to and from the fuel pump (1).
- (3) Inspect fuel pump (1) to see if it is pumping fuel, if no fuel is pumping, but the electric motor in the pump is heard, then the fuel pump is faulty.

b. Removal.

- (1) Disconnect negative battery cable (para. 4-26).
- (2) Loosen hose clamps (2) on fuel discharge line (3). Remove fuel discharge line (3) from hose barbs (4).
- (3) Loosen female swivel (5) and remove fuel supply line (6) from elbow (7).
- (4) Disconnect power wire connector (8).
- (5) Remove three self-tapping screws (9) from heater control box (10). Let heater control box (10) hang away from heater cover (11). Loosen screw (12) 1/4 turn on heater cover (13). Remove cover (11) together with attached pump (1).
- (6) Remove two bolts (13) and two flanged locknuts (14) and remove fuel pump (1) from heater cover (11).
- (7) Remove elbows (7 and 15) from fuel pump (1).

c. Installation.**NOTE**

Before installation, wrap threads on male threads of fuel pump (1) with Teflon Tape.

- (1) Install elbow (7) and elbow (15) with hose barb (4) attached onto fuel pump (1).
- (2) Align fuel pump (1) on heater cover (11) and install two bolts (13) and two flanged locknuts (13), securing fuel pump (1).
- (3) Replace heater cover (11) together with attached pump (1). Tighten screw (12). Replace heater control box (10) and attach with three self tapping screws (9).
- (4) Reconnect power wire connector (8).
- (5) Install fuel supply line (6) to elbow (7) by tightening female swivel (5).
- (6) Install fuel discharge line (3) onto hose barbs (4) and tighten two hose clamps (2).
- (7) Connect negative battery cable (para 4-26)

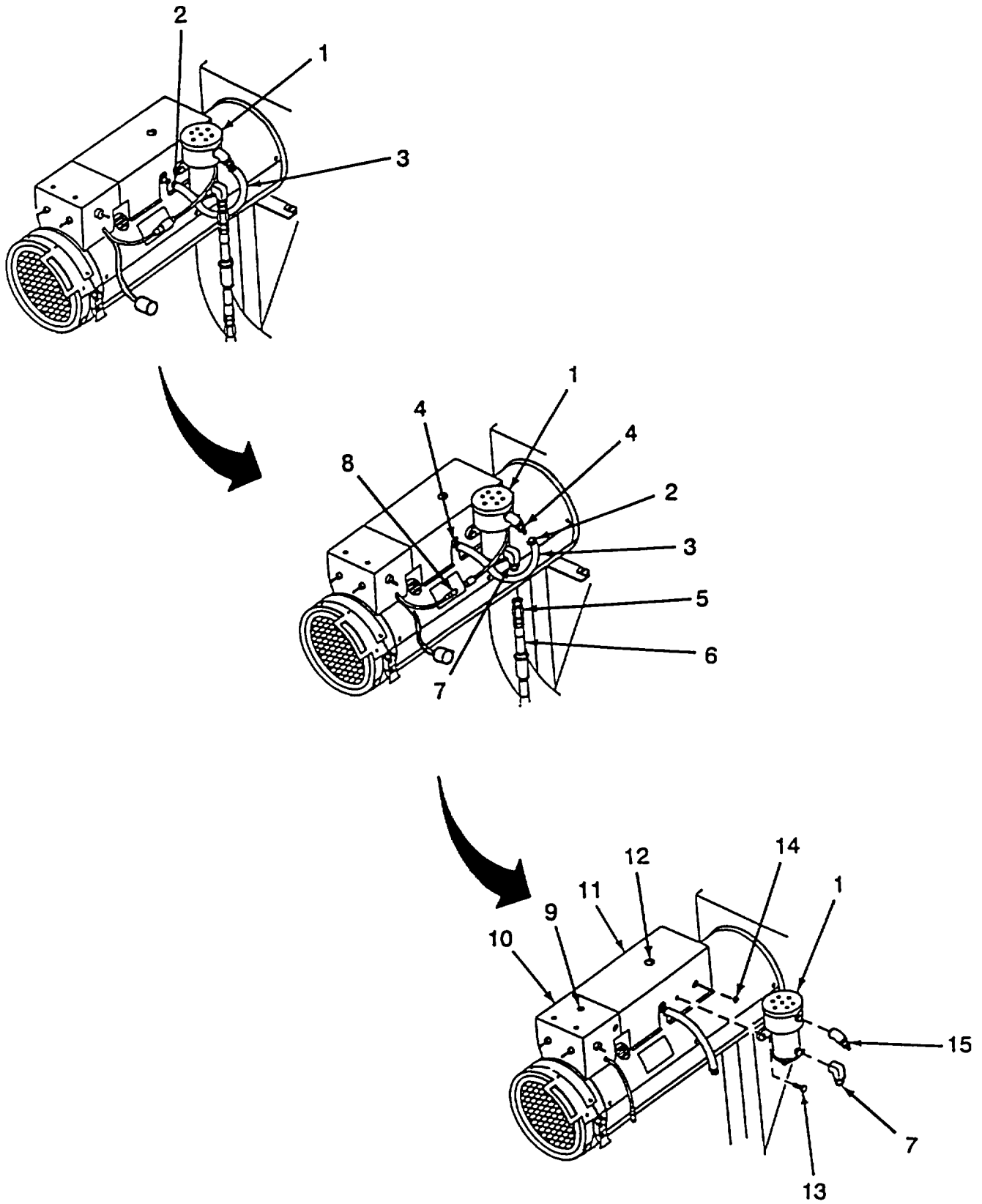


Figure 4-44. Fuel Pump and Fuel Line

4-45. CONTROL BOX ASSEMBLY AND HEATER - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1)
Multimeter (Appendix B, Section II, Item 2).

Equipment Condition

Unit shut down and cool.

WARNING

- **Prevent electrical shocks or burns. DO NOT wear jewelry or dog tags when working on electrical components.**
- **Use caution when working with diesel fuel. It is flammable**

a. Removal. (Refer to Figure 4-45).

- (1) Disconnect negative battery cable (para 4-26)
- (2) Disconnect male plug (1) from female connector (2)
- (3) Remove three self tapping screws (3) from control panel (4) and heater (5).
- (4) Slide control panel (4) forward. Disconnect wire harness (6) from plug (7).

b. Installation.

- (1) Screw wiring harness (6) onto plug (7).
- (2) Align holes on control panel (4) with heater (5)
- (3) Install and tighten three self tapping screws (3)
- (4) Reconnect male plug (1) to female connector (2)

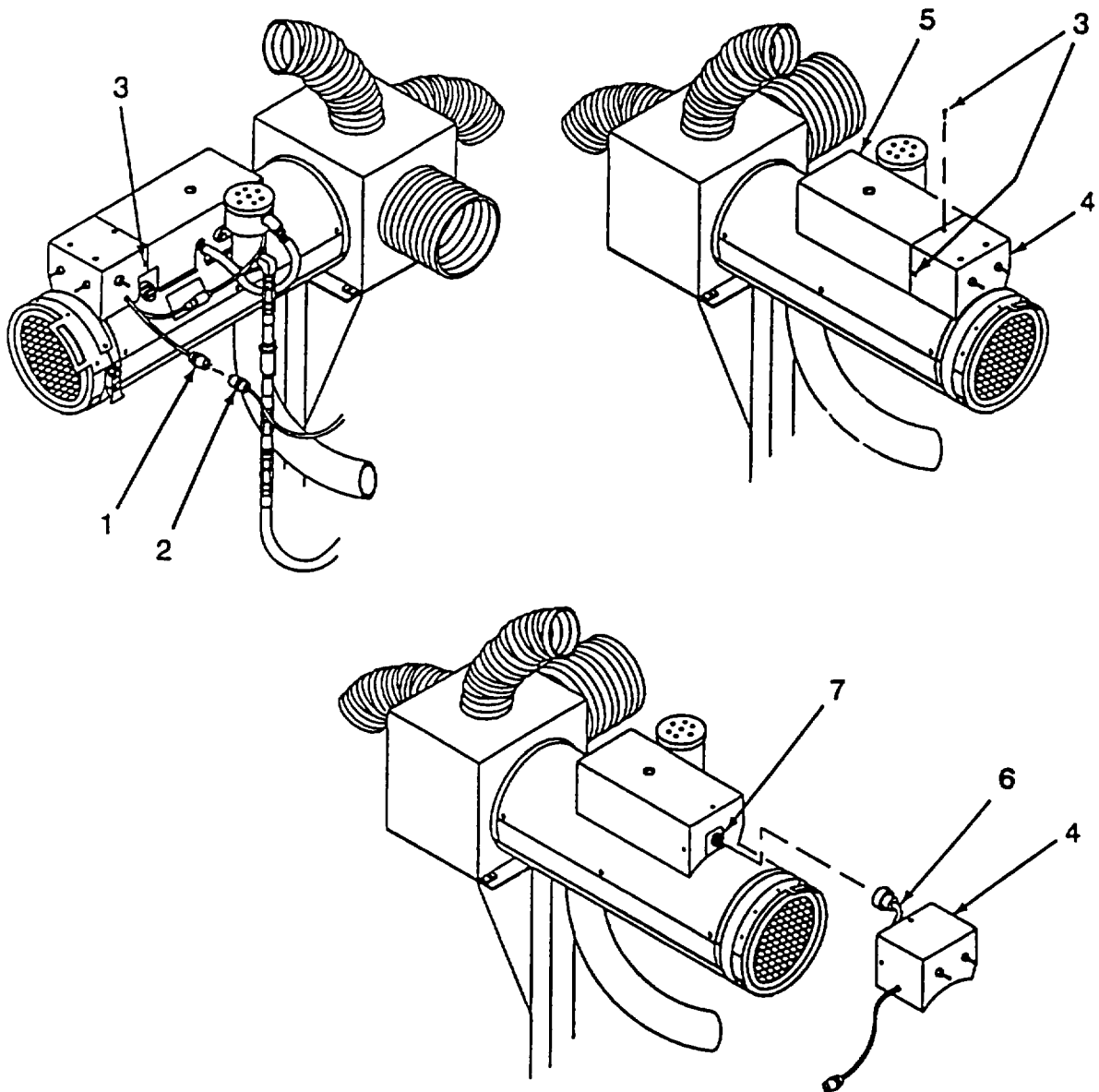


Figure 4-45. Control Box Assembly and Heater

- (10) Remove wire #41 (16) from "run" terminal of start-off-run switch (12).
- (11) Remove wire #33 (17) from wire #32 (18) of start-off-run switch (22).
- (12) Remove wire #34 (19) from wire #32 (18) and "run" terminal of start-off-run switch (12).
- (13) Remove jumper wire #32 (18) from "run" and "start" terminals of start-off-run switch (12).
- (14) Remove wire #35 (20) from "run" terminal of start-off-run switch (12).
- (15) Remove wire #45 (21) from "off" terminal of on-off switch (22).

c. Installation.

NOTE

- **Replace wires by matching tags.**
- **Make sure that wires are firmly secured.**

- (1) Install wire #35 (20) onto "run" terminal of start-off-run switch (12).
- (2) Install wire #41 (16) onto piggyback terminal of wire #35 (20).
- (3) Install jumper wire #32 (18) onto "run" and "start" terminal of start-off-run switch (12).
- (4) Install wire #34 (19) onto piggyback "run" terminal of wire #32 (18).
- (5) Install wire #33 (17) onto piggyback "start" terminal of wire #32 (18) and "on" terminal of on-off switch (22).
- (6) Install wire #37 (14) onto "off" terminal of start-off-run switch (12).
- (7) Install wire #38 (13) onto "start" terminal of start-off-run switch (12).
- (8) Install wire #39 (12) onto "low" terminal of low-high switch (11) and "start" terminal of start-off-run switch (12).
- (9) Install wire #40 (10) onto "high" terminal of low-high switch (11).
- (10) Install wire #30 (8) and wire #31 (9) onto brass colored screw of circuit breaker (5). Install lockwasher (7) and hex nut (6) onto wires #30 (8) and #31 (9) and tighten.
- (11) Install other end of wire #31 (9) onto "off" terminal of start-off-run switch (12).
- (12) Install wire #29 (15) onto silver colored screw of circuit breaker (5) and tighten, using lockwasher (7) and hex nut (6).
- (13) Install wire #45 (21) onto "off" terminal of on-off switch (22).
- (14) Install wire #36 (4) onto circuit breaker ground (5) and tighten locknut (3).
- (15) Install control box (2). (para 4-45).
- (16) Install two electrical connectors (1). (para. 4-45).

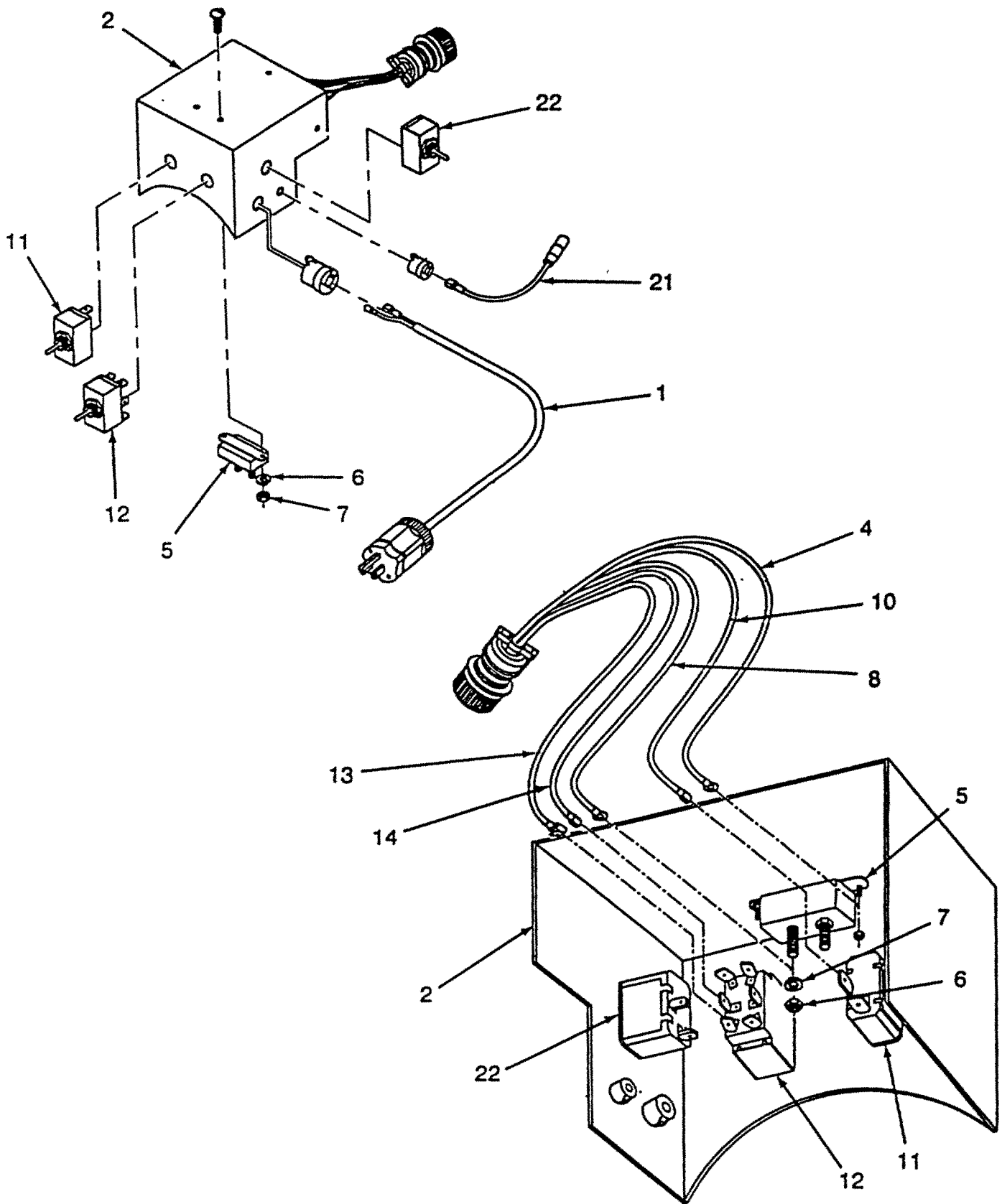


Figure 4-46. Heater Wiring Harness (Sheet 1 of 2)

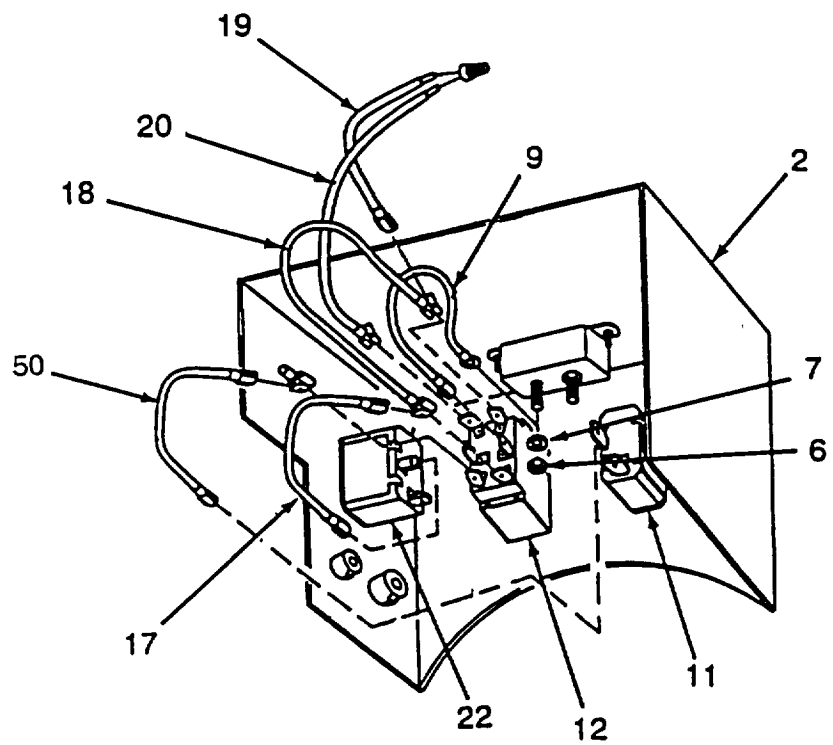
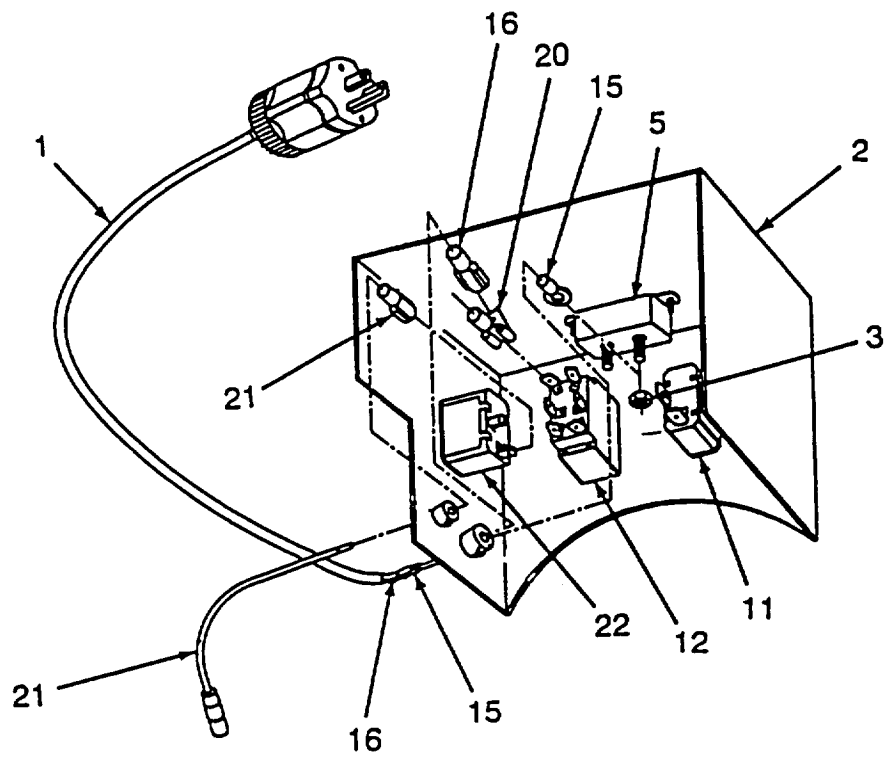


Figure 4-46. Heater Wiring Harness (Sheet 2 of 2)

4-47. EXHAUST LINE/HOSES - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section I, Item 1)

Materials/Parts Required

None.

Equipment ConditionUnit shut down and cool.

WARNING**Do not touch hot exhaust system components with bare hands****Components become hot during operation. Allow them to cool before handling.**

a. Removal. (Refer to Figure 4-47).

- (1) Remove four nuts (1) and two, brackets (2) from two u-clamps (3) holding interflex hose (4).
- (2) Remove interflex hose (4) and fiberglass sleeving (5) from muffler assembly (6) and diverter (7).
- (3) Remove four nuts (1) and two brackets (2) from u-clamps (3) holding interflex hose (8).
- (4) Remove interflex hose (8) and fiberglass sleeving (9) from diverter (7) and tube (10) on lube tank (5) Loosen clamps (11) and disconnect hose (12) at heater plenum (13) and heat inlet (14).
- (6) Loosen two bolts (15) and lockwashers (16) from bracket (17) and remove heat inlet (14), if necessary.
- (7) Loosen four clamps (18) on two remaining ducts (19) leading from heater plenum (13). Remove two ducts (19)

b. Installation.

NOTE

Check all ducts and hoses for defects; replace as needed.

- (1) Install heat inlet (14) to bracket (17) by installing two bolts (15) and two lockwashers (16).
- (2) Slide hose (12) onto heater plenum (13) and heat inlet (14). Tighten clamps (11).
- (3) Install heater ducts (19) onto heater plenum (13), slide clamps (18) up and tighten.
- (4) Slide interflex hose (8) and fiberglass sleeving (9) onto diverter (7) and tube (10) on lube tank.
- (5) Slide u-clamps (3) around interflex hose (8) and install two brackets (2), securing them using four nuts (1).
- (6) Slide interflex hose (4) and fiberglass sleeving (5) onto diverter (7) and muffler assembly (6).
- (7) Slide u-clamps (3) around interflex hose (4) and Install two brackets (2), securing them using four nuts (1).

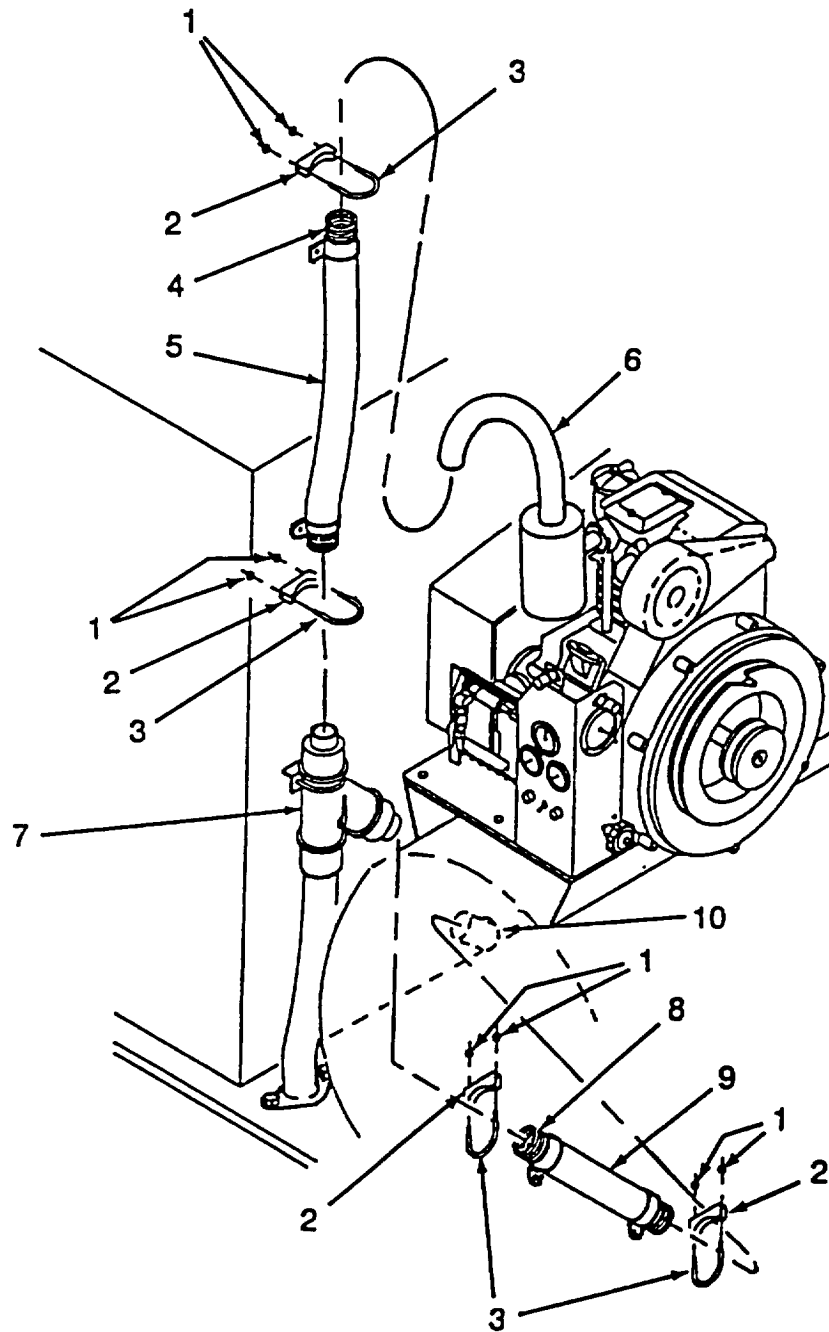


Figure 4-47. Exhaust Line/Hoses (Sheet 1 of 2)

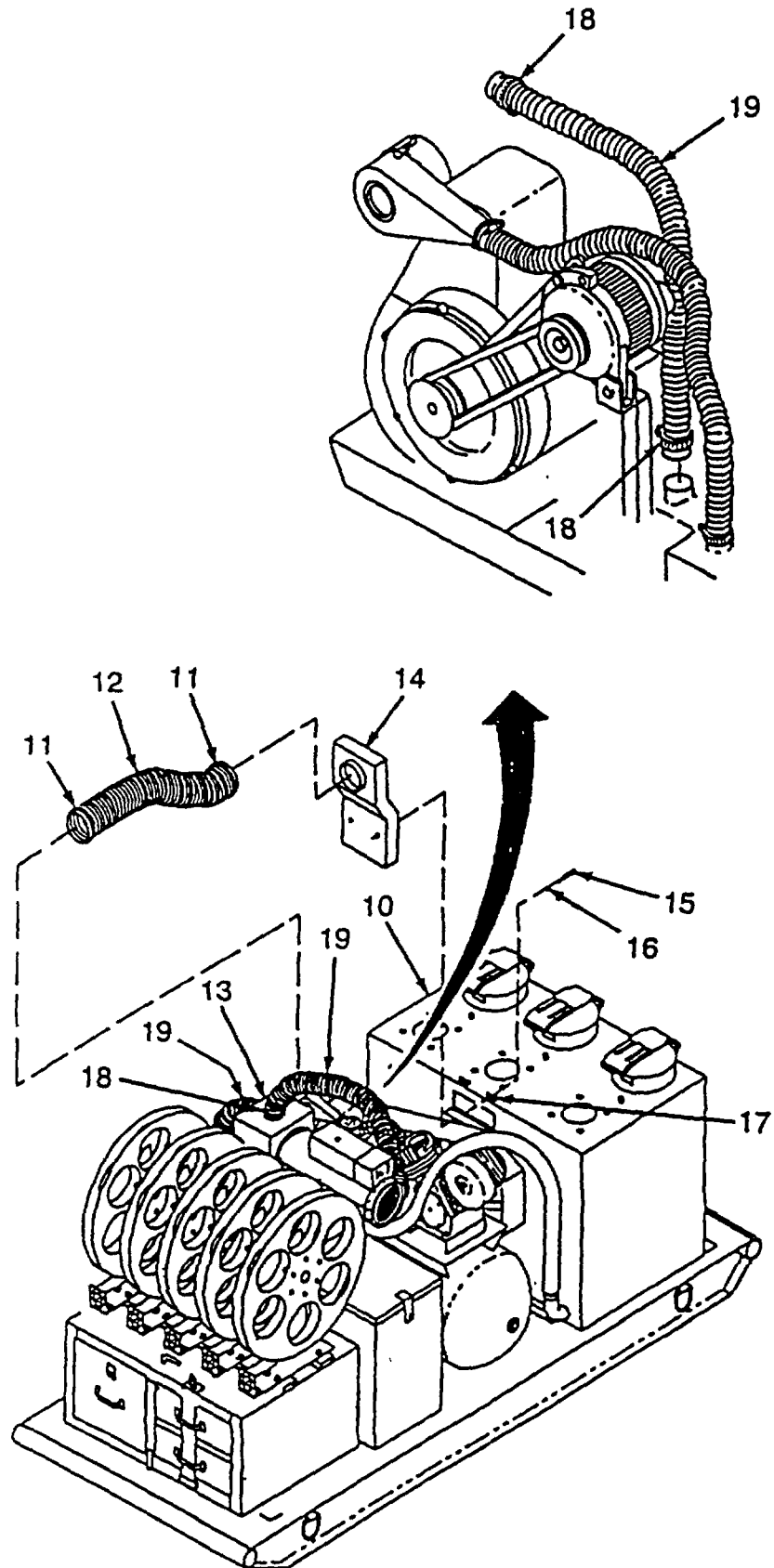


Figure 4-47. Exhaust Line/Hoses (Sheet 2 of 2)

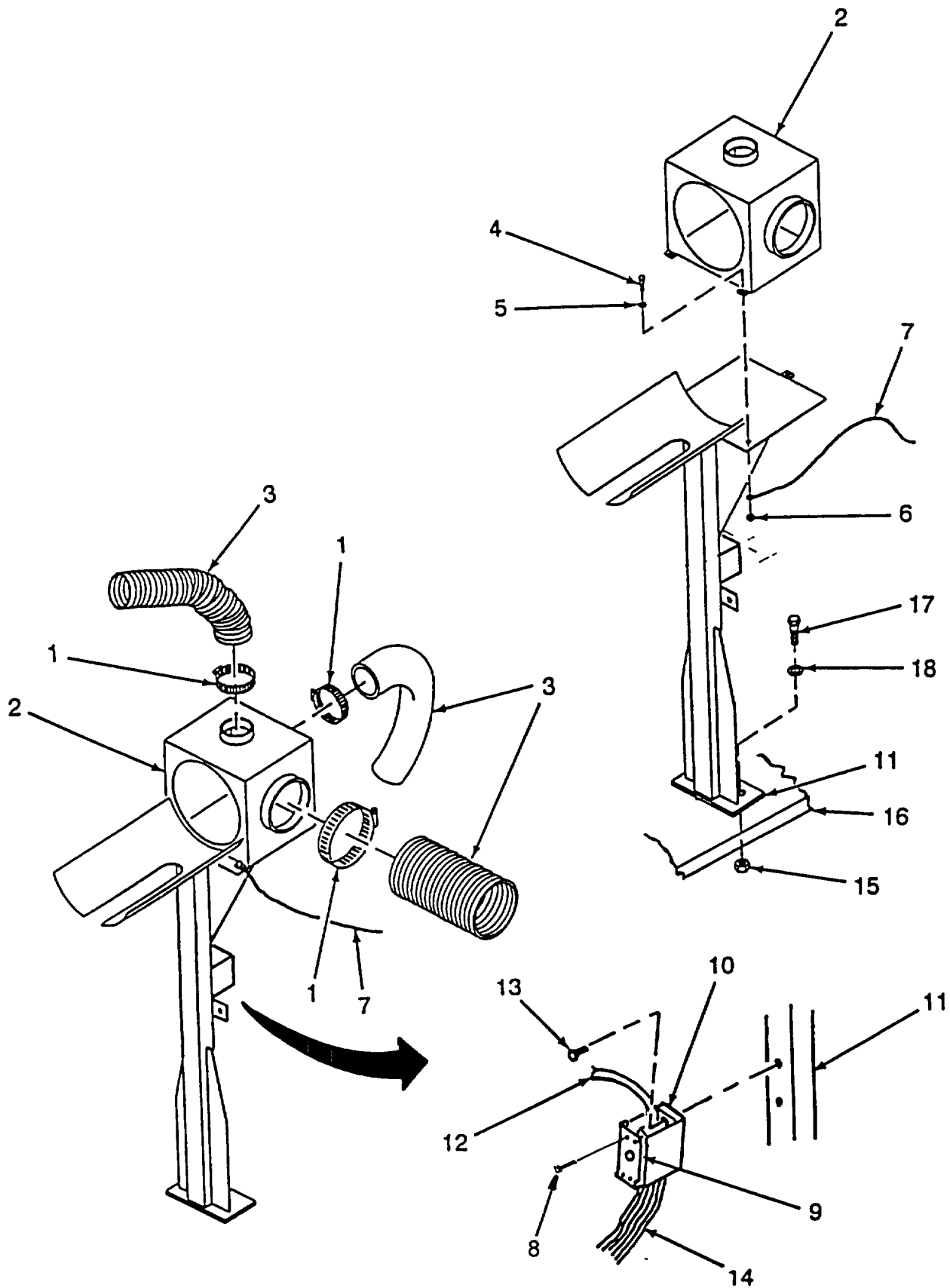


Figure 4-48. Heater Mounting Assembly

4-49. AIR HOSE ASSEMBLIES AND GLADHAND COUPLERS - REPLACE/REPAIR.

This Task Covers: a. Removal b. Repair c. Installation

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's' Automotive (Appendix B, Section II, Item 1)

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7)

Equipment Condition

Unit shut down and cool

a. Removal. (Refer to Figure 4-49).

- (1) Unscrew service brake (2) and emergency brake (1) hose assemblies from fittings (3) on trailer frame (4)
- (2) Unscrew gladhands (5) from service brake (2) and emergency brake (1) hose assemblies

b. Repair.

- (1) Inspect hose assemblies for damage or leakage. Repair if faulty.
- (2) Inspect gladhands for damage or defective components. Replace as necessary.

c. Installation

NOTE

Before installation, wrap threads on hose assemblies with Teflon Tape.

- (1) Install gladhand (5) onto service brake (1) and emergency brake (2) hose assemblies.
- (2) Install service brake (1) and emergency brake (2) hose assemblies into fittings (3) on trailer frame (4)

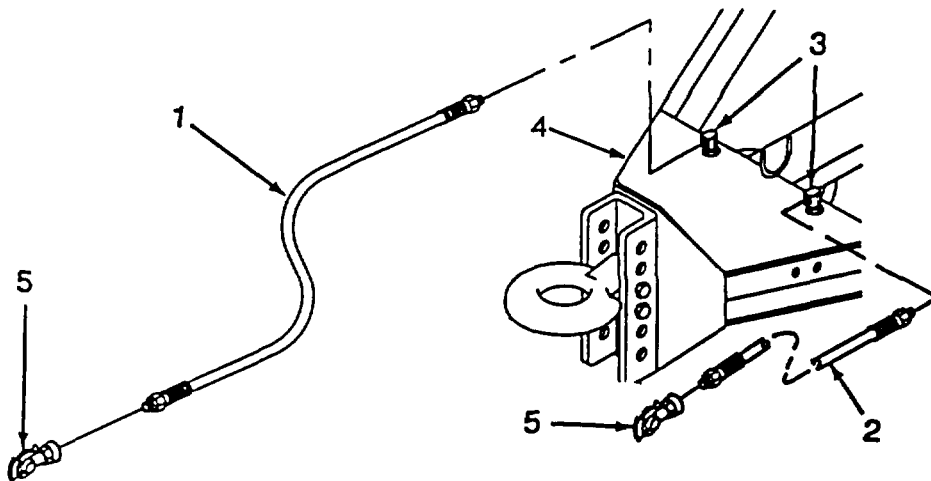


Figure 4-49. Air Hose Assemblies and Gladhand Couplers

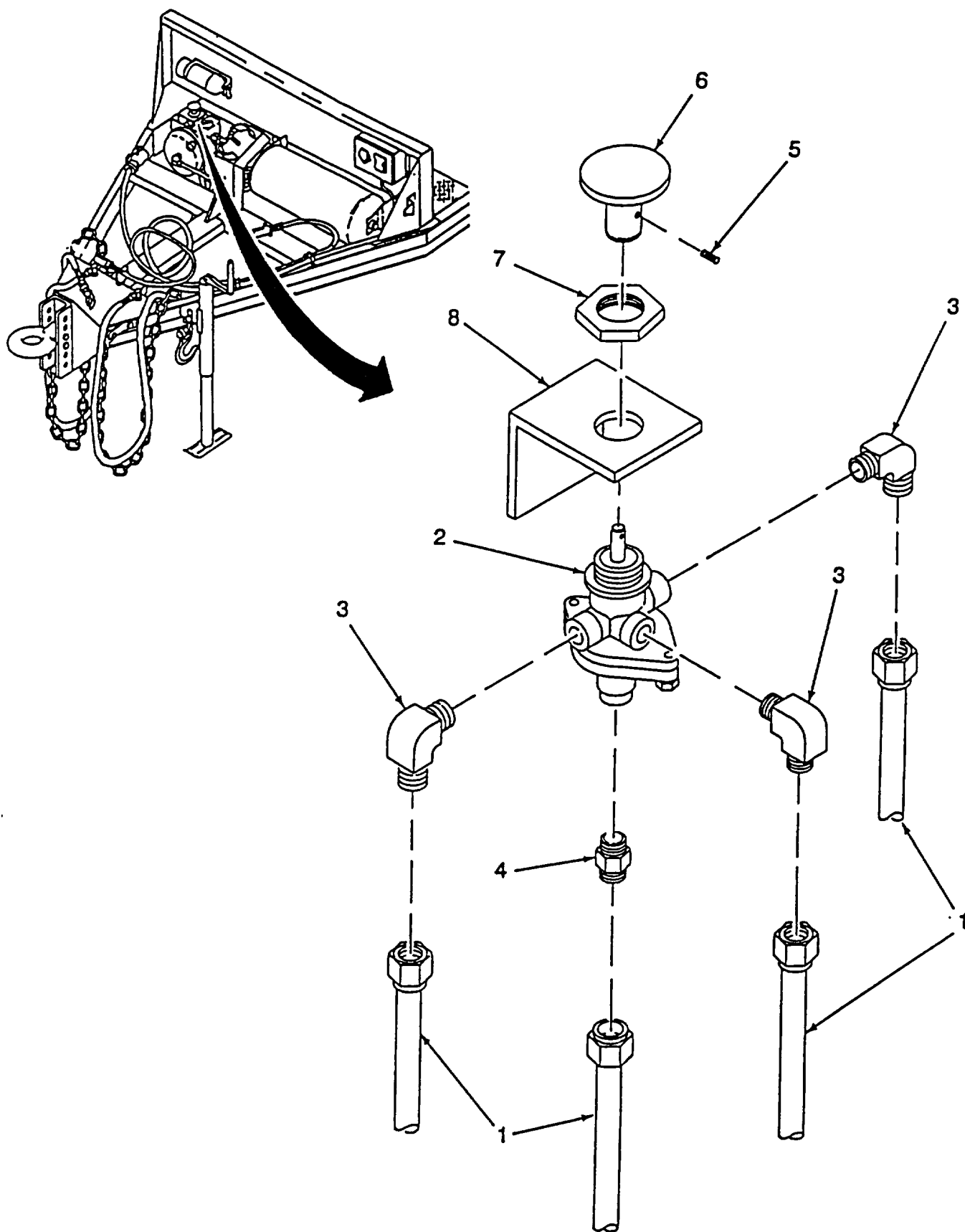


Figure 4-50. Control Valve

NOTE

Before installation wrap threads on three brass male elbows (3) and brass male adapter (4) with Teflon Tape.

- (4) Install three brass male elbows (3) into the ports on the parking brake control valve (2) and tighten.
- (5) Install brass male adapter (4) into bottom of parking brake control valve (2).

NOTE

Tighten all brass fittings. Angles of fittings should be appropriate for installing hoses.

- (6) Install air brake lines (1) onto three brass male elbows (3) and one brass male adapter (4), using tag numbers to match.

4-51. EMERGENCY RELAY VALVE - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7)
Rags, wiping (Appendix E, Section II, Item 1)

Equipment Condition

Unit shut down and cool

WARNING

- **Chock wheels when unit is not on a level surface. Unit could roll and cause injury.**
- **Compressed air may cause severe injury or death, if not used properly. Make sure that air pressure in trailer brake system is completely drained before maintenance.**

a. Removal. (Refer to Figure 4-51).

- (1) Completely vent trailer air brake system pressure by opening drain valve (1). Then close drain valve (1).
- (2) Tag and identify five air brake lines (2)
- (3) Disconnect five air brake lines (2) from emergency relay valve (3) fittings
- (4) Unthread hex nipple (4) and emergency relay valve (3) from tank bracket (5)
- (5) Remove hex nipple (4) from emergency relay valve (3).
- (6) Remove five air brake fittings (6), bushing (7) and plugs (8) from emergency relay valve (3) (7) Clean and inspect emergency relay valve (3), fittings (6), bushing (7) and plugs (8) and air brake lines (2).

b. Installation.

NOTE

Before installation wrap threads on hex nipple (4) and fittings (6), bushing (7) and plugs (8) with Teflon Tape.

- (1) Install hex nipple (4) into tank bracket (5)

- (2) Install plugs (8), bushing (7) and air brake fittings (6) into emergency relay valve (3).
- (3) Install emergency relay valve (3) onto hex nipple (4).
- (4) Connect five air brake lines (2) to emergency relay valve (3).
- (5) Remove Tags from air brake lines (2)

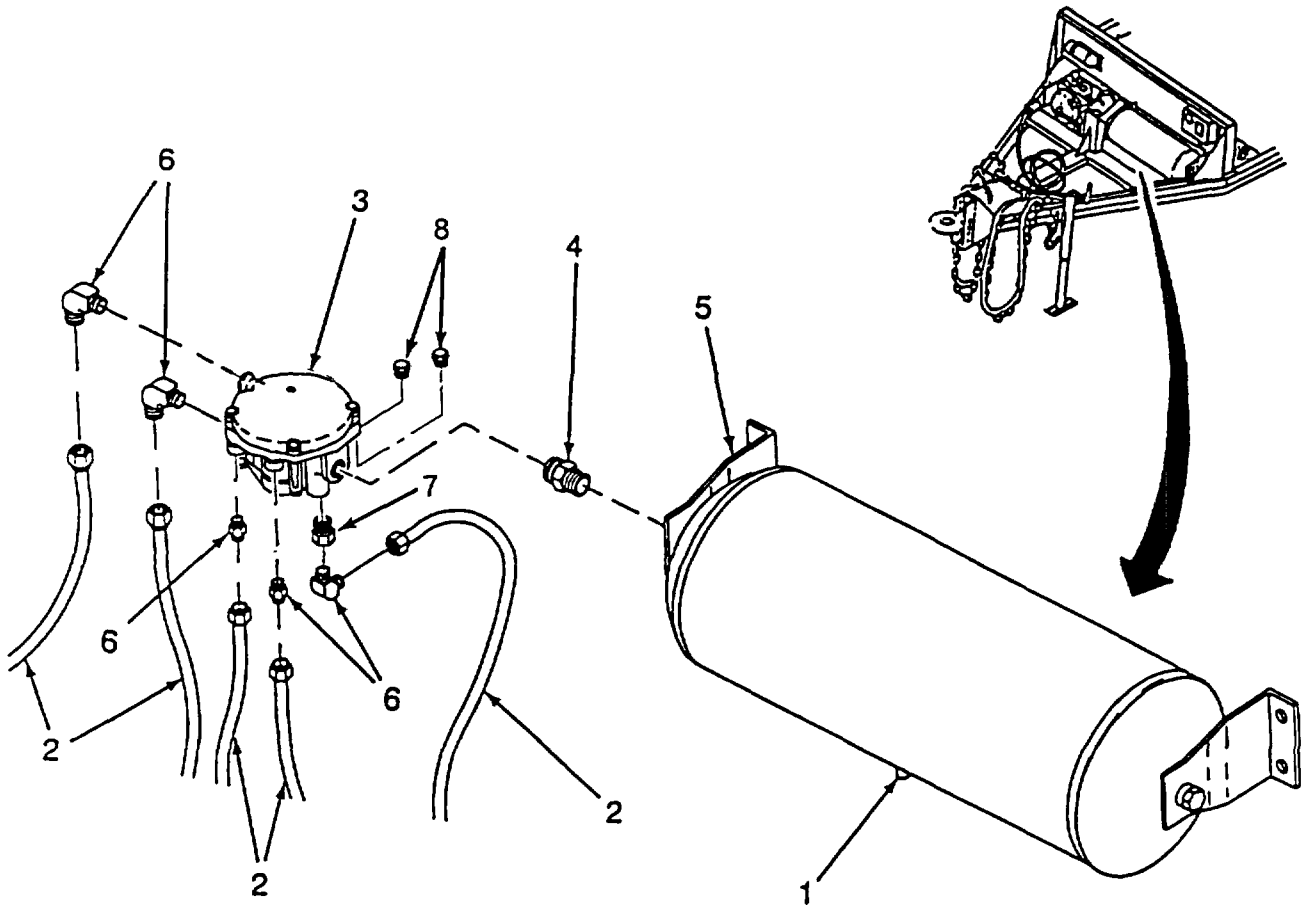


Figure 4-51. Emergency Relay Valve

4-52. QUICK RELEASE AND LIMITING VALVE - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1)

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7).
Rags, Wiping (Appendix E, Section II, Item 1).

Equipment Condition

Unit shut down and cool

WARNING

- **Chock wheels when unit is not on a level surface Unit could roll and cause injury.**
- **Compressed air may cause severe injury or death, if not used properly. Make sure that air pressure in trailer brake system is completely drained before maintenance**

a. Removal. (Refer to Figure 4-52).

- (1) Completely vent trailer air brake system pressure by opening drain valve. (para 4-51).
- (2) Disconnect two air brake lines (1) from quick release and limiting valve (2) fittings.
- (3) Remove two hex head-cap screws (3) and two locknuts (4) holding quick release and limiting valve (2) to trailer.
- (4) Unscrew quick release and limiting valve (2) from hex nipple (5) and synchronizing valve (6).
- (5) Remove hex head-plug (7), male adapter (8) and male elbow (9) from ports of quick release and limiting valve (2).
- (6) Clean and inspect quick release and limiting valve (2), hex head plug (7), male adapter (8), male elbow (9) and air brake lines (1)

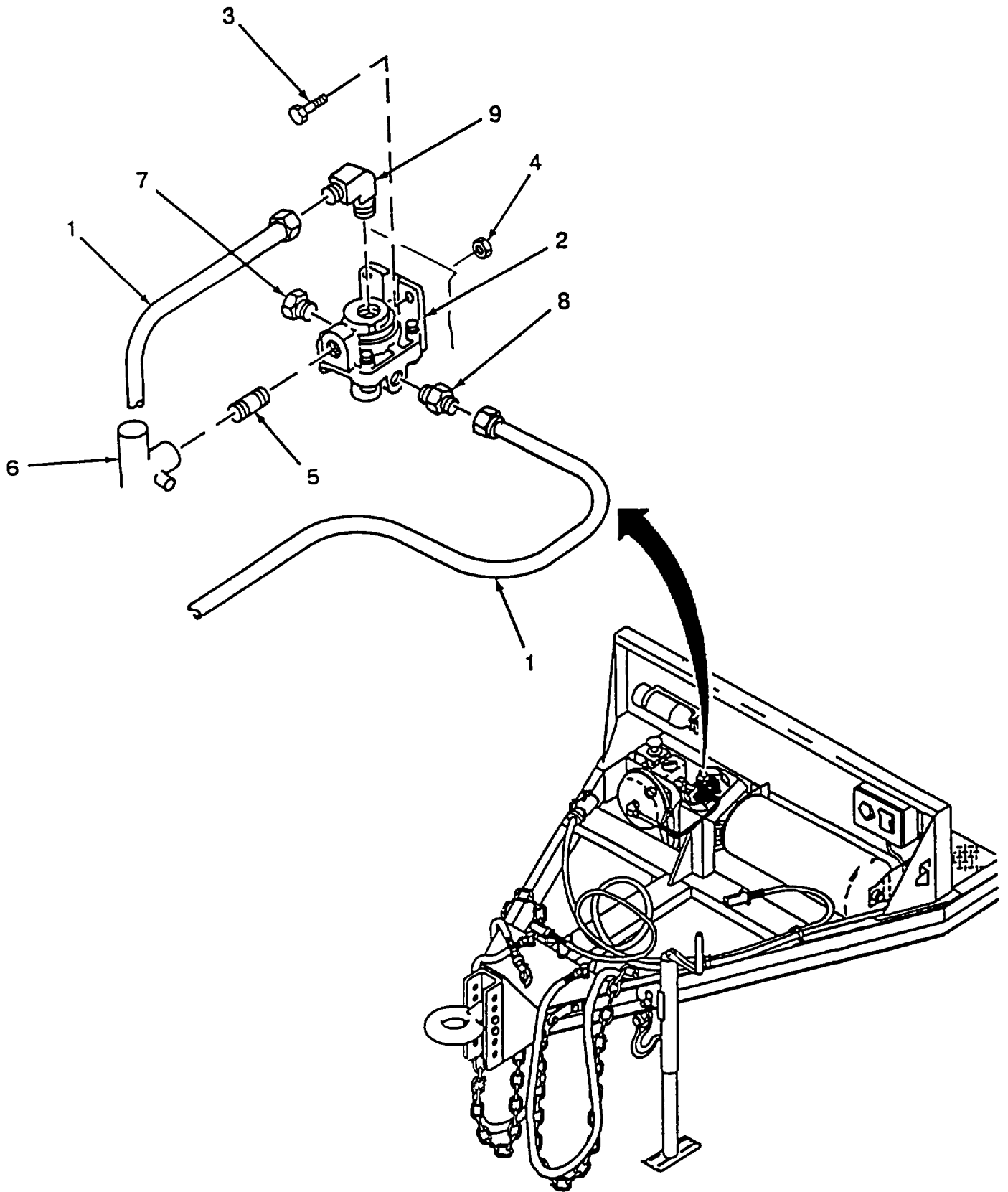


Figure 4-52. Quick Release and Limiting Valve

b. Installation.

NOTE

Before installation wrap threads on hex nipple (5), hex head-plug (7), male adapter (8) and male elbow (9) with Teflon Tape.

- (1) Install male elbow (9), male adapter (8) and hex head-plug (7) into ports of quick release and limiting valve (2).
- (2) Align holes in quick release and limiting valve (2) with holes in trailer, and install two hex headcap screws (3) and two locknuts (4).
- (3) Install hex nipple (3) and synchronizing valve (6) into port on quick release and limiting valve (2).
- (4) Connect two air brake lines (1) to quick release and limiting valve (2) fittings

4-53. SYNCHRONIZING VALVE - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7).

Rags, Wiping (Appendix E, Section II, Item 1).

Equipment ConditionUnit shut down and cool.

WARNING

- **Chock wheels when unit is not on a level surface. Unit could roll and cause injury.**
- **Compressed air may cause severe injury or death, if not used properly. Make sure that air pressure in trailer brake system is completely drained before maintenance.**

a. Removal. (Refer to Figure 4-53).

- (1) Completely vent trailer air brake system pressure by opening drain valve. (para. 4-51).
- (2) Disconnect two air brake lines (1) from two elbows (3).
- (3) Unscrew two elbows (3) from ports of synchronizing valve (2).
- (4) Remove synchronizing valve (2) from hex nipple (4) in quick release and limiting valve (5).
- (5) Clean and Inspect synchronizing valve (2), two male elbows (3), and air brake lines (1).

b. Installation.

NOTE**Before installation wrap threads on elbows (3), hex nipple (4) with Teflon Tape.**

- (1) Install synchronizing valve (2) onto hex nipple (4).
- (2) Install two elbows (3) into ports of synchronizing valve (2).
- (3) Connect two air brake lines (1) to synchronizing valve (2) fittings.

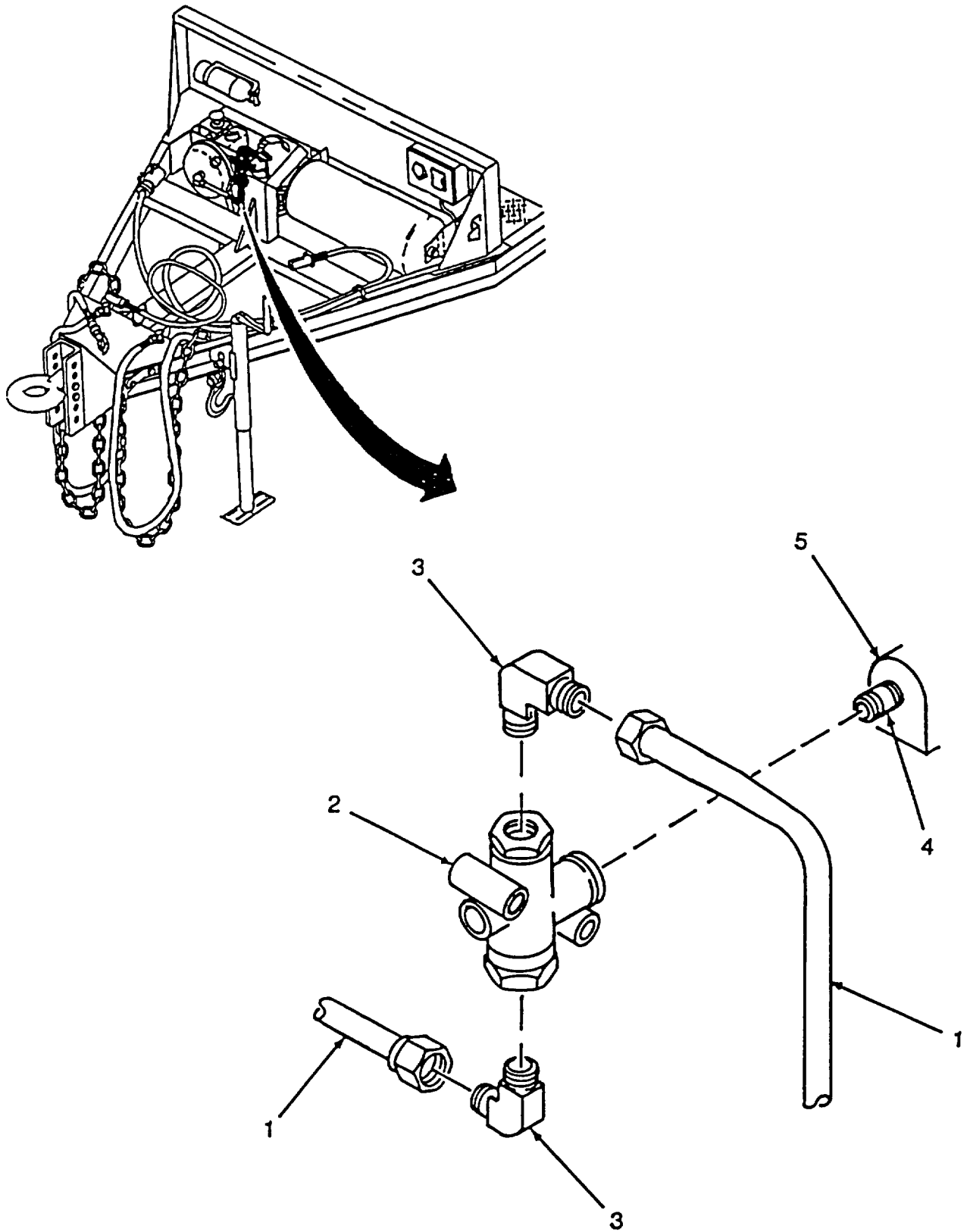


Figure 4-53. Synchronizing Valve

4-54. AIR TANK ASSEMBLY - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Unit shut down and cool.
Emerg. Relay Valve Removed (para. 4-51).

Personnel Required

2

WARNING

- **Chock wheels when unit is not on a level surface. Unit could roll and cause injury.**
- **Compressed air may cause severe injury or death, if not used properly. Do not disconnect air lines or components before first relieving the air tank of pressure.**

a. Removal. (Refer to Figure 4-54).

- (1) Remove four bolts (1) from air tank bracket (2) and four locknuts (3) from tank support brackets (4).
- (2) Remove air tank (5).

b. Installation.

NOTE

- **Prior to installation check tank for cracked welds or other defects. Replace tank if cracked or defective.**
- **Before installation wrap threads on hex nipple with Teflon Tape.**

- (1) Position air tank brackets (2) to align with holes in tank support brackets (4).
- (2) Install four bolts (1) through air tank brackets (2) and locknuts (3) from back side of tank support brackets (4).

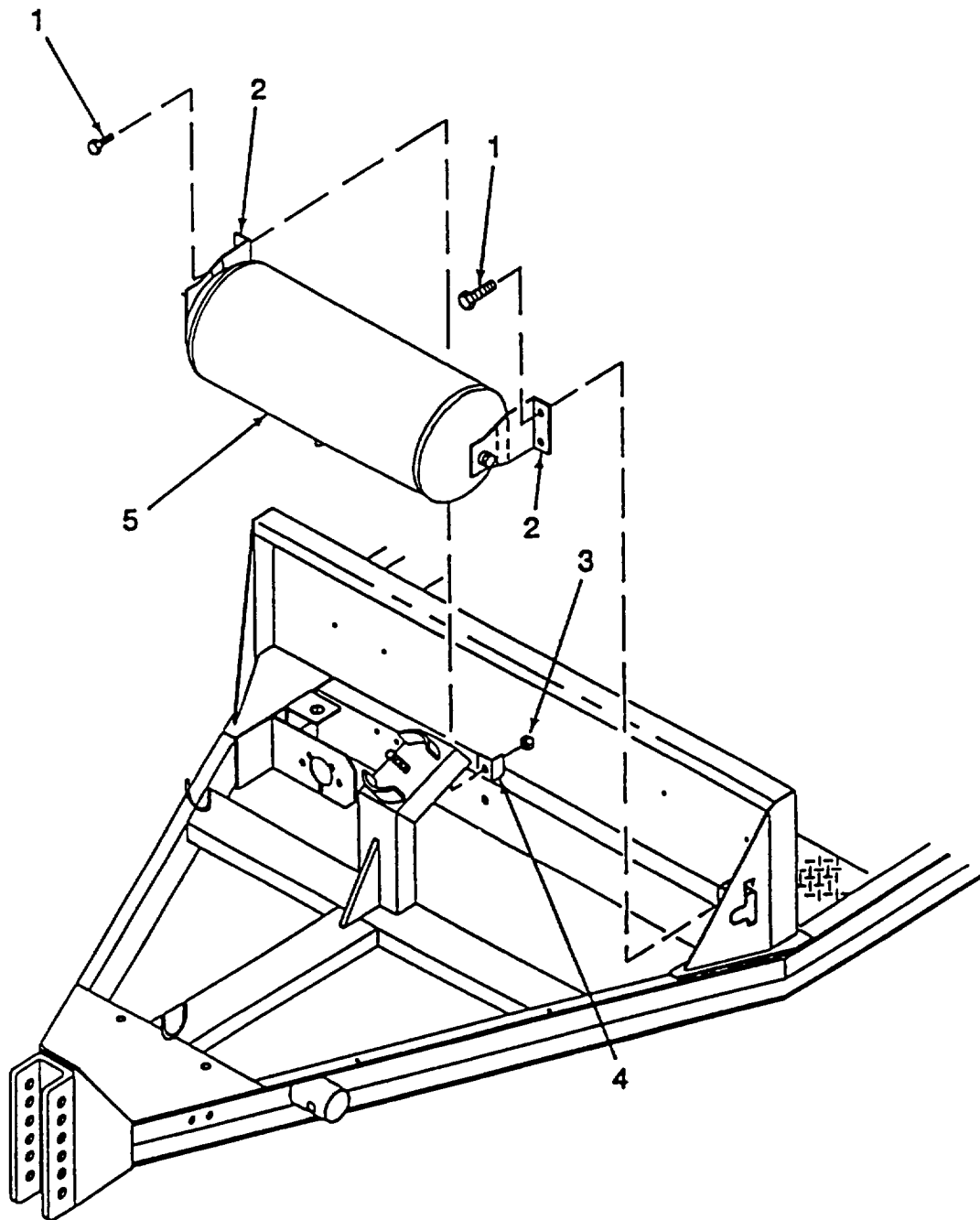


Figure 4-54. Air Tank Assembly

4-55. POWER CLUSTER AND MASTER CYLINDER - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Brake fluid (Appendix E, Section II, Item 2).
Teflon Tape (Appendix E, Section II, Item 7).
Rags, wiping (Appendix E, Section II, Item 1).
Dry cleaning solvent (Appendix E, Section II, Item 3).
Nut, self-locking (Appendix H, Section II, Item 10).
Lockwasher (Appendix H, Section II, Item 7).

Equipment Condition

Unit shut down and cool.

a. Removal. (Refer to Figure 4-55).

WARNING

Compressed air may cause severe injury or death, if not used properly. Make sure that air pressure in trailer brake system is completely drained before proceeding.

- (1) Completely vent trailer air brake system pressure by opening drain valve. (para. 4-51).
- (2) Disconnect air brake line (1) from elbow (2). Remove elbow (2) from power cluster (3).
- (3) Remove two nuts (4) and two lockwashers (5) from back side of bracket (6). Discard two lockwashers.
- (4) Remove power cluster (3) and spacer (7) from bracket (6).
- (5) Loosen brake line (8) from adapter (9) allowing brake fluid to drain into cup or other suitable container. Plug brake line (8) after draining.
- (6) Remove three screws (10), and three self-locking nuts (11) holding master cylinder (12) to bracket (6). Discard three self-locking nuts.
- (7) Slide master cylinder (12) out of bracket (6).
- (8) Loosen hose clamp (13) on rubber hose (14), and remove from hydraulic brake vent tubing (15).
- (9) Unscrew adapter (16) from cap (17) and remove vent tube (15) and adapter (16). Inspect packing (18) on cap (17) and remove if damaged.

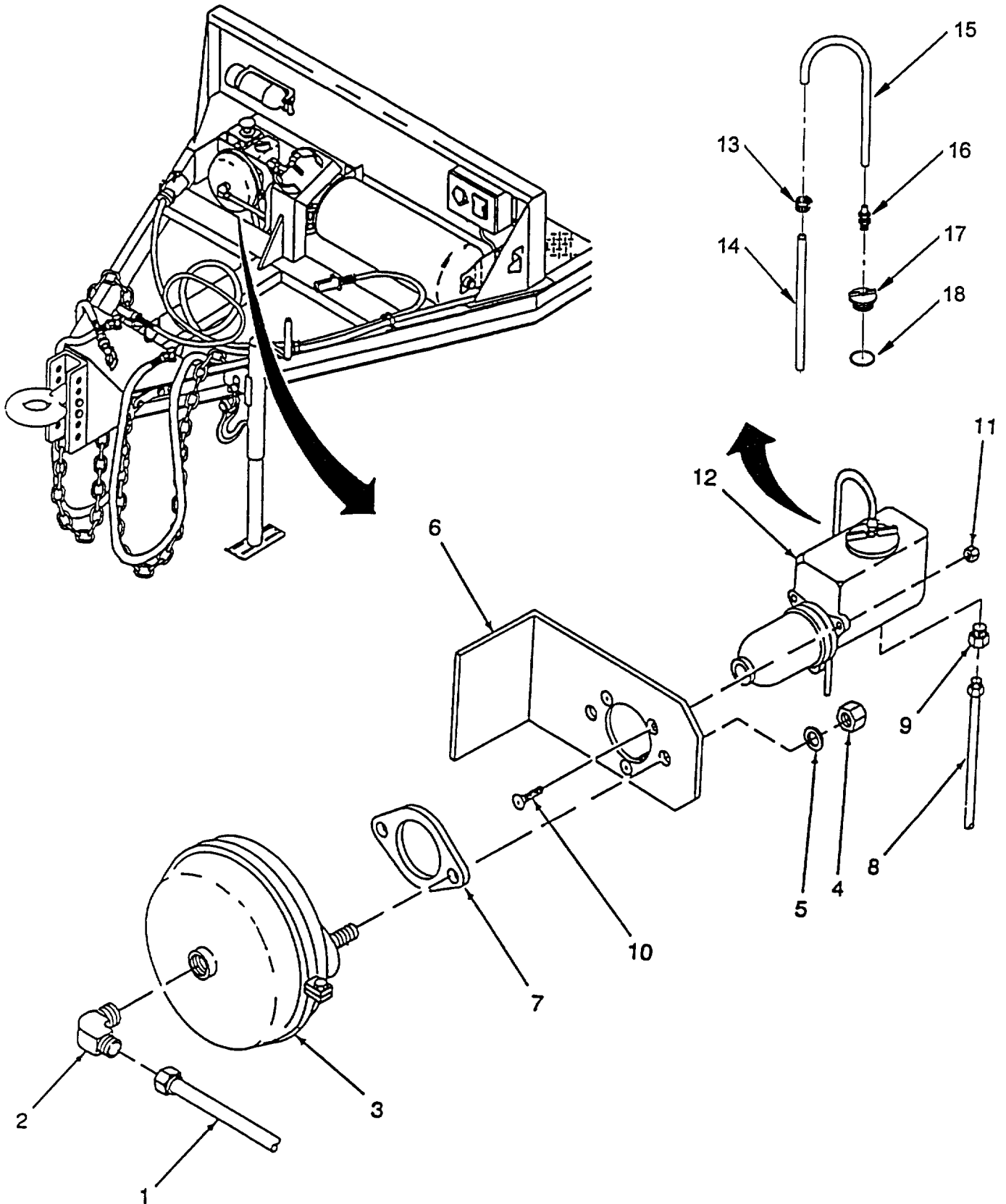


Figure 4-55. Power Cluster and Master Cylinder

b. Installation.

