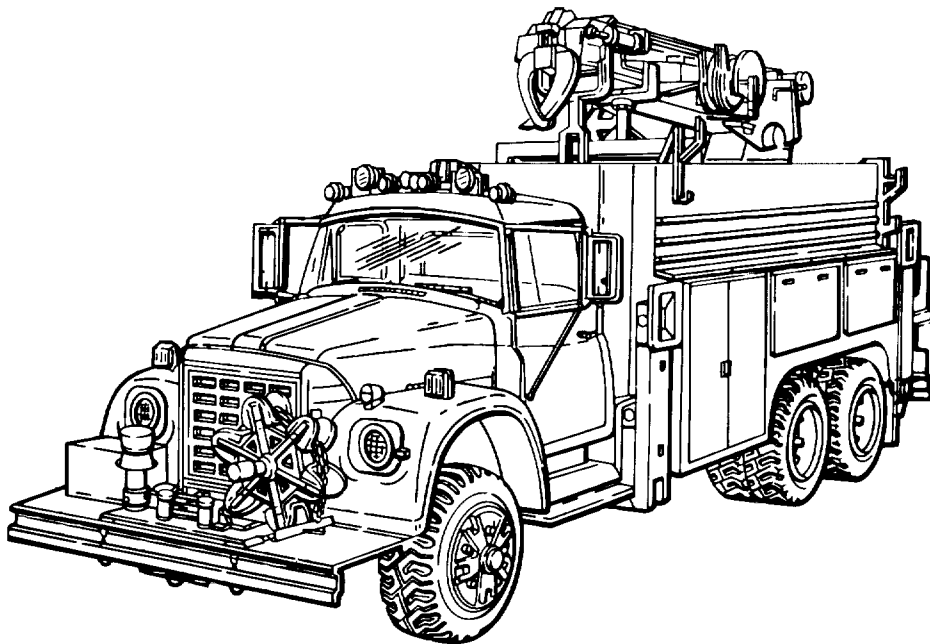


DEPARTMENT OF THE ARMY
TECHNICAL MANUAL

VOLUME 1 OF 2

DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE



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TRUCK, TELEPHONE MAINTENANCE
UTILITY, C/S, 36,000 GVW, 6 X 4, W/WN,
W/E, M876 (NSN 2320-00-000-0114)

Approval for public release, distribution is unlimited.

FEBRUARY 1987

HEADQUARTERS, DEPARTMENT OF THE ARMY

WARNING

When doing test with vehicle running and in gear, chock tires and stand aside. Vehicle could jump forward causing personnel injury.

WARNING

When doing tests with engine running, stand aside to avoid personnel injury from moving parts.

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

WARNING

Be careful when separating transmission from engine. Torque converter can slide out of transmission and fall, causing injury to you and damage to equipment.

WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

WARNING

When pickling acid is used on metal, phosphine gas forms quickly. Phosphine gas is colorless, poisonous, a fire hazard, and can explode. Do not smoke or use pickling acid near open flame. Provide adequate ventilation, and do not breathe vapors. Pickling acid can cause serious burns. Wear a rubber apron, gloves, and safety goggles or lenses. If splashed in eyes or on skin, flush with cool clean water, and refer to First Aid Manual FM 21-11.

WARNING

Avoid contact with live steam. Live steam can burn skin, cause blindness, and cause other serious injury. Safety goggles or lenses must be worn when using live steam. Eye injury can result if eye protection is not worn.

WARNING

Carbon cleaning compound is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin it can cause very serious burns. Be sure to wear safety goggles or lenses, rubber apron and rubber gloves. If accidentally splashed in eyes or on skin, flush with clean, cool water and refer to First Aid Manual, FM 21-11.

WARNING

Adjustments may be made with engine installed in the vehicle. Be sure that ignition key is removed from ignition switch. Be sure that fuel shutoff valve is held in the OFF position. When manually rotated, the diesel engine could start accidentally and cause serious injury to personnel.

WARNING

Diesel fumes can explode. If welding of fuel tank is necessary, always work in well ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.

WARNING

Keep away from injector tip when testing. Fuel spraying from nozzle tip is under high pressure and can penetrate skin, causing infection.

WARNING

Governor springs are under pressure. Release slowly. Parts can fly out striking you and others causing injury.

WARNING

Ether fumes are flammable, under pressure, and can explode. To avoid serious injury or death, do not smoke, allow open flame nearby, or hit the ether cartridge with tools.

WARNING

Make battery connections first. Disconnect battery connection last. Sparking battery terminal connections may cause battery to explode causing serious injury.

WARNING

Make sure ignition key is in the OFF position, and engine stop control is in the STOP position, when the crankshaft is rotated by hand. If the engine starts, serious injury or death could result.

WARNING

The control valve adjusting rings, plugs, and plates are spring loaded, and as they are removed, springs can fly out with great force and could cause serious injury to personnel. During removal, use care to hold these items while spring pressure is released.

WARNING

The regulator valve spring is under approximately 65-lb pressure. Be careful when removing snaprings. Parts can fly out with great force, causing injury to personnel.

WARNING

It is very important that the vehicle is firmly supported and balanced before you begin to maintain the front axle. If the truck is not properly supported with trestles, it could fall and crush you.

WARNING

In the following step, you will be securing the rear frame to an overhead hoist. You must make absolutely sure that the hoist can bear the weight of the vehicle and hold it securely when vehicle is raised. If hoist is not secured properly, the vehicle could fall causing serious Injury or death.

For first aid information, refer to FM 21-11.

TECHNICAL MANUAL }
NO. 9-2320-269-34-1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 12 Feb 1987

DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL

TRUCK, TELEPHONE MAINTENANCE,
UTILITY, C/S, 36,000 GVW, 6 X 4, WIWN,
WIE M876 (NSN 2320-00-000-0114)

Approved for public release; distribution is unlimited.

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be sent to you.

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This manual supersedes TM 9-2320-269-34, dated April 1978, including all changes.

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HOW TO USE THIS MANUAL

This manual is designed to help you maintain the Utility Telephone Maintenance Truck. The front cover table of contents is provided for quick reference to important information. There is also an index located in the final pages for use in locating specific items of information.

Measurements in this manual are given in US standard and metric units. A metric to US standard conversion chart can be found on the inside back cover.

Warning pages are located in the front of this manual. You should read the WARNINGS before operating or doing maintenance on the equipment.

Read all preliminary Information found at the beginning of each task. It has important information and safety instructions you must follow before beginning the task.

A section index appears at the beginning of each chapter listing sections that are included in that chapter. A paragraph index is located at the beginning of each section.

Troubleshooting and maintenance procedures are written in tasks, each conforming to some system or assembly. These tasks appear in the same order that the systems or assemblies appear in the RPSTL (Repair Parts and Special Tools List) for easy cross-referencing.

Tools, parts, materials, and equipment conditions are listed at the beginning of each task allowing you to gather all the things you need before starting the task.

Look under the heading Equipment Condition and see what other tasks must be performed before starting the main task.

Before beginning, familiarize yourself with both the main task under Equipment Condition and any General Maintenance Instructions referenced in the task. You should review the entire procedure before beginning maintenance.

Make sure an assistant is available if more than one person is called for in the Initial Setup.

Do the maintenance work as instructed in the task. These procedures have been carefully checked so you can use them with confidence.

Observe all CAUTIONS to prevent damage to equipment.

When you finish each task, operate that part as described in TM 9-2320-269-10 to be sure you have made an effective repair.

CHAPTER 1

INTRODUCTION

OVERVIEW

The purpose of this chapter is to give you general information and equipment specifications that you will need to refer to while performing Direct Support and General Support Maintenance for the M876 Utility Telephone Maintenance Truck.

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Section I. GENERAL INFORMATION

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SCOPE

Type of Manual: Direct Support and General Support Maintenance.

Model Number and Equipment Name: Model M876, Utility Telephone Maintenance Truck.

Purpose of Equipment: Construction and maintenance of telephone utility lines.

MAINTENANCE FORMS, RECORDS, AND REPORTS

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

EQUIPMENT IMPROVEMENT REPORT AND MAINTENANCE DIGEST (EIR MD)

The quarterly Equipment Improvement Report and Maintenance Digest, TB 43-0001-39 series, contains valuable field information on the equipment covered in this manual. The information in the TB 43-0001-39 series is compiled from some of the Equipment Improvement Reports that you prepared on the vehicle covered in this manual. Many of these articles result from comments, suggestions, and improvement recommendations that you submitted to the EIR program. The TB 43-0001-39 series contains information on equipment improvements, minor alterations, proposed Modification Work Orders (MWO's), warranties (if applicable), actions taken on some of your DA Form 2028's (Recommended Changes to Publications), and advance information on proposed changes that may affect this manual. The information will help you in doing your job better and will help in keeping you advised of the latest changes to this manual. Also refer to DA PAM 310-1, Consolidated Index of Army Publications and Blank Forms, and Appendix A, References, of this manual.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Refer to TM 750-244-6, Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use, US Army Tank-Automotive Command.

PREPARATION FOR STORAGE OR SHIPMENT

Refer to TM 740-90-1 for instructions on the Administrative Storage of Equipment.

QUALITY ASSURANCE/QUALITY CONTROL (QAIQC)

Make sure that you do all your work with quality of workmanship in mind. Use the following check list as a guide:

Always use the right tool for the job.

Make sure that calibration stickers on test equipment are current, not out of date.

Fill out all required forms and make sure all in-line inspections are properly stamped.

Have all of your work checked by your supervisor.

If you have any doubts about performing a maintenance task, notify your supervisor.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S)

If your M876 Truck 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. Put it on an SF-368 (Quality Deficiency Report). Mail it to: Commander, US Army Tank-Automotive Command, ATTN: AMSTA-QRT, Warren, MI 48397-5000. We will send you a reply.

Section II. EQUIPMENT DESCRIPTION AND DATA

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EQUIPMENT DESCRIPTION

Refer to TM 9-2320-269-10 for a description of the M876 Truck.

DIFFERENCES BETWEEN MODELS

This manual covers only the model M876 Truck.

EQUIPMENT DATA

Refer to TM 9-2320-269-10 for truck identification and data plates and end item component specifications. Additional major component specifications are listed on the following pages in tabular format. All weights and dimensions are approximate.

EQUIPMENT DATA

Vehicle	
Make	International Harvester
Model	F-1850
Air Compressor	
Type	Piston
Capacity	12 cu ft (0.34 cu m) at 1250 rpm
Lubrication	Pressure from engine
Cooling	Water
Alternator	
Model	Delcotron 1OST
Capacity	61 A
Battery	
Make	Prestolite
Type	12V
AH capacity	200 at 20-hr rate
Brakes	
Type	Air
Size:	
Front	15 x 4 in. (36.74 x 40.64 cm)
Rear	16.5 x 6 in. (41.94 x 15.24 cm)
Lining areas:	
Front	240 sq in. (1548 sq cm)
Rear	744 sq in. (4798.8 sq cm)
Lining Thickness:	
Front	7116 in. (1.11 cm)
Rear	3/4 in. (1.91 cm)
Cab	
Type	All steel with safety glass
Model	Coupe
Seating capacity	Three
Digger	
Torque output/rpm	7500 ft-lb/30 rpm (10,170 N m/30 rpm)
Hight speed rpm	85 rpm
Dimensions	
Frame length (back of cab)	198 in. (502.92 cm)
Rear axle to rear of body	78 in. (198.12 cm)

EQUIPMENT DATA - CONTINUED**Electrical System**

Volts
Ground

12
Negative

Engine

Model
Type

D-190
Four stroke, V-type naturally
aspirated diesel

Number of cylinders

Eight

Piston displacement

548.7 cu in. (8991.55 cu cm)

Bore

4.5 in. (11.43 cm)

Stroke

4.31 in. (10.94 cm)

Maximum governed speed
at full load

Maximum gross horsepower

3000 rpm

Gross horsepower at engine
governed speed

178 bhp at 3000 rpm

Gross torque

360 ft-lb(488.16 N m) at 2000 rpm

Maximum nut torque

346 ft-lb (469.18 N m) at 2000 rpm

Frame

Side members (heat treated):

Maximum section:

Depth

9 in. (22.9 cm)

Width ickn3.5 in. (8.89 cm)

Thickness

0.25 in. (0.635 cm)

Maximum section modules -
not including reinforcements

10.29 in. (26.14 cm)

Maximum section modules -
including reinforcements

20.07 in. (50.98 cm)

Material yield strength

110,000 psi (758,450 kPa)

Front Springs

Type
Load rating

Steel leaf
5250 lb (2381 kg)

Fuel Injection Nozzles

Model
Type

C-91
Inward opening, differential
hydraulically operated

Fuel Injection Pump

Make
Model
Type

Robert Bosch
C-91
Multi-cylinder, in-line plunger,
gear driven

Fuel System

Type of fuel
Fuel rating (minimum)

No.2 diesel
45 cetane

EQUIPMENT DATA - CONTINUED

Hydraulic Pump	
Reservoir capacity	35 (132.48 l)
GPM	25 GPM high-pressure side, 8 GPM low-pressure side; tandem-type
System capacity	38 - 40 gal. (143 - 151 l)
Oil Filters	
Type	Fuel flow, spin-off
Mounting and location	Bracket mounted to engine
Rear Springs	
Type	Steel leaf
Load rating	34,000 lbs (15,422 kg)
Starting Motor	
Make	Delco
Model	Heavy Duty
Tandem Axle Assembly	
Model	RT-340
Wheel base	50 in. (127 cm)
Transmission	
Make	Allison
Model	MT-650
Type	Automatic
Number of Speeds:	
Forward	Five
Reverse	One
Reductions:	
First	8.04
Second	3.58
Third	2.09
Fourth	1.39
Fifth	1.00
Reverse	5.65
Nominal input torque capacity	480 ft-lb (650 N m)
Voltage Regulator	
Make	Delco
Type	Integral with alternator
Wheel Air Diaphragm	
Size:	
Front	16
Rear	30

REPAIR AND REPLACEMENT STANDARDS

The following tabulated data lists the manufacturer's dimensions and tolerances for new and newly installed diesel engine components and the maximum amount of wear a used component may show and still be usable. Use this information while performing engine maintenance to insure that all parts are within allowable limits.

EXPLANATION OF COLUMNS**COMPONENT POINTS OF MEASUREMENT**

This column shows the part of the component to be measured.

MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)

This column shows the minimum and maximum tolerances for new and newly installed components in inches, with millimeters shown in parentheses.

MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)

This column shows the maximum amount of wear a used component may show and still be usable in inches, with millimeters shown in parentheses.

COMPONENT POINTS OF MEASUREMENT	MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)		MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)
	MINIMUM	MAXIMUM	
CAMSHAFT			
Bearing journal diameter:			(Data Unknown)
Front	2.346 (59.58)	2.347 (59.61)	
Second	2.315 (58.80)	2.316 (58.83)	
Third	2.289 (58.14)	2.290 (58.17)	
Fourth	2.246 (57.05)	2.247 (57.07)	
Bearing clearance	0.0015 (0.038)	0.0035 (0.089)	
End play	0.0035 (0.089)	0.0115 (0.292)	
Timing gear backlash	0.0005 (0.013)	0.0045 (0.114)	
CRANKSHAFT			
Main journal diameter	3.1235 (79.34)	3.1245 (79.36)	
Main bearing clearance	0.0013 (0.033)	0.0043 (0.109)	
End play	0.004 (0.102)	0.010 (0.254)	
Rod journal diameter	2.753 (69.93)	2.754 (69.95)	

REPAIR AND REPLACEMENT STANDARDS - CONTINUED

COMPONENT POINTS OF MEASUREMENT	MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)		MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)
	MINIMUM	MAXIMUM	
CONNECTING ROD			
Bearing bore diameter	2.9455 (74.816)	2.9460 (74.828)	
Out-of-round	0.0005 (0.0127)		
Taper	0.0005 (0.0127)		
Bearing clearance	0.0019 (0.048)	0.0044 (0.112)	
End clearance	0.008 (0.20)	0.018 (0.46)	
Bearing insert spread dimensions:			
Main bearing no.s 1, 2, 4, 5			
Bearing od (installed)	3.316 (84.23)	3.317 (84.25)	
Specified spread	0.030 (0.762)		
Spread of bearing x	3.346 (84.99)		
Main bearing no. 3 (thrust)			
Bearing od (installed)	3.316 (84.23)	3.317 (84.25)	
Specified spread	0.002 (0.050)	0.016 (0.381)	
Spread of bearing x	3.318 (84.28)	3.333 (84.65)	
Connecting rod bearings			
Bearing od (installed)	2.9455 (74.816)	2.9460 (74.88)	
Specified spread	0.030 (0.762)		
Spread of bearing x	2.9755 (75.578)		
PISTONS			
Clearance In cylinder bore	0.006 (0.15)	0.007 (0.18)	

REPAIR AND REPLACEMENT STANDARDS - CONTINUED

COMPONENT POINTS OF MEASUREMENT	MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)		MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)
	MINIMUM	MAXIMUM	
PISTON PINS			
Length	3.240 (82.30)	3.250 (82.55)	
Diameter	1.4998 (38.095)	1.5000 (38.1)	
Pin fit at 70°F (21 °C):			
Clearance in rod	0.0009 (0.023)	0.0013 (0.033)	
Clearance in piston	0.0002 (0.005)	0.0006 (0.015) loose	
PISTON RINGS			
Diameter	4.5(114.3)		
Compression rings			
Size (top)	Tapered		
Size (second)	3/32 (2.83)		
Fit in groove (top)	Tapered		
Fit in groove (second)	0.0035 (0.089)	0.0055 (0.140)	
Gap	0.013 (0.33)	0.023 (0.58)	
OIL CONTROL RINGS			
Size	0.188 (4.763)		
Fit in groove	0.0015 (0.038)	0.003 (0.076)	
Gap	0.013 (0.33)	0.028 (0.71)	
INTAKE VALVES			
Valve lift	0.455 (11.56)		
Stem diameter	0.3725 (9.461)	0.3730 (9.474)	
Clearance in guide	0.0008 (0.020)	0.0023 (0.054)	
Face angle	45 degrees		
Seat angle	45 degrees		
Seat width	0.080 (2.03)	0.090 (2.29)	
Maximum seat runout	0.002 (0.05)		
Maximum face runout	0.002 (0.05)		
Seat insert and counterbore data:			
Standard			
Insert od	2.204 (55.98)	2.207 (56.06)	
Counterbore diameter	2.200 (55.88)	2.204 (55.98)	
0.002 (0.05) oversize			
Insert od	2.206 (56.03)	2.207 (56.06)	
Counterbore diameter	2.202 (55.93)	2.204 (55.98)	
0.030 (0.762) oversize			
Insert od	2.234 (56.74)	2.235 (56.77)	
Counterbore diameter	2.230 (56.64)	2.232 (56.69)	

REPAIR AND REPLACEMENT STANDARDS - CONTINUED

COMPONENT POINTS OF MEASUREMENT	MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)		MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)
	MINIMUM	MAXIMUM	
INTAKE VALVES - CONTINUED			
Valve head recession (below cylinder head face)	0.027 (0.69)	0.047 (1.19)	
Valve tip to rocker arm clearance (hot or cold)	0.014 (0.36)		
EXHAUST VALVES			
Valve lift	0.465 (11.81)		
Stem diameter	0.3720 (9.449)	0.3725 (9.461)	
Clearance in guide	0.0013 (0.033)	0.0028 (0.071)	
Face angle	45 degrees		
Seat angle	45 degrees		
Seat width	0.080 (2.03)	0.090 (2.29)	
Maximum seat runout	0.002 (0.05)		
Maximum face runout	0.002 (0.05)		
Seat insert and counterbore data:			
Standard			
Insert od	1.950 (49.53)	1.951 (49.55)	
Counterbore diameter	1.946 (49.53)	1.948 (49.48)	
0.002 (0.50) oversize			
Insert od	1.952 (49.58)	1.953 (49.61)	
Counterbore diameter	1.948 (49.48)	1.950 (49.53)	
0.015 (0.381) oversize			
Insert od	1.965 (49.91)	1.966 (49.94)	
Counterbore diameter	1.961 (49.81)	1.963 (49.86)	
0.030 (0.762) oversize			
Insert od	1.980 (50.29)	1.981 (50.32)	
Counterbore diameter	1.976 (50.19)	1.978 (50.24)	
Valve head recession (below cylinder head face)	0.042 (1.07)	0.062 (1.57)	
Valve tip to rocker arm clearance (hot or cold)	0.016 (0.41)		
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REPAIR AND REPLACEMENT STANDARDS - CONTINUED

COMPONENT POINTS OF MEASUREMENT	MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)		MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)
	MINIMUM	MAXIMUM	
VALVE GUIDES			
Bore diameter	0.3738 (9.495)	0.3748 (9.520)	
Length			
Intake		3.25 (82.4)	
Exhaust		2.968 (75.2)	
Height above top cylinder head		1.219 (30.96)	
VALVE TAPPETS			
Length	2.550 (64.77)	2.590 (65.79)	
Diameter	0.9955 (25.286)	0.9966 (25.298)	
Clearance in bore of block	0.003 (0.076)	0.005 (0.127)	
VALVE SPRINGS			
Free length		2.075 (52.71)	
Test length		1.397 (35.4)	
Load (at test length)		192 - 208 lb (854-925 N)	
ROCKER ARMS			
Shaft bore diameter	0.8661 (21.999)	0.8670 (22.022)	
Clearance on shaft	0.0011 (0.028)	0.0045 (0.114)	
Rocker arm to valve tip clearance			
Intake		0.014 (0.36)	
Exhaust		0.016 (0.41)	
VALVE TIMING			
Intake opens (before tdc)		16 degree	
Intake closes (after bdc)		52 degree	
Exhaust opens (before tdc)		68 degree	
Exhaust closes (after bdc)		16 degree	

REPAIR AND REPLACEMENT STANDARDS - CONTINUED

COMPONENT POINTS OF MEASUREMENT	MANUFACTURER'S DIMENSIONS AND TOLERANCES IN INCHES (MILLIMETERS)		MAXIMUM ALLOWABLE WEAR AND CLEARANCE IN INCHES (MILLIMETERS)
	MINIMUM	MAXIMUM	
OIL PUMP			
Gear to body end clearance	0.003 (0.076)	0.0045 (0.114)	
Gear to body side clearance	0.0014 (0.036)	0.0054 (0.137)	
Shaft diameter	0.4905 (12.459)	0.4912 (12.476)	
Shaft clearance in bore	0.0013 (0.033)	0.003 (0.076)	
Gear backlash	0.0005 (0.013)	0.0065 (0.165)	
Pressure relief valves	1.53 (38.86)	1.59 (40.39)	
Length diameter	0.744 (18.90)	0.745 (18.92)	
Relief valve springs			
Free length	3.873 (98.37)		
Test length		2.885 (73.28)	
Load (at test length)	30.6 lb (136 N)	34.6 lb (154 N)	
Oil pressure			
Idle speed	10 psi (68.9 kPa)	20 psi (137.9 kPa)	
At rated speed	40 psi (275.8 kPa)	55 psi (379.2 kPa)	
PISTON COOLING VALVE			
Piston length	1.30 (0.3302)	1.32 (0.335)	
Piston diameter	0.743 (0.189)	0.745 (0.189)	
Valve spring			
Free length		2.95 (0.747)	
Test length		2.46 (0.625)	
Test load (at test length)	16 lb (71 N)	19 lb (84 N)	
FLYWHEEL			
Housing runout		0.010 (0.254)	
WATER PUMP			
Impeller to body clearance	0.010 (0.254)	0.020 (0.508)	
INJECTION PUMP DRIVE			
Drive gear backlash	0.0005 (0.013)	0.0045 (0.113)	
Coupling to drive lugs clearance		0.0034 (0.086)	

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CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

OVERVIEW

This chapter contains references, troubleshooting and general maintenance instructions, and detailed maintenance procedures that Direct Support and General Support Maintenance may perform to maintain the M876 Truck.

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Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

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Repair Parts.....	2-2	Support Equipment	2-1

COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Refer to TM 9-2320-269-34P, Repair Parts and Special Tools List, and the Maintenance Allocation Chart (MAC) in TM 9-2320-269-20-2 for a description of necessary tools, TMDE, and support equipment. Refer to appendix C, Illustrated List of Manufactured Items in this manual for a description of fabricated tools and equipment.

REPAIR PARTS

Repair parts for the M876 Truck are listed and illustrate in TM 9-2320-269-34P, Direct Support and General Support Maintenance Repair Parts and Special Tools List.

Section II. TROUBLESHOOTING PROCEDURES

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Symptom Index	2-2	Troubleshooting Table	2-4

TROUBLESHOOTING

The troubleshooting table lists the common malfunctions which may occur in the M876 Truck or its components. You should perform the tests/inspections and corrective actions in the order listed. This manual cannot list all malfunctions that may occur, not all the tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

EXPLANATION OF COLUMNS

MALFUNCTION	Visual or operational indication that something is wrong with the equipment.
TEST/INSPECTION	Procedure to isolate the problem to a component or system.
CORRECTIVE ACTION	Procedure to correct problem.

SYMPTOM INDEX

This symptom index is provided as a quick way to get you to the troubleshooting procedure that will help you solve the problem you are having.

To use the symptom index, find the problem you have with the truck. go to the page indicated for the troubleshooting procedure to help you find and correct the problem.

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TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

ENGINE

1. CRANKS BUT WILL NOT START

Step 1. Check for proper fuel pressure to fuel injectors (1).

- a. Open hood panels (TM 9-2320-269-20-1).
- b. Remove air cleaner (TM 9-2320-269-20-1).
- c. Using 11/2-inch socket, 3-inch extension, and ratchet handle with 11/2-inch drive, unscrew and take out four screws (2) and clamps (3).
- d. Unscrew nut (4) part way. Unscrew, and take off nut (5) using 11/16-inch open-end wrench. Turn pipe (6) aside, and tighten nut (4) using 11/16-inch open-end wrench.
- e. Install in-line pressure gage between nut (5) and fuel injector (1). Have assistant crank engine, and note gage reading and pipe (6) checked.
- f. Remove in-line pressure gage, unscrew nut (4) part way using 11/16-inch open-end wrench, and turn pipe (6) into place.
- g. Screw on, and tighten nuts (4) and (5) using 11/16-inch wrench.
- h. Repeat steps d through g for remaining seven pipes (6).
- i. If all gage readings were 2225-2375 psi (15383 16375 kPa), put clamps (3) in place, screw in and tighten screws (2) using 1/2-inch socket, 3-inch extension, and ratchet handle with 11/2-inch drive, and go to step 5.

Step 2. Inspect injector pipes (6) for blockage.

- a. Remove any pipes (6) that did not have gage reading of 2225-2375 psi (15383 16375 kPa) (pages 2-270 and 2-259).
- b. Inspect, and replace as needed (pages 2-270 and 2-259).
- c. Install pipes (6) removed (pages 2-270 and 2-259).

TROUBLESHOOTING - CONTINUED

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

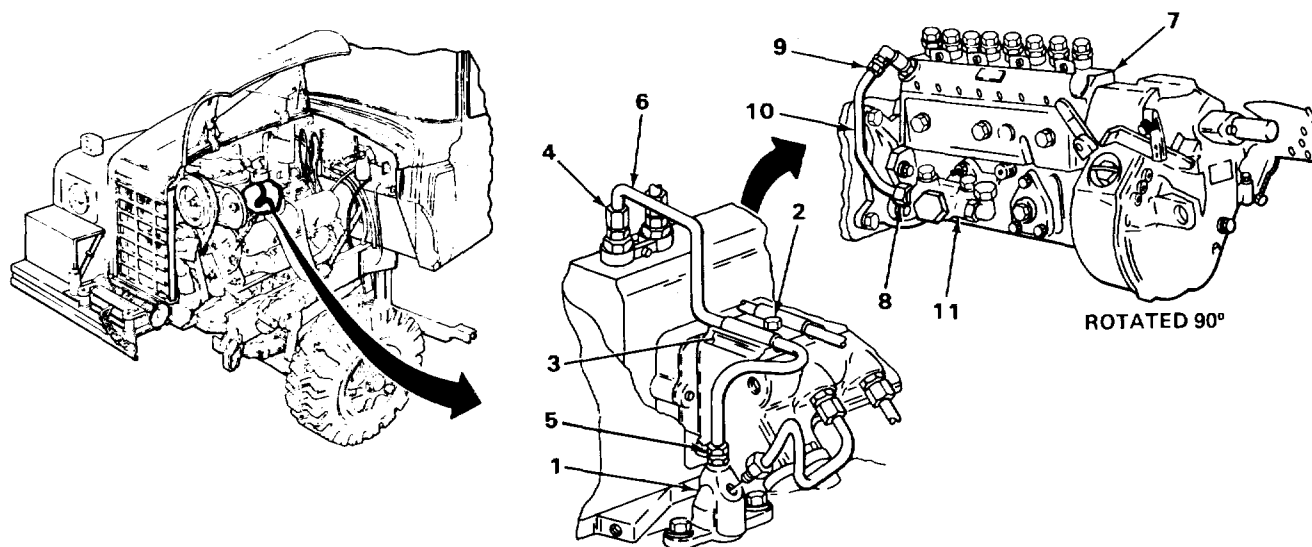
1. CRANKS BUT WILL NOT START - CONTINUED

Step 3. Inspect fuel supply pipe blockage.

- a. Remove pipe (6) (page 2-259).
- b. Inspect, and replace as needed (page 2-259).
- c. Install pipe (6) (page 2-259).

Step 4. Check proper fuel pressure to fuel injection pump (7).

- a. Unscrew nut (8) part way. Unscrew, and take off nut (9) using 11/16-inch open-end wrench. Turn pipe (10) aside, and tighten nut (8) using 11/16-inch wrench.
- b. Install in-line pressure gage between nut (9) and fuel injection pump (7), have assistant crank engine, and note gage reading.
- c. Remove in-line pressure gage, unscrew nut (8) part-way using 11/16-inch open-end wrench, and turn pipe (10) into place.
- d. Screw on, and tighten nuts (8) and (9) using 11/16-inch open-end wrench.
- e. If gage reading was not 28 psi (193 kPa), remove fuel injection pump (7) and fuel supply pump (11) (page 2-278). Replace, and install fuel supply pump (11), and install fuel injection pump (7) (page 2-278).



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TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. CRANKS BUT WILL NOT START - CONTINUED

Step 5. Test fuel injector (1) operation.

- a. Open hood panels (TM 9-2320-260-20-1).
- b. Remove air cleaner (TM 9-2320-269-20-1).
- c. Remove fuel injectors (1), and test (page 2-245).
- d. Repair or replace as needed, and install (page 2-245).

Step 6. Test engine (2) for proper compression.

- a. Remove one fuel injector (1) (page 2-245).
- b. Install adapter and compression gage, have assistant crank engine, and note gage reading of fuel injector removed.
- c. Install fuel injector (1) (page 2-245).
- d. Repeat steps a through c for remaining seven fuel injectors (1).
- e. If gage readings were not 375 - 425 psi (2584 - 2928 kPa), go to step 9.

Step 7. Check fuel injection pump (3) timing.

- a. Remove fuel injection pump (3) (page 2-278).
- b. Remove left hand cylinder head cover (4) (page 2-180).
- c. Have assistant rotate engine (2), using 2-inch socket and ratchet handle with 3/4-inch drive on crankshaft pulley nut (5), until timing pointer (6) shows top dead center and number one cylinder rocker arms (7) are at rest.
- d. If marked tang (8) on drive hub (9) is not straight up, adjust hub (9) (page 2-325).

Step 8. Test fuel injection pump (3) operation.

- a. Test fuel injection pump (3) operation, and adjust (TM 9-4910-387-14) or repair (page 2-278) as needed.
- b. Install fuel injection pump (3) (page 2-278).

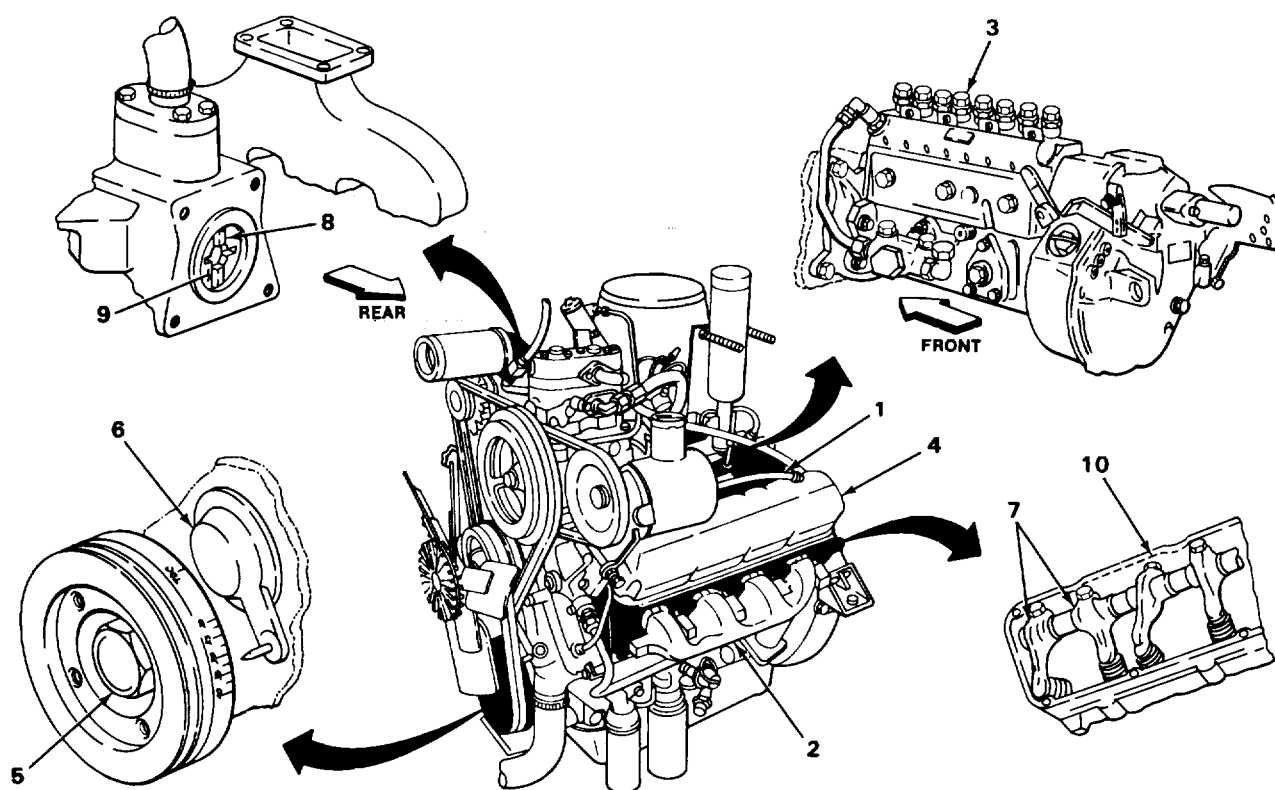
TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

1. CRANKS BUT WILL NOT START - CONTINUED

Step 9. Test cylinder heads (10) for leakage.

- a. Remove cylinder heads (10) (page 2-102).
- b. Test using air tester, and repair or replace cylinder heads (10) as needed (page 2-102).
- c. If cylinder heads (10) were not repaired or replaced, repair or replace engine (2) as needed (page 2-51).
- d. Install air cleaner (TM 9-2320-269-20-1).
- e. Close hood panels (TM 9-2330-269-20-1).



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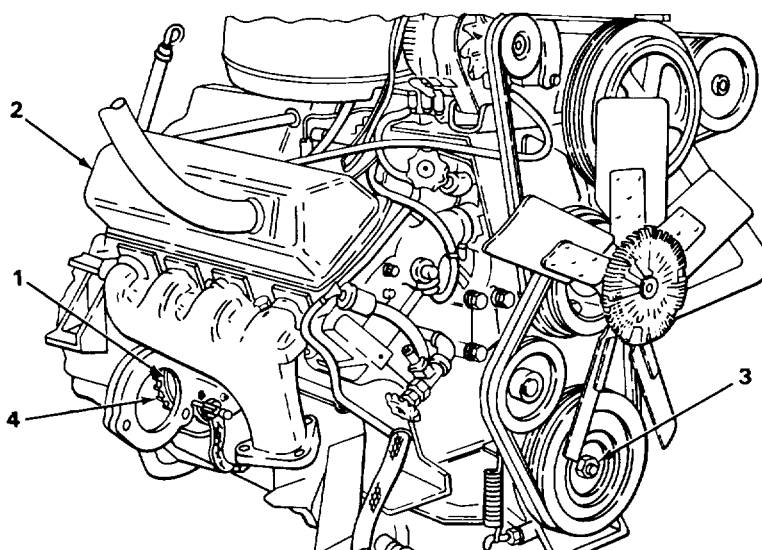
TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

2. DOES NOT CRANK

Check flywheel (1) for damage.

- a. Remove starter (TM 9-2320-269-20-1).
- b. With assistant, rotate engine (2) using 2-inch socket and 3/4-inch drive ratchet handle on crankshaft pulley nut (3), and check for damaged or missing flywheel teeth (4).
- c. If flywheel teeth (4) are damaged or missing, replace flywheel (1) (page 2-134).
- d. If engine (2) will not rotate, repair or replace as needed (page 2-51).



3. USES TOO MUCH OIL

Step 1. Check for external leakage.

- a. Start engine (2), and allow to warm up (TM 9-2320-269-10).
- b. Open hood panels (TM 9-2320-269-20-1).
- c. Check for leaking oil, and shut off engine (2) (TM 9-2320-269-10).
- d. If oil pan (5) or gasket (6) leak, replace as needed (page 2-203).

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TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

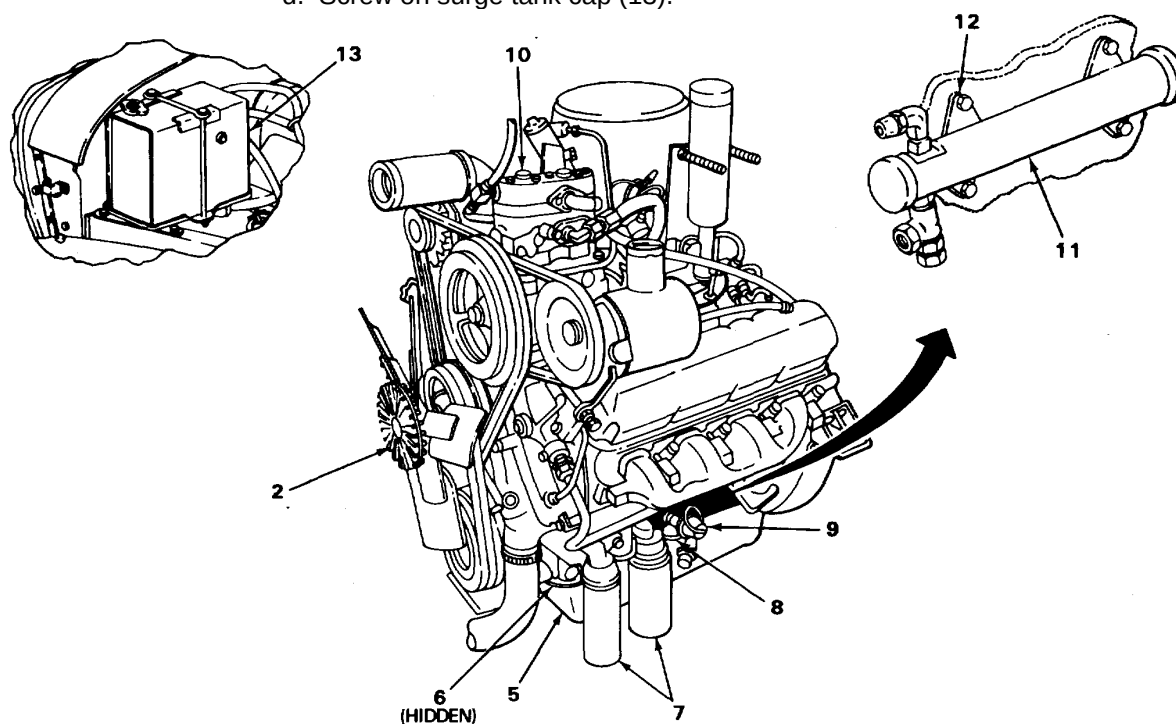
3. USES TOO MUCH OIL - CONTINUED

Step 1. Check for external leakage - Continued

- e. If oil filters (7), oil pressure sending unit (8), oil pressure lockout switch (9), or air compressor (10) leak, replace as needed (TM 9-2320-269-20-1).
- f. If oil cooler (11) or gasket (12) leak, replace as needed (page 2-218).