NOTE

Before installation wrap threads on elbow and air brake line with Teflon Tape.

- (1) Replace any parts that show obvious wear or damage.
- (2) Slide master cylinder (12) into hole in bracket (6).
- (3) Install three screws (10) through bracket (6), securing master cylinder (8) to bracket (9) with three locknuts (4).
- (4) Unplug brake line (8). Install brake line (8) into adapter (9) using a 7/16 open end wrench. Tighten.
- (5) Place spacer (7) on studs of power cluster (3).
- (6) Install power cluster (3) on bracket (6) and secure with two new lockwashers (5) and two nuts (4).
- (7) Assemble adapter (16) and vent tube (15). Install adapter (16) into cap (17). Install packing (18).
- (8) Refill master cylinder (12) with brake fluid and install cap (17).
- (9) Install elbow (2) into power cluster (3). Connect air brake line (1) to elbow (2).
- (10) Slide rubber hose (14) and hose clamp (13) onto hydraulic brake vent tubing (15). Tighten hose clamp (13).
- (11) Bleed hydraulic system to remove air from lines. (para. 4-60).
- (12) Check for leaks; repeat procedures if necessary.

4-56. BRAKE LINES - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Brake fluid (Appendix E, Section II, Item 2).
 Teflon Tape (Appendix E, Section II, Item 7).
 Rags, wiping (Appendix E, Section II, Item 1).
 Dry cleaning solvent (Appendix E, Section II, Item 3).
 Nut, self-locking (Appendix H, Section II, Item 10).

Equipment Condition

Unit shut down and cool.

a. Removal. (Refer to Figure 4-56).

WARNING

- **Chock wheels when unit is not on a level surface. Unit could roll and cause injury.**
- **Compressed air may cause severe injury or death, if not used properly. Make sure that air pressure in trailer brake system is completely drained before proceeding.**

- (1) Completely vent trailer air brake pressure by opening valve. (para. 4-51).
- (2) Loosen brake wheel cylinder (1) bleeder screw and bleed until emerging fluid is free of bubbles. Use a clean jar or container to submerge free end of bleed line in the fluid.
- (3) Loosen brake line (2) at rear of brake cylinder (3) and drain brake fluid into jar or container.
- (4) Disconnect brake line (2) from wheel cylinder (3).
- (5) Disconnect brake line (2) from axle tee (4) (6) Disconnect brake line (5) from wheel cylinder (1).
- (7) Disconnect brake line (5) from axle tee (4).
- (8) Holding hydraulic hose assembly (6) end fitting, disconnect brake line (7) from hydraulic hose assembly (6).

- (9) Disconnect hydraulic hose assembly (6) end fitting.
- (10) Remove hose clip (8) and hydraulic hose assembly (6) from trailer frame (9).
- (11) Remove two self-locking nuts (10), two pan head machine screws (11), two cushioned cable clamps (12), from brake lines (7 and 13) and trailer frame (9). Discard nuts.
- (12) Holding brake line coupling (14) with wrench, disconnect brake line (7) from brake line coupling (14).
- (13) Holding brake line coupling (14) with wrench, disconnect brake line (13) from brake line coupling (14).
- (14) Loosen brake line (13) at adapter (15) and allow brake fluid to drain from master cylinder (16) into cup or other suitable container.
- (15) Holding adapter (15) with wrench, disconnect brake line (13) from adapter (15).
- (16) Inspect all parts for any deterioration or damage. Replace if necessary.

WARNING

Dry cleaning solvent is flammable and toxic. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin.

- (18) Clean all threads and fittings with dry cleaning solvent Wipe clean using wiping rags.

b. Installation.

NOTE

Before installation wrap threads on brake line fittings with Teflon Tape where needed.

- (1) Connect brake line (13) into adapter (15).
- (2) Holding brake line (13) fitting with wrench, install brake line coupling (14) onto brake line (13). Tighten brake line coupling (14).
- (3) Holding brake line coupling (14) with wrench, install brake line (7) onto brake line coupling (14). Tighten brake line coupling (14).
- (4) Slide two cushioned cable clamps (12) onto brake lines (7 and 13). Align the two cushioned cable clamps (12) with holes in frame (9). Install two pan head machine screws (11) through holes in frame (9), securing it using two self-locking nuts (10). Tighten.

- (5) Install hydraulic hose assembly (6) onto axle tee (4) and tighten.
- (6) Install hydraulic hose assembly (6) onto trailer frame (9) with hose clip (8).
- (7) Install brake line (7) into hydraulic hose assembly (6) and tighten.
- (8) Install brake line (5) into axle tee (4). Tighten
- (9) Install brake line (2) into axle tee (4) Tighten.
- (10) Install brake line (5) fitting into wheel cylinder (1). Tighten
- (11) Install brake line (2) fitting into wheel cylinder (3). Tighten
- (12) Bleed hydraulic brake line procedure. (para 4-60).

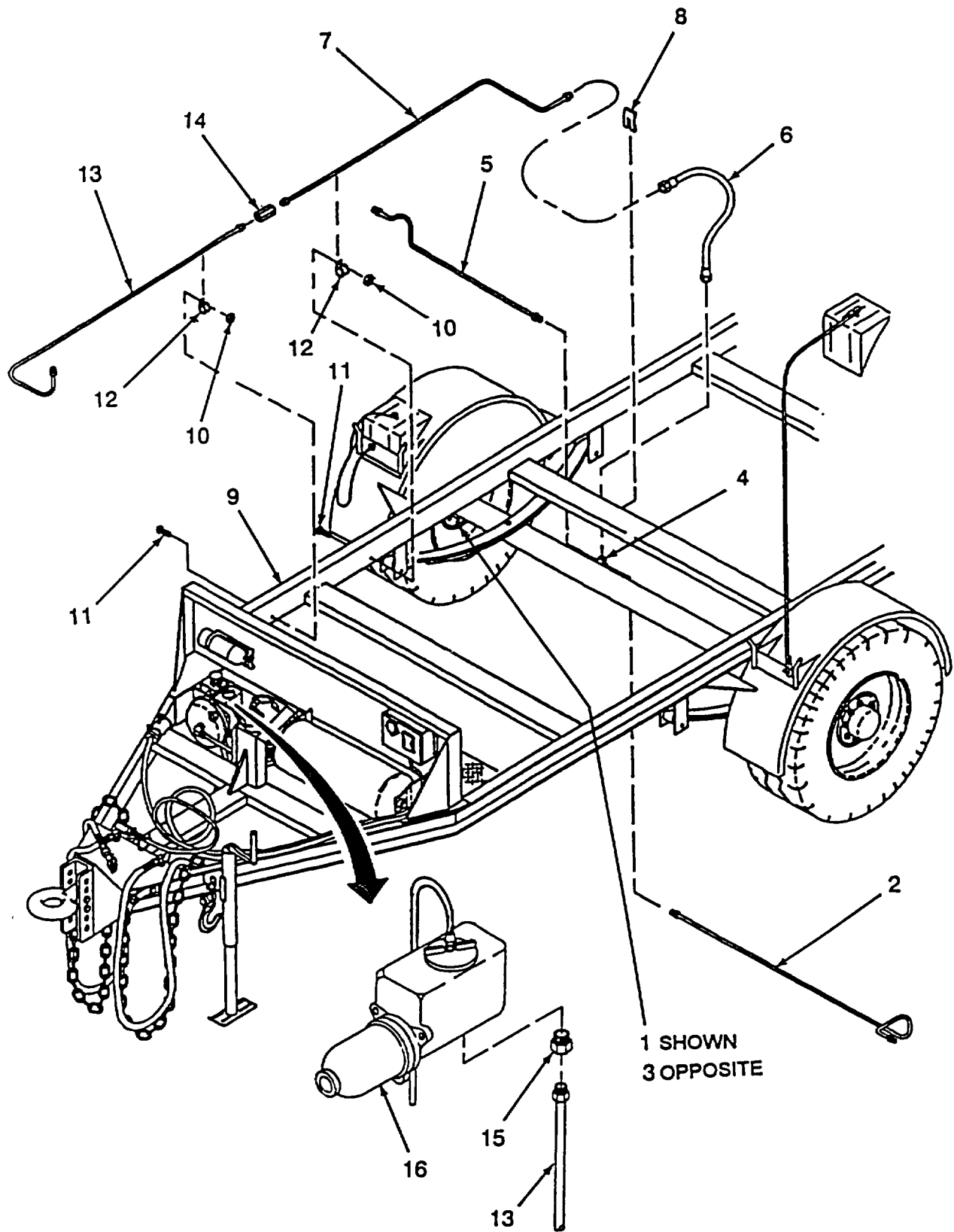


Figure 4-56. Brake Lines

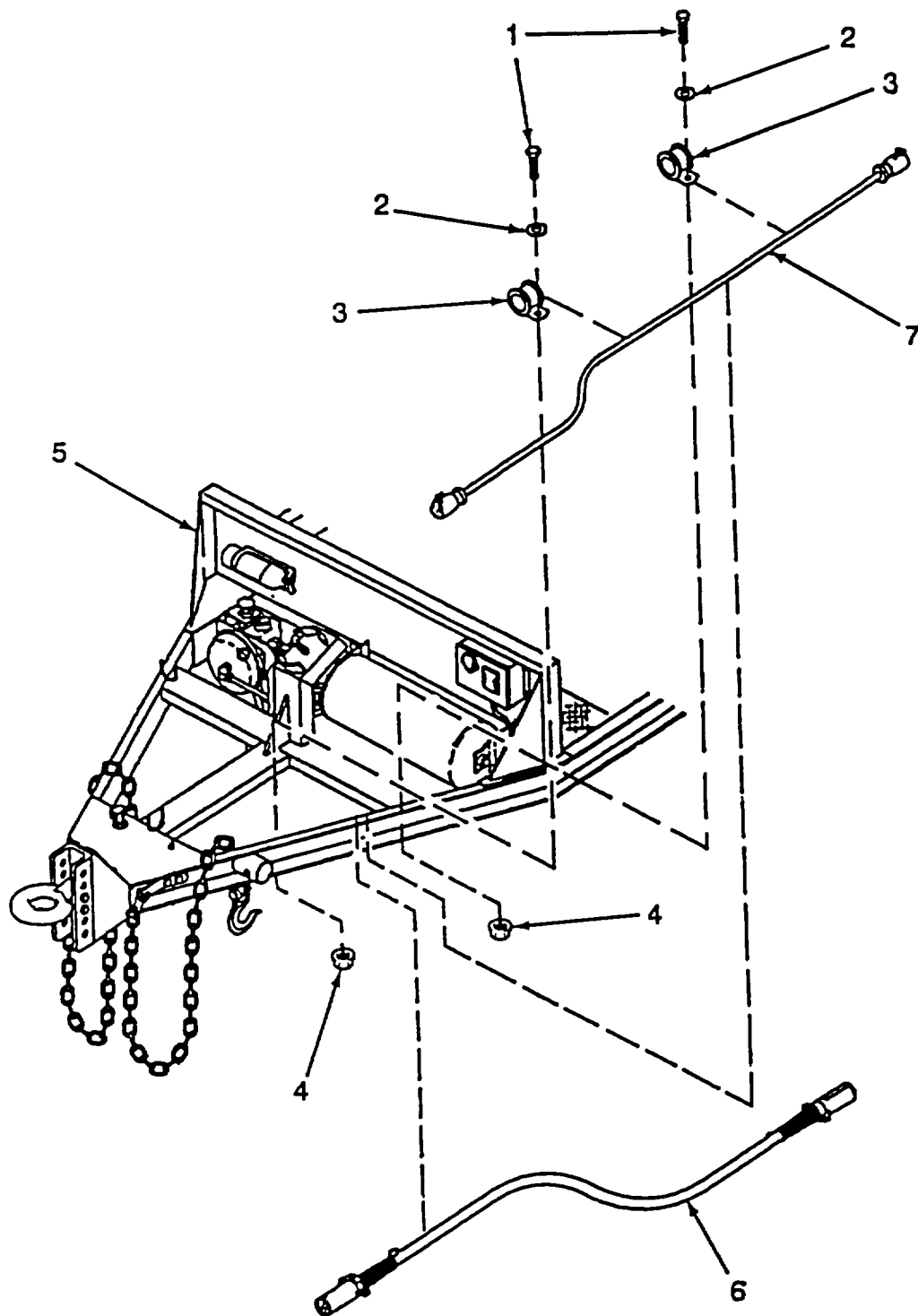


Figure 4-57. Intervehicular Trailer Harnesses

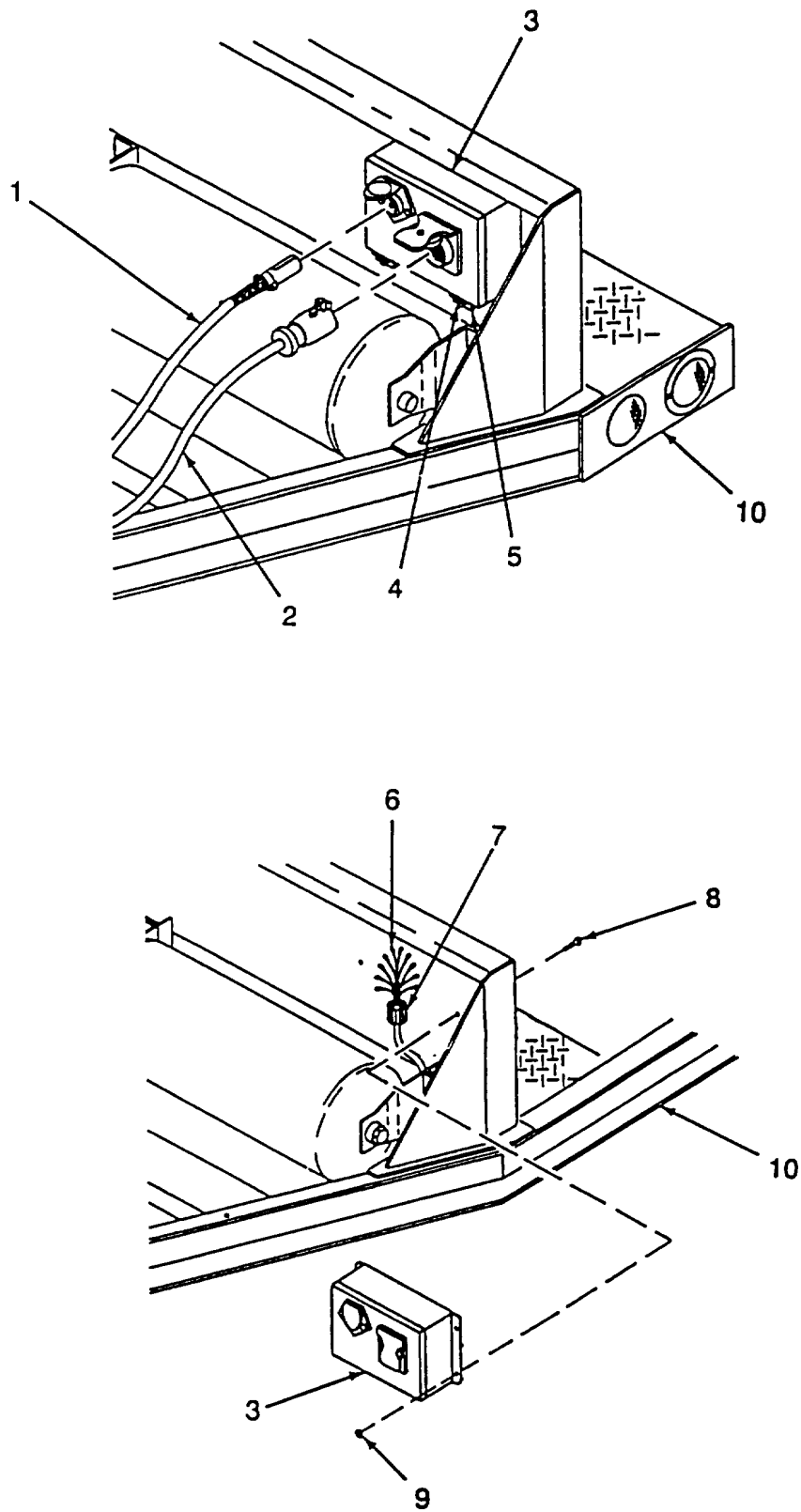


Figure 4-58. Voltage Reducer Box

4-59. FRONT AND REAR JACKS/SAFETY CHAIN ASSEMBLY - REPLACE.

This Task Covers: **a. Removal** **b. Installation****Initial Setup:****Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Jack stands (Appendix B, Section III, Item 2)
 Nuts, self-locking (Appendix H, Section II, Item 11).
 Cotter pin (Appendix H, Section II, Item 3).

Equipment Condition

Unit shut down and cool.

a. Removal. (Refer to Figure 4-59).

WARNING

- **Chock trailer wheels before performing any maintenance. Unit could roll and cause injury.**

- (1) Support lunette (1) with jack stand or other suitable brace.
- (2) Raise front jack (2) until it is above the ground.
- (3) Remove cotter pin (3) from jack pin (4).
- (4) Remove jack pin (4) from front jack (2).
- (5) Slide front jack (2) from mount sleeve (5).
- (6) Support trailer axle (6) with jack stand. (para. 4-60).
- (7) Hold scissors jack (7) with one hand and pull out pin (8) with other hand from side of jack guide (9).
- (8) Slide scissors jack (7) down and out of jack guide (9).
- (9) Remove two cotter pins (10) from two pins (11), releasing yoke (12) from safety chain bracket (13), and safety chain (14) Typical two places.
- (10) Remove cotter pin (15) from pin (16), releasing hook (17) Typical two places (11) Remove two self-locking nuts (18), safety chain bracket (13) and two hex cap screw (19) from trailer frame (20) Typical two places. Discard self-locking nuts

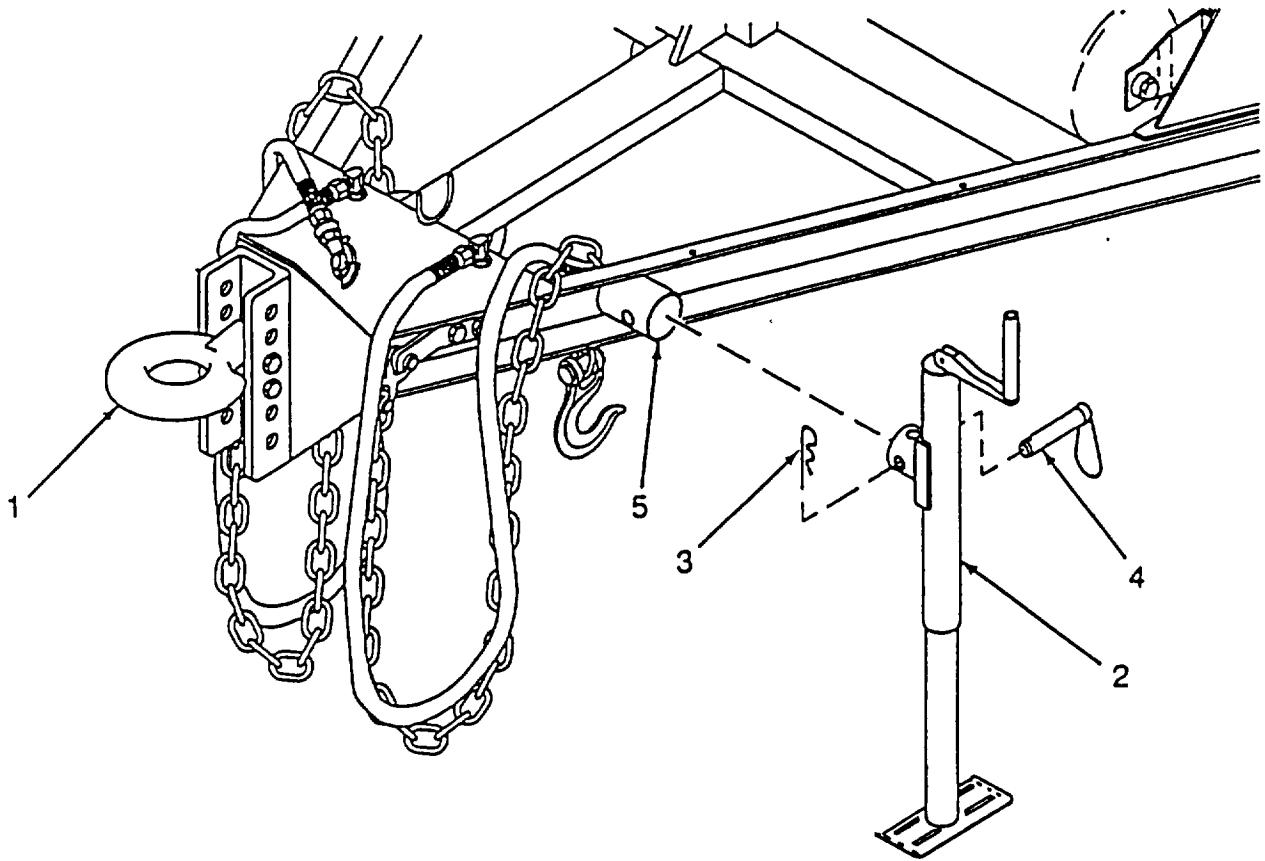


Figure 4-59. Front and Rear Jacks' and Safety Chain Assembly (Sheet 1 of 2)

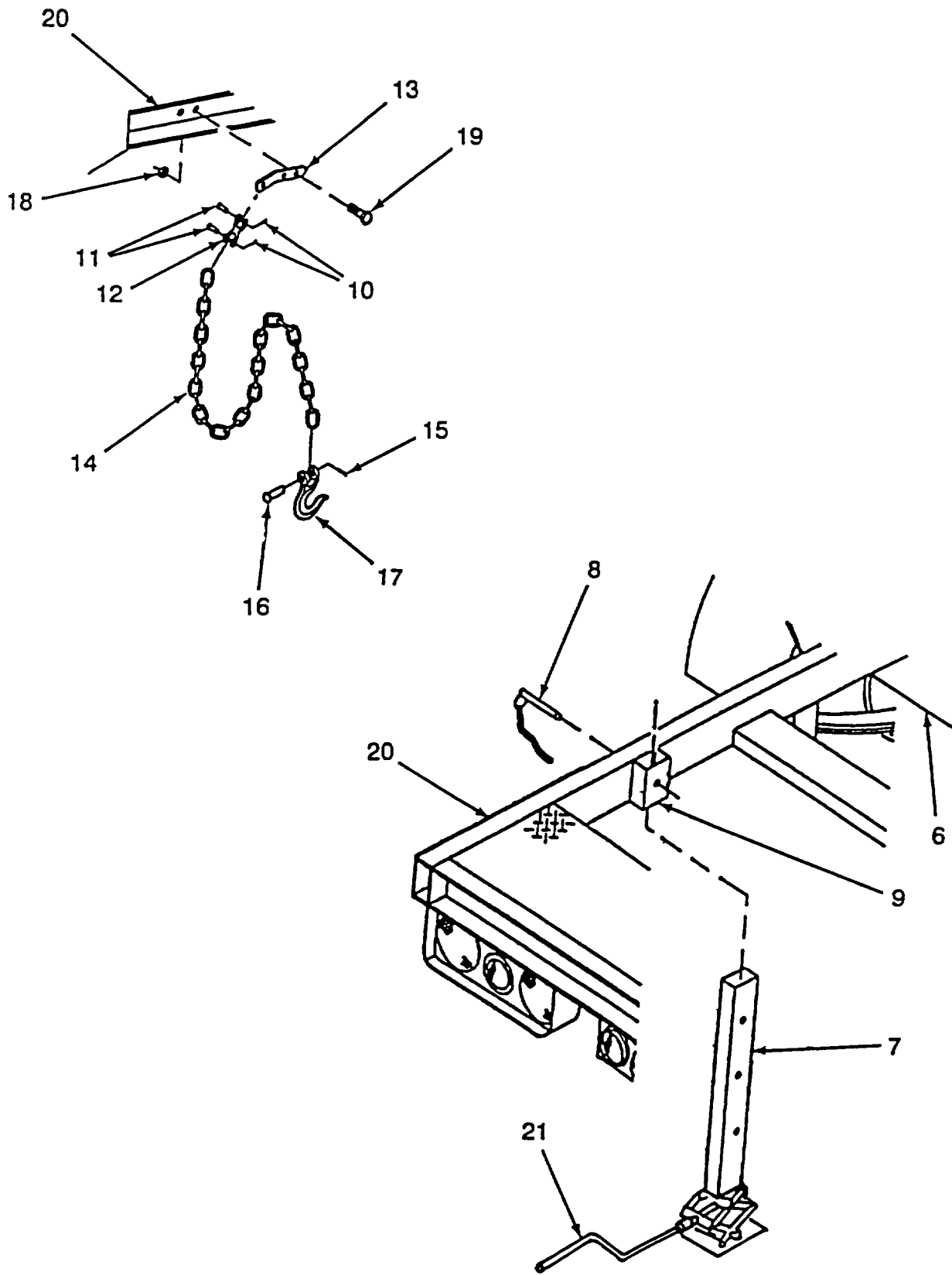


Figure 4-59. Front and Rear Jacks and Safety Chain Assembly (Sheet 2 of 2)

b. Installation.

- (1) Slide front jack (2) into mount sleeve (5).
- (2) Slide jack pin (4) through front jack (2).
- (3) Install cotter pin (3) into jack pin (4).
- (4) Lower front jack (2) until it touches the ground. Continue to raise front jack (2) until trailer rises above jack stand or other suitable brace. Remove jack stand from under lunette ring.
- (5) Slide scissors jack (7) up and into jack guide (9).
- (6) Align holes in scissors jack (7) and jack guide (9) and install pin (8).
- (7) Align safety chain bracket (13) with holes in trailer frame (20), securing safety chain bracket (13) with two hex cap screws (19) and two self-locking nuts (18). Typical two places.
- (8) Align safety chain bracket (13) with yoke (12), install pin (11) through yoke (12) and safety chain bracket (13), securing pin (11) with cotter pin (10). Typical two places.
- (9) Align safety chain (14) with hook (17), install pin (16) through hook (17) and safety chain (14), securing pin (16) with cotter pin (15). Typical two places.
- (10) Align safety chain (14) with yoke (12), install pin (11) through yoke (12), and safety chain (14), securing pin (11) with cotter pin (10). Typical two places.
- (11) Hold scissors jack (7) with one hand and pull out pin (8) with other hand from side of jack guide (9).
- (12) Slide scissors jack (7) down and out of jack guide (9), until it rest snugly on the ground. V.
- (13) Slide jack handle (21) onto rear scissors jack (9) and jack the trailer frame (20) up until frame (20) has cleared jack stand. Repeat opposite side.

4-60. HUB AND DRUM - REPLACE/REPAIR.

This Task Covers:	a. Removal	b. Disassembly	c. Repair
	d. Assembly	e. Installation	

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Tool Kit, Common Number 1 (Appendix B, Item 2).
 Jack stands (Appendix B, Section III, Item 2).
 Jack (Appendix B, Section III, Item 7)

Materials/Parts Required

Rags, wiping (Appendix E, Section II, Item 1)
 Brake Fluid (Appendix E, Section II, Item 2).
 Dry Cleaning Solvent (Appendix E, Section II, Item 3).
 GAA Grease (Appendix E, Section II, Item 15).
 Oil Proof Paper

Equipment Condition

Unit shut down and cool.
 Unit parked on dry, level ground.
 Trailer connected to towing vehicle.

Personnel Required2

WARNING

- **Chock wheels when unit is not on a level surface. Unit could roll and cause injury.**
- **Use extreme caution when jacking up the trailer. It could fall causing serious injury or death.**

a. Removal. (Refer to Figure 4-60).

- (1) Loosen, but do not remove eight lug nuts (1) holding wheel assembly (2) onto drum (3).
- (2) Lift trailer assembly (4) with a jack until wheel assembly (2) is approximately one inch above the ground Position jack stand under axle assembly (5). Raise jack stand up until it is securely against axle assembly (5).
- (3) Lower jack until axle assembly (5) is supported by jack stand.
- (4) Remove jack from under trailer assembly (4).
- (5) Remove eight lug nuts (1) from wheel assembly (2).
- (6) Remove wheel assembly (2) from drum (3). Inspect lug studs (6) on drum (3) for damage.

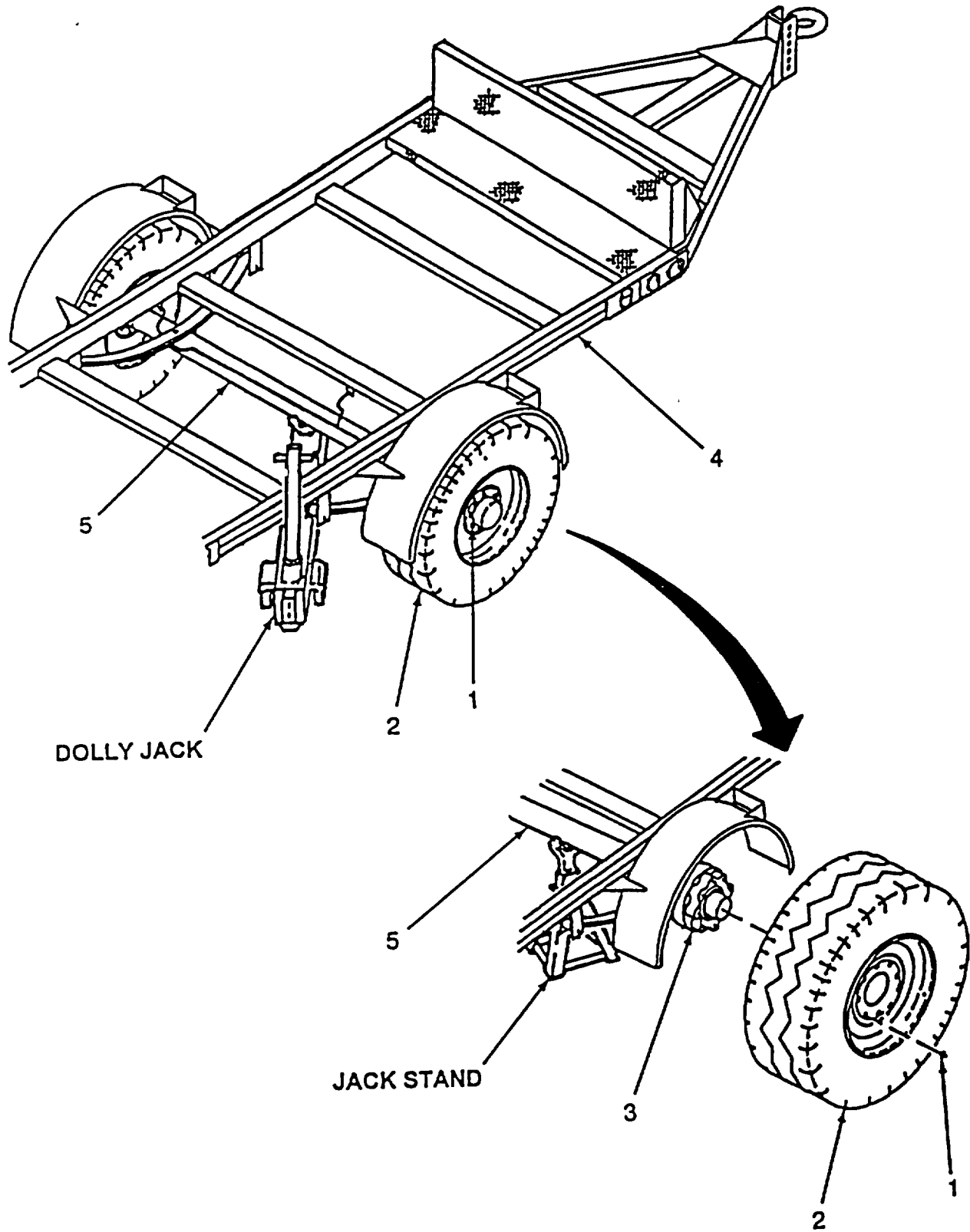


Figure 4-60. Hub and Drum (Sheet 1 of 2)

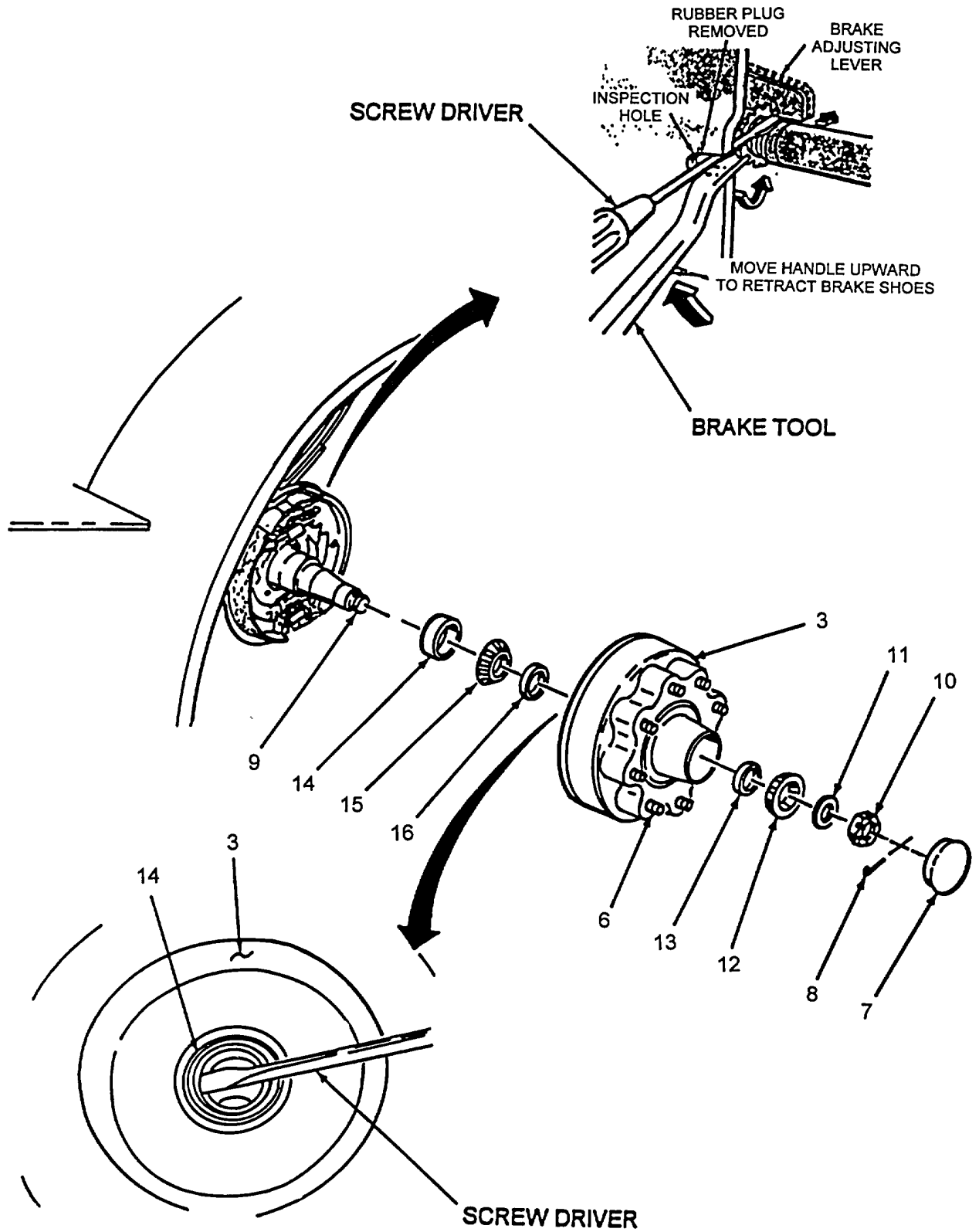


Figure 4-60. Hub and Drum (Sheet 2 of 2)

- (7) Vent trailer air brake system pressure by opening drain valve. Close drain valve after all pressure is released (para. 4-51).

b. Disassembly.

- (1) Dislodge bearing cap (7) from hub and drum (3) by working around the outer circumference of the bearing cap (7) with a hammer and chisel.
- (2) Remove the cotter pin (8) from spindle (9) and discard it.
- (3) Unscrew spindle nut (10) and bearing washer (11) from spindle (9).
- (4) Pull the hub and drum (3) out slightly, then push it back into its original position. This should force the outer bearing (12) off the spindle (9) enough so it can be removed.

NOTE

If drum does not come off the spindle, release tension on brake shoes.

- (5) Remove rubber plug from brake back plate inspection hole and insert screw driver and brake tool through inspection hole. Back off the brake adjustment screw with a screw driver and brake tool while holding the brake adjusting lever away from the wheel until the brake shoes are just slightly a drag on the hub and drum (3). The hub and drum (3) must still be able to rotate freely.
- (6) Pull the hub and drum (3) off the spindle (9).

NOTE

As this is done, note how the grease seal is installed.

- (7) Use a screwdriver to pry the grease seal (14) out of the rear of the hub and drum (3).
- (8) Remove the inner bearing (15) from the hub and drum (3). Wrap inner and outer bearings (12 and 15) in oil proof paper if parts are not to be used right away.
- (9) If bearings (12 and 15) are being replaced, use a puller to remove outer and inner bearing cups (13 and 16) from hub and drum (3).

c. Repair.

WARNING

Dry cleaning solvent is flammable and toxic. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin.

CAUTION

Bearings must not be dried or spun with compressed air. See TM9-213, Inspection, Care and Maintenance of Anti-friction Bearings, for care and maintenance of bearings.

- (1) Use dry cleaning solvent to remove all traces of the old grease from the bearings (12 and 15), hub and drum (3) and spindle (9). A small brush may prove helpful; however make sure no bristles from the brush embed themselves inside the bearing rollers. Allow the pair to air dry.

- (2) Inspect the hub and drum (3) for cracks, score marks, deep scratches and hard spots, which will appear as small discolored areas. If the hard spots cannot be removed with fine emery cloth or if any other conditions listed above exist, the drum must be resurfaced.
- (3) Inspect the wheel assembly (2) for cracks, dents, warping, holes, deformed lug holes, broken or leaky valve stems. Replace if needed.
- (4) Inspect tires for cuts, cracks, holes loose tread, uneven wear, or any other deterioration. Replace if faulty

NOTE

Bearings and bearing cups come as matched sets and new bearings should never be installed in old bearing cups.

- (5) Carefully inspect the bearings (12 and 15) for cracks, heat discoloration, worm rollers, etc. Inner and outer bearing cups (13 and 16) for wear and damage.

d. Assembly.

- (1) Use GAA grease to pack the inner and outer bearings (12 and 15) Work the grease completely into the bearings, forcing it between the rollers, cone and cage from the back side.
- (2) Press inner and outer bearing cups (13 and 16) into hub and drum (3).
- (3) Put a small quantity of grease in board of each bearing cup (13 and 16) inside the hub and drum (3). Using your finger, form a dam at these points to provide extra grease availability and to keep thinned grease from flowing out of the bearings (12 and 15).
- (4) Place the grease-packed inner bearing (15) into the rear of the hub and drum (3) and put a little more grease outboard of the inner bearing (15).
- (5) Place a new grease seal (14) over the inner bearing (15) and tap the grease seal (14) evenly into place with a hammer and blunt punch until it's flush with the hub and drum (3).

e. Installation.

- (1) Apply a thin coat of grease to spindle (9).
- (2) Carefully place the hub and drum (3) onto the spindle (9) and push the grease-packed outer bearing (12) into position.
- (3) Slide hub and drum (3) onto spindle (9) until snug upon back lip of spindle (9).
- (4) Install bearing washer (11) onto spindle (9). Install bearing spindle nut (10) onto spindle (9).
- (5) Hand tighten bearing spindle nut (10) until slightly snug

NOTE

Do not install cotter pin or bearing cap yet.

- (6) Mount wheel assembly (2) onto lug studs (6).

NOTE

Do not lower jack stands yet

- (7) Hand tighten lug nuts (1) on lug studs (6).
- (8) Spin wheel assembly (2) in a forward direction while tightening the spindle nut (10) to approximately 20 ft-lbs. to seat the bearings (12 and 15) and remove any grease or burns which could cause excessive bearing play later.
- (9) Loosen the spindle nut (10) 1/4 turn, then using your hand (not a wrench of any kind), tighten the spindle nut (10) until it's snug.
- (10) Install new cotter pin (8) through the hole in the spindle (9) and the slots in the bearing spindle nut (10). Bend the ends of the cotter pin (8) until they're flat against the bearing spindle nut (10). Cut off any extra length which could interfere with the bearing cap (7).
- (11) Install bearing cap (7), tapping it into place onto hub and drum (3) with a hammer.
- (12) Place jack under axle assembly (5) and lift trailer assembly (4) until it clears jack stand. Lower jack stands and remove from under trailer assembly (4).
- (13) Tighten stud nuts (1) alternately and evenly. Torque to 110-120 lb-ft.
- (14) Check tires for correct air pressure of 55 psi.

4-61. BRAKES - REPLACE/REPAIR.

This Task Covers:	a. Removal	b. Repair	c. Installation
	d. Bleeding		

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Tool Kit, Common Number 1 (Appendix B, Item 2)

Materials/Parts Required

Rags, wiping (Appendix E, Section II, Item 1).
 Brake Fluid (Appendix E, Section II, Item 2).
 GAA Grease (Appendix E, Section II, Item 15)

Equipment Condition

Unit shut down and cool.
 Unit parked on dry, level ground.
 Trailer connected to towing vehicle.
 Hub and drum removed (para. 4-60)

a. Removal. (Refer to Figure 4-61.)

- (1) Remove two shoe return springs (1) and retainer plate (2) from back plate (3).
- (2) Remove retainer spring (4) and brake adjustment screw (5) from back plate (3)..
- (3) Turn 1/2 turn and remove spring and cup (6), and pins (7) from back plate (3) and remove brake shoes (8).
- (4) Loosen brake line (9) and bleed emerging fluid into a clean jar or container.
- (5) Remove two bolts (10) from back of brake wheel cylinder (11) and remove brake wheel cylinder (11).
- (6) Disconnect brake line (9) at rear of brake wheel cylinder (11).
- (7) Remove five nuts (12), five washers (13), and back plate (3) off of spindle (14). Remove rubber plug (15).

b. Repair.

- (1) Inspect back plate (3) for cracks, wear, or damage Replace if faulty.
- (2) Inspect brake wheel cylinder (11) for damage or leakage. Replace if damaged.
- (3) Measure brake lining thickness on brake shoes (8); if less than 1/8", replace brake shoes (8).
- (4) Replace brake adjustment screw (5) if worn, corroded, or bent Replace if there is wear on knurled wheel.
- (5) Inspect shoe return springs (1), and retainer springs (4), for cracks or distortion. Replace if faulty.

c. Installation.

- (1) Install back plate (3) onto spindle (14) and install five washers (13) and five nuts (12) onto spindle (14) studs. Tighten five nuts (12). Install rubber plug (15).
- (2) Hold brake wheel cylinder (11) in place before securing it and install brake line (9) hand tight. This will prevent cross threading fitting threads.
- (3) Install two bolts (10) through the back of back plate (3) into brake wheel cylinder (11). Tighten.
- (4) Tighten brake line (9) on rear of brake wheel cylinder (11).
- (5) Apply GAA grease to the areas on the backing plate (3) that support the brake shoes (8) (don't use too much grease or get it on the brake shoes (8) or brake drum).
- (6) Install pins (7) through both sides of back plate (3). Install brake shoes (8) over pins (7) securing them with springs and cups (6).
- (7) Lubricate the threads and the sliding surface of the button of the adjusting screw (5) with GAA grease.
- (8) Install retainer spring (4) and adjusting screw (5) to brake shoes (8).
- (9) Install retainer plate (2) and shoe springs (1) to brake shoes (8).

d. Bleeding.

NOTE

Check the fluid level often during the bleeding operation and add brake fluid as necessary to prevent the fluid level from falling low enough to allow air bubbles into the master cylinder.

- (1) After hub and drum is installed, remove the brake cylinder cap (16) and fill the master cylinder (17) with brake fluid.
- (2) Install brake cylinder cap (16) hand tight.

NOTE

Make sure that free end of hose (18) is below the level of brake fluid.

When bleeding, make sure the brake fluid coming out of the bleeder is not only free of bubbles, but clean also.

- (3) Slide one end of plastic hose (18) over wheel cylinder bleeder screw (19). Place free end of hose into container (20). Half fill the container (20) with brake fluid.
- (4) Have your helper pump the brakes a few times to get pressure in the system, then hold the pedal firmly depressed.
- (5) While the pedal is held depressed, open the bleeder screw (19) just enough to allow a flow of fluid to leave the valve. Watch for air bubbles to exit the submerged end of the plastic hose (18). When the fluid flow slows after a couple of seconds, tighten the bleeder screw (19), then have your helper release the pedal.

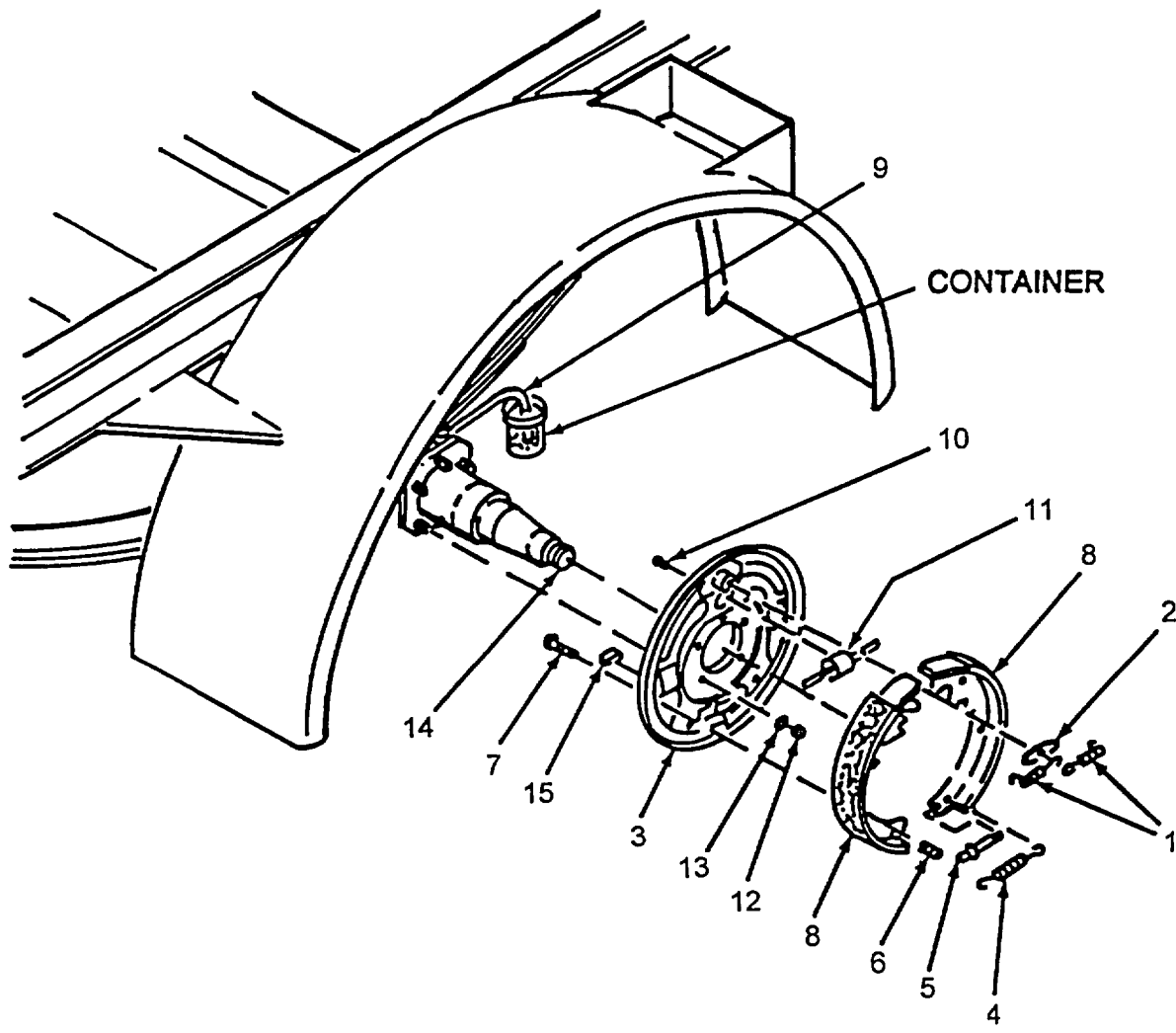


Figure 4-61. Brakes (Sheet 1 of 2)

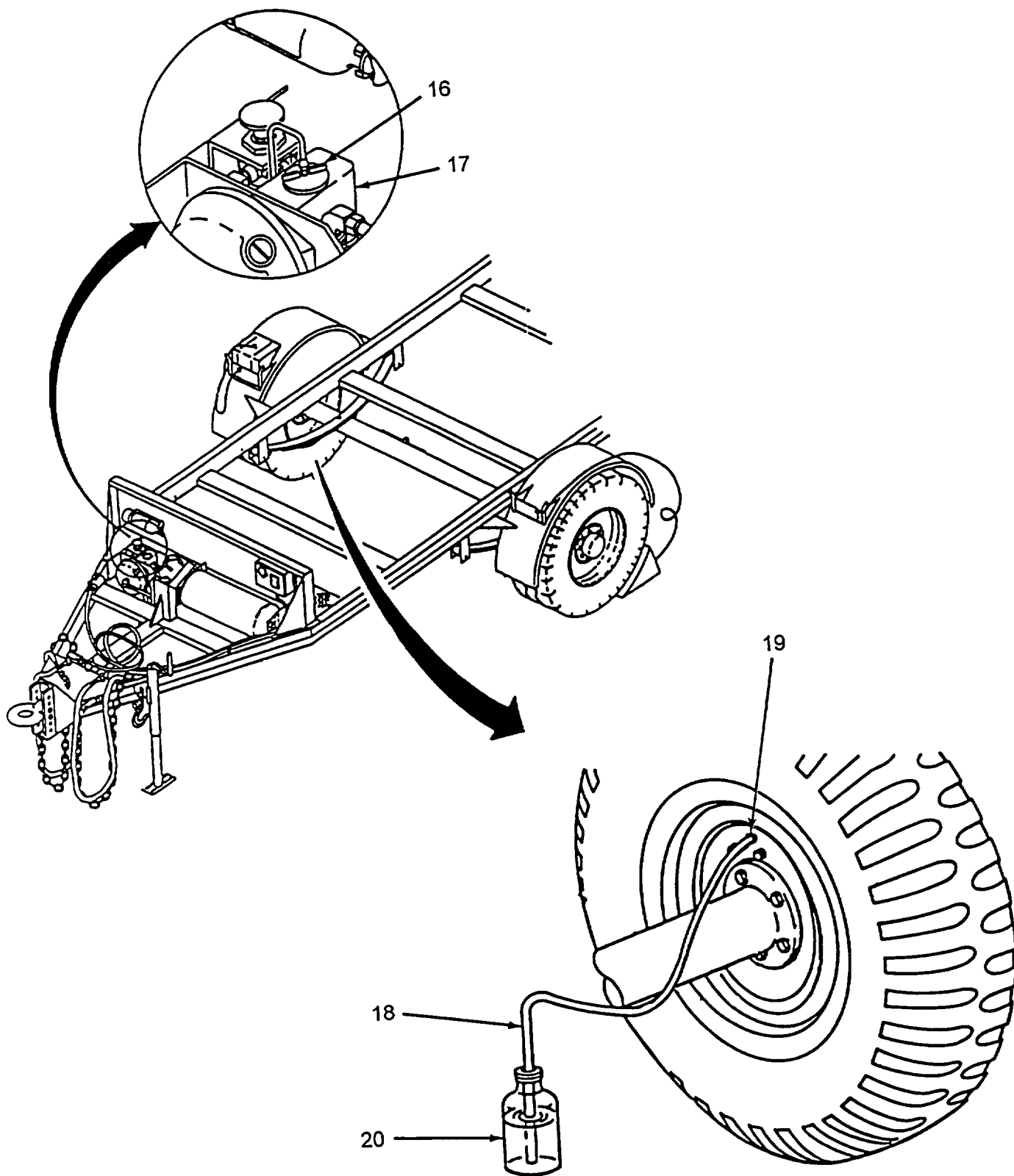


Figure 4-61. Brakes (Sheet 2 of 2)

- (6) Refill the master cylinder (17) with new brake fluid at the end of the operation.
- (7) Check the operation of the brakes.
- (8) Repeat above steps (1 through 7) for opposite side.

Section VI. PREPARATION FOR STORAGE OR SHIPMENT**4-62. SCOPE.**

- a. This section provides instructions on preserving and protecting the lube unit in preparation for shipment.
- b. Protection for the lube unit must be sufficient to protect the material against deterioration and physical damage.

4-63. CLEANING.**WARNING**

Dry cleaning solvent is flammable and toxic. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin.

NOTE

Prior to application of preservatives, surfaces must be cleaned to ensure removal of corrosion, soil, grease, or other acid and alkaline residues.

Clean exterior surfaces of lube unit to ensure removal of all dirt and foreign matter. After cleaning, immediately dry parts to remove excess cleaning solutions or residual moisture. Allow parts to air dry or wipe with clean, dry, lint-free cloths (App. E, Sect. II, Item 1).

4-64. LUBRICATION.

After cleaning has been accomplished, wipe all grease fittings clean with dry cleaning solvent (App. E, Sect. II, Item 3) and lubricate the lube unit in accordance with companion publication LO 5-4930-244-12, Lubrication Order Remove excess grease after lubrication and before processing.

4-65. PRESERVATION AND PACKING/PREPARATION FOR SHIPMENT.

- a. Refer to TM 38-230-1, Preservation and Packing of Military Equipment.
- b. Prepare all Army shipping documents accompanying lube unit in accordance with DA Pam 738-750.

4-66. SPECIAL INSTRUCTIONS FOR ADMINISTRATIVE STORAGE.

- a. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.
- b. Before placing equipment in administrative storage, current Preventive Maintenance Checks and Services (PMCS) should be completed, shortcomings and deficiencies should be corrected, and all Modification Work Orders (MWO's) should be applied.
- c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers and other containers may be used.

**CHAPTER 5
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS**

Paragraph		Page
Section I	Direct Support Maintenance Instructions	5-1
5-1.	Skid Assembly.....	5-2
5-2.	Transfer Pump	5-4
5-3.	A-Frame.....	5-10
5-4.	Fuel Tank Assembly	5-12
5-5.	Gear-Lube and Oil Dispensers	5-14
5-6.	Battery Box	5-18
5-7.	Reel Cabinet Frame	5-20
5-8.	Air Pump	5-22
5-9.	Air Tank	5-29
5-10.	Diesel Engine	5-32
	Fuel Pipe and Leak-off Pipe	5-33
	Fuel Injector	5-35
	Fuel Control Solenoid Valve	5-37
	Fuel Injector Pump.....	5-39
	Fuel Filter Head.....	5-42
	Fuel Lift Pump	5-44
	Crankcase Breather Assembly.....	5-46
	Variable Speed Control	5-48
	Stop/Run Lever	5-51
	Engine Air Cowling.....	5-53
	Lubricating Oil Pipe	5-55
	Oil Pan, Gasket and Strainer	5-57
	Cylinder Head and Cylinder Barrel	5-59
	Intake, Exhaust Valves and Decompression Lever Adjustment	5-63
5-11.	Low Pressure Pump	5-65
5-12.	High Pressure Pump	5-72
5-13.	Lube Tank	5-80
5-14.	Heater Wiring Harness.....	5-85
5-15.	Skid Weldment	5-87
5-16.	Intervehicular Wiring Harness	5-88
5-17.	Trailer Wiring Harness	5-90
5-18.	Axle Assembly	5-93
5-19.	Trailer Frame	5-96

5-1. SKID ASSEMBLY - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Hoist.

Common Tool Kit #1 (Appendix B, Section III, Item 2).

Nut, self-locking (Appendix H, Section II, Item 11).

Equipment Condition

Unit shut down and cool

Enclosure removed (para. 4-13).

Personnel Required

2

WARNING

- **Chock wheels on trailer when working on unit; trailer could roll and cause injury.**
- **Personnel must stand clear when unit is lifted. Chains could snap or the load could shift causing the unit to fall.**
- **Make sure lifting rings are tight before attaching chains.**
- **Inspect chains and hooks for defects; repair if necessary.**

a. Removal. (Refer to Figure 5-1).

- (1) Remove six bolts (1), six beveled washers (2), from skid assembly (3), six self-locking nuts (4) from trailer (5). Discard six self-locking nuts.
- (2) Attach and secure chains to lifting rings (6).
- (3) Attach and secure other ends of chains to lifting device.
- (4) Slowly lift skid assembly (3) off trailer (5). Place skid assembly (3) on firm level surface.

b. Installation.

- (1) Lift skid assembly (3) with lifting device. Position and set skid assembly (3) onto trailer (5).
- (2) Insert six bolts (1), through beveled washers (2), skid assembly (3) and trailer (5). Attach six self-locking nuts (4) to bolts (1).
- (3) Remove chains from lifting rings (6).

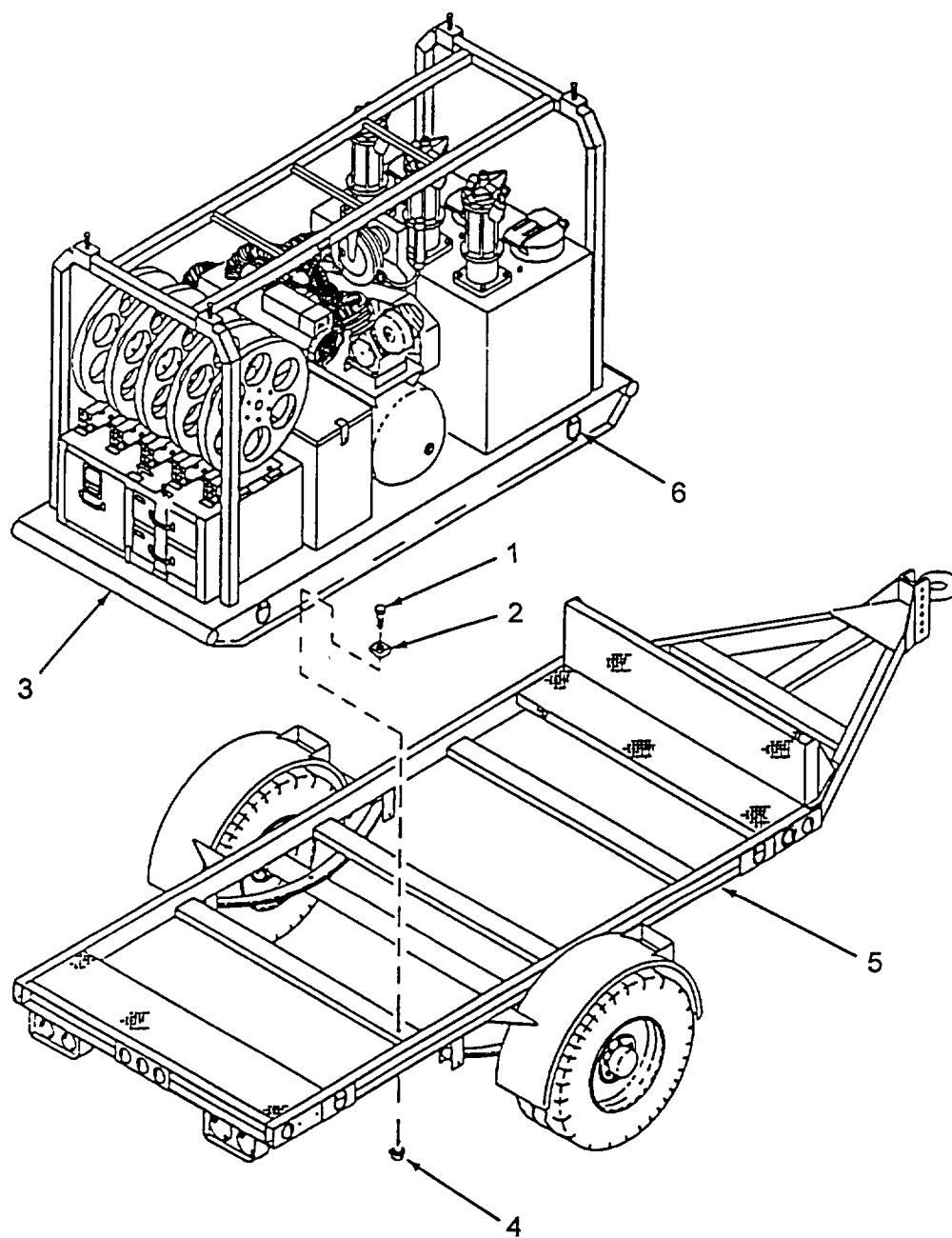


Figure 5-1. Skid Assembly

5-2. TRANSFER PUMP - REPAIR.

This Task Covers: a. Disassembly b. Repair c. Assembly

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Pin, Cotter (Appendix H, Section II, Item 3).
Block, "V" Packing (Appendix H, Section II, Item 12).
O-Ring (Appendix H, Section II, Item 13 and 14).
Packing Set (Appendix H, Section II, Item 15).
Teflon Tape (Appendix E, Section II, Item 7).

Equipment Condition

Transfer Pump removed from unit (para. 4-19).

a. Disassembly. (Refer to Figure 5-2).

- (1) Remove quick-disconnect nipple (1) from ball valve (2).
- (2) Remove ball valve (2) from power head assembly (3).
- (3) Remove hex-head bushing (4) from pump casting (5).

NOTE

Some precision parts may be clamped into a vise, it is recommended that the vise be equipped with non-destruct jaws.

- (4) Grip the pump casting (5) in a vise by clamping to the flat parts on the outlet body of the pump casting (5).
- (5) Loosen and remove jam nut (6) and bung adapter (7) from cylinder (8).
- (6) Remove aluminum gasket (9) from pump casting (5).
- (7) Unscrew power head assembly (3) from pump casting (5) to expose cotter pin (10).
- (8) Remove cotter pin (10) releasing piston assembly (11).
- (9) Remove o-ring (12) and packing screw (13) and packing set (14) from pump casting (5). Discard o-ring (12) and packing set (14).

CAUTION

DO NOT mount the cylinder in the vise as the pressure of the vise jaws can distort the cylinder.

- (10) Remove the pump casting (5) from the vise and clamp the valve base (15) in the vise.
- (11) Using a strap wrench (or a pump wrench if necessary), unscrew the cylinder (8).
- (12) Remove o-ring (16), stop nut (17), valve base (15), washer (18), and stud (19) from cylinder (8). Remove valve base (15) from the vise.
- (13) Unscrew stop nut (20) from rod and stop assembly (21).
- (14) Remove plunger (22), and flat washer (23) from rod and stop assembly (21).
- (15) Clean the air cylinder assembly (24) and inspect it for a smooth bore.
- (16) Check the conical spring (25) which is part of cylinder (8) for looseness or breakage.
- (17) Unscrew adapter assembly (26) from air cylinder assembly (24), removing o-ring (27), v-block packing (28) and backup washer (29) from adapter assembly (26).
- (18) Remove the three elastic stop nuts (30), three aluminum gaskets (31), three screws (32), three spacers (33), and seal plate (34).
- (19) With wrench, hold the piston assembly (11) with the flats at the top and remove adapter (35).
- (20) Remove washer (36), piston packing (37), washer (38) and washer (39).
- (21) Remove spring (40), spacer (41), washer (42), and copper crush gasket (43). Remove o-ring (44) from adapter (35).