Step 2. Check for internal leakage.

- a. Unscrew, and take off surge tank cap (13).
- b. If coolant has oil in it, or is foamy, go to step 6 of CRANKS BUT WILL NOT START (page 2-4) and test engine compression.
- c. Remove oil cooler (11) (page 2-218). Pressurize the coolant section of cooler (11) to 70 psi (482.65 KPa) and check for leaks. If cooler (11) leaks, replace and install (page 2-218).
- d. Screw on surge tank cap (13).



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TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

3. USES TOO MUCH OIL - CONTINUED

WARNING

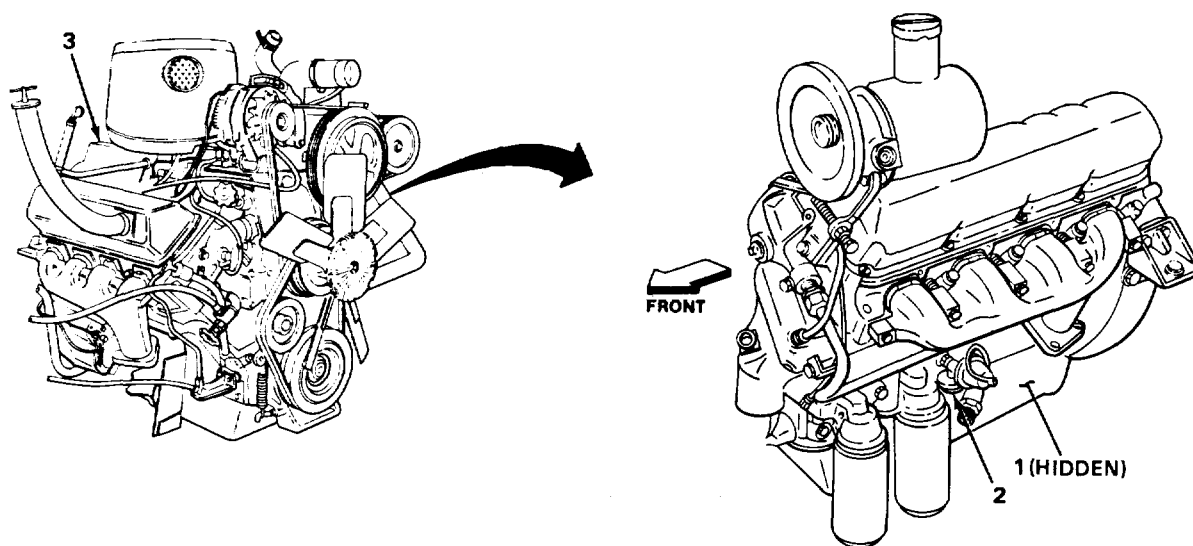
When doing tests with engine running, stand aside to avoid personnel injury from moving parts.

Step 3. Test oil pump (1) for proper operation.

- a. Remove oil pressure sending unit (2) (TM 9-2320-269-20-1), and install pressure gage.
- b. Start engine (3), and let run at 1800 rpm (TM 9-2320-269-10). Check gage reading, and shut off.
- c. Remove pressure gage, and install oil pressure sending unit (2) (TM 9-2320-269-20-1).
- d. If gage reading was not 45-60 psi, (310-413 kPa), remove oil pump (1), repair or replace as needed, and install (page 2-208).

Step 4. Test engine (3) for proper compression.

- a. Go to step 6 of CRANKS BUT WILL NOT START (page 2-4).
- b. Close hood panels (TM 9-2320-269-20-1).



TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

4. EXHAUST SHOWS BLACK OR GREY SMOKE

Step 1. Check fuel system and engine compression. Go to CRANKS BUT WILL NOT START (page 2-4).

Step 2. Check for oil burning. Go to USES TOO MUCH OIL (page 2-8).

5. RUNS UNEVENLY

Check fuel system and engine compression. Go to CRANKS BUT WILL NOT START (page 2-4).

ELECTRICAL SYSTEM

6. STANDARD WIRING HARNESS WORKING IMPROPERLY

NOTE

This is a common procedure for connector to component type wiring harnesses. The headlight wiring harness is shown. The engine wiring harness, taillight wiring harness, and 12-volt trailer receptacle wiring harnesses are done in a similar way.

When doing tests, always note wire number and meter reading for each wire.

TROUBLESHOOTING - CONTINUED

MALFUNCTION	
TEST OR INSPECTION	
CORRECTIVE ACTION	

6. STANDARD WIRING HARNESSWORKING IMPROPERLY - CONTINUED

Step 1. Test component harness (1) for power.

- a. Open left side hood panel (TM 9-2320-269-20-1).
- b. Disconnect bulkhead connector (2).
- c. Have assistant turn key switch and light switch to the ON position and master light switch to the SERVICE/DRIVE position (TM 9-2320-269-10).
- d. Using voltmeter, connect negative lead to vehicle ground and positive lead to wire #52 and #53 at dash panel wiring bulkhead connector (3) one at a time, and note meter reading. Disconnect voltmeter, and have assistant turn master light switch, light switch, and key switch to the OFF position (TM 9-2320-269-10).
- e. If meter reading was 12 volts, go to step 3.
- f. If meter reading was less than 12 volts, go to step 2.

Step 2. Trace power source to harness (4).

- a. Using electrical systems functional diagrams (TM 9-2320-269-20-2), locate harness or power source (5) to harness (4) tested.
- b. Using applicable troubleshooting and maintenance procedures as needed, repeat step 1.

NOTE

When doing tests for continuity, do not let open wire ends touch vehicle ground or touch together to avoid incorrect meter readings.

Step 3. Test harness (1) for broken wires.

- a. Disconnect fender connectors (6) and (7), turn/marker light connectors (8) and (9), horn (10), and washer pump (11).
- b. With assistant, connect ohmmeter leads to wire #52 at bulkhead connector (2) and fender connector (6), and note meter reading. If meters read more than zero ohms, wire #52 is broken. Disconnect ohmmeter from bulkhead connector (2).
- c. Connect ohmmeter to wire #52A at fender connection (7), and note meter reading. If meter reads more than zero ohms, wire #52A is broken. Disconnect meter from fender connectors (6) and (7).
- d. Repeat for remaining wires in harness (1) using wiring diagram.

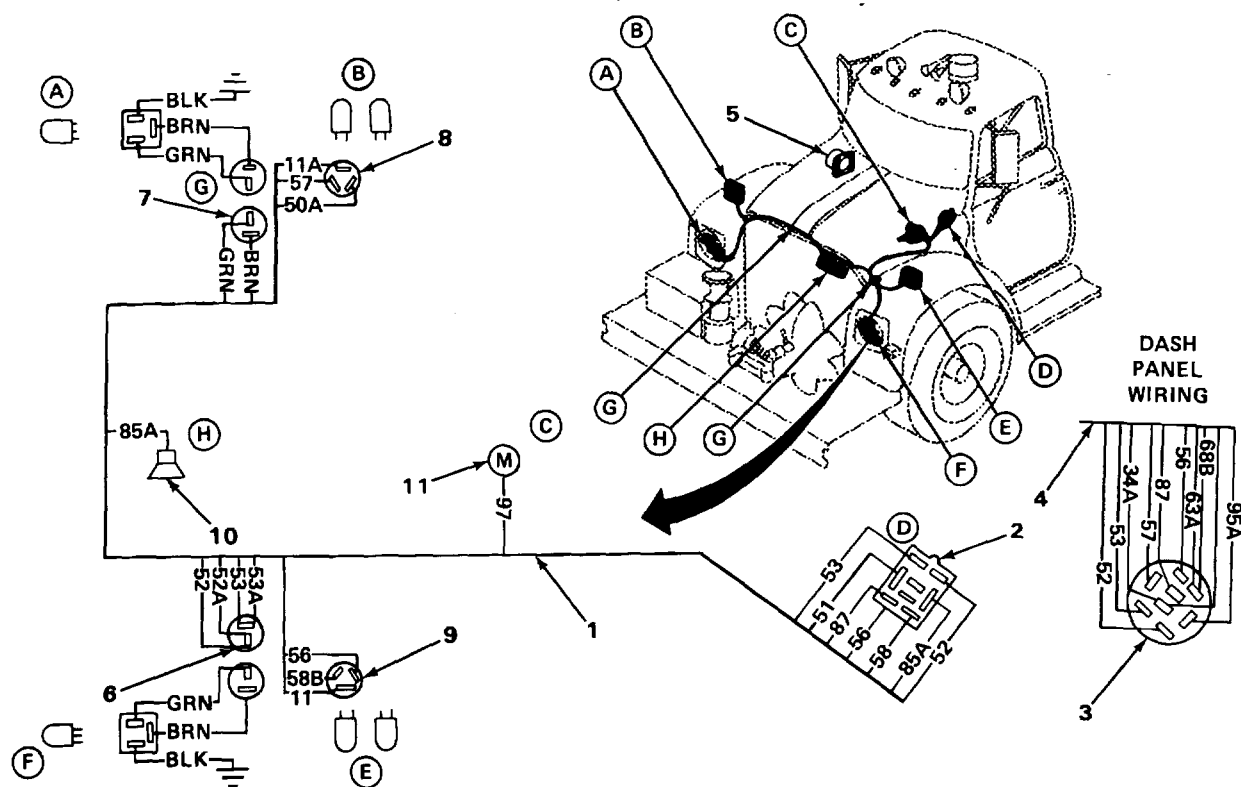
TROUBLESHOOTING - CONTINUED

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6. STANDARD WIRING HARNESS WORKING IMPROPERLY - CONTINUED

Step 4. Test harness (1) for wires shorted to ground.

- With assistant, connect ohmmeter to vehicle ground.
- Connect ohmmeter to wire #52 at bulkhead connector (2), note meter reading, and disconnect from wire. If meter reads more than zero ohms, wire is shorted to ground.
- Repeat for remaining wires at bulkhead connector (2), and disconnect ohmmeter from vehicle ground.



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

6. STANDARD WIRING HARNESS WORKING IMPROPERLY - CONTINUED

Step 5. Test harness (1) for wires shorted together.

- a. With assistant, connect ohmmeter to wire #52 at bulkhead connector (2).
- b. Connect ohmmeter to remaining wires at fender connectors (3), turn/marker light connectors (4), horn (5), and washer pump (6) one at a time, and note meter readings. If meter reads more than zero ohms, wires are shorted together.
- c. Disconnect ohmmeter from wire #52 at bulkhead connector (2).
- d. Repeat for remaining wires in harness (1).

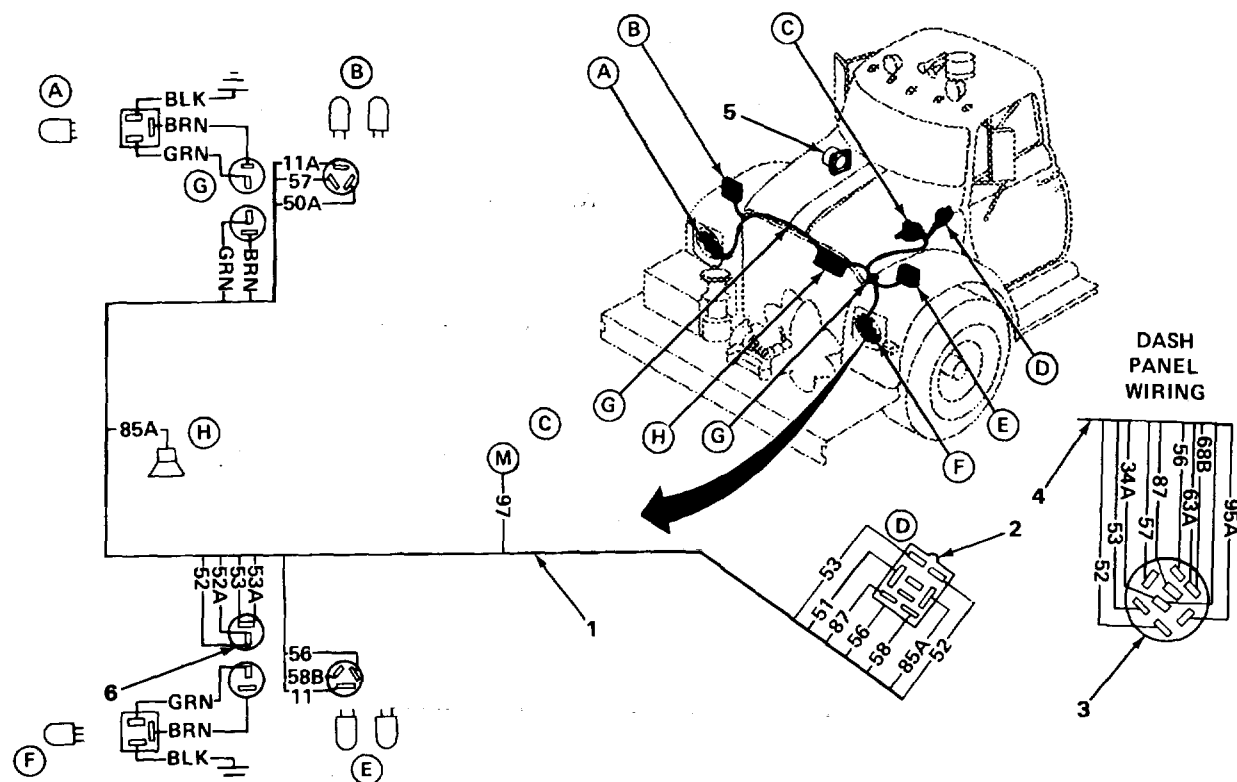
Step 6. Repair or replace harness (1) as needed.

- a. Using wiring diagrams and applicable maintenance procedures (TM 9-2320-269-20-1), remove harness (1).
- b. Using notes from steps 3 thru 5, repair harness using applicable maintenance procedures (TM 9-2320-269-20-1) or replace as needed.
- c. Install harness (1) using wiring diagrams and applicable maintenance procedures (TM 9-2320-269-20-1).
- d. Connect bulkhead connector (2), fender connectors (3), turn/marker connectors (4), horn (5), and washer pump (6).
- e. Close left side hood panel (TM 9-2320-269-20-1).

TROUBLESHOOTING - CONTINUED

[illegible]

6. STANDARD WIRING HARNESS WORKING IMPROPERLY - CONTINUED



7. MULTIPLE COMPONENT WIRING HARNESS WORKING IMPROPERLY

NOTE

This is a common procedure for wiring harnesses with multiple switches and components. The cab lights wiring harness is shown, the dash panel wiring harness, derrick wiring harness, marker light and stoplight switch wiring harness, steering column wiring harness, and submersible fuel pump wiring harness can be done in a similar way.

When doing tests, always note wire number and meter reading for each wire.

TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

7. MULTIPLE COMPONENT WIRING HARNESS WORKING IMPROPERLY - CONTINUED

Step 1. Test component wiring harness (1) for power.

- a. Using applicable wiring diagrams (TM 9-2320-269-20-2), locate power source (2) to harness (1) being tested.
- b. Disconnect power source (2) using applicable maintenance procedure (TM 9-2320-269-20-1).
- c. Test harness (1) for power (see STANDARD WIRING HARNESS WORKING IMPROPERLY, steps 1 and 2, page 2-11).

NOTE

When testing harnesses with multiple switches and components, be sure all switches are in the operating position, and test all connected wires at the same time to avoid incorrect meter readings.

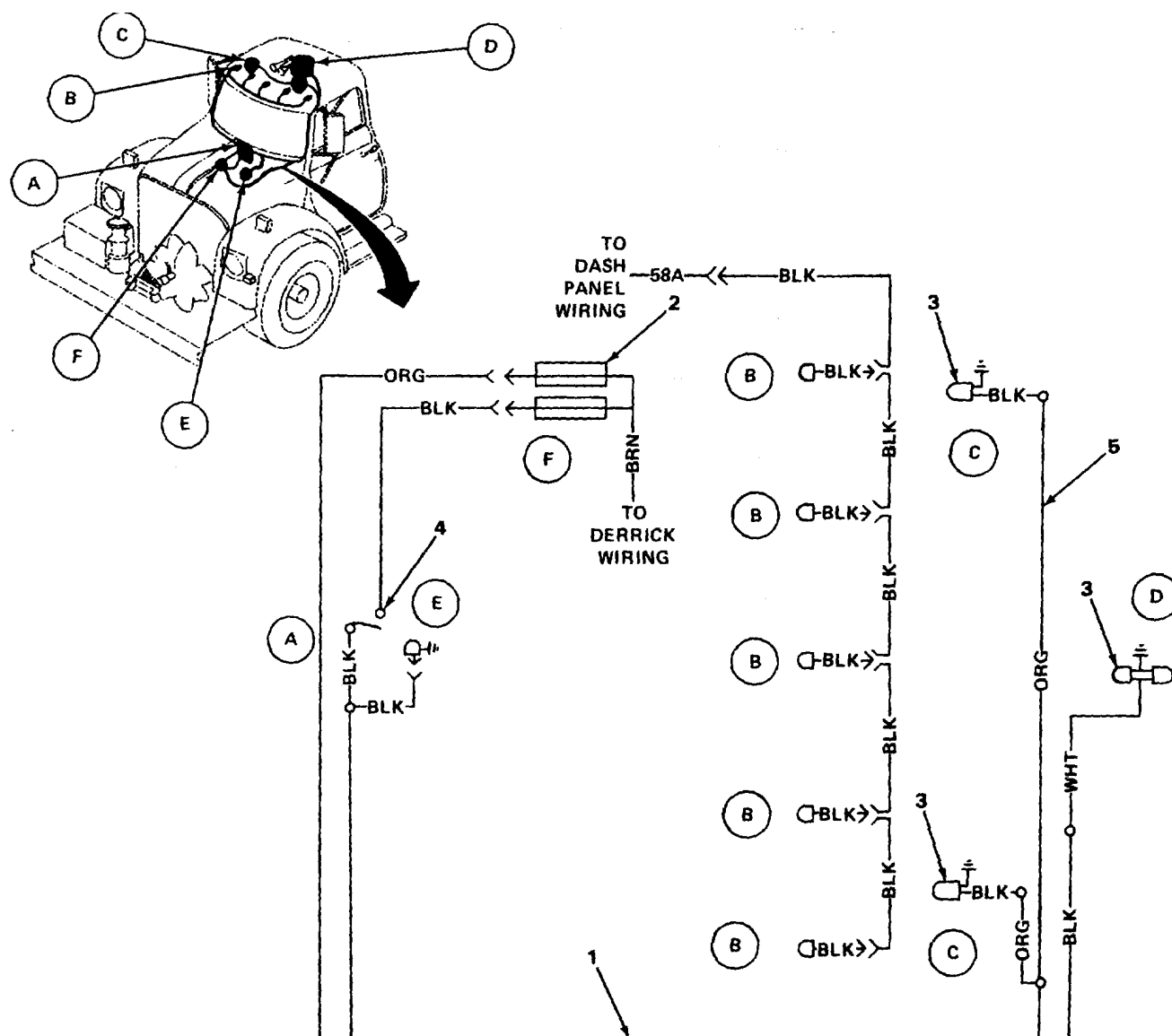
Step 2. Test component (3) wiring harness (1) for broken and shorted wires.

- a. Using applicable wiring diagrams (TM 9-2320-269-20-2), locate all common terminals on switches (4) and connected wires in harness (1) being tested.
- b. Using wire (5) markings, switch (4) markings, and applicable diagrams (TM 9-2320-269-20), locate all common terminals on switches (4) and connected wires in harness (1) being tested.
- c. Turn on all switches (4) to the component (3) operating position (TM 9-2320-26910).
- d. Test component harness (1) for broken and shorted wires (see STANDARD WIRING HARNESS WORKING IMPROPERLY, steps 3 thru 6, page 2-11).
- e. Turn component switches (4) to the OFF position (TM 9-2320-269-10), and connect power source (2) using applicable maintenance procedure (TM 9-2320-269-20-1).

TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

7. MULTIPLE COMPONENT WIRING HARNESS WORKING IMPROPERLY - CONTINUED



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

8. UNDERCHARGING

Step 1. Connect test light.

- a. Lift latches (1), and take off battery box cover (2).
- b. Connect test light from battery ground cable (3) to frame (4).
- c. Check, and turn off all electrical switches.

Step 2. Find faulty harness (5).

- a. Using diagram, find all harness connections (6).
- b. While assistant watches test light, disconnect harness leads (5) one at a time using applicable maintenance procedure as needed, working towards power source until test light goes out.
- c. Disconnect faulty harness (5).

Step 3. Inspect faulty harness (5).

- a. Using diagram, find all components (7) in faulty harness (5).
- b. Follow harness (5) from components (7) towards power source, and check for broken casing, wear, or pinched sections.
- c. Replace or repair as needed using applicable maintenance procedure.

Step 4. Test faulty harness (5).

- a. Using test light, connect ground side of each component (7) and switch (8) in harness (5) to ground, one at a time, working towards power source. Note any sections of harness (5) where test light comes on.
- b. Replace or repair as needed using applicable maintenance procedure.
- c. Connect remaining harnesses (5).

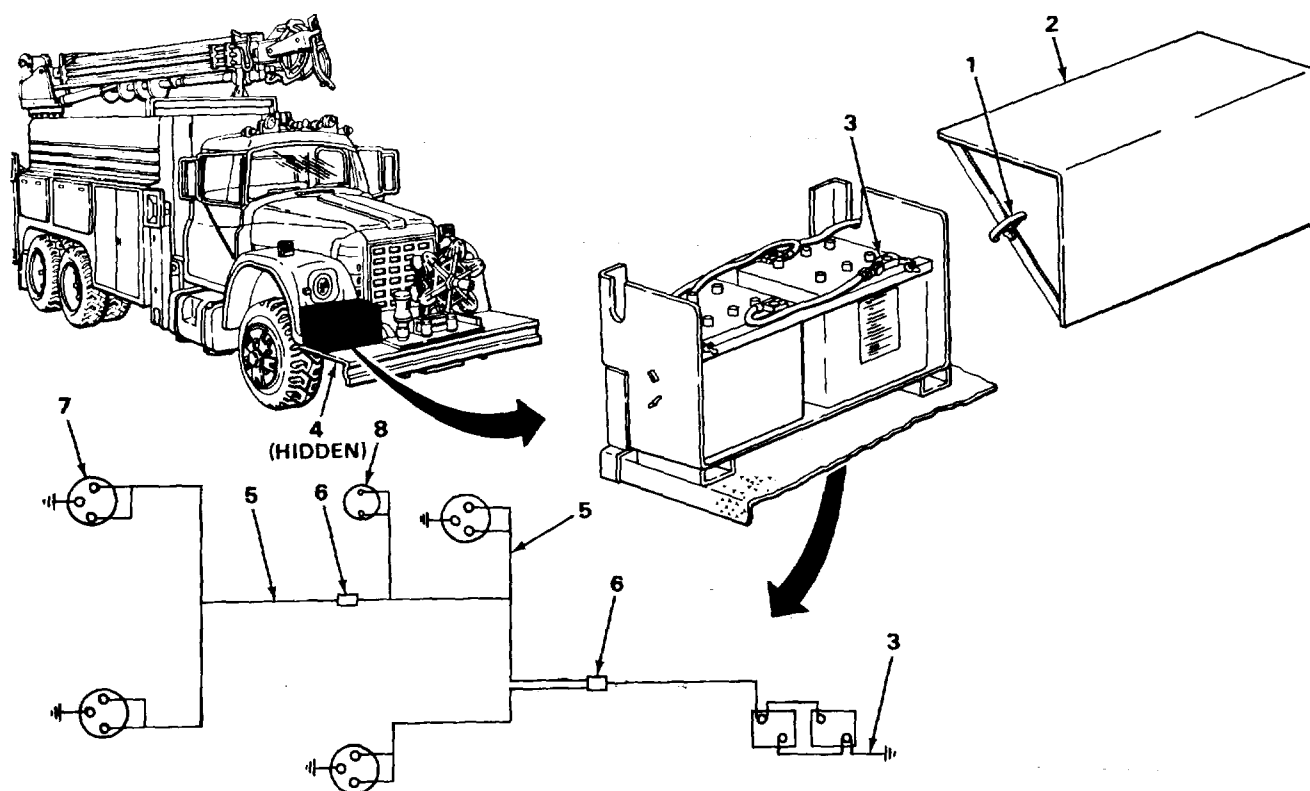
TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

8. UNDERCHARGING - CONTINUED

Step 5. Disconnect test light.

- Disconnect test light from battery ground cable (3) and frame (4).
- Put on battery box cover (2), and close latches (1).



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

TRANSMISSION

9. WILL NOT RESPOND TO SELECTOR HANDLE MOVEMENT

WARNING

When doing test with vehicle running and in gear, chock tires and stand aside. Vehicle could jump forward causing personnel injury.

Step 1. Test main oil pressure.

- a. Remove oil pressure sending unit (1) (TM 9-2320-269-20-2).
- b. Install pressure gage, and put chocks in front and back of rear tires (2).
- c. Start engine (TM 9-2320-269-10), and let warm up.
- d. Check to be sure parking brakes are applied, apply service brakes, and move selector (3) to forward drive range (TM 9-2320-269-10).
- e. Run engine at 600 rpm and 1200 rpm, and have assistant note gage readings.
- f. Turn off engine, release service brakes, and move selector (3) to neutral (TM 9-2320-269-10).
- g. Remove chocks from rear tires (2), and install oil pressure sending unit (1) C(TM 9-2320-269-20-2).
- h. If gage reading was 125 psi (861 kPa) at 600 rpm and 187 - 217 psi (1289 - 1496 kPa) at 1200 rpm, go to step 4.

Step 2. Inspect control valve assembly (4).

- a. Remove (page 2-650).
- b. Inspect and repair, or replace as needed (page 2-713).
- c. Install (page 2-650).

TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

9. WILL NOT RESPOND TO SELECTOR HANDLE MOVEMENT - CONTINUED

Step 3. Inspect oil pump (5).

- a. Remove (page 2-650).
- b. Inspect and repair, or replace as needed (page 2-278).
- c. Install (page 2-650).

Step 4. Inspect range selector (6).

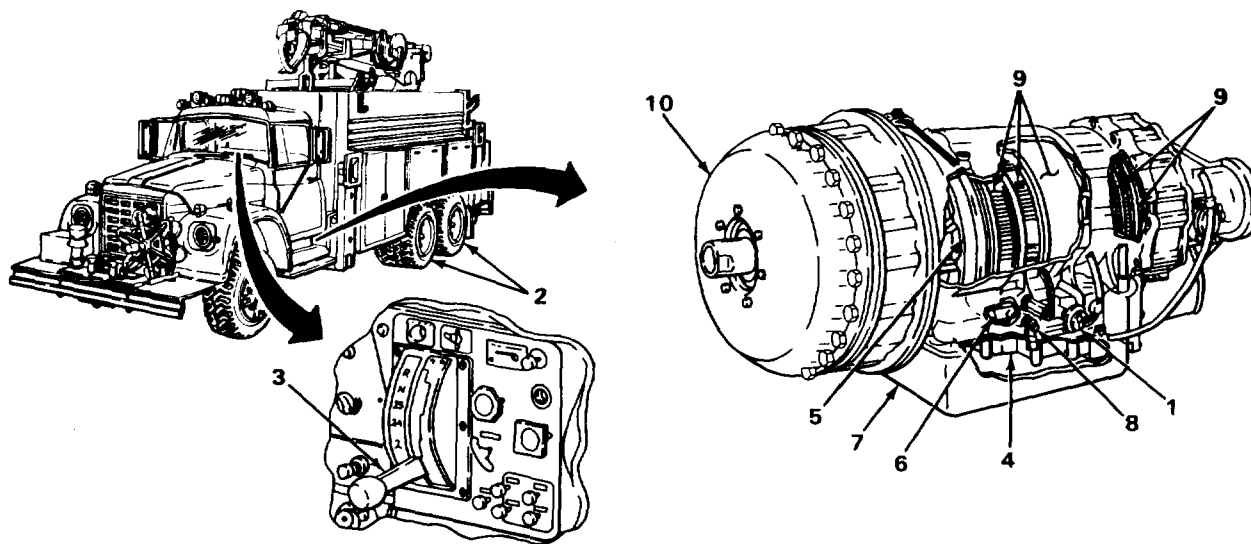
- a. Remove oil pan (7) (TM 9-2320-269-20-1).
- b. Inspect range selector (6) and control shaft (8) for loose and broken parts, and tighten or replace as needed (page 2-789).
- c. Install oil pan (7) (TM 9-2320-269-20-1).

10. SHIFTS IMPROPERLY - SLIPS

Step 1. Test main oil pressure (see WILL NOT RESPOND TO SELECTOR HANDLE MOVEMENT, steps 1 thru 3, page 2-20).

Step 2. Inspect clutch packs (9).

- a. Disassemble transmission (10) (page 2-650).



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

10. SHIFTS IMPROPERLY - SLIPS - CONTINUED

Step 2. Inspect clutch packs - Continued

- b. Inspect clutch packs (1), and repair or replace as needed using applicable maintenance procedure.
- c. Assemble and install transmission (2) (page 2-650).

11. OIL LEAKING

Check transmission (2) for leakage.

- a. If rear cover (3) is leaking or damaged, remove, replace seals, gaskets, or cover (3) as needed, and install (page 2-771).
- b. If planetary adapter (4) is leaking or damaged, remove, replace seals, gaskets, or adapter (4) as needed, and install (page 2-779).
- c. If housing (5) is leaking or damaged, remove, replace seals, gaskets, or housing as needed, and install (page 2-783).
- d. If front seal (6) is leaking, remove oil pump (7), replace seal (6), and install (page 2-728).

12. OVERHEATS

Check for leaking oil (TM 9-2320-269-20-1).

13. CREEPS IN FIRST OR REVERSE GEAR

Adjust engine idle speed (TM 9-2320-269-20-1).

14. SHIFTS ROUGHLY

NOTE

The transmission will shift at lower road speeds without modulator pressure.

Step 1. Test modulator valve (8) operation.

- a. Using 1/2-inch socket and ratchet handle with 3/8-inch drive, take off modulator valve (8) and retainer (9), and tie out of the way.
- b. Cover opening in modulator valve (8) and housing (4) with dust caps.

TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

14. SHIFTS ROUGHLY - CONTINUED

Step 1. Test modulator valve (8) operation - Continued

- c. Take vehicle for test drive, and note shifting action.
- d. If shifting action was smooth, repair or replace modulator valve (8) as needed (page 2-803).
- e. Take dust covers out of housing (5) and modulator valve (8).
- f. Move modulator valve (8) and retainer (9) into place, and put on using 112-inch socket and ratchet handle with 318-inch drive.

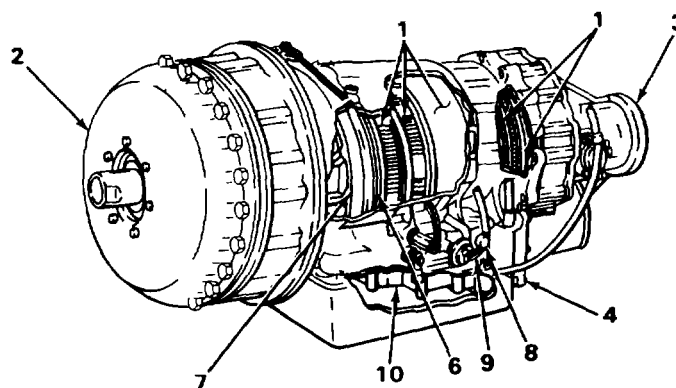
Step 2. Inspect control valve assembly (10).

- a. Remove (page 2-650).
- b. Inspect and repair, or replace as needed (page 2-713).
- c. Install (page 2-650).

15. SHIFTS AT IMPROPER SPEEDS

Step 1. Inspect modulator valve (8).

- a. Remove (page 2-803).
- b. Inspect and repair, or replace as needed (page 2-803).
- c. Install (page 2-803).



TROUBLESHOOTING - CONTINUED

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

15. SHIFTS AT IMPROPER SPEEDS - CONTINUED

Step 2. Inspect governor (1).

- a. Remove (page 2-810).
- b. Inspect and repair, or replace as needed (page 2-810).
- c. Install (page 2-810).

Step 3. Inspect control valve assembly (2).

- a. Remove (page 2-650).
- b. Inspect and repair, or replace as needed (page 2-713).
- c. Install and adjust (page 2-650).

16. DOES NOT SHIFT

Step 1. Check oil level, and fill as needed (LO 9-2320-269-12).

Step 2. Check for oil leaking (page 2-22).

Step 3. Check for shifts at improper speeds (page 2-23).

AIR SYSTEM AND AIRBRAKES

17. BRAKES NOISY OR UNEVEN

Inspect brakeshoes (3) and drums (4).

- a. Remove hub and drum assembly (5) (TM 9-2320-269-20-1).
- b. Inspect brakeshoes, and repair as needed using applicable maintenance procedure.
- c. Inspect brakedrum (4), and repair as needed using applicable maintenance procedure.
- d. Install hub and drum assembly (5) (TM 9-2320-269-20-1).

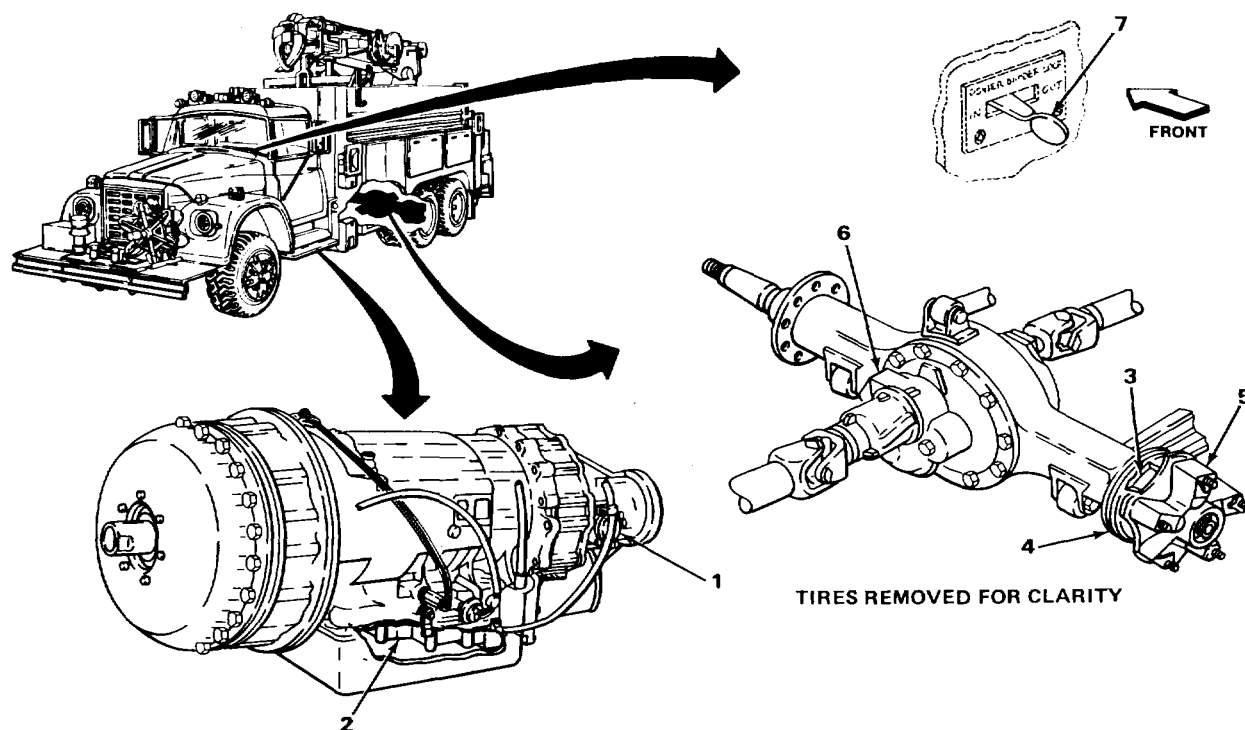
TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

18. LOW AIR PRESSURE OR AIR PRESSURE LOSS

Check power divider lockout assembly (6) for leaking.

- a. Coat power divider lockout assembly (6) with soapy water.
- b. Start engine, let air pressure build up, and shut off (TM 9-2320-269-10).
- c. Check power divider lockout assembly (6) for soap bubbles.
- d. Have assistant turn power divider lockout control valve (7) to the IN position, and check power divider lockout assembly (6) for soap bubbles.
- e. Have assistant turn power divider lockout control valve (7) to the OUT position.
- f. If power divider lockout assembly (6) leaks, repair or replace as needed (page 2-1012).



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

BRAKE ANTI-LOCK SYSTEM

NOTE

There are two computer modules used on this vehicle. The green computer module has an integral rfi filter, and the black computer module has an external rfi filter. Be sure to use the proper procedures for each computer module.

19. MONITOR LIGHT DELAYED - TRUCK NOT MOVING

Step 1. Locate faulty signal.

- a. Remove cover (1) from forward-rear axle computer module (2) using flat-tip screwdriver.
- b. Have assistant turn key switch (3) on, and check monitor light (4).
- c. Connect jumper wire to terminal (5) and FI terminal (6), and have assistant check monitor light (4).
- d. If monitor light (4) went out, rear-rear axle computer module (7) is sending faulty signal.
- e. Disconnect jumper wire, install cover (1) using flat-tip screwdriver, and have assistant turn key switch (3) off.
- f. If monitor light (4) did not go out, remove cover (8) from front axle computer module (9) using flat-tip screwdriver, connect jumper wire to terminal (10) and F2 terminal (11), and have assistant check monitor light (4). If monitor light (4) went out, forward-rear axle computer module (2) is sending faulty signal; if monitor light (4) did not go out, front axle computer module (9) is sending faulty signal.
- g. Install cover (8) using flat-tip screwdriver, and have assistant turn key switch (3) off.

Step 2. Test modulator valve (12) for open solenoid.

- a. Remove cover (1) from computer module (2), (7), or (9) sending faulty signal using flat-tip screwdriver.
- b. Take off air valve connector (13), connect ohmmeter to terminal (14), check meter reading, and disconnect.
- c. If meter reading was not 4-8 ohms, repair or replace modulator valve (12) as needed (page 2-1002), put on air valve connector (13), and install cover (1) using flat-tip screwdriver.
- d. If meter reading was 4-8 ohms, put on air valve connector (13).

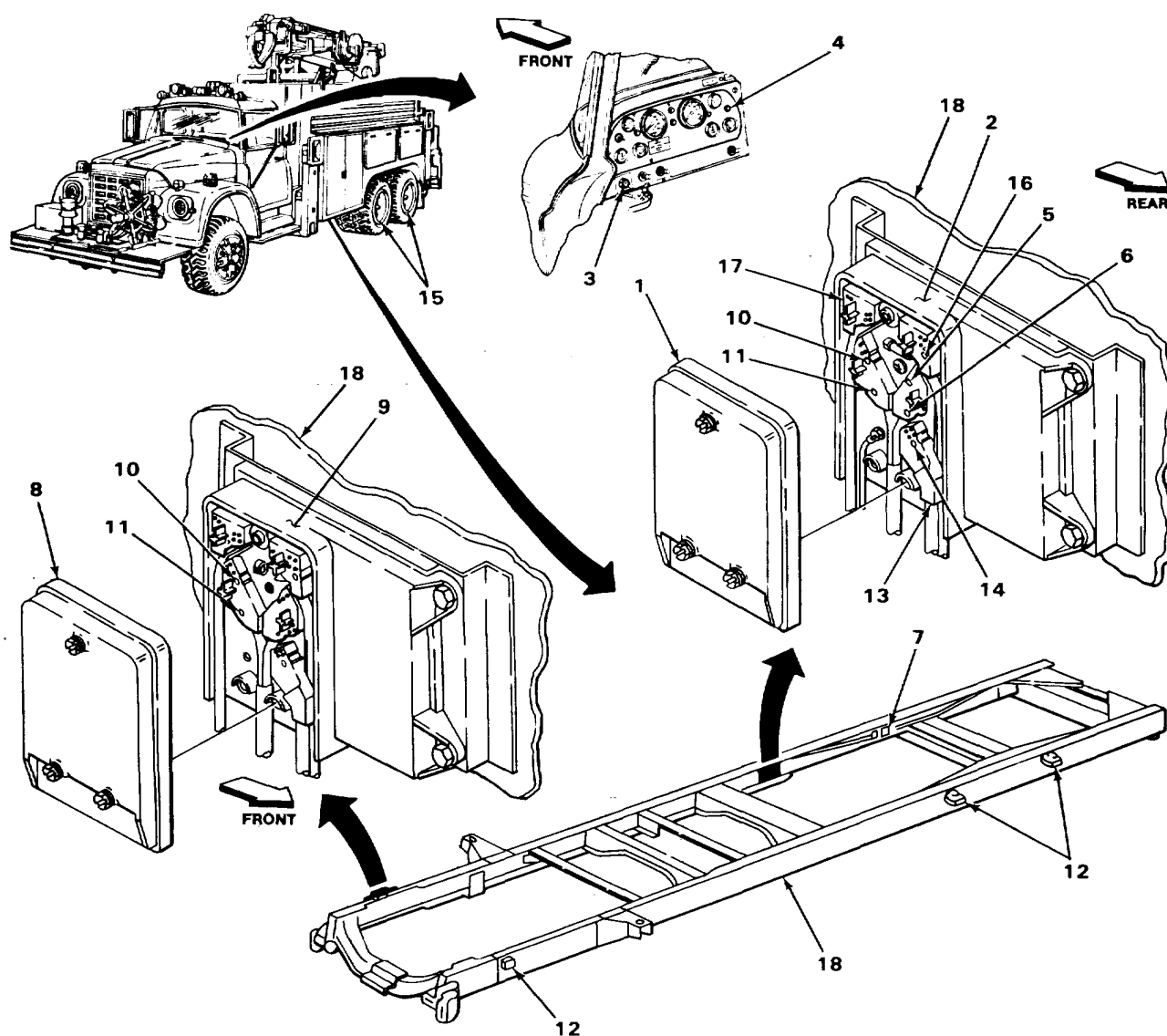
TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

19. MONITOR LIGHT DELAYED - TRUCK NOT MOVING --CONTINUED

Step 3. Test wheel sensor (15) for short circuit.

- a. Take off left sensor terminal (16).
- b. Connect ohmmeter to one sensor wire (17) and to frame (18), check meter reading, and disconnect.



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TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

19. MONITOR LIGHT DELAYED - TRUCK NOT MOVING - CONTINUED

Step 3. Test wheel sensor (1) for short circuit - Continued

- c. If meter reading was less than 10,000 ohms, inspect right sensor wires (2) and repair or replace as needed, or replace left wheel sensor (1) (TM 9-2320-269-20-2). Install cover (3) using flat-tip screwdriver.
- d. Put on sensor connector (4).
- e. Repeat steps a thru d for right sensor terminal.

Step 4. Replace computer module (5), (6), or (7) sending faulty signal (page 2-498).

20. MONITOR LIGHT STAYS ON

Step 1. Check operation of computer modules (7) and (5) and modulator valves (8) Ignition cycle the system).

- a. Start engine, let air pressure build to at least 80 psi (551.6 kPa), and shut off engine (TM 9-2320-269-10).
- b. Turn key switch (9) on and off several times.
- c. Have assistant check modulator valve (8), and turn key switch on and off.
- d. Repeat for remaining modulator valves (8).
- e. If none of the modulator valves (8) exhaust air pressure, go to step 2.
- f. If some of the modulator valves (8) exhaust air pressure, go to steps 3 thru 6.
- g. If all modulator valves (8) exhaust air pressure, go to step 7.

Step 2. Check for power to all computer modules (7) and (5).

- a. Using diagram (page 2-31), find lead wire (10) from fuse (11) to front axle computer module (7).
- b. Inspect wire (10), and repair or replace as needed (page 2-498).
- c. Connect voltmeter to fuse (11) and frame (12), and have assistant turn key switch (9) on.
- d. Check meter reading, have assistant turn key switch (9) off, and disconnect meter.
- e. If meter reading was not 11-14 volts, replace fuse (11) (TM 9-2320-269-20-1).

TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

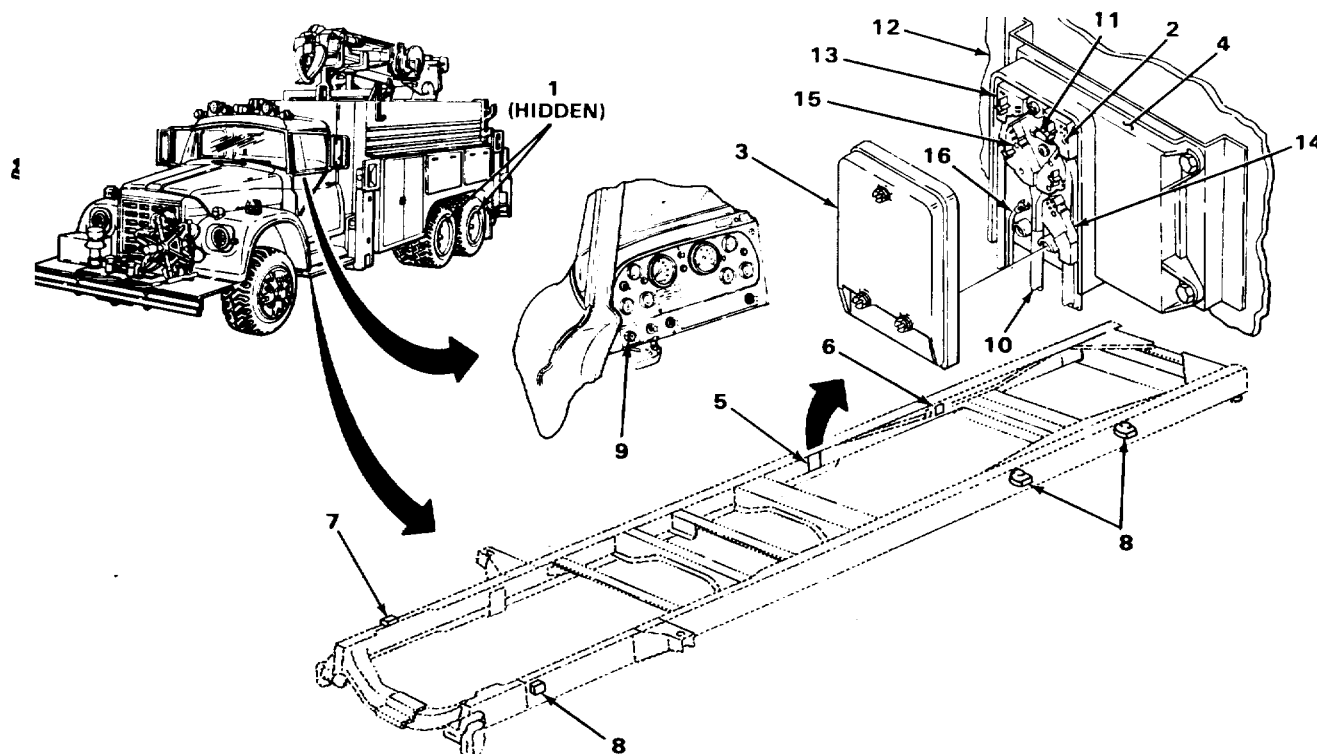
20. MONITOR LIGHT STAYS ON - CONTINUED

Step 3. Test wiring for faulty computer module (7) or (5).

- a. Remove cover (3) from faulty computer module (7) or (5) closest to front of vehicle using flat-tip screwdriver.
- b. Connect voltmeter to terminal (13) and frame (12), and have assistant turn key switch (9) on.
- c. Check meter reading, and disconnect.
- d. If meter reading was not 9 - 14 volts, have assistant turn key switch (9) off, and repair or replace harness (14) as needed (page 2-481).
- e. Connect voltmeter to terminal (13) and ground terminal (15), check reading, and disconnect.
- f. Have assistant turn key switch (9) off.
- g. If meter reading was not 9 - 14 volts, repair or replace ground wire (16) as needed (TM 9-2320-269-20-1).

NOTE

To test computer module with an external rfi filter, go to step 5.



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

20. MONITOR LIGHT STAYS ON - CONTINUED

CAUTION

Never bypass fuse with jumper wire only. Damage to computer module may occur. Do not leave jumper wire connected longer than two minutes. Damage to computer module may occur.

Step 4. Test computer module (1) and modulator valves (2).

- a. Connect voltmeter to fuse board screw (3) and ground terminal (4), and have assistant turn key switch (5) on.
- b. Check meter reading, have assistant turn key switch (5) off, and disconnect meter.
- c. If meter reading was 11 - 14 volts, replace computer module (1) (page 2-498).
- d. Take off air valve wires (6), replace polar fuse board (7) (TM 9-2320-269-20-1), and connect voltmeter to air valve terminals (8) and (9) as shown.
- e. Have assistant apply brakes, and turn key switch (5) on and off several times.
- f. If meter reads 11 - 14 volts with key switch (5) on, disconnect meter and repair or replace modulator valves (2) as needed (page 2-1002).
- g. If meter does not read 11 - 14 volts with key switch (5) on, disconnect meter, and replace computer module (1) (page 2-498).

Step 5. Test computer module (10).

- a. Connect voltmeter to sensor terminal (11) and air terminal (12) as shown, and have assistant turn key switch (5) on.
- b. Check meter reading, have assistant turn key switch (5) off, and disconnect meter.
- c. If meter reading was 3 volts, replace computer module (10) (page 2-498).
- d. If meter reading was not 3 volts, take off air valve wires (13) and (14), and connect ohmmeter to air valve wire (14) and ground. Check meter reading, and disconnect.
- e. If meter reading was at least 10,000 ohms, replace computer model (10) (page 2-498).
- f. Put air valve wires (12) and (13) on.

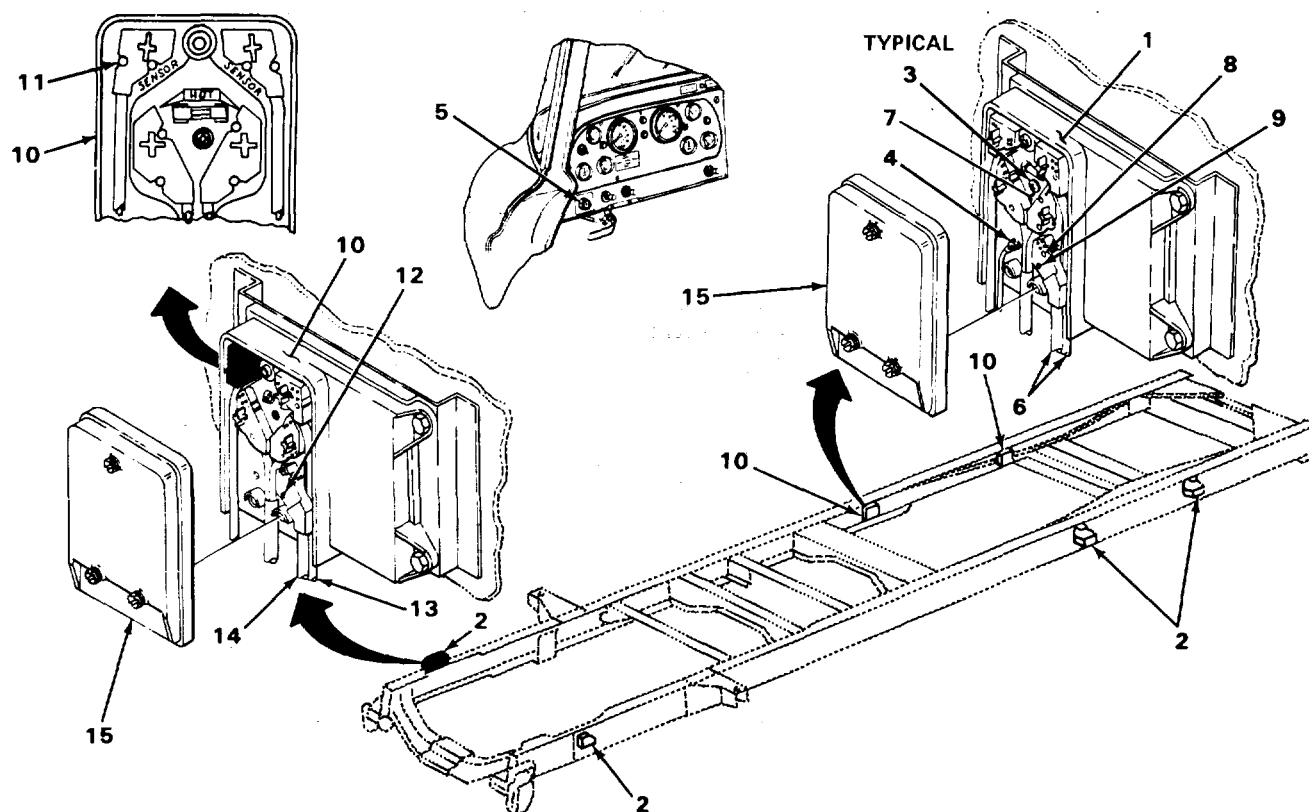
TROUBLESHOOTING - CONTINUED

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

20. MONITOR LIGHT STAYS ON - CONTINUED

Step 6. Inspect modulator valves (2) and wires (12) and (13).

- a. Inspect wires (12) and (13) for corrosion, wear, and sharp bends.
- b. Repair or replace as needed (page 2-1002).
- c. If wires (12) or (13) are not damaged, repair or replace modulator valves (2) as needed (page 2-1002).
- d. Install cover (15) using flat-tip screwdriver on module (1) or (10).



TROUBLESHOOTING - CONTINUED

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

20. MONITOR LIGHT STAYS ON - CONTINUED

CAUTION

Do not leave jumper wire connected longer than two minutes. Damage to computer module may occur.

Step 7. Test forward-rear axle computer module (1).

- a. Remove cover (2) from forward-rear axle computer module (1) using flat-tip screwdriver.
- b. Connect jumper wire to terminal (3) and F1 terminal (4).
- c. Have assistant turn key switch (5) on, check monitor light (6), and turn key switch (5) off.
- d. Disconnect jumper wire, and install cover (2) using flat-tip screwdriver.
- e. If monitor light (6) did not go out, go to step 10.

Step 8. Test rear-rear axle computer module (7).

- a. Remove cover (8) from rear-rear axle computer module (7) using flat-tip screwdriver.
- b. Connect jumper wire to terminal (3) and F1 terminal (4), have assistant turn key switch (5) on, and check monitor light (6).
- c. Have assistant turn key switch (5) off, and disconnect jumper wire.
- d. If monitor light (6) went off, inspect and repair or replace connector (9) as needed (TM 9-2320-269-20-1).
- e. Install cover (8) using flat-tip screwdriver.

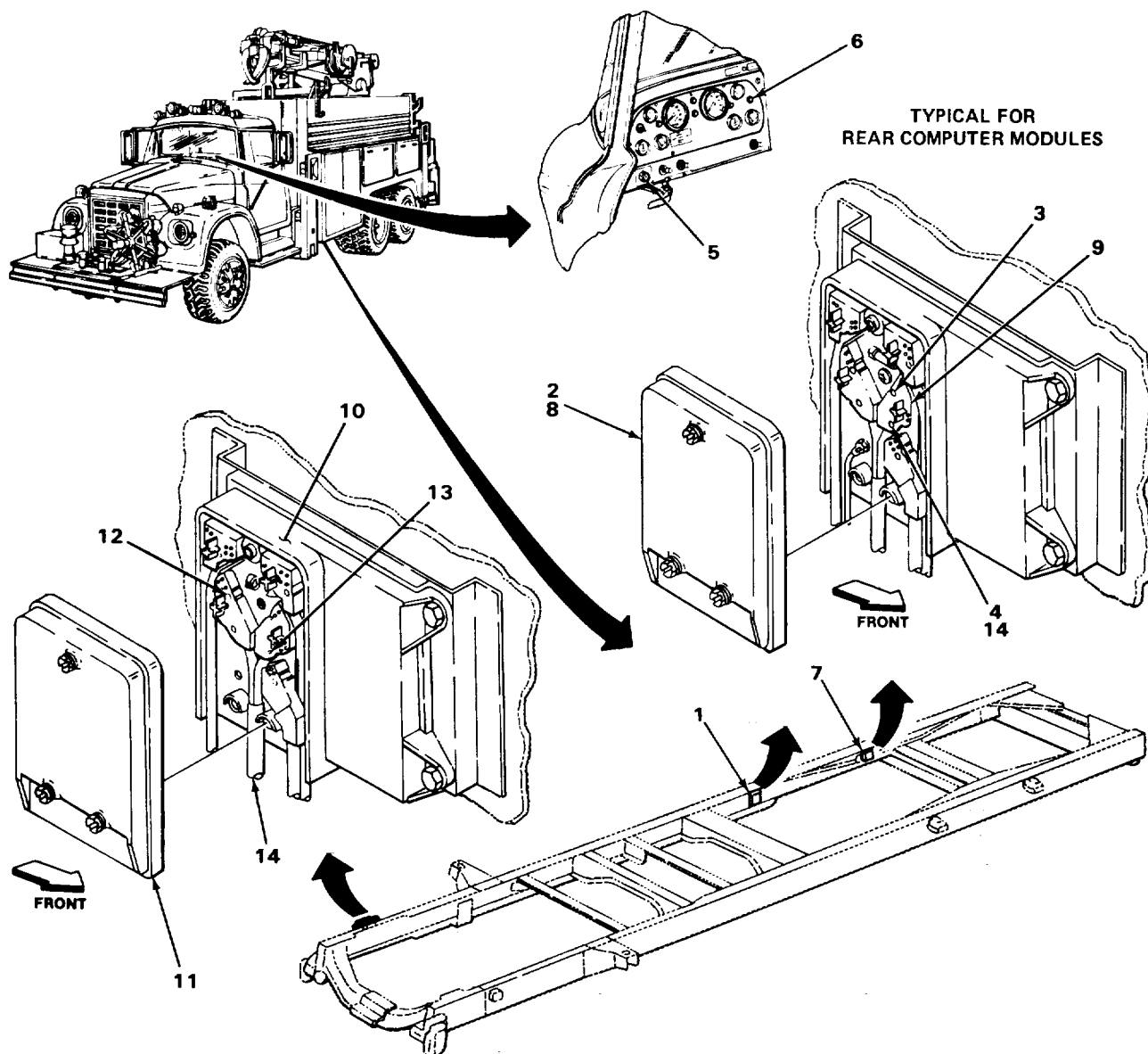
Step 9. Test front axle computer module (10).

- a. Remove cover (11) from front axle computer module (10) using flat-tip screwdriver.
- b. Connect jumper wire to terminal (12) and F1 terminal (13), have assistant turn key switch (5) on, and check monitor light (6).
- c. Have assistant turn key switch (5) off, and disconnect jumper wire.
- d. If monitor light (6) did not go off, inspect F1 wire (14) from rear-rear axle computer module (7) to forward-rear axle computer module (1), and repair or replace as needed (page 2-498), and install cover (11) using flat-tip screwdriver.
- e. If monitor light (6) went off, replace computer module (7) (page 2-498).

TROUBLESHOOTING - CONTINUED

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20. MONITOR LIGHTSTAYS ON - CONTINUED



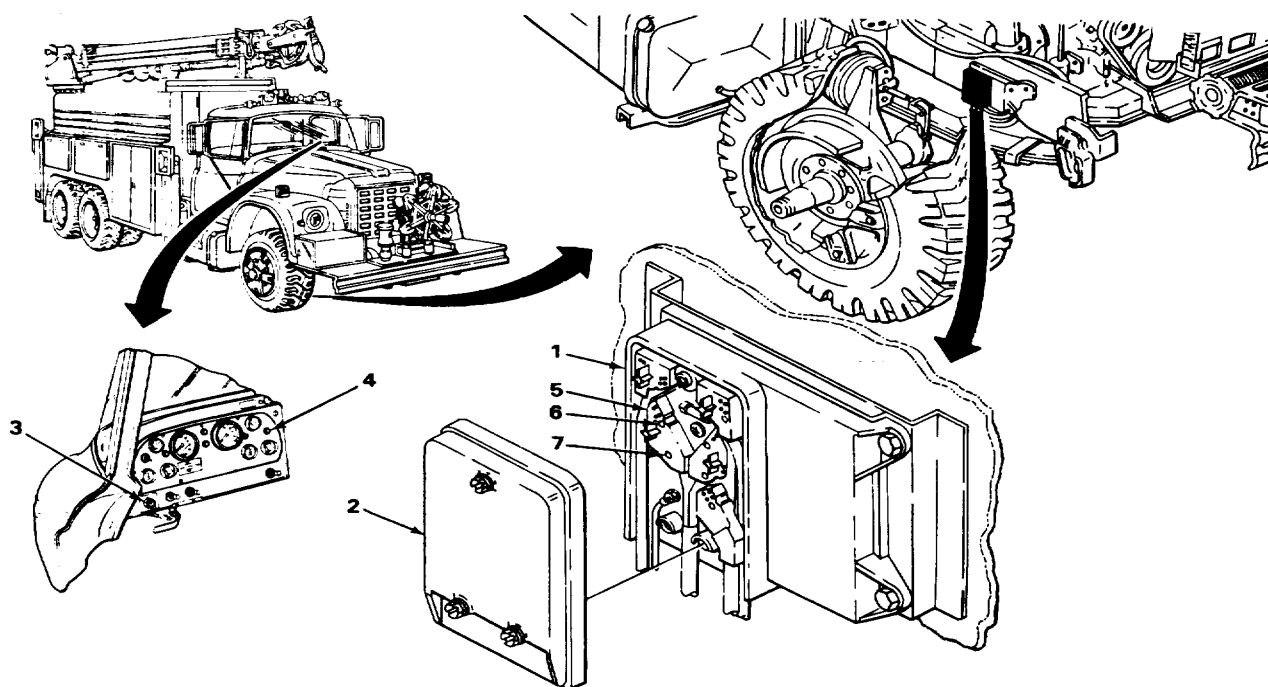
TROUBLESHOOTING - CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

20. MONITOR LIGHT STAYS ON - CONTINUED

Step 10. Test front axle computer module (1).

- a. Remove cover (2) from front axle computer module (1) using flat-tip screwdriver.
- b. Have assistant turn key switch (3) on, and check monitor light (4).
- c. Take connector (5) off terminal (6) and F2 terminal (7). Put connector (5) back on terminals (5) and (6). Have assistant turn key switch (3) off.
- d. If monitor light (4) did not go off, repair or replace wiring from monitor light (4) to computer module (1) as needed using applicable maintenance procedure.
- e. If monitor light (4) went off, replace computer module (1) (page 2-498).
- f. Install cover (2) using flat-tip screwdriver.



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

21. MONITOR LIGHT COMES ON AT SPEEDS OVER 15 MPH

Step 1. Locate faulty signal.

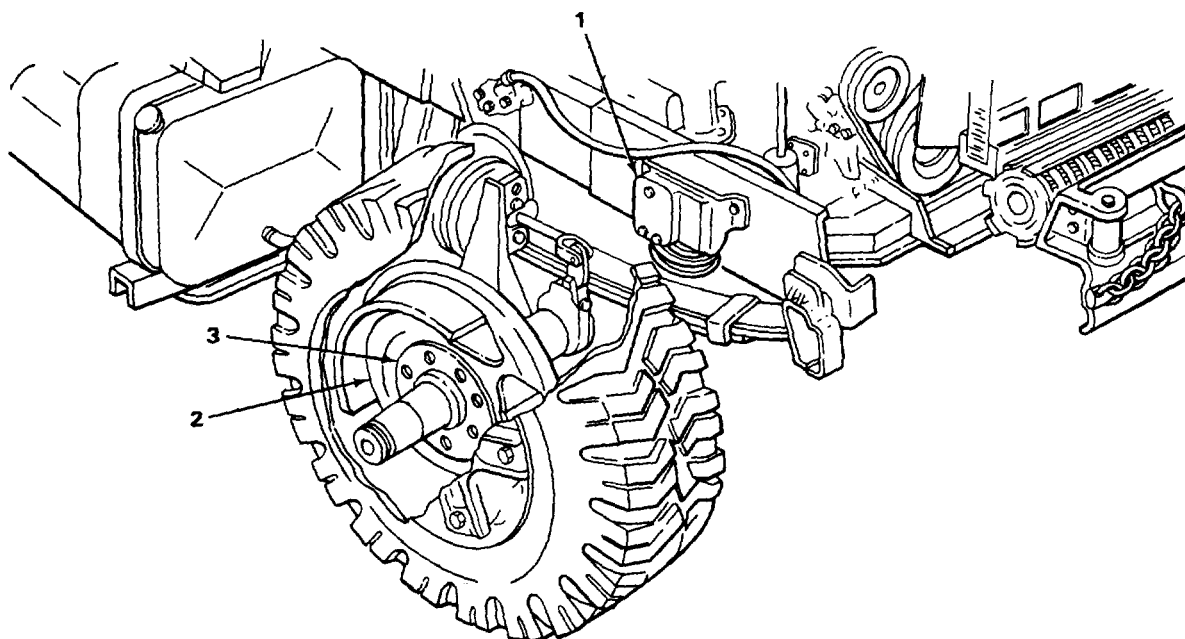
Go to step 1 of MONITOR LIGHT DELAYED - TRUCK NOT MOVING (page 2-26), and find computer module (1) sending faulty signal.

Step 2. Inspect brake assembly (2) for binding.

Inspect brake assembly (2) for computer module (1) sending faulty signal, and repair as needed (TM 9-2320-269-20-1).

Step 3. Inspect wheel bearing (3) adjustment.

Inspect wheel bearings (3) for computer module (1) sending faulty signal, and adjust or replace as needed (TM 9-2320-269-20-1).



TROUBLESHOOTING - CONTINUED

MALFUNCTION	
TEST OR INSPECTION	
CORRECTIVE ACTION	

21. MONITOR LIGHT COMES ON AT SPEEDS OVER 15 MPH - CONTINUED

Step 4. Test sensor (1) voltage.

- a. Remove cover (2) from computer module (3) sending faulty signal using flat-tip screwdriver.

WARNING

It is very important that the vehicle is firmly supported and balanced before you begin to maintain the front axle. If the truck is not properly supported with trestles, it could fall and crush you.

- b. Raise axle (4) using dolly jack, support with trestles, and loosen slack adjuster (5) using 9116-inch socket and ratchet handle with 3/8-inch drive.
- c. Connect voltmeter set on ac scale to sensor terminals (6) as shown, spin tire (7) for sensor (1) being tested, and check meter reading. Disconnect meter, repeat for remaining sensor terminals (8) and front tire. Disconnect meter. If both meter readings were at least 0.3 volts, replace computer module (3) (page 2-498).
- d. Remove trestles and dolly jack.

Step 5. Test sensor wires (9) for short circuit.

- a. Take connector (10) off sensor terminals (6) for sensor (1) with faulty signal.
- b. Connect ohmmeter to sensor terminals (6) as shown, check reading, and disconnect.
- c. Connect ohmmeter to terminal (6) and frame (11), check meter reading, and disconnect.
- d. If meter readings were lower than 4000 - 6000 ohms for step b or 10,000 ohms for step c, inspect wires (9) and repair or replace as needed (page 2-498).
- e. If meter readings were 4000 - 6000 ohms for step b and 10,000 ohms for step c, replace sensor (1) (TM 9-2320-269-20-2).
- f. Put connector (10) on, install cover (2) using flat-tip screwdriver, and adjust brakes (12) and sensor (1) (TM 9-2320-269-20-2).

TROUBLESHOOTING - CONTINUED

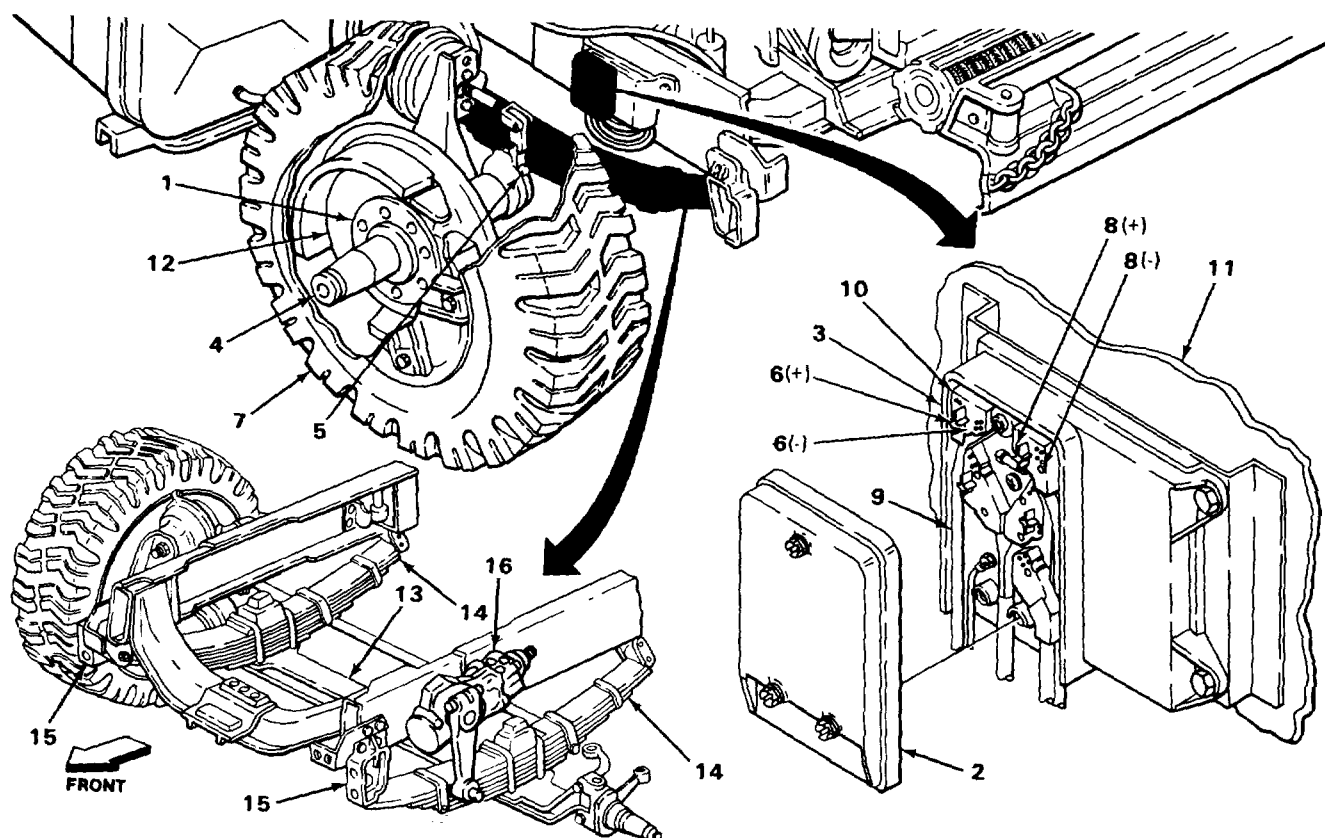
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

STEERING SYSTEM

22. FRONT WHEEL SHIMMY OR WANDER

Step 1. Check front axle (13) for loose and broken components.

- a. If springs (14) or seats (15) are loose or broken, tighten or replace as needed (page 2-819).
- b. If steering gear (16) is loose, broken, or shows signs of leakage, tighten, repair, or replace as needed (page 2-1067).



TROUBLESHOOTING - CONTINUED

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

22. FRONT WHEEL SHIMMY OR WANDER - CONTINUED

Step 2. Test steering knuckle bushings (1).

- a. Lift front axle (2) using dolly Jack, and support with trestles.
- b. Install camber gage on front wheel (3), and have assistant apply brakes.
- c. Rock wheel (3) in and out, check gage reading, have assistant release brakes, and remove camber gage.
- d. Repeat steps b and c for opposite front wheel (4).
- e. If gage reading changed more than one-quarter degree, replace bushings (1) or kingpins (5) as needed (page 2-819).
- f. Lift front axle (2) using dolly jack, remove trestles, and lower axle (2).

Step 3. Adjust steering gear (6) (page 2-1067).

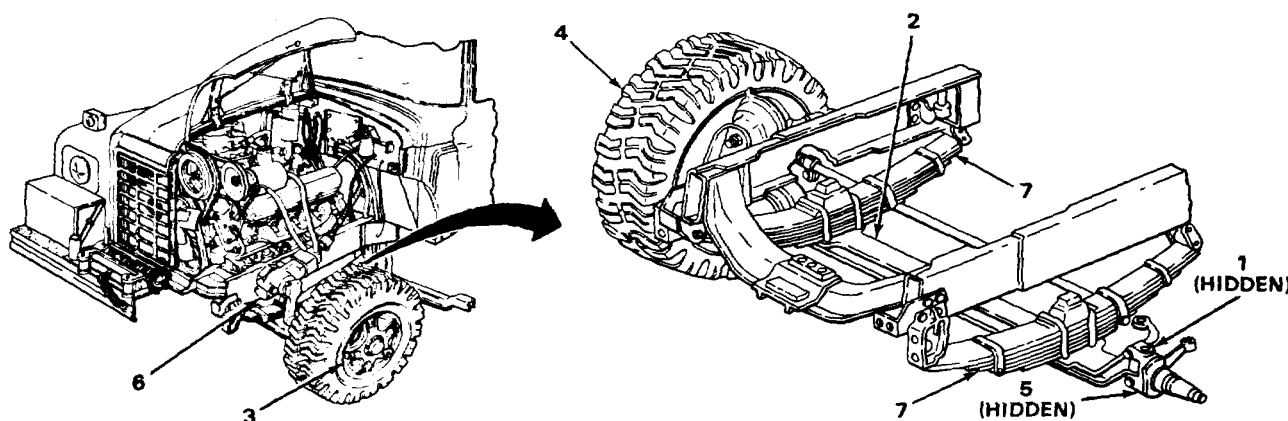
Step 4. Inspect steering gear (6).

Repair or replace as needed (page 2-1067).

Step 5. Replace front springs (7) (page 2-819).

23. PULLS OR WILL NOT RECOVER FROM TURNS

Check front axle (2) and components (see FRONT WHEEL SHIMMY OR WANDER, page 2-37).



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

WINCHES

NOTE

There are three winches; front winch, body winch, and turret winch. The trouble-shooting procedure is similar for all three.

24. OPERATE IMPROPERLY - SLOW, JERKY, OR NOT AT ALL

Step 1. Check low hydraulic pressure.

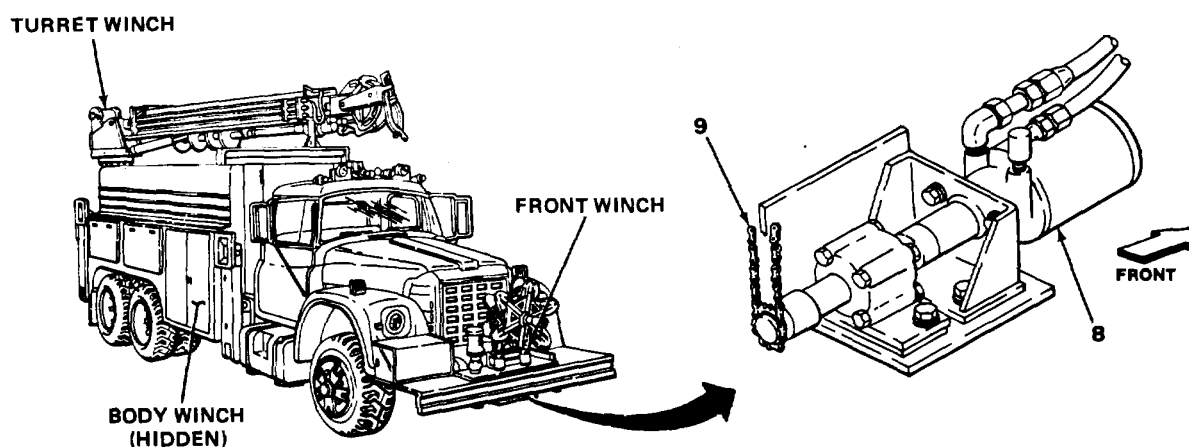
See HYDRAULIC SYSTEM - LOW OR NO PRESSURE (page 2-44).

Step 2. Check winch controls.

See WINCH CONTROLS DO NOT OPERATE (page 2-40).

Step 3. Check operation of winch motor (8).

- a. Engage power takeoff, start engine, and turn on winch motor (8) (TM 9-2320-269-10).
- b. Check operation of winch motor (8) (TM 9-2320-269-10).
- c. Turn winch motor (8) off, shut off engine, and disengage power takeoff (TM 9-2320-269-10).
- d. If motor shaft (9) did not turn or turned unevenly, replace winch motor (8) (page 2-1439, 2-1444, or 2-1451).



TROUBLESHOOTING - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

24. OPERATE IMPROPERLY - SLOW, JERKY, OR NOT AT ALL - CONTINUED

Step 4. Inspect winch drain (1) and clutch (2).

- a. Remove winch (3) (page 2-1785, 2-1831, or 2-1815).
- b. Disassemble and repair, or replace parts as needed.
- c. Install winch (3) (page 2-1785, 2-1831, or 2-1815).

25. OPERATE NOISILY - KNOCK, WHINE, OR GRIND

Inspect winch (3).

- a. Remove winch (3) (page 2-1785, 2-1831, or 2-1815).
- b. Disassemble, and repair or replace as needed.
- c. Install winch (3) (page 2-1785, 2-1831, or 2-1815).

26. WINCH CONTROLS DO NOT OPERATE

Step 1. Check winch controls (4) and motor controls (5).

- a. Move controls (4) or (5) and check for loose, broken, and binding parts.
- b. Tighten, or replace as needed using applicable maintenance procedure.
- c. Lubricate (LO 9-2320-269-12).

Step 2. Test hydraulic system pressure (TM 9-2320-269-20-2).

If pressure is low, see HYDRAULIC SYSTEM - LOW OR NO PRESSURE (page 2-44).

Step 3. Test control valve (6) pressure.

- a. Find hydraulic lines from control valve (6) to faulty winch (3).
- b. Remove control valve outlet line (7) using applicable maintenance procedure, and install in line pressure gage.