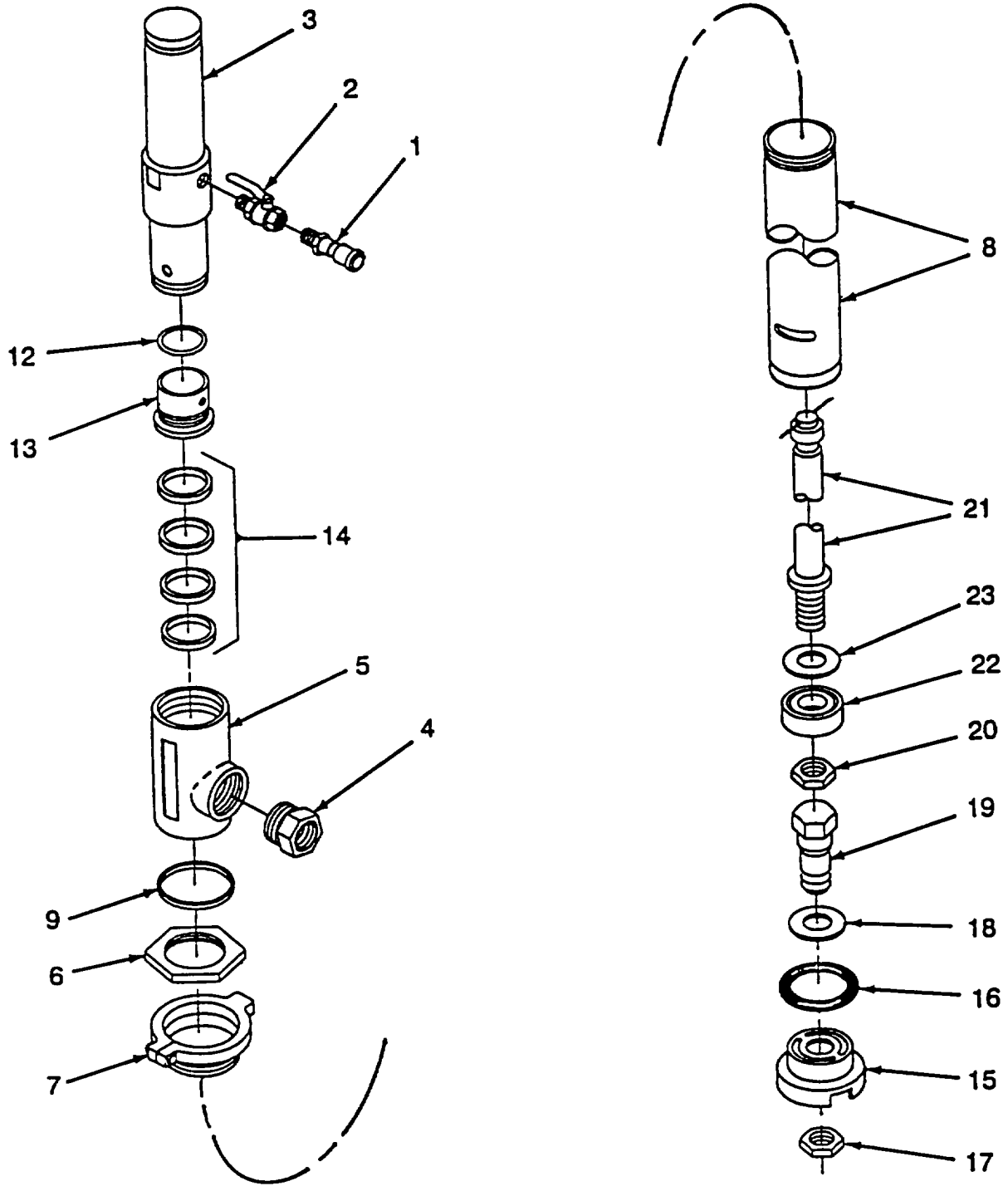


Figure 5-2. Transfer Pump (Sheet 1 of 2)

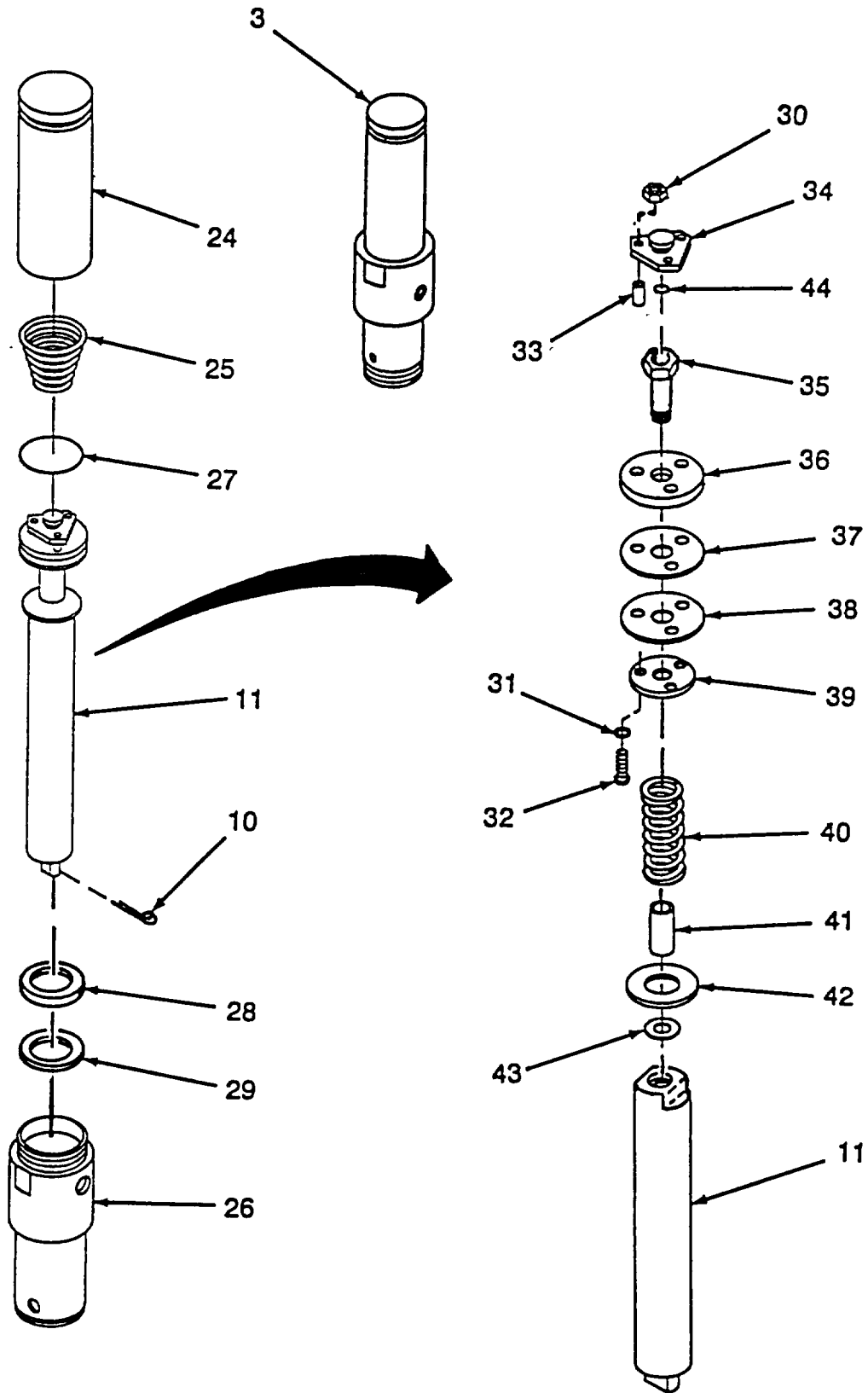


Figure 5-2. Transfer Pump (Sheet 2 of 2)

- b. Repair.
- (1) Clean the air cylinder and inspect it for a smooth interior.
 - (2) Clean all parts which have been removed.
 - (3) Repair is limited to defective components.
 - (4) Replace all parts that have a replacement part in the kit.

c. Assembly.

NOTE

Lubricate all packings, o-rings and sealing rings with SAE No. 10 oil or lubricant supplied in repair kit.

- (1) Install adapter (35) through washer (36), piston packing (37), washer (38) and washer (39).
- (2) Install new o-ring (44) into adapter (35).

NOTE

Ensure that piston packing is installed with the surface marked "Top Side" facing up.

CAUTION

Washers (36 and 38) must be installed in order as shown or leakage will occur. Washer (36) is thicker than washer (38).

- (3) Position three spacers (33) under seal plate (34). Install lower part of three spacers (33) through washer (36), piston packing (37), washer (38) and washer (39).
- (4) Install three aluminum gaskets (31) and three screws (32) through three spacers (33). Install three plastic stop nuts (30) onto three screws (32). Torque the three plastic stop nuts (30) to 2327 inch-lbs.
- (5) Install spring (40), spacer (41), washer (42) and copper crush gasket (43) onto adapter (35).

NOTE

DO NOT distort spacer.

- (6) Tighten adapter (35) into piston assembly (11) until it seats against copper crush gasket (43). Torque adapter to 20 ft. lbs.
- (7) Lubricate the bore of air cylinder assembly (24) and piston packing (37) with all its attached parts with SAE No. 10 oil or lubricant supplied in repair kit.
- (8) Insert v-block packing (28), so that it faces the top of the air cylinder assembly (24) and back-up washer (29) into adapter assembly (26).

NOTE

Be careful not to cross-thread the air cylinder assembly (24) or the adapter assembly (26).

- (9) Initially, tighten air cylinder assembly (24) hand tight only.

NOTE

Care must be taken when installing packing set (14) to avoid damage from threads in pump casting (5).

- (10) Install packing set (14) into pump casting (5).
- (11) Install o-ring (12) onto packing screw (13) Install power head assembly (3), packing screw (13) into pump casting (5).
- (12) Install piston assembly (11) into adapter assembly (26).
- (13) Install o-ring (27) and air cylinder assembly (24) with conical spring (25) onto piston assembly (11).
- (14) Install drive power head assembly (3) into pump casting (5)
- (15) Install flat washer (23) and plunger (22) onto rod and stop assembly (21)
- (16) Install stop nut (20) onto rod and stop assembly (21). Tighten.
- (17) Install o-ring (16) onto valve base (15).
- (18) Install washer (18) onto stud (19) and through valve base (15) securing them using stop nut 917) Tighten
- (19) Install rod and stop assembly (21) with all its attached parts into cylinder (8)
- (20) Install cotter pin (10) into piston assembly (11) and rod and stop assembly (21)
- (21) Install stud (19) and all its attached parts into cylinder (8), securing it using valve base (15)
- (22) Install cylinder (8), aluminum gasket (9), bung adapter (7) and jam nut (6) into bottom of pump casting (5)

NOTE

Before installation, wrap threads on hex-head bushing, ball valve, and quick-disconnect nipple with Teflon Tape

- (23) Install hex-head bushing (4) into the side of pump casting (5).
- (24) Install ball valve (2) into the side of the power head assembly (3).
- (25) Install quick-disconnect nipple (1) into ball valve (2)

5-3. A-FRAME - REPLACE/REPAIR.

This Task Covers:	a. Removal	b. Repair	c. Installation
--------------------------	-------------------	------------------	------------------------

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Common Tool Kit #1 (Appendix B, Section III, Item 2).
 Electric Welder (Appendix B, Section III, Item 3).

Materials/Parts Required

Nut, self-locking (Appendix H, Section II, Item 11).

Equipment Condition

Unit shut down and cool.
 Enclosure removed (para. 4-13).
 Skid Assembly removed (para. 5-1).
 Lube Supply Hoses removed (para. 4-18).
 Transfer Pump removed (para. 4-19).

References

FM 43-2, Metal Body Repair and Related Operations.
 TM 43-0139, Painting Instructions for Field Use.
 TM 9-237, Welding Theory and Application.

Personnel Required

4

-
- a. Removal. (Refer to Figure 5-3).
 - (1) Remove twelve hex head - cap screws (1), twelve washers (2) and twelve self-locking nuts (3) holding A-frame (4) onto skid weldment (5). Discard twelve self-locking nuts. Typical four places.
 - (2) Lift A-frame (4) from skid weldment (5).

 - b. Repair.
 - (1) Inspect A-frame (4) for dents, cracks, or corrosion.
 - (2) Fix dents as needed. (Ref. FM 43-2).
 - (3) Weld cracks as needed. (Ref. TM 9-237).
 - (4) Clean off corrosion with wire brush then repaint in accordance with TM 43-0139.

 - c. Installation.
 - (1) Align A-frame (4) up with holes in skid weldment (5). Install A-frame (4) into skid weldment (5).
 - (2) Install twelve hex - cap screws (1) into skid weldment (5), securing it using twelve washers (2) and twelve new self-locking, flanged nuts (3). Typical four places.

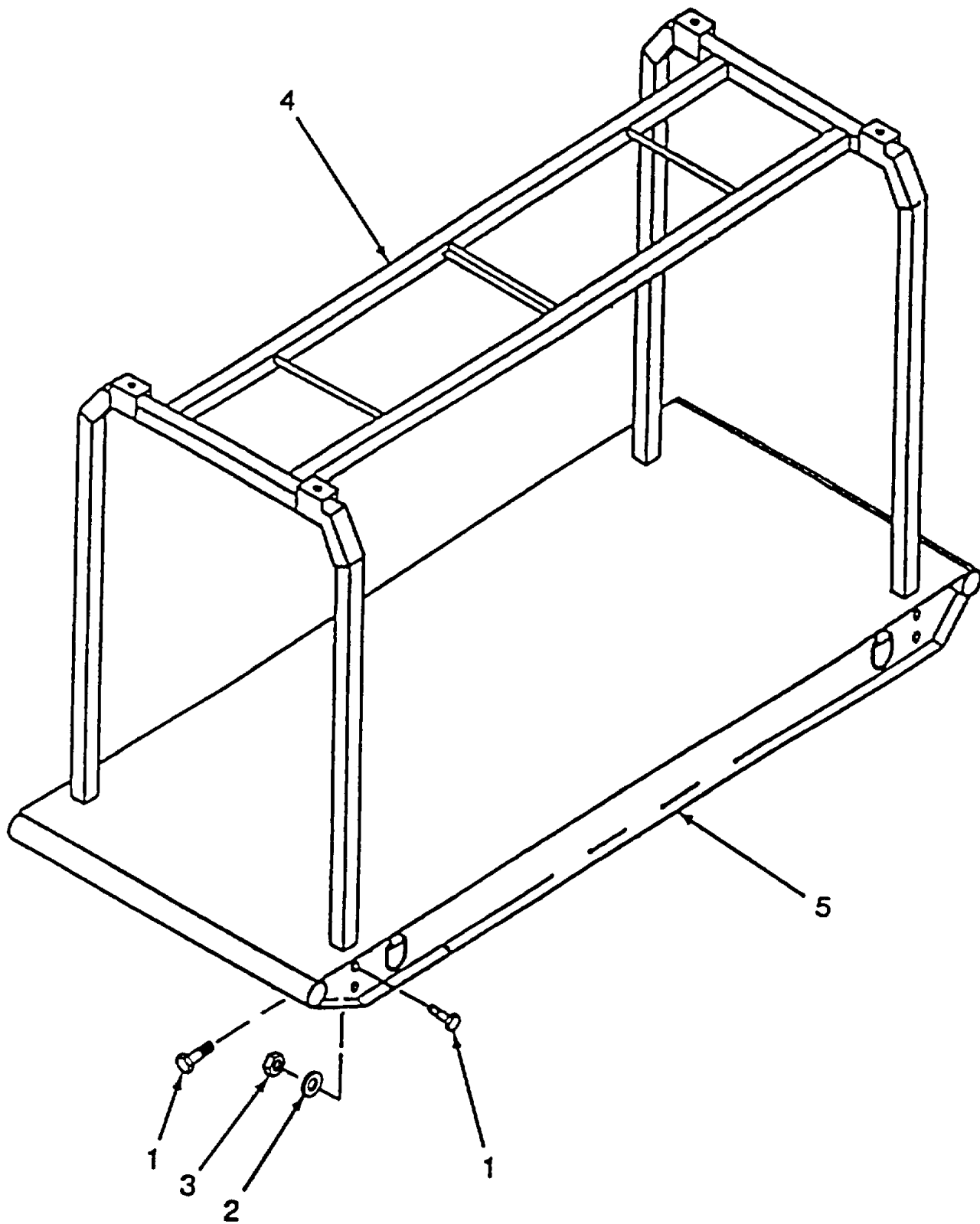


Figure 5-3. A-Frame

5-4. FUEL TANK - REPAIR.

This Task Covers: a. Repair

Initial Setup:

Tools and Test Equipment Required

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Electric Welder (Appendix B, Section III, Item 3).

Materials/Parts Required

Rags, wiping (Appendix E, Section II, Item 1).
Dry cleaning solvent (Appendix E, Section II, Item 3).

Equipment Condition

Unit shut down and cool.
Enclosure removed (para. 4-13).
Fuel Tank Assembly removed (para. 4-21).

References

FM 43-2, Metal Body Repair and Related Operations.
TM 9-237, Welding Theory and Application.
TM 43-0139, Painting Instruction for Field Use.

Personnel Required

2

WARNING

- Use caution when working with diesel fuel; it is flammable.
- Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 1000 F to 1380 F (380 C to 590 C).

- a. Repair. (Refer to Figure 5-4).
- (1) Thoroughly flush out fuel tank (1) with dry-cleaning solvent. Observe all warnings listed above.
 - (2) Inspect fuel tank (1) for cracks or broken weldments, dents or distortion. Repair as required.
 - (3) Clean off corrosion with wire brush, then repaint in accordance with TM 43-0139.
 - (4) Fix dents as needed. (Reference FM 43-2).
 - (5) Weld cracks as needed. (Reference TM 9-237).

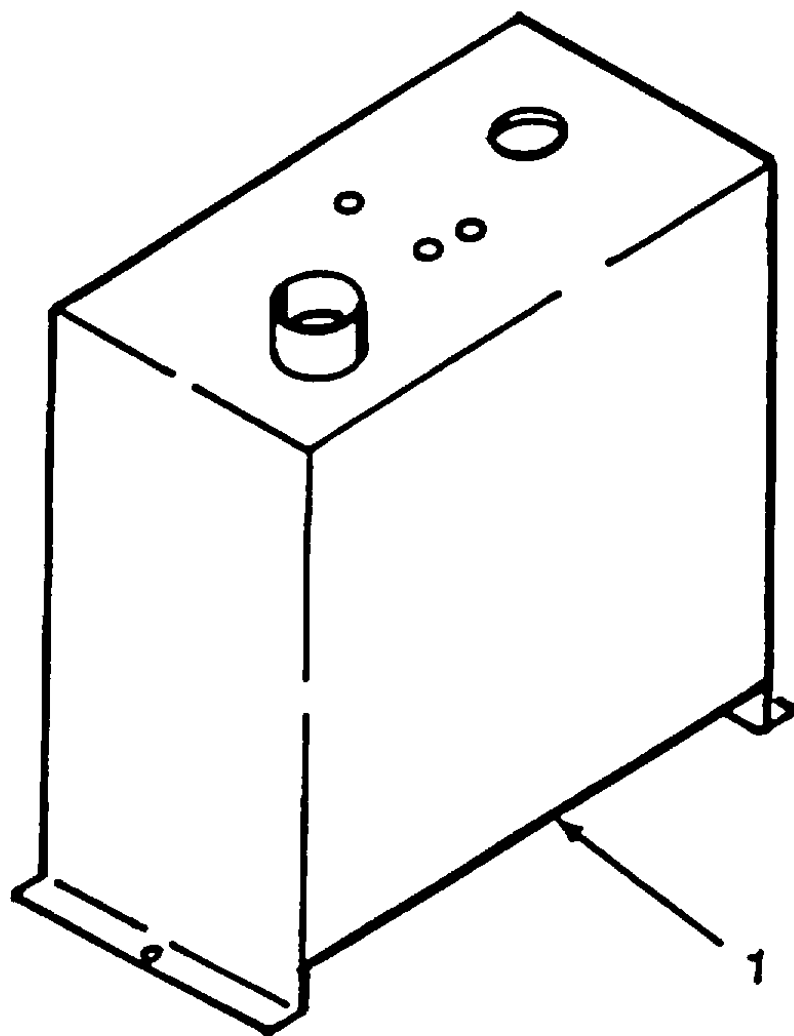


Figure 5-4. Fuel Tank

5-5. GEAR-LUBE AND OIL DISPENSERS - REPAIR.

This Task Covers:	a. Disassembly	b. Repair	c. Assembly
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Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1).

Equipment Condition

Unit shut down and cool.

Gear Lube and Engine Oil Dispensers removed (para. 4-23).

-
- a. Disassembly. (Refer to Figure 5-5).

Gear-Lube.

- (1) Remove two retaining rings (1) from pin (2) on both sides of lever (3).
- (2) Remove pin (2) from oil lube dispenser (4) and lever (3).
- (3) Remove lever (3) from oil lube dispenser (4).
- (4) Remove oil lube nozzle assembly (5) from oil lube dispenser (4).
- (5) Remove four screws (6) from dial (7).
- (6) Remove dial (7) and totalizer (8) from oil lube dispenser (4). Oil Lube
- (7) Remove two retaining rings (9) from pin (10) on both sides of lever (11).
- (8) Remove pin (10) from gear lube dispenser (12).
- (9) Remove extension (13) from gear lube dispenser (12).
- (10) Remove gear lube nozzle assembly (14) from extension (13).
- (11) Remove four screws (15) from dial (16).
- (12) Remove dial (16) totalizer (17) from gear lube dispenser (12).

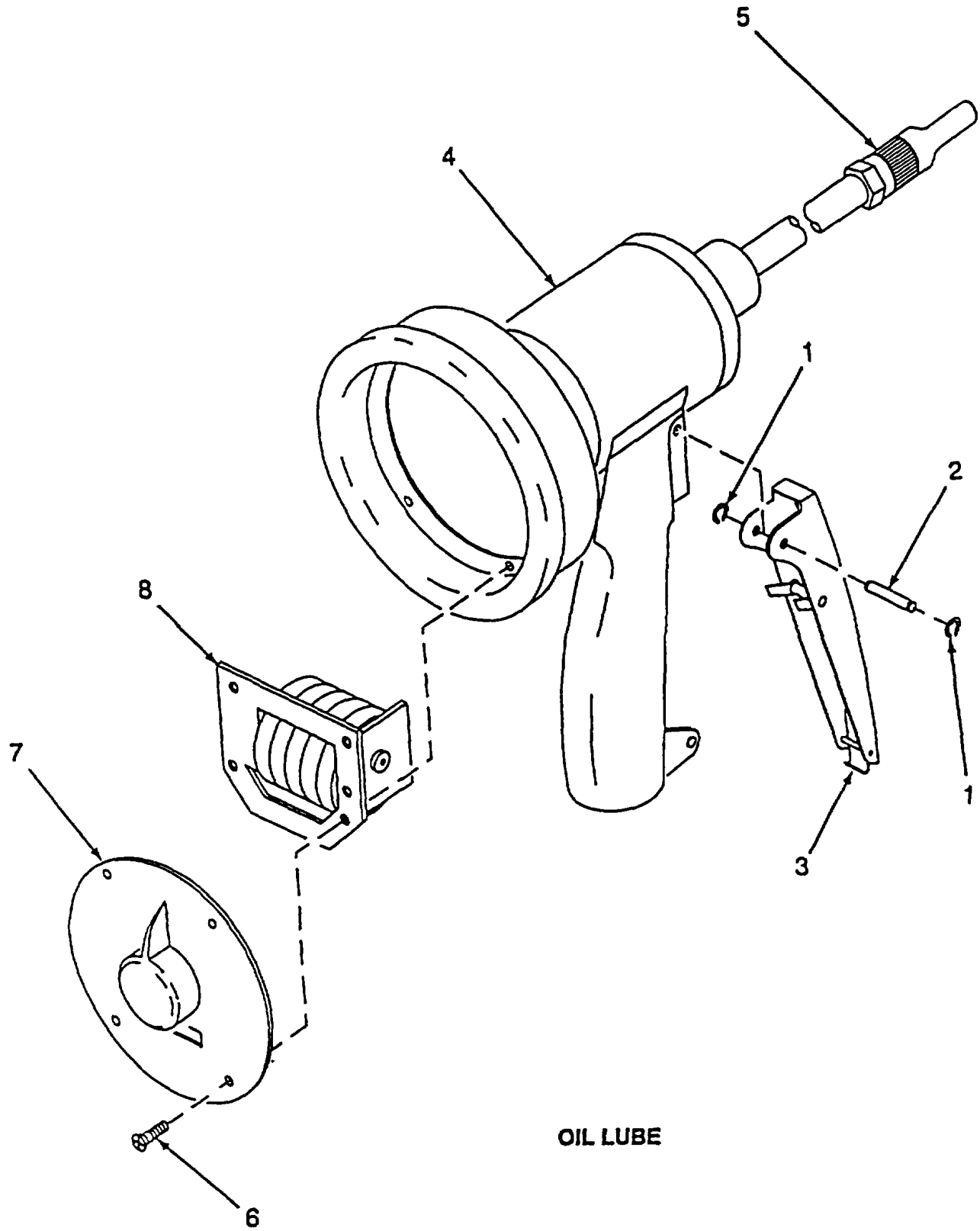
- b. Repair.

Inspect all parts for wear or damage. Replace as needed.

c. Assembly.

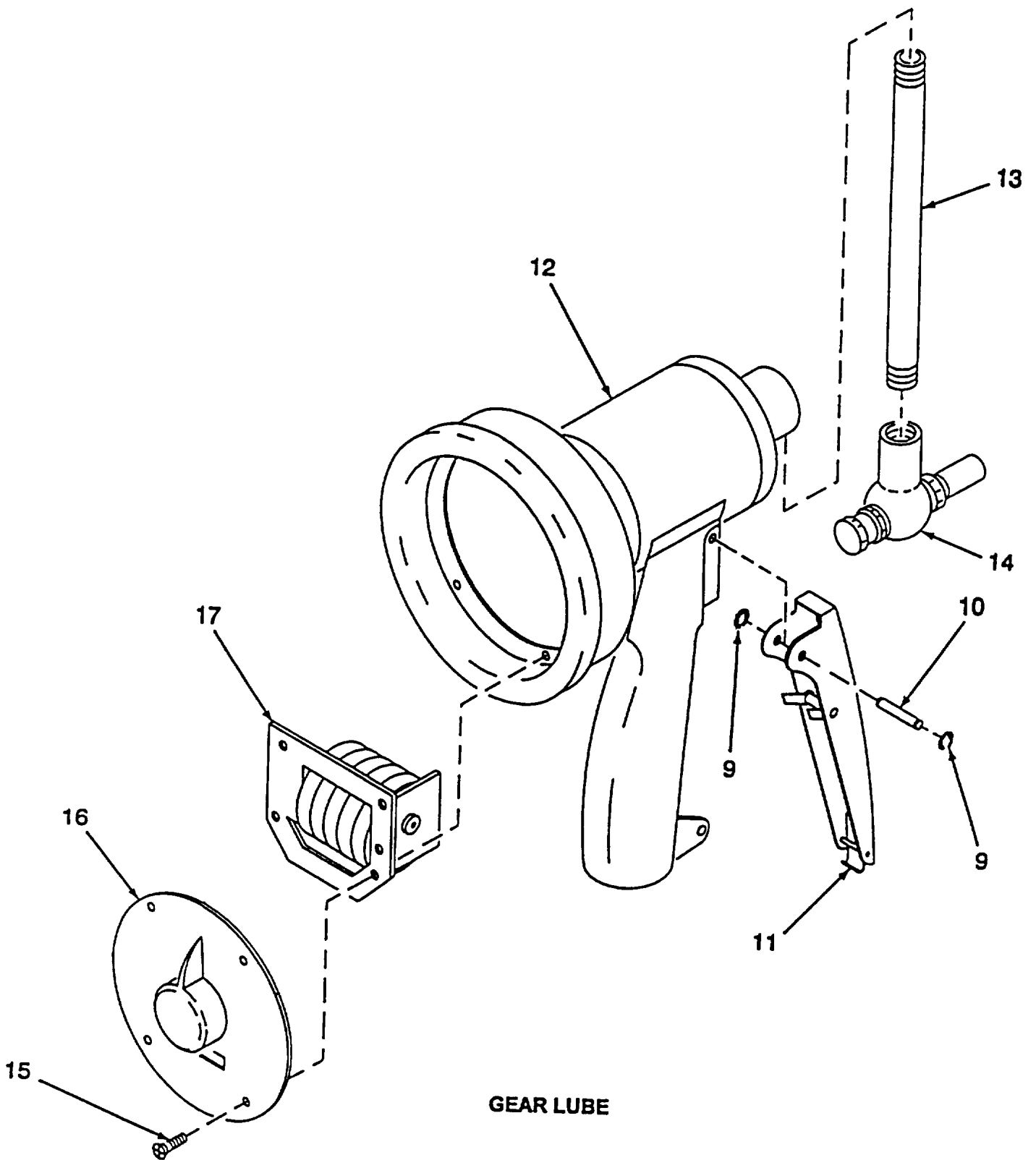
Oil Lube.

- (1) Install totalizer (8) into oil lube dispenser (4).
- (2) Place dial (7) onto totalizer (8) and install four screws (6) through totalizer (8) into oil lube dispenser (4). Tighten screws (6).
- (3) Install oil lube nozzle assembly (5) into oil lube dispenser (4).
- (4) Install lever (3) onto oil lube dispenser (4).
- (5) Install pin (2) through lever (3) and oil lube dispenser (4) Install two retainer rings (1) on each end of pin (2) Gear-Lube.
- (6) Install totalizer (17) into gear lube dispenser (12).
- (7) Place dial (16) onto totalizer (17) and install four screws (15) through totalizer (17) into gear lube dispenser (12) Tighten screws (15).
- (8) Install gear lube nozzle assembly (14) onto extension (13)
- (9) Install extension (13) into gear lube dispenser (12).
- (10) Install level (11) onto gear lube dispenser (12).
- (11) Install pin (10) through lever (11) and gear lube dispenser (12). Install two retainer rings (9) on each side of pin (10).



OIL LUBE

Figure 5-5. Gear Lube and Oil Dispensers (Sheet 1 of 2)



GEAR LUBE

Figure 5-5. Gear Lube and Oil Dispenser (Sheet 2 of 2)

5-6. BATTERY BOX - REPAIR.

This Task Covers: a. Repair

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1). K,
Electric Welder (Appendix B, Section III, Item 3).

Materials Parts Required

Wiping Rags (Appendix E, Section II, Item 1).
Dry cleaning solvent (Appendix E, Section II, Item 3).
Terminal, Battery, Positive (Appendix H, Section II, Item 78).
Terminal Battery, Negative (Appendix H, Section II, Item 79).

Equipment Condition

Unit shut down and cool.
Battery Box Removed (para. 4-26).

References

FM 43-2, Metal Body Repair and Related Operations.
TM 9-237, Welding Theory and Application.
TM 43-0139, Painting Instruction for Field Use.

- a. Repair. (Refer to Figure 5-6).

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**

- **DO NOT smoke when working with solvents.**

- (1) Thoroughly flush out battery box (1) with dry-cleaning solvent. Observe all warnings listed above.
- (2) Inspect all sheet metal parts for cracks or broken weldments, dents or distortion. Repair as required.
- (3) Clean off corrosion with wire brush, then repaint in accordance with TM 43-0139.
- (4) Fix Dents as needed. (Reference FM 43-2).
- (5) Weld cracks as needed. (Reference TM 9-237).

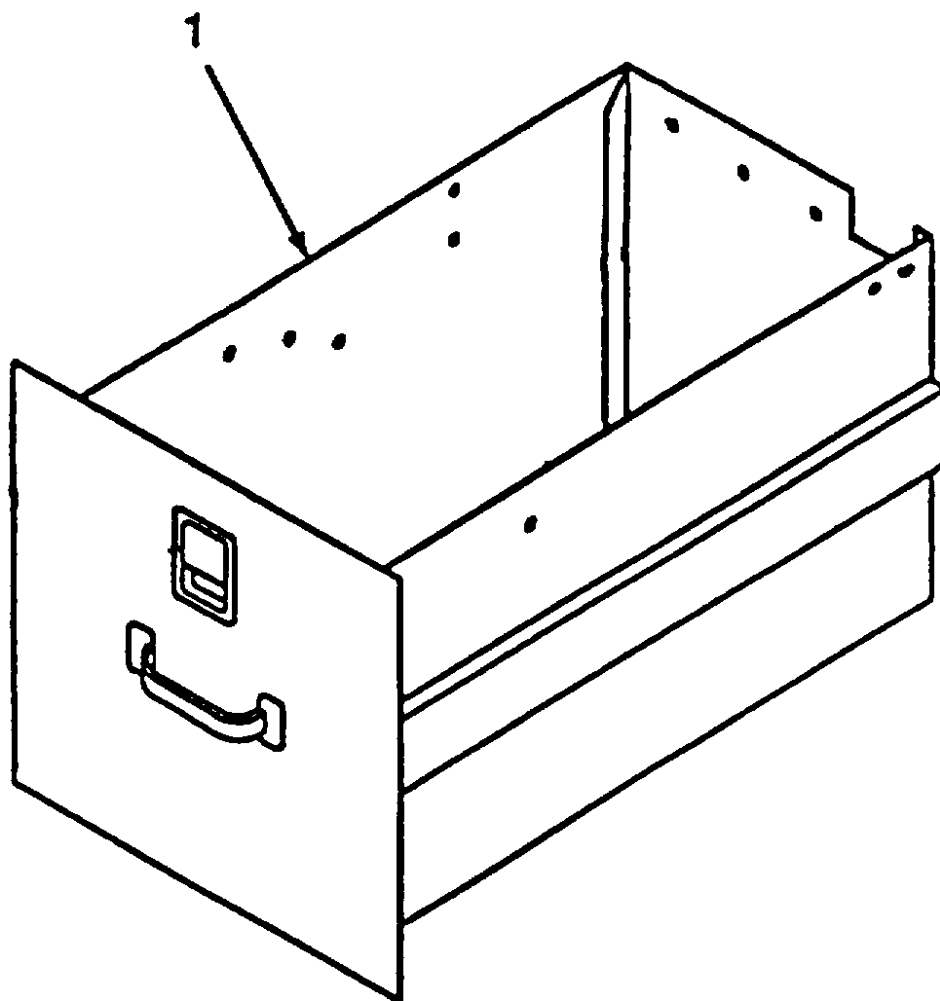


Figure 5-6. Battery Box

5-7. REEL CABINET FRAME - REPAIR.

This Task Covers: a. Repair

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Electric Welder (Appendix B, Section III, Item 3).

Materials Required

Dry cleaning solvent (Appendix E, Section II, Item 3).

References

FM 43-2, Metal Body Repair and Related Operations.
TM 9-237, Welding Theory and Application.
TM 43-0139, Painting Instructions for Field Use.

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para. 4-13).
Reel Cabinet Assembly Removed (para. 4-28).
Battery Box Removed (para. 4-26).
Condensate Drain Assembly Removed (para. 4-27).
Reel Assembly Removed (para. 4-25).

- a. Repair. (Refer to Figure 5-7).

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**

- (1) Use dry cleaning solvent to clean all areas of cabinet.
- (2) Inspect cabinet frame for cracks, defective drawer guides, broken weldments and other damage.
- (3) Clean off corrosion with wire brush, then repaint in accordance with TM 43-0139.
- (4) Fix dents as needed. (Reference FM 43-2).
- (5) Weld cracks as needed. (Reference TM 9-237).

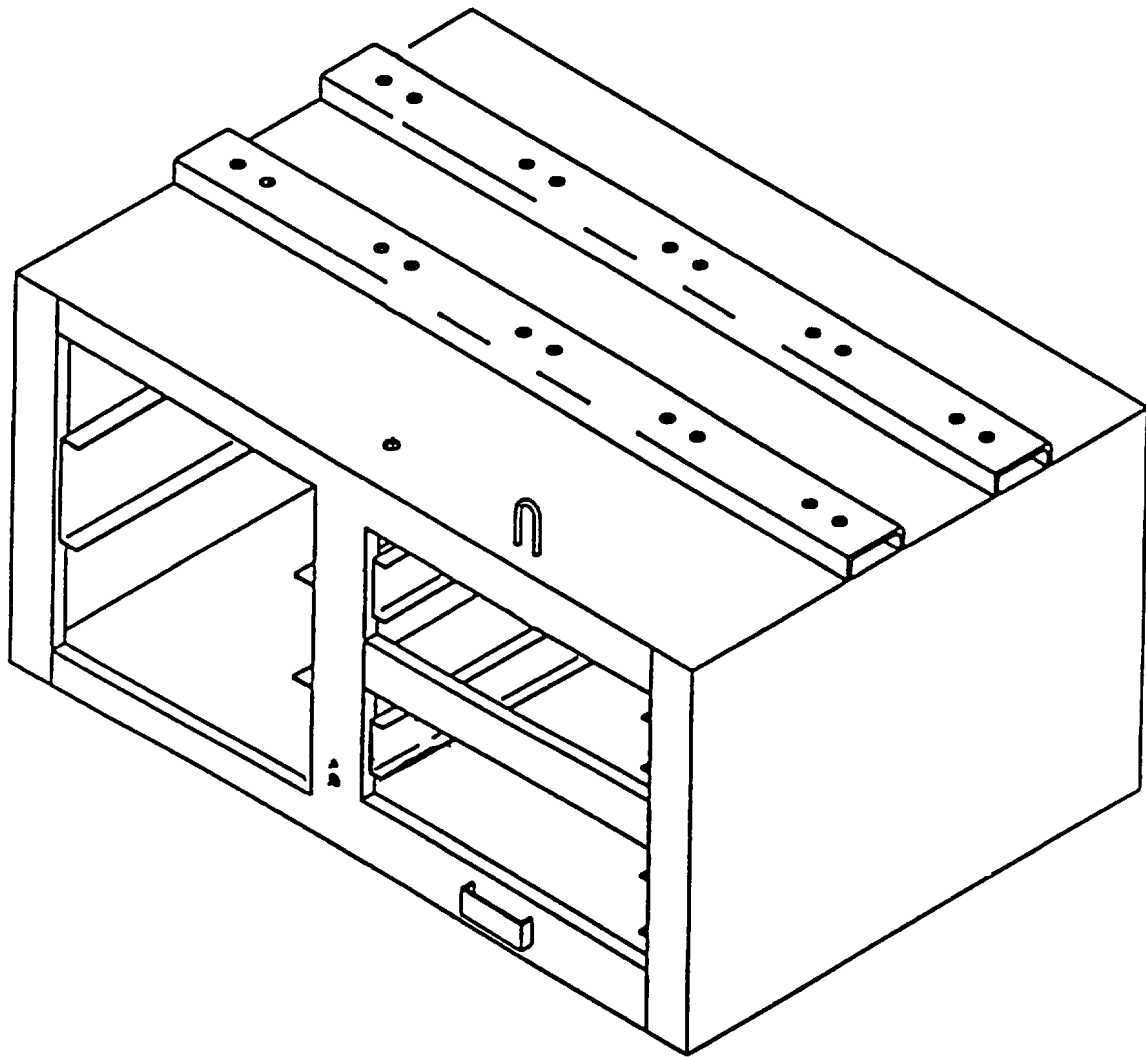


Figure 5-7. Reel Cabinet Frame

5-8. AIR PUMP - REPAIR.

This Task Covers: **a. Disassembly** **b. Repair** **c. Assembly**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Common Tool Kit #1 (Appendix B, Section III, Item 2).

Materials/Parts Required

Dry cleaning solvent (Appendix E, Section II, Item 3).
Primer, Sealing Compound (Appendix E, Section II, Item 4).
Sealing Compound (Appendix E, Section II, Item 5).
Gasket, Upper Kit (Appendix H, Section II, Item 52).
Gasket, Lower Kit (Appendix H, Section II, Item 53).
Gasket (Appendix H, Section II, Item 54).

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para. 4-13).
Belts Removed (para. 4-31).
Air Pump Removed (para. 4-34).

a. Disassembly.

- (1) Remove nut (1, Figure 5-8) and washer (2) securing flywheel (3) to crankshaft (4).
- (2) Remove flywheel (3) from crankshaft (4).
- (3) Disconnect intercooler (5) from cylinder head fitting on high pressure side, elbow on low pressure side.
- (4) Remove four bolts (6) from bearing retainer (7).
- (5) Remove seal retainer (8) and gasket (9) from bearing retainer (7). Discard gasket (9).
- (6) Remove woodruff key (10) from crankshaft (4).
- (7) Remove crankshaft vent tube (11) from vent tube fittings (12).
- (8) Remove oil level gauge (13) and gasket (14) from crankcase cover (15). Discard gasket (14).
- (9) Remove four bolts (16) and crankcase cover (15) from crankcase (17).
- (10) Remove lower gasket (18) from crankcase (17). Discard lower gasket (18).
- (11) Remove four bolts (19) and round disk (20) from crankshaft (4).
- (12) Remove six bolts (21) holding bearing retainer (7) onto crankcase (17).
- (13) Slide bearing retainer (7) and crankshaft (4) from connecting rods and crankcase (17).
- (14) Place the crankshaft (4) in a suitable press and carefully remove the oil seal (22) and two tapered bearings (23) from the crankshaft (4).

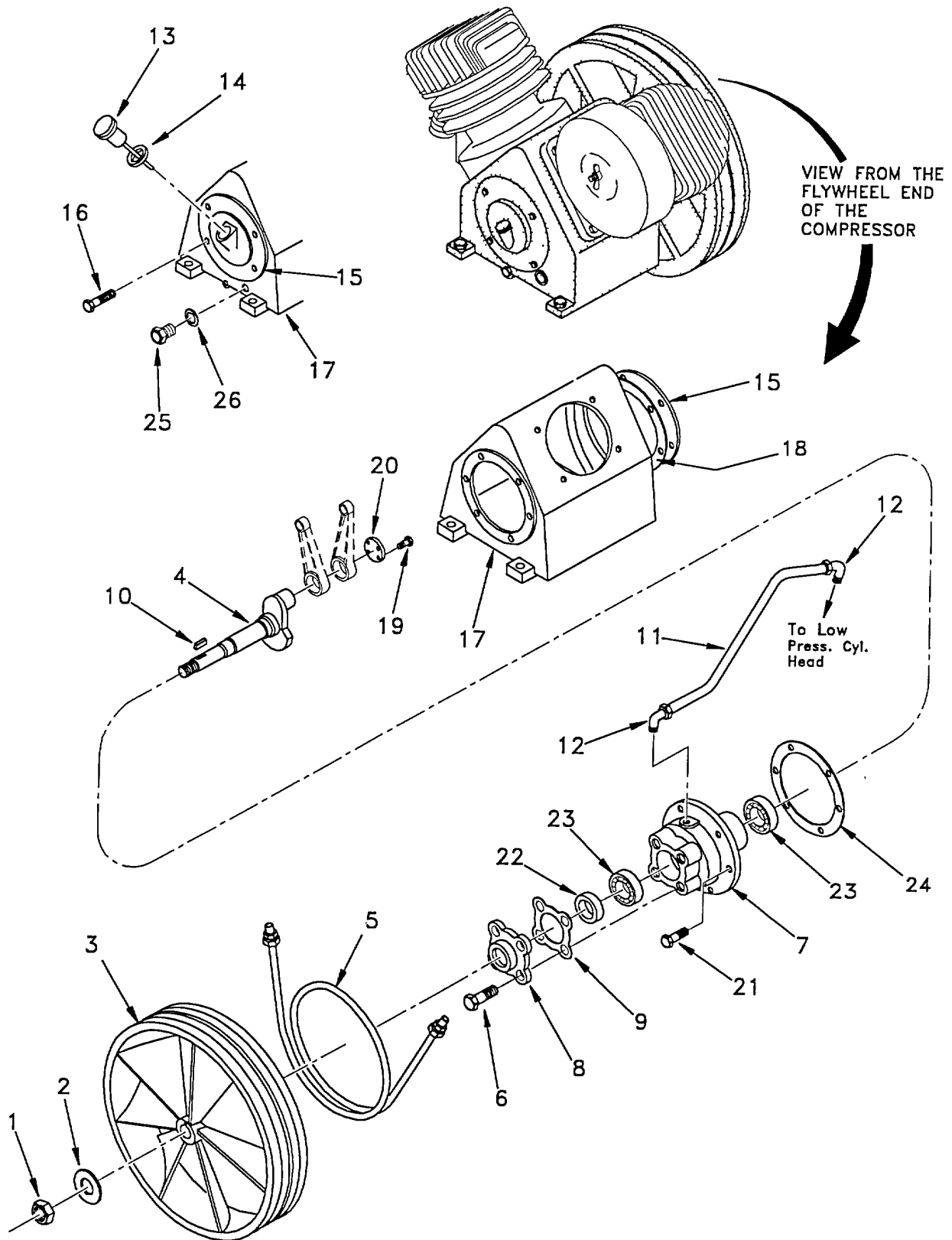


Figure 5-8. Crankshaft, crankcase and Related Parts

- (15) Using a blunt instrument, drive the tapered bearings (23) and oil seal (21) out of the flywheel (3) side of the crankcase (17). Discard oil seal (22).
- (16) Remove gasket (24) from crankcase (17). Discard gasket (24).
- (17) Remove sight gauge (25) and washer (26) from crankcase (17).

NOTE

Mark the position of the high pressure cylinder head to aid in correct reassembly.

Tag all parts to insure correct reassembly.

- (18) Remove four bolts (1, Figure 5-9) from high pressure cylinder head assembly (2).
- (19) Remove the high pressure cylinder head assembly (2) with piston assembly (3) and high pressure connecting rod (4) in it from the crankcase (5).
- (20) Remove five bolts (6) from high pressure cylinder head (7) and remove high pressure cylinder head (7) from cylinder (8).
- (21) Remove head gasket (9) and valve gasket assembly (10) from cylinder (8) Discard head gasket (9) and valve gasket assembly (10).
- (22) Remove head gasket (11) from cylinder (8). Discard head gasket (11).
- (23) Remove two snap rings (12) and piston pin (13) from high pressure piston (14).
- (24) Remove piston rings (15) from high pressure piston (14).
- (25) Remove bushing (16) from high pressure connecting rod (4).
- (26) Remove high pressure connecting rod (4) from high pressure piston (14).
- (27) Remove lower gasket (17) from crankcase (5). Discard lower gasket (5).
- (28) Remove four bolts (18) from low pressure cylinder head assembly (20).
- (29) Remove the air cleaner assembly (19) and elbow (34) from the low pressure cylinder head assembly (20).

NOTE

- **Mark the position of the low pressure cylinder head to aid in correct reassembly.**

- **Tag all parts to insure correct reassembly.**

- (30) Remove the low pressure cylinder head assembly (20) with piston assembly (21) and low pressure connecting rod (22) in it from the crankcase (5).
- (31) Remove six bolts (23) from low pressure cylinder head (24) and remove low pressure cylinder head (24) from cylinder (25).
- (32) Remove valve gasket (26) and valve gasket assembly (27) from cylinder head (24). Discard valve gasket (26) and valve gasket assembly (27).

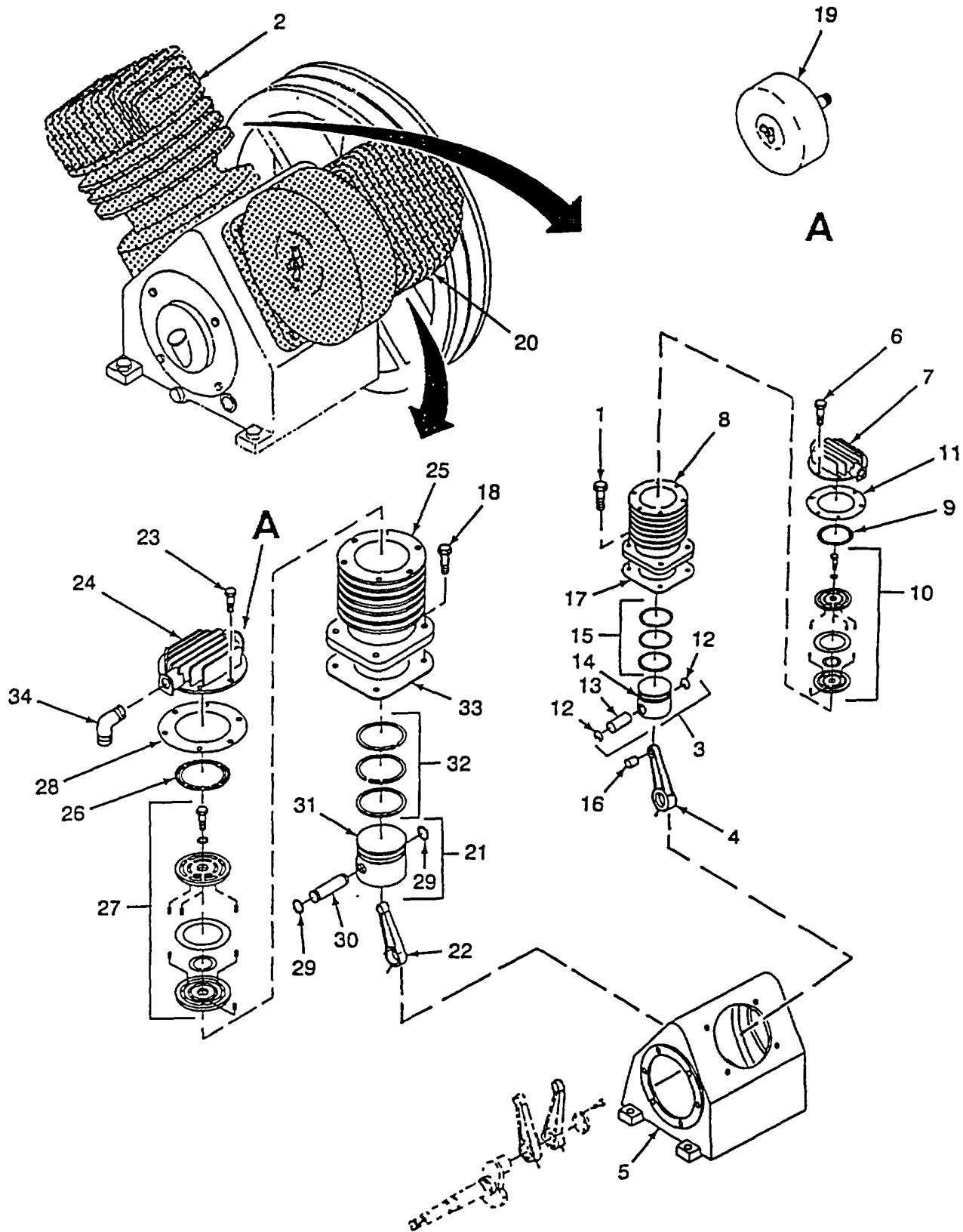


Figure 5-9. Pistons and Connecting Rods and Related Parts

- (33) Remove head gasket (28) from low pressure cylinder head (24). Discard head gasket (28).
- (34) Remove two snap rings (29) and piston pin (30) from low pressure piston (31).
- (35) Remove piston rings (32) from low pressure piston (31).
- (36) Remove low pressure connecting rod (22) from low pressure piston (31).
- (37) Remove lower gasket (33) from crankcase (5). Discard lower gasket (33).

b. Repair.

WARNING

- **Dry cleaning solvent is flammable and toxic. Do not use near open flame, sparks or non-ventilated areas.**

- (1) Thoroughly clean all parts with dry cleaning solvent.
- (2) Inspect the crankcase for breaks, cracks, drips or other defects. Replace if defective.
- (3) Inspect the bearings for free and even rotation. Replace if defective.
- (4) Inspect the crankshaft for cracks, scores, and distortion. Replace if defective.
- (5) Inspect the connecting rods for any visible damage or misalignment. Realign slightly twisted rods or replace them if they are badly damaged.
- (6) Inspect the piston pin for any visible damage. If damaged replace it.
- (7) Inspect the piston rings for any visible damage or wear. If there is replace the set.
- (8) Inspect all threaded fittings for damaged threads.
- (9) Remove all traces of carbon and old gasket materials.
- (10) Replace all gaskets.
- (11) Replace all worn or damaged parts.

c. Assembly.

NOTE

Prior to reassembly, lubricate all o-rings and packings with SAE No. 10 oil or light machine oil. Protect all seals and sealing surfaces from damage and scratches in any way possible.

- (1) Reassemble the piston (31, Figure 5-9) and connecting rod (22) as follows. Lubricate each piston and connecting rod assembly with a light coat of engine oil.
 - (a) Install piston pin (30) through piston (31) and connecting rod (22). Secure with snap rings (29).
 - (b) Install piston rings (32) in piston (31).

- (2) Install the assembled piston assembly (21) and low pressure connecting rod (22) into the crankcase (5).
- (3) Slide the low pressure connecting rod (22) onto the crankshaft.
- (4) Align the holes in the lower gasket (33) with holes in the crankcase (5).
- (5) Align the holes in the cylinder (25) with lower gasket (33) and crankcase (5).
- (6) Install four bolts (18) through the flange on the cylinder (25), lower gasket (33) into the crankcase (5) Tighten.
- (7) Install new valve gasket assembly (27) into cylinder (25) Align the holes in head gasket (28) with holes in the cylinder (25).
- (8) Align low pressure cylinder head (24) holes with holes in head gasket (28) and cylinder (25).
- (9) Install six bolts (23) through low pressure cylinder head (24), head gasket (28) and cylinder (25). Tighten.
- (10) Install air cleaner assembly (19) and elbow (34) into the low pressure cylinder head assembly (20).
- (11) Reassemble the high pressure piston (14) and connecting rod (4) as follows.
 - (a) Install bushing (16) into high pressure connecting rod (4).
 - (b) Install piston rings (15) in piston (14).
 - (c) Install piston pin (13) through piston (14) and connecting rod (4). Secure with two snap rings (12).

- (12) Install the assembled piston assembly (3) and high pressure connecting rod (4) into the crankcase (5).
- (13) Slide the high pressure connecting rod (4) onto the crankshaft.
- (14) Align the holes in the lower gasket (17) with holes in the crankcase (5).
- (15) Align the holes in the lower gasket (17) with holes in the crankcase (5).
- (16) Install four bolts (1) through the flange on the cylinder (8), lower gasket (17) into the crankcase (5). Tighten.
- (17) Install new valve gasket assembly (10) into cylinder (8).
- (18) Align the holes in head gasket (11) with holes in the cylinder (8).
- (19) Align high pressure cylinder head (7) holes with holes in head gasket (11) and cylinder (8).
- (20) Install five bolts (6) through high pressure cylinder head (7), head gasket (11) and cylinder (8). Tighten.
- (21) Using a suitable bearing driver press the bearing (23, Figure 5-8) and oil seal (22) onto the crankshaft (4).

- (22) Align gasket (24) up with holes in bearing retainer (7) and crankcase (17).
- (23) Slide the bearing retainer (7) and crankshaft (4) onto connecting rods and crankcase (17).
- (24) Install six bolts (21) through bearing retainer (7) and gasket (24) into crankcase (17).
- (25) Align gasket (9) up with holes in bearing retainer (7) and seal retainer (8).
- (26) Install four bolts (6) through seal retainer (8) and gasket (9) into bearing retainer (7).
- (27) Align holes in round disk (20) with holes in crankshaft (4).
- (28) Install four bolts (19) through round disk (20) into crankshaft (4). Tighten.
- (29) Install woodruff key (10) into crankshaft (4).
- (30) Install vent tube fitting (12) into bearing retainer (7).
- (31) Install crankshaft vent tube (11) onto vent tube fitting (12) and elbow on low pressure cylinder head.
- (32) Position intercooler (5) behind flywheel (3) and slide flywheel (3) onto crankshaft (4).
- (33) Install washer (2) and nut (1) securing flywheel (3) to crankshaft (4).
- (34) Align lower gasket (18) holes up with holes in crankcase (17), and holes in crankcase cover (15).
- (35) Install four bolts through crankcase cover (15) and lower gasket (18) into crankcase (17).
- (36) Install sight gauge (25) and washer (26) into lower portion of crankcase (17).
- (37) Install oil level gauge (13) and gasket (14) into crankcase cover (15).

NOTE

Run the air pump long enough to warm up Shut down the air pump and retorque cylinder head bolts (6 and 23, Figure 5-9) to 30 ft. lbs.

5-9. AIR TANK - REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's- Automotive (Appendix B, Section II, Item 1)

Materials/Parts Required

Dry cleaning solvent (Appendix E, Section II, Item 3)

Teflon Tape (Appendix E, Section II, Item 7).

Nut, self-locking (Appendix H, Section II, Item 48)

Equipment Condition

Unit shut down and cool.

Enclosure Removed (para. 4-13).

Belts Removed (para 4-31)

Control Panel and Throttle Removed (para. 4-30).

Diesel Engine Removed (para 4-39).

Shut Off Valve Removed (para 4-35).

Unloader Valve Removed (para 4-38)

Pressure Relief Valve Removed (para. 4-36).

Ball Valve Removed (para 4-37).

Plumbing Removed (para 4-33)

Air Pump Removed (para. 4-34)

WARNING

Compressed air may cause severe injury or death. Do not disconnect air hose assemblies or components before first relieving pressure from the air-receiver tank of pressure

a. Removal. (Refer to figure 5-10).

- (1) Disconnect air tubing (1) from elbow push-in fitting (2) Remove elbow push-in fitting (2) from air-receiver tank (3).
- (2) Remove hex nipple (4) and hose assembly (5) from side of air-receiver tank (3).
- (3) Remove swivel adapter (6) and hose assembly (7) from hex bushing (8).
- (4) Remove hex bushing (9) and remaining fittings from air-receiver tank (3).
- (5) Remove four self-locking nuts (10), four washers (11) from bottom of skid weldment (12). Discard four self-locking nuts.
- (6) Remove four hex head-cap screws (13), four washers (14), and four vibration isolator washers (15).

- (7) Lift air-receiver tank (3) from skid weldment (12).
- (8) Remove four washers (16) and four vibration isolators (17) from skid weldment (12).

c. Installation.

- (1) Install four washers (16) and four vibration isolators (17) into skid weldment (12).
- (2) Install new air-receiver tank (3) on skid weldment (12) aligning holes in air-receiver tank (3) with holes in vibration Isolators (17) and holes in skid weldment (12).
- (3) Install four vibration isolator washers (15), four washers (14), and four hex head-cap screws (13) through holes in air-receiver tank (3) and skid weldment (12).
- (4) From bottom of skid weldment (12) install four washers (11) and four new self-locking nuts (10) onto four hex head-cap screws (13). Tighten.
- (5) Install hex bushing (9) and attached fittings into air-receiver tank (3).
- (6) Install swivel adapter (6) and hose assembly (7) into hex bushing (8).
- (7) Install hex nipple (4) and hose assembly (5) into side of air-receiver tank (3).
- (8) Install elbow, push-in fitting (2) into air-receiver tank (3). Slide nylon hose (1) onto elbow, push-in fitting (2).

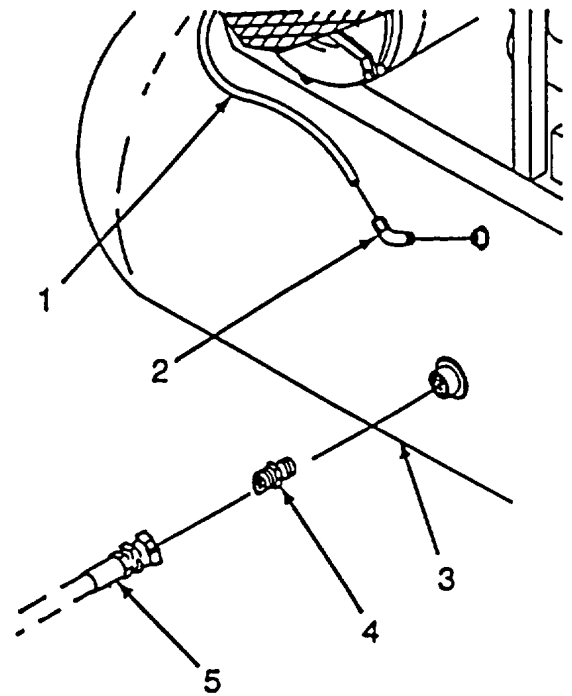
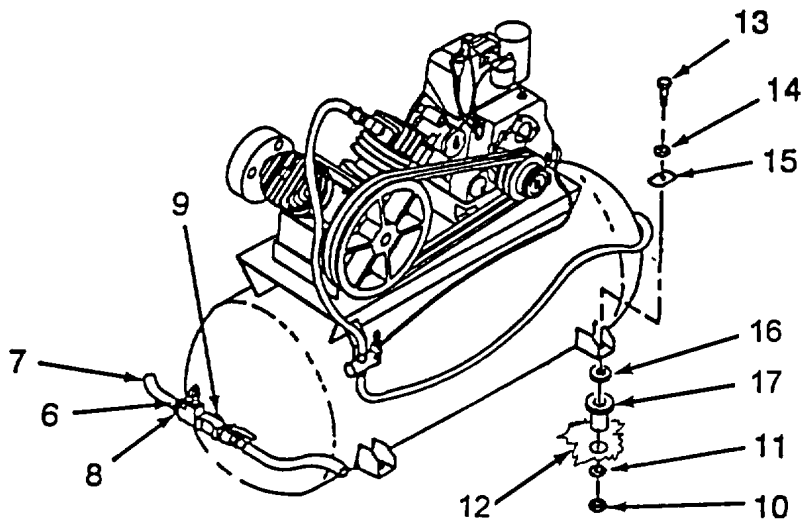


Figure 5-10. Air Tank

5-10. DIESEL ENGINE - REPLACE/REPAIR.

This Task Covers:	<ul style="list-style-type: none"> a. Fuel Pipe-Pump and Leak-Off Pipe c. Fuel Control Solenoid Valve e. Fuel Filter Head g. Crankcase Breather Assembly i. Stop/Run Lever k. Lubricating Oil Pipe 	<ul style="list-style-type: none"> b. Fuel Injector d. Fuel Injector Pump f. Fuel Lift Pump h. Variable Speed Control j. Engine Air Cowling l. Oil Pan, Gasket and Strainer n. Intake, Exhaust Valves, and Decompression Lever Adjustment
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Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Tester, Diesel Fuel (Appendix B, Section III, Item 25).
 Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
 Industrial Goggles (Appendix B, Section III, Item (9)).
 Stud Remover/Setter (Appendix B, Section III, Item 26).
 Wrench, Tap and Reamer (Appendix B, Section III, Item 28).
 Thread-Cutting Tap (Appendix B, Section III, Item 29).
 Torque Wrench, 0-600 in-lb (Appendix B, Section III, Item 30).
 Torque Wrench, 0-175 ft-lb (Appendix B, Section III, Item 21).

Materials/Parts Required

Dry cleaning solvent (Appendix E, Section II, Item 3).
 Manifold gasket (Appendix H, Section II, Item 16).
 Gasket (Appendix H, Section II, Item 17).
 Gasket (Appendix H, Section II, Item 18).
 Seal (Appendix H, Section II, Item 19).
 Oil Seal (Appendix H, Section II, Item 20).
 O-Ring (Appendix H, Section II, Item 21).
 Sealing Ring (Appendix H, Section II, Item 22).
 Shim-0.38MM (Appendix H, Section II, Item 23).
 Shim-0.25MM (Appendix H, Section II, Item 24).
 Gasket (Appendix H, Section II, Item 25).
 Washer Shield (Appendix H, Section II, Item 69).
 Wiping Rags (Appendix E, Section II, Item 1).
 Sealing Compound (Appendix E, Section II, Item 5).
 Gasket (Appendix H, Section II, Item 70).
 Gasket (Appendix H, Section II, Item 66).
 Brush, Acid Swabbing (Appendix E, Section II, Item 26).
 Kerosene (Appendix E, Section II, Item 27).
 Lockwasher (Appendix H, Section II, Item 71).
 Washer, Copper (Appendix H, Section II, Item 72).
 Gasket (Appendix H, Section II, Item 73).
 Pin, Spring (Appendix H, Section II, Item 74).
 Pin, Spring (Appendix H, Section II, Item 75).

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para. 4-13).
Alternator and Guard Removed (para. 4-31).
Compressor Drive Belts and Guard Removed (para. 4-31).
Control Panel Removed (para. 4-30).
Diesel Engine Removed (para. 4-39).
Fuel Tank Drained and Removed (para. 4-21).
Air Cleaner Assembly Removed (para. 4-39).
Heater Plug Removed (para. 4-39).
Starter Motor Removed (para. 4-39).
Oil Filter Assembly Removed (para. 4-39).
Lubricating Oil Pipe Removed (para. 4-39).
Exhaust System Removed (para. 4-39).
Rope Start Assembly Removed (para. 4-39).
Clutch Removed (para. 4-40).
Drain Diesel Engine Oil (para. 4-39).

Personnel Required

2

a. Fuel Pipe-Pump and Leak-Off Pipe.**(1) Removal. (Refer to Figure 5-11).**

- (a) Remove pump-to-injector fuel pipe (1) from fuel injector (2) and fuel pump (3) by removing fuel pipe nuts (4).
- (b) Remove bolt (5), two washers (6), swivel union (7) from top of fuel injector (2). Remove pipe assembly tube (8) from swivel union (7).

(2) Repair.

Inspect pipe assemblies for damage, cracks, distortion and other damage. Replace parts as needed.

(3) Installation.