TROUBLESHOOTING - CONTINUED

MALFUNCTION

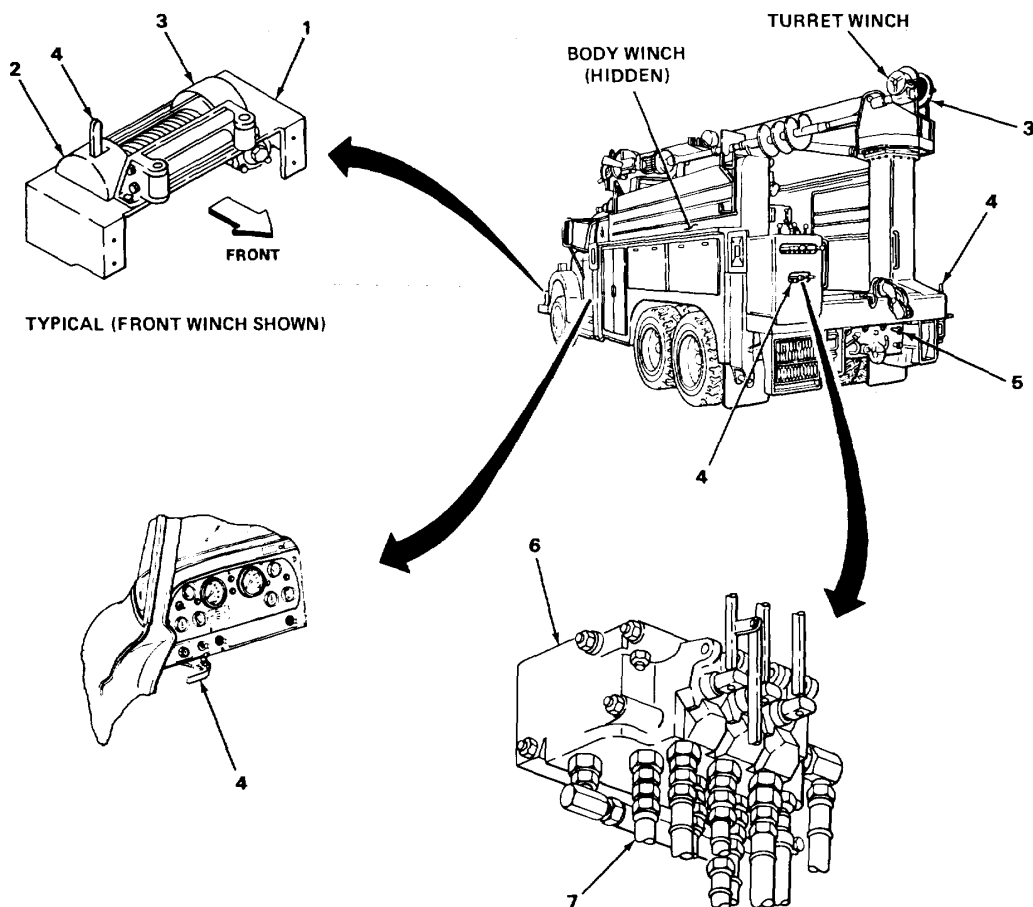
TEST OR INSPECTION

CORRECTIVE ACTION

26. WINCH CONTROLS DO NOT OPERATE - CONTINUED

Step 3. Test control valve (6) pressure - Continued

- c. Engage power takeoff, start engine, and operate control valve (6) (TM 9-2320-269-10).
- d. Check gage reading, shut off engine, and disengage power takeoff (TM 9-2320-269-10).
- e. If gage reading was not 2800 ± 50 psi (19360 ± 344 kPa) repair or replace control valve (6) as needed using applicable maintenance procedure.



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TROUBLESHOOTING - CONTINUED

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

HYDRAULIC SYSTEM

27. DERRICK WILL NOT RAISE OR HOLD LOAD

Step 1. Test main hydraulic pressure (TM 9-2320-269-20-2).

If pressure is low, see LOW OR NO PRESSURE (page 2-44).

Step 2. Test derrick controls (1).

See step 3 of WINCH CONTROLS DO NOT OPERATE (page 2-40).

Step 3. Inspect elevation cylinder (2).

Remove elevation cylinder (2) (TM 9-2320-269-20-2), disassemble, and inspect. Repair or replace as needed, and install (page 2-1591).

28. DERRICK WILL NOT LOWER

See DERRICK WILL NOT RAISE OR HOLD LOAD (above).

29. OUTRIGGERS OPERATE IMPROPERLY - JERKY, WILL NOT HOLD, OR NOT AT ALL

Step 1. Test main hydraulic pressure (TM 9-2320-269-20).

If pressure is low, see LOW OR NO PRESSURE (page 2-44).

Step 2. Test outrigger controls (3).

See step 3 of WINCH CONTROLS DO NOT OPERATE (page 2-40).

TROUBLESHOOTING - CONTINUED

MALFUNCTION

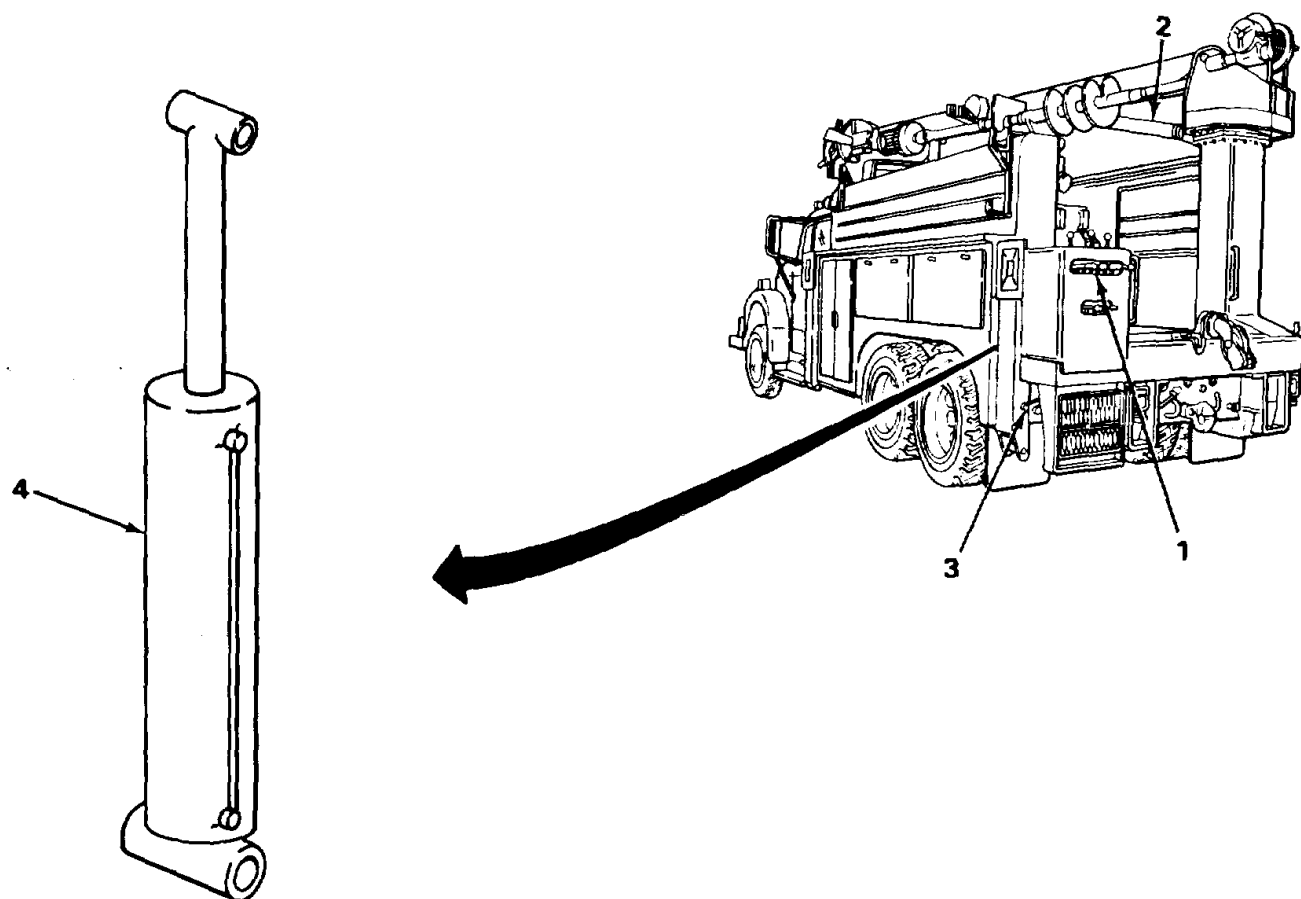
TEST OR INSPECTION

CORRECTIVE ACTION

29. OUTRIGGERS OPERATE IMPROPERLY - JERKY, WILL NOT HOLD, OR NOT AT ALL - CONTINUED

Step 3. Inspect outrigger hydraulic cylinder (4).

Remove cylinder (4), disassemble, and inspect. Repair or replace as needed, and install (page 2-1561).



TROUBLESHOOTING - CONTINUED

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

30. LOW OR NO PRESSURE

Step 1. Check power takeoff (1) operation.

- a. Have assistant engage power takeoff (1), and start engine (TM 9-2320-269-10).
- b. Check operation of power takeoff drive shaft (2).
- c. Have assistant shut engine off, and disengage power takeoff (1) (TM 9-2320-269-10).
- d. If drive shaft (2) did not turn, remove (page 2-1735), and repair or replace as needed. Repeat steps a thru c, and check operation of power takeoff output shaft (3).
- e. If output shaft (3) did not turn, check for broken cable (4). Replace as needed (TM 9-2320-269-20-2), or remove power takeoff (1). Repair or replace as needed (page 2-1719).
- f. If output shaft (3) turned, remove hydraulic pump (5), and repair or replace as needed (page 2-1401).
- g. Install power takeoff drive shaft (2) (page 2-1735).

Step 2. Check hydraulic pump (5) for loose parts, damage, and leakage.

- a. If pump (5) is loose, damaged or leaking, tighten, repair or replace as needed (page 2-1401).
- b. If lines (6 and 7) are damaged, replace (TM 9-2320-269-20-2).

Step 3. Check intake line (7) for blockage.

- a. Remove line (7) using 3/4-inch open-end wrench and check for dirt and debris.
- b. Clean out or replace as needed, and install using 3/4-inch open-end wrench.

Step 4. Check in-tank filter (8) for dirt.

- a. Remove filter (8) (TM 9-2320-269-20-2), and clean or replace as needed.
- b. Install filter (8) (TM 9-2320-269-20-2).

TROUBLESHOOTING - CONTINUED

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

30. LOW OR NO PRESSURE - CONTINUED

Step 5. Check hydraulic oil for dirt and viscosity.

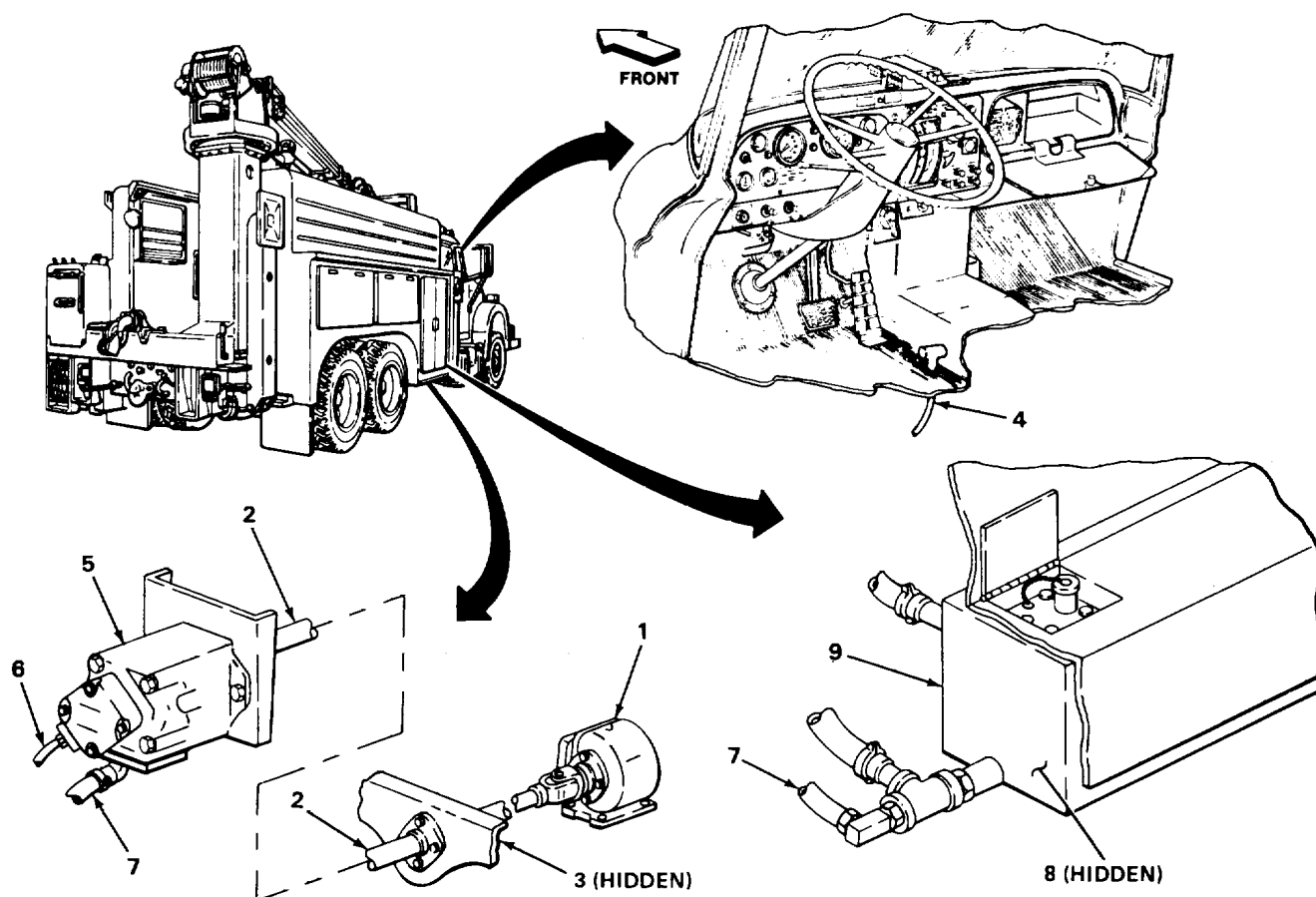
a. If intake line (7) or in-tank filter (8) were dirty, or if hydraulic oil is dirty or thick, drain tank (9) (TM 9-2320-269-20-2).

b. Fill tank (9) with fresh hydraulic oil (LO 9-2320-269-12).

Step 6. Inspect hydraulic pump (5).

a. Remove pump (5), and disassemble (page 2-1401).

b. Inspect pump (5), repair or replace as needed, and install (page 2-1401).



Section III. GENERAL MAINTENANCE INSTRUCTIONS

	Page		Page
Cleaning	2-46	Preshop Analysis	2-46
Fluid Disposal	2-50	Repair.....	2-48
Inspection	2-47	Work Safety	2-46

PRESHOP ANALYSIS

The purpose of preshop analysis is to find out how much repair, modification, or replacement is needed to fix the equipment as outlined in this manual. Sometimes the reason for equipment failure can be seen right away, and therefore complete teardown is not necessary for repair. Disassemble equipment only as far as necessary to repair or replace broken parts.

All tags and forms attached to the equipment must be checked to find the reason for removal from service. Also, check all Modification Work Orders (MWO) and Technical Bulletins (TB) for equipment changes and updates.

In some cases, you may damage a part just by removing it. If the part appears to be good, and you are sure parts behind it are not defective, leave it in place and continue with the procedure. Here are a few simple rules:

1. Don't remove dowel pins unless bent, broken, or damaged.
2. Don't pull off bearings or bushings unless they are defective. If you have to get at parts behind bearings or bushings, use the proper tool for the job, and pull off very carefully.
3. Replace all cotter pins, gaskets, lockwashers, locknuts, oil seals, and preformed packings.

WORK SAFETY

Before you start a task, think about the risks and hazards to your personal safety and to others. Wear protective gear such as safety goggles or lenses, safety shoes, hard hat, rubber apron, or gloves.

When lifting heavy parts, have someone help you. Make sure that lifting equipment or Jacking tools are working properly, that they meet the weight requirement of the part to be lifted, and that they are securely fastened to the part.

Always use power tools carefully.

Observe all WARNINGS, CAUTIONS, and NOTES found in this manual.

CLEANING

All parts must be cleaned before inspection and assembly and after repair. If a part is removed from the truck, wipe away grease and grime before removal so that debris will not fall into other parts.

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

CLEANING - CONTINUED

Clean inner and outer surfaces of metallic parts that get greasy and oily with drycleaning solvent, Type II (SD-2) Fed Spec PD-680. Clean out sludge and gummy deposits on metal parts with a stiff brush and drycleaning solvents. Small metal parts should be placed in a wire mesh basket before immersing them in drycleaning solvent. For stubborn grease and dirt buildup on metal parts, steam clean. Clean off rust with a wire brush or abrasive cloth, then clean again in drycleaning solvent.

Dry metal parts with clean, dry rags.

Use clean, soapy water to clean rubber or plastic parts. Do not use solvent. Dry parts with clean, dry rags.

WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

Use a clean rag dampened in drycleaning solvent to clean metal parts for electrical components. Do not dip electrical parts or components in solvent. Clean rust off electrical connectors with small wire brush or abrasive cloth. Use low-pressure compressed air to blow away rust particles on electrical parts. Clean off solder with soldering iron.

Delicate engine parts and parts for the hydraulic system must be cleaned and dried with special care so that metal or fiber particles cannot contaminate engine or hydraulic fluid.

Do not clean bearings in drycleaning solvent. Refer to TM 9-214 for procedures for cleaning and inspecting antifriction bearings.

After cleaning, cover parts to protect from dust and dirt.

Additional information on cleaning procedures can be found in these manuals:

TM 9-247 - Materials for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials, including Chemicals.

TB 750-1047 - Elimination of Combustibles from Interiors and Metal or Plastic Gasoline and Diesel Fuel Tanks.

INSPECTION

The reason for parts inspection is to find out which parts can be used and which must be replaced.

Specifications and tolerances are given in this manual, but sometimes you, the inspector, must decide which parts should be replaced.

To find out if you can use a part that is otherwise in good condition, check the clearance between mating surfaces. If clearance is within given tolerance, reinstall the part.

Look carefully at machined surfaces and polished areas. Use a bright light to shine across surfaces to check for score marks, cracks, breaks, and excessive wear.

Inspect gears for cracked, nicked, and chipped teeth. Look for metal-to-metal abrasion, pitting, and wear. When a gear is found to be defective, replace it and mating gear.

Many service replacement parts are available in various undersize and/or oversize, as well as standard sizes. Also, service kit for reconditioning certain parts and service sets which include all of the parts necessary to complete a task are available (i.e., steering shaft universal joint kit).

REPAIR Bearing clearance: A strip of soft plastic squeezed between crankshaft journal and connecting rod bearing or main bearing may be used to measure bearing clearance.

The strip is a specially molded plastic "wire" and is available in three sizes and colors. Type PG-1 (green) has a clearance range of 0.001 to 0.003-inch (0.025 to 0.76 millimeter). Type PR-1 (red) has a range of 0.002 to 0.006-inch (0.050 to 0.152 millimeter), and Type PB-1 (blue) has a range of 0.004 to 0.009-inch (0.101 to 0.228 millimeter).

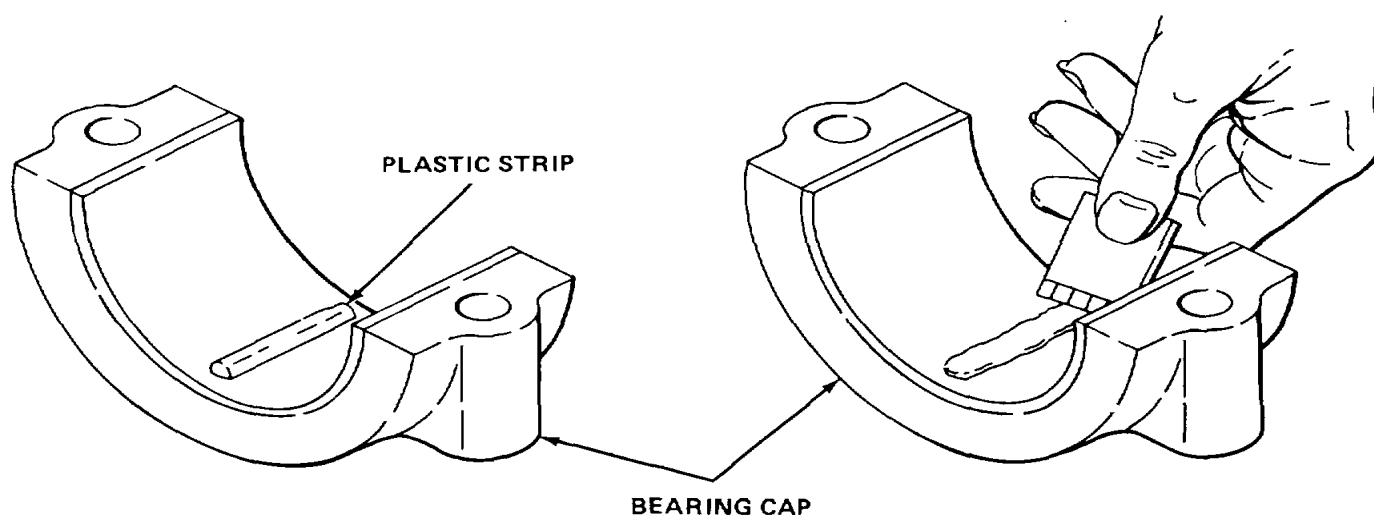
Check bearing clearance as follows:

- a. Remove bearing cap, and wipe off oil from bearing shell and crankshaft journal.

NOTE

When checking main bearing clearances with engine in a position where main bearing caps are supporting weight of crankshaft and flywheel, a bad reading may result because of weight of crankshaft and flywheel. Support weight by using a jack under counterweight, next to the bearing being checked.

- b. Put a piece of plastic strip the full width of the bearing shell, about 1/4-inch (6.35 millimeter), off center.
- c. Rotate crankshaft about 300 from bottom dead center and install bearing cap. Tighten screws to specified torque.
- d. Take off bearing shell. Flattened plastic strip will stick to either the bearing shell or crankshaft.
- e. Compare width of flattened strip at its widest point, with graduation on envelope. The number within the graduation on the envelope will indicate the bearing clearance in thousandths of an inch. Taper may indicate when one end of flattened strip is wider than the other. Measure each end of plastic; the difference between readings is the approximate amount of taper.



REPAIR - CONTINUED

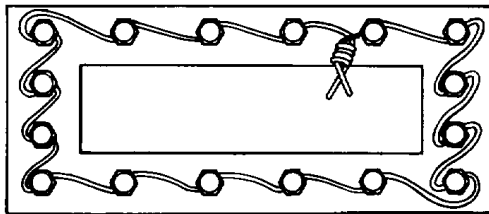
Bonding: To bond parts that use sealing compound, clean and degrease mating surfaces with trichloroethane. Apply a thin coat of primer, if necessary, and let dry. Put on only enough sealing compound to fill the space between the surfaces to be mated, and install. Wipe away any extra compound with clean, dry rags and allow time for bond to cure.

Air-dry cure time, at room temperature 72°F (22°C), is printed on sealant container label. Bond cure time increases at lower temperatures. Bond cure time decreases at higher temperature.

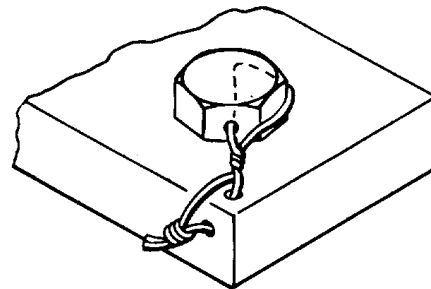
Lockwire: Always use new lockwire. Three screws are the maximum number that may be wired in series when screws are placed 4 to 6 inches apart (102 to 152 millimeters). When lockwiring closely spaced multiple groups of screws, the maximum number that may be lockwired together is limited to the number that can be wired with a 24-inch (620 millimeter) length of wire.

NOTE

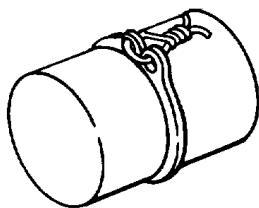
Drilled head screws do not usually need lockwire if installed with self-locking nuts or lockwashers.



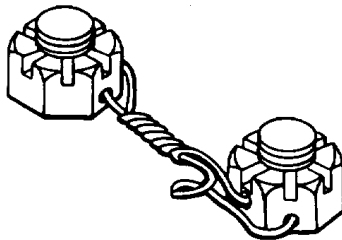
**SMALL SCREWS IN CLOSELY
SPACED, CLOSED GEOMETRICAL
PATTERN SINGLE WIRE METHOD**



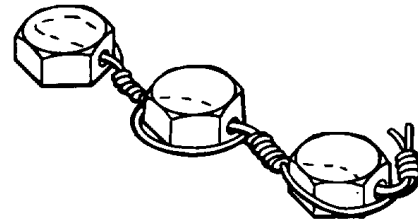
**SINGLE FASTENER APPLICATION
DOUBLE-TWIST METHOD**



**EXTERNAL SNAP RING
SINGLE-WIRE METHOD**



**CASTELLATED NUTS
ON UNDRILLED STUDS
DOUBLE-TWIST METHOD**



**MULTIPLE FASTENER APPLICATION
DOUBLE-TWIST METHOD**

REPAIR - CONTINUED

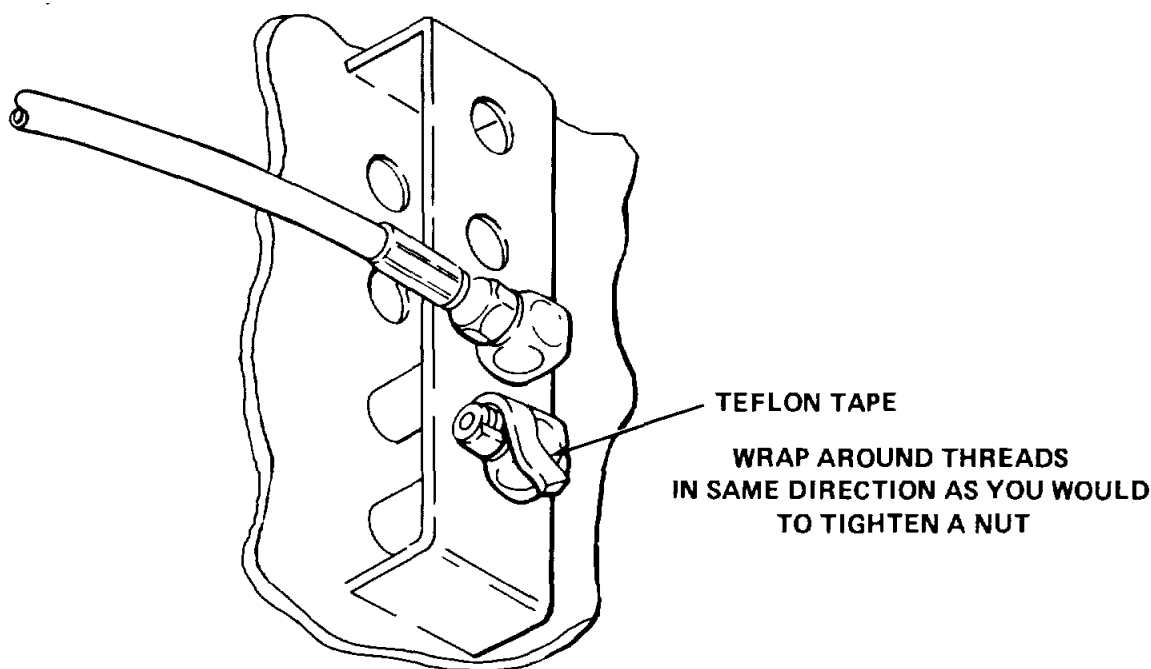
Painting: Refer to TM 43-0139.

Soldering: Solder connections must be bright and clean before soldering. Take off dirt and grease with cleaning compound MIL-C-81302 and small, stiff-fiber brush. Solder must be nonacid type (SN60 per QQ-S-571). Rosin flux, O-F-506, Type 1, Form A, can be used. All wires, parts, and solder Iron must be pretinned for good connection and maximum transfer of heat. Clean all solder joints with acid swabbing brush and cleaning compound after soldering to get a bright and clean surface.

Teflon Tape: Be sure threads are clean and dry. Start tape one or two threads from small or leading edge of plug or screw. Joining tape together with an overlap about 1/8-inch (3.18 millimeters). For coarse threads, tape may be wrapped around two or three times.

Wrap tape tightly in the same direction as you would turn a nut. Press tape into the threads without cutting or tearing the tape.

Hand tighten and hand torque the plug or screw. DO NOT go over specified torque. DO NOT use power tools.



FLUID DISPOSAL

Get rid of fluids in accordance with your unit's Standard Operating Procedures (SOP).

Section IV. ENGINE

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Camshaft Bearings	2-190	Engine Seals	2-51
Crankshaft and Camshaft Timing		Exhaust Manifolds	-232
Gears	2-193	Flywheel	2-134
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Engine Oil Pan	2-203		

ENGINE ASSEMBLY REBUILD

This task covers:

General Information (page 2-51)

GENERAL INFORMATION

An engine assembly rebuild consists of the performance of all applicable maintenance tasks which will return the engine assembly to like-new condition in accordance with original manufacturing standards. For listing of manufacturer's dimensions and tolerances, go to page 1-6.

TASK ENDS HERE

ENGINE SEALS

This task covers:

General Information (page 2-51)

GENERAL INFORMATION

In this manual, engine assembly seals are covered with the parts to which they are most closely related. For information on an individual seal, go to the maintenance paragraph that covers the part to which the particular seal is installed.

TASK ENDS HERE

ENGINE ASSEMBLY

This task covers:

a. Removal (page 2-53)	c. Couple (page 2-68)
b. Uncouple (page 2-66)	d. Installation (page 2-70)
-

INITIAL SETUP

Tools

Driftpin, brass, 1/4-inch
 Driftpin, brass, 1/2-inch
 Extension, 1/2-inch drive, 3-inch
 Extension, 1/2-inch drive, 6-inch
 Hammer, ball-peen, machinist's, 2-lb
 Handle, ratchet, 3/8-inch drive
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Hoist with lifting slings
 Pail, utility
 Pallet, wooden, 4 ft x 4 ft
 Plates, lifting (Manufactured Items
 List, appendix C) (two required)
 Pliers, diagonal cutting
 Pliers, slip-joint, angle-nose
 Screwdriver, cross-tip, number two
 Screwdriver, flat-tip, 1/4-inch
 Socket, 3/8-inch drive, 7/16-inch
 Socket, 3/8-inch drive, 1/2-inch
 Socket, 3/8-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 11/2-inch drive, 3/4-inch
 Socket, 1/2-inch drive, 15/16-inch
 Socket, 3/4-inch drive, 2-inch
 Socket, deep well, 1/2-inch drive,
 9/16-inch
 Stand, engine overhaul
 Trestle, motor vehicle, 2-ton
 Wrench, open-end, 1/4-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 1/2-inch
 Wrench, open-end, 5/8-inch
 Wrench, open-end, 7/16-inch
 (two required)
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 3/4-inch
 Wrench, open-end, 7/8-inch
 Wrench, open-end, 15/16-inch
 Wrench, open-end, 1-inch
 (two required)
 Wrench, open-end, 1 11/16-inch

Materials/Parts - Continued

Cotter pin, yoke and clevis
 Gasket, transmission to flywheel housing
 Lockwasher, accelerator cable bracket
 Lockwasher, cable clamp
 Lockwasher, hand hole cover
 Lockwasher, rear engine mount (two required)
 Lockwasher, solenoid
 Lockwasher, wire clamp bracket
 Lockwasher, side engine mounting brackets
 (two required)
 Lockwire (item 26, appendix B)
 Oil, engine (item 32, appendix B)
 Rags, wiping (item 42, appendix B)
 Seals, exhaust pipe (two required)
 Tag, marking (item 50, appendix B)

Personnel Required

One

Equipment Condition

Tachometer adapter and cable removed
 (TM 9-2320-269-20-2).
 Oil pressure lockout switch removed
 (TM 9-2320-269-20-1).
 Winch, winch support, and bumper assembly
 removed (TM 9-2320-269-20-2).
 Fenders, radiator, and grille assembly
 removed (TM 9-2320-269-20-2).
 Engine and transmission cover removed
 (TM 9-2320-269-20-2).
 Air cleaner removed (TM 9-2320-269-20-1).
 Thermostats removed (TM 9-2320-269-20-1).
 Fuel shutoff cable removed
 (TM 9-2320-269-20-1).
 Crankcase drained (LO 9-2320-269-12).
 Transmission-to-center bearing flange re-
 moved (TM 9-2320-269-20-1).
 Air reservoir tanks drained
 (TM 9-2320-269-20-1).

ENGINE ASSEMBLY - CONTINUED

INITIAL SETUP - Continued

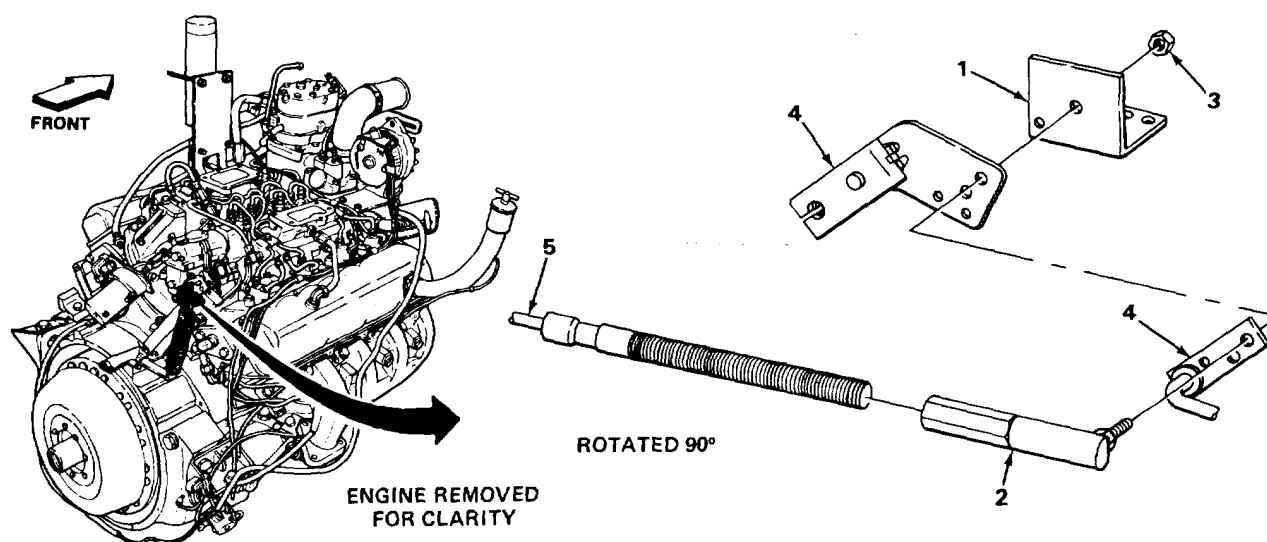
Tools - Continued

Wrench, torque, 1/2-inch drive

Equipment Condition - Continued

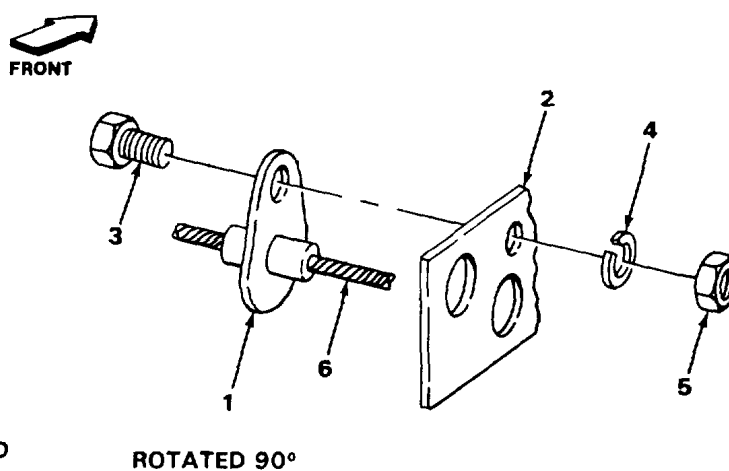
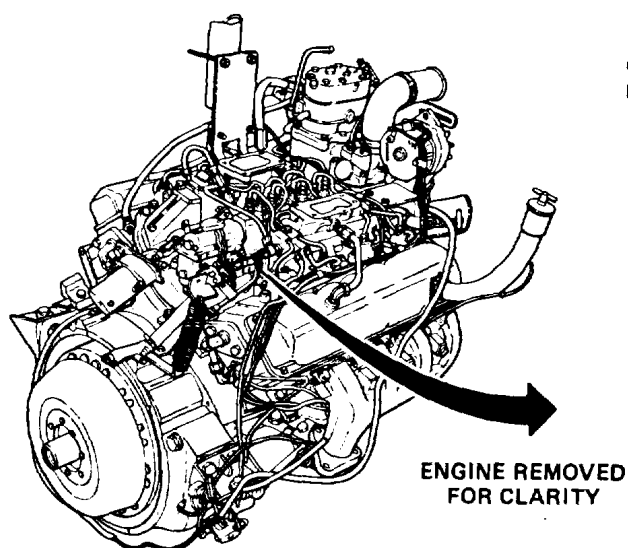
Throttle slave cylinder removed (page 2-1649).
 Emergency stop solenoid removed
 (TM 9-2320-269-10-1).
 Secondary fuel filter head removed
 (page 2-361).
 Primary filter to secondary filter fuel line
 removed (TM 9-2320-269-20-1).
 Engine wiring harness removed (page 2-470).
 Transmission oil level gage and tube removed
 (TM 9-2320-267-20-1).
 Air compressor governor removed
 (TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION REMARKS
REMOVAL		
1. Bracket (1) and ball joint (2)	Nut (3)	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take off.
2. Bracket (1)	Ball joint (2) and two plates (4)	Take out.
3. Accelerator cable (5)	Ball joint (2)	Using 3/8-inch open-end wrench, unscrew and take off.



ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
4. Accelerator cable bracket (1) and bracket (2)	Screw (3), lock-washer (4), and nut (5)	a. Using two 7/16-inch open-end wrenches, unscrew and take out. b. Get rid of lockwasher (4).
5. Bracket (2)	Accelerator	Pull through and move out of the way.

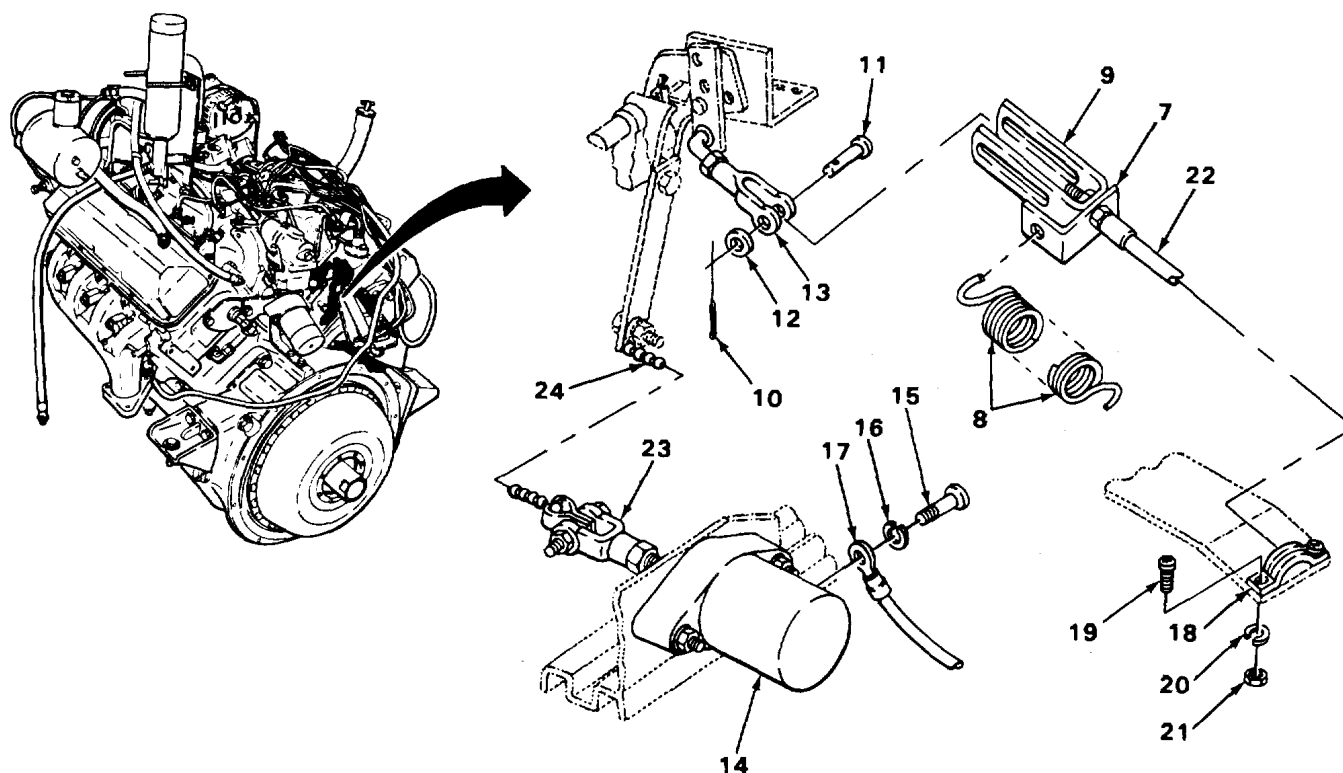


6. Clevis bracket (7) Spring (8)	Using angle-nose slip-joint pliers, take off.
7. Clevis (9)	Cotter pin (10), pin (11), and three washers (12) a. Using angle-nose slip-joint pliers, straighten pin (10) and pull out. b. Get rid of cotter pin (10). c. Pull out pin (11) and washers (12).
8. Yoke (13)	Clevis (9) Move away from.

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ENGINE ASSEMBLY - CONTINUED

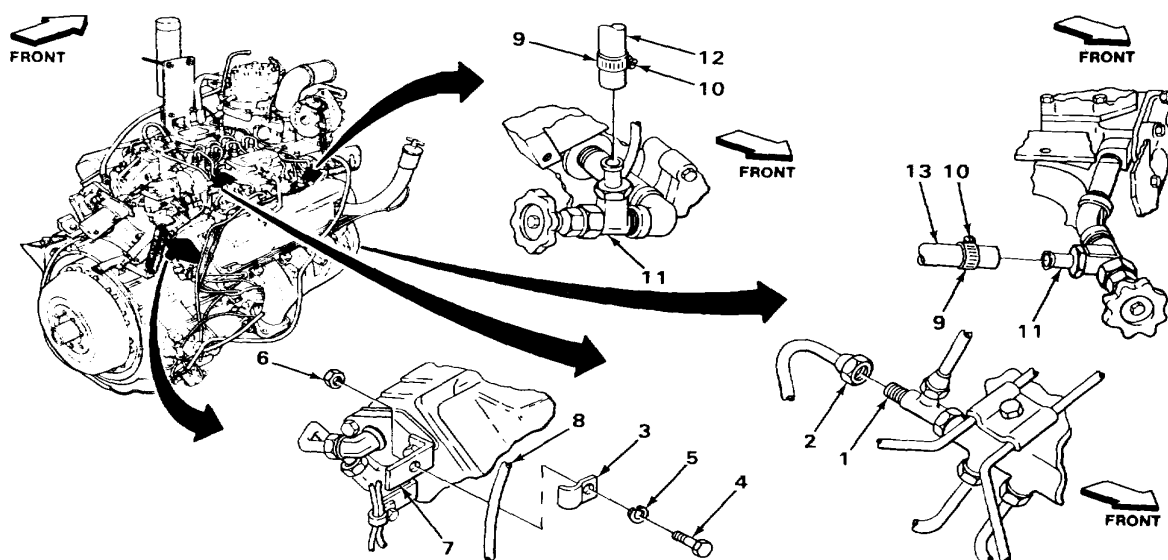
LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
9. Solenoid (14)	Screw (15), lock-washer (16), and wire (17) c.	a. Using 1/4-inch flat-tip screwdriver, unscrew and take out. b. Tag wire (17). Get rid of lockwasher (16).
10 . Cable clamp (18)	Screw (19), lock-washer (20), and nut (21)	a. Using 3/8-inch open-end wrench and cross-tip screwdriver, unscrew and take off. b. Get rid of lockwasher (20).
11.	Cable (22)	Move away from.
12. Chain connector (23)	Chain (24)	Take off.



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ENGINE ASSEMBLY - CONTINUED

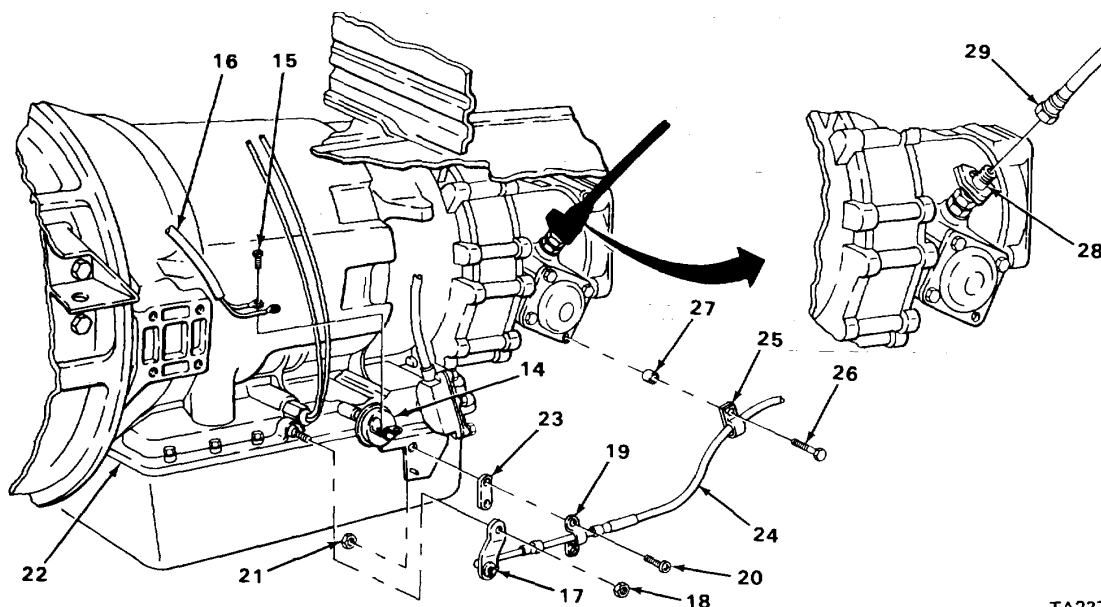
LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
13. Fuel return pipe tee (1)	Tee-to-side member pipe (2)	a. Put pail underneath to catch draining fluid. b. Using 5/8-inch open-end wrench, unscrew and take off. c. Allow fluid to drain. d. Tag pipe(2). e. Get rid of fluid (page 2-46).
14. Clamp (3)	Screw (4), lock-washer (5), and nut (6)	a. Using two 7/16-inch open-end wrenches, unscrew and take off. b. Get rid of lockwasher (5).
15. Bracket (7)	Clamp (3) and wires (8)	Move away from.
16. Two clamps (9)	Two screws (10)	Using 1/4-inch flat-tip screwdriver, unscrew and loosen.
17. Two connectors (11)	Two clamps (9), inlet hose (12), and heater return hose (13)	a. Slide clamps (9) down on hoses (12) and (13). b. Twist hoses (12) and (13) to break free and take off. c. Tag hoses (12) and (13).



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ENGINE ASSEMBLY - CONTINUED

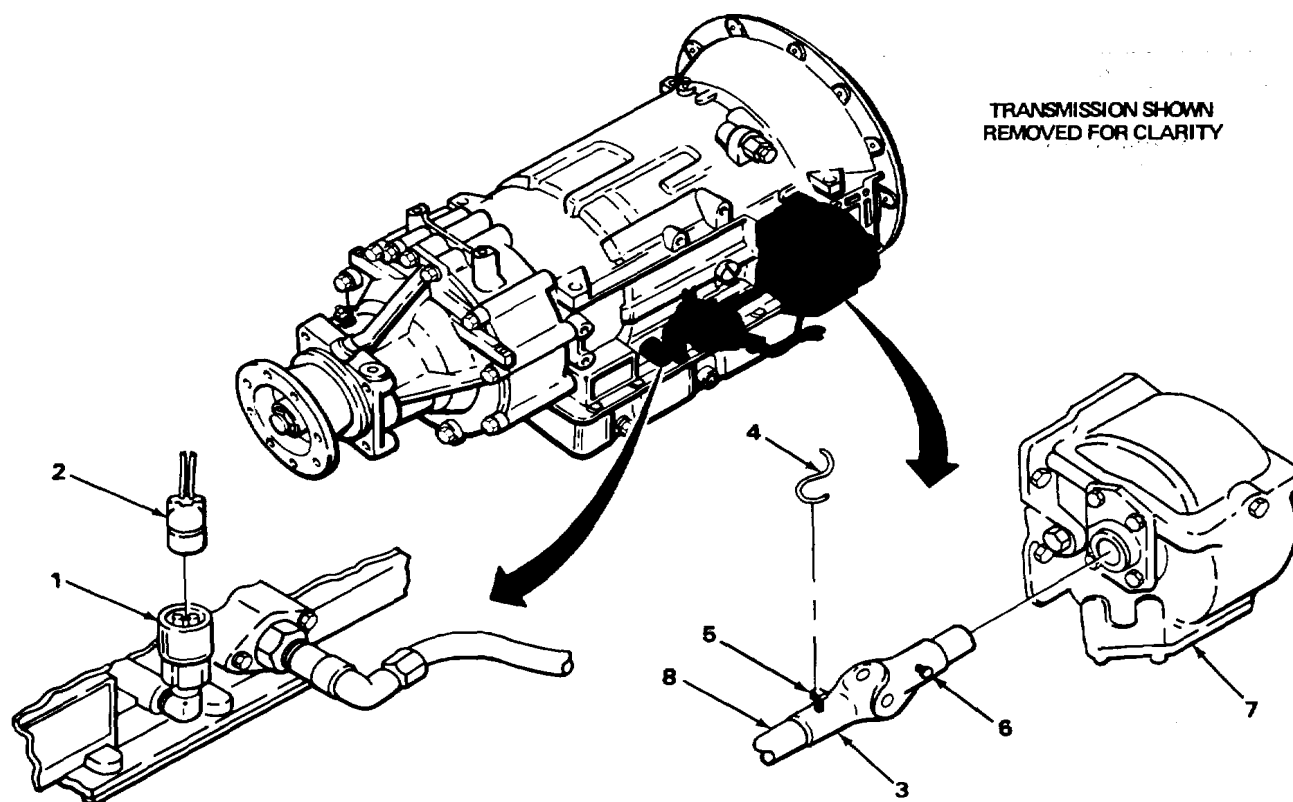
LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
18. Oil temperature sending unit (14)	Two screws (15) and wires (16)	a. Using 1/4-inch flat-tip screwdriver, unscrew and take off. b. Tag wires (16).
19. Shift lever (17)	Nut (18)	Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take off.
20. Cable clamp (19)	Two screws (20) and nuts (21)	Using 3/8-inch open-end wrench and number two cross-tip screwdriver, unscrew and take out.
21. Transmission assembly (22)	Cable clamp (19), cable clamp bar (23), and cable (24)	Move away from.
22. Cable clamp (25)	Screw (26) and spacer (27)	Using 1/2-inch open-end wrench, unscrew and take out.
23. Transmission assembly (22)	Cable clamp (25) with cable (24)	Move away from.
24. Speedometer cable adapter (28)	Speedometer cable (29)	Using two 1-inch open-end wrenches, unscrew and take off.



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ENGINE ASSEMBLY - CONTINUED

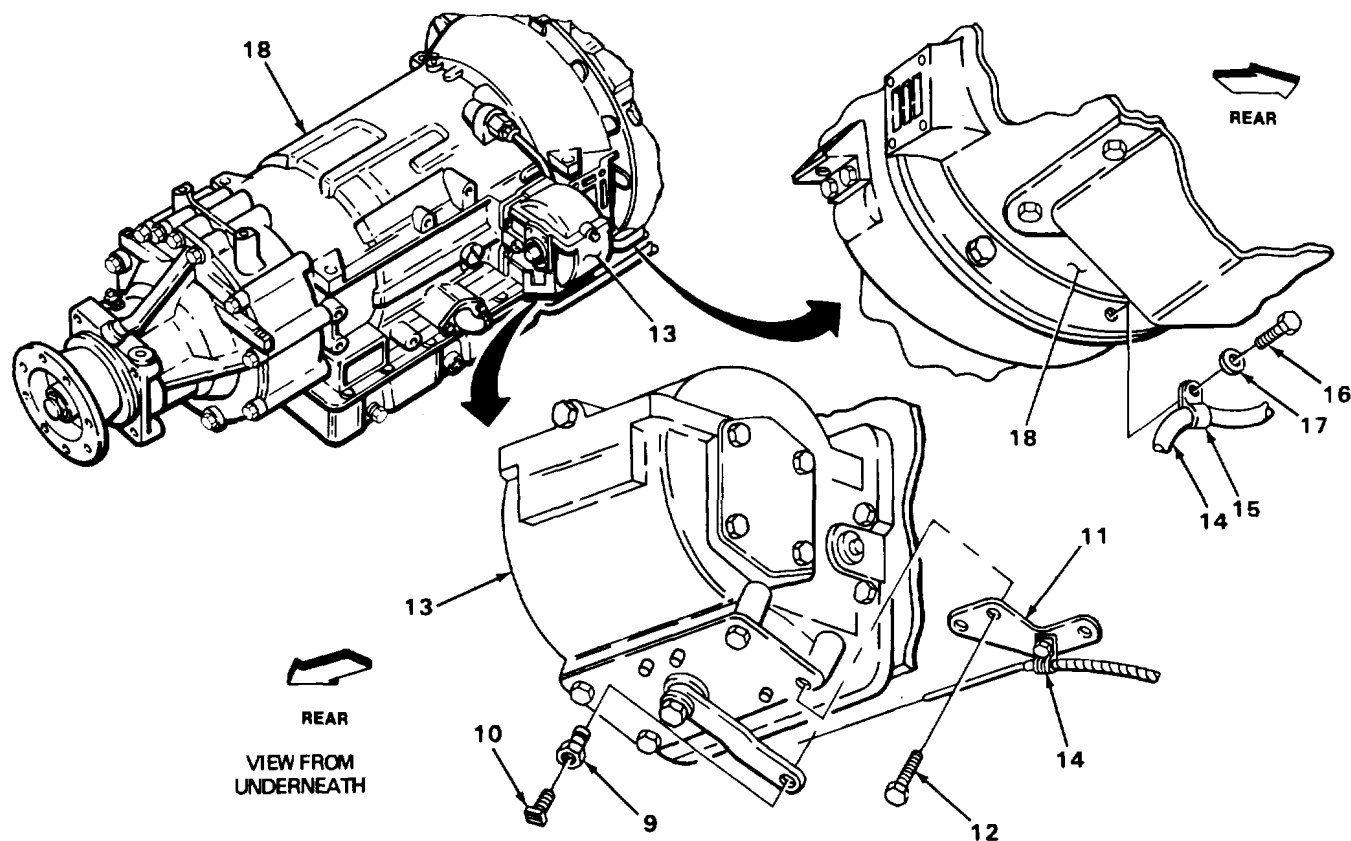
LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
25. Transmission oil pressure switch (1)	Plug (2)	Pull out.
26. U-Joint (3)	Two lockwires (4) and setscrews (5)	a. Using diagonal cutting pliers, cut wires (4) and take off. b. Using 3/8-inch open-end wrench, unscrew and take out screws (5). c. Get rid of lockwires (4).
27.	Screw (6) and U-joint (3)	Using 9/16-inch open-end wrench, unscrew and take out.
28. Power takeoff bearing cap assembly (7)	U-joint (3)	a. Using 2-lb ball-peen hammer and 1/2-inch brass driftpin, tap back onto and shaft (8) shaft (8). b. Lower shaft (8).



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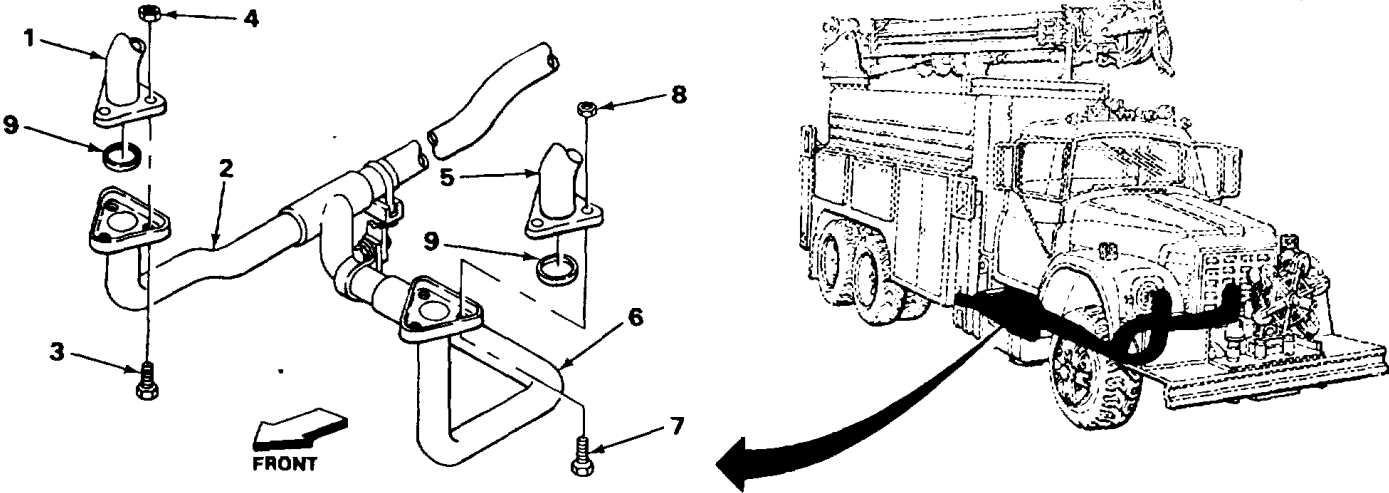
ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
29. Shift lever pin (9)	Setscrew (10)	Using 1/2-inch and 1/4-inch open-end wrenches, unscrew part way.
30. Bracket (11)	Screw (12)	Using 11/2-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
31. Power takeoff assembly (13)	Bracket (11) with cable (14)	Move away from.
32. Cable clamp (15)	Screw (16) and washer (17)	Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
33. Transmission assembly (18)	Cable clamp (15) with cable (14)	Take off, and move away from.



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ENGINE ASSEMBLY - CONTINUED

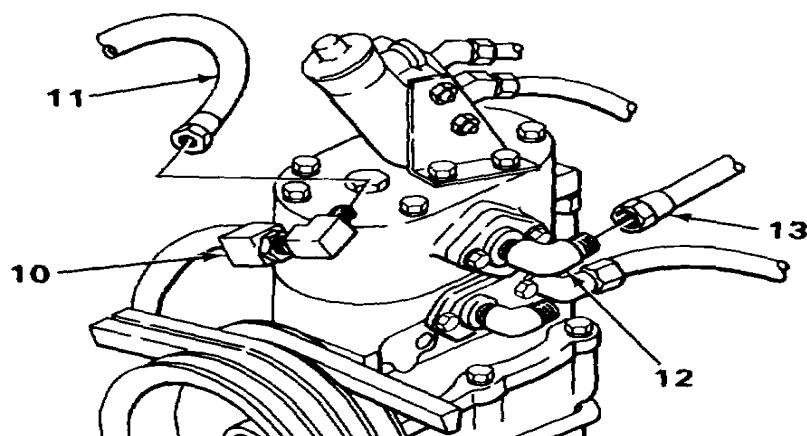
LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
34. Right side exhaust manifold (1) and exhaust pipe (2)	Three screws (3) and nuts (4)	Using 9/16-inch open-end wrench, 9/16-inch deep well socket, ratchet handle with 1/2-inch drive, and 6-inch extension, unscrew and take out.
35. Left side exhaust manifold (5) and exhaust pipe (6)	Three screws (7) and nuts (8)	Using 9/16-inch open-end wrench, 9/16-inch deep well socket, ratchet handle with 112-inch drive, and 6-inch extension, unscrew and take out.
36. Right side exhaust manifold (1) and left side exhaust manifold (5)	Two exhaust pipes (2) and (6) and two seals (9)	a. Take off. b. Get rid of seals (9).
		
37. Connector tee(10)	Coolant hose (11)	a. Using 9/16-inch and 112-inch open-end wrenches, unscrew and take off. b. Tag hose (11).
38. Elbow (12)	Copper air reservoir tube assembly (13)	a. Using 15/16-inch and 7/8-inch open-end wrenches, unscrew and take off. b. Tag tube (13).

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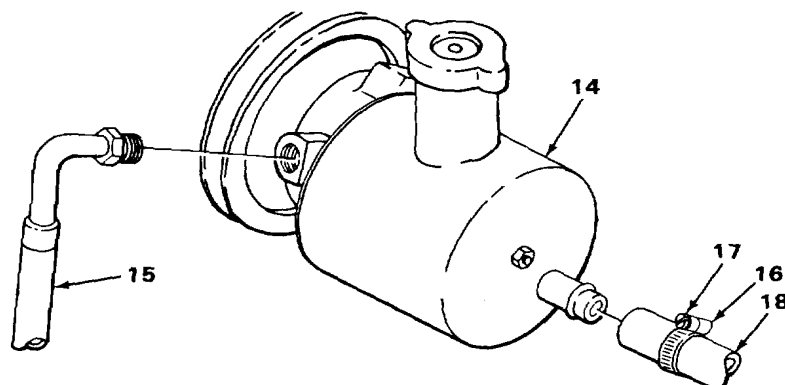
ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS

REMOVAL - CONTINUED

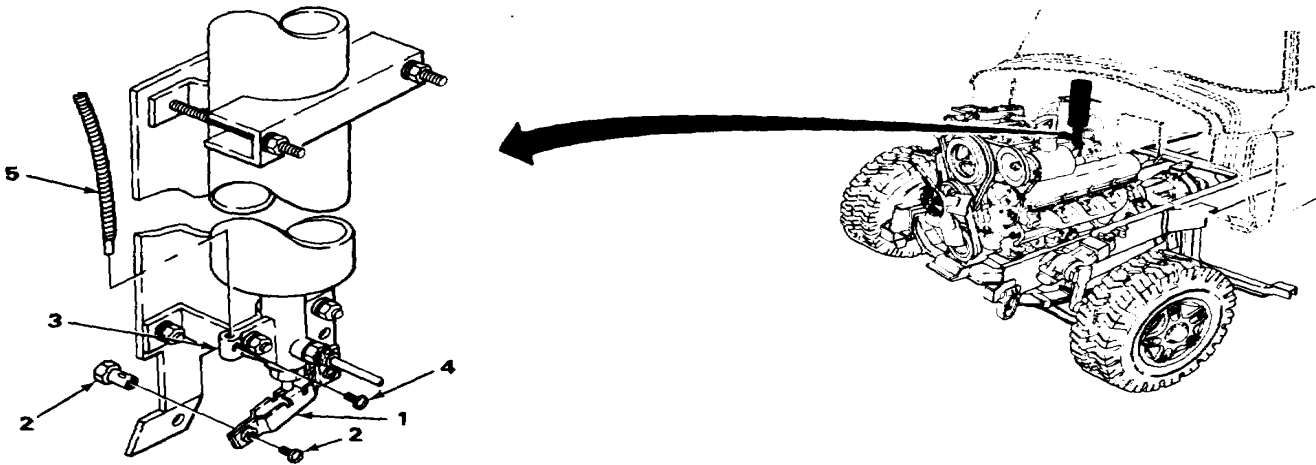


39. Power steering pump (14)	Pressure hose (15)	a. Place pail underneath to catch draining fluid. b. Using 3/4-inch open-end wrench, unscrew and take out. c. Allow fluid to drain. d. Tag hose(15). e. Get rid of fluid (page 2-46).
40. Hose clamp (16)	Screw (17)	Using 1/4-inch flat-tip screwdriver, unscrew to loosen.
41. Power steering pump (14)	Return hose (18) and hose clamp (16)	a. Slide clamp (16) down on hose (18). b. Twist hose (18) to loosen and pull off c. Tag hose (18).



TA237941

ENGINE ASSEMBLY - CONTINUED

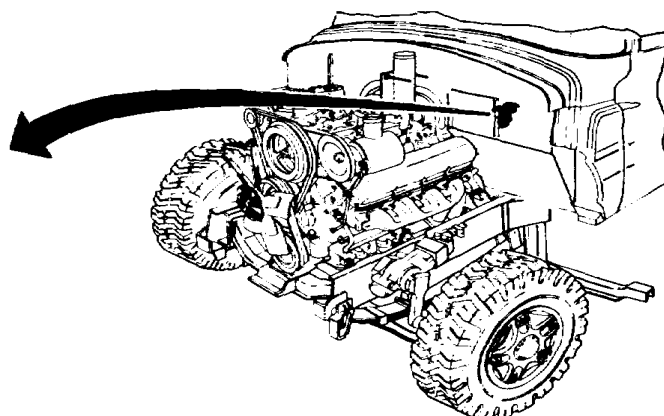
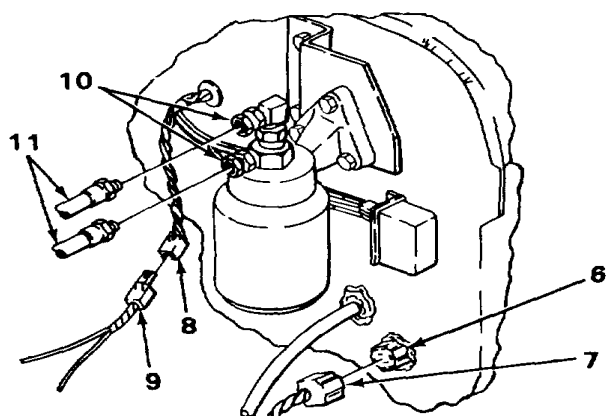
LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
42. Valve control lever (1)	Screw and stop (2)	Using 7/16-inch open-end wrench, and 1/4-inch flat-tip screwdriver, unscrew and take out.
43. Fuel release valve assembly (3)	Stop screw (4)	Using 1/4-inch flat-tip screwdriver, unscrew to loosen.
44.	Ether starting control cable (5)	Pull out and lay aside.
		
45. Light harness plug (6)	Connector (7)	a. Bend tab to release and pull off. b. Tag connector (7).
46. Connector (8)	Connector (9)	a. Pull apart. b. Tag connector (9).
47. Two adapters (10)	Two hoses assemblies (11)	a. Using 1/2-inch and 3/4-inch open-end wrenches, unscrew and take off. b. Tag hoses(11).

TA23794

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS

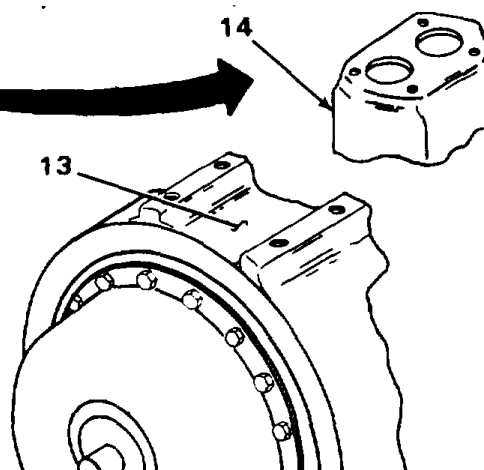
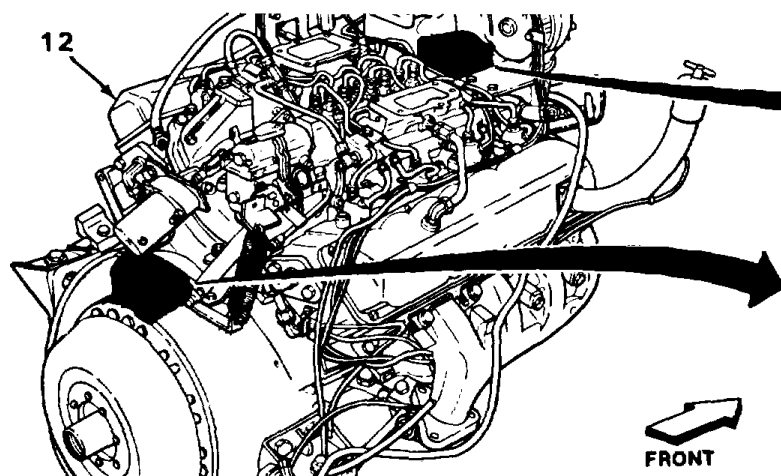
REMOVAL - CONTINUED



48. Engine (12)

Flywheel housing
(13) and crank-
case front
cover (14)

- Put on two engine lifting plates and secure with screws and lockwashers
- Attach lifting sling and hoist to lifting plates.
- Adjust lifting sling so that all slack is removed.



TA237943

ENGINE ASSEMBLY - CONTINUED

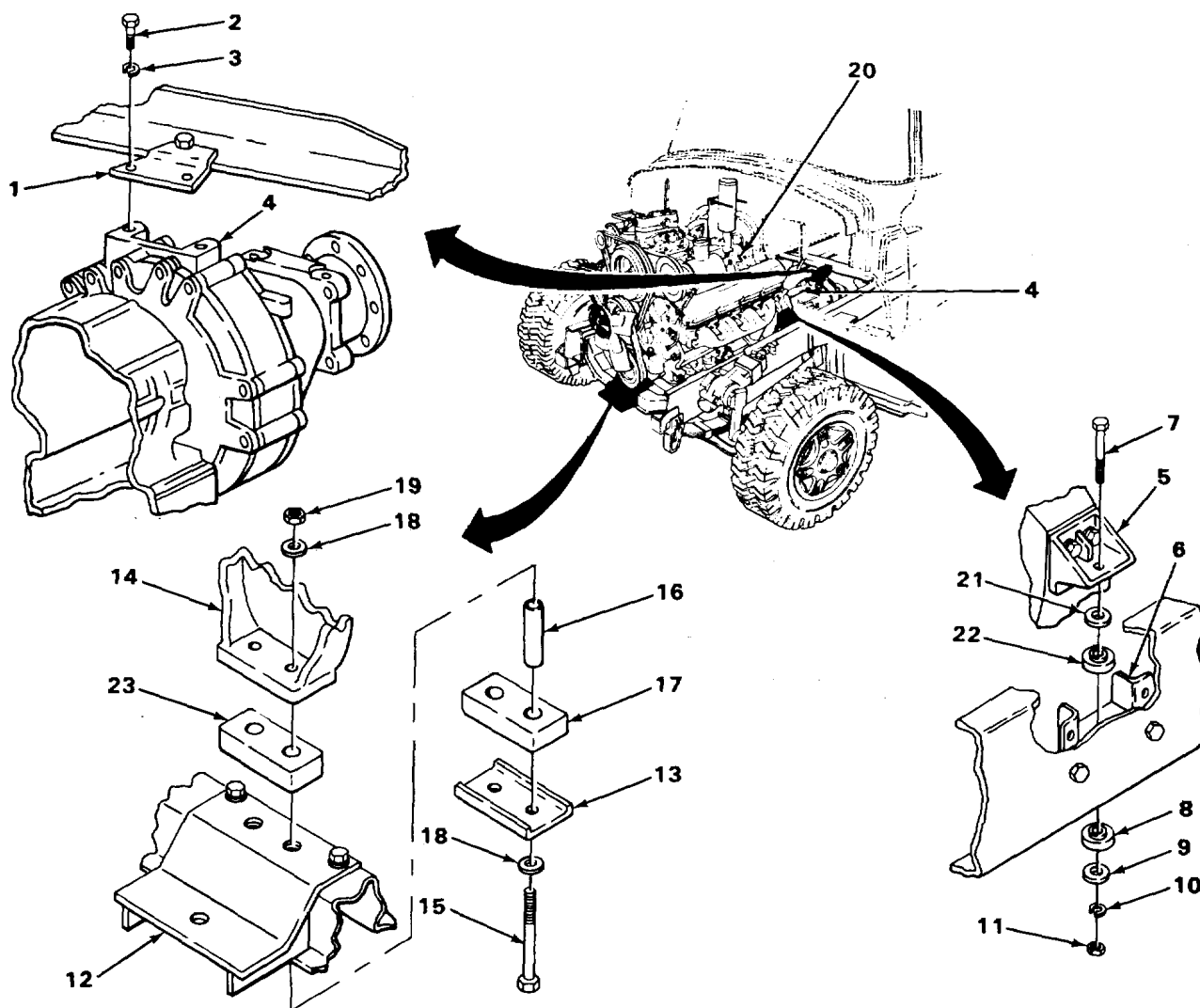
LOCATION		ITEM	ACTION REMARKS
REMOVAL - CONTINUED			
49.	Rear engine mount bracket (1)	Two screws (2) and lockwashers (3)	a. Support rear of transmission (4) with trestle. b. Using 15/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. c. Get rid of lockwashers (3).
50.	Two side engine mounting brackets (5) and engine mounting frame brackets (6)	Two screws (7), lower insulators (8), lower washers (9), lockwashers (10), and nuts (11)	a. Check lifting sling to make sure it is secure and free of slack. b. Using 1 1/16-inch open-end wrench, 15/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off nuts (10). c. Using 1/4-inch brass driftpin and 2-lb ball-peen hammer, drive out screws (7). d. Get rid of lockwashers (10).
51.	Front engine mounting bracket (12), front spacer (13), and crankcase front cover (14)	Two screws (15), spacers (16), lower insulator (17), four washers (18), and nuts (19)	a. Using 3/4-inch open-end wrench, 3/4-inch socket, ratchet handle with 1/2-inch drive, and 3-inch extension, unscrew nuts (19) and take off. b. Take off front spacer (13) and lower insulator (17).
52.	Front engine mounting bracket (12) and two side engine mounting frame brackets (6)	Engine assembly (20) and transmission assembly (4)	a. Using hoist, take out. b. Mount engine assembly (20) in engine overhaul stand with transmission assembly (4) supported by hoist.
53.		Two upper washers (21), upper insulators (22), and one locking plate (23)	Take off.

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS

REMOVAL- CONTINUED

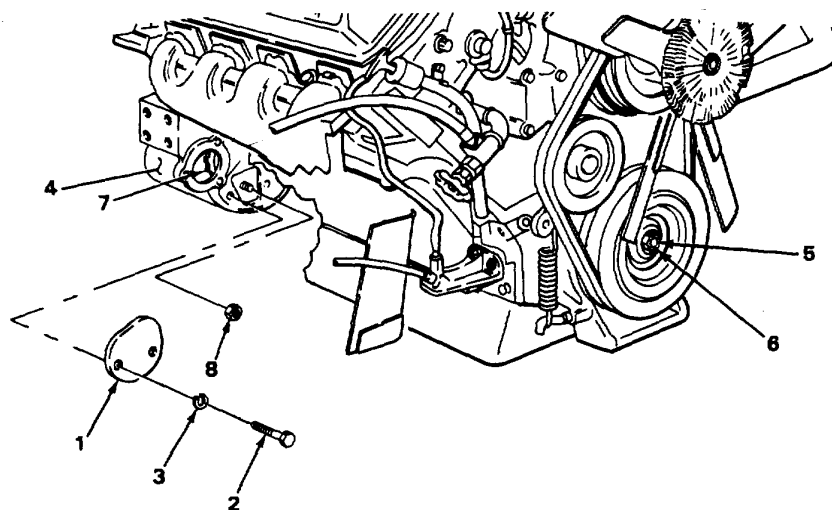
54. Transmission oil cooler lines Remove (TM 9-2320-269-20-1).



TA237944

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
UNCOUPLE		
55. Hand hole cover (1)	Screw (2) and lock-washer (3)	a. Using 7/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwasher (3).
56. Flywheel housing (4)	Hand hole cover (1)	Take off.
57. Crankshaft (5)	Crankshaft pulley nut (6)	Using 2-inch socket and ratchet handle with 3/4-inch drive, have an assistant turn pulley and nut (6) which will rotate flywheel (7) so that torque converter nuts (8) can be seen through housing cover hole.
58. Flywheel (7)	Six nuts (8)	Using 9/16-inch deep well socket and ratchet handle with 1/2-inch drive, unscrew and take out. Assistant should turn crankshaft after each nut has been removed until you can see the next nut and until all six are taken out.



TA237945

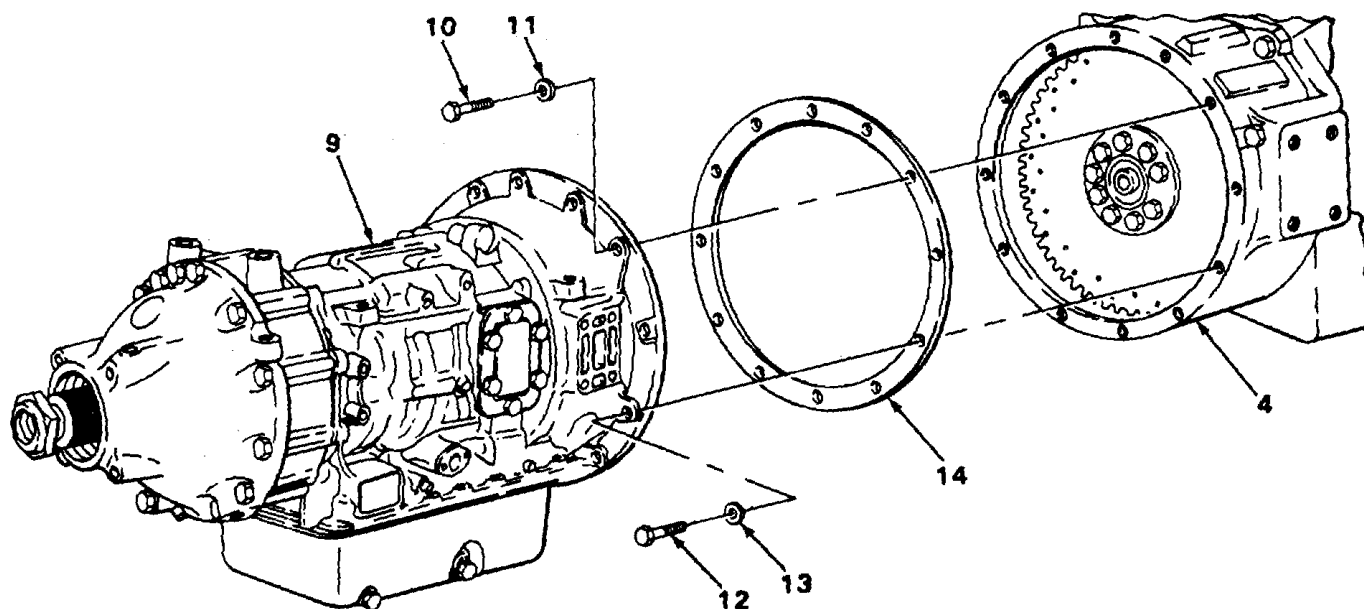
ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
UNCOUPLE - CONTINUED		
59. Transmission (9)	Four screws (10) and washers (11)	Using 9/16-inch socket and ratchet hand with 112-inch drive, or 9/16-inch open- end wrench, unscrew only at 9, 11, 1, and 3 o'clock positions and take out. Use 6-inch extension with 112-inch drive, where needed.
60.	Eight screws (12) and washers (13)	Using 9/16-inch socket and ratchet handle with 112-inch drive, unscrew and take out.