- (a) Install swivel union plug (5), two washers (6), and swivel union (7), into top of fuel injector (2).
- (b) Slide pipe assembly tube (8) onto swivel union (7).
- (c) Install pump-to-injector fuel pipe (1) into fuel injector (2) and fuel pump (3) using pipe nuts (4).

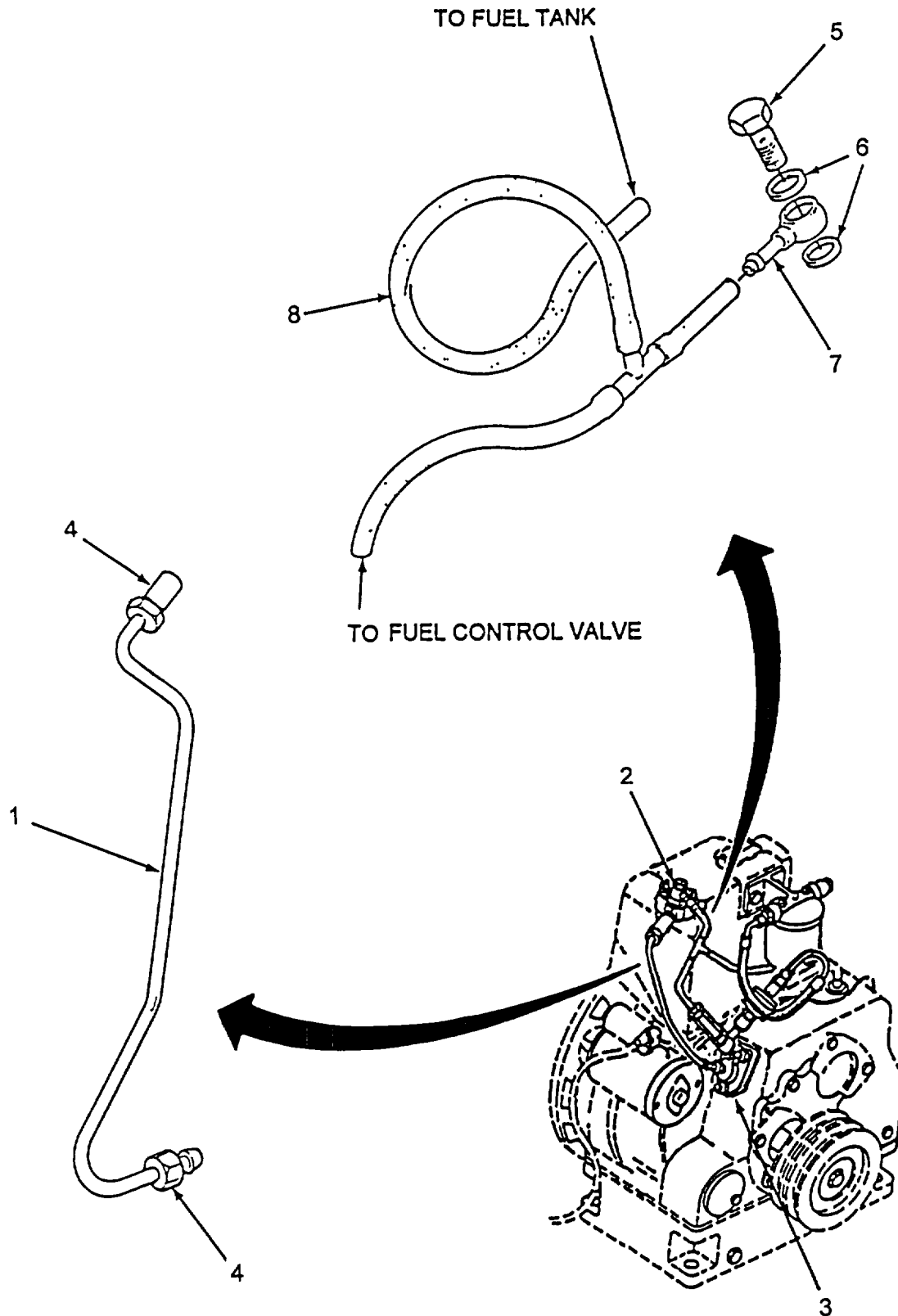


Figure 5-11. Fuel Pipe-Pump and Leak-Off Pipe

b. Fuel Injector.

WARNING

- **Keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Fuel is very flammable and can explode easily.**
- **Wipe up spilled fuel immediately with rags. You can slip and fall on spilled fuel.**

(1) Removal. (Refer to Figure 5-12).

- (a) Remove two nuts (2) from fuel injector clamp (3) and cylinder head studs (4).
- (b) Remove fuel injector (1), clamp (3), and washer (5) from cylinder head (6).
- (c) Remove cylinder head studs (4) from cylinder head (6).
- (d) Inspect parts for damage. Replace as required.
- (e) Clean threads (9) in cylinder head (6), with thread-cutting tap.

(2) Test.

- (a) Connect fuel injector (1) to tester (7).
- (b) Test injector (1) for cracking pressure between 2864-2937 psi. If pressure is not between 2864-2937 psi, replace fuel injector (1).
- (c) Check fuel injector (1) for a four-point star spray pattern (8) Pattern (8) should have two opposing long legs and two opposing short legs as shown. If pattern (8) does not show star pattern (8), replace fuel injector (1).

(3) Installation.

- (a) Apply sealing compound to thread of studs (4). Install cylinder head studs (4) into cylinder head (6).
- (b) Install new washer (5) and injector (1) In cylinder head (6).
- (c) Install clamp (3) and two nuts (2) on fuel injector (1) and studs (4).

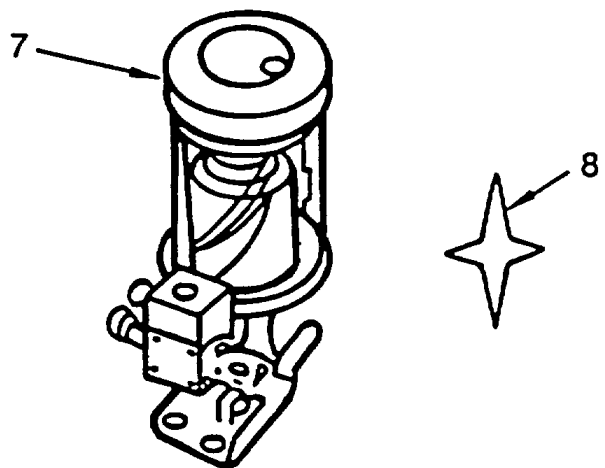
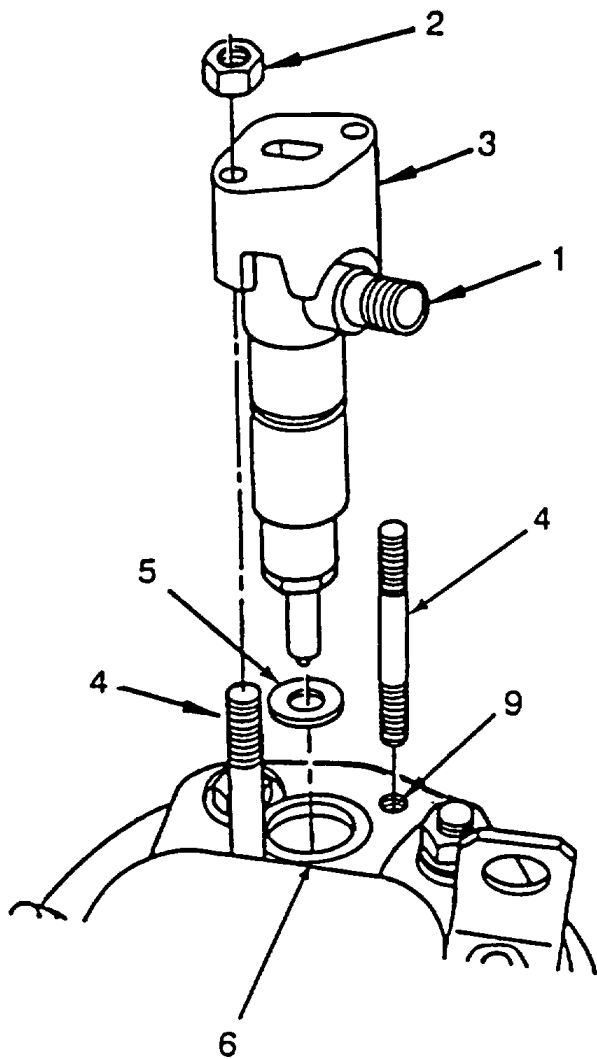


Figure 5-12. Fuel Injector

c. Fuel Control Solenoid Valve.

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Clean up spills as soon as they occur. Spills may result in serious slip and fall injuries.**

(1) Removal. (Refer to Figure 5-13).

- (a) Remove flexible pipe (1) from fuel filter (2), by loosening and removing union nut (3) from fuel filter.
- (b) Remove self bleed pipe (4) from hose adapter (5).
- (c) Remove hose adapter (5), copper washer (6), non return valve (7), copper washer (8), from solenoid adapter (9) by removing bolt (10) from solenoid adapter (9).
- (d) Remove swivel union-plug (10) and two washers (11) from solenoid adapter (9) and fuel pump (12).
- (e) Remove union (13) and ferrule (14) from valve (15).
- (f) Remove valve (15) and copper washer (16) from solenoid adapter (9).
- (g) Tag and remove wires on solenoid valve (15).

(2) Repair.

Inspect all parts for damage, cracks, distortion and other damage. Replace parts as needed.

(3) Installation.

- (a) Install washer (11) between fuel pump (12) and solenoid adapter (9) and washer (11) onto swivel union-plug (10). Screw swivel union-plug (10) into port on fuel pump (12).
- (b) Install copper washer (8) onto non return valve (7). Screw non return valve (7) into swivel union-plug (10).
- (c) Install copper washer (6) onto hose adapter (5) Screw hose adapter (5) into non return valve (7).
- (d) Install copper washer (16) onto valve (15). Screw valve (15) into solenoid adapter (9)
- (e) If new flexible pipe (1) is being installed, insert curved pipe end of flexible pipe (1) through union (13) and install ferrule (14) onto end of curved pipe end (17).
- (f) Insert curved pipe end (17) into valve (15), securing it with union (13) into port of valve (15).
- (g) Screw union nut (3) on end of flexible pipe (1) onto port of fuel filter (2).

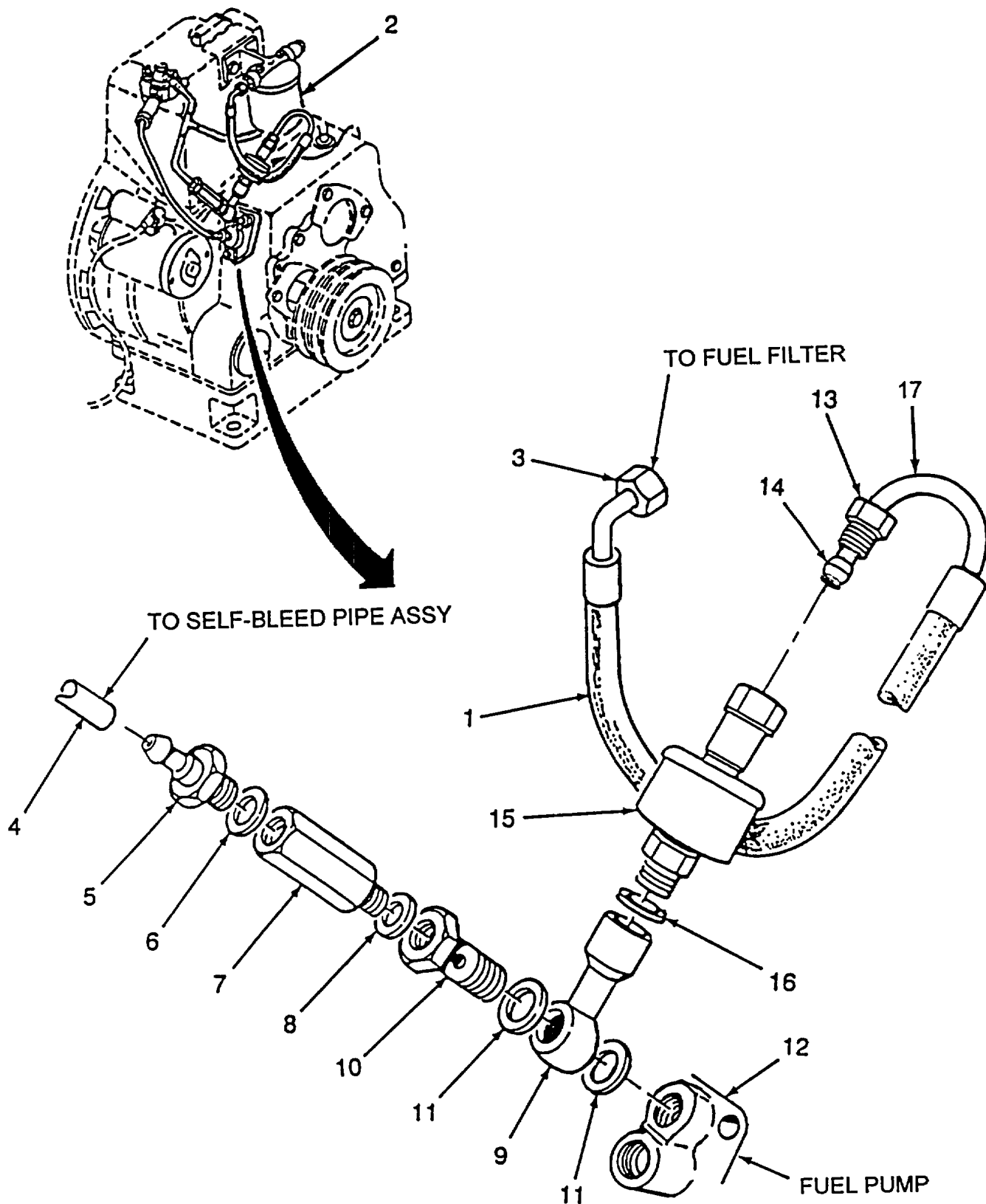


Figure 5-13. Fuel Control Solenoid Valve

d. Fuel Injector Pump.

WARNING

- **Keep fuel away from open fire and keep fire extinguisher within easy' reach when working with fuel. Fuel is very flammable and can explode easily.**
- **Wipe up spilled fuel immediately with rags. You can slip and fall on spilled fuel · Fuel is highly combustible. Put up "No Smoking Within 50 Feet of Vehicle" signs before draining fuel * Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin Flash point of solvent is 100° F to 138° F (38° C to 59° C).**

(1) Removal. (Refer to Figure 5-14).

- (a) Remove fuel control solenoid valve assembly (1). (Reference para. 5-10.c.).
- (b) Remove fuel pipe assembly (2) and leak-off pipe assembly (3). (Reference para 5-10 a.).
- (c) Remove two screws (4), cover (5), and gasket (6) from cylinder head (7).
- (d) Set engine to top dead center on exhaust stroke
- (e) Remove three retainer nuts (9) and lockwashers (10). Discard lockwashers (10).

NOTE

Do not use force to remove the fuel injector pump (8). If difficulty is experienced, remove the gear end cover (13) and position the fuel pump rack ball (14) to clear the cut-out (15)

- (f) Move stop/run lever (11) clockwise slowly and remove fuel injector pump (8) and any pump timing shims (12).
- (g) Carefully lift out the fuel injector pump (8) and retain the pump timing shims (12).
- (h) Remove pump mounting studs (17) from crankcase (16).

(2) Repair.

- (a) Inspect all parts for damage, cracks, distortion and other damage. Replace parts as needed. ,

CAUTION

Fuel pump is calibrated by the pump manufacturer and only the delivery side of the fuel pump can be dismantled.

- (b) Remove all shim material from the fuel injector pump (8) and around the cut-out (15) on the crankcase (16).
- (c) Replace all timing shims (12).
- (d) Inspect and clean threads on pump mounting studs (17) with thread-cutting tap.

(3) Installation.

- (a) Turn the engine to TDC on the exhaust stroke.
- (b) Position the fuel pump rack ball (14) with the cut-out (15) in the crankcase (16) by moving and holding the engine control lever (11) approximately 10 before the vertical position.

NOTE

- **Add shims (12) if timing is advanced (too large). Remove shims (12) if timing is retarded (too small).**
- **Approximately 10 of flywheel movement can be obtained by adding or removing one 0.127 mm shim.**

- (c) Place the new pump timing shims (12) over the pump mounting studs (17).
- (d) Install the fuel injector pump (8), taking care to ensure the fuel pump rack ball (14) is fully engaged in the governor lever fork (18).
- (e) Install three new lockwashers (10) and three retainer nuts (9). Torque retainer nuts (9) between 12-14 ft-lbs.
- (f) Install new gasket (6), cover (5) onto cylinder (7). Install two screws (4) through cover (5), gasket (6) into cylinder (7). Tighten.
- (g) Install the fuel pipe-pump to injector (2) to fuel injector (19) and fuel injector pump (8). Tighten the unions a further half turn.
- (h) Install the fuel control solenoid valve (1) to the fuel filter (20), fuel injector pump (8) and fuel Injector (19).

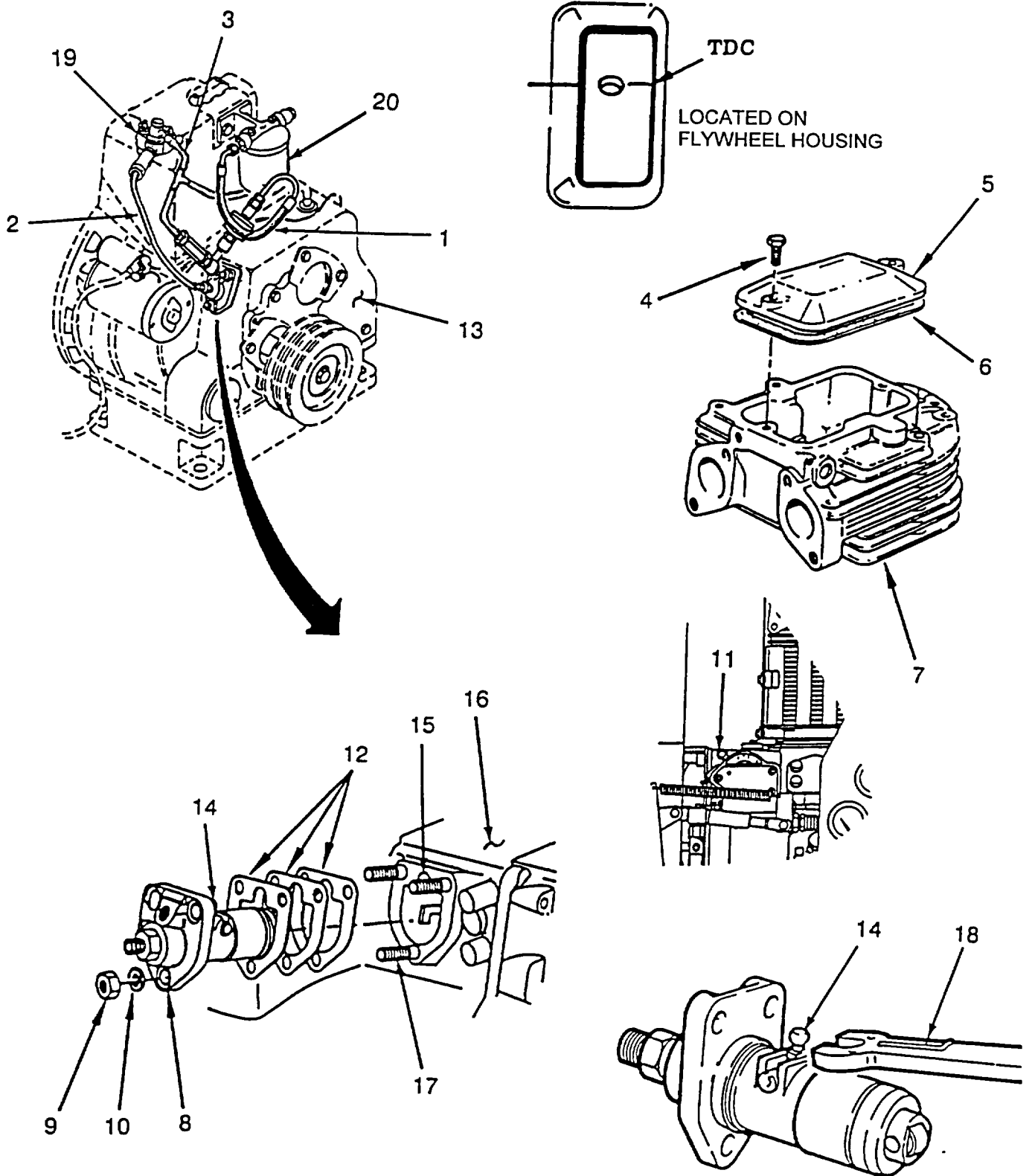


Figure 5-14. Fuel Injector Pump

e. Fuel Filter Head.

WARNING

Diesel fuel is flammable. Do not smoke or use open flame when near diesel fuel.

(1) Removal. (Refer to Figure 5-15).

- (a) Remove fuel filter head (1) and bracket (2) from cylinder head by removing two nuts (3), two washers (4) from two studs (5).
- (b) Remove two nuts (6), two washers (7), and two bolts (8) from bracket (2).
- (c) Remove bolt (9), two washers (10), and swivel union (11) from fuel filter head (1).
- (d) Remove union (12), and washer (13) from fuel filter head (1). Remove fuel control solenoid valve line (14) from union (12).

(2) Repair.

- (a) Inspect all parts for cracks, distortion and other damage. Replace parts as needed.

WARNING

Dry cleaning solvent is flammable. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes or contact with skin.

- (b) Thoroughly clean fuel filter head (1) with dry cleaning solvent Dry inside with wiping rags.

(3) Installation.

- (a) Attach fuel filter head (1) to bracket (2) by installing two bolts (8) through bracket (2) and fuel filter head (1), securing it with two washers (7) and two nuts (6).
- (b) Install fuel filter head (1) and bracket (2) to cylinder head studs (5) and install two washers (4) and two nuts (3).
- (c) Install bolt (9), two washers (10), and swivel union (11) into port of fuel filter head (1).
- (d) Install union (12), and washer (13) into port of fuel filter head (1). Install fuel pipe line (14) onto union (12).

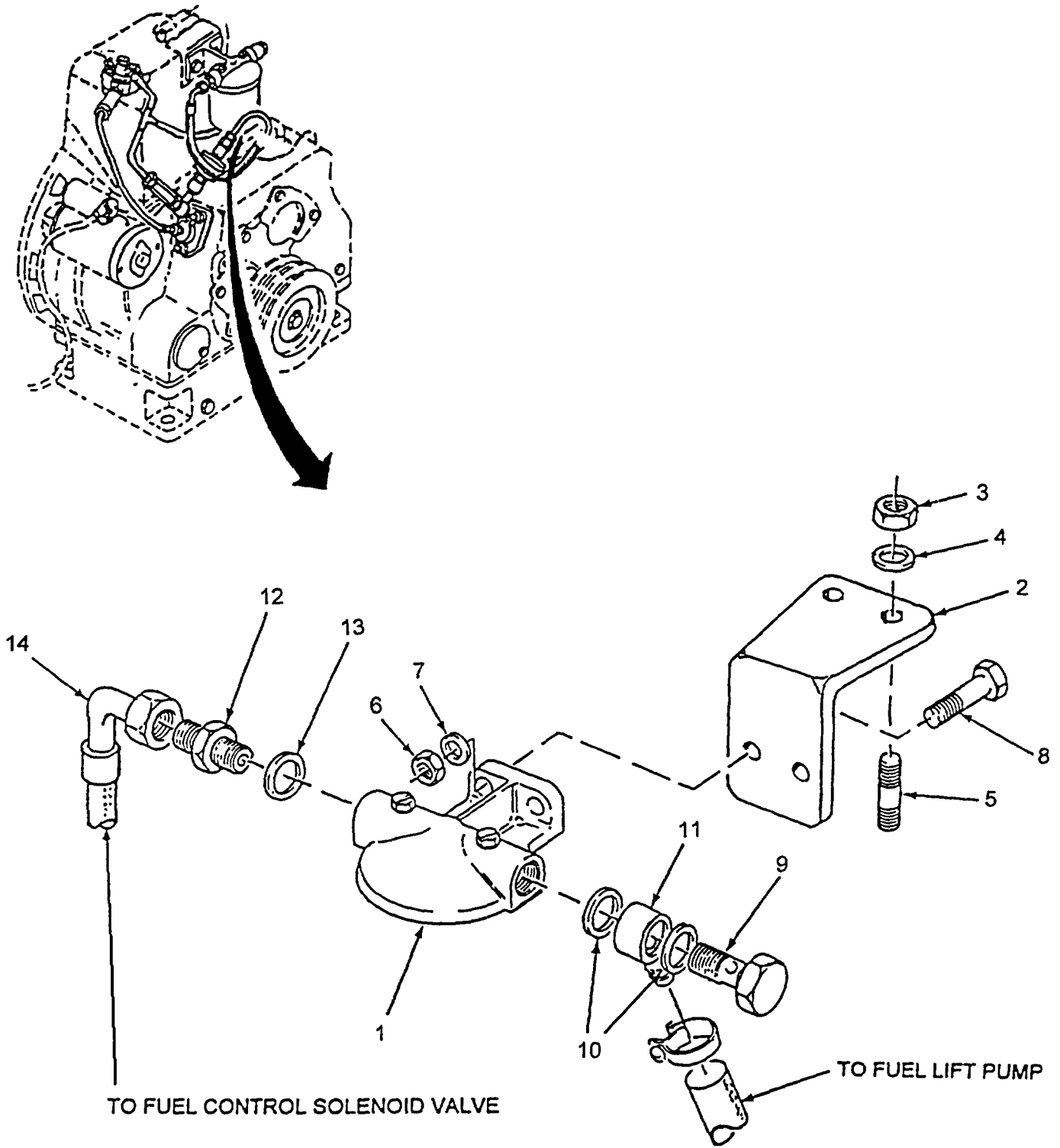


Figure 5-15. Fuel Filter Head

f. Fuel Lift Pump Replacement

WARNING

- **DO NOT smoke or use open flame when working on the fuel system. An explosion may occur, causing severe injury or death.**
- **Clean up spills as soon as they occur. Spills may result in serious slip and fall injuries.**
- **Keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Fuel is very flammable and can explode easily.**

(1) Removal. (Refer to Figure 5-16).

- (a) Loosen pipe clips (1) and slide them down on flexible fuel pipes (2 and 3). Remove flexible fuel pipe (2 and 3) from connections (4).
- (b) Remove four cap screws (5) and four washers (6) holding fuel lift pump (7) onto diesel engine (8).
- (c) Remove fuel lift pump (7), gasket (9) and push rod (10) from diesel engine (8).
- (d) Unscrew union (11) from port of fuel lift pump (7).
- (e) Remove connection (4), with ferrule (12) and union (11) from port of fuel lift pump (7).

(2) Repair.

- (a) Inspect all parts for damage, cracks, distortion and other damage. Replace parts as needed.
- (b) Replace gasket (9).

(3) Installation.

- (a) Install push rod (10).
- (b) Align new gasket (9) and fuel lift pump (7) with holes on diesel engine (8). Install four washers (6) and four cap screws (5). Tighten.
- (c) If new connection (4) is required, assemble union (11) onto connection (4) and install ferrule (12)
- (d) Screw unions (11) into ports of fuel lift pump (7).
- (e) Install flexible fuel pipes (2 and 3) onto connections (4) Slide pipe clips (1) on flexible fuel pipes and tighten pipe clips on flexible fuel pipes.

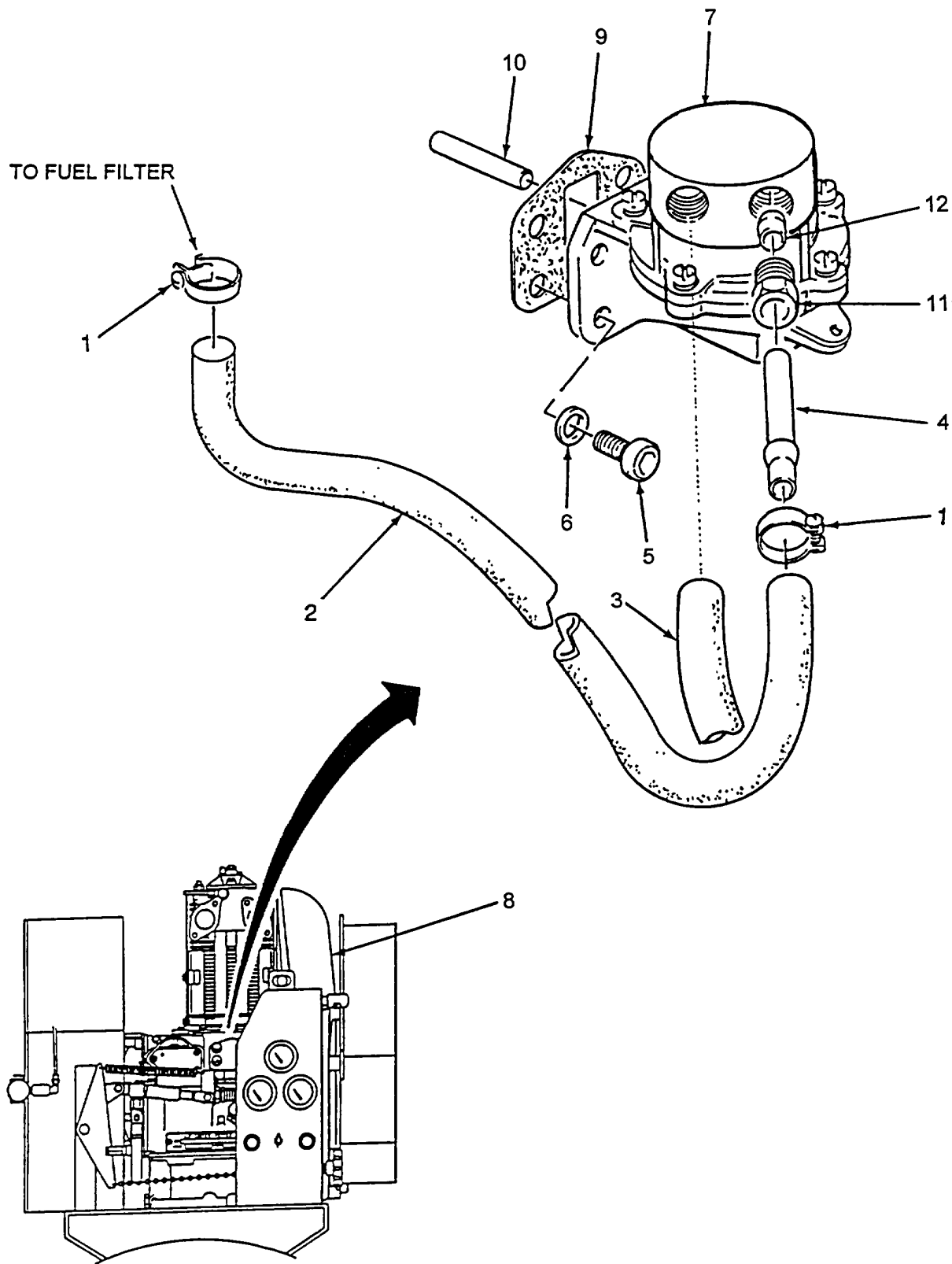


Figure 5-16. Fuel Lift Pump

g. Crankcase Breather Assembly.

(1) Removal. (Refer to Figure 5S-17).

- (a) Loosen hose clamp (1) and pull hose (2) from breather (3).
- (b) Remove screw (4), cover (5), flap (6), and preformed packing (7) from breather base (8).
- (c) Remove breather base (8), preformed packing (9), and washer (10) from crankcase mounting surface (11)

(2) Repair.

- (a) Inspect parts for damage. Replace as required.
- (b) Clean mounting surface (11) with rags.

(3) Installation.

- (a) Install breather base (8), packing (9), and washer (10).
- (b) Install screw (4), cover (5), flap (6), and packing (7) to base (8).
- (c) Position hose (2) on breather (3), and tighten clamp (1).

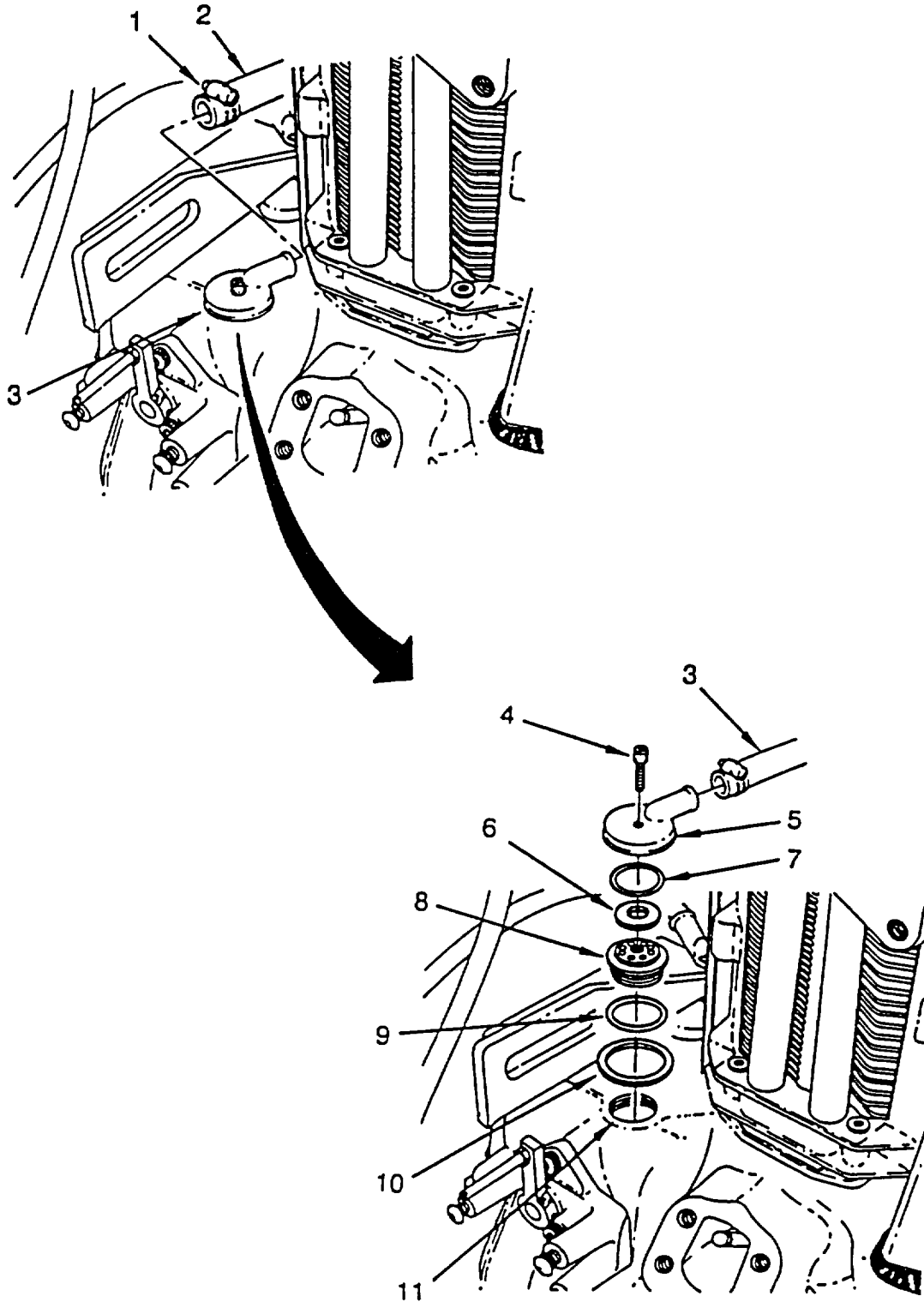


Figure 5-17. Crankcase Breather Assembly

h. Variable Speed Control.

(1) Removal. (Refer to Figure 5-18).

- (a) Remove tension spring (1) from air cylinder support bracket (2) and from upper throttle bracket (3).
- (b) Remove cotter pin (4) from pin (5) holding throttle assembly (6) to upper throttle bracket (3).
- (c) Remove three capscrews (7), holding bracket (8) onto guard (9).

(2) Disassembly.

- (a) Remove two nuts (10), and adjusting nut (11) from control rod (12). Slide sleeve (13) off of control rod.
- (b) Remove nut (14) from control rod (12) on outside of upper throttle bracket (3).
- (c) Slide upper throttle bracket (3) from control rod (12). Remove nut (15) from control rod.
- (d) Slide control rod (12) out from plunger (16).
- (e) Remove bellows (17), adjuster (18) and sealing ring (19) from plunger (16). Slide speeder spring (20) off of plunger.

(3) Repair.

- (a) Inspect all parts for cracks, distortion and other damage. Replace parts as needed..
- (b) Replace sealing ring (19).

(4) Installation.

- (a) Install control rod (12) into nut (15) and through upper throttle bracket (3) into nut (14).
- (b) Install control rod (12) through holding bracket (8), sleeve (13) into adjusting nut (11). Run adjusting nut (11) upon control rod (12) until upper throttle bracket (3) and plunger (16) are in the correct position. Adjust nuts (14 and 15) so that they are tight against upper throttle bracket (3).
- (c) Thread two nuts (10) onto end of control rod (12). Tighten until they are firmly against adjusting nut (11)
- (d) Slide bellows (17), adjuster (18) and sealing ring (19) onto plunger (16) until control rod (12) can be installed into hole in plunger (16). Slide speeder spring (20) onto plunger (16). Install adjuster (18) into side of engine casing (21).
- (e) Install three capscrews (7) and holding bracket (8) onto guard (9).
- (f) Install fork of throttle assembly (6) to upper throttle bracket (3). Insert pin (5) through fork of throttle assembly and upper throttle bracket. Install cotter pin (4) through pin (5). Spread cotter pin apart and snug it up to end of pin.
- (g) Install tension spring (1) to air cylinder support bracket (2) and upper throttle bracket (3).

(5) Adjustment.

- (a) Move the locknuts (10) to the end of the control rod (12).
- (b) Adjust the idling speed to 1200v/min by screwing in the adjusting nut (11) to increase the speed or out to decrease it

NOTE

If the minimum speed required is above the idling speed turn the adjusting nut (11) toward the holding bracket (8) until the required speed is attained and lock the adjusting nut (11) in position

- (c) Lock the adjusting nut (11) with the two locknuts (10).
- (d) Slacken the adjust nut (14).
- (e) Move the control rod (12) in the direction of the arrow so that the adjust nut (15) is hard against the upper throttle bracket (3).
- (f) Maintain the adjust nut (14) hard against the upper throttle bracket (3) and adjust the full speed by turning the adjust nut (14) counterclockwise to increase the speed or clockwise to decrease it. The speed should be set at 8% above the rated speed.
- (g) Position the adjust nut (14) against the upper throttle bracket (3) and tighten the adjust nut (15).
- (h) Fit and adjust the holding throttle assembly (6) so that it is capable of moving the control rod (12) from the minimum speed to the full speed position.

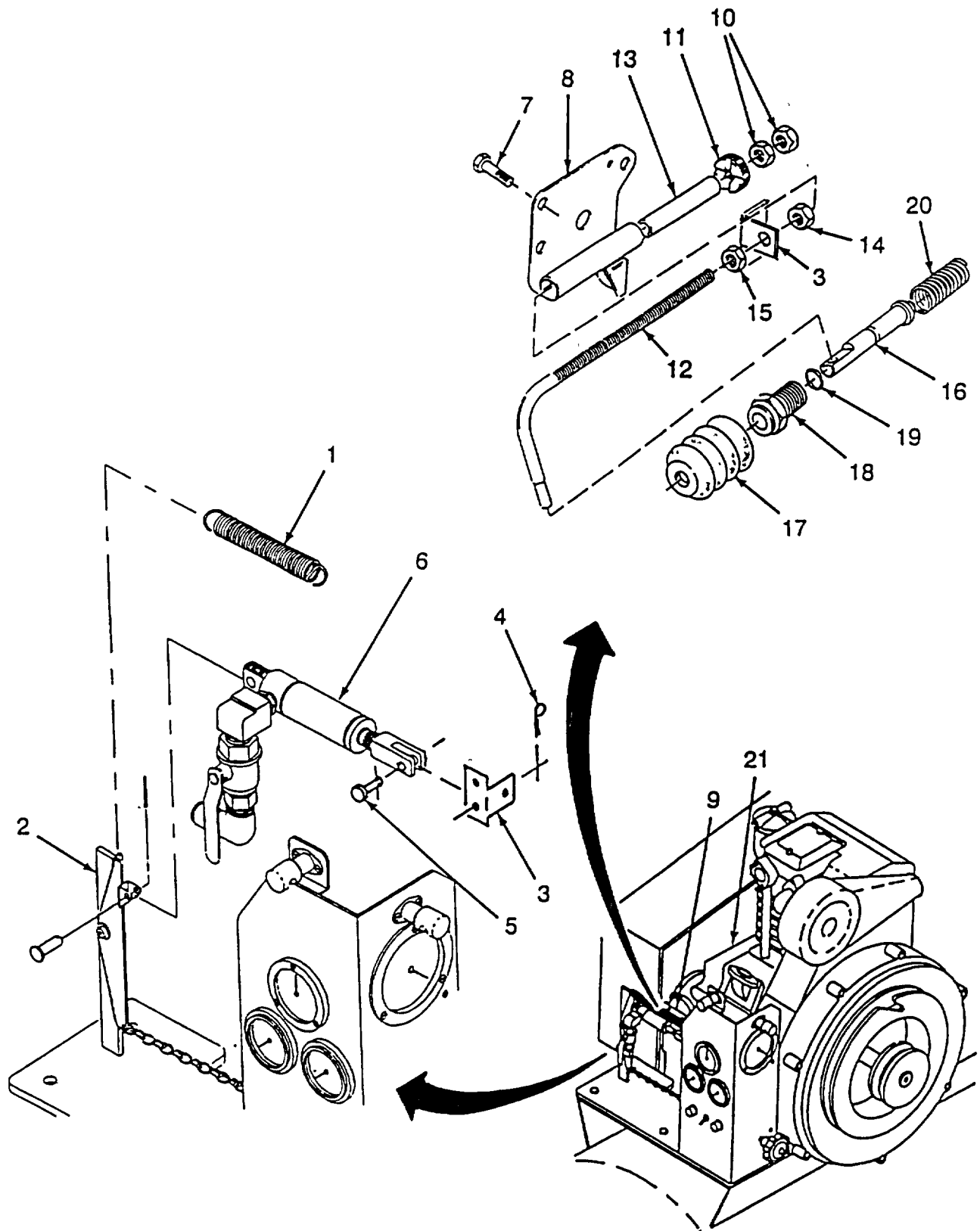


Figure 5-18. Variable Speed Control

i. Stop/Run Lever.

(1) Removal. (Refer to Figure 5-19.)

- (a) Remove three screws (1).
- (b) Move the cover (2) back sufficiently to gain access to spring (3)
- (c) Unhook the spring (3) from grooved nut (4) and remove cover (2). Unhook spring (3) from grooved nut (5) to remove spring
- (d) Remove pin (6) and pull lever (7) from shaft (8).
- (e) Remove grooved nut (4), lockwasher (9) and screw (10) from lever (7)
- (f) Remove grooved nut (5), lockwasher (11) and screw (12) from cover (2).
- (g) Remove two screws (13), housing (14), with shaft (8), and gasket (15)
- (h) Remove shaft (8) from housing (14) and remove gasket (16).
- (i) Remove screw (17) and nut (18) from housing (14)

(2) Repair.

Inspect all parts for cracks, distortion and other damage Replace parts as needed.

(3) Installation.

- (a) Thread nut (18) onto screw (17) and install screw into housing (14).
- (b) Assemble gasket (16) to shaft (8) and install shaft (8) into housing (14)
- (c) Assemble gasket (15) to housing (14) and install housing (14) and screws (13)
- (d) Install screw (10), lockwasher (9) and grooved nut (4) in lever (7) and screw (12), lockwasher (11) and grooved nut (5) in cover (2).
- (e) Install lever (7) on shaft (8) and align holes. Install pin (6)
- (f) Hook one end of spring (3) on grooved nut (5) then position cover (2) such that other end of spring (3) can be hooked on grooved nut (4).
- (g) Place cover (2) In position on housing (14) and install three screws (1)

(4) Setting the Stop/Run Lever.

- (a) Run the engine on load until it reaches its normal operating temperature.
- (b) Remove the load from the engine
- (c) Adjust the speed control to give full rated speed.
- (d) Obtain an idle speed and allow it to stabilize for a few seconds.
- (e) Accelerate the engine to full speed using the speed control.

- (f) Turn the stop/run lever counter-clockwise in small amounts until black smoke is emitted from the exhaust when the engine is accelerated. (It may be necessary to repeat this several times until this is achieved.
- (g) When black smoke is emitted from the exhaust turn the stop/run lever clockwise by a small amount at a time until the black smoke just clears and a barely visible haze is emitted.
- (h) Thread screw (17) In until it contacts stop/run lever (7) at the position determined in step g, above. Lock screw (17) in position by tightening nut (18) against housing (14).

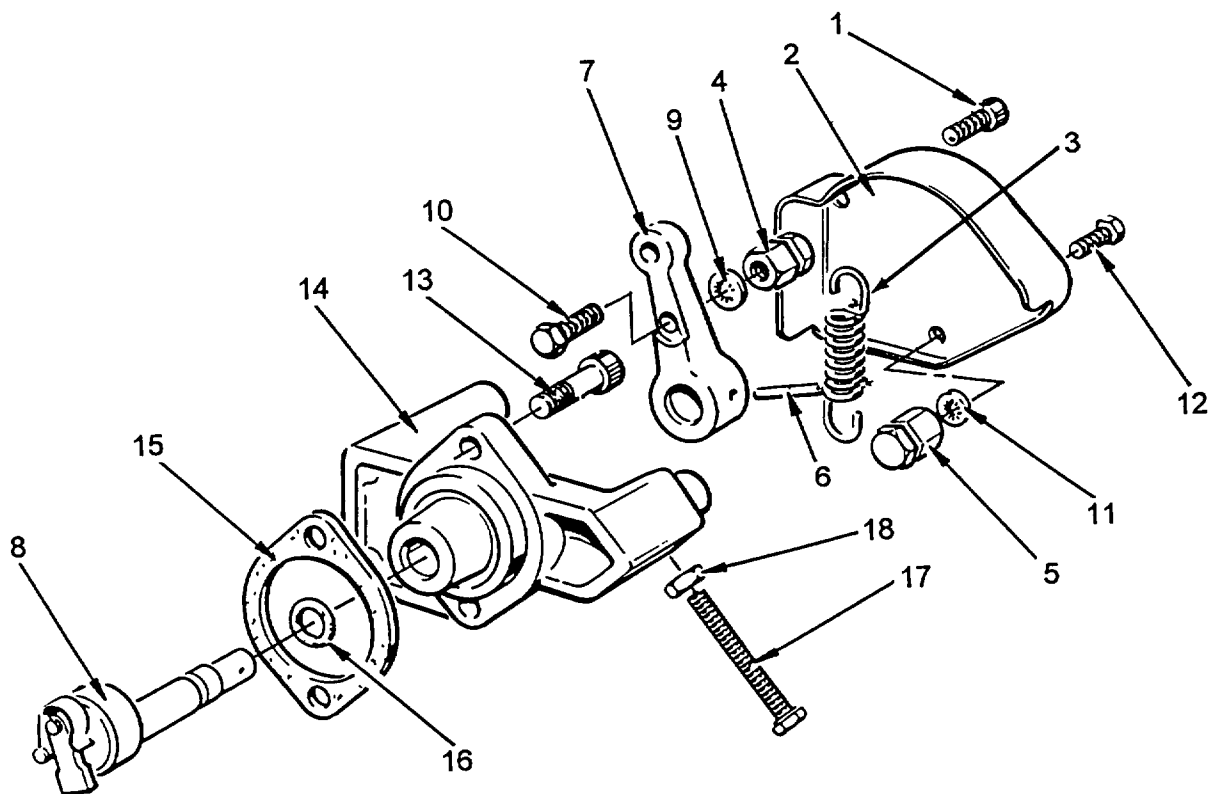


Figure 5-19. Stop/Run Lever

Figure 5-19. Stop/Run Lever

j. Engine Air Cowling.

(1) Removal. (Refer to Figure 5-20).

- (a) Remove nut (1), washer (2) and lifting eye (3).
- (b) Remove nut (4), washer (5) from top of engine air cowling (6).
- (c) Remove two cap screws (7), two washers (8) from side of engine air cowling (6).
- (d) Remove engine air cowling (6) and washers (11) from studs (9) on cylinder head (10). Remove captive nuts (13) from cowling (6)
- (e) Remove stud (9) from cylinder head (10).

(2) Repair.

- (a) Inspect all parts for damage, cracks, distortion and other damage. Replace parts as needed
- (b) Clean threads (12) in cylinder head (10) with thread-cutting tap.

(3) Installation.

- (a) Install studs (9) into cylinder head (10) and install two washers (11) on studs (9).
- (b) Position two captive nuts (13) on cowling (6). Position engine air cowling onto studs (9).
- (c) Install two cap screws (7) and two washers (8) on side of engine air cowling (6).
- (d) Install washer (5) and nut (4) onto stud (9). Tighten.
- (e) Install lifting eye (3), washer (2) and nut (1) onto stud (9). Tighten.

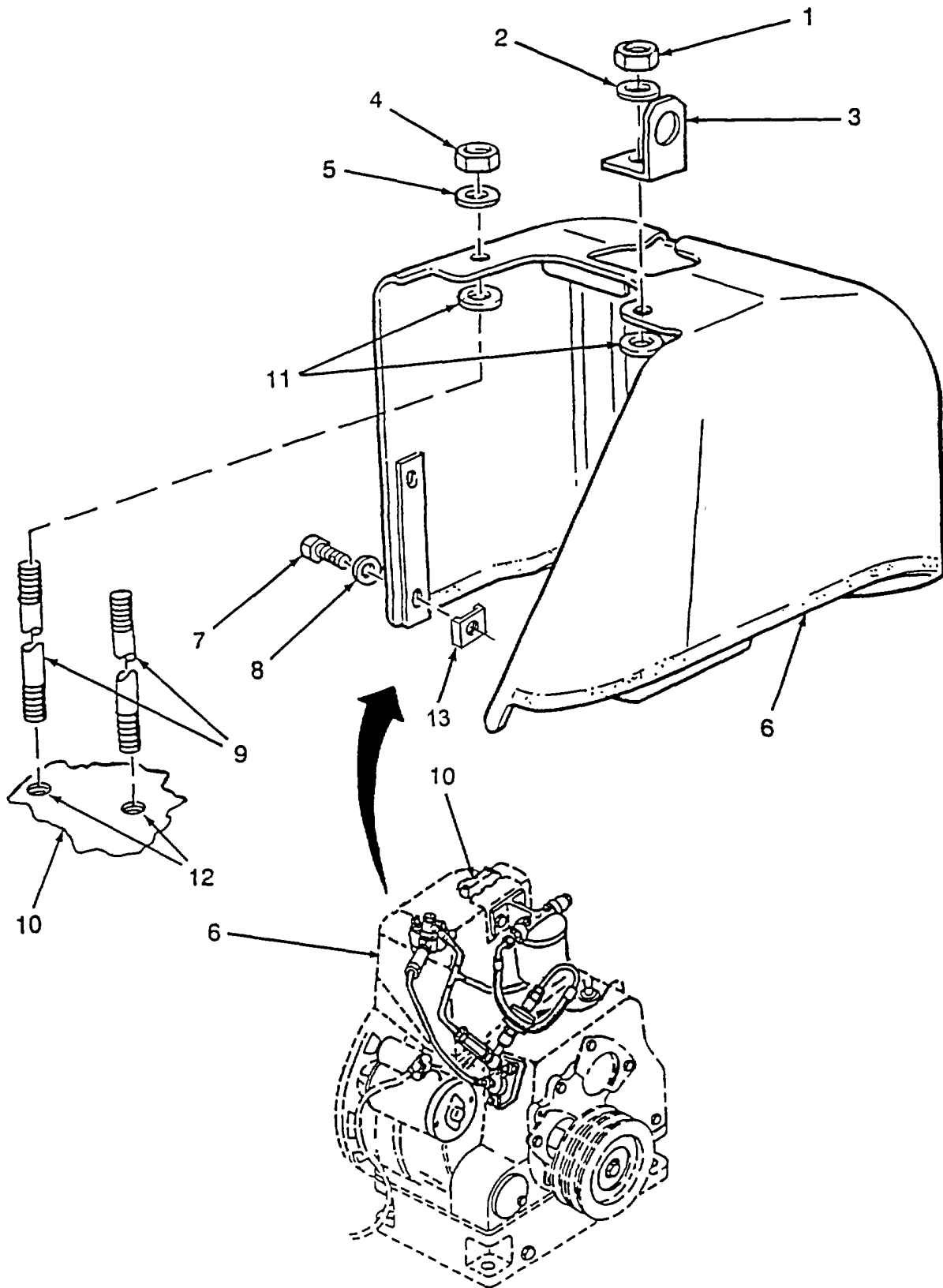


Figure 5-20. Engine Air Cowling

k. Lubricating Oil Pipe.

(1) Removal. (Refer to Figure 5-21).

- (a) Remove bolt (1), two copper washers (2) on each side of swivel union (3).
- (b) Remove bolt (4) and two copper washers (5) on each side of swivel union (6) from oil filter on diesel engine (7).
- (c) Remove lube oil pipe assembly (8) by removing lube oil nuts (9) from swivel unions (3 and 6).

(2) Repair.

Inspect pipe assemblies for damage, cracks, distortion and other damage. Replace parts as needed.

(3) Installation.

- (a) Install lube oil pipe assembly (8) onto swivel unions (3 and 6) using pipe nuts (9).
- (b) Install bolt (4), two copper washers (5) on each side of swivel union (6) into oil filter on diesel engine (7).
- (c) Install bolt (1), two copper washers (2) on each side of swivel union (3) into diesel engine (7).

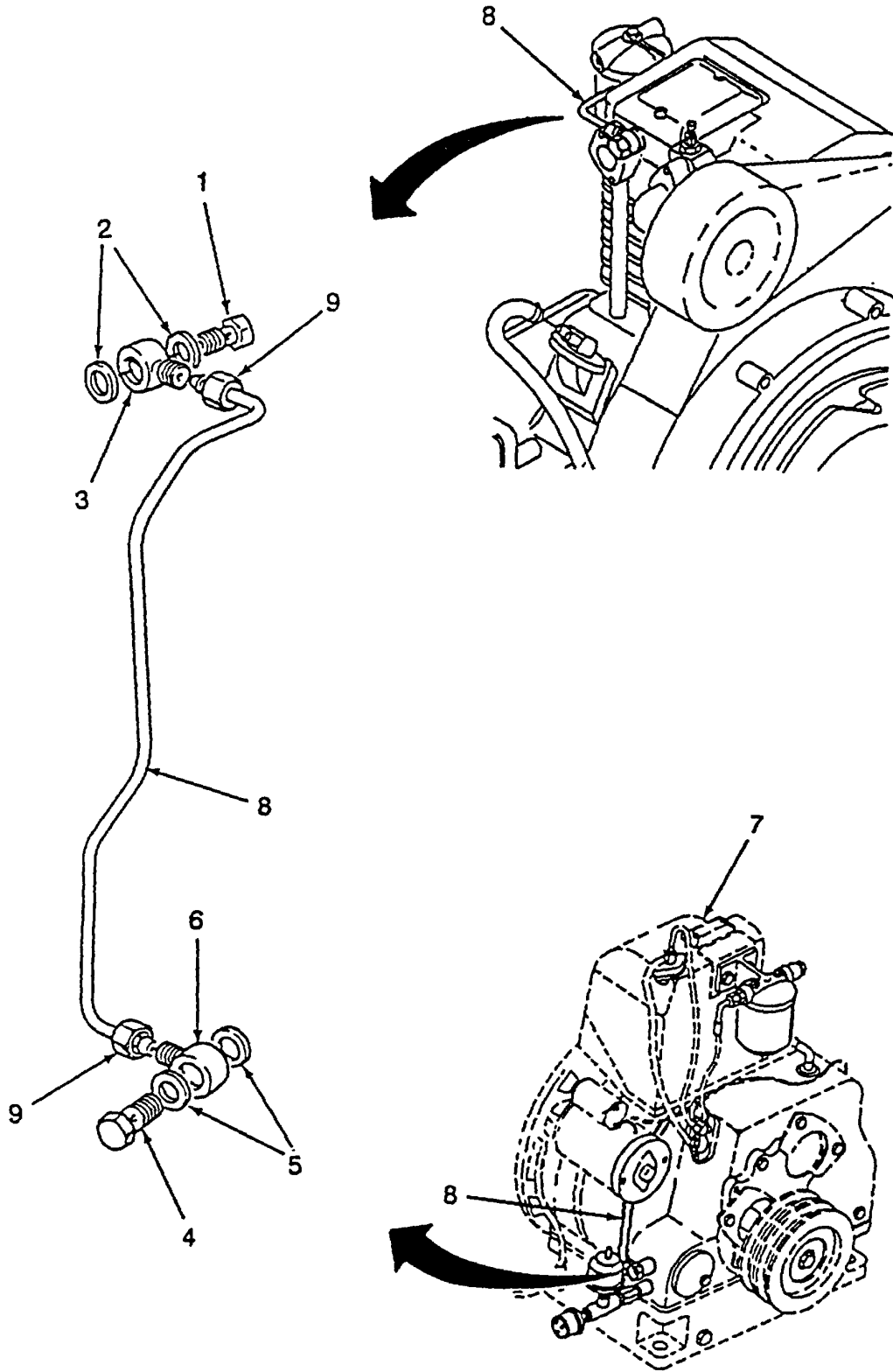


Figure 5-21. Lubricating Oil Pipe

I. Oil Pan, Gasket and Strainer.

(1) Removal. (Refer to Figure 5-22).

WARNING

**Dry cleaning solvent is flammable. Keep solvent away from open flames or sparks
Avoid inhaling solvent fumes or contact with skin**

- (a) Clean dirt and debris from around oil pan (1) and gasket (2) Use dry cleaning solvent, acid swabbing brush, and wiping rag.
- (b) Remove eight screws (3) from oil pan (1). Remove oil pan (1) from bottom of diesel engine block (4).
- (c) Discard gasket (2) from oil pan (1) and diesel engine block (4).
- (d) Clean outside surfaces of the oil pan (1) and diesel engine block (4) with dry cleaning solvent, acid swabbing brush and wiping rag

WARNING

Care must be taken to ensure that wiping rags are not used to wipe the inside of the crankcase during overhauls, to eliminate the possibility of fluff entering the strainer and causing a restricted oil flow.

- (e) Remove the center screw (5), lockwasher (6) from the oil strainer (7) and lift the oil strainer (7) out of the bottom of the oil pan (1).
- (f) Clean the oil strainer (7) using clear Kerosene and allowing it to drain and air dry.

(2) Repair.

- (a) Inspect all parts for damage Replace as required.
- (b) Replace gasket (2).

(3) Installation.

- (a) Position the oil strainer (7) in the oil pan (1), making sure it is correctly seated.
- (b) Install new lockwasher (6) and center screw (5), making sure that the oil strainer (7) is properly seated
- (c) Position gasket (2) and oil pan (1) onto bottom of diesel engine block (4).
- (d) Install eight screws (3) through oil pan (1) into bottom of the diesel engine block (4). Tighten.

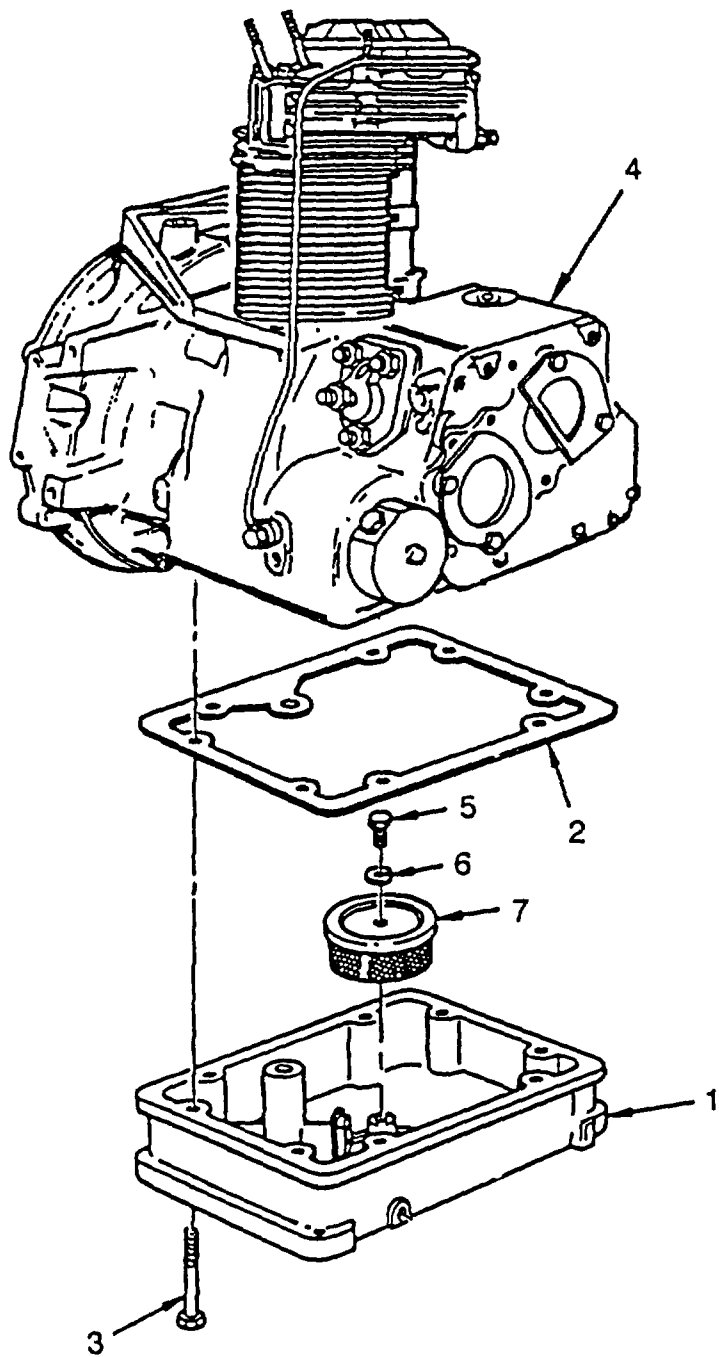


Figure 5-22. Oil Pan, Gasket and Strainer

m. Cylinder Head and Cylinder Barrel.

(1) Removal. (Refer to Figure 5-23).

- (a) Remove two screws (1), rocker cover (2), and gasket (3).
- (b) Scrape old gasket (3) off cylinder head (9).
- (c) Alternately loosen five nuts (4), 1/4-turn at time, starting at rocker support stud (5). (Refer to cylinder head nuts sequence.) Remove nuts (4) and washers (6).
- (d) Remove rocker arm assembly (7), and o-ring (8) from cylinder head (9).
- (e) Remove and tag two push rods (10).
- (f) Remove cylinder head (9), two push rod tubes (11), four seals (12), and gasket (13) from cylinder barrel (14).
- (g) Remove cylinder barrel (14) and gaskets (25) from crankcase (18).
- (h) Remove two screws (15) from housing (16) Remove housing (16) and gasket (17) from crankcase (18).

NOTE

If lever and stop (19) are being removed to replace cylinder head (9), do not remove lever (20) from shaft (21).

- (i) Remove studs (22) from cylinder head (9)
- (j) Clean threads (23) in cylinder head (9) with thread-cutting tap.
- (k) Pull spring pin (24) out of shaft (21).
- (l) Pull shaft (21) out of cylinder head (9).
- (m) Remove preformed packing (26) from shaft (21).
- (n) Drive shaft (21) and bushing (27) from lever (20).
- (o) Remove adjusting screw (28) and locking nut (29)

(2) Repair.

WARNING

**Dry cleaning solvent is flammable. Keep solvent away from open flames or sparks
Avoid inhaling solvent fumes or contact with skin.**

- (a) Clean mating surfaces of cylinder head (9). Use brush cleaning tool, solvent and wiping rag.
- (b) Inspect cylinder head (9), valves, springs and valve seats for damage. Replace as required.

(c) Inspect all parts for damage. Replace as required.

(3) Installation.