WARNING

Be careful when separating transmission from engine. Torque converter can slide out of transmission and fall, causing Injury to you and damage to equipment.

61. Flywheel housing (4)	Transmission (9) and gasket (14)	a. Using hoist, move away from engine set down on wooden pallet. b. Get rid of gasket (14).



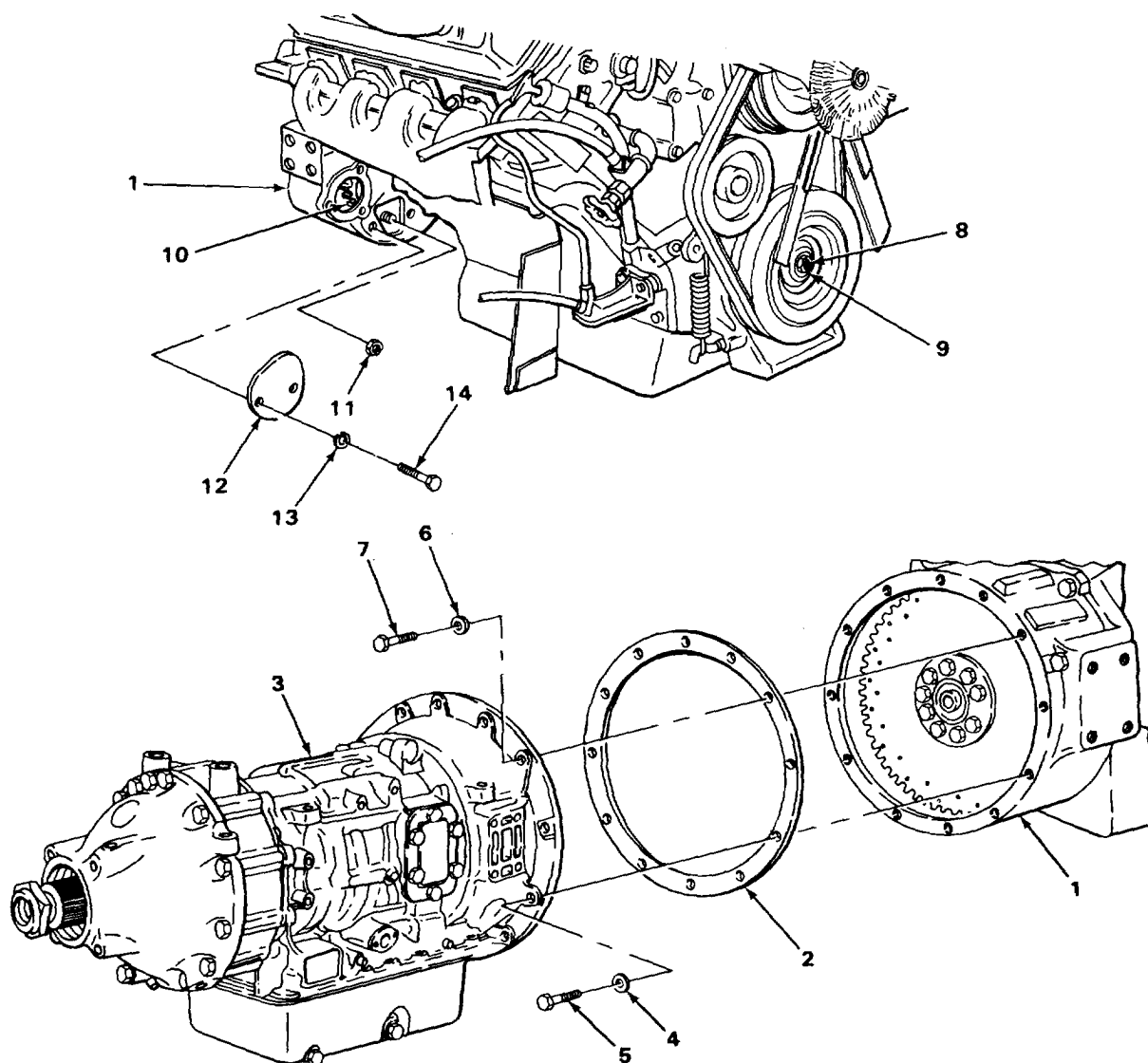
TA237946

ENGINE ASSEMBLY - CONTINUED

LOCATION		ITEM	ACTION REMARKS
COUPLE			
<u>WARNING</u>			
Be careful when lifting and mating transmission to engine. Torque converter can slide out of transmission housing and fall, causing injury to you and damage to equipment.			
62.	Flywheel housing (1)	New gasket (2) and transmission (3)	With transmission supported with hoist and engine assembly mounted in engine over-haul stand, move onto housing (1). Make sure torque converter studs mate with holes in flywheel.
63.	Transmission (3)	Four washers (4) and screws (5)	At 9, 11, 1, and 3 o'clock positions, screw in and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.
64.		Eight washers (6) and screws (7)	Screw in, and tighten using 9/16-inch socket, 6-inch extension, and ratchet handle with 1/2-inch drive.
65.		Twelve screws (5) and (7)	Using 9/16-inch socket, 6-inch extension, and torque wrench with 1/2-inch drive, tighten all screws (5) and (7) to 26 - 32 ft-lb (35 - 43 N m).
66.	Crankshaft (8)	Crankshaft pulley nut (9)	Using 2-inch socket and ratchet handle with 3/4-inch drive, have an assistant turn nut (9) which will rotate the flywheel (10) so that torque converter studs can be seen through housing (1) cover hole.
67.	Flywheel (10)	Six nuts (11)	a. Screw in, and tighten using 9/16-inch deep well socket and ratchet handle with 1/2-inch drive. b. Using 9/16-inch deep well socket and torque wrench with 1/2-inch drive, tighten to 33 - 40 ft-lb (45 - 54 N m) of torque.
68.	Flywheel housing (1)	Hand hole cover (12)	Place in position.

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
COUPLE - CONTINUED		
69. Hand hole cover (12)	New lockwasher(13) and screw (14)	Screw in, and tighten using 7/16-inch open-end wrench.
70.	Transmission oil cooler lines	Install (TM 9-2320-269-20-1).



TA237947

ENGINE ASSEMBLY - CONTINUED

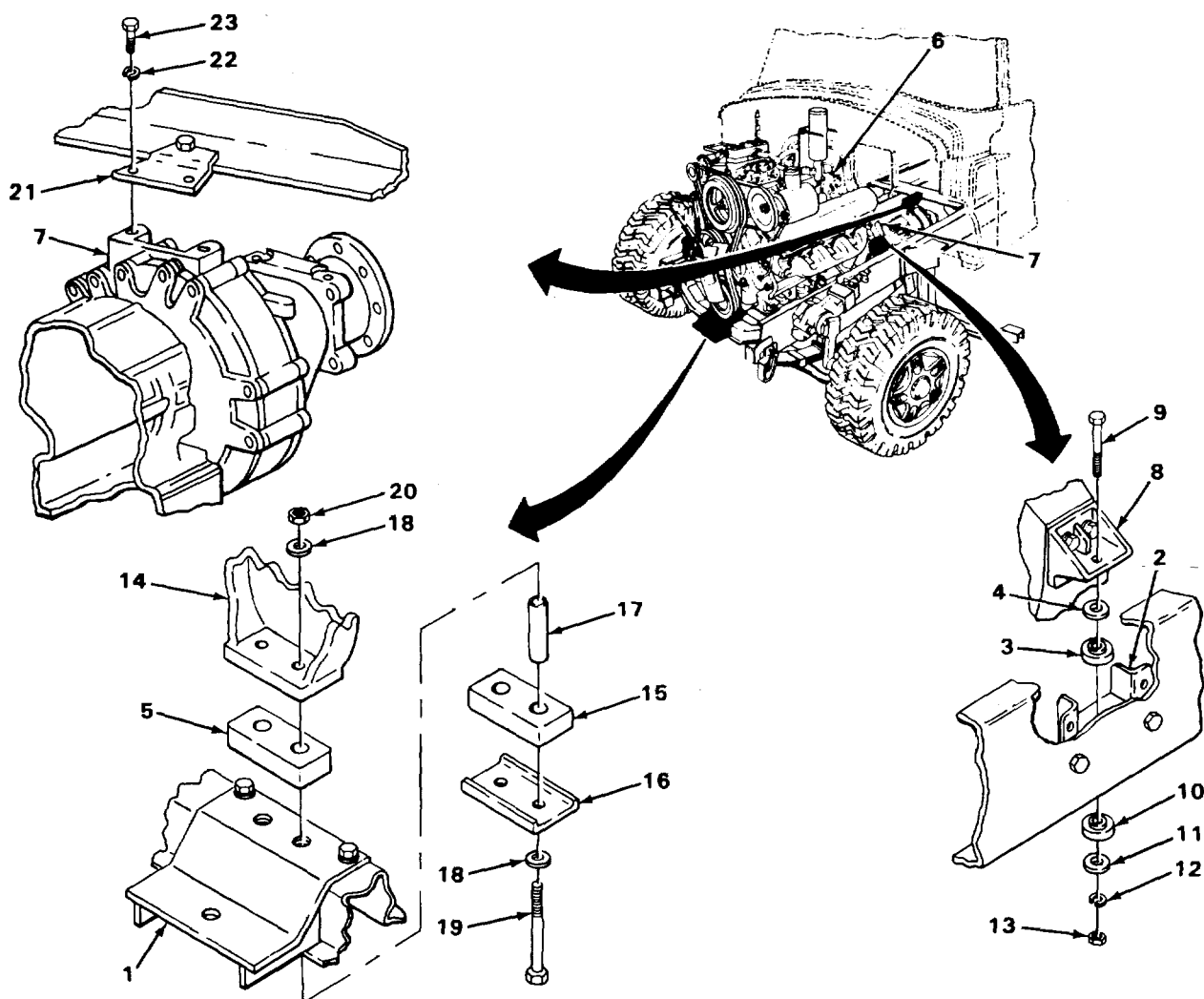
LOCATION		ITEM	ACTION REMARKS
INSTALLATION			
71.	Front engine mounting bracket (1) and two side engine mounting frame brackets (2)	Two upper insulators (3), two upper washers (4), and one locking plate (5)	Put in position.
72.		Engine assembly (6) and transmission assembly (7)	a. Take assembly (6) out of engine overhaul stand and support with hoist and lifting slings. b. With help from assistants, put in position on brackets (1) and (2). c. Support rear of transmission with trestle.
73.	Two side engine mounting brackets (8) and engine mounting frame brackets (2)	Screws (9)	a. Put in position. b. Using 2-lb ball-peen hammer, tap screws (9) through hole.
74.		Two lower insulators (10), washers (11), two new lockwashers (12) and nuts (13)	a. Place in position. b. Screw on, and tighten using 15/16-inch socket, 3-inch extension, ratchet handle with 3/4-inch drive, and 1 11/16-inch open-end wrench.
75.	Front engine mounting bracket (1) and crankcase front cover (14)	Lower Insulator (15), front spacer (16), and two spacers (17)	Put in position.
76.	Front spacer (16) and crankcase front cover (14)	Four washers (18), two screws (19), and nuts (20)	Screw together, and tighten using 3/4-inch socket, 3-inch extension, and ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench.

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

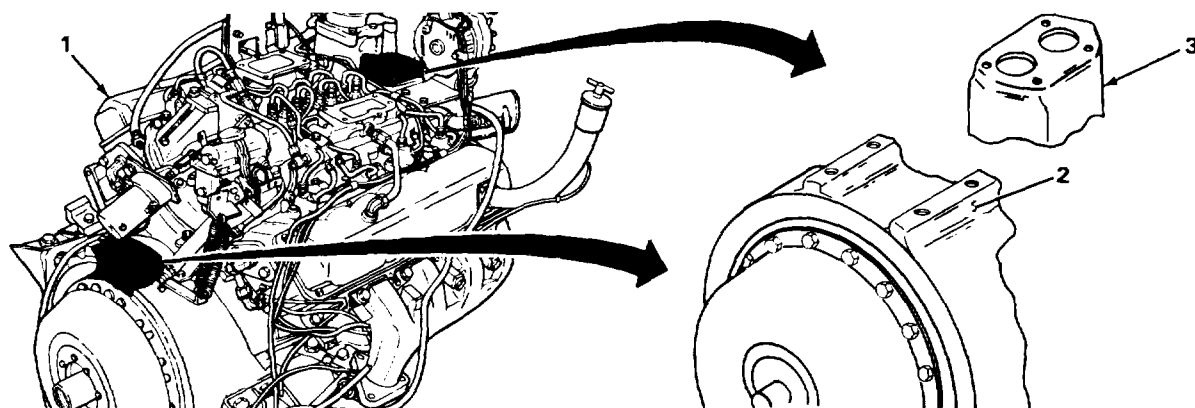
77. Rear engine mount bracket (21) and transmission assembly (7)
- Two new lockwashers (22) and screws (23)
- Screw in, and tighten using 15116-inch socket and ratchet handle with 3/4-inch drive.



TA237948

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
78.	Engine (1) (2) and crankcase front cover (3)	Flywheel housing attached to vehicle.	a. Make sure engine has been securely b. Take off hoist. c. Take off two lifting plates.



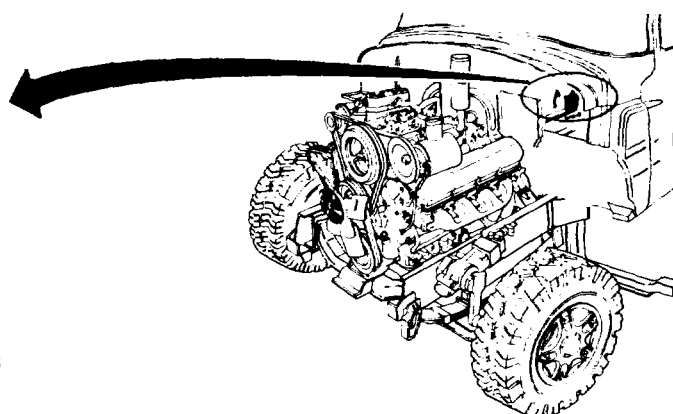
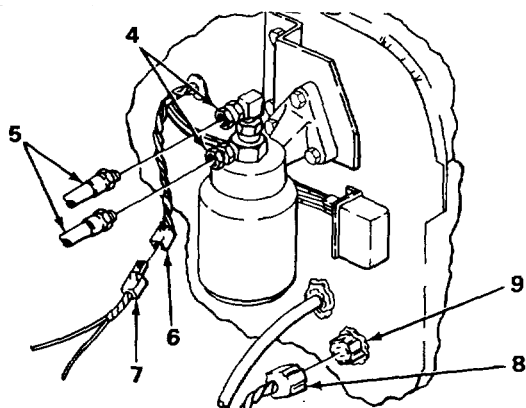
79.	Two adapters (4)	Two hose assemblies (5)	a. Check tags for proper locations. b. Take off tags. c. Screw on, and tighten using 1/2-inch and 3/4-inch open-end wrenches.
80.	Connector (6)	Connector (7)	a. Check tag for proper location. b. Take off tag. c. Push together.
81.	Light harness plug (8)	Connector (9)	a. Check tag for proper location. b. Take off tag. c. Push in.

TA237949

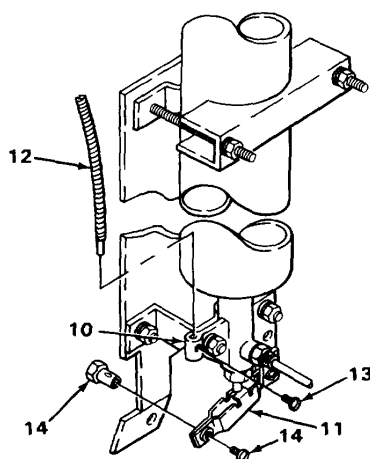
ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



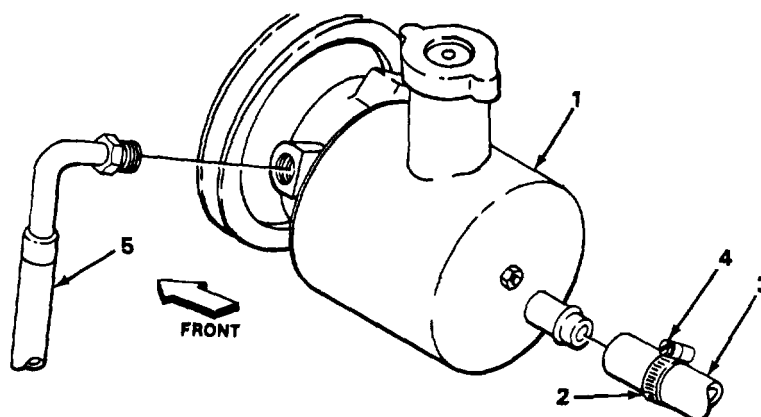
82.	Fuel release valve assembly (10) and valve control lever (11)	Ether starting control cable (12)	Put through.
83.	Fuel release valve assembly (10)	Stop screw (13)	Screw in, and tighten using 114-inch flat tip screwdriver.
84.	Valve control lever (11) and ether starting control cable (12)	Screw and stop (14)	Screw in, and tighten using 7116-inch open-end wrench and 1/4-inch flat-tip screwdriver.



TA237950

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
85. Power steering pump (1)	Hose clamp (2) and return hose (3)	a. Check tag for proper location. b. Take off tag. c. Twist hose (3) onto pump (1). d. Slide clamp (2) up onto hose.	
86. Clamp (2)	Screw (4)	Screw in, and tighten using 1/4-inch flat-tip screwdriver.	
87. Power steering pump (1)	Pressure hose (5)	a. Check tag for proper location. b. Take off tag. c. Screw on, and tighten using 3/4-inch open-end wrench.	



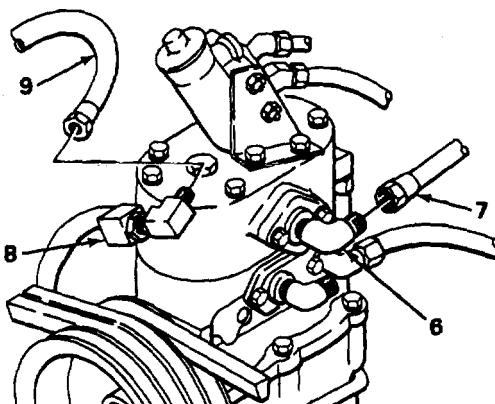
88. Elbow (6)	Copper air reservoir tube assembly (7)	a. Check tag for proper location. b. Take off tag. c. Screw on, and tighten using 15/16-Inch and 7/8-Inch open-end wrenches.	
89. Connector tee (8)	Coolant hose (9)	a. Check tag for proper location. b. Take off tag. c. Screw on, and tighten using 9/16-Inch and 1/2-inch open-end wrenches.	

TA237961

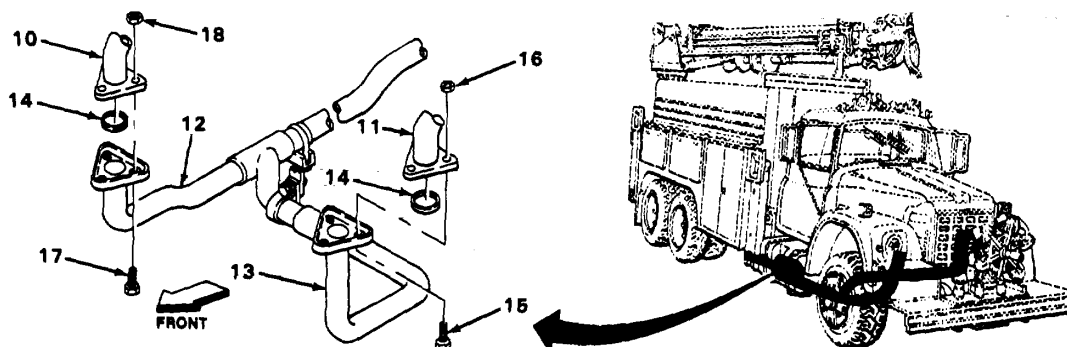
ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



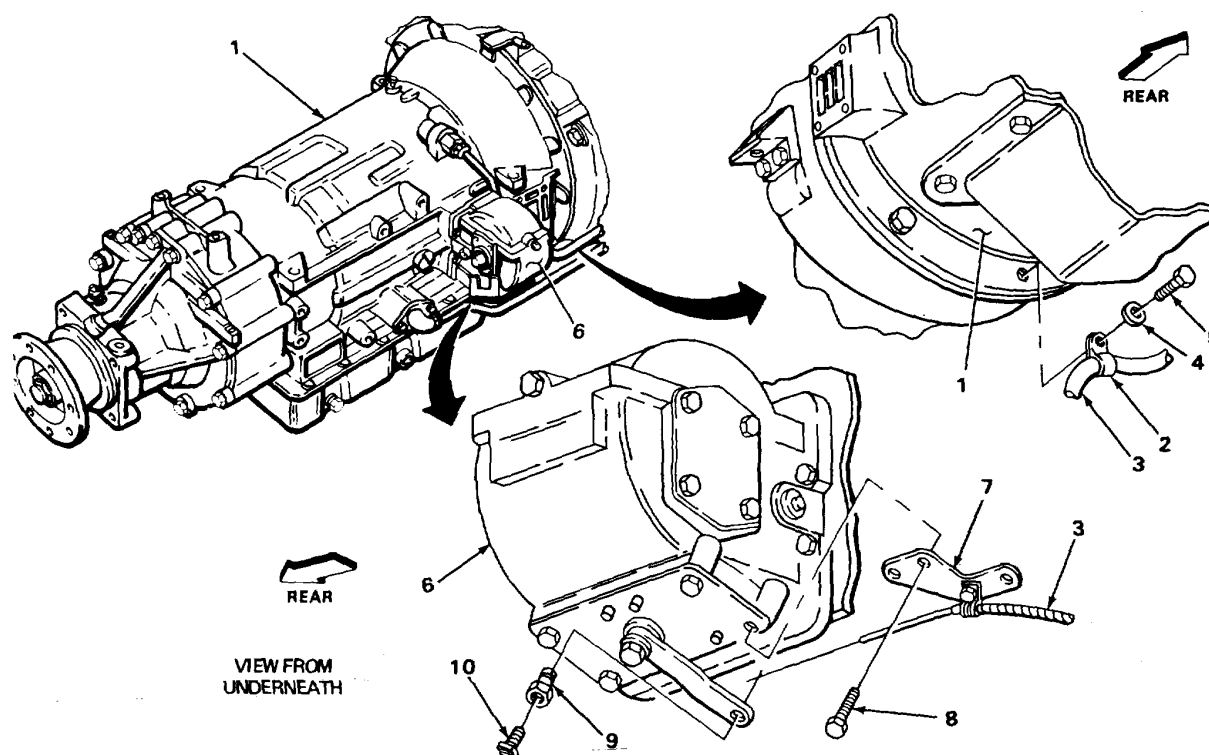
90. Right side exhaust manifold (10) and left side exhaust manifold (11)	Two exhaust pipes {12} and {13} and two new seals (14)	Put in position.
91. Left side exhaust manifold (11) and exhaust pipe (13)	Three screws (15) and nuts (16)	Screw In, and tighten using 9/16-inch deep well socket, ratchet handle with 11/2-inch drive, and 9/16-Inch open-end wrench.
92. Right side exhaust manifold (10) and exhaust pipe (12)	Three screws (17) and nuts (18)	Screw In, and tighten using 9/16-Inch deep well socket, ratchet handle with 1/2-inch drive, and 9/16-Inch open-end wrench.



TA237952

ENGINE ASSEMBLY - CONTINUED

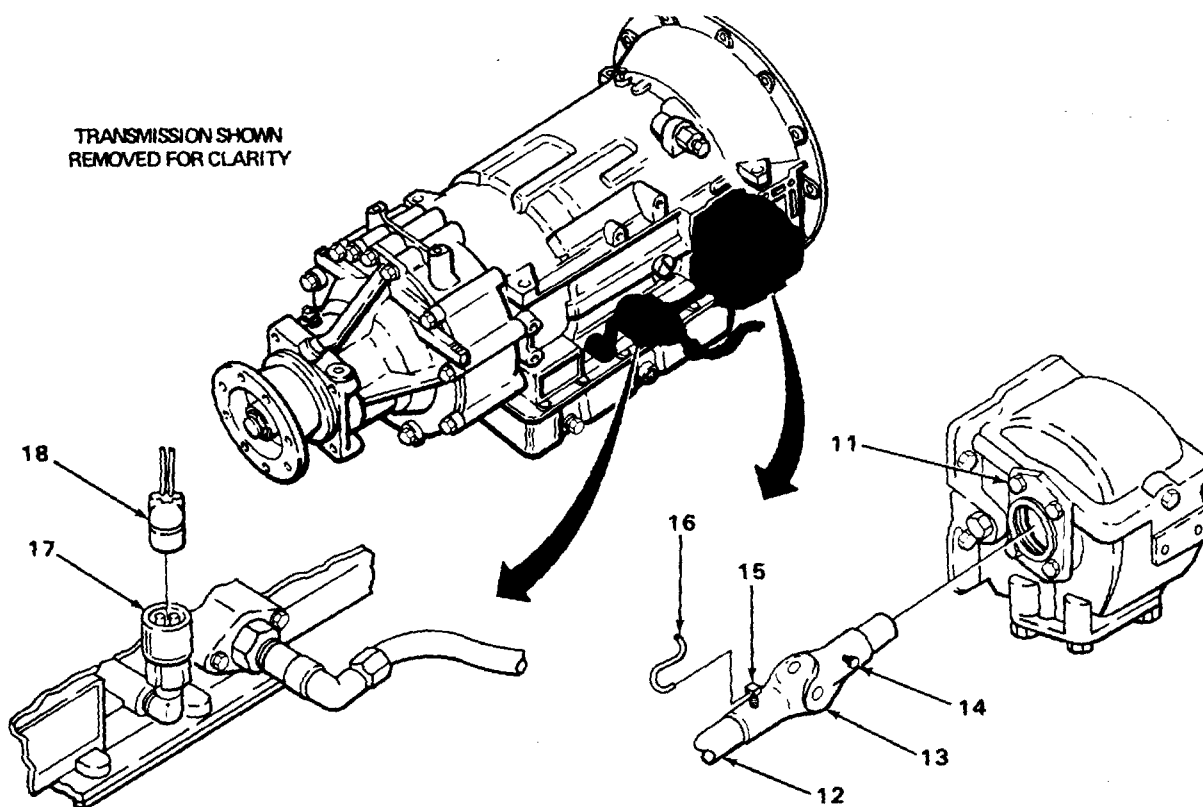
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
93. Transmission assembly (1)	Cable clamp (2) with cable (3)	Put in place.	
94. Cable clamp (3)	Washer (4) and screw (5)	Screw in, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch drive.	
95. Power take-off assembly (6)	Bracket (7) with cable (3)	Put in position.	
96. Bracket (7)	Screw (8)	Screw in, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch drive.	
97. Shift lever pin (9)	Setscrew (10)	a. Put in. b. Tighten using 1/2-inch and 1/4-inch open-end wrenches.	



TA237953

ENGINE ASSEMBLY - CONTINUED

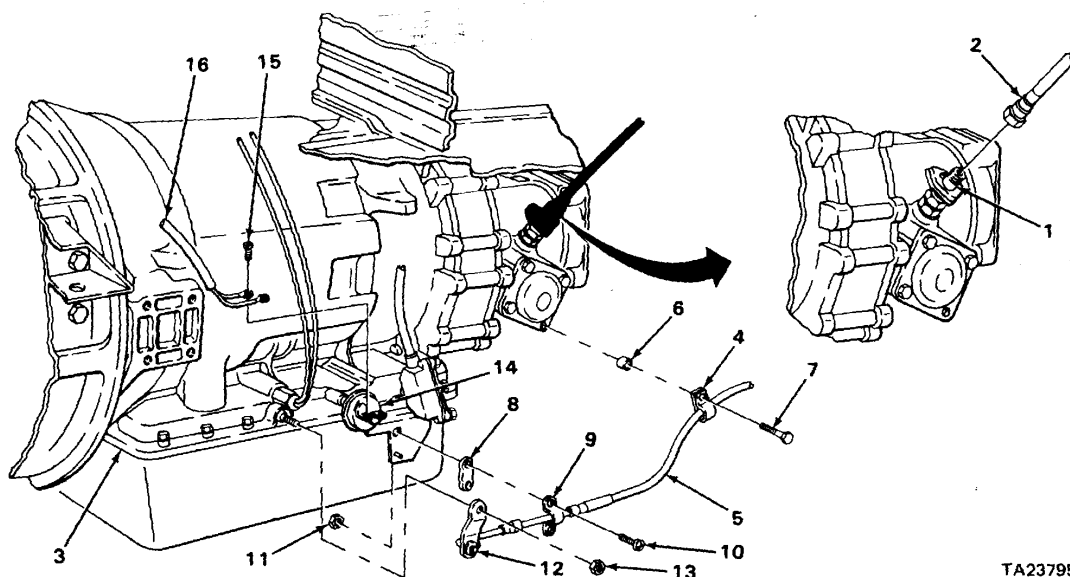
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
98. Power take-off bearing cap assembly (11) and shaft (12)	U-joint (13)	a. Raise shaft (12). b. Using 2-lb ball-peen hammer and 1/2 inch brass driftpin, tap into place.	
99. U-joint (13)	Screw (14)	Screw in, and tighten using 9/16-inch open-end wrench.	
100. Two setscrews (15) and two new lockwires (16)		a. Screw in, and tighten using 7/16-inch open-end wrench. b. Put on lockwires (16), and secure (page 2-46) using angle-nose slip-joint pliers.	
101. Transmission oil pressure switch (17)	Plug (18)	Push in.	



TA237954

ENGINE ASSEMBLY - CONTINUED

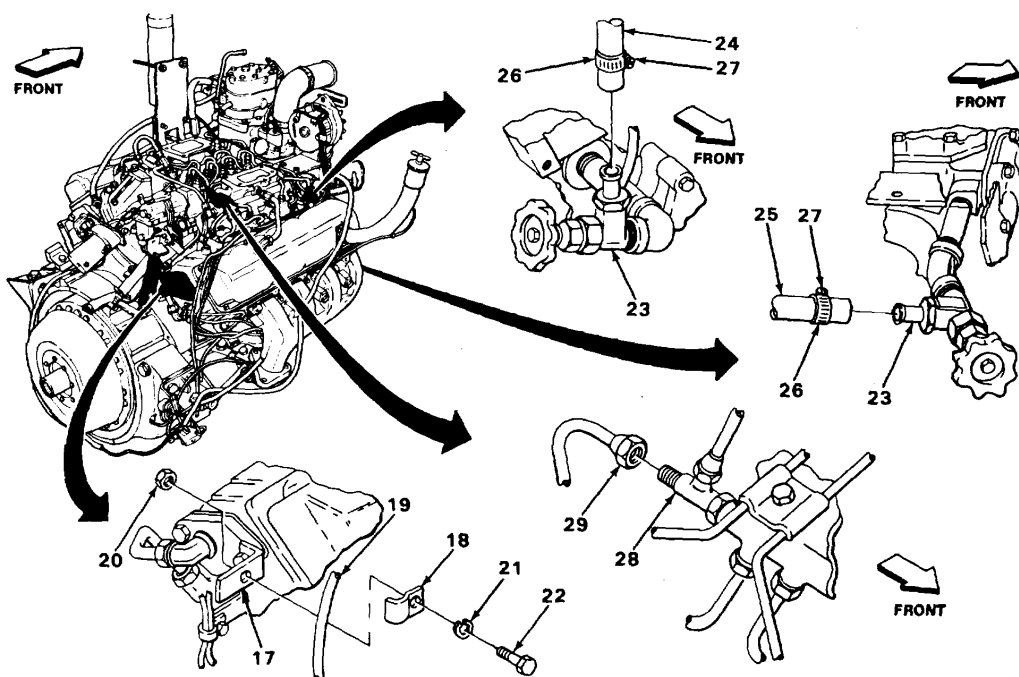
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
102.	Speedometer cable adapter (1)	Speedometer cable (2)	Screw on and tighten using two 1-inch open-end wrenches.
103.	Transmission assembly (3)	Cable clamp (4) with cable (5)	Put in position.
104.	Cable clamp (4) screw (7)	Spacer (6) and open-end wrench.	Screw in, and tighten using 1/2-inch
105.	Transmission assembly (3)	Cable (5), cable clamp bar (8), and cable clamp (9)	Put in position.
106.	Cable clamp (9) nuts (11)	Two screws (10) and	Screw in, and tighten using 3/8-inch open-end wrench and number two cross-tip screwdriver.
107.	Shift lever (12)	Nut (13)	Screw on, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.
108.	Oil temperature sending unit (14)	Two screws (15) and wire (16)	a. Check tags for proper location and take off. b. Screw in, and tighten using 1/4-inch flat-tip screwdriver.



TA237955

ENGINE ASSEMBLY - CONTINUED

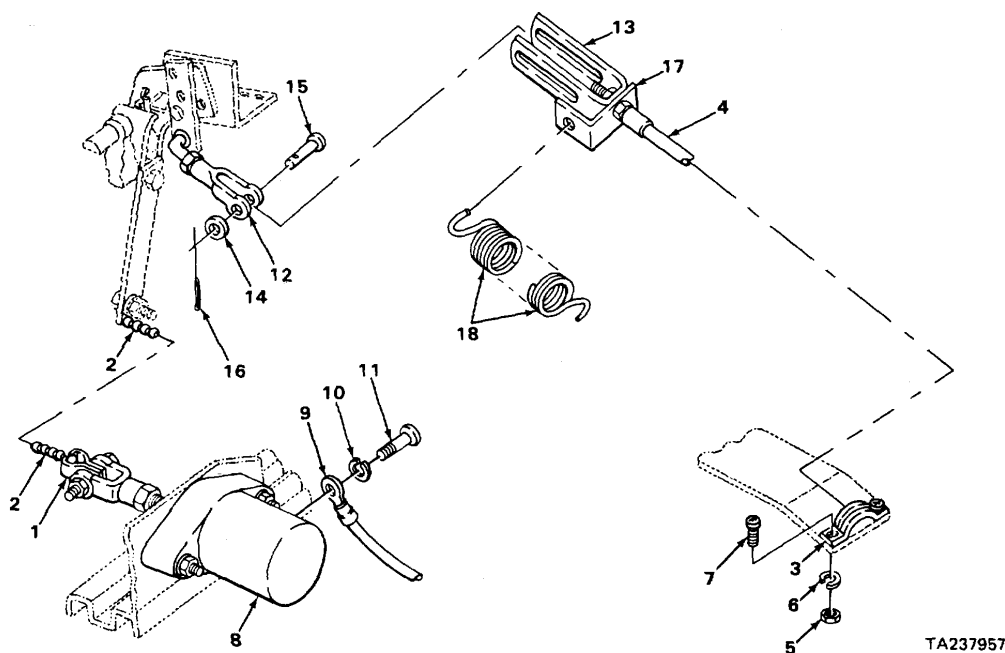
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
109. Bracket (17)	Clamp (18) and wires (19)	Place in position.	
110. Clamp (18)	Nut (20), new lock-washer (21) and screw (22)	Screw in, and tighten using two 7116-inch open-end wrenches.	
111. Two connectors (23)	Heater return hose (24) and inlet hose (25) with two clamps (26)	a. Check tags for proper location and take off. b. Twist and push on. c. Slide clamps (26) into position.	
112. Two clamps (26)	Two screws (27)	Using 114-inch flat-tip screwdriver, tighten.	
113. Fuel return pipe tee (28)	Tee-to-side member pipe (29)	a. Check tag for proper location and take off. b. Screw on, and tighten using 5/8-inch open-end wrench.	



TA237956

ENGINE ASSEMBLY - CONTINUED

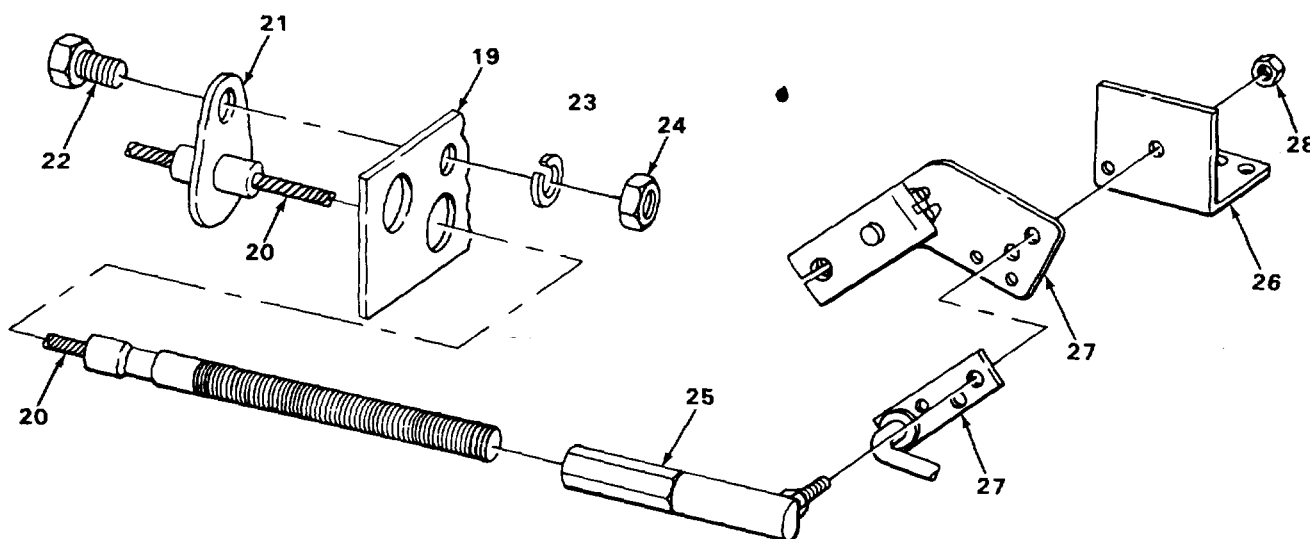
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
114. Chain connector (1)	Chain (2)	Put in.	
115. Cable clamp (3)	Cable (4)	Put in place.	
116.	Nut (5), new lock-washer (6), and screw (7)	Screw on, and tighten using 3/8-inch open-end wrench and number two cross-tip screwdriver.	
117. Solenoid (8)	Wire (9), new lock-washer (10), and screw (11)	a. Check tag for proper location and take off. b. Screw in, and tighten using 1/4-inch flat-tip screwdriver.	
118. Yoke (12)	Clevis (13)	Put in place.	
119. Clevis (13)	Three washers (14), pin (15), and new cotter pin (16)	a. Put in. b. Using angle-nose slip-joint pliers, separate ends of pin (29) and bend back.	
120. Clevis bracket (17)	Spring (18)	Using angle-nose slip-joint pliers, put on	



TA237957

ENGINE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
121.	Bracket (19)	Accelerator cable (20)	Put through.
122.	Accelerator cable bracket (21) and bracket (19)	Screw (22), new lockwasher (23), and nut (24)	Screw on, and tighten using two 7/16-inch open-end wrenches.
123.	Accelerator cable (20)	Ball joint (25) open-end wrench.	Screw on, and tighten using 3/8-inch
124.	Bracket (26)	Two plates (27) and ball joint (25)	Put in place.
125.	Ball joint (25) and bracket (26)	Nut (28)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.