- (a) Install adjusting screw (28) through rocker arm assembly (7) and secure adjusting screw (28) with locking nut (29).
- (b) Install shaft (21) and bushing (27) into lever (20).
- (c) Install new preformed packing (26) on shaft (21).
- (d) Push shaft (21) into cylinder head (9).
- (e) Install spring pin (24) into shaft (21).
- (f) Install studs (22) into cylinder head (9).
- (g) Position new gasket (17) on crankcase (18).
- (h) Install two screws (15) and housing (16) onto crankcase.
- (i) Position gaskets (25) and cylinder barrel (14) onto crankcase (18).
- (j) Use stud remover/setter to install fire studs (5) into cylinder barrel (14).
- (k) Position new gasket (13) on cylinder barrel (14).
- (l) Install two tubes (11) and four new seals (12). Position cylinder head (9) on cylinder (14).
- (m) Lubricate two push rods (10) with oil. Install push rods (10) into cylinder head (9).
- (n) Install new o-ring (8) and rocker arm assembly (7).
- (o) Loosely install fire nuts (4) and washers (6)
- (p) Torque nuts (4) between 20 ft-lbs (27.0 Nm) in sequence shown in detail.
- (q) Adjust intake and exhaust valves and decompression lever (Reference para. 5-10.n.).
- (r) Align holes in new gasket (3), cylinder head (9) and cover (2).
- (s) Install two screws (1) to secure cover (2) to cylinder head (9).

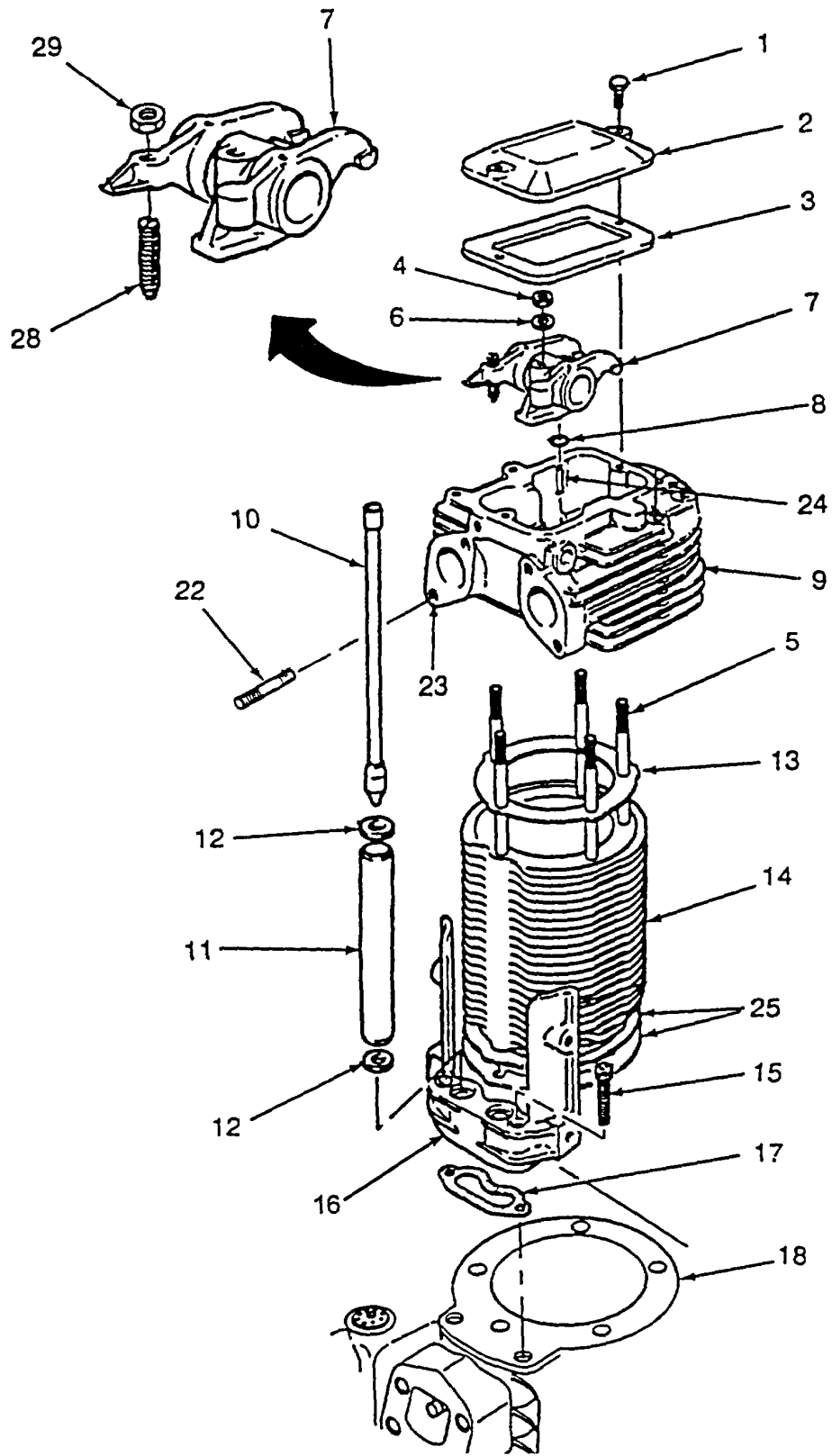
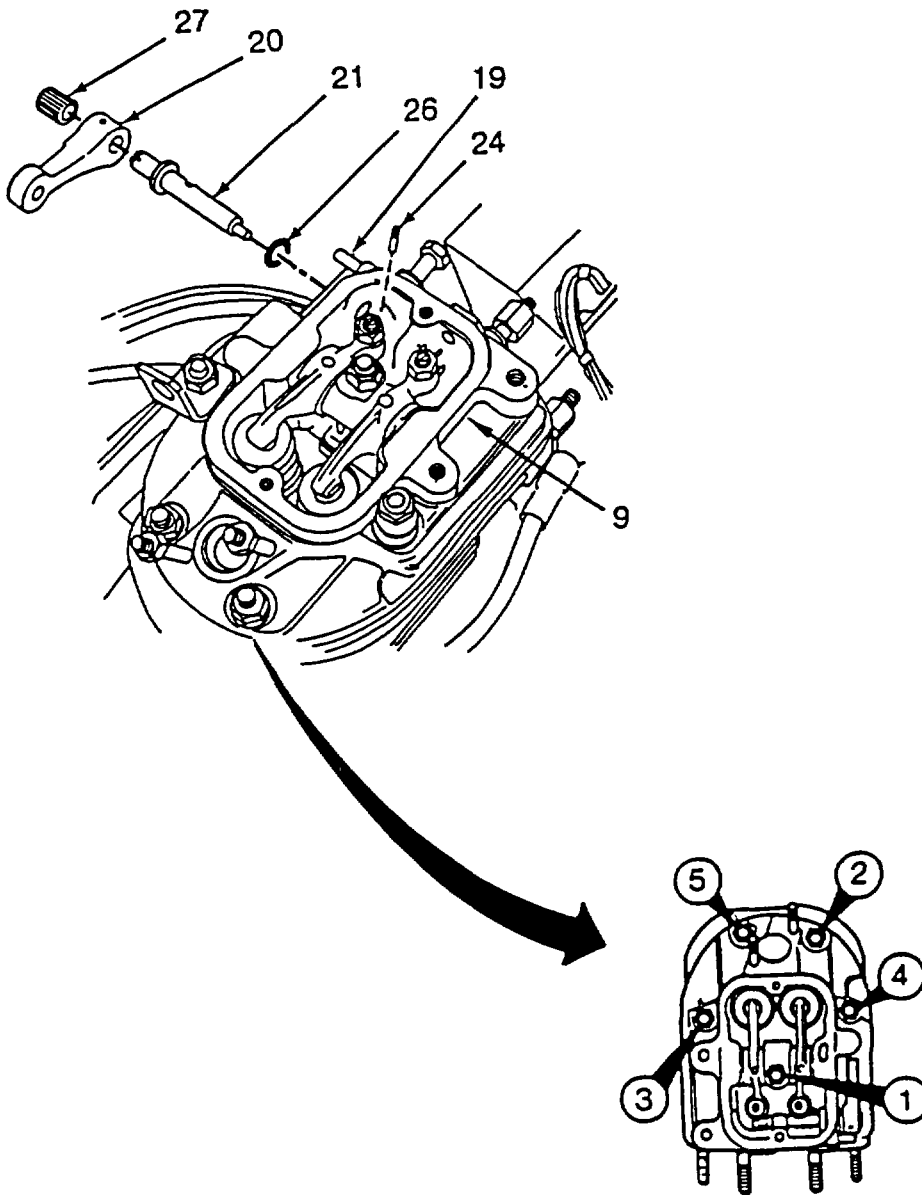


Figure 5-23. Cylinder Head and Cylinder Barrel (Sheet 1 of 2)



CYLINDER HEAD NUTS SEQUENCE

Figure 5-23. Cylinder Head and Cylinder Barrel (Sheet 2 of 2)

n. Intake Exhaust Valves and Decompression Lever Adjustment.

(1) Removal. (Refer to Figure 5-24).

- (a) Remove two screws (1), cover (2), and gasket (3) from cylinder head(4).
- (b) Clean excess gasket material (3) off of cylinder head (4) and cover (2).

(2) Adjustment.

NOTE**Decompression lever (5) must be fully released prior to adjustment**

- (a) Turn crankshaft pulley (6) clockwise until valves (7, 8) are in closed position.
- (b) Loosen locking nut (9) on rocker arm (10)
- (c) Place 0.004-inch thickness gage between stem of valve (7) and arm (10).
- (d) Turn adjusting screw (11) while moving gage between stem of valve (7) and arm (10) until a slight drag is felt
- (e) Hold screw (11) in place and tighten nut (9).
- (f) Repeat steps b thru e for valve (8)
- (g) Turn pulley (6) clockwise until valves (7, 8) are in closed position.
- (h) With lever (5) in vertical position, turn spindle slot (12) clockwise until spindle (13) is backed off from arm (10).
- (i) With lever (5) still in vertical position, turn slot (12) counterclockwise until valve stem (14) and arm (10) make contact.

(3) Installation.

Install two screws (1), cover (2) and new gasket (3) onto cylinder head (4).

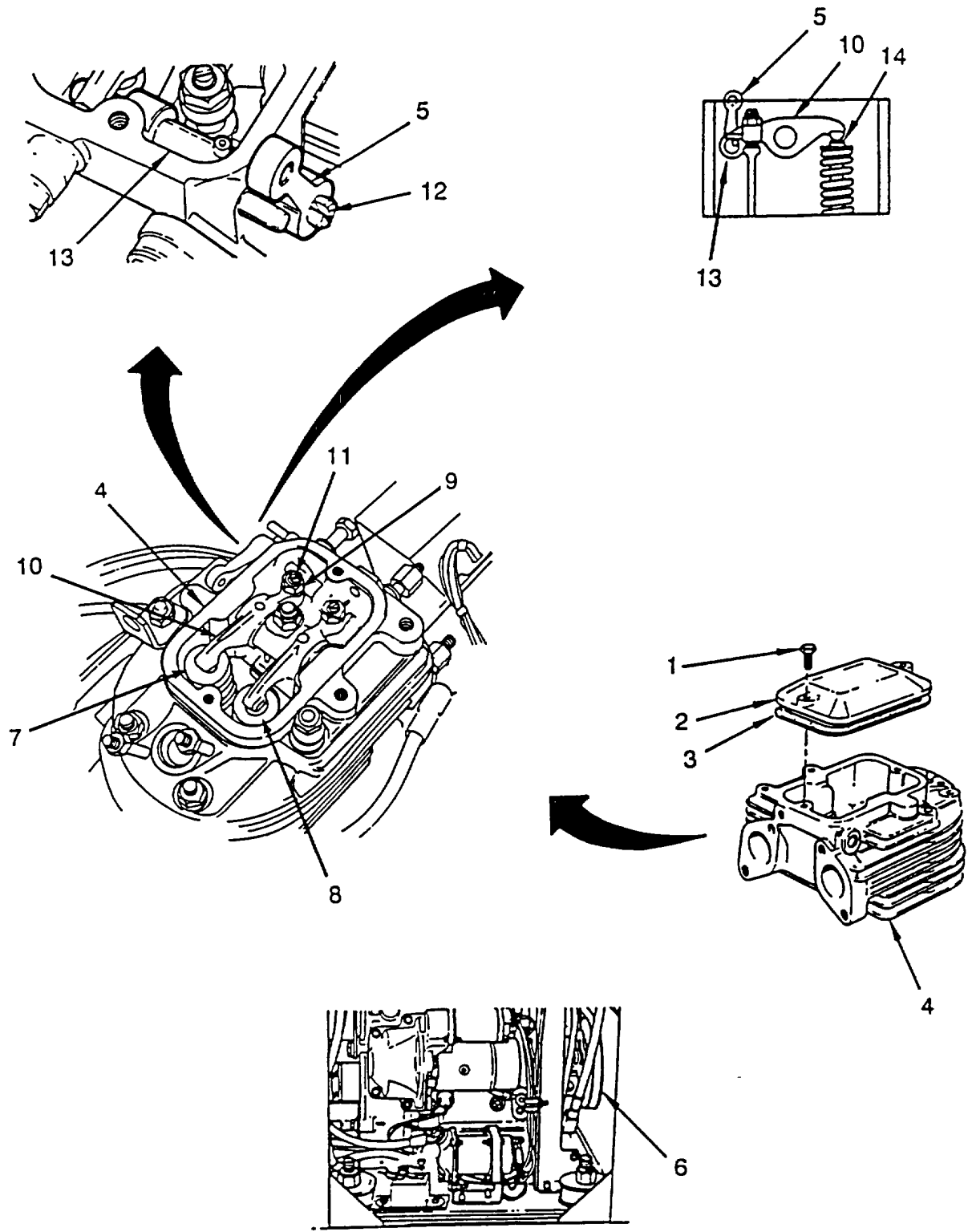


Figure 5-24. Intake and Exhaust Valves and Decompression Lever Adjustment

5-11. LOW PRESSURE PUMP - REPAIR.

This Task Covers: **a. Disassembly** **b. Repair** **c. Assembly**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's' Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Dry cleaning solvent (Appendix H, Section II, Item 3).
 Loctite Type 242 (Appendix H, Section II, Item 13)
 O-Ring (Appendix H, Section II, Item 26).
 O-Ring (Appendix H, Section II, Item 27).
 O-Ring (Appendix H, Section II, Item 28)
 O-Ring (Appendix H, Section II, Item 29).
 Lockwasher (Appendix H, Section II, Item 30).
 Gasket (Appendix H, Section II, Item 31).
 Block "V" Packing (Appendix H, Section II, Item 32)
 O-Ring (Appendix H, Section II, Item 33).
 O-Ring (Appendix H, Section II, Item 34).
 Packing (Appendix H, Section II, Item 35)
 O-Ring (Appendix H, Section II, Item 36).
 Packing (Appendix H, Section II, Item 37).
 Seal (Appendix H, Section II, Item 38).
 Seal (Appendix H, Section II, Item 39)
 O-Ring (Appendix H, Section II, Item 40).
 Gasket (Appendix H, Section II, Item 41).
 Gasket (Appendix H, Section II, Item 42).
 Seal (Appendix H, Section II, Item 43).
 Gasket (Appendix H, Section II, Item 44).
 Gasket (Appendix H, Section II, Item 45).
 Seal (Appendix H, Section II, Item 46).
 Oil, SAE No. 10 (Appendix H, Section II, Item 16).

Equipment Condition

Unit shut down and cool.
 Low Pressure Pump Removed (para 4-42).

a. Disassembly. (Refer to Figure 5-25).

- (1) Loosen jam nut (54), unscrew pump tube (55) from air motor assembly to expose upper coupler (57).
- (2) Remove upper spring clip (56) from upper coupling (57). Unthread upper coupling (57) from air motor piston rod (26) by rotating entire pump tube assembly.
- (3) Clamp air motor in vise vertically.
- (5) Remove four cap screws (1) from adapter (2) and valve body and stop assembly (3). Lift off adapters (2) and remove o-ring (4). Discard o-ring (4).
- (6) Loosen two set screws (5) and unscrew two caps (6). Remove springs (7) and aluminum gasket (8).

NOTE

Inspect cylinder for excessive wear. If worn or scored, it should be replaced.

- (7) Place cap (6) and assembled parts in vise. Using a drift pin and hammer, unscrew cylinder (9). Remove steel washer (10) and spring (11), from cap (6). Repeat for other cap.
- (8) Unscrew eyebolt (12) from insert assembly (13).
- (9) Unscrew plug and insert assembly (13) and remove o-ring (14). Discard o-ring (14).

CAUTION

When removing upper trip-rod nut, DO NOT scratch chrome finish on rod or part will be rendered useless.

NOTE

Watch for falling parts from bottom of body and stop assembly.

- (10) Lift shuttle (15), and with wrench, hold the trip rod (16) at the shoulder. Loosen upper trip-rod nut
- (17) Unscrew upper trip-rod nut (17) from the trip rod (16)
- (11) Unscrew eight stop nuts (18) securing valve body and stop assembly (3) to cylinder head and plug assembly (19).
- (12) Lift valve body and stop assembly (3) up and off eight tie rods (20).
- (13) Remove shuttle (15), plungers (21) and toggles (22).
- (14) Pull tube (23) from cylinder head and plug assembly (19).
- (15) Remove o-rings (24) from tube (23). Discard o-rings (24).
- (16) Lift cylinder (25) from cylinder head and plug assembly (19). Piston rod (26), trip rod (16), and o-ring (27) will come off with cylinder (25). Discard o-ring (27).
- (17) Remove slide valve (28).
- (18) Unscrew four hex head - socket screws (29) with four lockwashers (30), and remove two valve guide and plug assembly (31), two stops (32), valve seat (33) and gasket (34). Discard four lockwashers (30) and gasket (34).
- (19) Remove retaining ring (35), washer (36) and block "V" packing (37) from underside of valve body and stop assembly (3). Discard block "V" packing (37).
- (26) Lift o-ring (38) from cylinder head and plug assembly (19). Discard o-ring (38).
- (21) Unscrew three hex head - socket screws (39) and remove three steel washers (40) and packing retainer (41), from bottom of body (42). Pull two o-rings (43) from packing retainer (42). Discard two o-rings (43).
- (22) Grip piston retainer (44) in vise and loosen piston nut (45). Unscrew piston rod (26) with piston nut (45) from piston retainer (44).

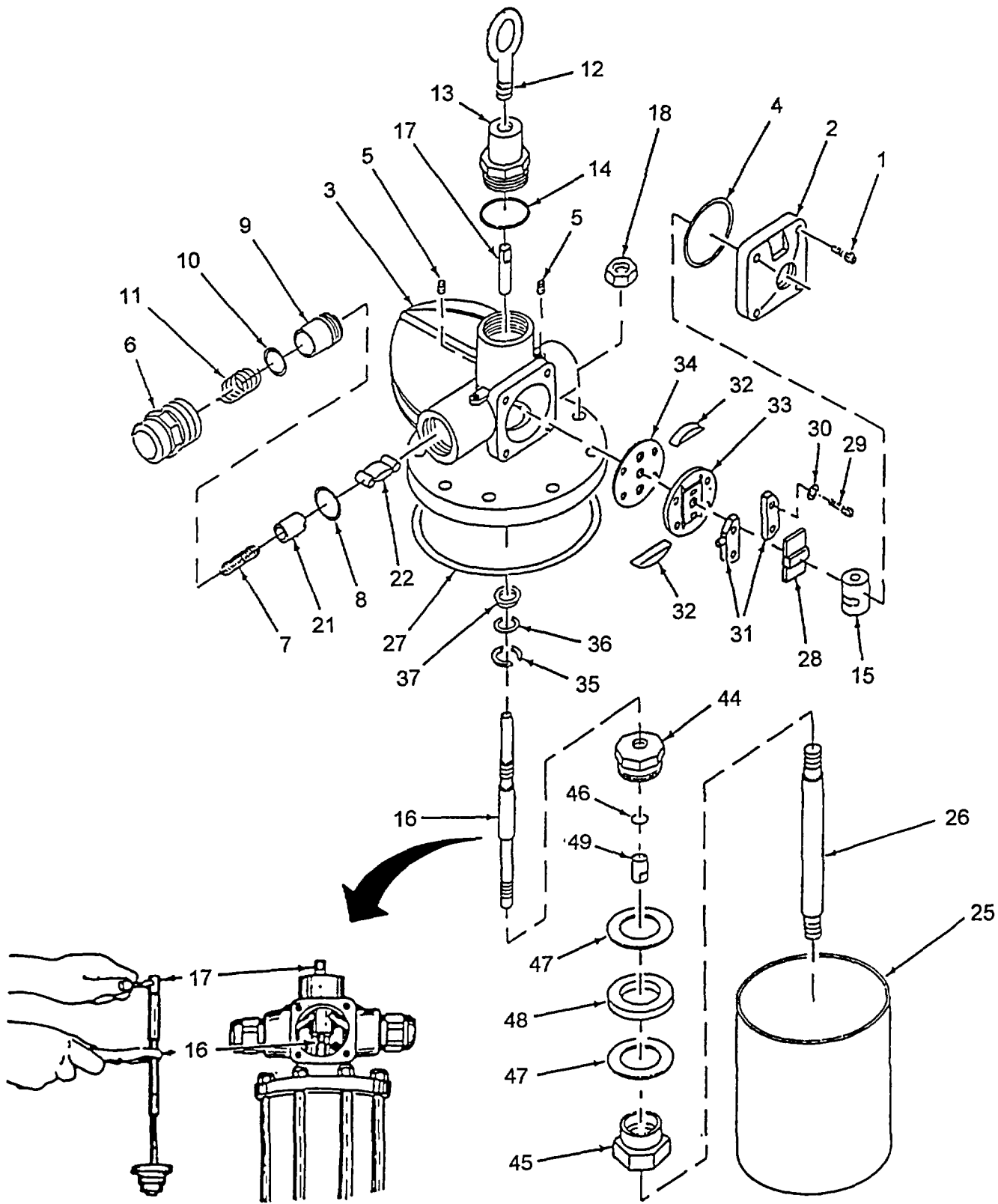


Figure 5-25. Low Pressure Pump (Sheet 1 of 2)

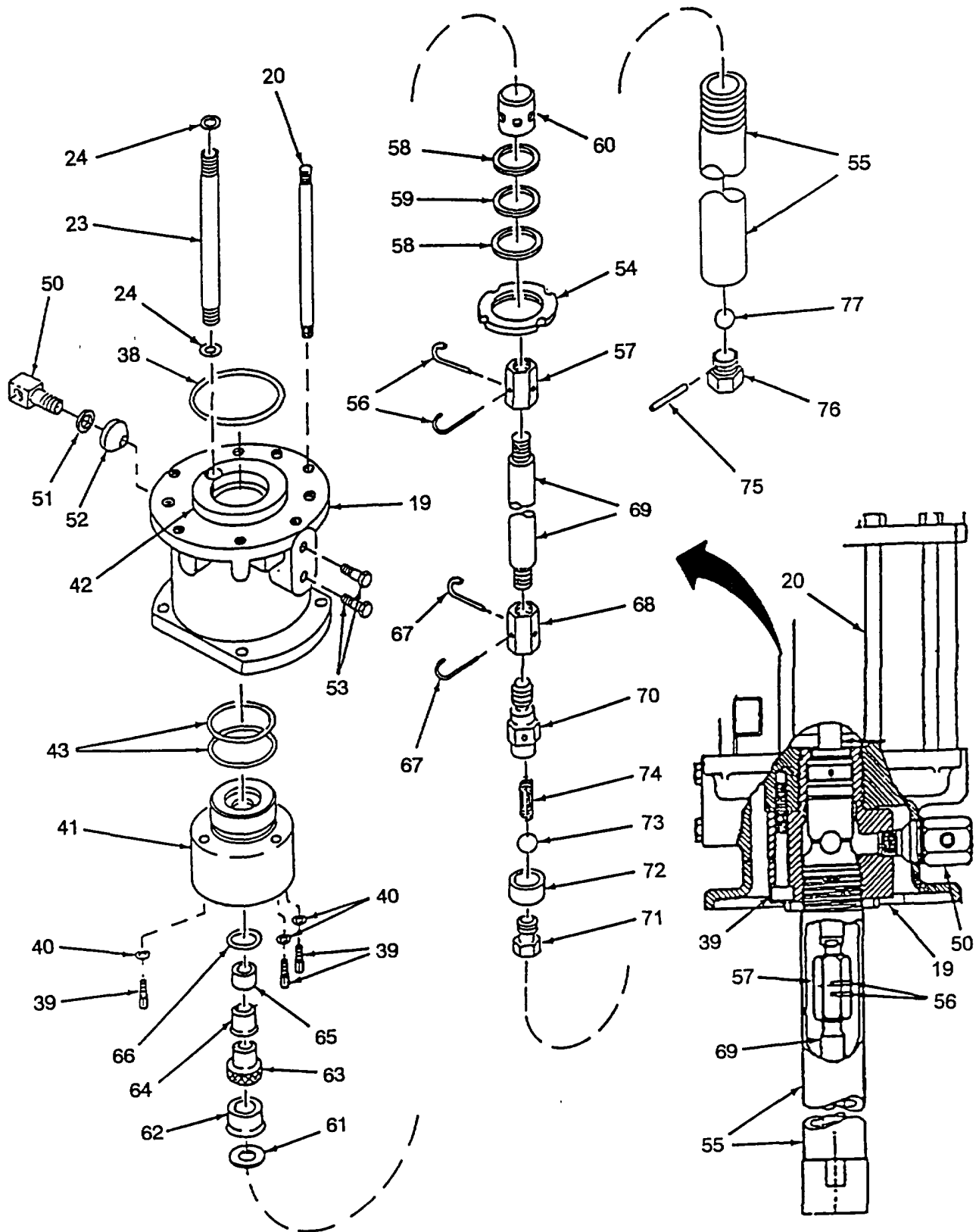


Figure 5-25. Low Pressure Pump (Sheet 2 of 2)

- (23) Remove o-ring (46). Discard o-ring (46).
- (24) Remove two washers (47) and packing (48). Discard packing (48).
- (25) Grip trip rod (16) at shoulder with wrench. Remove bottom trip-rod nut (51). Slip off piston retainer (44). See detail (26). Unscrew and remove adapter (50) from cylinder head and plug assembly (19). Remove washer (51) and bushing (52) from adapter (50).
- (27) Remove two hex head cap screws (53) from cylinder head and plug assembly (19).
- (28) Remove from bottom of packing retainer (42), gasket (58), washer (59), second gasket (58), and spacer (60.)
- (29) Remove washer (61), seal (62), lantern ring (63), seal (64), spacer (65) and o-ring (66) through bottom of body (42). Discard seal (62), seal (64), and o-ring (63).
- (30) Grab upper coupling (57) and pull upward until contents of pump tube (55) is removed.
- (31) Remove two lower spring clip (67) from lower coupling (68). Unthread and remove rod (69) from upper coupling (57), then remove lower coupling (68) from adapter (70).
- (32) Unthread and remove valve seat (71) from adapter (70). Remove piston (72), ball (73) and heavy spring (74).
- (33) Tap out pin (75) from foot valve body (76) and remove ball (77).

b. Repair.

WARNING

Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep solvent away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C)

- (1) Clean all parts with dry cleaning solvent.
- (2) Discard and replace all packings and gaskets.
- (3) Inspect all parts for wear or damage. Replace if necessary.
- (4) Inspect all threaded surfaces for damage. Replace if necessary.
- (5) Inspect pump rods and tubes for cracks, breaks, or other defects.
- (6) Inspect valve and valve seats for damage or wear. Replace if necessary.
- (7) If using repair kit, use all replacement parts in kit.

c. Assembly.

- (1) Install ball (77) into foot - valve body (76). Tap pin (75) into foot - valve body (76).

NOTE

Prior to reassembly, lubricate all o-rings and packings with SAE No. 10 oil or light machine oil. Protect all seals and sealing surfaces from damage and scratches in any way possible.

Apply Loctite "Type 242" to male threads of valve seat (71) prior to installation. Do not tighten more than 1/4 turn after coming in contact with piston (72). Allow 1 - 2 hours to cure.

- (2) Install heavy spring (74), ball (73) and piston (72) into adapter (70). Thread valve seat (71) into adapter (70).
- (3) Thread adapter (70) into lower coupling (68). Thread rod (69) into lower coupling (68). Insert spring clips (67) into lower coupling (68).
- (4) Thread upper coupling (57) onto rod (69) and insert two spring clip (56) into upper coupling (57).
- (5) Grab upper coupling (57) and push downward until contents are inside of pump tube (55).

NOTE

Lips of seal (64) and seal (62) must face downward.

- (6) Install new o-ring (66), spacer (65), seal (64), lantern ring (63), seal (62) and washer (61), into the bottom of packing retainer (41).
- (7) Install new gasket (58), washer (59), new second gasket (58) into bottom of packing retainer (41).
- (8) Install two hex head cap screws (53) into cylinder head and plug assembly (19).
- (9) Install bushing (52), washer (51) and screw adapter (50) into cylinder head and plug assembly (19).
- (10) Grip trip rod (16) at the shoulder with wrench and slip on piston retainer (44) onto trip rod (16), and new o-ring (46). Install the bottom trip rod nut (49). See detail.
- (11) Install two washers (47) and packing (48) onto trip rod (16). Screw piston nut (45) onto trip rod (16).
- (12) Install new two o-rings (43) onto packing retainer (42).
- (13) Install packing retainer (42) into cylinder head and plug assembly (19) and packing retainer (41).
- (14) Install packing retainer (41) into cylinder head and plug assembly (19), securing packing retainer (41) using three screws (39) and three new lockwashers (40).
- (15) Install new o-ring (38) onto lip of cylinder head and plug assembly (19). Install toggles (22) into valve body and stop assembly (3). Install cylinder (25) and piston rod (26), trip rod (16) into cylinder head and plug assembly (19).
- (16) Install new o-rings (24) onto tube (23). Install into body (42).

- (17) Install eight rods (20) into cylinder head and plug assembly (19).
- (18) Slide valve body and stop assembly (3) onto eight rods (20). Install eight stop nuts (18) onto eight rods (20).
- (19) Install retaining ring (35), washer (36) and block "V" packing (37) onto trip rod (16)

NOTE

Cross-torque four hex head - socket screws 45-50 in/lbs.

- (20) Install new gasket (34), two stops (32), valve seat (33), two valve guide and plug assembly (31) into port of valve body and stop assembly (3), securing with four lockwashers (30) and four hex head socket screws (29).
- (21) Slide valve (28) and shuttle (15) into port of valve body and stop assembly (3).
- (22) Install plunger (21), aluminum gasket (8), and toggles.
(22) into both side of valve body and stop assembly (3).
- (23) Using a wrench to hold trip rod (16) and install shuttle (15) onto trip rod (16). Install upper trip rod nut (17) onto trip rod (16) See detail.
- (24) Install new o-ring (14) onto insert assembly (13). Screw plug and insert assembly (13) into valve body and stop assembly (3).
- (25) Install eyebolt (12) into insert assembly (13).
- (26) Install spring (7), into plunger (21). Screw cylinder (9) into valve body and stop assembly (3).
- (27) Install steel washer (10), spring (11), and cap (6) into valve body and stop assembly (3).
- (28) Install new o-ring (4) into adapter (2). Align adapter (2) up with face on valve body and stop assembly (3), securing adapter (2) using four hex head cap screws (1).
- (29) Thread upper coupling (57) to air motor piston rod (26). Install upper spring clips (56).
- (30) Install jam nut (54) securing pump tube (55) to air motor assembly.

5-12. HIGH PRESSURE PUMP - REPAIR.

This Task Covers: **a. Disassembly** **b. Repair** **c. Assembly**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).

Materials/Parts Required

Dry cleaning solvent (Appendix H, Section II, Item 3).
 Loctite Type 242 (Appendix H, Section II, Item 13).
 O-Ring (Appendix H, Section II, Item 26).
 O-Ring (Appendix H, Section II, Item 27).
 O-Ring (Appendix H, Section II, Item 28).
 O-Ring (Appendix H, Section II, Item 29).
 Lockwasher (Appendix H, Section II, Item 30)
 Gasket (Appendix H, Section II, Item 31).
 Block "V" Packing (Appendix H, Section II, Item 32).
 O-Ring (Appendix H, Section II, Item 33).
 O-Ring (Appendix H, Section II, Item 34).
 Packing (Appendix H, Section II, Item 35).
 O-Ring (Appendix H, Section II, Item 36).
 Packing (Appendix H, Section II, Item 37).
 Seal (Appendix H, Section II, Item 38).
 Seal (Appendix H, Section II, Item 39).
 O-Ring (Appendix H, Section II, Item 40).
 Gasket (Appendix H, Section II, Item 41).
 Gasket (Appendix H, Section II, Item 42).
 Seal (Appendix H, Section II, Item 43).
 Gasket (Appendix H, Section II, Item 44).
 Gasket (Appendix H, Section II, Item 45).
 Seal (Appendix H, Section II, Item 46)
 Oil, SAE No. 10 (Appendix H, Section II, Item 16).

Equipment Condition

Unit shut down and cool.
 High Pressure Pump Removed (para. 4-42).

a. Disassembly. (Refer to Figure 5-26.)

- (1) Loosen jam nut (54) and unscrew pump tube (55) from air motor assembly to expose upper coupler (56).
- (2) Remove upper spring clip (57) from upper coupling (56). Unthread upper coupling (56) from air motor piston rod (27) by rotating entire pump tube assembly.
- (3) Clamp air motor in vise vertically.
- (4) Remove four hex head cap screws (1) from adapter (2) and valve body and stop assembly (3). Lift off adapters (2) and remove o-ring (4). Discard o-ring (4).
- (5) Loosen two set screws (5) and unscrew two caps (6). Remove springs (7 and 8) and aluminum gasket (9).

NOTE

Inspect cylinder for excessive wear. If worn or scored, it will be necessary to be replaced.

- (6) Place cap (6) and assembled parts in vise Using a drift pin and hammer, unscrew cylinder (10). Remove steel washer (11) and spring (12), from cap (6) Repeat for other cap.
- (7) Unscrew eyebolt (13) from insert assembly (14).
- (8) Unscrew insert assembly (14) and remove o-ring (15) Discard o-ring (14).

CAUTION

When removing upper trip-rod nut, DO NOT scratch chrome finish on rod or part will be rendered useless.

NOTE

Watch for falling parts from bottom of body and stop assembly.

- (9) Lift shuttle (16) and with wrench, hold the trip rod (17) at the shoulder Loosen upper trip-rod nut (18). Unscrew upper trip-rod nut (18) from the trip rod (17).
- (10) Unscrew five stop nuts (19) securing valve body and stop assembly (3) to cylinder head and plug assembly (20).
- (11) Lift valve body and stop assembly (3) up and off five tie rods (21).
- (12) Remove shuttle (16), plunger (22) and toggles (23).
- (13) Pull tube (24) from cylinder head and plug assembly (20).
- (14) Remove o-ring (25) from tube (24). Discard o-ring (25).
- (15) Lift cylinder (26) from cylinder head and plug assembly (20). Piston rod (27), trip rod (17), and o-ring (28) will come off with cylinder (26). Discard o-ring (28).
- (16) Remove slide valve (29).
- (17) Unscrew four hex head socket screws (30) with four lockwashers (31), and remove two valve guide and plug assembly (32), two stops (33), valve seat (34) and gasket (35). Discard four lockwashers (31) and gasket (35).
- (18) Remove retaining ring (36), washer (37) and block "V" packing (38) from underside of valve body and stop assembly (3). Discard block "V" packing (38).
- (19) Lift o-ring (39) from cylinder head and plug assembly.
- (20) Discard o-ring (39) (20) Unscrew three hex head socket screws (40) and remove packing retainer (41), from bottom of body (42). Pull o-rings (43) from packing retainer (41). Discard o-rings (43).
- (21) Grip piston retainer (44) in vise and loosen piston nut (45). Unscrew piston rod (27) with piston nut (45) from piston retainer (44).
- (22) Remove o-ring (46) Discard o-ring (46).
- (23) Remove two washers (47) and packing (48) Discard packing (48).

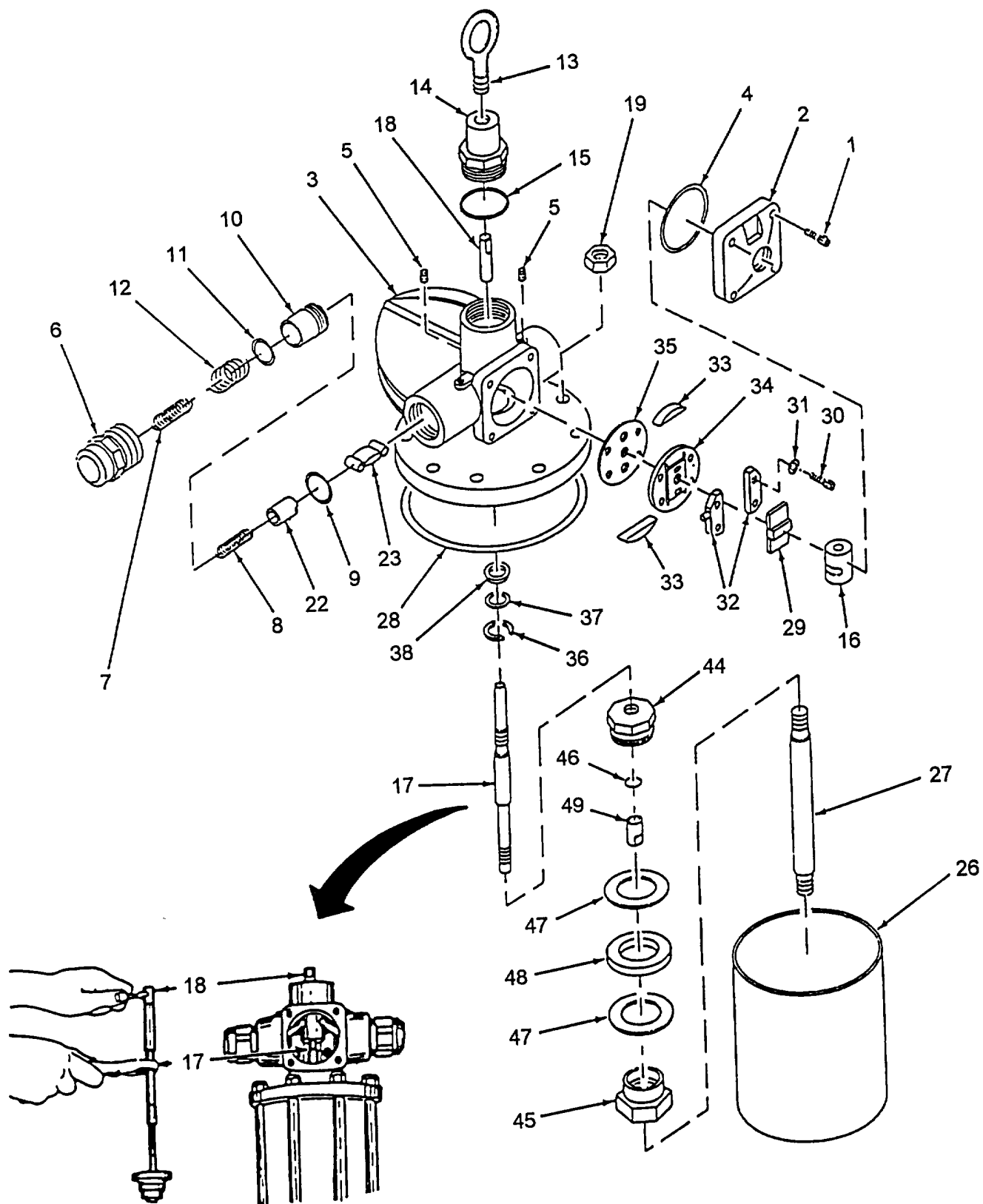


Figure 5-26. High Pressure Pump (Sheet 1 of 3)

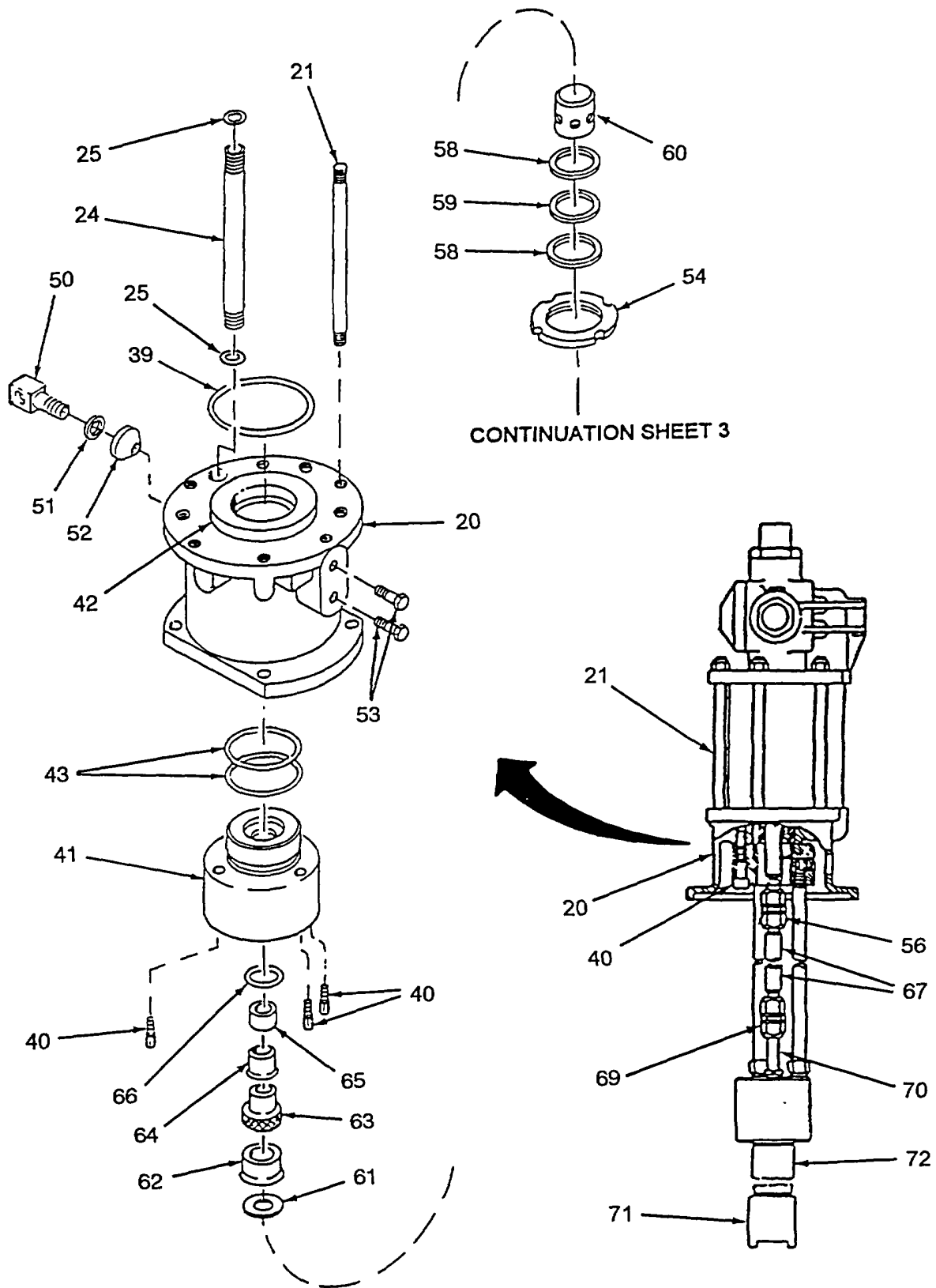


Figure 5-26. High Pressure Pump (Sheet 2 of 3)

CONTINUATION SHEET 2

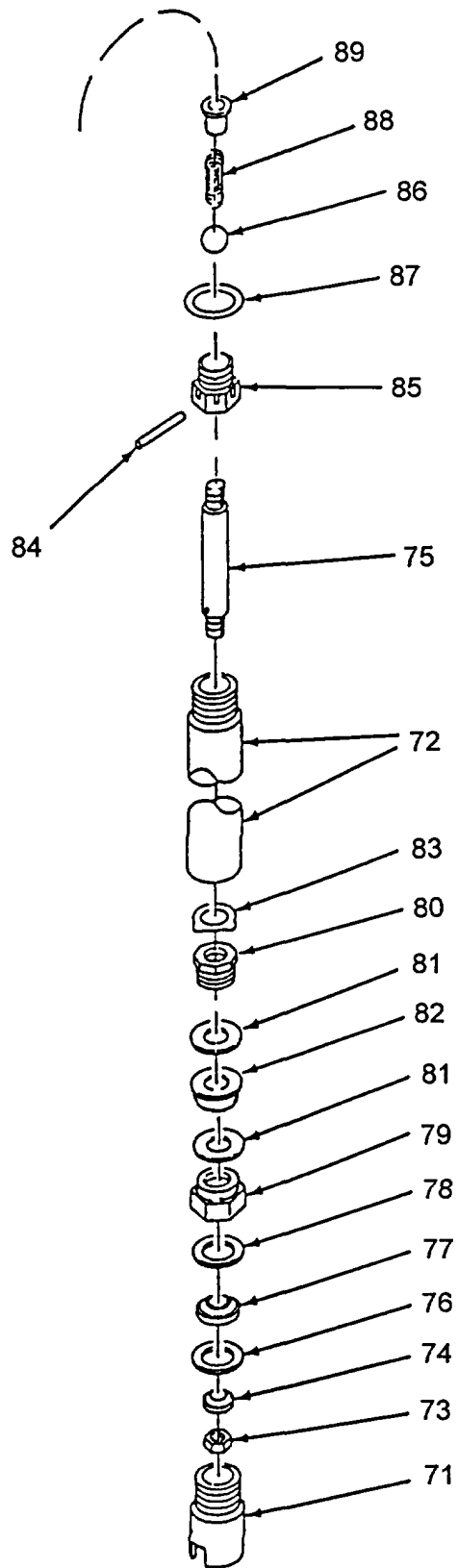
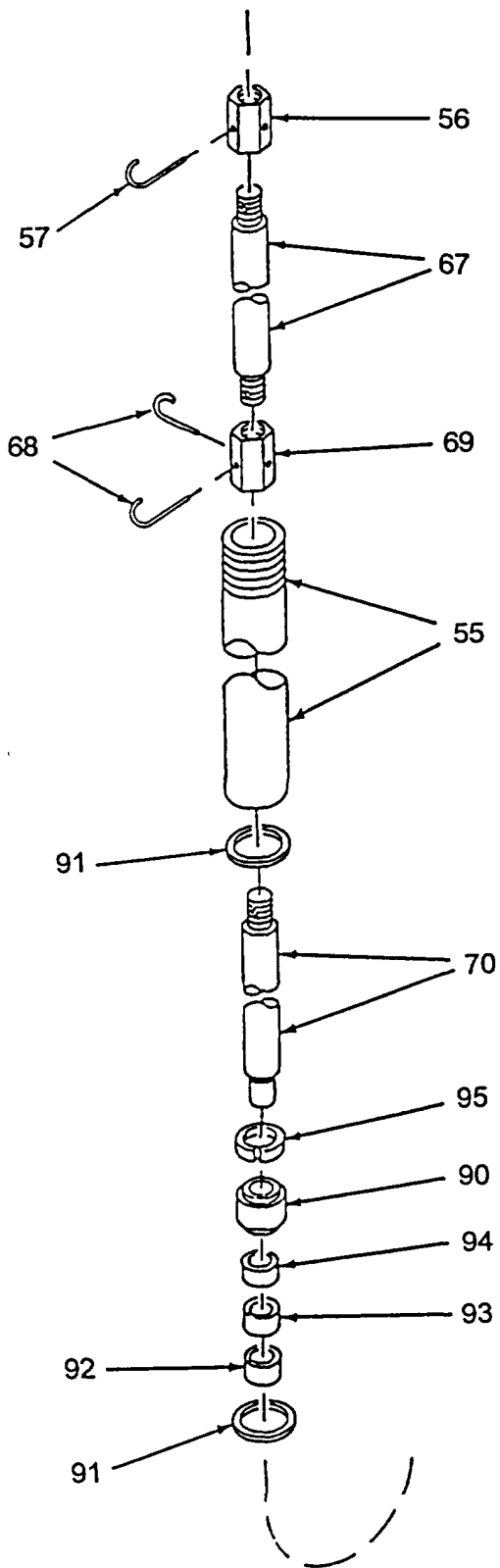


Figure 5-26. High Pressure Pump (Sheet 3 of 3)

- (24) Grip trip rod (17) at shoulder with wrench. Remove the bottom trip-rod nut (49). Slip off piston retainer (44).
- (25) Unscrew and remove adapter (50) from cylinder head and plug assembly (20). Remove washer (51) and bushing (52) from adapter (50).
- (26) Remove two hex head cap screws (53) from cylinder head and plug assembly (20).
- (27) Remove from bottom of packing retainer (41), gasket (58), washer (59), second gasket (58), and spacer (60).
- (28) Remove washer (61), seal (62), lantern ring (63), seal (64), spacer (65) and o-ring (66) through bottom of packing retainer (41). Discard seal (62), seal (64), and o-ring (66).
- (29) Grab upper coupling (56) and push upward until contents of cylinder (55) is removed.
- (30) Unthread and remove upper coupling (56) from rod (67).
- (31) Disengage two lower spring clips (68) from lower coupler (69). Unscrew rod (67) from coupler (69) and coupler (69) from piston (70).
- (32) Remove primer body (71) from pump tube adapter (72). Remove elastic stop nut (73) and plate (74) Use drift pin in 5/32" hole in primer rod (75).
- (33) Remove gasket (76), valve seat (77) and second gasket (78). Remove valve body (79) from pump tube adapter (72). Discard gasket (77).
- (34) Unscrew packing nut (80) from valve body (79) removing two nylon washers (81), seal (82), from primer rod (75). Remove guide washer (83) from primer rod (75).
- (35) Pull primer rod (75) with piston (70) still attached through bottom of adapter (72) to expose roll pin (84). Drive roll pin (84) out of primer rod (75) and insert assembly (85) with drift pin.
- (36) Unscrew adapter (72) from (55). Remove piston (70) from adapter (72) and insert assembly (85), and remove ball (86), gasket (87), spring (88), retainer (89) and barrel assembly (90).

NOTE

Inspect piston for excessive wear. If worn or scored, it will be necessary to be replaced

- (m) Pull barrel assembly (90) from piston (70) and remove two gaskets (91). Remove steel spacer (92), bearing (93), seal (94) and wear ring (95) from barrel assembly (90). Discard gaskets (91) and seal (94)

b. Repair.

WARNING

Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places Keep solvent away from open flames or sparks Avoid inhaling solvent fumes Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).

- (1) Clean all parts with dry cleaning solvent.
- (2) Discard and replace all packings and gaskets.

- (3) Inspect all parts for wear or damage. Replace if necessary.
 - (4) Inspect all threaded surfaces for damage. Replace if necessary.
 - (5) Inspect pump rods and tubes for cracks, breaks, or other defects.
 - (6) Inspect valve and valve seats for damage or wear. Replace if necessary.
 - (7) If using repair kit, use all replacement parts in kit.
- c. Assembly.

NOTE

Prior to reassembly, lubricate all o-rings and packings with SAE No. 10 oil or light machine oil. Protect all seals and sealing surfaces from damage and scratches in any way possible.

- (1) Install wear ring (95), seal (94), bearing (93), steel spacer (92) and barrel assembly (90) onto piston (70). Install two new gaskets (91) onto piston (70).
- (2) Insert retainer (89), spring (88), ball (86), gasket (87) into insert assembly (85). Install adapter (72) and insert assembly (85).
- (3) Install primer rod (75) to piston (70) through adapter (72) and install roll pin (84) through adapter (72) and insert assembly (85) through primer rod (75).
- (4) Install two nylon washers (81), seal (82) onto packing nut (80). Screw packing nut (80) onto valve body (79).
- (5) Install new second gasket (78), valve seat (77), new gasket (76), plate (74) onto bottom of adapter (72) onto primer rod (75), secure with elastic stop nut (73).

NOTE

Prior to reassembly, apply Loctite "Type 242" to the threads of adapter (72) and primer body (71).

- (6) Screw primer body (71) into bottom of adapter (72).
- (7) Thread rod (67) into lower coupling (69). Insert two spring clips (68) into lower coupling (69) and piston (70).
- (8) Thread upper coupling (56) onto rod (67) and insert spring clip (57) into upper coupling (56).

NOTE

Lips of seal (55) and seal (53) must face downward.

- (9) Install new o-ring (66), spacer (65), seal (64), lantern ring (63), seal (62) and washer (61) into the bottom of packing retainer (40).
- (10) Install new gasket (58), washer (59), new gasket (58) into bottom of packing retainer (40).
- (11) Install two hex head cap screws (53) into cylinder head and plug assembly (20).
- (12) Install bushing (52), washer (51) and screw adapter (50) into cylinder head and plug assembly (20).

- (13) Grip trip rod (17) at the shoulder with wrench and slip on piston retainer (44) onto trip rod (17), and new o-ring (46). Install the bottom trip rod nut (51). See detail.
- (14) Install two washers (47) and packing (48) onto trip rod (17). Screw piston nut (45) onto trip rod (17) Tighten.
- (15) Install o-rings (43) onto packing retainer (41).
- (16) Install packing retainer (42) into cylinder head and plug assembly (20) and packing retainer (41).
- (17) Install packing retainer (41) into cylinder head and plug assembly (20), securing packing retainer (41) using three screws (40).
- (18) Install new o-ring (39) onto lip of cylinder head and plug assembly (20). Install new o-ring (28) into valve body and stop assembly (3). Install cylinder (25) and piston rod (27), trip rod (17) into cylinder head and plug assembly (20).
- (19) Install new o-ring (25) onto tube (24). Install into body (42).
- (20) Install five rods (21) into cylinder head and plug assembly (20).
- (21) Slide valve body and stop assembly (3) onto five rods (21). Install five stop nuts (19) onto five rods (21).
- (22) Install retaining ring (36), washer (37) and block "V" packing (38) onto trip rod (17).

NOTE

Cross-torque four hex head - socket screws 45-50 in/lbs.

- (23) Install new gasket (35), two stops (33), valve seat (34), two valve guides and plug assembly (32) into port of valve body and stop assembly (3), securing with four lockwashers (31) and four hex head socket screws (30).
- (24) Slide valve (29) and shuttle (16) into port of valve body and stop assembly (3).
- (25) Install plunger (22), aluminum gasket (9), and toggles (23) into both side of valve body and stop assembly (3).
- (26) Using a wrench, hold trip rod (17) and install shuttle (16) onto trip rod (17). Install upper trip-rod nut (18) onto trip rod (17). See detail.
- (27) Install new o-ring (15) onto insert assembly (14) Screw plug and insert assembly (14) into valve body and stop assembly (3).
- (28) Install eyebolt (13) into insert assembly (14).
- (29) Install spring (8), into plunger (22) Screw cylinder (10) into valve body and stop assembly (3).
- (30) Install steel washer (11), spring (12), spring (7) and cap (6) into valve body and stop assembly (3).
- (31) Install new o-ring (4) into adapter (2) Align adapter (2) up with face on valve body and stop assembly (3), securing adapter (2) using four hex head cap screws (1).
- (33) Thread upper coupling (56) to air motor piston rod (27). Install upper spring clip (57).
- (34) Install jam nut (54) securing pump tube (55) to air motor assembly.

5-13. LUBE TANK - REPLACE/REPAIR.

This Task Covers: **a. Removal** **b. Repair** **c. Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's. Automotive (Appendix B, Section III, Item 1).
Electric Welder (Appendix B, Section III, Item 3).

Materials/Parts Required

Silicon Sealant (Appendix E, Section II, Item 6).
Nut, self-locking (Appendix H, Section II, Item 10).
Teflon Tape (Appendix E, Section II, Item 7).
Dry cleaning solvent (Appendix E, Section II, Item 3).

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para 4-13)
Alcohol Injector Removed (para. 4-16).
Air Regulators Removed (para. 4-41).
Low and High Pressure Pumps Removed (para. 4-42).
A-frame Removed (para. 5-3).

References

FM 43-2, Metal Body Repair and Related Operations.
TM 9-237, Welding Theory and Application.
TM 43-0139, Painting Instruction for Field Use.

Personnel Required

4

WARNING

- **Clean up spills as soon as they occur. Spills can cause falls and serious injuries**

a. Removal. (Refer to Figure 5-27).

NOTE

GAA Grease will have to be scooped out.

- (1) Completely drain all lubricants from lube tank (1) by removing three plugs (2) from bottom of skid (3).
- (2) Remove four nuts (4), bracket (5), and u-clamp (6) from interflex hose (7).
- (3) Remove interflex hose (7) from tube on lube tank (1) and from diverter (8).
- (4) Remove two nuts (4), bracket (5) and u-clamp (6) from interflex hose (9). (5) Remove interflex hose (9) from diverter (8).

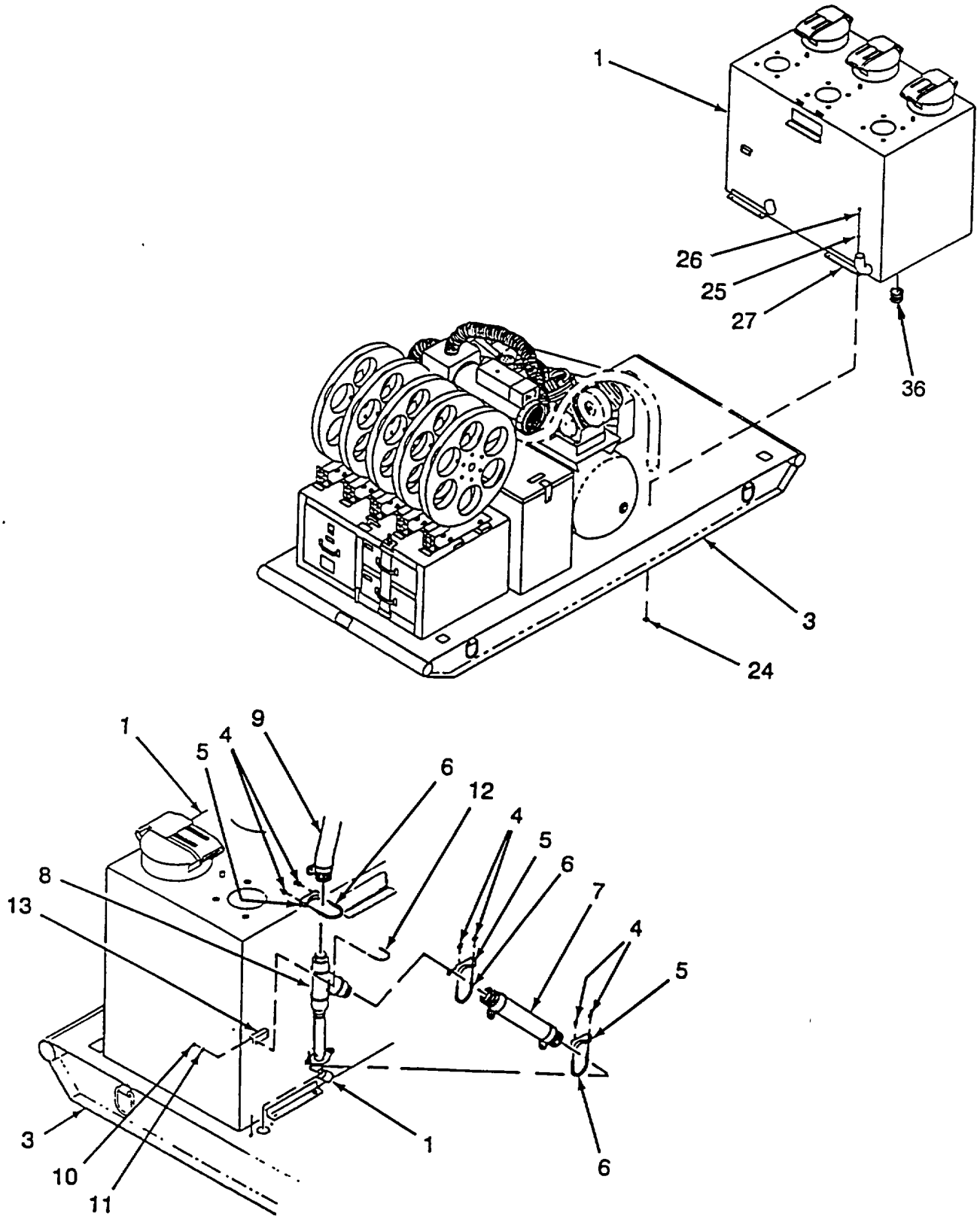


Figure 5-27. Lube Tank (Sheet 1 of 2)

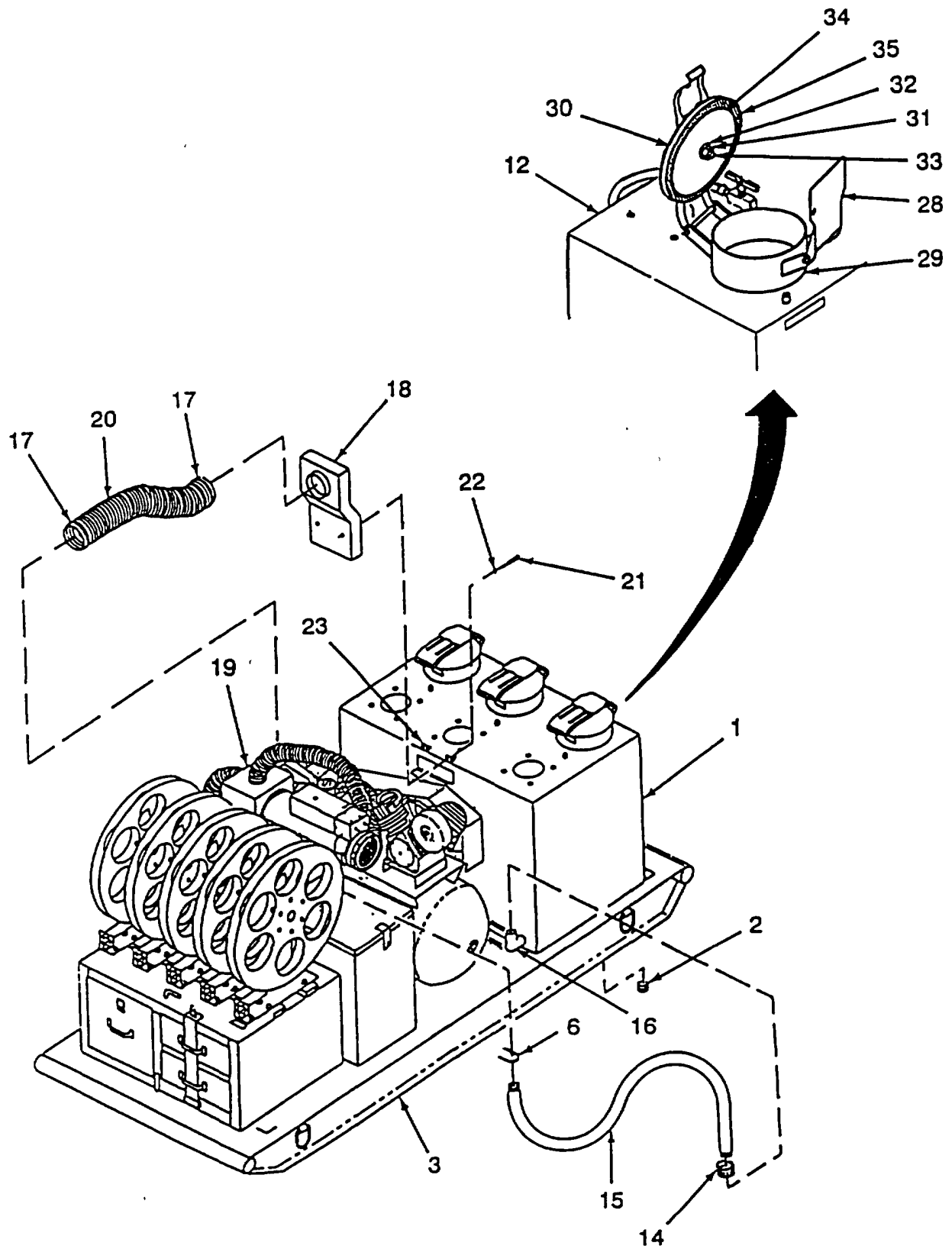


Figure 5-27. Lube Tank (Sheet 2 of 2)

- (6) Loosen two locknuts (10) and two lockwashers (11) and remove u-bolt (12) from exhaust diverter bracket (13).
- (7) Loosen outer worm gear hose clamp (14). Remove interflex tubing (15) from tube (16) on rear of lube tank (1).
- (8) Loosen two clamps (17) at heat inlet (18) and heater plenum (19). Remove 5" heater duct (20) from heat inlet (18) and heater plenum (19).
- (9) Remove two bolts (21) and lockwashers (22) from manifold bracket (23). Remove heat inlet (18).
- (10) Remove eight locknuts (24), washers (25), and bolts (26) from mount brackets (27) on lube tank (1).

NOTE

Steps (12) through (15) apply to all three lube compartments

- (11) Flip spring latch (28) on manhole cover (29). Lift up manhole lid (30)
- (12) Remove locknut (31) and formed washer (32) from bolt (33) Discard locknut (31)
- (13) Remove gasket retainer (34) and gasket (35) from manhole lid (30)
- (14) Check gasket (35) and gasket retainer (34) for wear or damage. Replace if necessary.