NOTE

FOLLOW-ON MAINTENANCE:

1. Install engine wiring harness (page 2-470).
2. Install primary filter-to-secondary filter fuel line (TM 9-2320-269-20-1).
3. Install secondary fuel filter head (page 2-361).
4. Install emergency stop solenoid (TM 9-2320-269-20-1).
5. Install throttle slave cylinder (page 2-1649).

TA237958

ENGINE ASSEMBLY - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE - CONTINUED**

6. Pressurize air reservoir tanks (TM 9-2320-269-20-1).
7. Install transmission-to-center bearing flange (TM 9-2320-269-20-1).
8. Lubricate crankcase (LO 9-2320-269-12).
9. Install fuel shutoff cable (TM 9-2320-269-20-1).
10. Install thermostats (TM 9-2320-269-20-1).
11. Install air cleaner (TM 9-2320-269-20-1).
12. Install engine and transmission covers (TM 9-2320-269-20-2).
13. Install winch, winch support, and bumper assembly (TM 9-2320-269-20-2).
14. Install fenders, radiator, and grille assembly (TM 9-2320-269-20-2).
15. Install transmission oil level gage and tube (TM 9-2320-269-20-1).
16. Install air compressor governor (TM 9-2320-269-20-1).
17. Install oil pressure lockout switch (TM 9-2320-269-20-1).
18. Install tachometer adapter and cable (TM 9-2320-269-20-2).

TASK ENDS HERE**FRONT ENGINE MOUNTS**

This task covers:

a. Removal (page 2-83)	c. Inspection/Replacement (page 2-84)
b. Cleaning (page 2-84)	d. Installation (page 2-84)
-

INITIAL SETUP**Tools**

Extension, 112-inch drive, 3-inch
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Jack, hydraulic hand
 Socket, 112-inch drive, 3/4-Inch
 Socket, 3/4-inch drive, 15/16-inch
 Wrench, open-end, 3/4-inch
 Wrench, open-end, 15/16-inch
 Wrench, open-end, 1 1/16-Inch

Personnel Required

Two

Equipment Condition

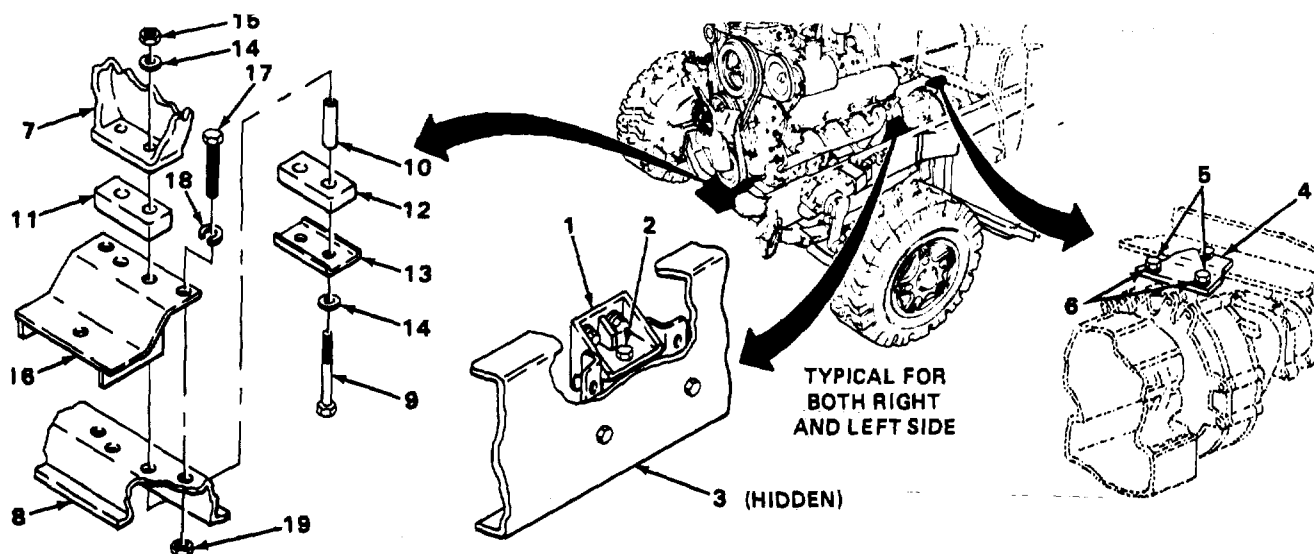
Engine and transmission cover
 removed (TM 9-2320-269-20-2).

Materials/Parts

Lockwashers, front engine mount and
 frame (two required)
 Rags, wiping (Item 42, appendix B)
 Solvent, drycleaning (Item 49, appendix B)

FRONT ENGINE MOUNTS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. Right and left side engine mounts (1)	Two screws (2) and nuts (3)	Using 15/16-inch socket, ratchet handle with 3/4-inch drive, and 1 1/16-inch open-end wrench, unscrew but do not take out.	
2. Rear engine mount (4)	Two screws (5) and lockwashers (6)	a. Support engine with hydraulic jack. b. Using 15/16-inch socket and ratchet handle with 3/4-inch drive, unscrew but do not take out.	
3. Front crankcase cover (7) and frame (8)	Two screws (9), spacers (10), upper locking plate (11), lower locking plate (12), lower Insulator (13), four washers (14), and two nuts (15)	a. Using 3/4-inch socket, 3-inch extension, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew and take out. b. Take off plate (12) and lower Insulator (13).	
4. Front engine mount (16) and frame (8)	Two screws (17), lockwashers (18), and nuts (19)	a. Using 15/16-inch socket, ratchet handle with 3/4-inch drive, and 15/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (18).	



TA237959

FRONT ENGINE MOUNTS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

5.	Frame (1)	Front engine mount (2) and upper locking plate (3)	a. Using jack and with help from assistant, raise engine just enough so that mount (2) and plate (3) can be removed. b. Take out mount (2) and plate (3).

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

6.	All metal parts	a. Clean in cleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as necessary.

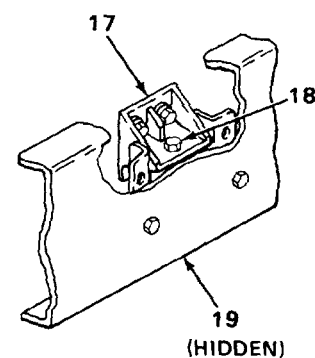
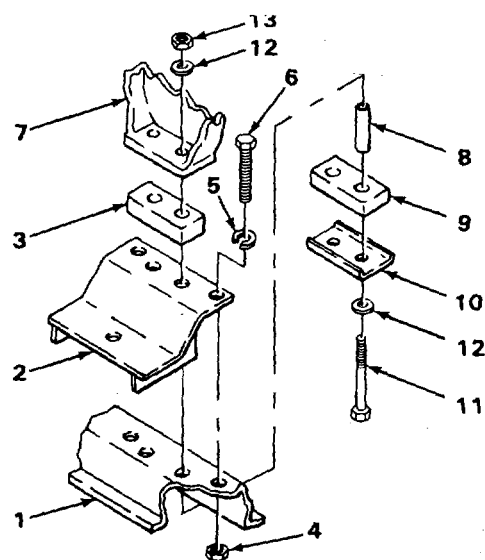
7.	Front engine mount (2)	Looks for breaks, cracks, and distortion.
8.	All other parts	Look for breaks, cracks, distortion, and stripped threads.

INSTALLATION

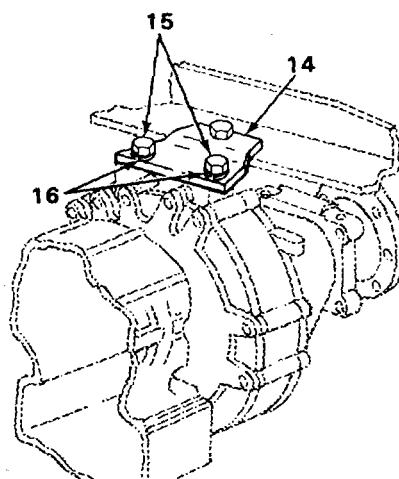
9.	Frame (1)	Front engine mount (2)	Put in position.
10.	Front engine mount (2) and frame (1)	Two nuts (4), new lockwashers (5), and screws (6)	Screw in, and tighten using 15/16-inch open-end wrench, 15/16-inch socket, and ratchet handle with 3/4-inch drive.

FRONT ENGINE MOUNTS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
11. Front engine mount (2) and front crankcase cover (7)	Upper locking plate (3)	a. Put in position, lining up holes. b. Using jack, lower engine onto plate (3) and frame (1).	
12. Front crankcase cover (7) and frame (1)	Two spacers (8), lower locking plate (9), and lower insulator (10)	Put in position.	
13. Lower insulator (10) and front crankcase cover (7)	Two screws (11), four washers (12), and nuts (13)	Screw in, and tighten using 3/4-inch socket, 3-inch extension, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench.	
14. Rear engine mount (14)	Two screws (15) and lockwashers (16)	Using 15/16-inch socket and ratchet handle with 3/4-inch drive, tighten.	
15. Right and left side engine mounts (17)	Two screws (18) and nuts (19)	a. Using 15/16-inch socket, ratchet handle with 3/4-inch drive, and 1 1/16-inch open-end wrench, tighten. b. Remove jack from under engine.	



TYPICAL FOR
BOTH RIGHT
AND LEFT SIDE



TA2379

FRONT ENGINE MOUNTS - CONTINUED

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE: Install engine and transmission cover (TM 9-2320-269-20-2).

TASK ENDS HERE

RIGHT AND LEFT SIDE ENGINE MOUNTS

This task covers:

a. Removal (page 2-86)	c. Inspection/Replacement (page 2-89)
b. Cleaning (page 2-88)	d. Installation (page 2-89)
-

INITIAL SETUP

Tools

Extension, 1/2-inch drive, 3-inch
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Jack, hydraulic hand
 Socket, 1/2-inch drive, 3/4-inch
 Socket, 3/4-inch drive, 15116-inch
 Wrench, open-end, 3/4-inch
 Wrench, open-end, 1 1/16-inch

Materials/Parts

Lockwashers, engine mounting bracket
 (four required)

Materials/Parts

Lockwashers, engine mounting frame
 bracket (four required)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

Two

Equipment Condition

Engine and transmission cover removed
 (TM 9-2320-269-20-2).

LOCATION	ITEM	ACTION	REMARKS

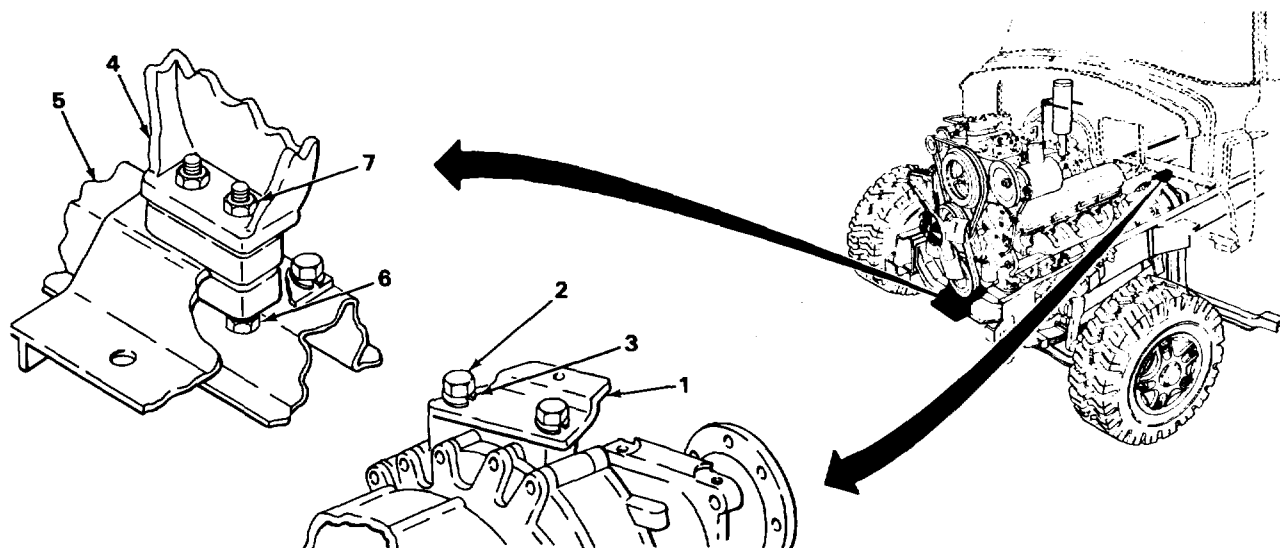
REMOVAL

1.	Rear engine mount (1)	Two screws (2) and lockwashers (3)	a. Support assembly with hydraulic jack. b. Using 15116-inch socket and ratchet handle with 3/4-inch drive, unscrew but do not take out.
2	Front crankcase cover (4) and frame (5)	Two screws (6) and nuts (7)	Using 3/4-inch socket, 3-inch extension, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew but do not take out

RIGHT AND LEFT SIDE ENGINE MOUNTS - COUNTINUED

LOCATION	ITEM	ACTION	REMARKS

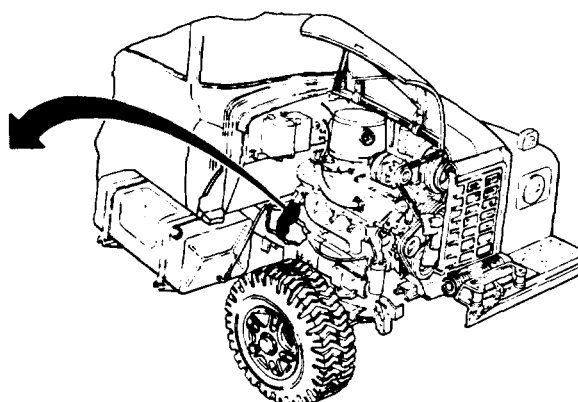
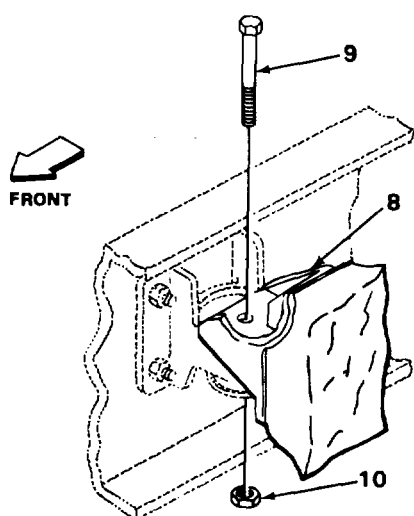
REMOVAL - CONTINUED



NOTE

Right and left side engine mounts are removed the same way. Left side is shown. Repeat steps 3 thru 8 for right side as necessary.

3.	Side engine mounting bracket (8)	Screw (9) and nut (10)	Using 15/16-inch socket, ratchet handle with 3/4-inch drive, and 1 1/16-inch open-end wrench, unscrew and take out.



TA237961

RIGHT AND LEFT SIDE ENGINE MOUNTS - COUNTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
4. Side engine mounting bracket (1)	Four screws (2) and lockwashers (3)	a. Using 15/16-inch socket and ratchet handle with 3/4-inch drive, unscrew and take out. b. Get rid of lockwashers (3).	
5. Flywheel housing (4)	Side engine mounting bracket (1)	Take off.	
6. Engine mounting frame bracket (5)	Two washers (6) and (7) and insulators (8) and (9)	Take off.	
7.	Four screws (10), lockwashers (11), and nuts (12)	a. Using 3/4-inch socket, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew and take off. b. Get rid of lockwashers (13).	
8. Frame (13)	Engine mounting frame bracket (5)	Take off.	

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

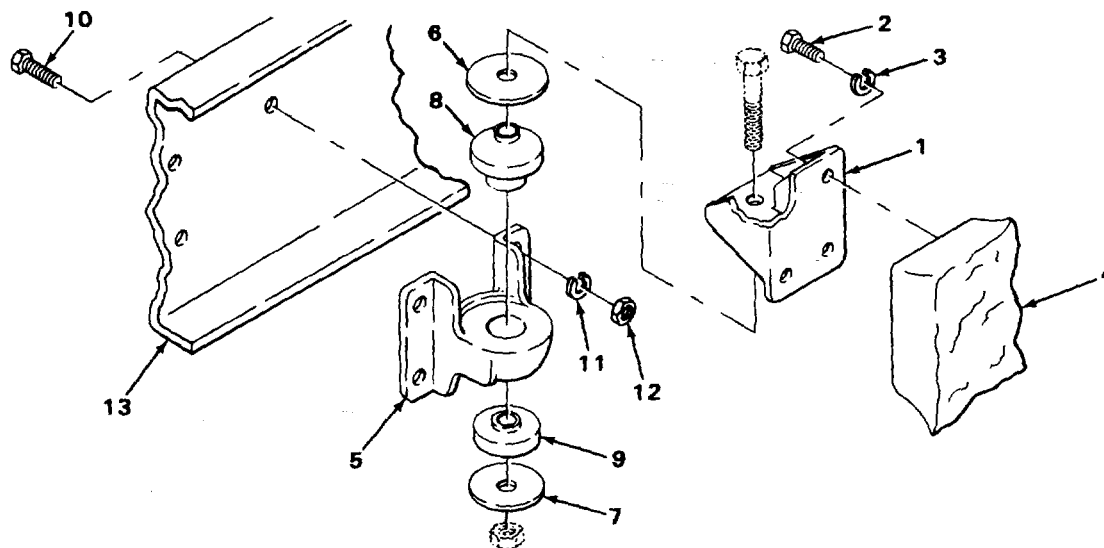
WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

9.	All metal parts	a. Clean in cleaning solvent. b. Wipe dry with clean, dry rags.	

RIGHT AND LEFT SIDE ENGINE MOUNTS - COUNTINUED

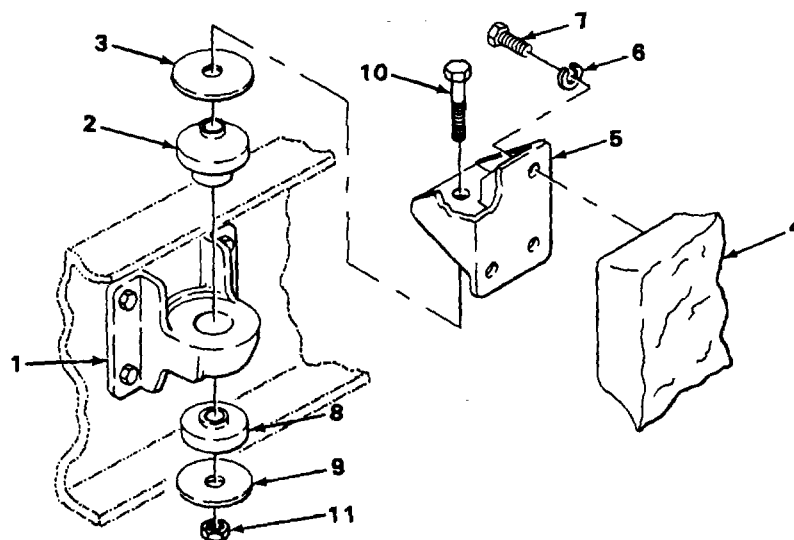
LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.			
10.	Side engine mounting bracket (1) and engine mounting frame bracket (5)	Look for cracks, breaks, bends, and distortion.	
11.	All other parts	a. Look for cracks and breaks. b. Look for stripped threads.	
INSTALLATION			
12. Frame (13)	Engine mounting frame bracket (5)	Put in position.	
13. Engine mounting frame bracket (5)	Four screws (10) new lockwashers (11), and nuts (12)	Screw in, and tighten using 3/4-inch socket, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench.	



TA23796

RIGHT AND LEFT SIDE ENGINE MOUNTS - COUNTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
14.	Engine mounting frame bracket (1)	Insulator (2) and washer (3)	Put In position.
15.	Flywheel housing (4)	Side engine mounting bracket (5)	Put in position.
16.	Side engine mounting bracket (5)	Four new lockwashers (6) and screws (7)	Screw In, and tighten using 15116-inch socket and ratchet handle with 3/4-inch drive.
17.	Engine mounting frame bracket (1)	Insulator (8) and washer (9)	Put In position.
18.	Side engine mounting bracket (5) and engine mounting frame bracket (1)	Screw (10) and nut (11)	Using 15/16-Inch socket, ratchet handle with 3/4-inch drive, and 1 1/16-inch open-end wrench, screw In and tighten.



19.	Frame (12) and front crankcase cover (13)	Two screws (14) and nuts (15)	Using 3/4-Inch socket, 3-inch extension, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, tighten.

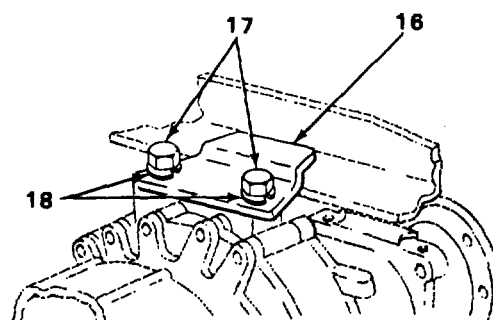
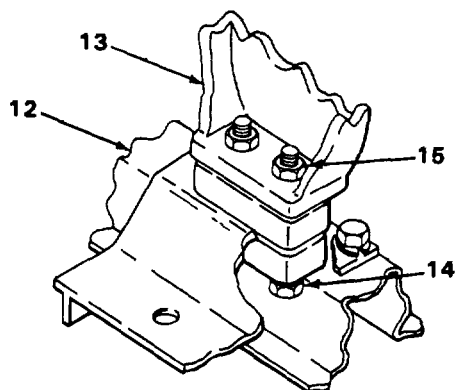
TA237963

RIGHT AND LEFT SIDE ENGINE MOUNTS - COUNTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

20. Rear engine mounts (16) Two screws (17) and lockwashers (18) Using 15/16-inch socket and handle with 3/4-inch drive, tighten.

**NOTE**

FOLLOW-ON MAINTENANCE: Install engine and transmission cover (TM 9-2320-269-20-2).

TASK ENDS HERE

TA237964

CYLINDER BLOCK

This task covers:

a. Disassembly (page 2-93) b. Cleaning (page 2-94) c. Inspection/Replacement (page 2-95)	d. Repair (page 2-98) e. Assembly (page 2-100)
-

INITIAL SETUP**Tools**

Apron, insulated, rubber
 Boring machine
 Caliper, micrometer, ID, 3 1/2
 to 5 1/2-inch capacity
 Cleaner, steam, pressure jet,
 trailer mounted
 Compressor, reciprocating air, power
 driven
 Drift pin, brass, 1/2-inch
 Drill, electric portable
 Gage, cylinder bore
 Gage, thickness
 Gloves, insulated, rubber
 Goggles, safety
 Gun, air blow
 Hammer, ball-peen, machinist's
 Hoist, with lifting cables
 Hone, cylinder
 Hose, air compressor
 Key, socket-head screw, 5/16-inch
 Remover, glaze
 Rule, machinist's, 18-inch
 Scraper, gasket
 Sleeve, adapter
 Wrench, open-end, 5/16-inch
 Wrench, open-end, 3/8-inch
 Wrench, pipe
 Wrench, pliers

Materials/Parts

Acid, pickling (item 1, appendix B)
 Alcohol, wood (item 2, appendix B)

Materials/Parts - Continued

Cloth, emery (item 8, appendix B)
 Kerosene (item 24, appendix B)
 Oil, engine (item 32, appendix B)
 Oxide, zinc (item 36, appendix B)
 Pins, dowel (three required)
 Rags, wiping (item 42, appendix B)
 Solution, alkaline (item 47, appendix B)

Personnel Required

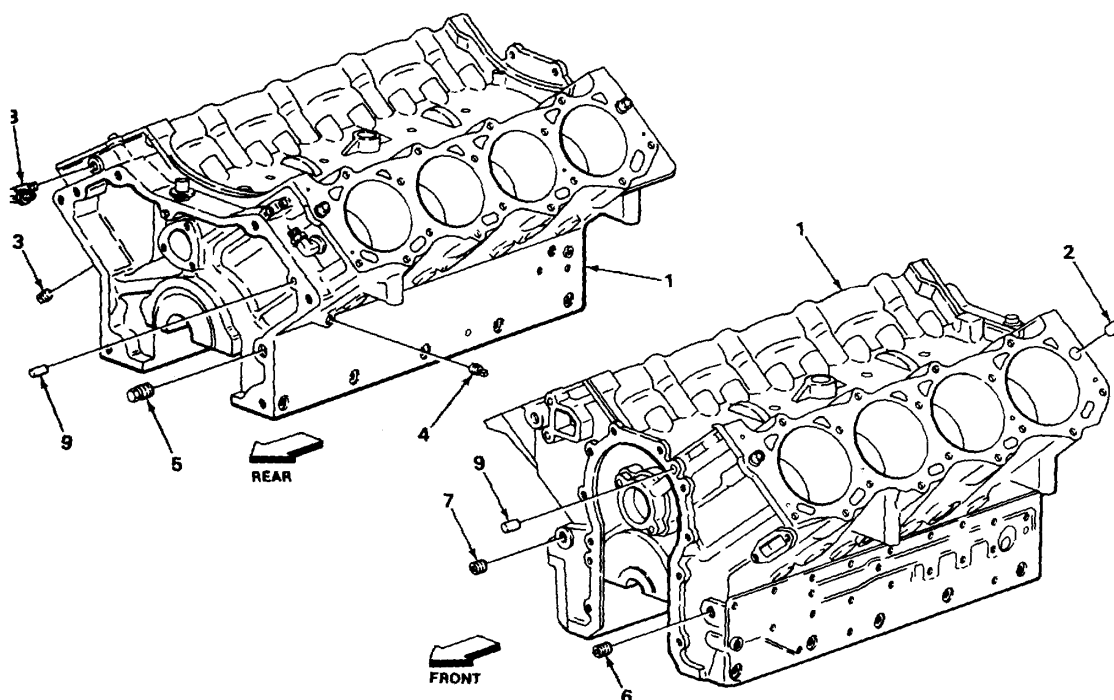
One

Equipment Condition

Engine uncoupled (page 2-52).
 Starting motor removed
 (TM9-2320-269-20-1)
 Alternator removed (TM9-2320-269-20-1).
 Power steering pump (TM9-2320-269-20-1).
 Air compressor removed
 (TM9-2320-269-20-1).
 Engine oil cooler bracket removed
 (page 2-222)
 Crankshaft and main bearings removed
 (page 2-114).
 Pistons and connecting rods removed
 (page 2-141).
 Camshaft bearing removed (page 2-190).

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
1.	Cylinder block (1)	Four rocker arm bracket bolt sleeves (2)	Take out.
2.		Two drain plugs (3) and (4)	Using 3/8-inch open-end wrench, unscrew and take out.
3.		Pipe plug (5)	Using 5/16-inch open-end wrench, unscrew and take out.
4.		Two pipe plugs (6)	Using 5/16-inch socket-head screw key, unscrew and take out.
5.		Pipe plug (7)	Using 5/16-inch socket-head screw key, unscrew and take out.
6.		Two elbows (8)	Using pipe wrench, unscrew and take out.
7.		Three dowel pins (9)	a. Using pliers wrench, pull out. b. Get rid of.



TA2375

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING**WARNING**

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

When pickling acid is used on metal, phosphine gas forms quickly. Phosphine gas is colorless, poisonous, a fire hazard, and can explode. Do not smoke or use pickling acid near open flame. Provide adequate ventilation, and do not breath vapors. Pickling acid can cause serious burns. Wear a rubber apron, gloves, and safety goggles or lenses. If splashed in eyes or on skin, flush with cool clean water, and refer to First Aid for Soldiers Manual FM 21-11.

Avoid contact with live steam. Live steam can burn skin, cause blindness, and cause other serious injury. Safety goggles or lenses must be worn when using live steam. Eye injury can occur if eye protection is not worn..

8.	Cylinder block (1)	a. Using gasket scraper, scrape off all gasket material. b. Attach hoist with cables. c. Immerse block (1) in hot bath of alkaline solution. d. Using hoist, remove block (1) from alkaline bath. e. Steam clean block (1) to remove alkaline solution. f. Remove cables and hoist. g. Using compressed air, dry.

NOTE

If water jackets are not heavily scaled, proceed to step 21. If jackets are heavily scaled, do steps 8h thru 8m.

- h. Attach hoist and cables to block (1).
- i. Agitate the block (1) in a bath of pickling acid for approximately 30 minutes, or until bubbling stops.

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
8.	Continued	Cylinder block (1)	j. Remove block from acid and allow to drain. k. Put block (1) back into acid for about 10 more minutes. l. Repeat steps 8i and 8j until all scale is removed. m. Rinse block in clean, hot water. n. Neutralize the acid that may cling to the casting by Immersing the block (1) in an alkaline bath. o. Steam clean block (1) to remove alkaline solution. p. Remove cables and hoist. q. Dry block (1) with compressed air.

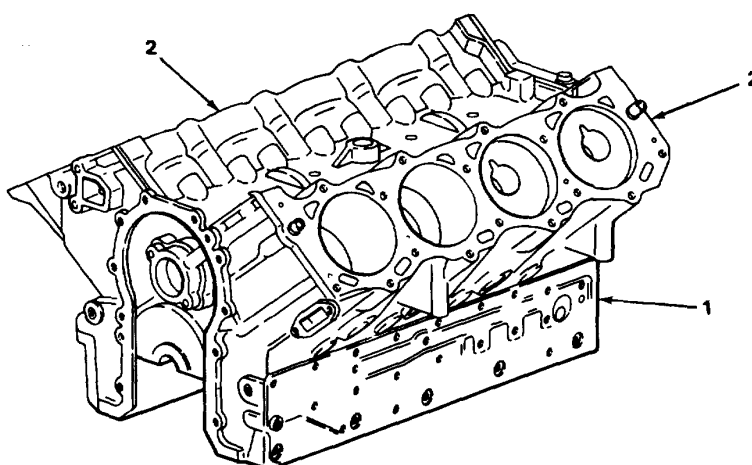
INSPECTION/REPLACEMENT

NOTE

For more information on how to Inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

9.	Cylinder block (1)	Top machined surfaces (2)	a. Using machinist's rule and thickness gage, check for flatness. Lengthwise the surface must not vary more than 0.006 inch (0.152 mm). Crosswise the surface must not vary more than 0.003 inch (0.076 mm).



TA237966

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
9.	Cylinder block (1) Continued	Top machined surfaces (2)	b. If surfaces are not within limits, re- place the block (1).
10.		Eight seal ring grooves (3)	a. Check for pitting, wear and chipping. b. If grooves (3) are damaged so that sealing will be affected, replace the block (1).
NOTE Step 11 is an inspection procedure for one cylinder block bore. Repeat procedure for seven other bores.			
11.		Cylinder block bore (4)	a. Using cylinder bore gage and setting fixture, measure each cylinder block bore (4) at 900 intervals. b. Check diameter of bore (4) at point A and record reading. c. Check diameter of bore (4) at point B. The difference between readings is out-of-round dimension. If out-of-round does not exceed 0.002 inch (0.05 mm), the bore is satis- factory. d. Check that taper from top of bore point C, (4) to bottom, point D, is not more than 0.005-inch (0.127 mm). e. If any bore (3) does not meet given limits, replace block (1).
12.		All surfaces	a. Look for cracks, dents, or distortion. b. If you suspect that there are cracks, do steps 12c thru 12e. c. Apply a mixture of light engine oil and kerosene to the suspected area.

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT - CONTINUED

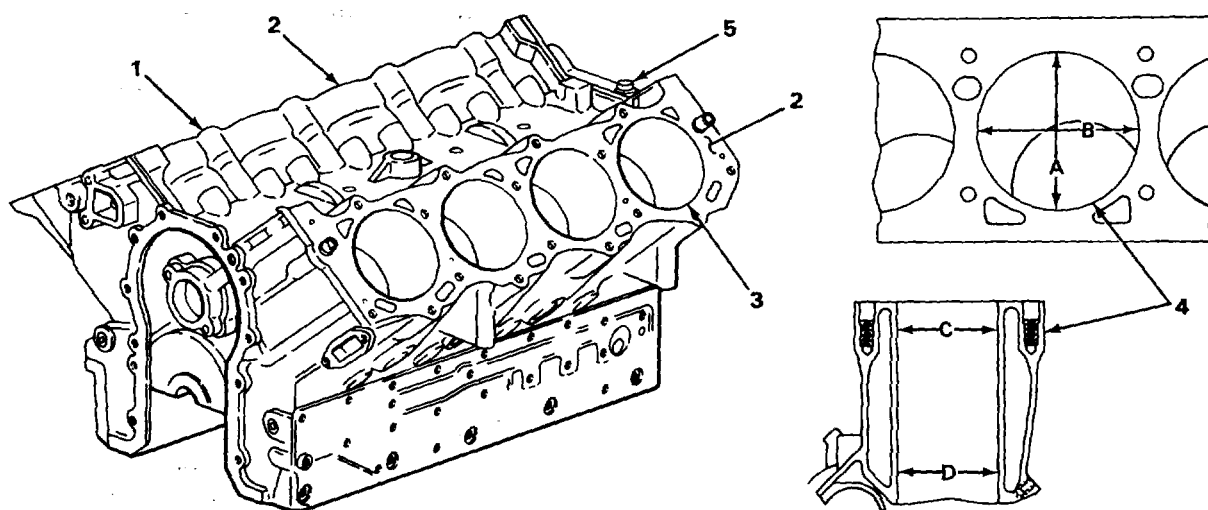
12. Continued

- d. Wipe area dry with clean, dry rag.
- e. Immediately apply a coating of quick-drying zinc oxide powder mixed with wood alcohol.
If cracks are present, a brown discoloration will appear in the zinc oxide mixture.
- f. If any cracks are found replace the block (1).

13.

Oil pump and
tachometer drive
shaft upper
bearing (5)

- a. Using micrometer, check inside diameter of lower part of bearing (4).
Diameter must not be more than 0.487 to 0.488 inch (12.357 to 12.382 mm).
- b. If bearing (5) is not within given limits, go to repair step 16 for replacement procedure.



TA23791

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REPAIR

NOTE

Step 14 is deglazing procedure for one cylinder block bore. Do the same step for all bores.

14. Cylinder block (1)	Cylinder block bore (2)	a. Using glaze remover tool and electric drill at low speed (350-500 rpm), break bore glaze and produce a crosshatch pattern on surface.

CAUTION

Do not use gasoline, kerosene, or cleaning solvent to clean the bore. Solvents will not remove the abrasives which can cause rapid engine wear and ring failure.

b. Using clean, dry rags, wipe away as much of the abrasive deposits as possible. c. Using clean rags soaked with engine oil, wipe out bore (2). d. Using clean, dry rags, wipe away all oil. e. Continue to clean with clean rags until the rags show no evidence of discoloration from the oil.	This usually requires three or more swabbing operations.

NOTE

Step 15 is reboring and honing procedure for one block bore. Do the same step for all bores.

15.	Cylinder block bores (2)	a. Using boring machine, enlarge bore (2) to within 0.003 inch (9.07 mm) of required oversize diameter. This will allow enough stock for final honing to get exact clearance for selected oversize pistons.

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

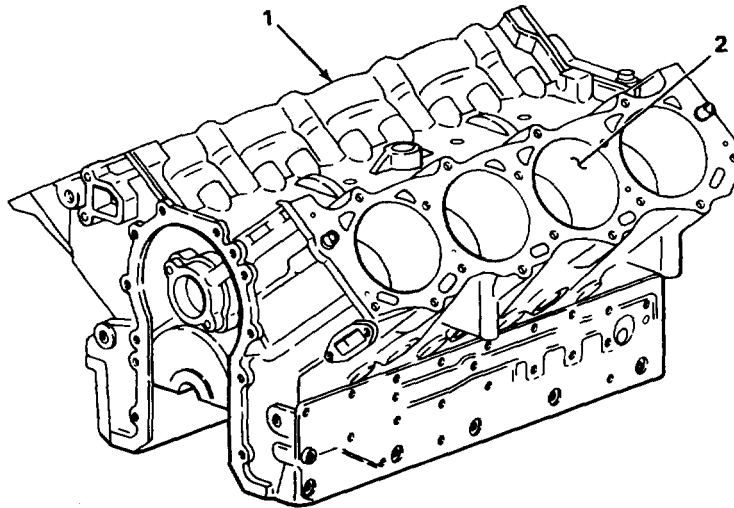
REPAIR - CONTINUED

15. Continued	Cylinder block bores (2)	b. Using cylinder hone, hone bore (2) as necessary to get specified piston running clearance.	When honing, the hone should be moved up and down to give a cross-hatch pattern on wall surface. The faster the hone rotates, the faster it must be moved to give the cross-hatch pattern.
		c. After honing, use an emery cloth to remove the sharp, burred edge that has developed at the bottom of the bore (2).	

CAUTION

Do not use gasoline, kerosene or cleaning solvent to clean bores. Solvents will not remove the abrasives which can cause rapid engine wear and ring failure.

- d. Repeat step 14b thru 14e to clean bores.
e. Repeat step 11 to check tolerances.



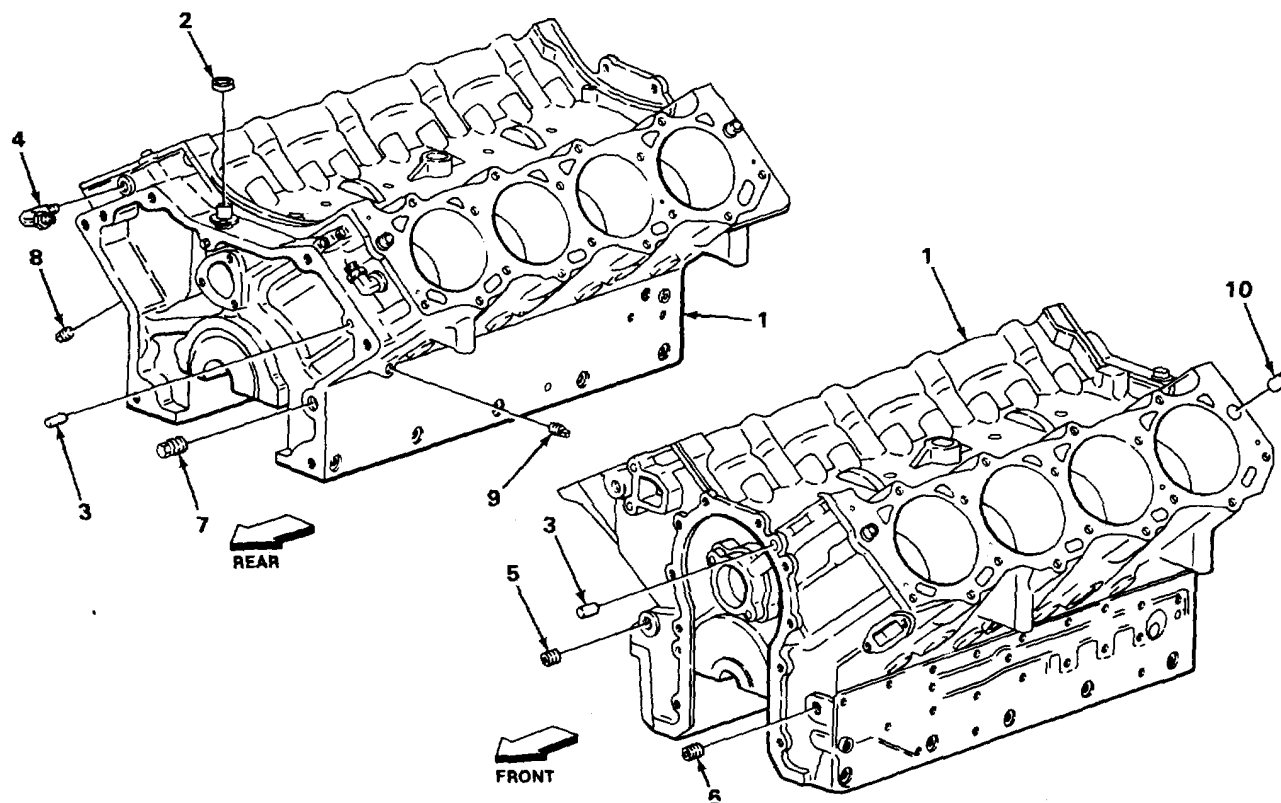
TA237968

CYLINDER BLOCK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REPAIR - CONTINUED			
16.	Cylinder block(1) Oil pump and tachometer drive shaft bushing (2)	a. Using ½ inch brass driftpin and ball- peen hammer, drive out from underside. b. Get rid of. c. Line up punchmark on new bushing (2) with rib on block(1)/ This will index the busing oil hole with block (1) oil passage. d. Using hammer and sleeve, tap in until flush with top of block.	
ASSEMBLY			
17.	Three new dowel pins (3)	Drive in using ½ inch brass driftpin and ball peen hammer.	
18.	Two elbows (4)	Screw in, and tighten using pipe wrench.	
19.	Pipe plug (5)	Screw in, and tighten using 5/16-inch sl socket head screw key.	
20.	Two pipe plugs (6)	Screw-in, and tighten using 5/16-inch socket-head screw key.	
21.	Pipe plug(7)	Screw in, and tighten using 5/16-inch open end wrench.	
22.	Two drain plugs(8) and (9)	ScREW, in and tighten using 3/8-inch open-end wrench.	
23.	Cylinder block(1) Four rocker arm Bracket bolt sleeves (10)	Put in.	