WARNING

- **Stand clear when lube tank is lifted. It could fall and cause serious injury.**

- (15) Position one person at each corner of lube tank (1) and lift lube tank (1) off of skid (3)

- a. Repair. (Refer to Figure 5-27.

WARNING

- **Clean all parts in a well ventilated area. Avoid inhaling solvent fumes and prolonged exposure of the skin to cleaning solvent. Failure to do so can cause severe injury or death. Do not use near flame or excessive heat Flash point of solvent is 100° F to 138° F (38° C to 59° C)**

- (1) Remove magnetic plugs (36) from bottom of lube tank. Flush out each of the three lubricant compartments in the tank using dry cleaning solvent.
- (2) Inspect tank for cracks, defective manhole hinges, broken weldments, and other damage. Repair defective tanks.
- (3) Inspect manhole for damage, corrosion, gasket damage or wear or other conditions that could impair its sealing ability. Replace parts as required.

- (4) Clean off corrosion with wire brush, then repaint in accordance with TM 43-0139.
- (5) Fix dents as needed. (Reference. FM 43-2).
- (6) Weld cracks as needed. (Reference. TM 9-237).

b. Installation.

- (1) Position two person at each corner of lube tank (1) and lift and place lube tank (1) onto skid (3), lining up holes on skid (3).

NOTE

Steps (2) through (4) apply to all 3 lube compartments.

- (2) Install gasket (35) and gasket retainer (34) onto manhole lid (30).
- (3) Install formed washer (32) and new locknut (31) onto bolt (33). Tighten.
- (4) Close manhole lid (30), securing it with spring latch (28).
- (5) Install eight bolts (26) and washers (25) through mount brackets (27) on lube tank (1) and skid (3). Install and tighten eight locknuts (24).
- (6) Install exhaust manifold (18) to manifold bracket (23) by installing two bolts (21) and lockwashers (22).
- (7) Install 5" heater duct (20) to exhaust manifold (18) and heater plenum (19). Tighten clamps (17) at exhaust manifold (18) and heater plenum (19).
- (8) Connect exhaust diverter (8) to exhaust diverter bracket (13) by installing u-bolt (12) two nuts (10) and two lockwashers (11).
- (9) Connect loose end of interflex hose (15) to tube (16) on rear of lube tank (1). Tighten outer worm gear hose clamp (14).
- (10) Slide interflex hose (9) onto diverter (8).
- (11) Slide u-clamp (6) around interflex hose (9). Install bracket (5) onto u-clamp (6). Secure bracket (5) by installing two nuts (4) onto u-clamp (6).
- (12) Slide interflex hose (7) onto tube on lube tank (1) and onto diverter (8).
- (13) Slide two u-clamps (6) around interflex hose (7). Install two brackets (5) onto u-clamps (6). Secure brackets (5) by installing two nuts (4) onto each u-clamp (6).

NOTE

Wind Teflon Tape ten times around each magnetic plugs (2).

- (14) Replace three plugs (2) into lube tank (1) under bottom of skid (3). Fill lube tank (1) with appropriate lubricants.

5-14. HEATER WIRING HARNESS - REPAIR.

This Task Covers: **a. Repair**

Initial Setup:

Tools Required

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Multimeter (Appendix B, Section III, Item 2).

Materials/Parts Required

Tags (Appendix E, Section II, Item 17).
Tape, Electrical (Appendix E, Section II, Item 18).

Equipment Condition

Unit shut down and cool.
Heater Control Box Assembly removed (para 4-45).
Wiring Harness removed (para. 4-46)

WARNING

Prevent electrical shocks or burns. DO NOT wear jewelry or dog tags when working on electrical components.

a. Repair.

- (1) Using the multimeter, check individual wires for continuity according to wiring diagram.
- (2) Replace wires having no continuity. Determine proper size and length of wire, or terminal, or connector to be used for replacement by reading the wire chart

Wire Chart

TERMINATION FROM	TERMINATION TO			LENGTH INCHES
	TYPE		TYPE	
CONNECTOR, 5-WAY.A	1	GROUND CIRCUIT	2	8
CONNECTOR, 5-WAY.D	1	CIRCUIT BREAKER	2	8
CONNECTOR, 5-WAY.B	1	TOGGLE SWITCH, ON-OFF	3	8
CONNECTOR, 5-WAY.E	1	TOGGLE SWITCH, ON-OFF-ON	4	8
CONNECTOR, 5-WAY.C	1	TOGGLE SWITCH, ON-OFF-ON	3	8

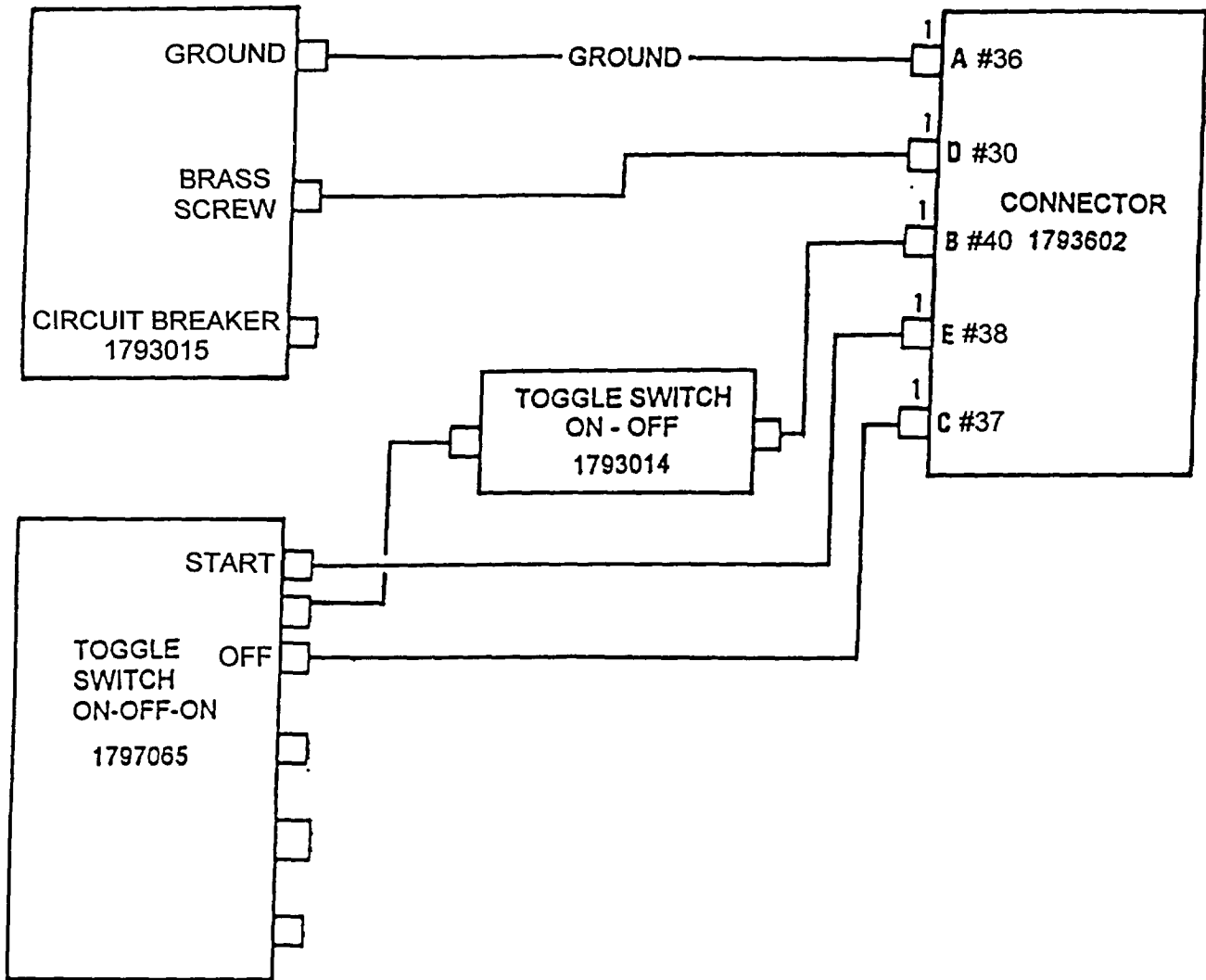


Figure 5-28. Heater Wiring Diagram

5-15. SKID WELDMENT -REPAIR.

This Task Covers: a. **Repair**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Electric Welder (Appendix B, Section II, Item 3).

References

FM 43-2, Metal Body Repair and Related Operations
TM 43-0139, Painting Instructions for Field Use.
TM 9-237, Welding Theory and Application.

Equipment Condition

Unit shut down and cool.
Enclosure Removed (para. 4-13).
A-frame removed (Reference para. 5-3).
Reel Cabinet removed (Reference para. 4-28).
Air Compressor Assembly removed (Reference para. 4-34)
Tool Box removed (para. 4-22).
Lube Tank removed (para. 5-13)
Fuel Tank removed (para. 4-21).
Diesel Engine removed (para. 4-39).
Skid Assembly Removed from Trailer (para. 5-1).

a. Repair. (Refer to Figure 5-28).

- (1) Inspect skid (1) for dents, cracks, or corrosion.
- (2) Weld cracks as needed (Ref. TM 9-237)
- (3) Fix dents as needed. (Ref. FM 43-2).
- (4) Clean off corrosion with wire brush then repaint in accordance with TM 43-0139.
- (5) Inspect skid (1) for straightness. Repair if necessary.

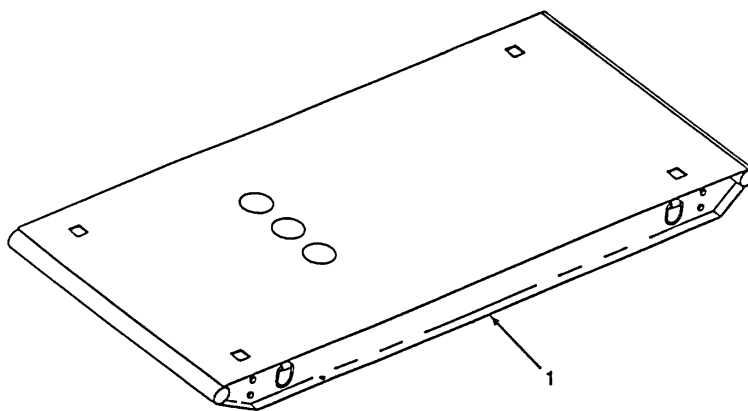


Figure 5-28. Skid Weldment

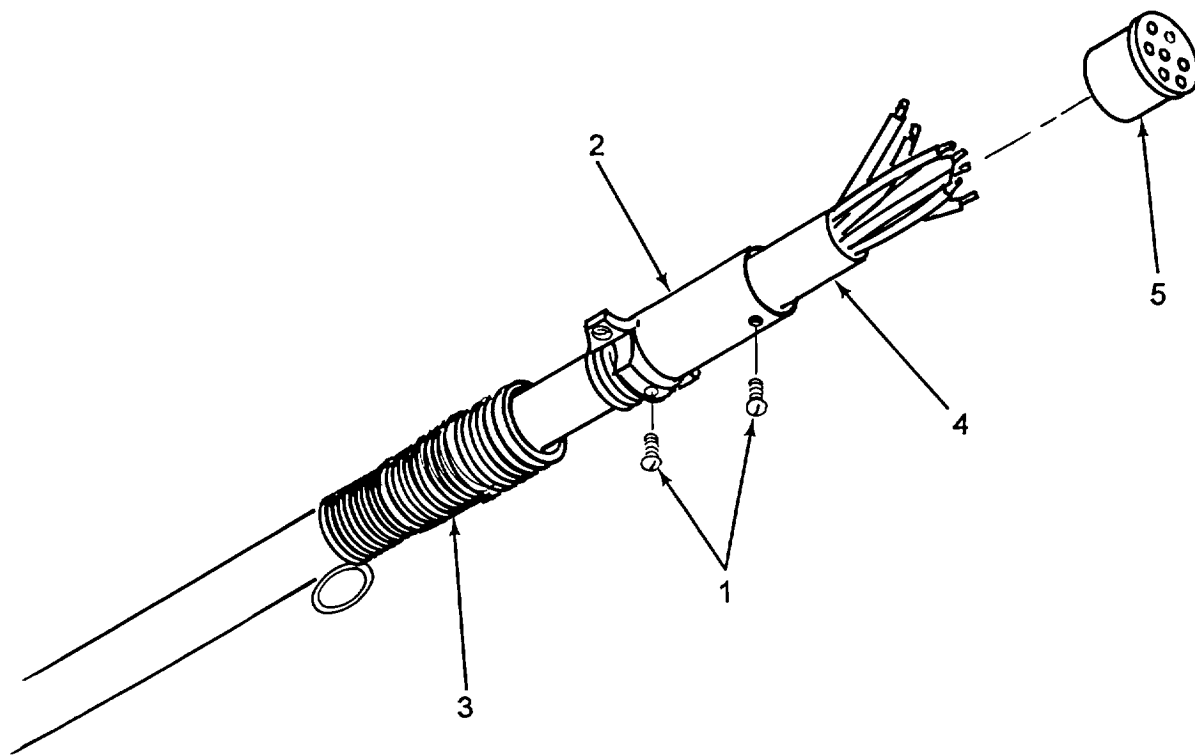


Figure 5-29. Intervehicular Wiring Harness

5-17. TRAILER WIRING HARNESS - TEST/REPLACE/REPAIR.

This Task Covers: a. **Removal** b. **Test and Repair** c. **Installation**

Initial Setup:**Tools Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Multimeter (Appendix B, Section III, Item 2).

Materials/Parts Required

Tags (Appendix E, Section II, Item 17).
Tape, Electrical (Appendix E, Section II, Item 18).

Equipment Condition

Unit shut down and cool.

a. Removal. (Refer to Figure 5-29.)

- (1) Tag and disconnect wires from ending points in voltage reducer box (1).
- (2) Tag and disconnect plugs from lights and markers.
- (3) Remove nine screws (2), nine lock-nuts (4) and nine cable clamps (5) along with trailer wiring harness (6) from frame (7).

b. Test and Repair.

WARNING

Prevent electrical shocks or burns. DO NOT wear jewelry or dog tags when working on electrical components.

- (1) Using a multimeter, Check individual wires for continuity according to wiring diagram.
- (2) Replace wires having no continuity. Determine proper size and length of wire, or terminal, or connector to be used for replacement by reading the wire chart.

c. Installation.

- (1) Replace wires by matching tags at lights and markers and at voltage reducer box (1).
- (2) Slide nine cable clamps (5) over trailer wiring harness (6). Align holes in frame (7) up with holes in cable clamps (5) and install nine screws (2) through holes in frame (7) and holes in cable clamps (5). install nine lock-nuts (4).

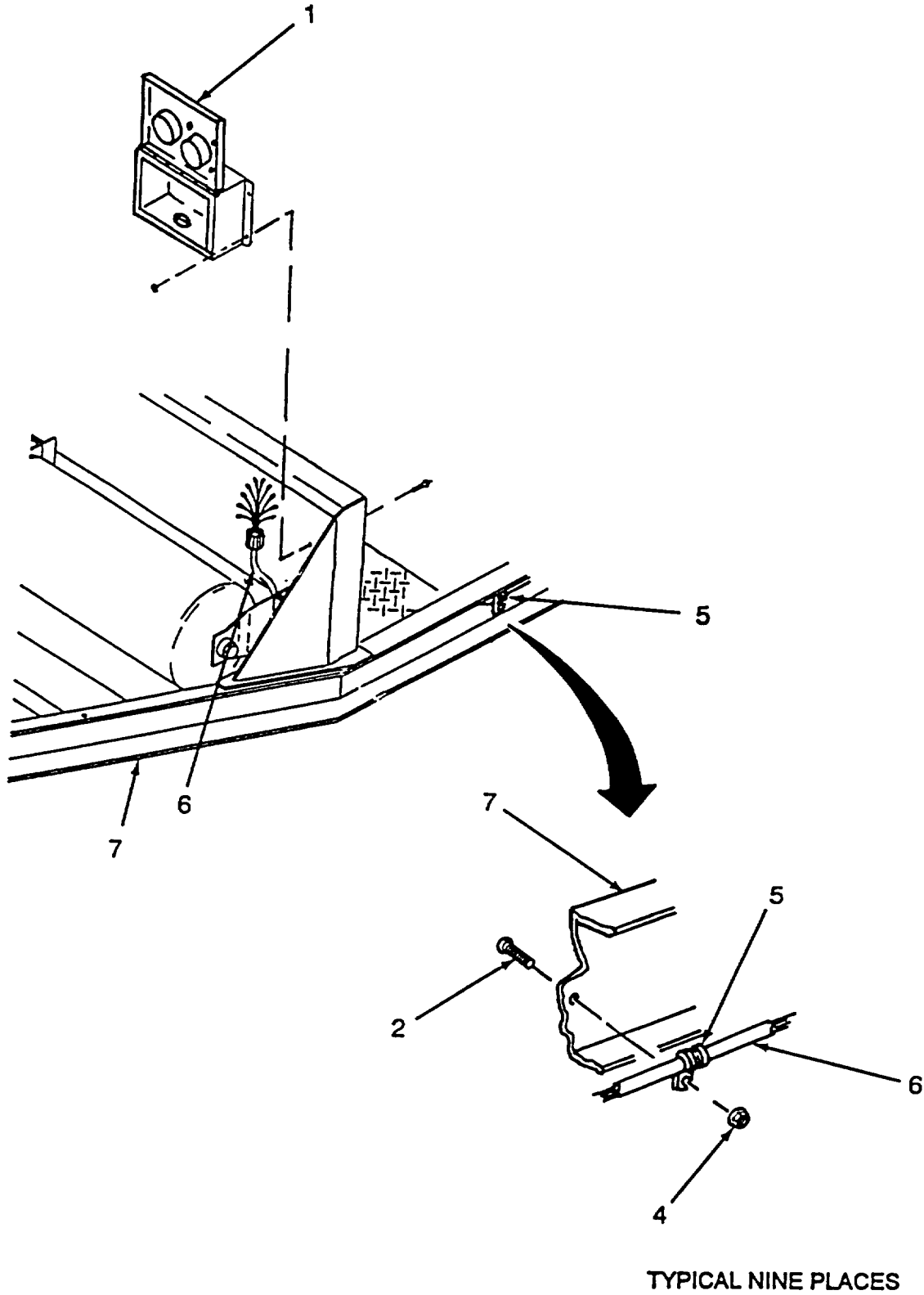


Figure 5-30. Trailer Wiring Harness

Wire Chart

WIRE NO.	TERMINATION		TERMINATION		LENGTH INCHES
	FROM	TYPE	TO	TYPE	
	CIRCUIT BREAKER #2	3	RIGHT TAIL/TURN	1	188
10	LEFT REAR MARK	2	LEFT TURN	2	7
12	LEFT TURN	2	LEFT STOP	2	7
14	LEFT STOP	2	LEFT TAIL	2	18
16	LEFT TAIL	2	CENTER TAIL	2	6.5
18	CENTER TAIL	2	RIGHT TAIL	2	6.5
20	RIGHT TAIL	2	RIGHT STOP	2	10
22	RIGHT STOP	2	RIGHT TURN	2	8
27	LEFT REAR MARKER	2	LEFT TAIL	2	32.5
30	LEFT TAIL	2	CENTER TAIL	2	6
32	CENTER TAIL	2	RIGHT TAIL	2	7
34	RIGHT TAIL	2	RIGHT REAR MARKER	1	21
24	LEFT STOP	2	RIGHT STOP	1	30
	LEFT TURN	1	CB 4	3	143
	CB 5	3	LEFT TURN	2	148
3	LEFT TURN	2	LEFT STOP	2	7
6	LEFT STOP	2	RIGHT STOP	2	35
8	RIGHT STOP	2	RIGHT TURN	1	10

TERMINAL TYPES

- 1 - BUTT CONNECTOR WITH SILICONE
- 2 - THREE WAY CONNECTOR WITH SILICONE
- 3 - 1/4" RING TERMINAL WITH SILICON

5-18. AXLE ASSEMBLY - REPLACE.

This Task Covers: a. Removal b. Installation

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1)
Trestle, Motor Vehicle Maint. (Appendix B, Section III, Item 2).
Jack, Dolly Type (Appendix B, Section III, Item 7).
Blocks

Materials Needed

Wiping rags (Appendix E, Item 1).
Brake Fluid (Appendix E, Item 2).

Equipment Condition

Unit shut down and cool
Trailer parked on level ground, wheels chocked
Air tank pressure drained (para 4-51)
Brake line disconnected (para 4-56)
Skid Assembly removed (para 5-1).

Personnel Required

2

WARNING

- **Do not use rear scissors jacks or front trailer jack to hold the trailer frame up. These jacks are for stabilization only and are not designed to hold or lift the trailer frame. If these jacks are used, the trailer frame could fall and cause bodily injury or death.**
- **Do not stand under trailer frame when it is being lifted. It could fall and cause serious bodily injury or death. Be careful to guide trailer frame manually when it is being transported on hoist so that it does not hit anyone. The trailer frame is very heavy and could cause serious bodily injury or death if it hits someone in the head.**
- **Do not get under the axle when removing it. It is heavy, and if it falls. It could cause bodily injury or death.**

a. Removal. (Refer to Figure 5-31).

- (1) Loosen lug nuts.
- (2) Attach hoisting equipment to four lifting rings (1) and lift trailer frame (2) so that tires are clear of the ground.
- (3) Remove tires and wheels and lower frame onto jack stands.
- (4) Support axle with dolly jack.
- (5) Remove front nut (4) and bolt (5) from leaf springs (3) on both sides of trailer frame (2).
- (6) Remove rear nut (6) and bolt (7) from leaf springs (3) on both sides of trailer frame (2).
- (7) Disconnect brake line (12) from attachment (13) on axle.

WARNING

Do not get under the axle when removing it. It is heavy, and if it falls it could cause bodily injury or death.

- (8) Lower axle assembly (8) with leaf springs (3) attached and pull clear of trailer frame (2).
- (9) Remove eight nuts (9), four u-bolts (10), and two plates (11) to remove springs from axle assembly (8).

b. Installation.

- (1) Attach springs (3) to axle assembly (8) using two plates (11), four u-bolts (10) and eight nuts (9).
- (2) Using dolly jack, move axle assembly (8) under trailer frame (2) with brake line attachment (13) toward rear of trailer frame (2). Lift axle assembly (8) into position.
- (3) Install rear bolts (7) and nuts (6) to leaf springs (3).
- (4) Install front bolts (5) and nuts (4) to leaf springs (3).
- (5) Attach brake line (12) to attachment (13) on axle.
- (6) Hoist trailer frame (2) off of jack stands and install tires and wheels.
- (7) Lower trailer to the ground and tighten lug nuts. Torque to 110-120 lb-ft.

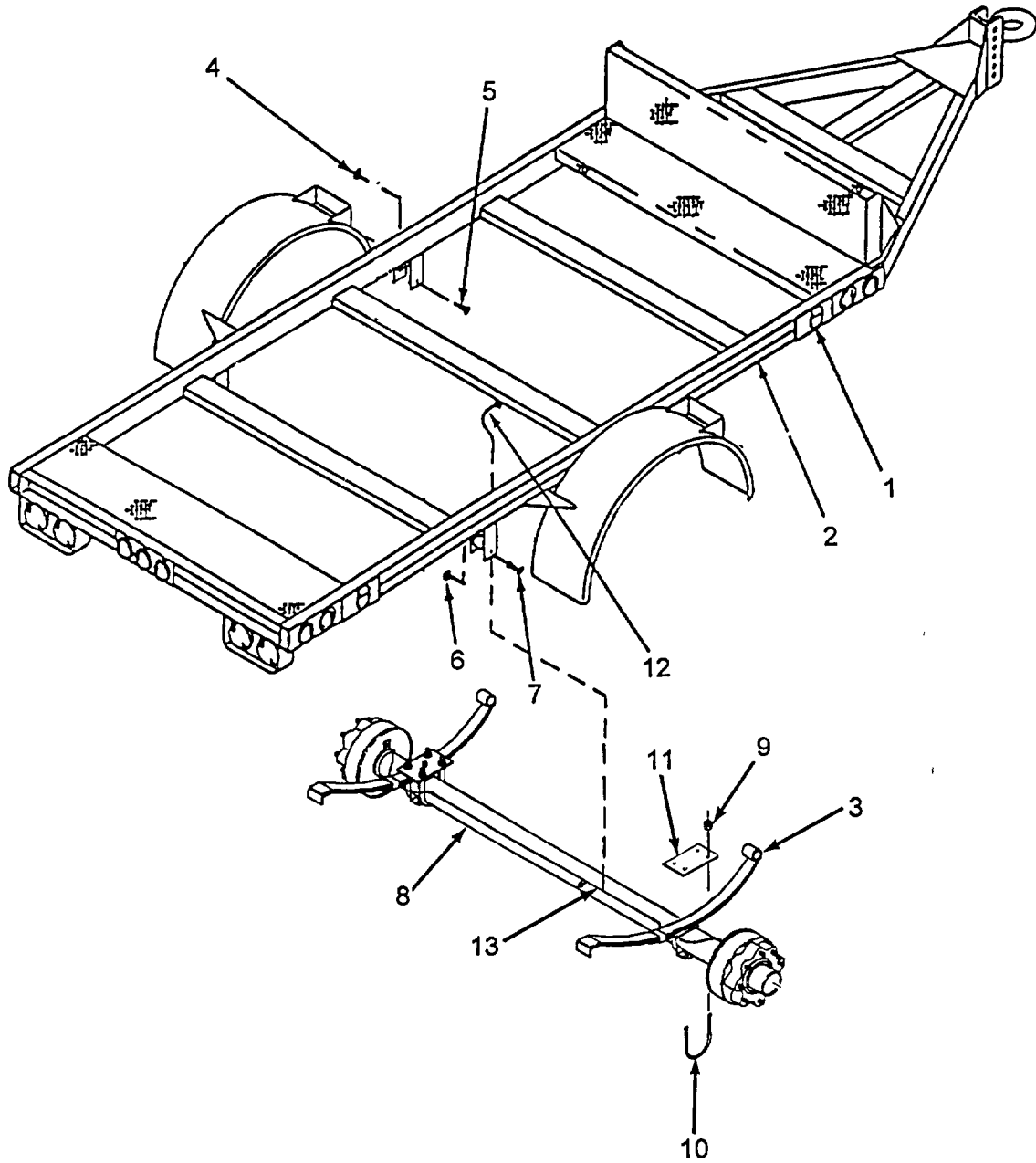


Figure 5-31. Axle Assembly

5-19. TRAILER FRAME - REPAIR.

This Task Covers: **a. Disassembly** **b. Repair** **c. Assembly**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's' Automotive (Appendix B, Section III, Item 1).
 Hoist (Appendix B, Remark A, Section IV, A).
 Common Tool Kit #1 (Appendix B, Section III, Item 2).
 Electric Welder (Appendix B, Section II, Item 3)

References

FM 43-2, Metal Body Repair and Related Operations.
 TM 43-0139, Painting Instruction for Field Use.
 TM 9-237, Welding Theory and Application.

Materials/Parts Required

Nut, self-locking (Appendix H, Section II, Item 10).

Equipment Condition

Unit shut down and cool.
 Enclosure Removed (para. 4-13).
 Skid Assembly removed (para. 5-1).
 Air Hose Assemblies and Gladhand Couplers removed (para. 4-49).
 Emergency Relay Valve removed (para. 4-51).
 Power Cluster And Master Cylinder removed (para. 4-55).
 Control Valve removed (para. 4-50).
 Air Tank Assembly removed (para. 4-54).
 Voltage Reducer Box removed (para. 4-58).
 Quick Release and Limiting Valve removed (para. 4-52).
 Synchronizing Valve removed (para. 4-53).
 Brake Lines removed (para. 4-56).
 Intervehicular Trailer Harness removed (para. 4-57).
 Front Jack removed (para. 4-59).
 Rear Scissors Jacks removed (para. 4-59).
 Safety Chain Assembly removed (para. 4-59).
 Wheel and Tire Assembly removed (para. 3-10).
 Axle Assembly removed (para. 5-18).
 Wire Harness removed (para. 5-16).

Personnel Needed

2

a. Disassembly. (Refer to figure 5-32)

WARNING

- Do not use rear scissors jacks or front trailer jack to hold the trailer up. These jacks are for stabilization only and are not designed to hold or lift the trailer. If these jacks are used, the trailer could fall and cause bodily injury or death.

- (1) Remove two bolts (1) and two locknuts (2) from trailer frame (3) holding lunette eye (4). Remove lunette eye (4).
- (2) Remove fire extinguisher (5) and mounting bracket (6) from trailer frame (3) by removing two screws (7) and two locknuts (8).
- (3) Remove amber reflector (9) and red reflector (10) by removing hex head cap screws (11) and self-locking nuts (12) Typical on trailer frame (3). Discard self-locking nuts (12).
- (4) Remove amber clearance marker (13) and grommet (14) from trailer frame (3) Typical both left and right side of trailer frame (3).
- (5) Remove stop/tail/turn light (15) and grommet (16) from rear of trailer frame (3) Typical both left and right rear of trailer frame (3).
- (6) Remove three red clearance markers (17) and three grommets (18) from rear of trailer frame (3).

b. Repair.

- (1) Inspect trailer frame assembly (3) for dents cracks or corrosion
- (2) Weld cracks as needed (Ref. TM 2-237)
- (3) Fix dents as needed (Ref. FM 43-2).
- (4) Clean off corrosion with wire brush then repaint in accordance with TM 43-0139.

c. Assembly.

- (1) Install three grommets (18) and three red clearance markers (17) into rear of trailer frame (3).
- (2) Install grommets (16) and stop/tail/turn light (15) into trailer frame (3). Typical both left and right rear of trailer frame (3) (3) Install grommets (14) and amber clearance marker (13) into trailer frame (3). Typical both left and right side of trailer frame.
- (4) Install amber reflector (9) and red reflector (10) onto trailer frame (3). Secure reflectors to trailer frame (3) by installing hex head cap screws (11) and new self-locking nuts (12). Typical on trailer frame (3).
- (5) Align mounting bracket (6) holes up with holes in trailer frame (3). Install two screws (7) through trailer frame (3) and mounting bracket (6) Secure screws (7) with two locknuts (8). Install fire extinguisher (5) into mounting bracket (6).
- (6) Align lunette eye (4) holes up with holes in trailer frame (3). Install two bolts (1) through holes in trailer frame (3) and lunette eye (4) Secure bolts (1) with two locknuts (2). Tighten

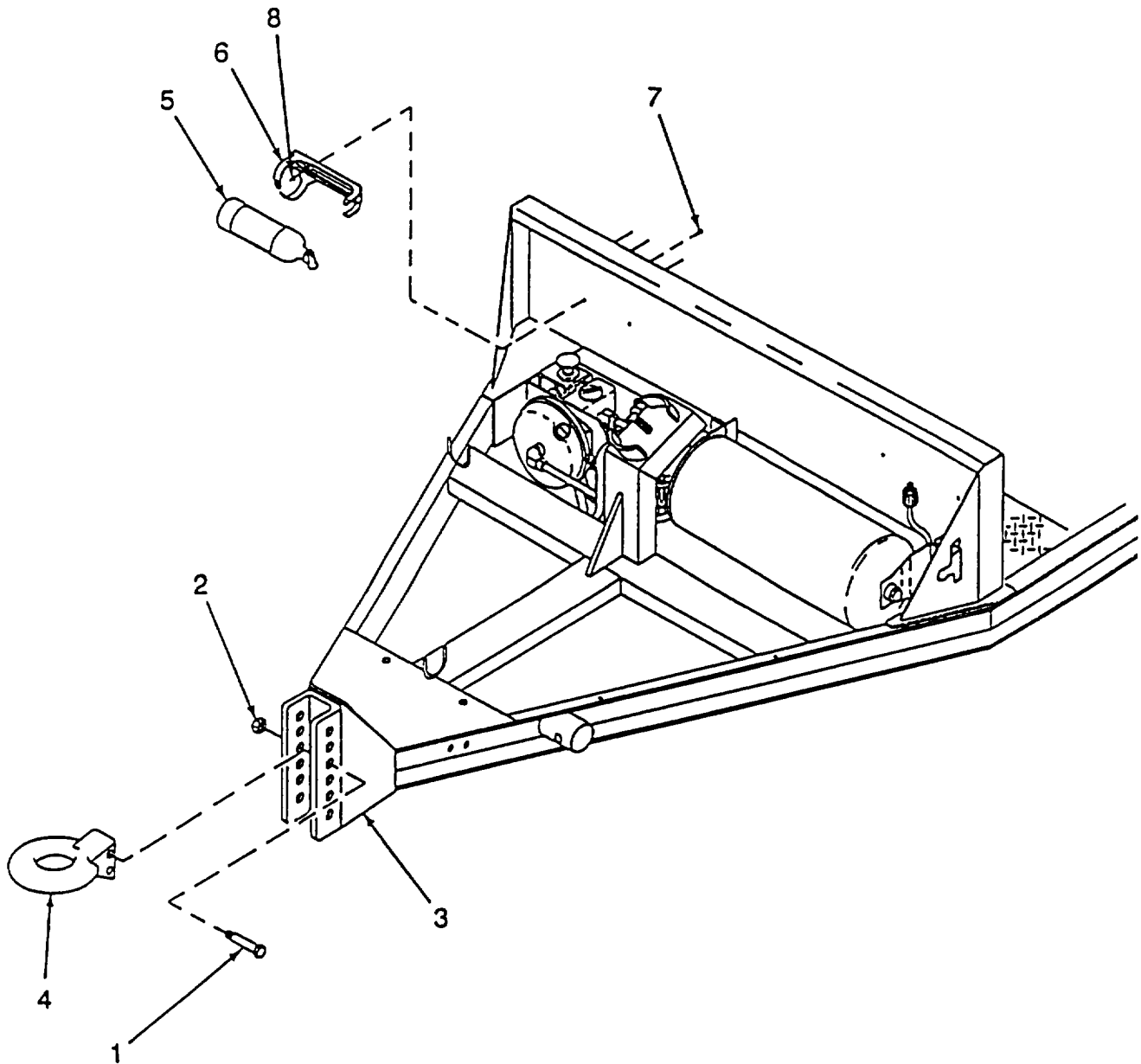


Figure 5-32. Trailer Frame (Sheet 1 of 3)

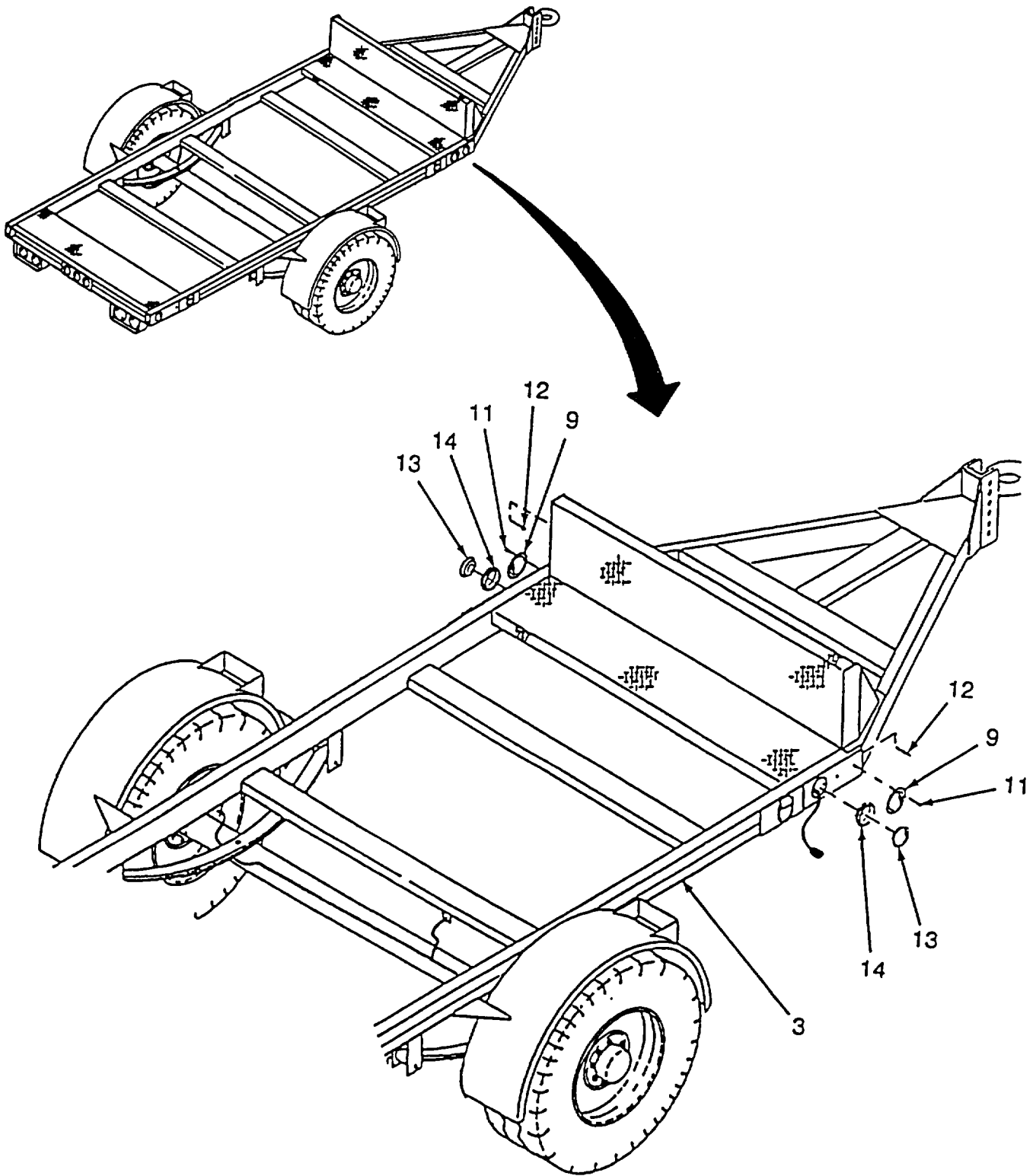


Figure 5-32. Trailer Frame (Sheet 2 of 3)

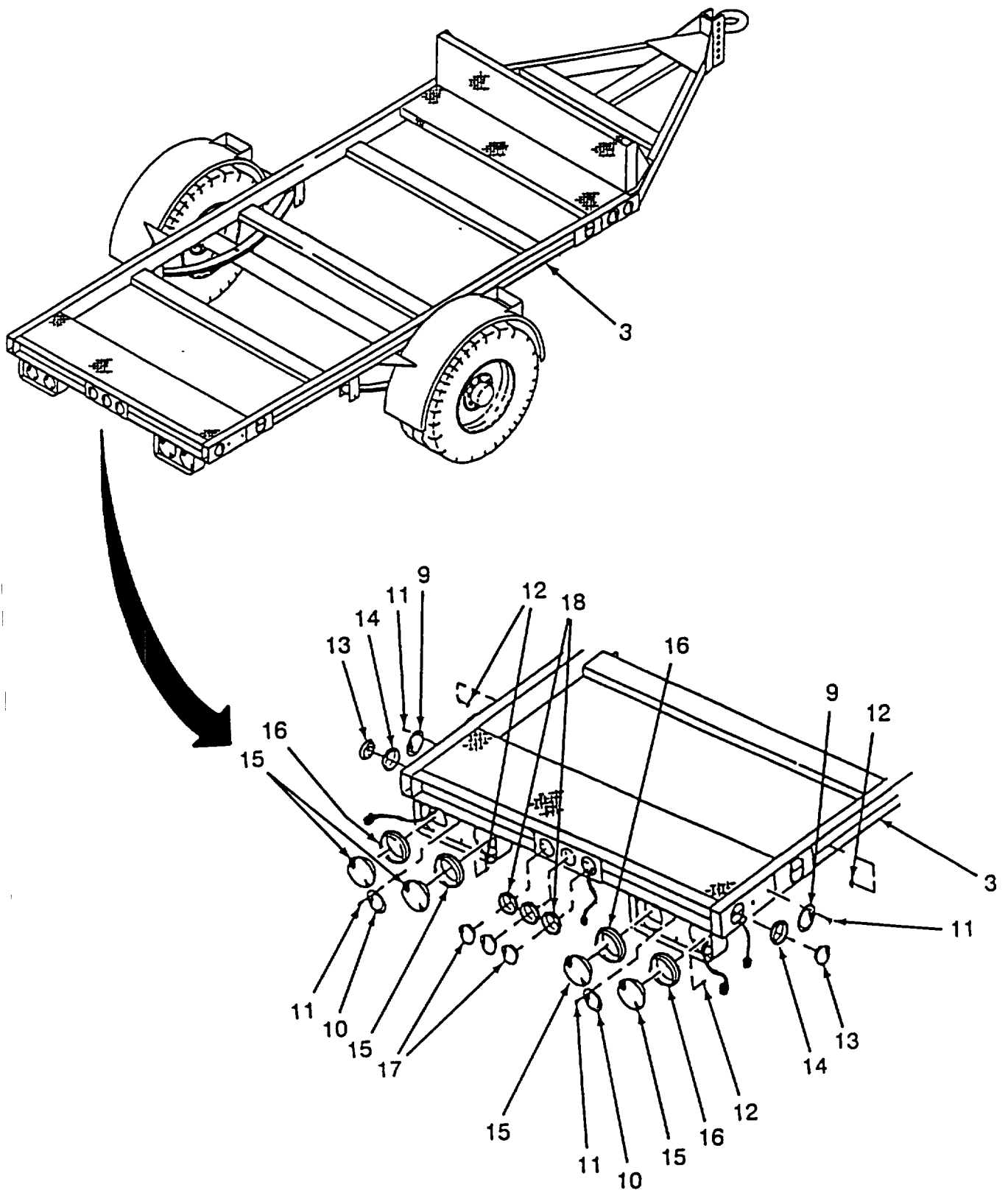


Figure 5-32. Trailer Frame (Sheet 3 of 3)

**CHAPTER 6
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS**

Paragraph		Page
Section I	General Support Maintenance Procedures.....	6-1
6-1.	General	6-1
6-2.	Diesel Engine (Cylinder Head)	6-2
6-3.	Cylinder, Piston and Connecting Rod Assembly	6-6
6-4.	Fan, Flywheel and.....	6-15
6-5.	Camshaft 6.....	6-25
6-6.	Governor	6-30
6-7.	Governor Linkage	6-33
6-8.	Governor Linkage Adjustment	6-37
6-9.	Oil Pump	6-39
6-10.	Crankcase	6-41
6-11.	Engine Running-In	6-44

Section I. GENERAL SUPPORT MAINTENANCE PROCEDURES

6-1. GENERAL. This chapter contains maintenance procedures authorized for general support maintenance level as directed in the Maintenance Allocation Chart included as Appendix B in this manual.

- (1) Brush head (7) and head component assemblies using a soft wire brush. Remove all carbon deposits, dirt, and other foreign substances. Wipe all components thoroughly with a clean rag.
- (2) Clean cylinder head injector bore (8) and seating faces with solvent and rags
- (3) Clean head (7) at valve head end of valve guide bore (9) with solvent and rags.
- (4) Clean two valves (5), four collets (4), valve springs (1), plates (2), seal (6) (inlet valve only), and two cups (3) with solvent and rags

c. Inspection.

- (1) Inspect head (7) and two guides (10) for damage, distortion, cracks, breaks, and other damage. If damaged, replace head (7)
- (2) Inspect seats (11) for pocketing. If seat (11) is badly pocketed, check valve face (12) to head clearance (13) as shown. If valve face (12) to head clearance (13) exceeds 0.010-inch (0.254 MM) for a new head (7) or 0.038 inch (0.965 MM) for a used head (7), replace head (7)
- (3) If inspection of seat (11) indicated need for seat (11) repair, grind seat (11) at 45.5° to 46° angle as shown
- (4) Inspect seat surface of valve (14) for damage. If damaged, grind at 45 to 45.50° angle as shown or replace valve (5)

d. Repair.

- (1) Replacing Valve Guides.
 - (a) Place cylinder head (5) in hot water for a few minutes
 - (b) Place the head (5) on its side in a soft jawed vise leaving access to the guide from the underside

WARNING

Take precautions when removing valve seat to prevent personal injury when it comes away from the cylinder head.

- (c) Use a seat puller and remove valve seat (11) from cylinder head (7)
- (d) Place cylinder head in hot water for a few minutes
- (e) Stand the cylinder head (7) up on bench.
- (f) Place the new valve guide (11) squarely into the valve guide hole in head (7).
- (g) Using a suitable press, carefully press the guide (11) into the head (7)

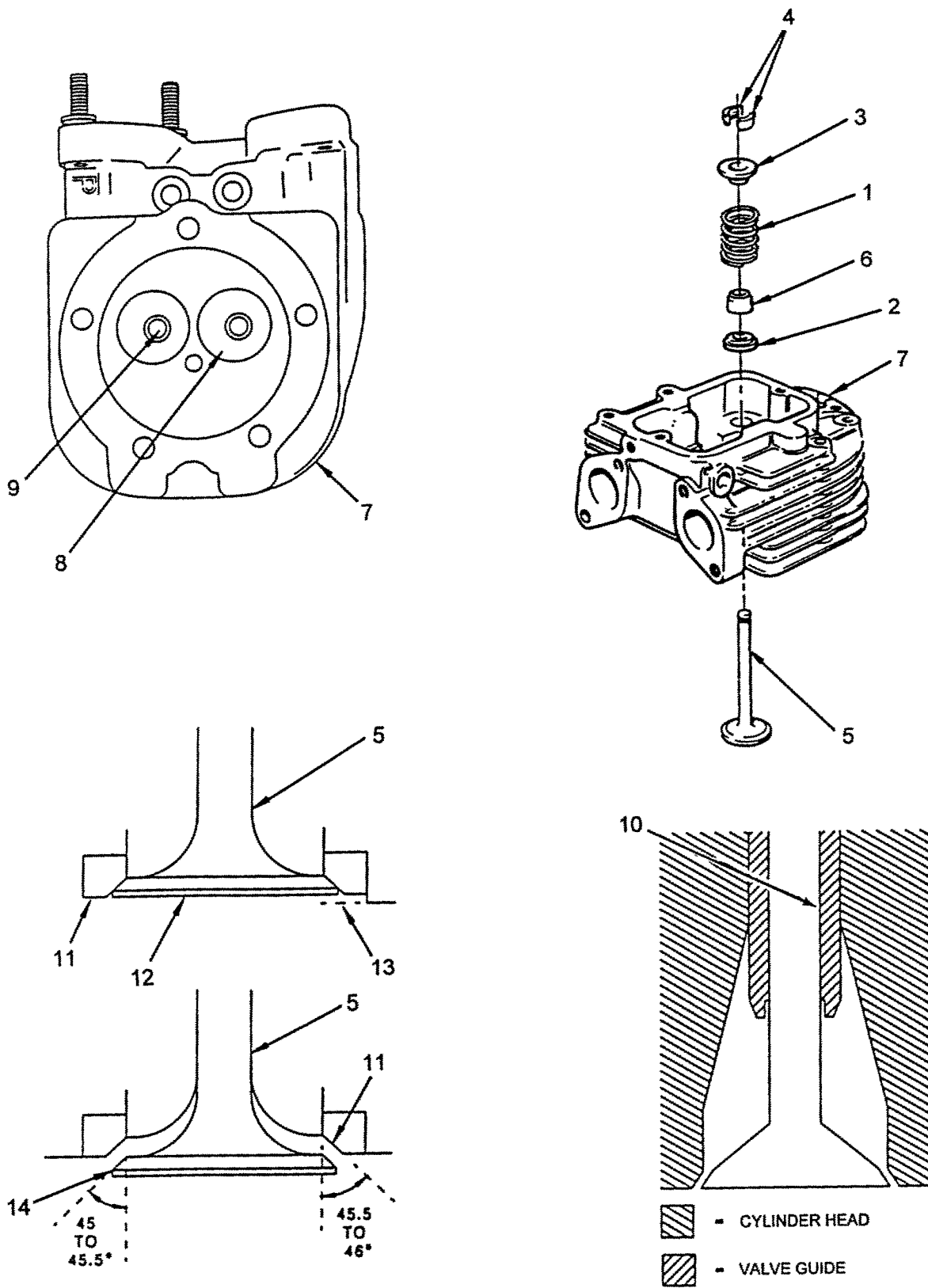


Figure 6-1. Cylinder Head Repair

WARNING

Dry cleaning solvent is flammable. Do not use near open flame or nonventilated places. Keep away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C)

NOTE

If new or reground valve (5) is to be placed in head (7), valve (5) must be lapped in before assembly.

- (2) Lap Valve (5).
- (a) Lightly lubricate stem of valve (5) with lubricating oil.
 - (b) Apply a small quantity of grinding compound paste evenly around seat (11)
 - (c) Insert valve (5) in proper valve guide (10) of head (7)
 - (d) Exerting firm but gentle pressure, partially rotate valve (5) backward and forward on seat (11).
 - (e) At short intervals, lift valve (5) from seat (11) and rotate valve (5) approximately 120°.

NOTE

Proper valve grinding will be indicated by a thin polished line on valve (5) and seat (11) mating surfaces. Grinding-in process should be continued until this is achieved

- (f) Check seat surface of valve (5) and seat (11) for thin polished line around mating surfaces.
- (g) Using dry cleaning solvent, clean all traces of grinding paste from valve (5) and seat (11).

e. Assembly.

NOTE

Do steps 1 thru 4 for inlet and exhaust valves. Inlet valve is shown

Cups (3), plate (2), and spring (1) must be assembled to valve (5) from which they were removed. Check markings of components to make sure they are mated to the proper valve (5)

- (1) Lightly coat stem of valve (5) with lubricating oil
- (2) Install valve (5) in head (7).
- (3) Install plate (2), new seal (inlet valve only) (6), spring (1), and cup (3) on valve (5) in head (7)
- (4) Compress spring (1) and cup (3). Install two collets (4) around stem of valve (5) and release spring (1) pressure

6-3. CYLINDER, PISTON AND CONNECTING ROD ASSEMBLY - REPAIR.

This Task Covers:	a. Disassembly	b. Cleaning	c. Inspection K)
	d. Repair	e. Assembly	

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Arbor Press (Appendix B, Section III, Item 13).
 Bearing Clearance Gage (Appendix B, Section III, Item, 14).
 Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
 Industrial Goggles (Appendix B, Section III, Item 9).
 Micrometer (Appendix B, Section III, Item 10).
 Piston Ring Compressor (Appendix B, Section III, Item 15).
 Snap Ring Pliers (Appendix B, Section II, Item 16).
 Torque Wrench, 0-175 ft - lb (Appendix B, Section III, Item 4).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).
 Lubricating Oil (Appendix E, Section II, Item 20).
 Sealing Compound (Appendix E, Section II, Item 5).
 Tin Alloy Solder (Appendix E, Section II, Item 21).
 Wiping Rags (Appendix E, Section II, Item 1).

Equipment Condition

Oil Pan and Gasket removed (para. 5-10 J.).
 Cylinder Head removed (para. 5-10).

a. Disassembly. (Refer to Figure 6-2, Sheet 1 of 4 and 2 of 4).

NOTE

Note the position of connecting rod (1) components. Mating surfaces of rod (1) are numbered for identification.

- (1) Remove two screws (2), connecting rod end cap (3), and bearing (4) from crankshaft (5).
- (2) Turn crankshaft (5) to set piston (6) at top dead center (TDC).
- (3) Lift off cylinder barrel (7) with piston and rod. Remove shims (4) and set aside for later assembly and for bumping clearance adjustment.
- (4) Remove piston (6) and rod (1) from cylinder barrel (7).
- (5) Remove two snap rings (5), wrist pin (11), and rod (1) from piston (6).
- (6) Remove upper rod bearing (7) from rod (1).
- (7) Remove rings (8) from piston (6).

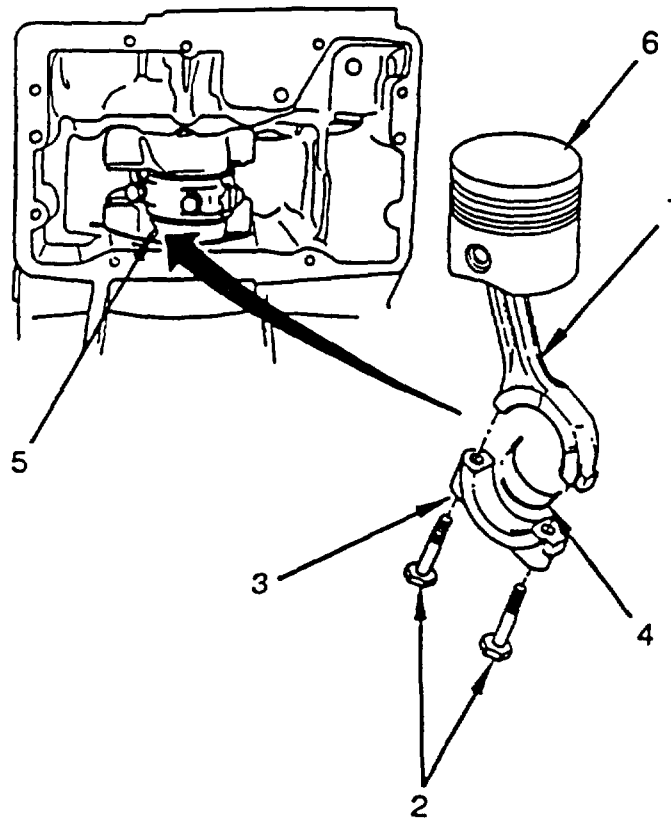


Figure 6-2. Cylinder, Piston, and Connecting Rod Assembly (Sheet 1 of 4)

b. Cleaning. (Sheet 2 of 4).

WARNING

Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).

- (1) Clean cylinder barrel (7), piston (6), rod (1), shims (4), and all attaching hardware of all carbon, grease, oil, and dirt with solvent and rags.
- (2) Remove all carbon deposits from piston (6) and ring grooves (9) with solvent and rags.
- (3) Remove all carbon deposits and other obstructions from small holes (oil ports) in piston (6).

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip-guarding and personal protective equipment (goggles/faceshield, gloves, etc).

- (4) Thoroughly dry all parts using clean rags or compressed air.

c. Inspection. (Sheet 2 of 4).

- (1) Inspect rod (1) and attaching hardware for cracks, breaks, scoring, burring, and general condition. Replace all unserviceable parts.
- (2) Inspect cylinder barrel (7).
 - (a) Inspect cylinder barrel (7) for cracks, breaks, hot spots, elongated holes, and general condition.
 - (b) Check cylinder bore (10) wear. If cylinder bore (10) exceeds the maximum allowable limit, of 3 150 inches (8 0 cm), replace cylinder barrel (7).
- (3) Inspect piston (6).
 - (a) Check wrist pin (11) and piston (6) for breaks, cracks, scoring, hot spots, and general condition. Replace any unserviceable parts
 - (b) Check diameter of piston (6). Measure piston (6) at the bottom of skirt (12) across thrust face (13). Piston diameter should be 3.1459 inches to 3.1449 inches (7.990 cm to 7.988 cm).
 - (c) Insert piston (6) into bore (10) with crown (14) toward bottom edge of bore (10) and about 0.5 inch (1.27 cm) from bottom edge.
 - (d) Insert new rings (15, 16, 17) one at a time into bore (10). Push each ring (15, 16, 17) against piston crown (14) to ensure that it is level in the base.
 - (e) Withdraw piston (6) far enough to allow ring gap to be measured. Ring gap should be 0 012 inch to 0.017 inch (0.305 mm to 0.432 mm) for the firing ring (15) and compression ring (16), and 0.009 inch to 0.019 inch (0.229 mm to 0.482 mm) for the oil ring (17).

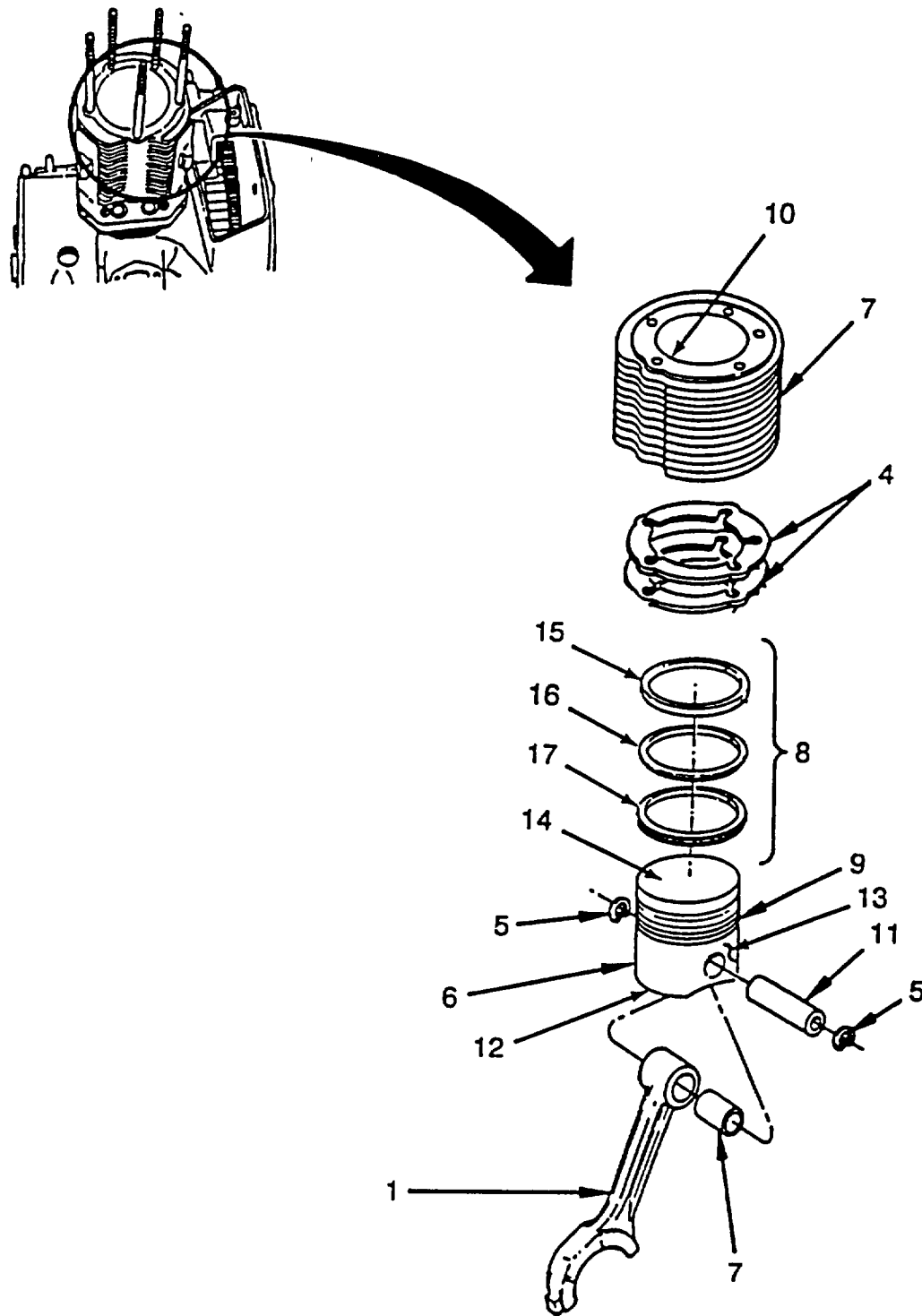


Figure 6-2. Cylinder, Piston and Connecting Rod Assembly (Sheet 2 of 4)

d. Repair. (Sheet 3 of 4).

(1) Repair piston (6).

(a) Assemble rings (15, 16, 17) in proper grooves on piston (6).

NOTE

Rings (15, 16, 17) should not bind and should move freely in grooves

(b) Check side clearance of piston rings (15, 16, 17). Side clearance should not exceed 0.010 Inch (0.254 mm). If side clearance exceeds maximum allowable limits, replace piston (6).

(2) Repair rod (1).

(a) Install sleeve (7) in rod (1), making sure oil hole on sleeve (7) lines up with hole on rod (1).

(b) Install new bearing set (18) in connecting rod end cap (3) and rod (1).

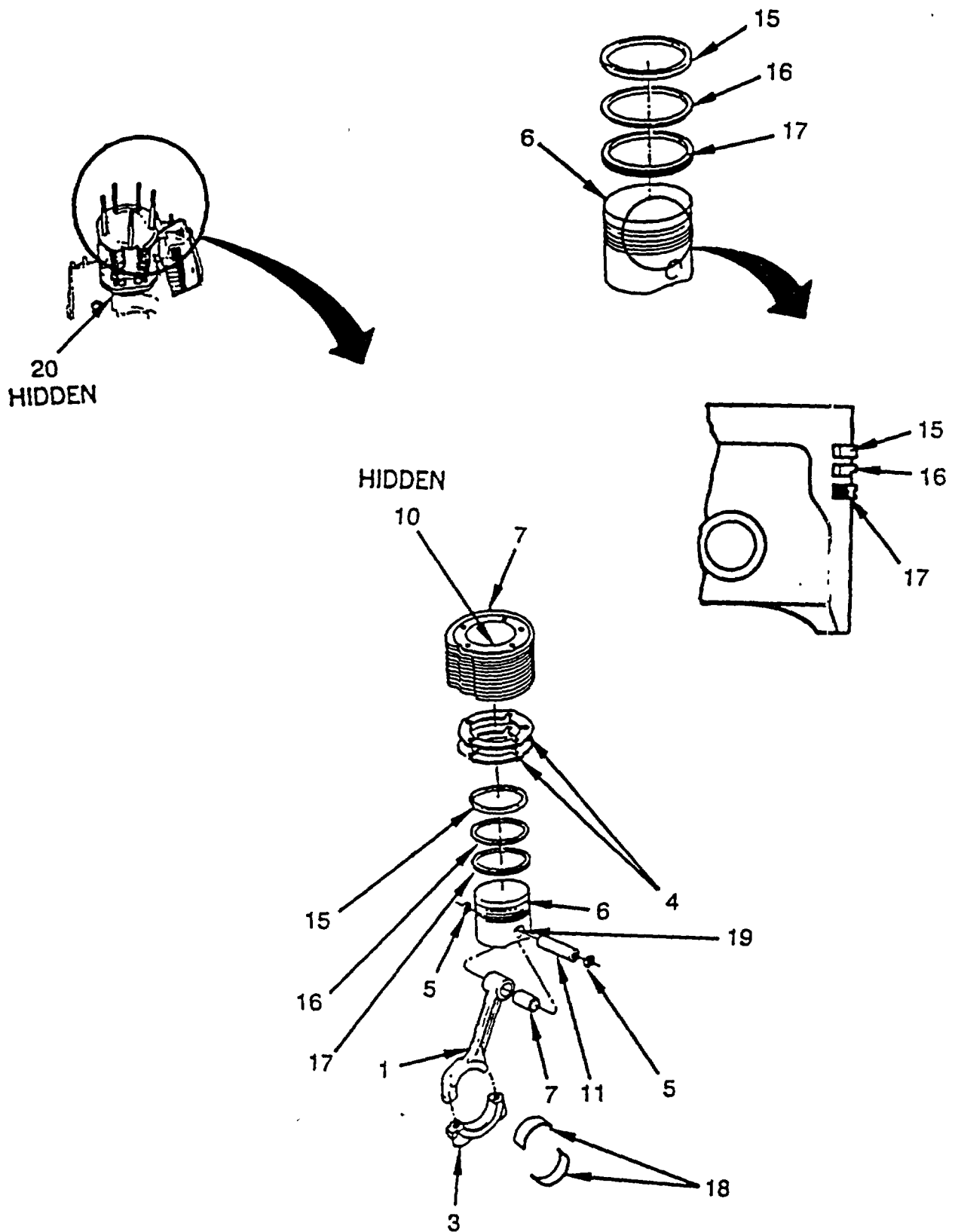


Figure 6.2. Cylinder, Piston and Connecting Rod Assembly (Sheet 3 of 4)

e. Assembly. (Sheet 3 of 4 and 4 of 4).

NOTE

When assembling piston to connecting rod, ensure that when the piston and connecting rod are in the engine the offset combustion chamber will be opposite the push rods.

- (1) Install rod (1) into piston (6) and slide wrist pin (11) through hole (19) in piston (6) and rod (1).
- (2) Secure pin (11) to piston (6) with two rings (5).
- (3) Stagger gaps of rings (15, 16, 17) around circumference of piston (6) so gaps are not aligned with each other.
- (4) Lightly lubricate cylinder bore (10) with lubricating oil.
- (5) Compress rings (15, 16, 17) and install piston (6) and rod (1) in cylinder (7).
- (6) Install same shims (4) removed in step 3 of removal between crankcase (20) and cylinder (7).
- (7) Lightly lubricate crankshaft journal (21) with lubricating oil. Rotate crankshaft (22) until journal (21) is at TDC.
- (8) Install cylinder (7), piston (6), and rod (1) over studs (23). Make sure numbers on rod (1) are facing toward camshaft side of engine (24). Turn crankshaft (22) while pushing down on piston (6) to gain access to rod (1)

CAUTION

Care must be taken to ensure the crankshaft is not turned when the Plastigauge is in place, and all traces of it must be removed before final assembly of the bearing.

- (9) Place a piece of the correct size Plastigauge approximately 0.25 in. (6.35 mm) off center across the full width of one bearing shell.
- (10) Install cap (3), making sure numbers on cap (3) and rod (1) are correctly matched and are on same side.
- (11) Install two screws (2) to rod (1). Torque screws (2) between 24-26 lb-ft (33-35 N•m).
- (12) Remove screws (2) and cap (3). Measure gage (25) and check for 0.0011 inch to 0.0044 inch (0.028 mm to 0.112 mm) clearance. If clearance is good, thoroughly clean cap (3) and install on crankshaft (22). If clearance is out of tolerance, replace crankshaft (Reference para. 6-4).
- (13) Apply sealing compound to threads of two new screws (2).
- (14) Install two screws (2) to rod (1). Torque screws (2) between 24-26 lb-ft (33-35 N•m).
- (15) Set piston (6) at 0.25 inch (6.35 mm) before TDC.
- (16) Place three pieces of solder (26) an equal distance from one another on top piston (6). Make sure pieces of solder (26) are not aligned with valves (27).

- (17) Install cylinder head (Reference para. 5-10.k.)
- (18) Turn engine to TDC.
- (19) Remove cylinder head (Reference para. 5-10 k.).
- (20) Remove solder (26) and measure thickness with micrometer.
- (21) Check that thickness of solder (26) is 0.022 inch to 0.030 inch (0.56 mm to 0.76 mm) for average of three readings (one reading for each piece of solder (26))
- (22) If bumping clearance is not within tolerance, do steps 23 and 24. If bumping clearance is within tolerances, do steps 25 thru 27.
- (23) Add or remove shims under cylinder (Reference para 6-2.a 3).
- (24) Repeat steps 16 thru 22. If bumping clearance is correct, do steps 25 thru 27. If bumping clearance is incorrect, go back to step 23.
- (25) Install oil pan and gasket (Reference para. 5-10.k.)
- (26) Install cylinder head (Reference para 5-10 k).
- (27) Perform engine running-in (Reference para. 6-10).

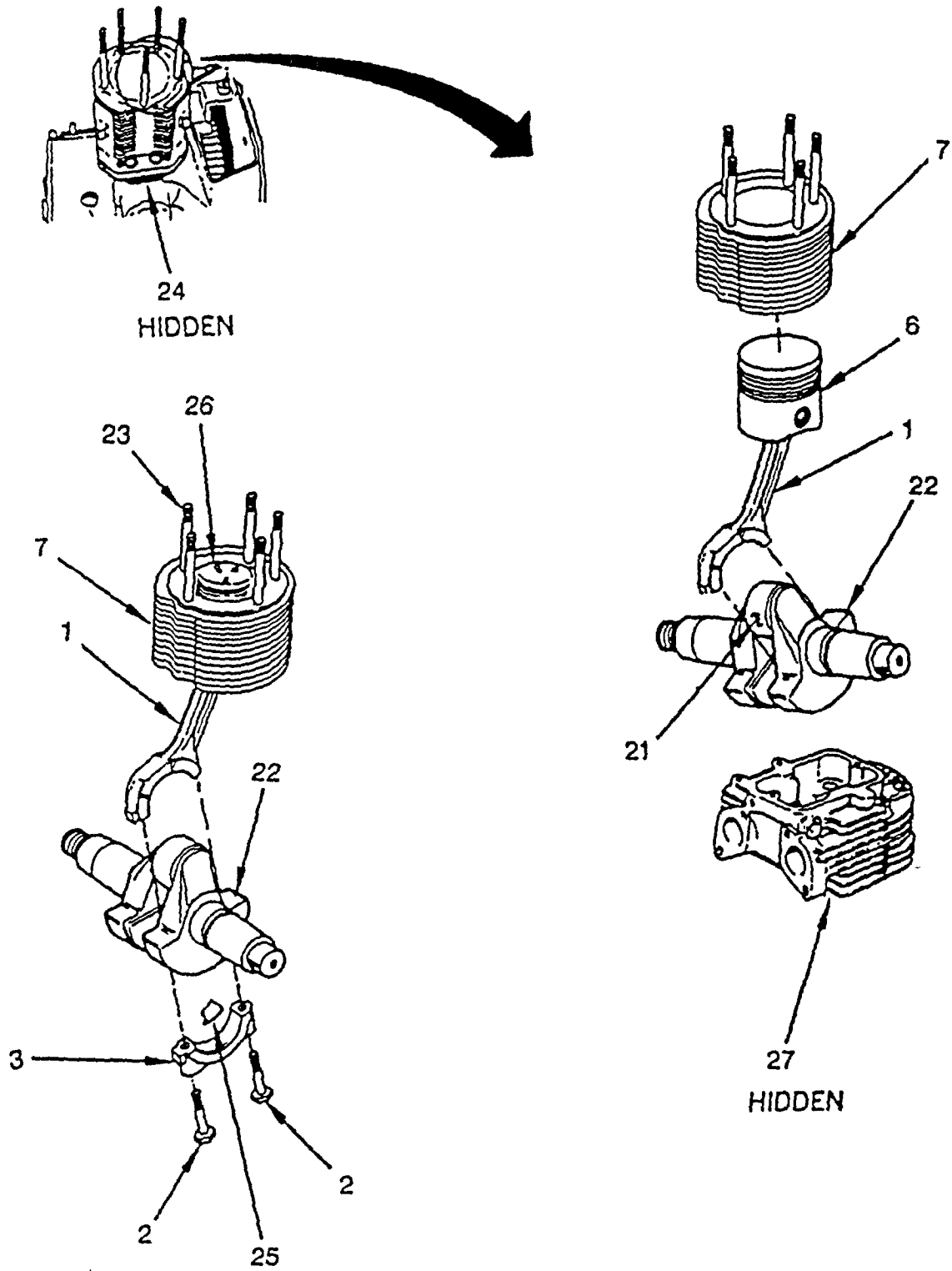


Figure 6-2. Cylinder, Piston and Connecting Rod Assembly (Sheet 4 of 4)

6-4. FAN, FLYWHEEL AND CRANKSHAFT REPLACEMENT.

This Task Covers: **a. Removal** **b. Cleaning** **c. Inspection**
 d. Assembly

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Tool Kit, Common No. 1 (Appendix B, Section III, Item 2)
 Adapter, 1/2 inch Drive (Appendix B, Section III, Item 17)
 Bar, Breaker, 3/4 inch Drive (Appendix B, Section III, Item 18).
 Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
 Gearwheel Puller (Appendix B, Section III, Item 19)
 Industrial Goggles (Appendix B, Section III, Item 9)
 Torque Wrench, 0-300 lb-in (Appendix B, Section III, Item 20)
 Torque Wrench, 0-175 ft-lbs (Appendix B, Section III, Item 21).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).
 Lubricating Oil (Appendix E, Section II, Item 20).
 Sealing Compound (Appendix E, Section II, Item 5)
 Self-Locking Nut (Appendix H, Section II, Item 55).
 Washer, Thrust (Appendix H, Section II, Item 56)
 Washer, Tab (Appendix H, Section II, Item 57).
 Woodruff Key (Appendix H, Section II, Item 58)
 Woodruff Key (Appendix H, Section II, Item 59)

Equipment Condition

Cylinder, Piston and Connecting Rod Assembly Removed (para. 6-3)
 Fuel Lift Pump Removed (para. 5-10 f.).
 Fuel Injection Pump Removed (para 5-10 d)

a. Removal. (Refer to Figure 6-3).

CAUTION

Gear cover (1) is mounted on dowels (2) secured to crankcase (3) Care must be taken when removing cover (1) to prevent damage to dowels (2), crankcase (3), or cover (1)

- (1) Remove screw (4) from crankcase (3)
- (2) Remove seven screws (5), gear cover (1), and gasket (6) from crankcase (3)

NOTE

Do steps 3 thru 5 only if oil leak is evident

- (3) Remove two screws (7), washers (8), and camshaft access cover (9) from cover (1).

- (4) Remove preformed packing (10) from cover (9).
- (5) Remove seal (11) from cover (1).
- (6) Align marking on crankshaft gear (12) so that mark on gear (12) is between two dots on camshaft gear (13).

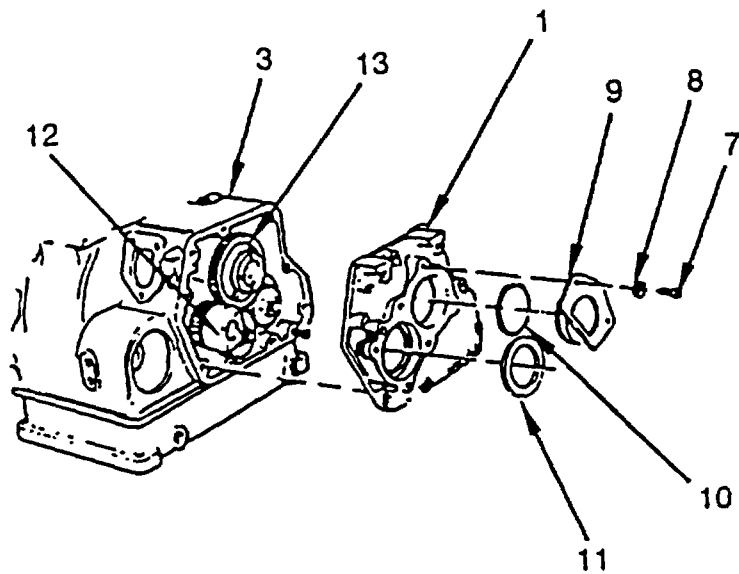
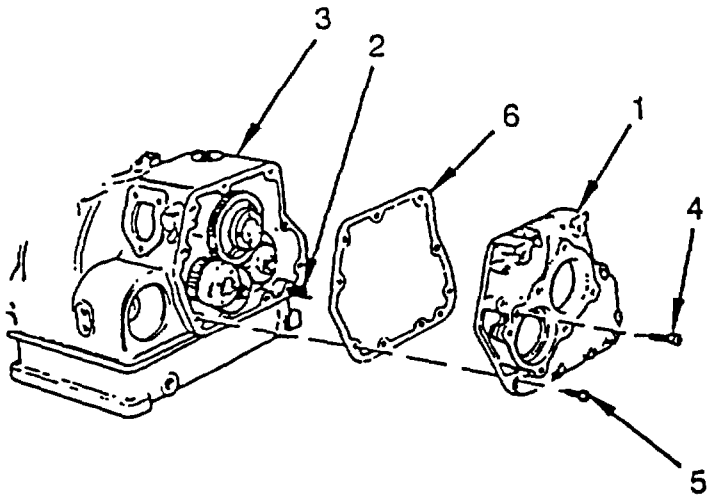


Figure 6-3. Flywheel and Crankshaft Replacement (Sheet 1 of 5)

- (7) Lock flywheel to prevent it from turning and remove screw (14) from crankshaft gear (12).
- (8) Remove plate (15) from gear (12) using two hex wrenches placed in bolt hole. See detail.
- (9) Remove packing (16) from plate (15).
- (10) Using gear puller, remove gear (12) from crankshaft (20).
- (11) Prevent flywheel (17) from turning by inserting bar stock through timing hole in bell housing and through hole in flywheel (17).
- (12) Bend tabs of washer (18) away from flats of nut (19). Remove nut (19) and washer (18) from shaft (20).
- (13) Remove flywheel (17) using puller.
- (14) Remove six screws (21) and washers (22) from flywheel (17). Remove fan (23) from flywheel (17).
- (15) Remove six self-locking nuts (24) and washers (25) from crankcase (3).
- (16) Remove guard (27), housing (26) and gasket (28) from crankcase (3).
- (17) Carefully remove crankshaft (20) through the flywheel end of the crankcase.
- (18) Remove woodruff key (29) from crankshaft (20).
- (19) Remove oil seal (30) from housing (26).
- (20) Remove thrust washer (31) from housing (26).
- (21) Remove bearing (32) from housing (26).
- (22) Remove bearing (33) from crankcase (3).
- (23) Remove thrust washer (34) from crankcase (3).
- (24) Inspect crankcase (3) and spring pins (35). If damaged or missing, replace any pin (35).

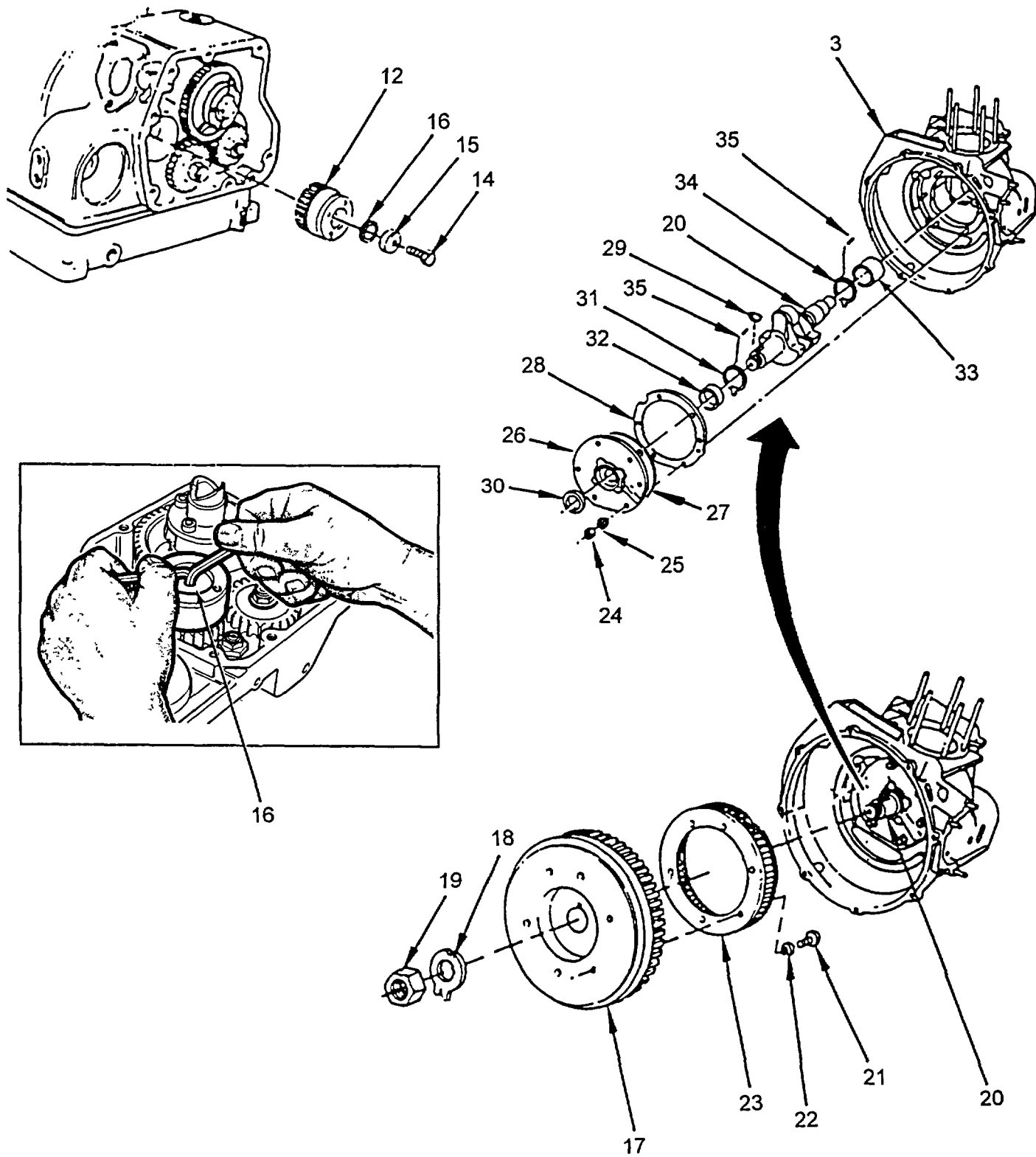


Figure 6-3. Fan, Flywheel, and Crankshaft Replacement (Sheet 2 of 5)

b. Cleaning.

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C)**
- **Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip-guarding and personal protective equipment (goggles/faceshield, gloves, etc.).**

- (1) Thoroughly clean crankshaft (20) bearing journals, crankpins, oil holes and strictures to remove debris that might restrict oil flow or affect installation. Use dry cleaning solvent or compressed air.
- (2) Thoroughly clean and dry all bearing surfaces, oil holes, and casings Use dry cleaning solvent and compressed air.
- (3) Thoroughly clean housing (26) and attaching hardware for ease of inspection and installation. Use dry cleaning solvent and compressed air.
- (4) Unless otherwise specified, thoroughly dry all components using clean, dry rags or compressed air.

c. Inspection.

- (1) Inspect journals of crankshaft (20) for score marks, elongation, wear, and other defects. If any or all of above defects are found, replace crankshaft (20).
- (2) Inspect all bearing surfaces for cracks, scrapes, filing marks, scores, sear, or other damage. Replace any defective or unserviceable parts.
- (3) Inspect flywheel (17) for damaged, cracked, or broken teeth, or other damage. If damaged, replace flywheel (17).
- (4) Inspect fan (23) for damage. If damaged, replace it.

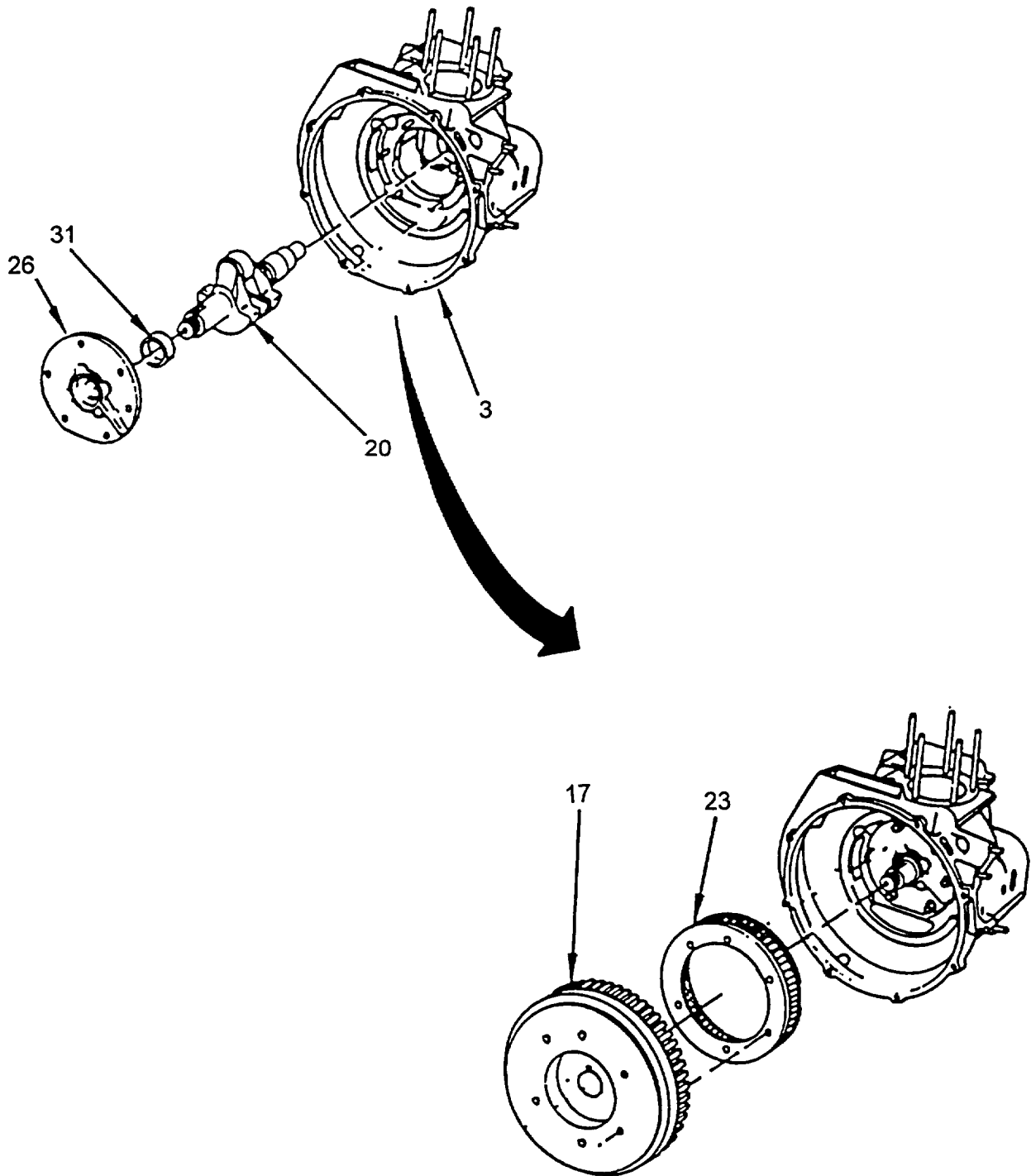


Figure 6-3. Fan, Flywheel and Crankshaft Replacement (3 of 5)

d. Installation.

CAUTION

To prevent damage to bearings (32 and 33) use care when installing bearings in crankcase (3) and when installing crankshaft (20).

NOTE

Apply a light coating of oil to bearings (32 and 33) and mating surfaces during replacement.

- (1) Install new bearing (3) in crankcase (3) at gear end.
- (2) Install new washer (34) In crankcase (3) at gear end Make sure groove side of washer (34) is facing away from the crankcase (3).
- (3) Install new bearing (32) in housing (26).
- (4) Install new washer (31) and two new pins (35) in housing (26).
- (5) Install new seal (30) in housing (26).

NOTE

Threaded end of crankshaft (20) faces housing (26).

- (6) Install crankshaft (20) through flywheel end of crankcase (3) and into bearing (33) at gear end.
- (7) Fit new gasket (28) to bearing housing (26) and carefully install housing (26) in crankcase (3) taking care not to damage seal (30) on keyway of crankshaft (20).
- (8) Install guard (27), nuts (24) and washers (25) and torque nuts diagonally to 17 lb-ft (23 Nm).
- (9) Check clearance between face of thrust washer (31) and crankshaft (20) Clearance should be 0.004 inch to 0 025 inch (0.102 mm to 0 635 mm) maximum. If end float clearance is incorrect, replace crankshaft (20).
- (10) Install new woodruff key (29) In crankshaft (20).
- (11) Apply sealing compound to six screws (21). Install screws (21), washers (22), and fan (23) in flywheel (17).
- (12) Install flywheel (17) with fan (23) facing crankcase (3), aligning flywheel (17) groove with woodruff key (29) Install new washer (18) and nut (19) on crankshaft (20).

NOTE

To prevent flywheel (17) from turning, insert bar stock through timing hole in bell housing and through hole in flywheel (17)

- (13) Torque nut (19) to 155 lb-ft (210 Nm) Bend tabs of washer (18) against flats of nut (19).
- (14) Align holes in camshaft gear (13), with screw heads of thrust plate behind gear (13).

WARNING

Handling hot items presents a serious burn potential. Temperature resistant gloves are required.

NOTE

Insufficient heat or delay in installing gear (12) could cause the gear to become jammed on the crankshaft (20), whereas overheating may cause softening of the gear (12).

- (15) Heat the crankshaft gear (12) to straw yellow and install it on the crankshaft (20) without delay.
- (16) Install plate (15), without the packing (16), and install screw (14). Torque to 27.5 lb-ft (37.5 Nm).
- (17) When the gear (12) has cooled sufficiently, remove the plate (15).
- (18) Soak new packing (16) in engine oil at ambient temperature for 24 hours. Install new packing (16) on plate (15) and install plate by pushing it into position. Resistance will be felt due to the new packing (16).
- (19) Install screw (14) and torque to 27 5 lb-ft (37.5 Nm).

NOTE

Do step 17 only if access cover (9) was removed.

- (20) Install new packing (10). Apply sealing compound to two screws (7). Install screws (7), washers (8) and cover (9) on cover (1).
- (21) Install new seal (11) in gear cover (1).
- (22) Install new gasket (6) on crankcase (3).
- (23) Apply sealing compound on seven screws (5) and long screw (4).
- (24) Install cover (1) and screws (4 and 5) to crankcase (3).
- (25) Torque screws (4 and 5) to 9 lb-ft (12 Nm).
- (26) Install fuel Injection pump (Reference para. 5-10 d.).
- (27) Install fuel lift pump (Reference para. 5-10.f.).
- (28) Install cylinder, piston, and connecting rod assembly (Reference para. 6-3).
- (29) Perform engine running-in (Reference para. 6-10).

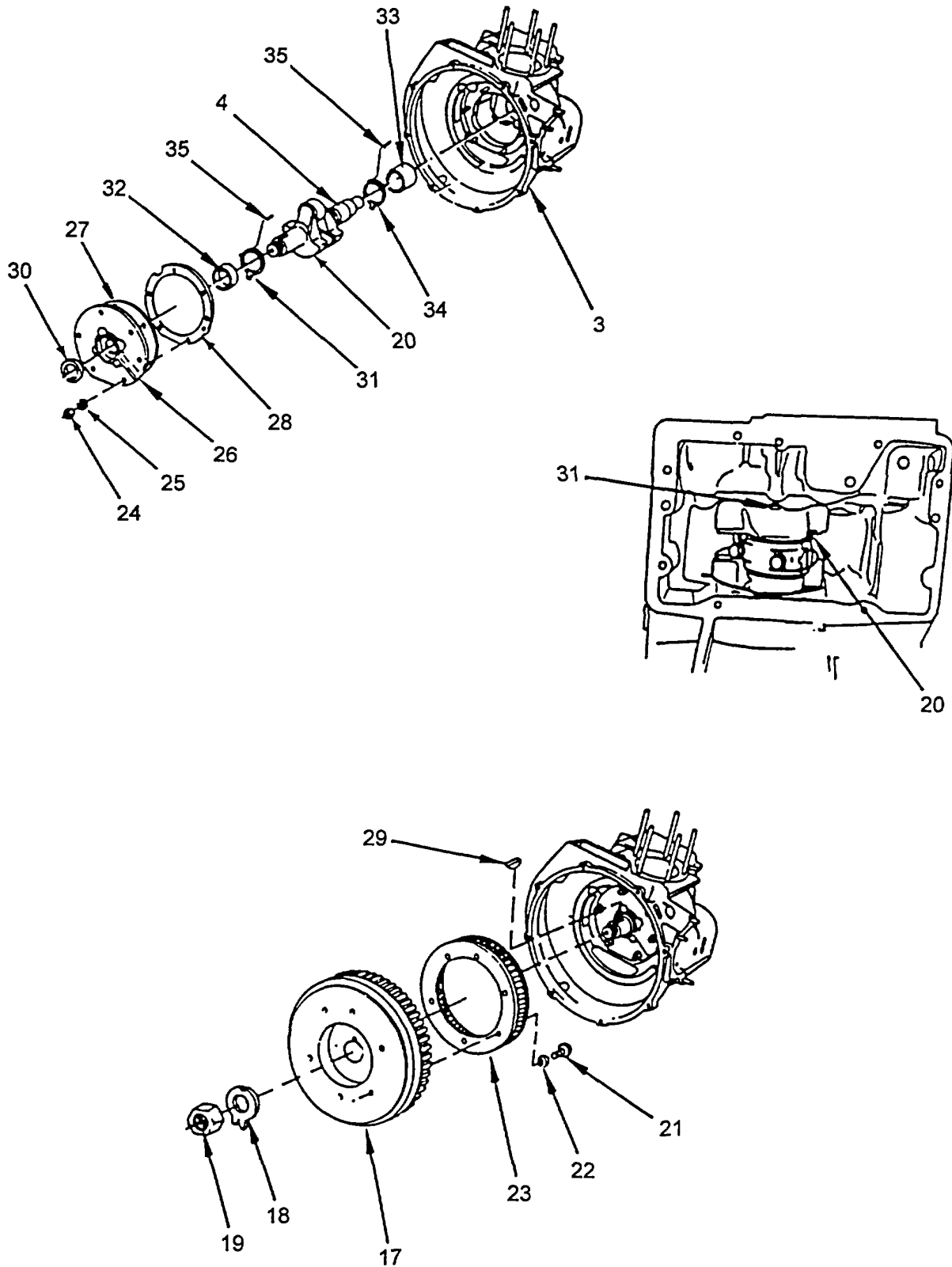


Figure 6-3. Fan, Flywheel and Crankshaft Replacement (Sheet 4 of 5)

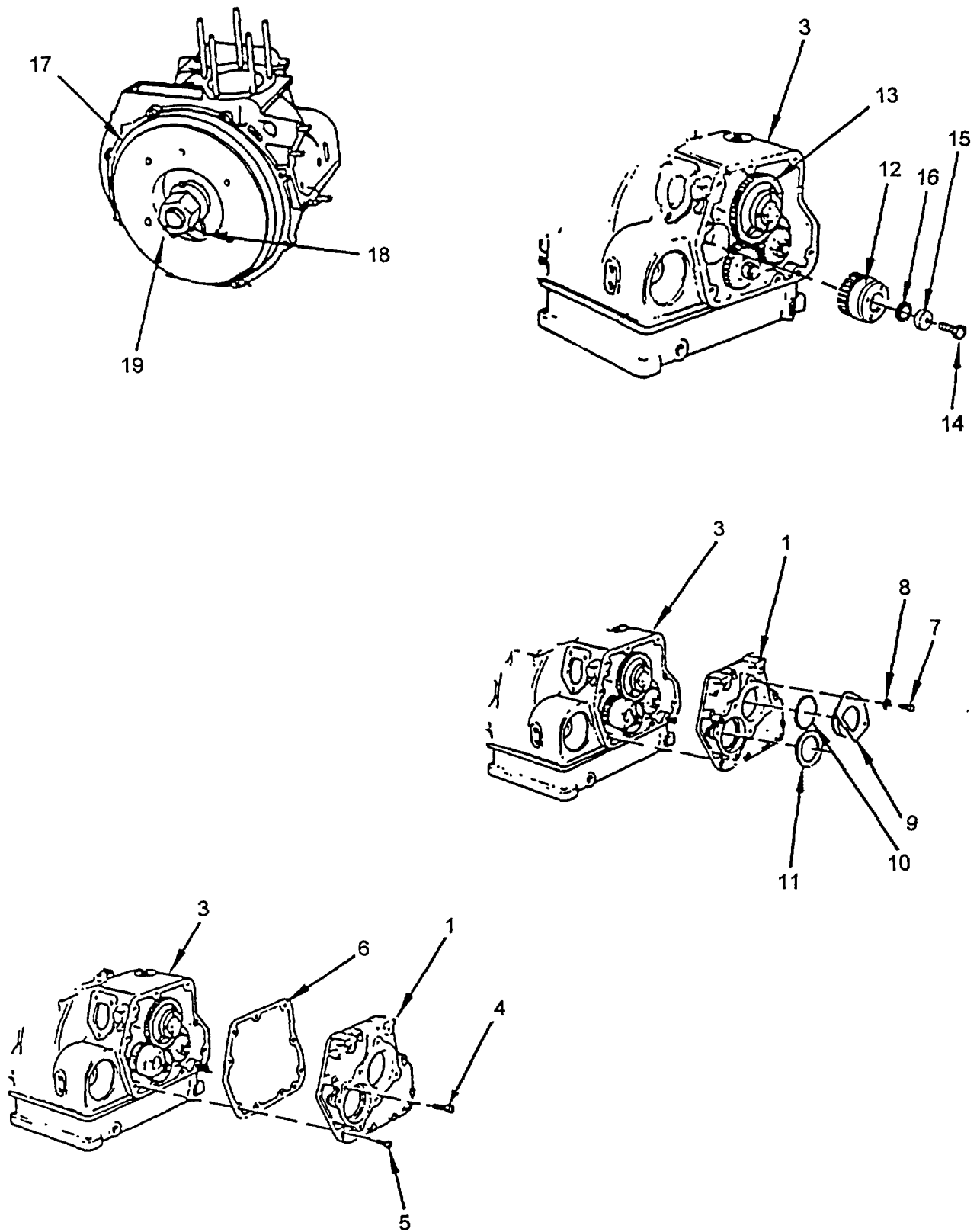


Figure 6-3. Fan, Flywheel and Crankshaft Replacement (Sheet 5 of 5)

6-5. CAMSHAFT-REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section II, Item 1).
 Adapter, 1/2 inch Drive (Appendix B, Section III, Item 17).
 Arbor Press (Appendix B, Section III, Item 13).
 Puller Kit (Appendix B, Section III, Item 22).
 Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
 Dial Indicator (Appendix B, Section III, Item 23).
 Gearwheel Puller (Appendix B, Section III, Item 19).
 Industrial Goggles (Appendix B, Section III, Item 9).
 Torque Wrench, 0-175 ft-lbs (Appendix B, Section III, Item 21).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).
 Sealing Compound (Appendix E, Section II, Item 5).
 Gasket (Appendix H, Section II, Item 60).
 Packing, Preformed (Appendix H, Section II, Item 61).
 Seal, Oil (Appendix H, Section II, Item 62).
 Wiping Rags (Appendix E, Section II, Item 1).
 Woodruff Key (Appendix H, Section II, Item 59).

Equipment Condition

Cylinder Head Removed (para. 6-2).
 Oil Pan and Gasket Removed (para. 5-10j).
 Fuel Injection Pump Removed (para. 5-10.d.).
 Fuel Lift Pump Removed (para. 5-10.f.).

a. Removal. (Refer to Figure 6-4).

CAUTION

Gear cover (1) is mounted on dowels (2) secured to crankcase (3). Care should be taken when removing cover (1) to prevent damage to dowels (2).

(1) Remove fuel lift pump push rod (4) from crankcase (3).

NOTE

Do steps 2 and 3 to remove access cover (5) as required.

(2) Remove screw (6), from crankcase (3).

(3) Remove seven screws (7), cover (1), and gasket (8) from crankcase (3).

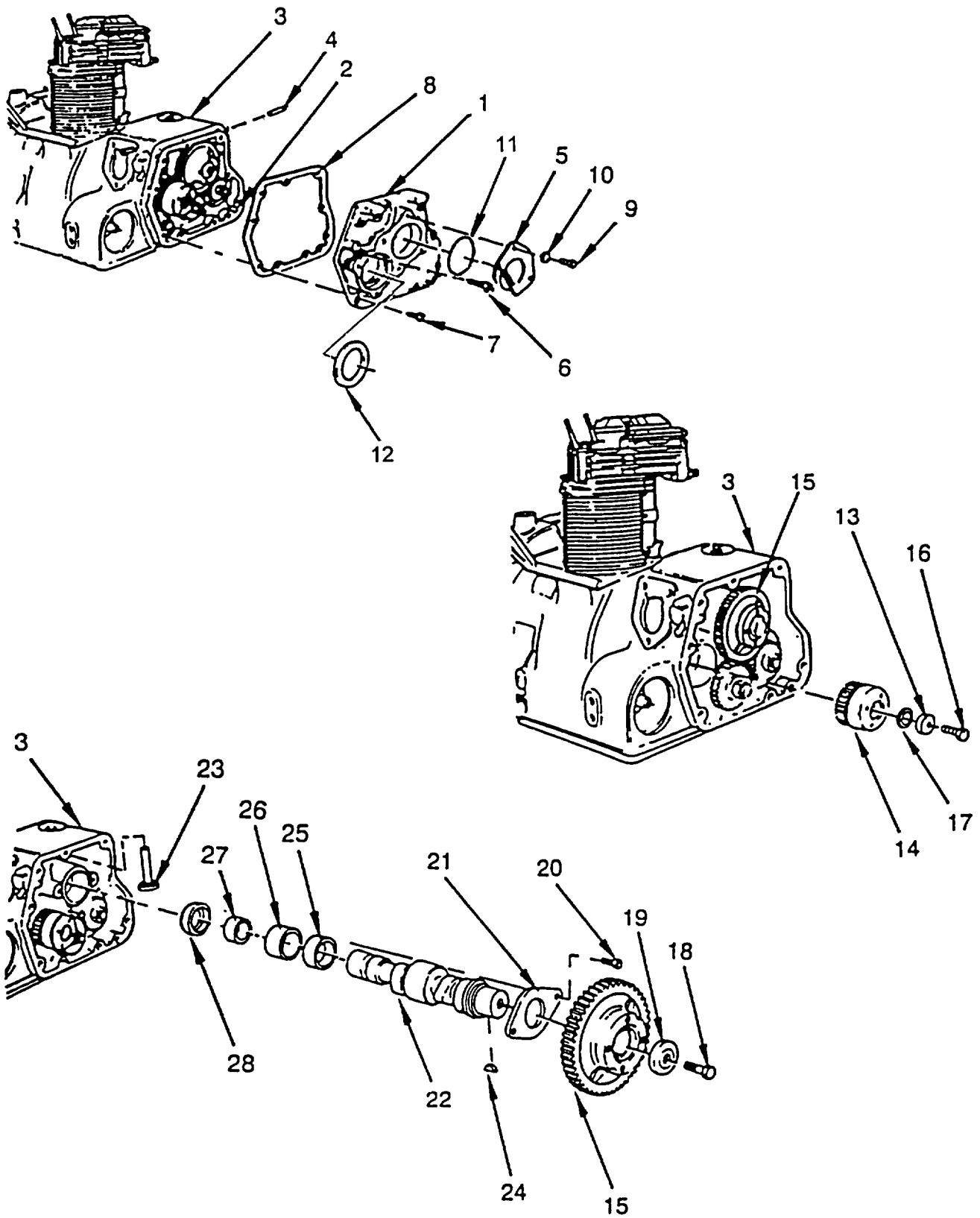


Figure 6-4. Camshaft Replacement

- (4) Remove two screws (9), washers (10), and cover (5) from cover (1).
- (5) Remove preformed packing (11) from cover (5).
- (6) Remove seal (12) from cover (1).
- (7) Lock flywheel to prevent it from turning and remove screw (16) from crankshaft gear (14).
- (8) Remove plate (13) from gear (14) using two hex wrenches placed in bolt hole.
- (9) Remove packing (17) from plate (13).
- (10) Using gear puller, remove gear (14) from crankshaft.
- (11) Remove two cap screws (20) through access holes in camshaft gear (15).
- (12) Push tappets (23) away from camshaft as far as possible and remove camshaft (22) from crankcase (3).
- (13) Remove two tappets (23) from crankcase (3), noting their positions.
- (14) Remove screw (18) and retaining plate (19) from gear (15).
- (15) Using a gear puller, remove gear (15) from camshaft (22).
- (16) Remove key (24) and thrust plate (21) from camshaft (22).
- (17) Remove bearings (25, 26, 27) from crankcase (3).
- (18) Remove plug (28) from crankcase (3).

WARNING

- **Dry cleaning solvent is flammable Do not use near open flame or non-ventilated places Keep away from open flames or sparks Avoid inhaling solvent fumes Avoid contact with skin Flash point of solvent is 100° F to 138° F (38° C to 59° C)**
- **Compressed air used for cleaning purposes will not exceed 30 psi Use only with effective chip-guarding and personal protective equipment (goggles/faceshield, gloves, etc).**

- (19) Using dry cleaning solvent and compressed air, clean all parts.
- (20) Inspect all parts for damage. Replace as required.

b. Installation.

- (1) Coat bearings (25, 26, 27) with engine oil and press new bearings (25, 26, 27) into crankcase (3).
- (2) Install new plug (28) from inside of the crankcase (3) with the cup bottom entering first.
- (3) Place the thrust plate (21) onto the camshaft (22).
- (4) Install key (24) in camshaft (22).

WARNING

Handling hot items presents a serious burn potential. Temperature resistant gloves are required.

NOTE

Insufficient heat or delay in installing gear (15) could cause the gear to become jammed on the camshaft (22), whereas overheating may cause softening of the gear (15).

- (5) Heat the camshaft gear (15) to straw yellow and install it on the camshaft (22) without delay.
- (6) When the gear (15) has cooled sufficiently, install the plate (19) and screw (18). Torque screw to 27.5 lb-ft (37.5 Nm).
- (7) With the engine standing on its flywheel, place the tappets (23) in their original positions and push them as far as they will go into the crankcase (3).
- (8) Lightly oil the camshaft (22) and bearings (25, 26, 27) with new engine oil.
- (9) Carefully install the camshaft (22) through the gear end of the crankcase (3).
- (10) Align holes in gear (15) with holes for screws (20) and install screws (20).
- (11) Using dial indicator, check clearance (endfloat) on front face of spur gear (15). Clearance should be between 0.005 inch to 0.012 inch (0.13 mm to 0.31 mm) and is not adjustable.
- (12) If camshaft (22) clearance is not within tolerances, install new plate (21).

WARNING

Handling hot items presents a serious burn potential. Temperature resistant gloves are required.

NOTE

Insufficient heat or delay in installing gear (14) could cause the gear to become jammed on the crankshaft, whereas overheating may cause softening of the gear (14).

- (13) Heat the crankshaft gear (14) to straw yellow and install it on the crankshaft without delay. Make sure that mark on crankshaft gear (14) is aligned between two dots on camshaft gear (15).
- (14) Install plate (13), without the packing (17), and install screw (16). Torque to 27.5 lb-ft (37.5 Nm).
- (15) When the gear (14) has cooled sufficiently, remove the plate (13).
- (16) Install new packing (17) on plate (13) and install plate by pushing it into position. resistance will be felt due to the new packing (17).
- (17) Install screw (16) and torque to 27.5 lb-ft (37.5 Nm).

NOTE

Do steps 18 and 19 only if cover (5) was removed.

- (18) Install new packing (11) on cover (5).
- (19) Apply sealing compound to two screws (9).
- (20) Install screws (9) and washers (10) on cover (1) Install new seal (12) to cover (1).
- (21) Apply sealing compound on seven screws (7) and long screw (6).
- (22) Install screw (6) on crankcase (3).
- (23) Install screws (7), new gasket (8), and cover (1) to crankcase (3).
- (24) Torque three screws (7, 6,) to 9 lb-ft (12 Nm).
- (25) Install fuel lift pump (para. 5-10 f.)
- (26) Install fuel injection pump (para. 5-10 d).
- (27) Install oil pan and gasket (para. 5-10j)
- (28) Install cylinder head (para. 6-2).

6-6. GOVERNOR-REPLACE.

This Task Covers: **a. Removal** **b. Installation****Initial Setup:****Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Adapter, 3/8 to 1/2 inch Drive (Appendix B, Section III, Item 24)
Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
Industrial Goggles (Appendix B, Section III, Item 9).
Torque Wrench, 0-175 ft-lbs (Appendix B, Section III, Item 21).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).
Gasket (Appendix H, Section II, Item 60).
Seal, Oil (Appendix H, Section II, Item 62).
Sealing Compound (Appendix E, Section II, Item 5).
Self-Locking Nut (Appendix H, Section II, Item 63).
Wiping Rags (Appendix E, Section II, Item 1).
Woodruff Key (Appendix H, Section II, Item 64).

Equipment Condition

Oil drained from crankcase

a. Removal. (Refer to Figure 6-5).

CAUTION

Gear cover (1) is mounted on dowels (2) secured to crankcase (3). Care should be taken when removing cover (1) to prevent damage to dowels (2).

- (1) Remove screw (4) from cover 1.
- (2) Remove seven screws (5), cover (1), and gasket (6) from crankcase (3).
- (3) Remove self-locking nut (12) from governor shaft (13).
- (4) Remove governor spur gear (14).
- (5) Remove woodruff key (15) from shaft (13).
- (6) Remove three screws (16) and governor (17) from crankcase (3).

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep away from open flames or sparks Avoid Inhaling solvent fumes Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**
- **Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip-guarding and personal protective equipment (goggles/faceshield, gloves, etc).**

(7) Using dry cleaning solvent and compressed air, clean all parts.

(8) Check the governor balls and sliding cone for wear or damage.

(9) Hold the assembly horizontal, by the housing, in one hand and spin the gear (14) with the other hand As the gear revolves, the governor cone assembly should be forced towards the retaining ring If there are any tight spots or damage, the complete governor assembly should be replaced.

b. Installation.

(1) Apply sealing compound to three screws (16) Install screws (16) and governor (17) to crankcase (3).

(2) Install new key (15) in shaft (13).

(3) Install gear (14) and new nut (12) to governor (17).

(4) Apply sealing compound to eight screws (4, 5).

(5) Install seven screws (5), new gasket (6), and cover (1) to crankcase (3).

(6) Install screw (4) to crankcase (3).

(7) Torque screws (4, 5) to 9 lb-ft (12 Nm).

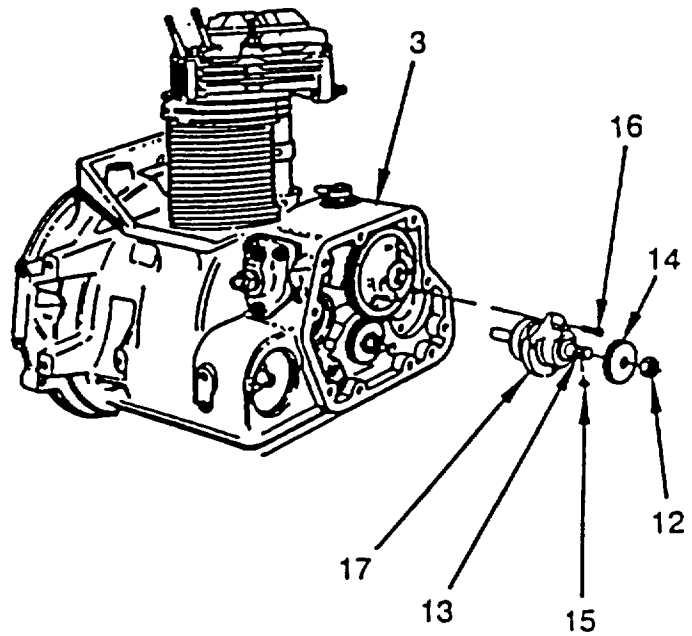
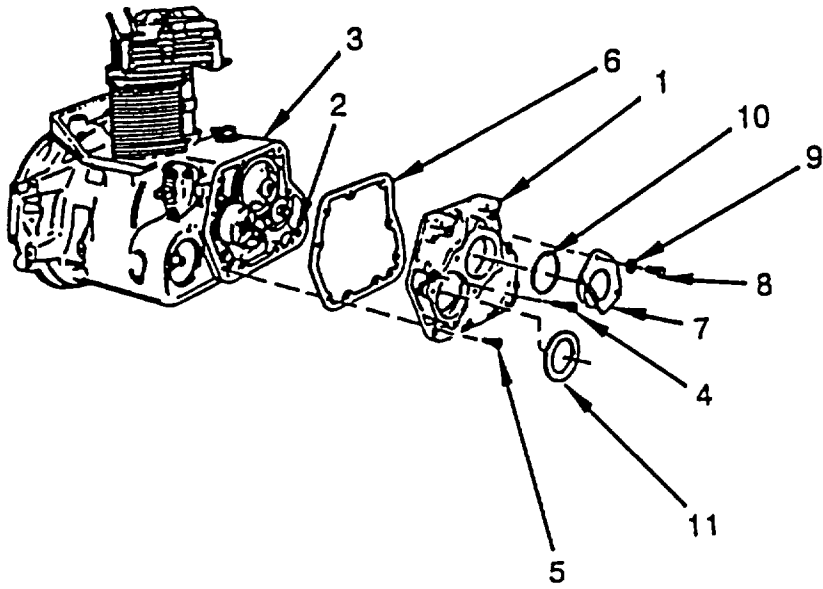


Figure 6-5. Governor Replacement

6-7. GOVERNOR LINKAGE - REPAIR.

This Task Covers: **a. Disassembly** **b. Assembly****Initial Setup:****Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
Industrial Goggles (Appendix B, Section III, Item 9).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).
Wiping Rags (Appendix E, Section II, Item 1)
Wood Block (Appendix E, Section II, Item 25)

Equipment Condition

Fuel Lift Pump Removed (para 5-10.f.)
Fuel Injection Pump Removed (para 5-10.d)
Camshaft Removed (para. 6-4, steps 1 thru 11).
Governor Removed (para 6-5).

Personnel Required2

a. Disassembly. (Refer to Figure 6-6).

- (1) Remove screw (1), breather assembly cover (2), preformed packing (3), and breather flap (4) from crankcase (5)
- (2) Unscrew breather (6) from crankcase (5). Remove breather (6) and washer (7) from crankcase (5).
- (3) Remove plunger (8) from crankcase (5).
- (4) Remove nut (9) and washer (10) from speed adjuster (11).
- (5) Remove adjuster (11) and speeder spring (12) from crankcase (5).
- (6) Loosen socket head screw (13) and remove bracket (14) from shaft (15).
- (7) Lift shaft (15) and place a block of wood (16) under shaft (15). Place hollow tubular drift through hole (17) over shaft (15) on top of operating lever (18) Drive lever (18) off shaft (15). Remove wood block (16)
- (8) Remove lever (18) and shaft (15) from crankcase (5).
- (9) Remove sleeve (19) from crankcase (5)

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**
 - **Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip-guarding and personal protective equipment (goggles/faceshield, gloves, etc.).**
- (10) Using dry cleaning solvent and clean rag or compressed air thoroughly clean speed adjuster (11), nut (9), washer (10), sleeve (19), lever (18), spring wire (20), spring (12), plunger (8), shaft (15), and bracket (14).
- (11) Inspect parts for damage. Replace as required.

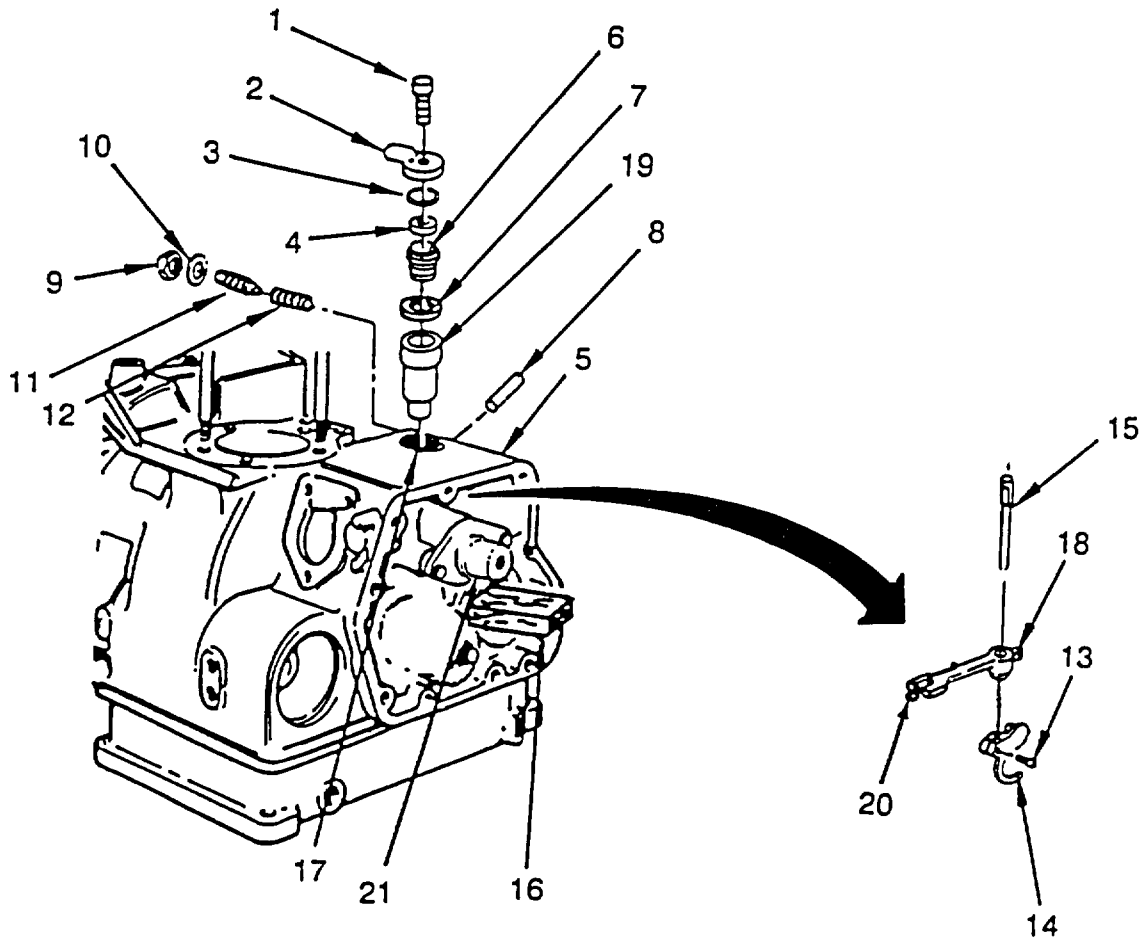


Figure 6-6. Governor Linkage Repair

b. Assembly.

- (1) Place sleeve (19) through hole (17) in crankcase (5). Place flat washer (7) on sleeve (19). Place shaft (15) in sleeve (19) and drive sleeve (19) in crankcase (5) using drift punch through hole (17).
- (2) Remove shaft (15) and washer (7) from sleeve (19).
- (3) Place lever (18) into crankcase (5) and place block of wood (21) under lever (18).
- (4) Place shaft (15) through hole (17) and lever (18). Place drift punch through hole (17) and drive shaft (15) into lever (18).
- (5) Place bracket (14) in crankcase (5) and over lower end of shaft (15). Tighten screw (13).
- (6) Install spring (12) and adjuster (11) in crankcase (5). Install washer (10) and nut (9) on adjuster (11).
- (7) Install governor (para. 6-5).
- (8) Adjust governor linkage (para. 6-7).
- (9) Install plunger (8) to crankcase (5).
- (10) Install washer (7) and breather (6) to crankcase (5).
- (11) Install flap (4), new packing (3), cover (2), and screw (1) to crankcase (5).
- (12) Install camshaft gear (para. 6-4).
- (13) Install fuel injection pump (para. 5-10.d.).
- (14) Install fuel lift pump (para. 5-10.f.).
- (15) Perform engine running-in (para. 6-11).

6-8. GOVERNOR LINKAGE ADJUSTMENT.

This Task Covers: a. Adjust**Initial Setup:****Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1)

Materials/Parts Required

Wiping Rags (Appendix E, Section II, Item 1).

Equipment ConditionCamshaft Removed (para. 6-4).

a. Adjust. (Refer to Figure 6-7).

NOTE**Engine is sitting on flywheel end**

- (1) Install fuel injection pump (Reference para 5-10.d.).
- (2) Set Governor Linkage
 - (a) Loosen socket head screw (1).
 - (b) Check that bracket (2) is hard against governor (3) with sliding cones (4) and governor (3) together.
 - (c) If bracket (2) is not hard against governor (3), adjust speed adjuster (5) against spring (6) to position cones (4) and governor (3) together.
 - (d) Push fuel injector pump operating lever (7) toward flywheel to maximum position.
 - (e) Loosen setscrew (8) and move bracket (2) up and down shaft (9).
 - (f) Insert feeler gage at point A Push down on lever (7) while pushing up on bracket (2).
 - (g) Set distance between lever (7) and top of governor shaft bushing (10) to 0.010 inch (0.25 mm).
 - (h) Tighten screw (1) to ensure feeler gage bracket distance is secure.
 - (i) Tighten setscrew (8) on bracket (2).
- (3) Remove fuel Injection pump (para 5-10 d).
- (4) Install camshaft (para 6-4).

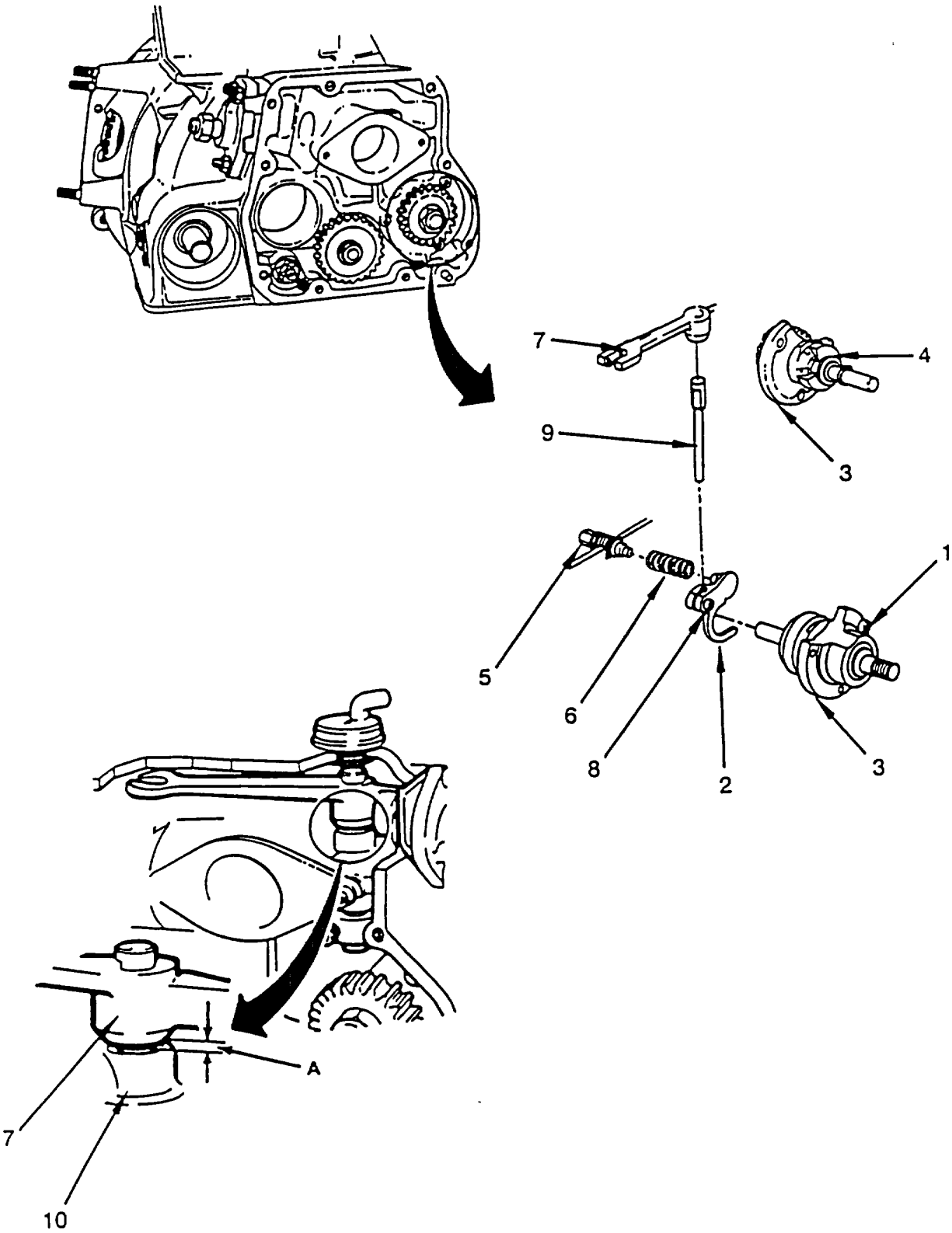


Figure 6-7. Governor Linkage Adjustment

6-9. OIL PUMP-REPLACE.

This Task Covers: **a. Removal** **b. Installation**

Initial Setup:**Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Adapter, 3/8 to 1/2 inch Drive (Appendix B, Section III, Item 24)
 Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
 Industrial Goggles (Appendix B, Section III, Item 9).
 Torque Wrench, 0-150 ft-lbs (Appendix B, Section III, Item 4).

Materials/Parts Required

Dry Cleaning Solvent (Appendix E, Section II, Item 3).
 Gasket (Appendix H, Section II, Item 65).
 Packing, Preformed (Appendix H, Section II, Item 61)
 Self-Locking Nut (Appendix H, Section II, Item 66).
 Seal, Oil (Appendix H, Section II, Item 67).
 Sealing Compound (Appendix E, Section II, Item 5).
 Wiping Rags (Appendix E, Section II, Item 1).
 Woodruff Key (Appendix H, Section II, Item 68).
 Woodruff Key (Appendix H, Section II, Item 59).

Equipment Condition

Camshaft removed (para. 6-5).

a. Removal. (Refer to Figure 6-8).

- (1) Remove self-locking nut (1) and washer (2) from oil pump (3).
- (2) Pull oil pump drive gear (4) and key (5).
- (3) Remove three screws (6) and washers (7).
- (4) Remove pump (3) from crankcase (8).

WARNING

- **Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).**
- **Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip-guarding and personal protective equipment (goggles/faceshield, gloves, etc.) (5) Using dry cleaning solvent and compressed air clean all parts.**

- (6) Inspect all parts for damage. Replace as required.

b. Installation.

- (1) Pour a small quantity of new engine oil into the pump through the inlet and delivery ports.
- (2) Align the pump (3) with the offset screw holes in crankcase (8).
- (3) Install three screws (6) and washers (7). Torque screws (6) to 10 lb-ft (13.6 Nm).
- (4) Install new key (24) in shaft (22).
- (5) Align key (24) and gear (23) and install gear (23), washer (22), and new nut (20).
- (6) Install camshaft (para. 6-4).

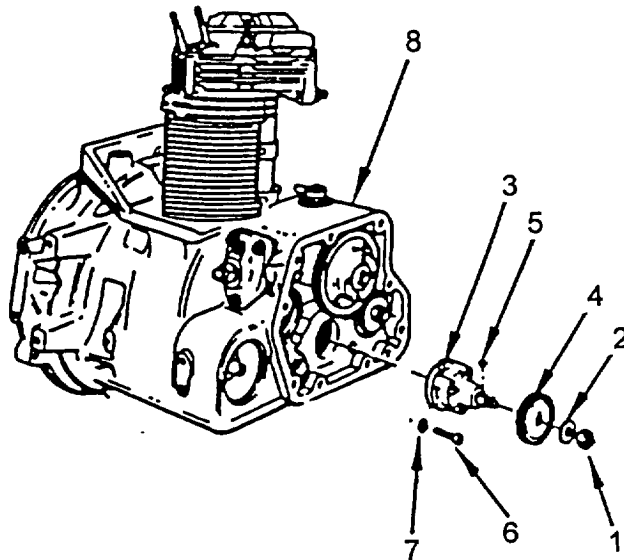


Figure 6-8. Oil Pump Replacement

6-10. CRANKCASE - REPAIR.

This Task Covers: **a. Disassembly** **b. Assembly****Initial Setup:****Tools and Test Equipment Required**

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
 Chemical and Oil Protective Gloves (Appendix B, Section III, Item 8).
 Industrial Goggles (Appendix B, Section III, Item 9).
 Stud Remover/Setter (Appendix B, Section III, Item 26).

Materials/Parts Required

Acid Swabbing Brush (Appendix E, Section II, Item 22)
 Dry Cleaning Solvent (Appendix E, Section II, Item 3).
 Sealing Compound (Appendix E, Section II, Item 5).
 Wiping Rags (Appendix E, Section II, Item 1).

Equipment Condition

Fan, Flywheel, and Crankshaft Removed (para. 6-3).
 Camshaft Removed (para. 6-4).
 Governor Linkage Removed (para 6-6).
 Oil Pump Removed (para. 6-8).

a. Disassembly. (Refer to Figure 6-9).

- (1) Inspect pins (1), studs (2 thru 6) cam shaft bore plug (7), oil tube adapter (8), relief valve assembly (9), and oil plug (10) for damage. Replace as required. Do not adjust or disassemble relief valve assembly (9) No adjustment is required.

NOTE

Remove pins (1), studs (2 thru 6), plug (7), adapter (8), valve (9), or plug (10) only if damaged.

- (2) Remove two pins (1) from crankcase (11).
- (3) Remove plug (7) from crankcase (11)
- (4) Remove valve (9) from crankcase (11).
- (5) Remove plug (10) from crankcase (11) near bearing housing at flywheel end.
- (6) Remove studs (2) from crankcase (11).
- (7) Remove studs (6) from crankcase (11).
- (8) Remove short studs (4) from crankcase (11).
- (9) Remove long studs (5) from crankcase (11).
- (10) Remove oil tube adapter (8) from crankcase (11).

- (11) Remove studs (3) from crankcase (11).

WARNING

Dry cleaning solvent is flammable. Do not use near open flame or non-ventilated places. Keep away from open flames or sparks. Avoid inhaling solvent fumes. Avoid contact with skin. Flash point of solvent is 100° F to 138° F (38° C to 59° C).

- (13) Clean all surfaces of crankcase with dry cleaning solvent, brush, and rags.
- (11) Inspect crankcase for damage. Replace as required.

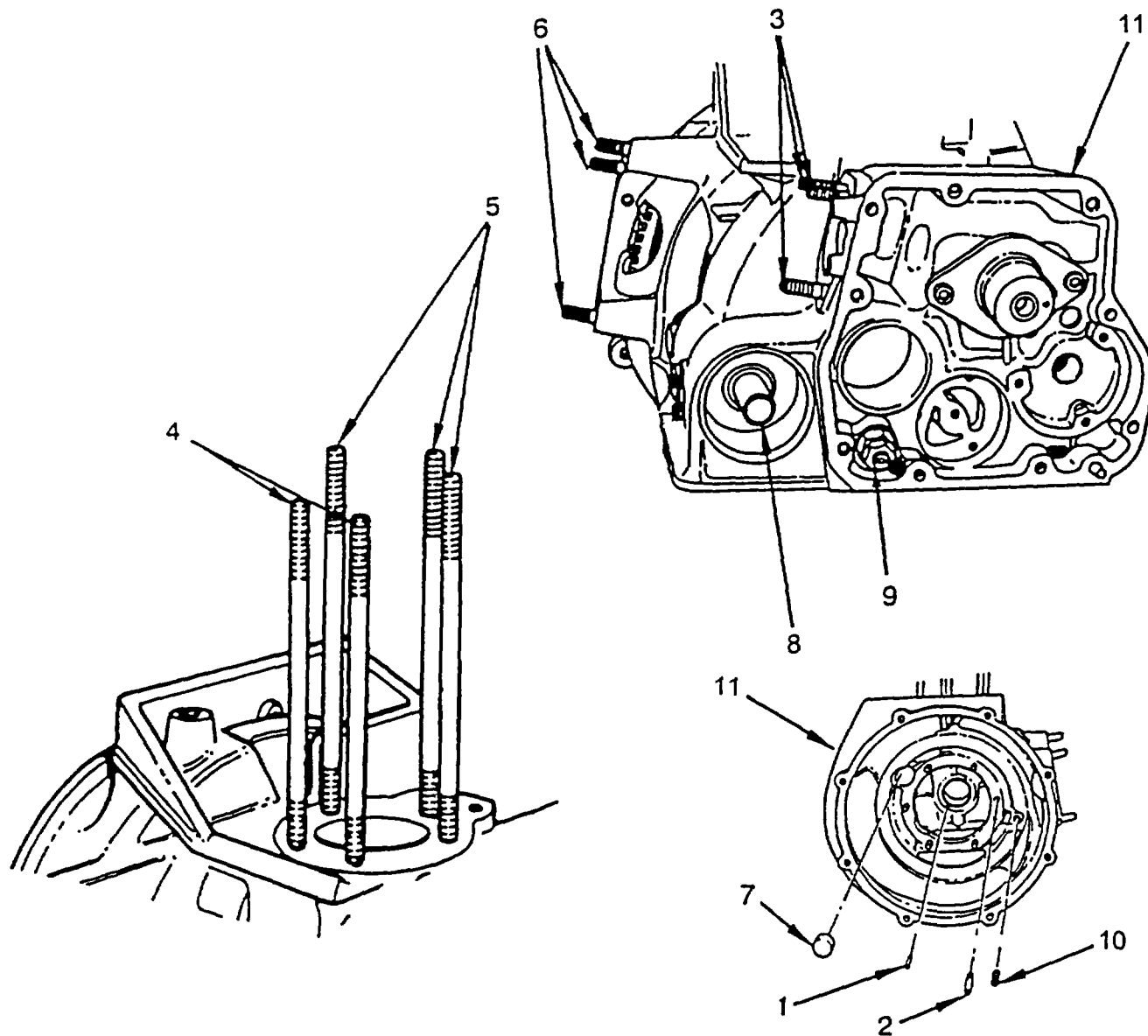


Figure 6-9. Crankcase Repair

b. Assembly.

- (1) Apply sealing compound to studs (2). Install studs (2) in crankcase (11) at bearing housing location at flywheel end.
- (2) Apply sealing compound to oilway plug (10) Install plug (10) in crankcase (11).

NOTE**Valve (9) is preset Do not make any adjustments**

- (3) Install valve (9) into crankcase (11).
- (4) Apply sealing compound to outer diameter of plug (7). Install plug (7) in crankcase (11).
- (5) Install two pins (1) in crankcase (11).
- (6) Install adapter (8) in crankcase (11).
- (7) Install studs (6) in crankcase (11).
- (8) Install long studs (5) in crankcase (11)
- (9) Install short studs (4) in crankcase (11).
- (10) Install studs (3) in crankcase (11).
- (11) Install oil pump (para. 6-8).
- (12) Install governor linkage (para. 6-6).
- (13) Install camshaft (para. 6-4).
- (14) Install fan, flywheel, and crankshaft (para. 6-3).
- (15) Perform engine running-in (para. 6-11).

6-11. ENGINE RUNNING-IN.

This Task Covers: a. Run**Initial Setup:**

Tools and Test Equipment Required

Tool Kit, General Mechanic's: Automotive (Appendix B, Section III, Item 1).
Tachometer, Mechanical (Appendix B, Section III, Item 27).

Materials/Parts Required

Writing Paper (Appendix E, Section II, Item 24).
Writing Pencil (Appendix E, Section II, Item 23).

References

LO 9-2350-264-12. Lubrication Order.

a. Run. (Refer to Figure 6-10).

NOTE

To avoid excessive oil consumption, the running-in procedure must be performed on repaired engines.

(1) Install engine (1) in locally fabricated run-in fixture.

NOTE

The level of engine oil usually falls slightly after initial circulation during engine run

(2) Run engine (1) for 2 minutes and check for oil and fuel leaks.

(3) Stop engine (1) and check engine oil level (LO 9-2350-264-12).

(4) Loosen jamnuts (2) on control rod (3).

(5) Start engine (1) and place tachometer to center of flywheel (4) long enough to obtain revolutions-per-minute (RPM) reading. Record reading.

NOTE

Engine speed should be 3000 rpm \pm 150 rpm.

(6) Screw in the adjusting nut (5) to increase the speed or out to decrease it. Adjust engine RPM to proper speed. Tighten jamnuts (2).

(7) Place tachometer to center of flywheel (4) and verify engine speed.

(8) Allow engine (1) to run for 10 minutes

(9) Stop engine and check engine oil level (LO 9-2350-264-12).

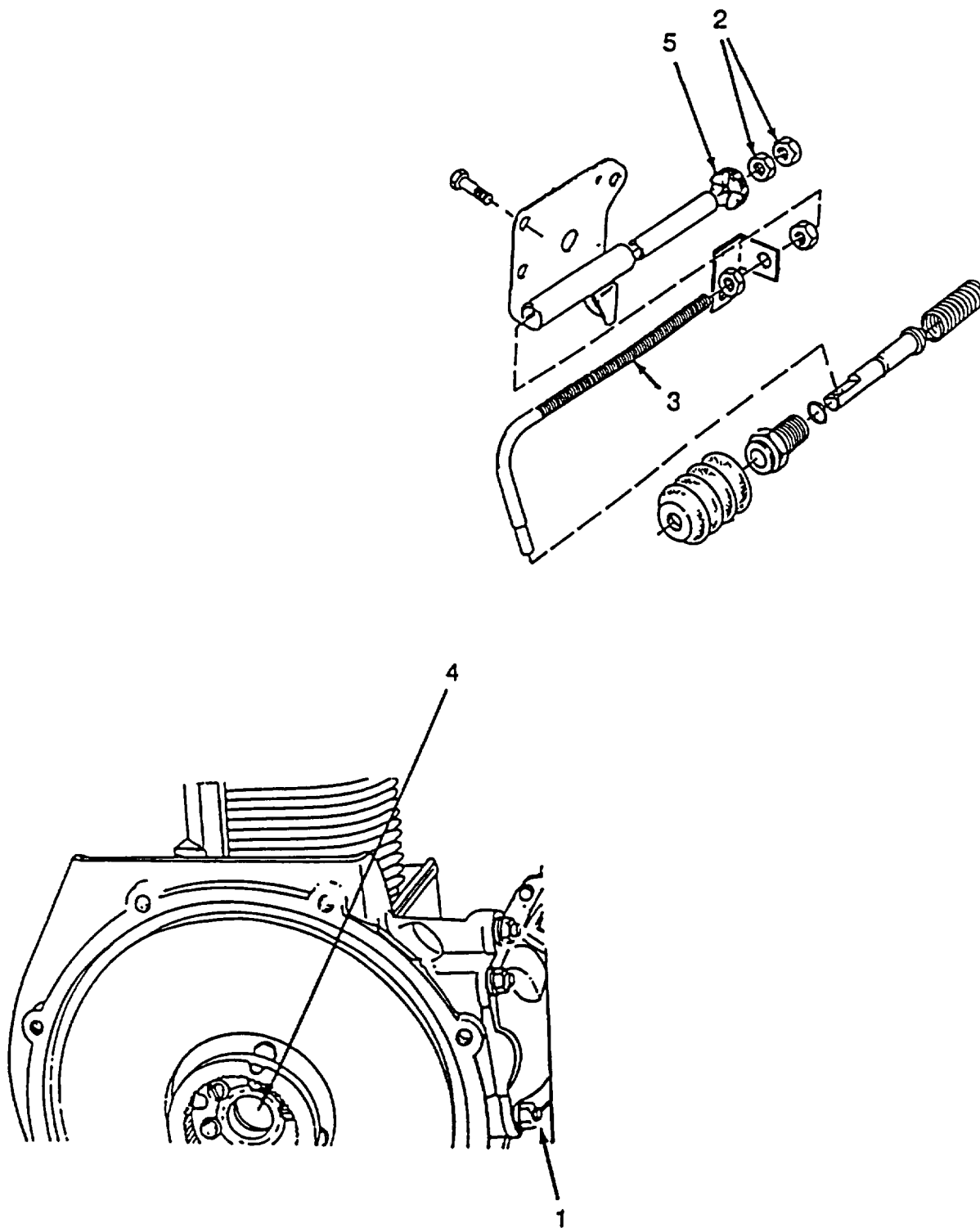


Figure 6-10. Engine Running-In

APPENDIX A
REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Recommended changes to Equipment Technical Publications DA Form 2028-2
 Equipment Inspection and Maintenance Worksheet DA Form 2404
 Product Quality Deficiency Report SF 368
 Report of Discrepancy SF 364

A-3. FIELD MANUALS.

Manual For The Wheeled Vehicle Driver..... FM 21-305
 First Aid For Soldiers FM 21-11
 NBC Contamination Avoidance..... FM 3-3
 NBC Protection FM 3-4
 NBC Decontamination FM 3-5
 Operation and maintenance of Ordnance Materiel in Cold Weather FM 9-207

A-4. TECHNICAL MANUALS.

Lubrication Order, Lubricating and Servicing Unit..... LO 5-4930-244-12
 Inspection and Test of Air and Other Compressors TB 43-0151
 Hand Portable Fire Extinguishers Approved for Army Users TB 5-4200-200-10
 Preservation and Packing of Military Equipment..... TM 38-230-1
 Painting Instructions for Field Use TM 43-0139
 Operator, Unit, Direct Support and General Support RPSTL..... TM 5-4930-244-24P
 Administrative Storage of Equipment TM 740-90-1
 Procedures For Destruction Of Equipment To Prevent
 Enemy Use (Mobility Equipment Command) TM 750-244-3
 Welding Theory And Application TM 9-237
 Cleaning Solvents TM 9-247

A-5. MISCELLANEOUS PUBLICATIONS AND STANDARDS.

The Army Maintenance Management System.....DA Pam 738-750

General Mechanic's Tool KitSC 5180-90-N26

Army Medical Department Expendable/Durable ItemsCTA 8-100

Expendable Items (Except Medical Class V, Repair Parts
And Heraldic Items)CTA 50-970

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. The Army Maintenance System MAC.

a. This introduction (section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Unit - includes two sub-columns, C (operator/crew) and O (unit Maintenance).

Direct Support - includes an F sub-column.

General Support - includes an H sub-column.

Depot - Includes a D sub-column.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of placing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services including fault location/troubleshooting², removal/installation, and disassembly/assembly³ procedures, and maintenance actions⁴, to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

¹Services Inspect, test, service, adjust, align, calibrate, and/or replace.

²Fault location/troubleshooting The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault with in a system or unit under test (UUT).

³Disassembly/assembly The step-by-step breakdown (taking apart) of a spare/functional group coded Item to the level of its least component, that is assigned an SMR code for level of maintenance under consideration (i.e., identified as maintenance significant).

⁴Actions Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

B-3. Explanation of Columns in the MAC, Section II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance-significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the Item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.).

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate sub-column(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or difficulty of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time),

troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the Maintenance Allocation Chart. The symbol designations for the various maintenance levels are listed below.

- COperator or crew maintenance
- OUnit maintenance
- FDirect support maintenance
- LSpecialized repair activity (SRA)
- HGeneral support maintenance
- DDepot maintenance

e. Column 5. Tools and Test Equipment reference code. Column 5 specifies, by code, those common tool sets (not individual tools) common TMDE, and special tools, special TMDE, and special support equipment required to perform the designated function. Codes are keyed to tools and test equipment in Section III.

f. Column 6, Remarks. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks contained in Section IV.

B-4. Explanation of Columns In Tool and Test Equipment Requirements, Section III.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number, model number, or type number.

B-5. Explanation of Columns in Remarks, Section IV.

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

**Section II. MAINTENANCE ALLOCATION CHART
FOR
LUBRICATING AND SERVICING UNIT**

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
00	Lubricating and Servicing Unit								
01	Enclosure Assembly	Inspect Replace	0.2	0.5			1	A,C	
0101	Doors	Inspect Replace Repair	0.2	0.8 1.5			1,2 1,2		
0102	Panels	Inspect Replace Repair	0.2	1.5 1.5			1,2 1,2		
02	Skid Assembly	Inspect Replace	0.2		0.5		1	A,B,C	
0201	A-Frame Assembly								
020101	Air Filter/ Moisture Separator	Inspect Replace Service	0.2	0.4			1		
020102	Alcohol Injector	Inspect Service Adjust Replace Repair	0.2 0.2 0.2	0.4 0.4			1 1 1 1		
020103	Lube Supply Hoses	Inspect Replace Repair	0.2	0.5 0.5			1 1		
020104	Transfer Pump	Inspect Adjust Repair	0.2	0.2	0.6		1 1		
020105	A-Frame	Replace Repair			0.5 1.0		1 1,2,3	C	
0202	Fuel Tank Assembly								
020201	Fuel Cap & Neck Assembly	Inspect Replace Repair	0.2	0.3 0.3			1 1		

MAC (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
020202	Fuel Tank Assembly (Without Fuel Neck & Cap)	Inspect Service Replace Repair	0.2	0.2 0.5	1.0			1 1 1,3	
0203	Tool Box Assembly	Replace Repair		0.3 0.3				1 1	
0204	Reel Cabinet Assembly								
020401	Gear-Lube & Oil Dispensers	Inspect Replace Repair	0.2	0.5	1.0			1 1	
020402	Grease Control Valves	Inspect Replace	0.2	0.5				1	
020403	Reels and Hoses	Inspect Replace Repair	0.2	0.5 1.0				1 1	
020404	Cabinet Assembly	Replace		1.0				1	
02040401	Battery Box Assembly	Inspect Service Replace Repair	0.2 0.2	0.5 1.0	1.0			1 1 1,3	
02040402	Condensate Drain Assembly	Inspect Replace Repair	0.2	0.5 0.5				1 1	
02040403	Reel Cabinet Frame	Inspect Repair	0.2		1.0			1,3	
0205	Air Compressor Assembly	Inspect Test	0.2	0.2				1	
020501	Control Panel & Throttle	Inspect Test Replace Repair	0.2	0.3 0.5 1.0				1 1 1	
020502	Belts	Inspect Adjust Replace	0.1	0.3 0.4				1 1	
020503	Alternator Assembly	Inspect Test Replace	0.2	0.2 0.5				1 1	

MAC (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
020504	Air Pump Assembly								
02050401	Plumbing	Replace		0.5				1	
02050402	Air Pump	Inspect Service Replace Repair	0.3	0.5 1.0	2.0			1 1 1	A,C
02050403	Air Filter	Inspect Replace	0.2 0.4					1	
020505	Tank Assembly								
02050501	Shut Off Valve	Inspect Replace	0.2	0.3				1	
02050502	Pressure Relief Valve	Inspect Replace	0.1	0.5				1	
02050503	Ball Valve	Inspect Replace	0.1	0.3				1	
02050504	Unloader Valve	Inspect Replace	0.1	0.3				1	
02050505	Air Tank	Inspect Replace	0.1		1.5			1	
020506	Diesel Engine	Inspect Service Replace Repair	0.5 0.5	2.0 2.0	2.0 3.0	3.0		1 1 1	A,C
020507	Clutch	Inspect Replace	0.2	0.5				1	
0206	Lube Tank Assembly								
020601	Air Regulators	Inspect Replace Repair	0.2	0.3 0.3				1 1	
020602	Low Pressure Pumps	Inspect Service Replace Repair	0.2	0.4 0.4	2.0			1 1 1	A,C

MAC (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
020603	High Pressure Pump	Inspect Service Replace Repair	0.2	0.4 0.4	2.0	1	1 1	A,C	
020604	Lube Tank	Inspect Replace Repair	0.2		0.6 0.5		1 1	A,B,C	
0207	Winterization Assembly								
020701	Heater Assembly	Inspect Replace	0.1	0.4			1		
02070101	Fuel Pump & Fuel Lines	Inspect Replace	0.1	0.2 0.5			1		
02070102	Control Box Assembly & Heater	Inspect Replace	0.2	0.5			1	A,C	
020702	Wiring Harness	Test Replace Repair		0.3 0.3	0.3		1 1		
020703	Exhaust Line / Hoses	Inspect Replace	0.2	0.6			1		
020704	Heater Mounting Assembly	Inspect Replace	0.1	0.5			1		
0208	Skid Weldment	Inspect Repair	0.2		2.0		1,3		
03	Trailer Assembly								
0301	Air Brake System								
030101	Air Hose Assemblies & Gladhand Couplers	Inspect Replace Repair	0.1	0.5 0.5			1 1		
030102	Control Valve	Inspect Replace	0.1	0.5			1		
030103	Emergency Relay Valve	Inspect Replace	0.2	0.5			1		
030104	Quick Release & Limiting Valve	Inspect Replace	0.1	0.5			1		

MAC (Continued)

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
030105	Synchronizing Valve	Inspect Replace	0.1	0.5				1	
030106	Air Tank Assembly	Inspect Replace	0.1	0.5				1	
030107	Power Cluster & Master Cylinder	Inspect Service Replace	0.1 0.1	0.5				1	
0302	Brake Lines	Inspect Replace	0.1	0.5				1	
0303	Electrical System								
030301	Inter-vehicular Trailer Harnesses	Inspect Test Replace Repair	0.2	0.2 0.5	0.5			1,2 1 1,2	
030302	Voltage Reducer Box	Inspect Test Replace	0.2	0.2 0.3				1 1,2 1	
030303	Trailer Wiring Harness	Inspect Test Replace Repair	0.2		0.3 1.5 1.0			1,2 1 1,2	
0304	Front & Rear Jacks I/ Safety Chain Assembly	Inspect Replace	0.2	0.5				1,2	B
0305	Wheel & Tire Assembly	Inspect Service Replace	0.2 0.2 2.0					1 1	
0306	Axle Assembly	Inspect Replace	0.2		1.0			1,2,7	
030601	Hub & Drum	Replace Repair		2.0 2.0				1,2,7 1,2,7	
030602	Brake Assembly	Inspect Replace Repair	0.3	2.0 2.0				1,2 1,2	
0307	Trailer Frame	Inspect Repair	0.2		1.5	1,3			

Section III. SPECIAL TOOLS AND TEST EQUIPMENT REQUIREMENTS

(1) REFERENCE TOOL CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL/AUTO STOCK NUMBER	(5) TOOL NUMBER
1	O	Tool Kit, General Mechanic's: Automotive (GMTK)	5180-00-177-7033	SC 5180-90- CL-N26
2	O	Tool Kit, Common Number 1	4910-00-754-0654	SC 4910-95- CL-A74
3	F,H	Electric Welder		
4	F	Torque Wrench, 0-150 ft-lbs	5120-00-247-2540	SC 4910-95- A31
5	O	Caulking Gun	5120-00-061-1283	
6	O	Primer Brush		
7	F	Jack, Dolly Type, Hydraulic, 10-Ton Capacity	4910-00-289-7233	
8	H	Gloves, Chemical and Oil Protective	84-15-00-641-4601	SC 4910-95- CL-A72
9	H	Goggles, Industrial	4240-00-269-7912	SC 4910-95- A31
10	H	Micrometer	5120-00-293-1683	SC 4910-95- A63
11	H	Lapper, Poppet Valve	5120-00-289-0502	SC 4940-95- CL-B02
12	O	Brush, Wire	7920-00-291-5815	SC 4910-95- CL-A72
13	H	Press, Arbor, Hand	3444-00-449-7295	SC 4910-95- A31
14	H	Gage, Bearing Clearance	5210-00-640-6177	CTA 50-970
15	H	Compressor, Piston Ring	5120-00-191-9542	CTA 50-970
16	H	Pliers, Snap Ring	5120-00-789-0492	SC 4940-95- CL-B02
17	F	Adapter, 1/2-inch Drive	5120-00-144-5207	SC 4910-95- A31
18	F	Breaker Bar 3/4-inch Drive	5120-010-221-7959	SC 4910-95- A31
19	H	Puller, Gear Wheel	5180-00-423-1596	SC 4910-95- A31

Section III. SPECIAL TOOLS AND TEST EQUIPMENT REQUIREMENTS (Continued)

(1) REFERENCE TOOL CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE STOCK NUMBER	(4) NATIONAL/AUTO NUMBER	(5) TOOL
20	H	Wrench, Torque, 0-300 in-lbs	5120-00-247-2536	SC 4910-95-A31
21	H	Wrench, Torque, 0-175 ft-lbs	5120-00-640-6364	SC 4910-95-A31
22	H	Puller, Kit, Universal	5180-00-089-3660	CTA 50-970
23	H	Indicator, Dial	5210-00-277-8840	SC 4940-95-CL-B20
24	H	Adapter, 3/8-inch to 1/2-inch	5120-00-240-8703	SC 4910-95-A31
25	H	Tester, Diesel Fuel	4910-00-255-8641	SC 4940-95-CL-B20
26	H	Stud Remover/Setter	5120-00-596-0980	SC 4910-95-A31
27	H	Tachometer, Mechanical	6680-00-171-4584	SC 4910-95-A31
28	H	Wrench, Tap and Reamer	5120-00-289-0537	SC 4910-95-A31
29	H	Thread-Cutting Tap	5136-00-276-1032	SC 4910-95-A31
30	H	Torque Wrench, 0-600 in-lb	5120-00-542-5681	SC 5180-95-CL-A12

Section IV. REMARKS

REFERENCE CODE	REMARKS
A	A hoist or crane is needed for this procedure.
B	Use jackstands and wheel chocks for safety.
C	Two or more personnel may be required for this procedure.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. SCOPE. This appendix lists components of end item and basic issue items for the lubrication and servicing unit to help you inventory items required for safe and efficient operation of the equipment.

C-2. GENERAL. The Component of End Item and Basic Issue Items (BII) lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the Lubricating and Servicing Unit, but they are to be removed and separately packaged for transportation or shipment. As part of the Lubricating and Servicing Unit, these items must be with the Lubricating and Servicing Unit whenever it is issued or transferred between property accounts. Illustrations are furnished to help you identify and find the items

b. Section III. Basic Issue Items (BII). These essential items are required to place the Lubricating and Servicing Unit in operation, operate it, and do emergency repairs on it. Although shipped separately packaged, BII must be with the Lubricating and Servicing Unit during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the Lubricating and Servicing Unit by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

C-3. EXPLANATION OF COLUMNS. The following provides an explanation of columns found in the tabular listing:

a. Column (1) Illustration Number (Illus. Number). This column indicates the number of the illustration in which the item is shown.

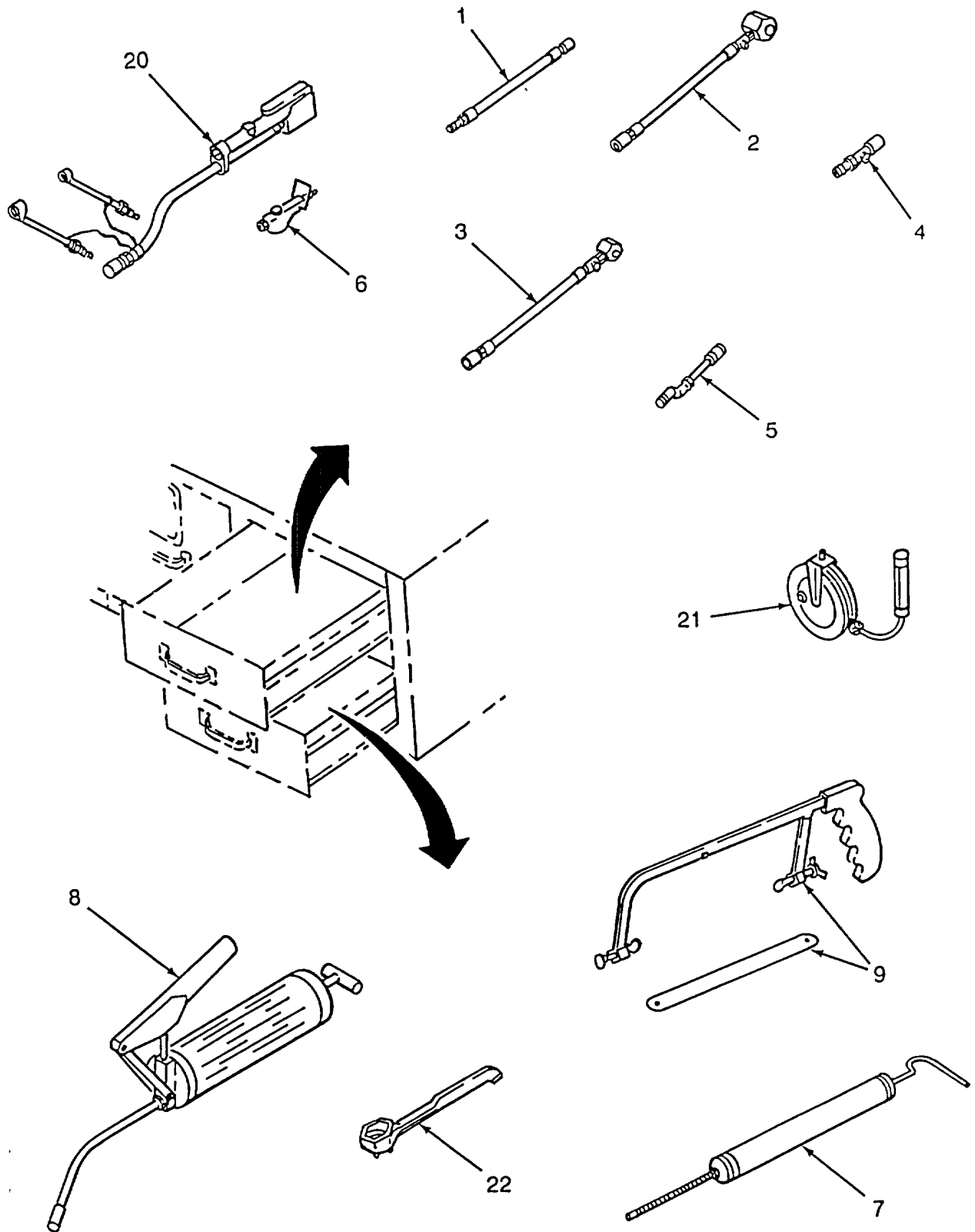
b. Column (2) National Stock Number (NSN) Index. Indicates the National stock number of the item to be used for requisitioning purposes.

c. Column (3) Description. Indicates the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the CAGEC (Commercial and Governmental Entity Code) (in parentheses), and the part number.

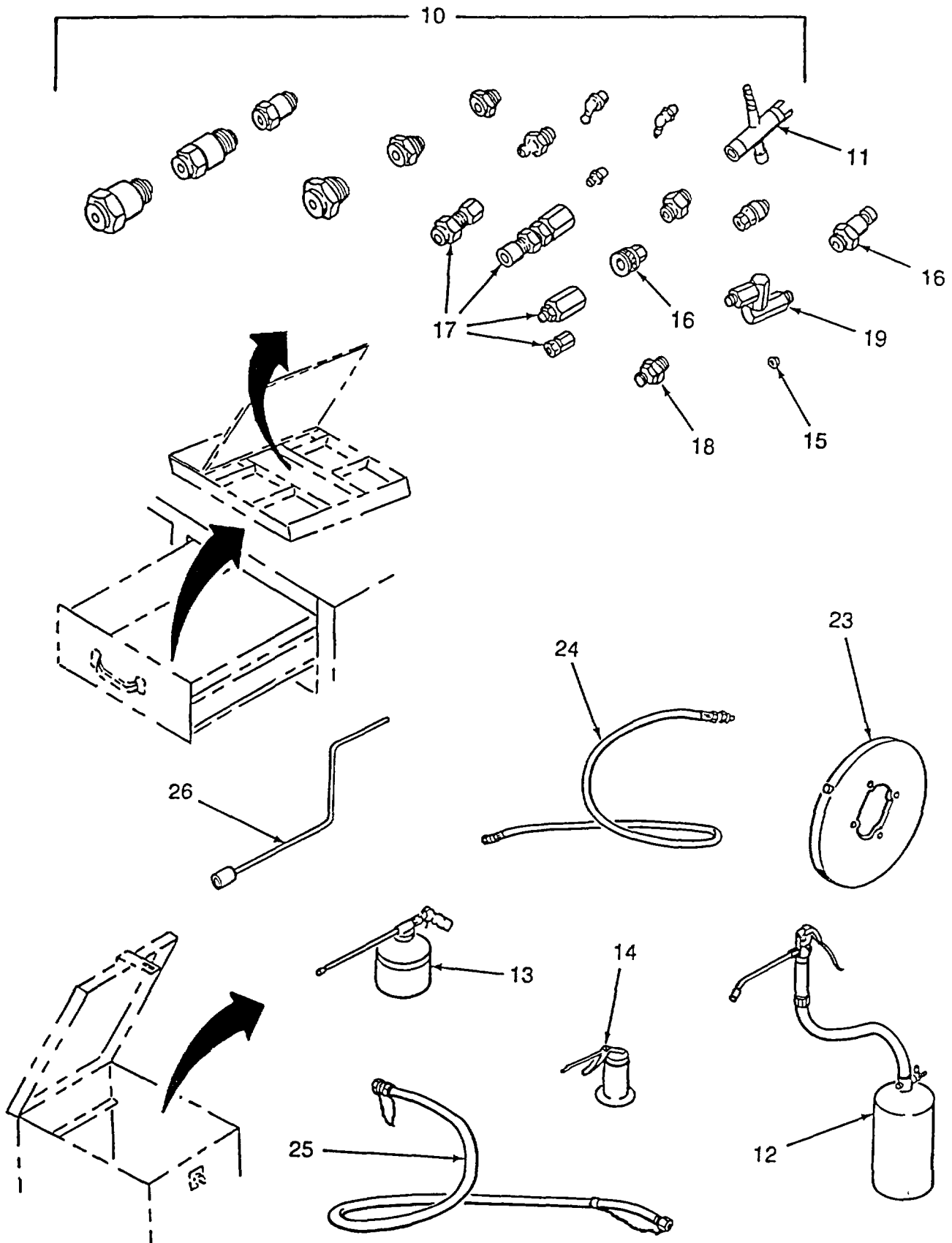
d. Column (4) Unit of Issue (U/I). Indicates how the item is issued for the National Stock Number shown in Column two.

e. Column (5) Quantity Required (Qty Rqr). Indicates the quantity required.

Section II. COMPONENTS OF END ITEM



Section II. COMPONENTS OF END ITEM



Section II. COMPONENTS OF END ITEM

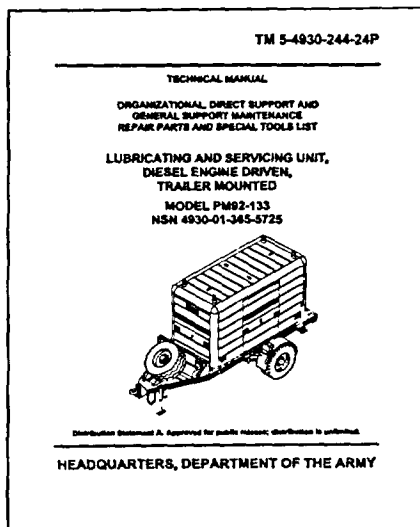
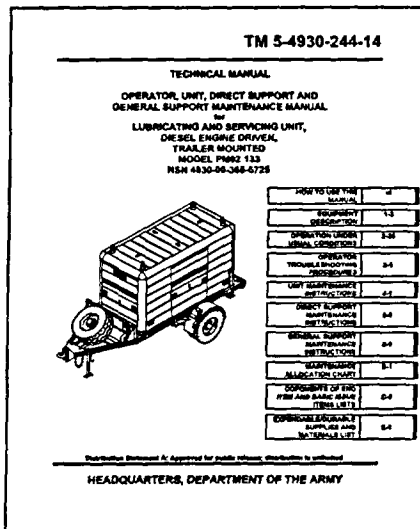
(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable on Code U/M	(5) Qty. Rqrd.
1		ADAPTER, FLEXIBLE EXTENSION. (locking sleeve on one end, hydraulic coupling on other end) (OBGA6) 1791185	EA	1
2		ADAPTER, FLEXIBLE EXTENSION. (with large button-head coupling and 500 psig pressure relief valve) (OBGA6) 1790002	EA	1
3		ADAPTER, FLEXIBLE EXTENSION. (with standard button-head coupling) (OBGA6) 1790003	EA	1
4		ADAPTER, RIGID. (with relief and 500 psig pressure relief valve) (OBGA6) 1790004	EA	1
5		ADAPTER, RIGID. (swivel coupling) (95879) 6278	EA	1
6		AIR BLOW GUN. (OBGA6) 1790005	EA	1
7		FLUID SUCTION GUN. (plunger-operated) (72031) 350	EA	1
8		GREASE GUN, HAND. (lever-operated) (03990) 610101-LVR	EA	1
9		HACKSAW FRAME AND BLADE. (72896) 100 (61922) 024HE	EA	1
10		FITTINGS, LUBRICATION. (various sizes& configurations) (57733) 1823-1 (4E051) 1822-1A (95879) A-1186 (95879) A-1188 (OBGA6) 1790010 (95879) A-1184 (96906) MS15003-1 (96906) MS15003-4 (96906) MS15001-1 (96906) MS15001-3	EA	50
11		LUBRICATION FITTING TOOLS, 3-IN-1. consisting of tap, wrench, and easy-out) (57733) B-315791 (4E051) B-315790	EA	2
12		PORTABLE LUBRICATOR WITH HARNESS. (03990) 640105	EA	1
13		OIL SPRAY GUN, AIR OPERATED. (03990) 640035-1	EA	1
14		HAND OILER, PUMP-FEED. (03990) 50-512	EA	1

Section II. COMPONENTS OF END ITEM

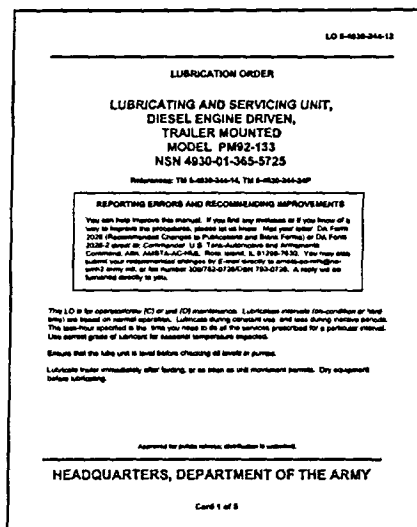
(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable on Code U/M	(5) Qty. Rqrd.
15		PLUGS. (for hydraulic lines) (4E051) 17831	EA	3
16		COUPLING HALVES, QUICK-DISCONNECT. (81349) M4109-02-08-00-B (81349) M4109-09-08-00-C	EA	2
17		COUPLINGS, REUSABLE (for repair air and lubricant hoses) (7S568) 42506N-106 (0BGA6) 1790023 (6X414) 6X423 (0BGA6) 1790024	EA	4
18		SWIVEL, STRAIGHT. (95879) 393521	EA	1
19		Z-SWIVEL. (81349) M4387-45	EA	1
20		TIRE INFLATOR AND PRESSURE GAUGE (0BGA6) 1790026	EA	1
21		TROUBLE LIGHT (94344) 24 VOLT STUBBY	EA	1
22		BUNG WRENCH (4E051) 6512A12	EA	1
23		COVER, DRUM (95879) 1790044	EA	1
24		HOSE ASSEMBLY, AIR (0BGA6) 1797995	EA	1
25		HOSE ASSEMBLY, TRANSFER (0BGA6) 1790051	EA	1
26		HANDLE (0BGA6) 1790043	EA	1

Section III. BASIC ISSUE ITEMS

2



1



3

(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable on Code U/M	(5) Qty. Rqrd.
1	L05-4930-244-12	Technical Manual, Lubrication Order, Lubricating and Servicing Unit. LO5-4930-244-12	EA	1
2	TM5-4930-244-14	Technical Manual, Operator, Unit, Direct Support and General Support Maintenance Manual. TM 5-4930-244-14.	EA	1
3	TM5-4930-244-24P	Technical Manual, Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List. TM 5-4930-244-24P	EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE. This appendix lists additional items you are authorized for the support of the Lubricating and Servicing Unit.

D-2. GENERAL. This list identifies items that do not have to accompany the Lubricating and Servicing Unit and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TEA, OR JTA.

D-3. EXPLANATION OF LISTINGS. National stock numbers (NSN), descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name. If the item you require differs between serial numbers of the same model, effective serial numbers are shown in the last line of the description. If item required differs for different models of this equipment, the model is shown under the "Usable on" heading in the description column.

Section II. ADDITIONAL AUTHORIZED ITEMS LIST

(1) National Stock Number	(2) Description CAGEC and Part Number	(3) Usable on Code	(4) Qty. U/M	(4) Rec.
<p>THERE ARE NO ADDITIONAL AUTHORIZED ITEMS</p>				

APPENDIX E

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE. This appendix lists expendable/durable supplies and materials you will need to operate and maintain the Lubricating and Servicing Unit. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable Items (except medical, class V, repair parts, and heraldic items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

E-2. EXPLANATION OF COLUMNS.

a. Column 1 Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Dry cleaning solvent item 5, appendix E)."

b. Column 2 Level. This column identifies the lowest level of maintenance that requires the listed item.

- C - Operator/Crew
- O - Unit Maintenance
- F - Direct Support Maintenance
- H - General Support Maintenance

c. Column 3 National Stock Number. This is the National stock number assigned to the item which you can use to requisition it.

d. Column 4 Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number. This provides the other information you need to identify the item.

e. Column 5 Unit of Measure (U/M). This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Item Number	National Level	Stock Number	Item Name, Description, CAGEC, Part Number	U/M
1	O	7920-00-205-1711	Rags, Wiping (58536) MIL-D-16791	lb.
2	O	9150-01-102-3650	Brake Fluid, Silicone (BFS) MIL-B-46167, 1 qt. can	qt.
3	O	6850-00-281-3061	Dry Cleaning Solvent, 4 oz. can (81348) P-D-680	oz.
4	F	8030-00-181-8372	Primer, Sealing Compound, 6 oz. can (05972) MIL-S-22473, Grade T	oz.
5	F	8140-00-339-0310	Sealing Compound, 50 cc bottle (05972) MIL-S-22473	cc

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Item Number	National Level	Stock Number	Item Name, Description, CAGEC, Part Number	U/M
6	O		Sealant, Silicon	ea.
7	O		Tape, Teflon	roll
8	O	8010-00-935-7080	Primer Coating, Epoxy-Polyamide MIL-P-23377	gal.
9	O		Plastic Ties	doz.
10	O		Battery Electrolyte	ea.
11	O		Distilled Water	oz.
12	O		Rubber Caulking	ea.
13	F		Loctite "Type 242"	ea.
14	O		15 Gal. Bucket	ea.
15	O		GAA Grease	lb.
16	O		Oil, SAE No. 10 (81348)	qt.
17	O	9905-00-537-8954	Tag, marker MIL-T-12755 (81349) Box of 50	box
18	O		Tape, Electrical Roll	ea.
19	F	5350-00-193-7227	Lapping and Grinding, grit 120	lb.
20	O	9150-01-320-3706	Lubricating Oil	qt.
21	O	3439-00-896-8746	Solder, Lead-tin Alloy, 1-pound can	oz.
22	O	7920-00-314-2417	Brush, Acid Swabbing, Box of 144	gross
23	O	7510-00-189-7881	Pencil, Writing, Package of 12	doz.
24	O	7530-00-285-5836	Paper, Writing, 3x5, Package of 50	sheet
25	O		Wood Block, 4x4x12-inch, Make From Lumber	
26	O	7920-00-514-2417	Brush, Acid Swabbing, Box of 144	gross
27	F		Kerosene	gal.

APPENDIX F

ILLUSTRATED LIST OF MANUFACTURED ITEMS

F-1. INTRODUCTION.

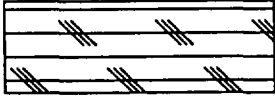
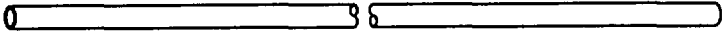
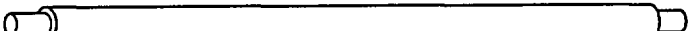
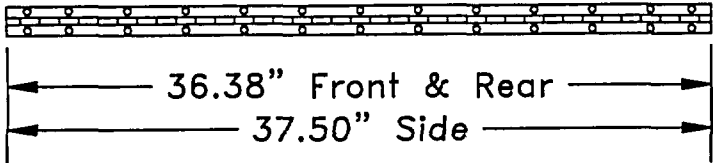
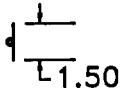
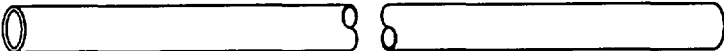
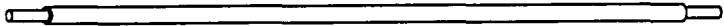

a. This appendix includes complete instructions for making items authorized to be manufactured or fabricated at unit maintenance level.

b. A part number index in alpha-numeric order is provided for cross-referencing the part number of the item to be manufactured to the figure which covers fabrication criteria. When applicable, bulk materials needed for manufacture of an item are also listed by part number and/or specification number.

F-2. ILLUSTRATED PART NUMBER INDEX.

PART NUMBER INDEX			
Part Number to Be Manufactured	Specification	Part Description	Figure No.
NONE	QQ-A-250/11,6061T4	Aluminum Alloy, Sheet (for patches to the enclosure)	1
1791081-1 thru 1791081-12	MIL-H-13444, Type 1	Hoses, Air and Drain, 1/4" ID x 1/2"	2
1791420-1 thru 1791420-4	MS13846/1-12	Cable, Battery (various lengths)	3
1792085-1 & 1792085-2	MS35827-1A	Hinge, Continuous, Enclosure	4
1797075-1 & 1797075-2	SAE J517, Type 100R2 AT, 3/8 ID	Hoses, Reel	5
1797075-3, -4, & -5		Hoses, Lube Supply	
1797961- (various dash nos.)	M13486/1-5	Wire, Electrical (various lengths)	
1797962-	M13486/1-9	Wire, Electrical (various lengths)	6
1797963-	M13486/1-3	Wire, Electrical (various lengths)	
1798319-	SAE J1128-GXL	Wire, Electrical (various lengths)	
1798322	Safety Chain, Trailer Grade 43, High Test Chain, 3/8", Working Load 54,000 lb.	Safety Chain	7

ILLUSTRATED LIST OF MANUFACTURED ITEMS (Cont.).

- | | | |
|---|---|---|
| 1 |  | Cut to size/shape. |
| 2 |  | Cut to length. |
| 3 |  | Cut to length. |
| 4 |  <p style="text-align: center;">36.38" Front & Rear
37.50" Side</p> |  <p style="text-align: center;">1.50</p> |
| 5 |  | Cut to length. |
| 6 |  | Cut to length. |
| 7 |  | Cut to length. |

APPENDIX G

TORQUE LIMITS

G-1. GENERAL. This appendix provides general torque limits for fasteners. Special torque values are indicated in the maintenance procedures for applicable components. The general torque values given in this appendix shall be used when specific torque values are not indicated in the maintenance procedures.

G-2. TORQUE LIMITS. Torque limits are listed in Table G-1 for fasteners. Dry fasteners are defined as fasteners on which no lubricants are applied to the threads. Wet fasteners are defined as fasteners on which graphite or polydisulphide greases or other extreme pressure lubricants are applied to the threads. Table G-2 lists the minimum breakaway torque values for locknuts.

Table G-1. General Torque Requirements for Dry Fasteners

Bolt/Screw Size	Torque Requirement in lb-ft (N-m)			
	SAE Grade	SAE Grade	SAE Grade	SAE Grade
	1 or 2	5	6 or 7	8
1/4-20 UNC	5 (7)	8 (11)	10 (14)	12 (16)
1/4-28 UNF	6 (8)	10 (14)	12 (16)	14 (19)
5/16-18 UNC	11 (15)	17 (23)	19 (26)	24 (33)
5/16-24 UNF	13 (18)	19 (26)	23 (31)	27 (37)
3/8-16 UNC	18 (24)	31 (42)	34 (46)	44 (60)
3/8-24 UNF	20 (27)	35 (47)	42 (57)	49 (66)
7/16-14 UNC	28 (38)	49 (66)	55 (75)	70 (95)
7/16-20 UNF	30 (41)	55 (75)	67 (91)	78 (106)
1/2-13 UNC	39 (53)	75 (102)	85 (115)	105 (142)
1/2-20 UNF	41 (56)	85 (115)	102 (138)	120 (163)
9/16-12 UNC	51 (69)	110 (149)	120 (163)	155 (210)
9/16-18 UNF	55 (75)	120 (163)	145 (197)	170 (231)
5/8-11 UNC	63 (85)	150 (203)	167 (226)	210 (285)
5/8-18 UNF	95 (129)	170 (231)	205 (278)	240 (325)
3/4-10 UNC	105 (142)	270 (366)	280 (380)	375 (509)
3/4-16 UNF	115 (156)	295 (400)	357 (484)	420 (570)
7/8-9 UNC	160 (217)	395 (536)	440 (597)	605 (820)
7/8-14 UNF	175 (237)	435 (590)	555 (753)	675 (915)
1-8 UNC	235 (319)	590 (800)	660 (895)	910 (1234)
1-14 UNF	250 (339)	660 (895)	825 (1119)	990 (1342)

Table G-1. General Torque Requirements for Dry Fasteners * - Continued

Bolt/Screw Size	Torque Requirement in lb-ft (N-m)			
	SAE Grade 1 or 2	SAE Grade 5	SAE Grade 6 or 7	SAE Grade 8
1-1/8-7 UNC 1-1/8-12 UNF	350 (475) 400 (542)	800 (1085) 880 (1193)	1000 (1356) 1050 (1424)	1280 (1736) 1440 (1953)
1-1/4-7 UNC 1-1/4-12 UNF	500 (678) 550 (746)	1080 (1464) 1125 (1526)	1325 (1797) 1325 (1797)	1820 (2468) 1820 (2712)
1-3/8-6 UNC 1-3/8-12 UNF	660 (895) 740 (1003)	1460 (1980) 1680 (2278)	1800 (2441) 1960 (2658)	2380 (3227) 2720 (3688)
1-1/2-6 UNC 1-1/2-12 UNF	870 (1180) 980 (1329)	1940 (2631) 2200 (2983)	2913 (3950) 3000 (4068)	3160 (4285) 3560 (4827)

* Torque given is for clean, dry threads. Reduce to 10% when engine oil is used as lubricant.

Table G-2. Locknut Breakaway Torque Values

NOTE

To determine breakaway torque, thread locknut onto screw or bolt until at least two threads stick out. Locknut shall not make contact with a mating part. Stop the locknut. Torque necessary to begin turning locknut again is the breakaway torque. Do not reuse locknuts that do not meet minimum breakaway torque.

Thread Size	Minimum Breakaway Torque	
	lb-in.	(N-m)
10-32	2.0	(0.23)
1/4-28	3.5	(0.40)
5/16-24	6.5	(0.73)
3/8-24	9.5	(1.07)
7/16-20	14.	(1.58)
1/2-20	18.0	(2.03)
9/16-18	24.0	(2.71)
5/8-18	32.0	(3.62)
3/4-16	50.0	(5.65)
7/8-14	70.0	(7.91)
1-12	90.0	(10.17)
1-1/8-12	117.0	(13.22)

APPENDIX H

MANDATORY REPLACEMENT PARTS

Section I. INTRODUCTION

H-1. SCOPE. This appendix lists mandatory replacement parts you will need to have when performing maintenance on the Pumping Assembly. Any time a maintenance procedure is performed that required you to remove any of the items shown on this list, you are required to replace that item with a new one. You will know that your procedure requires one of these replacement parts when the statement "(Appendix H, Item X)" appears in the "Material Required" area of the Initial Setup portion of the maintenance procedures in Chapter 4.

H-2. EXPLANATION OF COLUMNS. The table shown in Section II identifies the parts which must be replaced during maintenance of the Pumping Assembly. An explanation of the columns in each in this table is as follows.

a. Column (1) Item number. This number is assigned to the entry in this listing and is referenced in the narrative instructions to identify the material (e.g., "Rivet (Appendix I, Item 1)").

b. Column (2) CAGEC. The Contractor and Government Entity Code (CAGEC) is a 5-digit numeric code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

c. Column (3) Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

d. Column (4) Nomenclature. This column identifies the common name for the part in accordance with the name given to the part on the applicable engineering drawing or specification.

Section II. MANDATORY REPLACEMENT PARTS LIST

(1) ITEM NUMBER	(2) CAGEC	(3) PART NUMBER	(4) NOMENCLATURE
1	81349	M24243/1-B604	RIVET, BLIND, 3/16" X 1/4" AL/AL
2	81349	M24243/1-B606	RIVET, BLIND, .784-.815, .501 -.625 GRIP
3	96906	MS24665-515	PIN, COTTER, 3/16" X 1 3/4"
4	0BGA6	1799050	GASKET
5	81349	M24243/1-B401	RIVET, BLIND, 1/8" DIA., 0.031-0.062 GRIP
6	96906		HEAT SHRINK TUBE
7	96906	MS35338-43	LOCK WASHER
8	0BGA6		FILTERS
9	96906	MS51988-5	NUT, SELF-LOCKING
10	96906	MS51988-3	NUT, SELF-LOCKING
11	96906	MS51988-11	NUT, SELF-LOCKING
12	4E051	318471	BLOCK 'V' PACKING
13	4E051	317526	O-RING
14	4E051	171000-29	O-RING
15	4E051	336503	PACKING SET
16	97947	266086	GASKET, MANIFOLD
17	97947	350031	GASKET
18	97947	360737	GASKET
19	97947	318514	SEAL
20	97947	358693	OIL SEAL - INLET VALVE
21	97947	355176	O-RING
22	97947	367050	SEALING RING
23	97947	362013	SHIM - 0.38 MM

Section II. MANDATORY REPLACEMENT PARTS LIST

(1) ITEM NUMBER	(2) CAGEC	(3) PART NUMBER	(4) NOMENCLATURE
24	97947	360718	SHIM - 0.25 MM
25	97947	360712	GASKET
26	97947	171009-47	O-RING
27	97947	171009-29	O-RING
28	97947	171000-12	O-RING
29	97947	171003-20	O-RING
30	97947	384232	LOCKWASHER
31	97947	323468	GASKET
32	97947	324290	BLOCK 'V' PACKING
33	97947	171003-20	O-RING
34	97947	171009-33	O-RING
35	97947	314632	PACKING
36	97947	141009-4	O-RING
37	97947	323462	PACKING
38	97947	172190-6	SEAL
39	97947	172190-5	SEAL
40	97947	171009-13	O-RING
41	97947	323693	GASKET
42	97947	131402	GASKET
43	97947	172190-8	SEAL
44	97947	50666	GASKET
45	97947	131402	GASKET
46	97947	172190-7	SEAL

Section II. MANDATORY REPLACEMENT PARTS LIST

(1) ITEM NUMBER	(2) CAGEC	(3) PART NUMBER	(4) NOMENCLATURE
47	97947	MS51922-9	LOCKNUT, 5/16" - 18
48	97947	MS51922-17	NUT, SELF-LOCKING
49	97947	360983	O-RING
50	97947	MS51988-7	NUT, SELF-LOCKING
51	97947	MS90725-17	NUT, SELF-LOCKING
52	35301	220-296-25	GASKET, UPPER KIT
53	35301	220-296-25	GASKET, LOWER KIT
54	35301	220-296-22	GASKET
55	97947	746006	NUT, LOCKING
56	97947	314711	WASHER, THRUST
57	97947	350481	WASHER, TAB
58	97947	792018	WOODRUFF, KEY
59	97947	792011	WOODRUFF, KEY
60	97947	367870	GASKET
61	97947	844132	PACKING, PREFORMED
62	97947	359421	SEAL, OIL
63	97947	747105	NUT, SELF-LOCKING
64	97947	792002	WOODRUFF, KEY
65	57386	198250	GASKET (PART OF KIT P/N 350234)
66	97947	747103	NUT, SELF-LOCKING
67	97947	363686	SEAL, OIL
68	97947	792003	WOODRUFF, KEY
69	97947	361296	WASHER, SHIELD (PART OF KIT P/N 362164)

Section II. MANDATORY REPLACEMENT PARTS LIST

(1) ITEM NUMBER	(2) CAGEC	(3) PART NUMBER	(4) NOMENCLATURE
70	97947	365229	GASKET
71	97947	786029	LOCKWASHER
72	97947	843103	WASHER, COPPER
73	97947	350031	GASKET
74	19207	774160	PIN, SPRING
5	97947	774122	PIN, SPRING
6	96906	MS15795-847	WASHER
7	96906	MS17830-3C	LOCKNUT
8	96906	MS75004-1	TERMINAL, BATTERY, POSITIVE
9	96906	MS75004-2	TERMINAL, BATTERY, NEGATIVE

(Blank)

APPENDIX I

GLOSSARY

A. LIST OF ABBREVIATIONS/ACRONYMS

PSI	Pressure per square inch.
RPM	Revolutions per minute.
GAA	General Artillery Automotive

B. GLOSSARY

Amperage	The strength of a current of electricity expressed in amperes.
Basic Issue Items List	A list of essential items required to place in operation, operate, and perform emergency repairs.
Chock	A wedge or block for blocking the movement of a wheel.
Components of End Item	Items or components which are part of the end item but are removed and packaged separately for shipment.
Compressed Air	Air under pressure greater than that of the atmosphere.
Continuity	Uninterrupted connection, succession, or union.
Corrosion	Rusting or deterioration of materials, such as metal, rubber, or plastics.
Coupling	A device that serves to connect the ends of adjacent parts or objects.
Dispensing	Extruding, spraying, or feeding out.
Electrolyte	(Sulfuric acid and water solution) Allows batteries to charge and produce current.
Glow Plug	A device used to prime a diesel engine for starting.
Sub-zero	Temperatures at or below 0° F.

ALPHABETICAL INDEX

	Paragraph	Page
A		
Additional Authorization List	D-1	D-1
A-Frame	5-3	5-10
Air Compressor Air Filter	3-8	3-13
Air Compressor Assembly	4-29	4-68
Air Filter/Moisture Separator		
Removal and Installation	4-16	4-21
Service.....	3-5	3-8
Air Hose Assemblies and Gladhand Couplers	4-52	4-155
Air Pump		
Removal and Installation	4-34	4-91
Repair.....	5-8	5-22
Service.....	4-34	4-91
Air Regulators and Plumbing	4-41	4-127
Air Tank	5-9	5-29
Alcohol Injector		
Adjusting and Servicing	3-6	3-10
Replacement and/or Repair	4-17	4-23
Alternator Assembly	4-32	4-85
Assembly and Preparation for Use.....	2-7	2-26
Axle Assembly.....	5-18	5-93
B		
Ball Valve	4-37	4-97
Basic Issue Items List		C-6
Battery Box Assembly		
Removal and Installation	4-27	4-57
Repair, Direct Support	5-4	5-12
Repair, Unit	4-27	4-57
Servicing.....	3-7	3-12
Belts	4-31	4-77
Brake Lines	4-56	4-169
Brake Assembly	4-61	4-187
C		
Cabinet Assembly	4-26	4-50
Camshaft	6-5	6-25
Checking Unpacked Equipment	4-6	4-3
Cleaning	4-63	4-192
Clutch	4-40	4-125
Common Tools and Equipment	4-1	4-2
Components of End Item and Basic Issue Items List .		C-1
Components of End Item.....		C-2
Condensate Drain Assembly	4-28	4-65
Control Box Assembly (Heater)	4-45	4-141
Control Panel and Throttle	4-30	4-72
Control Valve (Air Brake)	4-50	4-154
Corrosion Prevention and Control	1-4	1-1
Crankcase.....	6-10	6-41
Cylinder, Piston and Connecting Rod Assembly.....	6-3	6-6

Alphabetical Index - Continued

	Paragraph	Page
D		
Decals and Instruction Plates	2-10	2-43
Description and Use of Operator Controls and Indicators.....	2-1	2-1
Destruction of Army Materiel To Prevent Enemy Use	1-5	1-2
Diesel Engine		
Air Cleaner	3-9	3-14
Removal and Installation, Direct Support	5-10	5-32
Removal and Installation, Unit	4-39	4-100
Repair, Direct Support	5-10	5-32
Repair, General Support	<i>Chapter 6</i>	
Repair, Unit.....	4-39	4-100
Direct Support Maintenance Instructions	<i>Chapter 5</i>	
Doors, Enclosure	4-14	4-14
E		
Emergency Procedures	2-13	2-61
Emergency Relay Valve	4-51	4-157
Enclosure Assembly.....	4-13	4-11
Engine Air Cleaner	3-9	3-14
Engine Running-In.....	6-11	6-44
Equipment Characteristics, Capabilities, and Features	1-10	1-3
Equipment Data	1-12	1-5
Exhaust Line/Hoses	4-49	4-145
Expendable/Durable Supplies and Materials List		E-1
F		
Fan, Flywheel and Crankshaft	6-4	6-15
Front, Rear Jack and Safety Chain Assembly	4-59	4-177
Fuel Cap and Neck Assembly.....	4-20	4-32
Fuel Pump and Fuel Lines (Heater)	4-44	4-138
Fuel Tank Assembly (without Fuel Cap and Neck Assembly)	4-21	4-34
Fuel Tank	5-4	5-21
G		
Gear-Lube and Oil Dispensers		
Removal and Installation	4-23	4-41
Repair, Direct Support	5-5	5-15
General Information		1-1
General Support Maintenance Procedures	<i>Chapter 6</i>	
Glossary.....		I-1
Governor Linkage	6-7	6-33
Governor Linkage Adjustment	6-8	6-37
Grease Control Valves	4-24	4-44
H		
Heater	4-45	4-141
Heater Mounting Assembly	4-55	4-151
Heater Wiring Harness		
Removal and Installation	4-46	4-143
Repair	5-14	5-85
High Pressure Pump	5-12	5-72

Alphabetical Index - Continued

	Paragraph	Page
Hub and Drum	4-60	4-181
I		
Illustrated List of Manufactured Items		F-1
Initial Adjustments and Checks	2-8	2-28
Intervehicular Trailer Harness		
Removal and Installation	4-57	4-173
Testing	4-57	4-173
Repair of 12 Volt Harness	5-16	5-88
L		
Leakage Definitions for Operator PMCS	2-5	2-11
List of Abbreviations	1-9	1-2
List of Abbreviations/Acronyms		1-1
Location and Description of Major Components	1-11	1-3
Low and High Pressure Pumps and Mufflers	4-42	4-133
Low Pressure Pump	5-11	5-65
Lube Supply Hoses	4-18	4-26
Lube Tank		
Removal and Installation	5-13	5-80
Repair	5-13	5-80
Lubrication of the Unit	4-64	4-192
Lubrication Instructions		3-1
M		
Maintenance Allocation Chart		B-1
Maintenance Forms, Records and Procedures	1-2	1-1
Maintenance Instructions,		
Operator		<i>Chapter 3</i>
Unit		<i>Chapter 4</i>
Direct Support		<i>Chapter 5</i>
General Support		<i>Chapter 6</i>
Malfunction Index		
For Operator Troubleshooting Procedures	3-2	3-2
For Unit Troubleshooting Procedures	4-8	4-4
Mandatory Replacement Parts		H-1
Muffler, Pump	4-42	4-133
N		
Nomenclature Cross-Reference List	1-8	1-2
Nuclear, Biological, and Chemical Decontamination Procedures	2-14	2-63
O		
Oil Pump (Diesel Engine)	6-9	6-39
Operation In Unusual Environment/Weather	2-12	2-56
Operating Procedures	2-9	2-28
Operator Controls and Indicators	2-2	2-1
Operator Preventive Maintenance Checks and Services(PMCS)	2-6	2-12
General Information	2-3	2-10
Operator Maintenance Procedures		3-8

Alphabetical Index - Continued

	Paragraph	Page
Operator Troubleshooting Procedures	3-1	3-1
P		
Preventive Maintenance Checks and Services (PMCS)		
Operator	2-4	2-10
Unit	4-10	4-8
Panels, Enclosure	4-15	4-18
Plumbing, Air Pump Assembly	4-33	4-88
Power Cluster and Master Cylinder	4-55	4-166
Preparation for Storage Or Shipment		4-192
Preservation and Packing/Preparation for Shipment	4-65	4-192
Pressure Relief Valve (Air Tank Assembly)	4-36	4-96
Pump		
Removal and Installation	4-42	4-133
Repair, High Pressure	5-12	5-72
Repair, Low Pressure	5-11	5-65
Service.....	4-42	4-133
Pump, Air	<i>See Air Pump</i>	
Pump, O1	<i>See Oil Pump</i>	
Pump, Transfer	<i>See Transfer Pump</i>	
Q		
Quick Release and Limiting Valve	4-52	4-159
R		
Reels and Hoses	4-25	4-46
Reel Cabinet Frame	5-7	5-20
References.....		A-1
Repair Parts	4-3	4-2
Repair Parts and Special Tools List	4-1	4-2
Reporting of Equipment Improvement Recommendations (EIR's)	1-7	1-2
S		
Safety, Care, and Handling	1-3	1-1
Scope	1-1	1-1
Shelter Requirements	4-5	4-3
Shutdown Procedures	2-11	2-53
Shut-off Valve	4-35	4-95
Siting	4-4	4-3
Skid Assembly	5-1	5-2
Skid Weldment	5-15	5-87
Special Instructions for Administrative Storage	4-66	4-192
Special Tools; Test, Measurement and Diagnostic Equipment and Support Equipment (TMDE)	4-2	4-2
Synchronizing Valve	4-53	4-162
T		
Theory of Operation	1-13	1-7
Tool Box Assembly	4-22	4-39
Trailer Frame	5-19	5-96
Torque Table		G-1

Alphabetical Index - Continued

	Paragraph	Page
Trailer Wiring Harness	5-17	5-90
Transfer Pump		
Adjustment	4-20	4-30
Repair	5-2	5-4
Troubleshooting, Operator		
Introduction	3-1	3-1
Malfunction Index	3-2	3-2
Troubleshooting Table	3-3	3-2
Troubleshooting, Unit		
Introduction	4-7	4-4
Malfunction Index	4-8	4-4
Troubleshooting Table	4-9	4-5

U

Unit Maintenance Procedures		
General Instructions	4-12	4-9
Unit Preventive Maintenance Checks and Services (PMCS)	4-10	4-8
Unit PMCS Table	4-11	4-8
Unit Troubleshooting Procedures	4-7	4-4
Unloader Valve	4-38	4-98

V

Voltage Reducer Box	4-58	4-175
---------------------------	------	-------

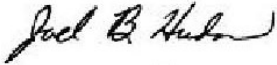
W

Wheel and Tire Assembly	3-10	3-15
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By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:



JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
05271

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COA, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

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TM 5-4930-244-14

PUBLICATION DATE

PUBLICATION TITLE

Manual for Lub and Servicing Unit,
Diesel, Engine Driven, Model PM92-133

BE EXACT PIN-POINT WHERE IT IS

PAGE NO. PARA-GRAPH FIGURE NO. TABLE NO.

6

2-1
a

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders

B1

4-3

figure 4-3 is a bolt. In key 4-3, item 16 is called rim. Please correct or the other.

125

line 20

I ordered a gasket, item 19 on figure B-16 by NSN 2 910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

JOHN DOE, PFC (268) 317-7111

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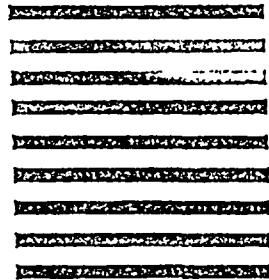
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These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whoever" <whoever@avma27.army.mil>
To: amsta-ac-@ria-emh2.army.mil

Subject: DA Form 2028

1. **From:** Joe Smith
2. *Unit:* home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT-93
8. **Pub no:** 55-2840-229-23
9. **Pub Title:** TM
10. **Publication Date:** 04-JUL-85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. **Submitter FName:** Joe
14. *Submitter MName:* T
15. **Submitter LName:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. **Text:**

This is the text for the problem below line 27.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.461	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit	5/9 (after	Celsius	°C
	temperature	subtracting 32)	temperature	