CYLINDER BLOCK - CONTINUED

ASSEMBLY - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE:

1. Install camshaft bearings (page 2-190).
2. Install crankshaft and main bearings (page 2-114).
3. Install pistons and connecting rods (page 2-141).
5. Install valve lifter rods and tappet valve assemblies (page 2-172).
5. Install engine oil cooler bracket (page 2-222).
6. Install air compressor (TM 9.2320-269-20-1).
7. Install power steering pump (TM 9.2320-269-20-1).
8. Install alternator (TM 9-2320-269-20-1).
9. Install starting motor (TM 9-2320-269-20-1).
10. Couple engine (page 2-52).

TASK ENDS HERE

TA237969

CYLINDER HEADS

This task covers:

a. Removal (page 2-103)	e. Repair (page 2-108)
b. Disassembly (page 2-106)	f. Assembly (page 2-111)
c. Cleaning (page 2-106)	g. Installation (page 2-111)
d. Inspection/Replacement (page 2-106)	

INITIAL SETUP

Tools

Brush, stiff bristle
 Brush, valve guide cleaner
 Extension, socket-wrench, 1/2-inch drive, 10-inch
 Face, inserted hammer, soft-plastic
 Fixture, cylinder head support
 Gage, thickness, ribbon, .006-inch
 Gage, valve guide
 Grinder, valve seat Insert
 Hammer, ball-peen, machinist's, 3-lb
 Handle, ratchet, 1/2-inch drive
 Hoist with lifting slings
 Holder, inserted hammer-face
 Indicator, dial
 Press, arbor, hand-operated
 Puller, slide hammer
 Punch, drive-pin, 114-inch blunt-end
 Reamer, valve guide
 Remover and Installer, valve guide
 Remover and installer, valve seat insert
 Rule, machinist's, 24-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 112-inch drive, 1/2-inch 12-point
 Socket, 1/2-inch drive, 3/4-inch
 Vise, machinist's
 Wrench, open-end, 9116-inch
 Wrench, open-end, 15/16-inch
 Wrench, pipe
 Wrench, torque, 1/2-inch drive 0-200 ft-lb capacity

Materials/Parts

Gasket, water bypass cover (two required)

Materials/Parts - Continued

Gasket, cylinder head
 Ice, dry (item 22, appendix B)
 Insert, valve seat
 Lockwasher, water bypass cover (two required)
 Lockwasher, bracket (two required)
 Lockwasher, right side cylinder head
 Oil, engine (item 32, appendix B)
 Prussian blue (item 41, appendix B)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)
 White lead (item 25, appendix B)

Personnel Required

One

Equipment Condition

Coolant drained (TM 9-2320-269-20-1)
 Alternator and bracket removed (right side only) (TM 9-2320-269-20-1).
 Power steering pump removed (left side only) (page 2-1099).
 Air compressor removed (left side only) (TM 9-2320-269-20-1).
 Exhaust manifolds removed (page 2-232).
 Right water outlet removed (page 2-395).
 Left water outlet removed (page 2-391).
 Intake manifolds removed (page 2-226).
 Valve lifter rods removed (page 2-172).
 Fuel injectors removed (page 2-245).
 Emergency stop solenoid removed (TM 9.2320-269-20-1)

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

NOTE

This procedure covers right side cylinder head. Procedure for left side is similar.

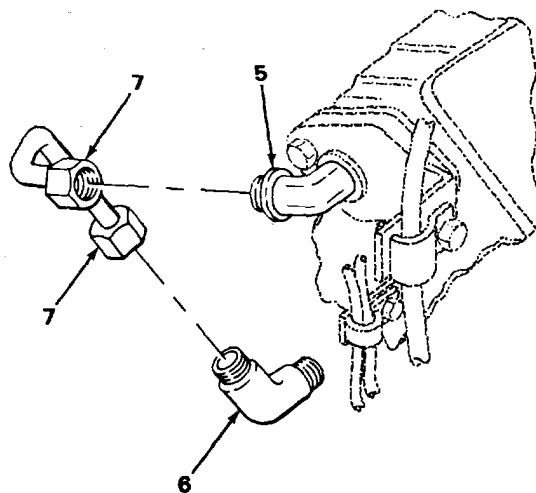
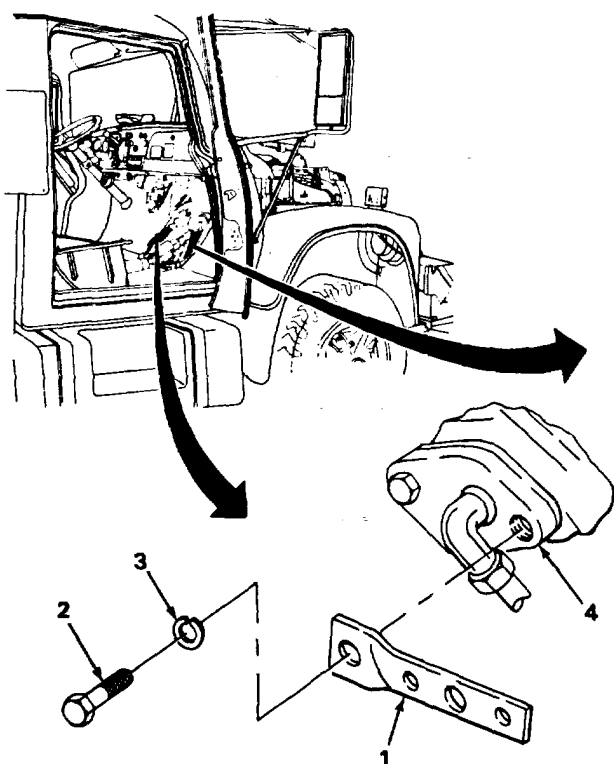
REMOVAL

1.	Cab	Transmission cover	Remove (TM 9-2320-269-20-2).

NOTE

Steps 2 and 3 apply to left side cylinder head.

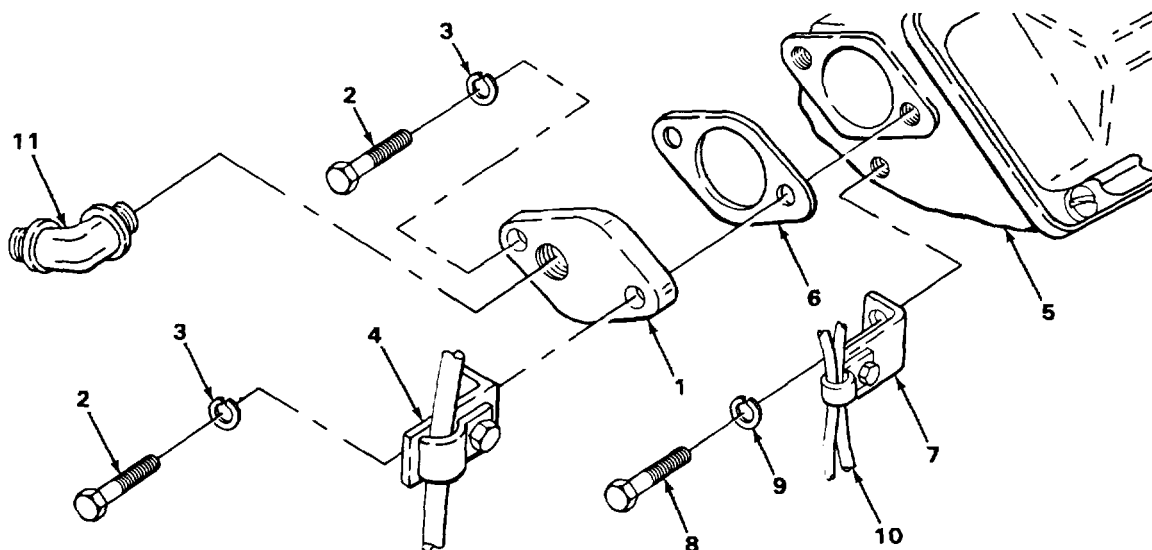
2.	Bracket (1)	Screw (2) and lockwasher (3)	a. Using 9/16-inch open-end, unscrew and take out. b. Get rid of lockwasher (3).
3.	Water bypass	Bracket (1)	Take off. over (4)
4.	Two elbows (5) and (6)	Two water bypass pipe nuts (7)	Using pipe wrench and 15/16-inch open-end wrench, unscrew and take off.



TA237970

CYLINDER HEADS - CONTINUED

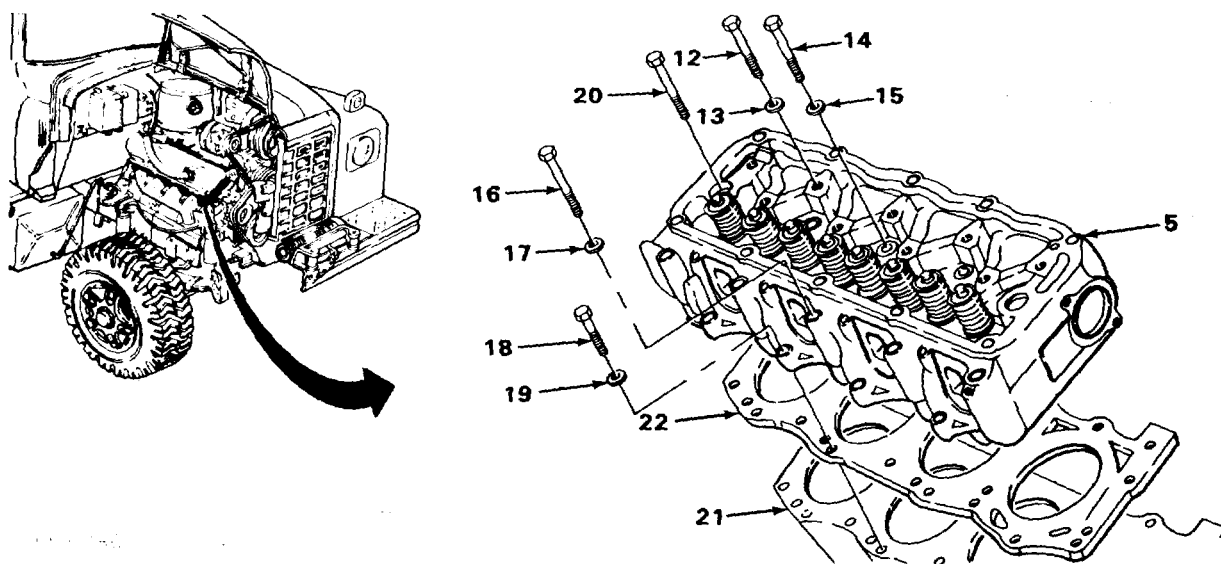
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
5.	Water bypass cover (1)	Two screws (2), lockwashers (3), and bracket (4)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (3).
6.	Cylinder head (5)	Water bypass cover (1) and gasket (6)	a. Take off. b. Get rid of gasket (6).
7.	Bracket (7)	Screw (8) and lockwasher (9)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwasher (9).
8.	Cylinder head (5)	Bracket (7) with wires (10)	Take off and move out of the way.
9.	Water bypass	Elbow (11) cover (1)	a. Put cover (1) in vise. b. Using pipe wrench, unscrew and take out. c. Take cover (1) out of vise.



TA237971

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
10. Cylinder head (5)	Four screws (12) and washers (13)	a. Attach lifting sling to left side of head (5). b. Using 3/4-inch socket, 10-inch extension, and ratchet handle with 1/2-inch drive, unscrew and take out.	
11.	Three screws (14) and washers (15)	Using 3/4-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
12.	Five screws (16) and washers (17)	Using 3/4-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
13.	Four screws (18) and washers (19)	Using 3/4-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
14.	Two screws (20)	Using 1/2-inch 12-point socket and ratchet handle with 1/2-inch drive, unscrew and take off.	
15. Cylinder block (21)	Cylinder head (5) and gasket (22)	a. Using hoist, lift off and place on clean workbench. b. Take off gasket (22), and get rid of.	



TA237972

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY

16.	Cylinder head (1)	Intake and exhaust Valves	Remove (page 2-158).

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

17.	Cylinder head (1)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags. c. Check all water passages to make sure they are clean. d. If water passages are clogged, use stiff bristle brush to clean them and then repeat step a above. e. Clean valve guide bores with valve guide brush.

INSPECTION/REPLACEMENT

NOTE

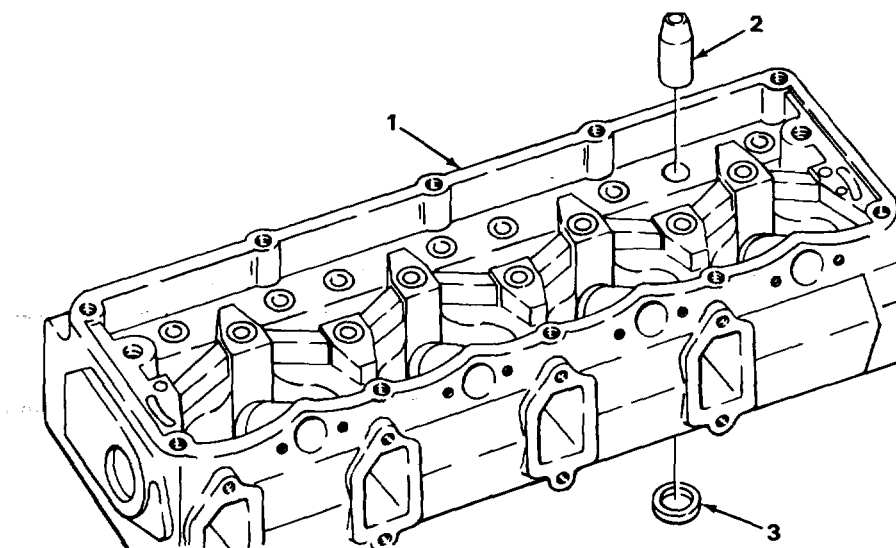
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

18.	Cylinder head (1)	a. Look for water leaks, cracks in combustion chambers, exhaust ports, or around valve seats. b. Check machined surfaces and gasket surfaces for scratches and burrs which would affect sealing and cause leakage.

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
18.	Continued	c.	Using machinist's rule and 0.006 inch (0.152 mm) thickness gage, check fire deck for flatness. If gage can be inserted between head and straight edge, replace head. Cylinder heads are NOT resurfaced.
19.	Cylinder head (1)		
	Eight valve guides (2)	a.	Using valve guide gage, check diameter. Diameter must be 0.3738 - 0.3748 Inch (9.495 - 9.520 mm).
		b.	Check to see if guides are bellmouthed or egg shaped. Guides cannot be bellmouthed more than 0.0005 inch (0.0127 mm).
		c.	If any guide (2) is bellmouthed, egg-shaped, or does not meet given limits, go to repair step 21 to replace it.
20.	Cylinder head (1)		
	Eight valve seat inserts (3)	a.	Look for looseness, burn marks, and cracks.
		b.	Look for signs of excessive grinding.
		c.	If any defects are found in any insert (3), go to repair step 22 to replace it.



TA237973

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REPAIR			
NOTE			
Step 21 is replacement procedure for one valve guide. Repeat as necessary for other damaged guides.			
21. Cylinder head (1)	Valve guide (2)	a. Position head (1) bottom side up on support fixture in arbor press. b. Using valve guide remover tool and press, press out guide (2). All guides must be pressed out from bottom through top of head. c. Get rid of damaged guide (2). d. Position head (1) top side up on support fixture in arbor press. e. Adjust valve guide installer tool for 1.219-inch (30.96 mm) valve guide height above head (1). f. Put top end of new guide (2) into installer tool. g. Lubricate outside diameter of guide (2) with mixture of clean engine oil and white lead. h. Using installer tool and press, press new guide (2) into head (1). i. Reaming is not necessary but use a reamer to make sure burrs are removed and that the guide (2) was not distorted during installation.	
NOTE			
Step 22 is replacement procedure for one valve seat insert. Repeat as necessary for other damaged seat inserts.			
22.	Valve seat insert (3)	a. Position head (1) bottom side up. b. Using valve seat remover tool and slide hammer, take out. c. Get rid of insert (3). d. Using chart below, select the proper size insert (3). e. Using valve seat insert grinder, clean up, or machine to the correct oversized diameter, the valve seat counterbores.	

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REPAIR - CONTINUED

22. Continued

- f. Chill insert (3) thoroughly with dry ice.
- g. Position insert (3) on installer tool and using installer tool and 3-lb ball-peen hammer, drive insert (3) into head (1).

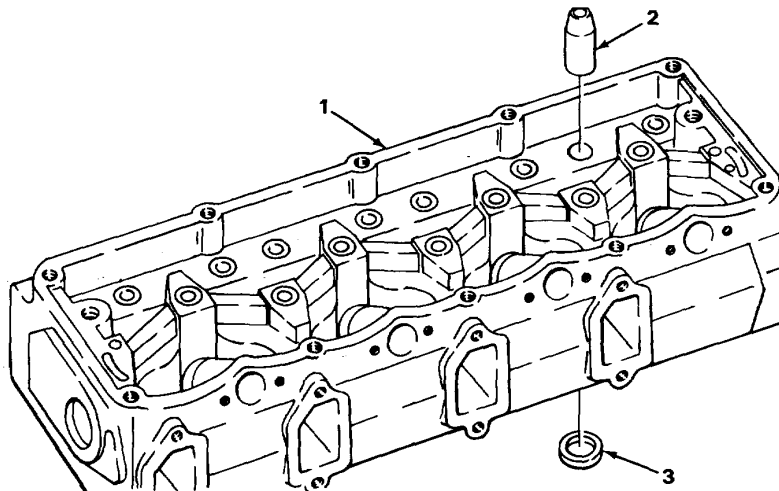
NOTE

Do not peen around injection nozzle area or on intake valve insert.

- h. Using 1/4-inch blunt end drive-pin punch and 3-lb ball-peen hammer, peen head (1) metal over outer edge of insert (3).
- i. Using valve seat grinder, reface insert (3).

Use chart below for specific angle and seat width. During grinding operation, take off the minimum amount of material necessary to t up the insert.

INTAKE AND EXHAUST VALVE SEAT INSERTS	
FACE ANGLE	45 degrees
SEAT ANGLE	45 degrees
SEAT WIDTH	0.080 - 0.090 inch 2.03 - 2.29 millimeter



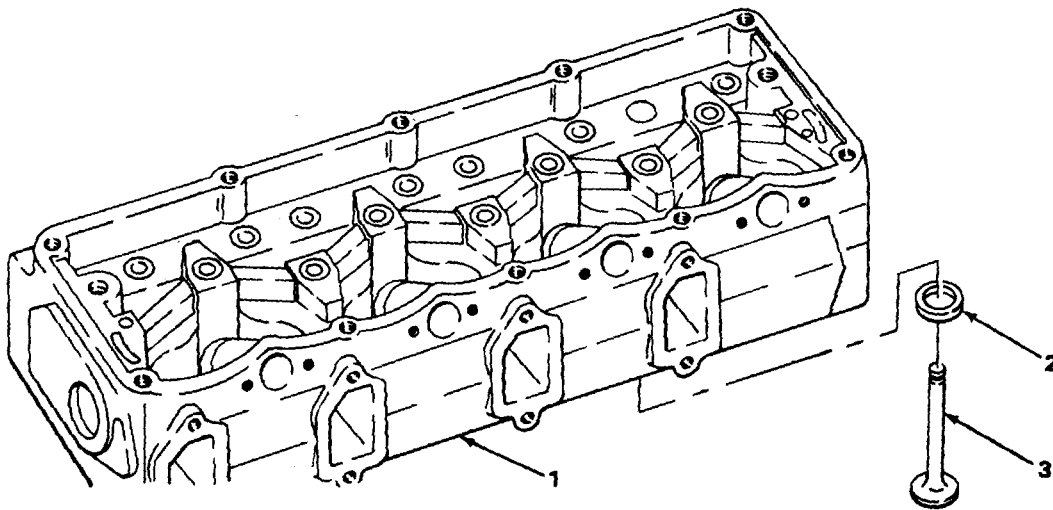
TA237974

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REPAIR - CONTINUED			
22. Cylinder head (1) Continued	Valve seat insert (2) and valve (3)	j. Using dial indicator, check insert (2) for runout. k. To check valve face contact, apply thin coat of Prussian blue on respective valve (3) (location noted during removal). l. Position valve (3) in cylinder head (1), and using soft plastic-face hammer, tap lightly to seat. m. Take out valve (3). n. Note markings on insert, and make necessary corrections so that seat dimensions given below are met. o. When seat contact is satisfactory, mark each valve (3) for installation.	Maximum runout allowed for Intake and exhaust valve seat Inserts is 0.002 inch (0.05 mm).

INTAKE AND EXHAUST VALVE SEAT INSERTS

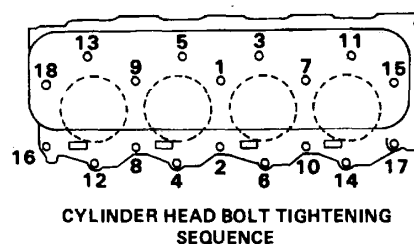
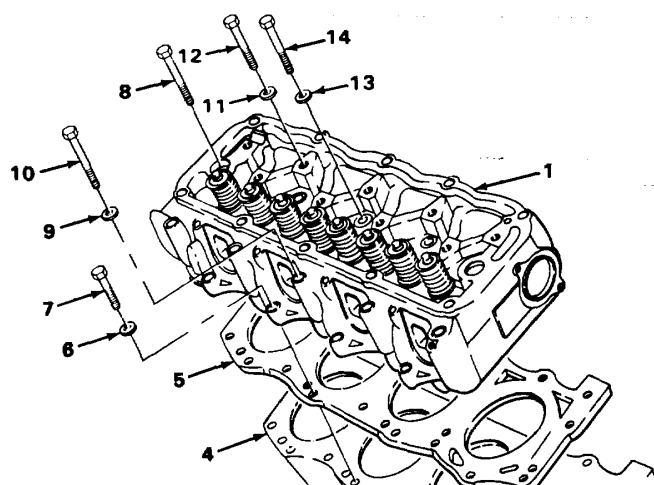
FACE ANGLE	45 degrees
SEAT ANGLE	45 degrees
SEAT WIDTH	0.080 - 0.090 inch (2.03 - 2.29 millimeter)



TA237975

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
23.	Cylinder head (1)	Intake and exhaust valves	Install (page 2-158).
INSTALLATION			
24.	Cylinder block (4)	New gasket (5)	Put on over dowels.
25.	Cylinder head (1)		a. Attach lifting sling. b. Using hoist, lift and place in position over dowels.
26.	Four washers (6)		Screw in until snug.
27.	Cylinder head (1)	Two screws (8)	and screws (7)
28.	Five washers (9)		Screw in until snug.
29.	Three washers (11)		Screw in until snug.
30.	Four washers (13)		and screws (12)
31.	Eighteen screws (7), (8), (10), (12), and (14)		Screw in until snug.
			Using 3/4-inch socket, 10-inch extension, 1/2-inch 12-point socket, and torque wrench with 112-inch drive, tighten in sequence shown below to 142 - 149 ft-lb (105 - 110 N m) of torque.



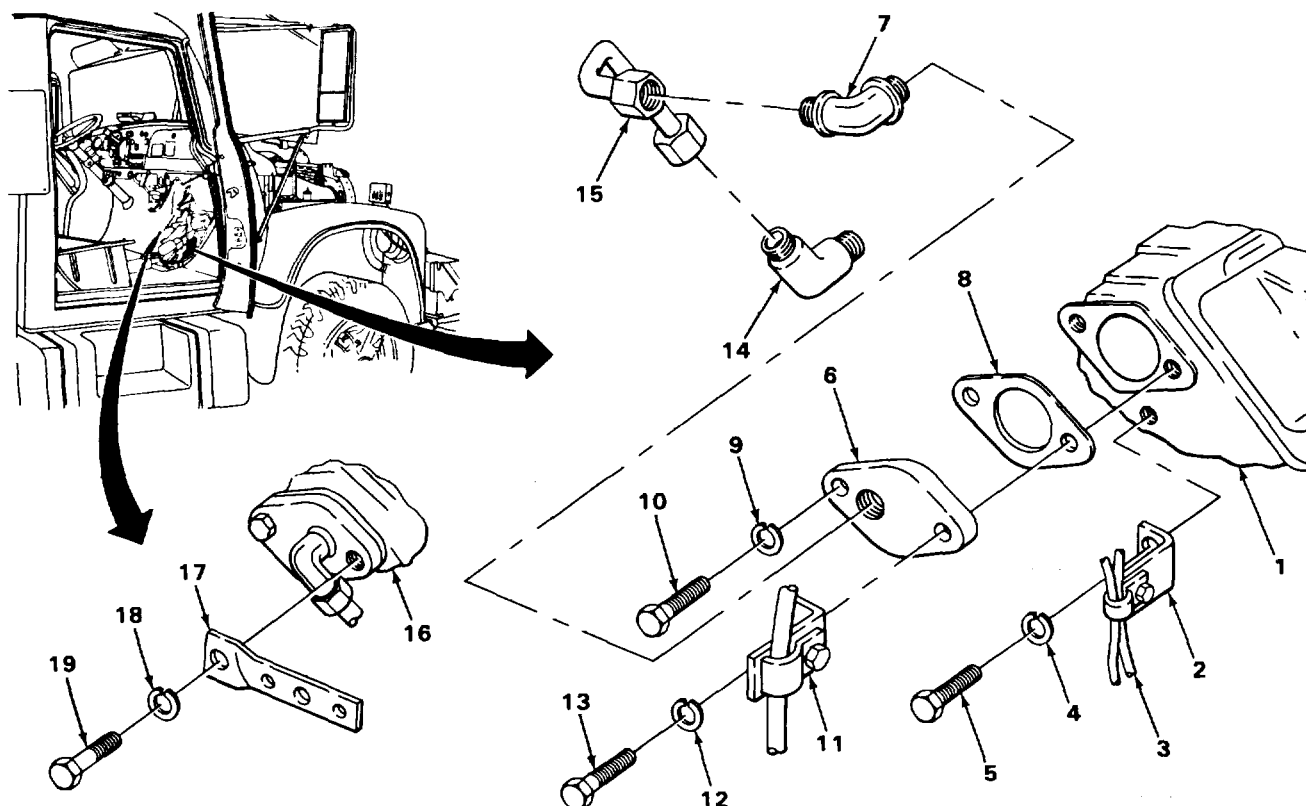
TA237976

CYLINDER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
32.	Cylinder head (1)	Bracket (2) with wires (3)	Put in position.
33.	Bracket (2)	New lockwasher (4) and screw (5)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.
34.	Water bypass cover (6)	Elbow (7)	Screw in, and tighten using pipe wrench.
35.	Cylinder head (1)	New gasket (8) and water bypass cover (6)	Put in position.
36.	Water bypass cover (6)	Two new lockwashers (9) and screws (10)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.
37.		Bracket (11)	Put in place
38.	Bracket (11)	New lockwasher (12) and screw (13)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.
39.	Two elbows (7) and (14)	Water bypass pipe (15)	Screw on, and tighten using 15/16-inch open-end wrench.
NOTE Steps 40 and 41 apply to left side cylinder head.			
40.	Water bypass cover (16)	Bracket (17)	Put in place.
41.	Bracket (17)	New lockwasher (18) and screw (19)	Screw in, and tighten using 9/16-inch open-end wrench.

CYLINDER HEADS - CONTINUED

INSTALLATION - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE:

1. Install emergency stop solenoid (TM 9-2320-269-20-1).
2. Install fuel injector (page 2-245).
3. Install valve lifter rods (page 2-172).
4. Install tappet cover (page 2-182).
5. Install exhaust manifolds (page 2-232).
6. Install right water outlet (page 2-395).
7. Install left water outlet (page 2-391).
8. Install air compressor (left side only) (TM 9-2320-269-20-1).
9. Install power steering pump (left side only) (page 2-1099).
10. Install alternator and bracket (TM 9-2320-269-20-1).
11. Service cooling system (TM 9-2320-269-20-1).

TASK ENDS HERE

TA237977

CRANKSHAFT AND MAIN BEARINGS

This task covers:

a. Removal (page 2-115)	d. Inspection/Replacement (page 2-120)
b. Disassembly (page 2-119)	e. Installation (page 2-122)
c. Cleaning (page 2-120).	
-

INITIAL SETUP**Tools**

Caliper, micrometer, OD
 Clamp, piston holddown
 (eight required)
 Face, inserted hammer, soft-plastic
 Hammer, ball-peen, machinist's
 Hammer, slide
 Handle, ratchet, 1/2-inch drive
 Hoist, with lifting slings
 Holder, inserted hammer-face
 Indicator, dial
 Installer, crankshaft oil seal
 and sleeve
 Installer, main bearing cap seal
 Knife, pocket
 Puller, gear
 Puller, gear adapter
 Puller, seal
 Punch, drive-pin, 1/4-inch
 Punch, drive-pin, 3/8-inch, blunt-end
 Remover and installer, main bearing cap
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 11/16-inch
 Socket, 1/2-inch drive, 13/16-inch
 Studs, guide (two required)
 Wrench, open-end, 2-inch
 Wrench, torque, 1/2-inch drive

Materials/Parts

Oil, engine (item 32, appendix B)
 Rags, wiping (item 42, appendix B)
 Seal, crankshaft
 Seal, rear main bearing (two required)
 Sleeve, crankshaft (as needed)
 Solvent, drycleaning (item 49, appendix B)
 Tag, marking (item 50, appendix B)
 Tape, plastic gage (item 53, appendix B)
 Washers, cylinder block (ten required)
 Washers, main and rear main bearing cap
 (ten required)

Personnel Required

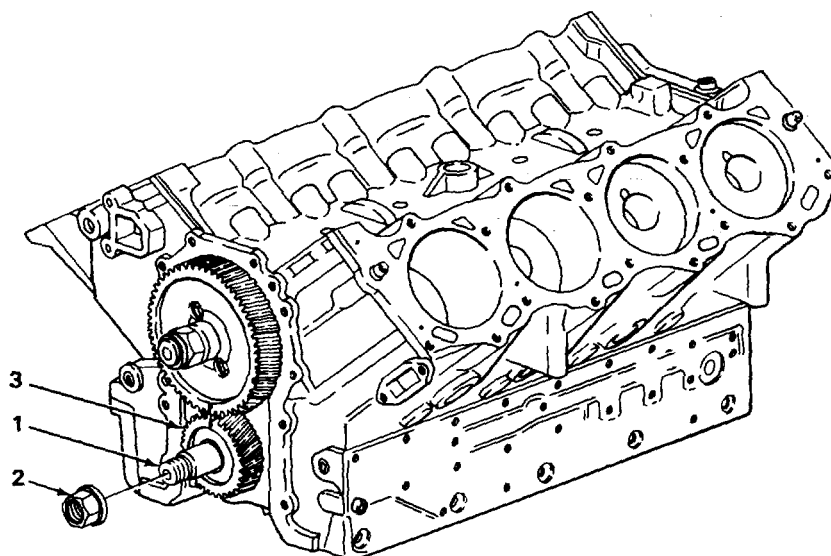
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Equipment Condition

Cylinder heads removed (page 2-102).
 Front crankcase cover removed (page 2-197).
 Flywheel housing removed (page 2-137).
 Engine oil pump removed (page 2-208).

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

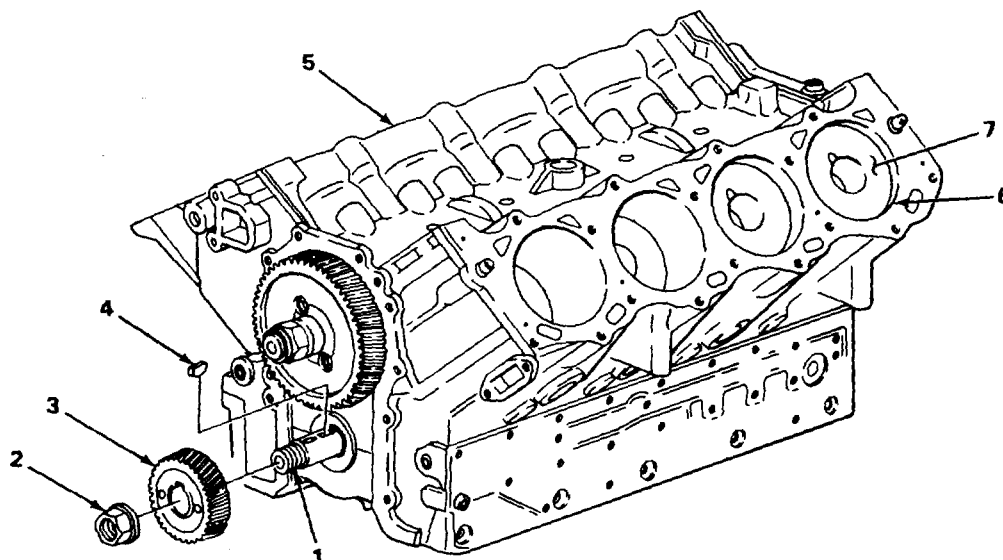
LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Crankshaft (1)	Crankshaft pulley nut (2)	Using 2-inch open-end wrench, screw on and tighten. This will allow you to turn the crankshaft by hand.
2.	Crankshaft timing gear (3)		- Using 2-inch open-end wrench, turn crankshaft (1) until gear timing marks line up. - Write down their locations so timing gears can be installed in their original position. - Using dial indicator, check backlash between gears. Backlash should be 0.0005 - 0.0045 inch (0.013 - 0.114 mm). If backlash is not within limits, the timing gear will be replaced. - Using dial indicator, check and record end play. End play should be 0.004 - 0.010 inch (0.102 - 0.254 mm). Too much end play usually indicates that bearing shells and/or thrust flanges are worn:-



TA23797

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

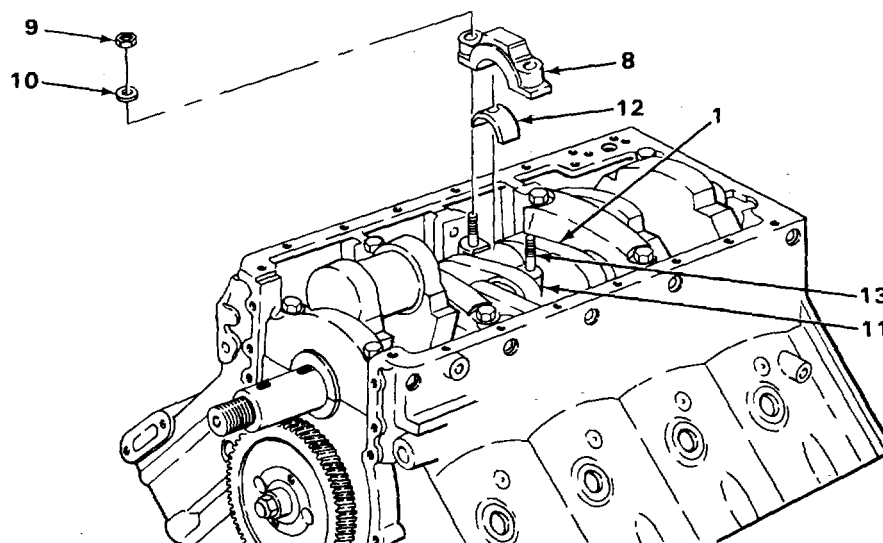
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
3.	Crankshaft (1)	Crankshaft pulley nut (2)	Using 2-inch open-end wrench, unscrew and take off.
4.		Crankshaft timing gear (3)	Using gear puller, pull off.
5.		Woodruff key (4)	Using ball-peen hammer and 1/4-inch drive-pin punch, tap out.
6.	Cylinder block (5)	Eight cylinders (6)	Install eight holddown clamps so that pistons (7) will not fall out.
7.	Crankshaft (1)	Crankshaft pulley nut (2)	Using 2-inch open-end wrench, screw on and tighten.



TA237979

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

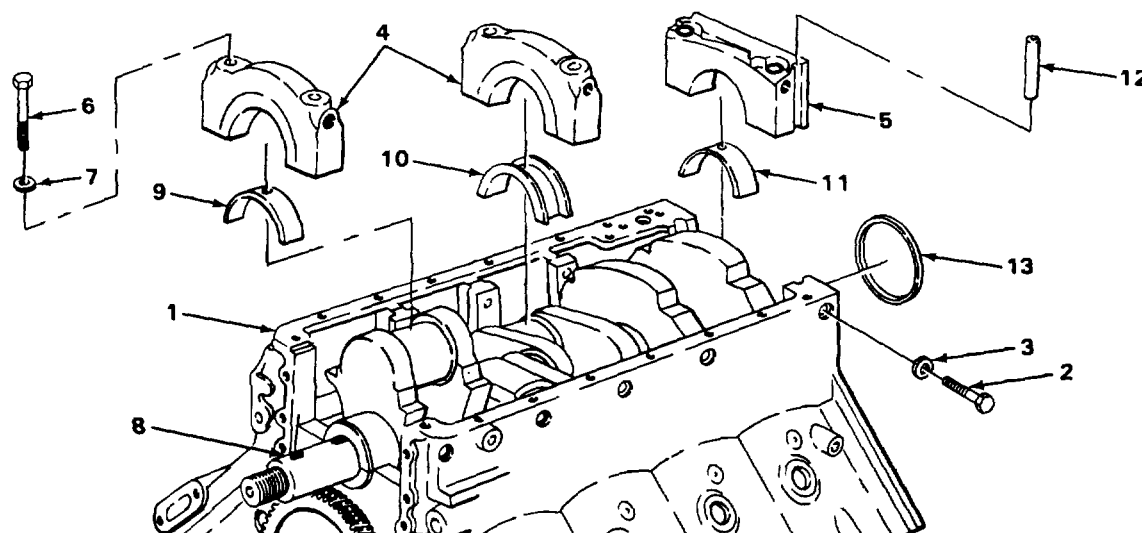
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
NOTE Connecting rods and their bearing caps are numbered for proper placement during installation. All connecting rod bearing caps and lower bearing shells come off the same way. One set is shown. Repeat steps 8 thru 10 for each set.			
8.	Connecting rod bearing cap (8)	Two nuts (9) and washers (10)	a. Using 2-inch open-end wrench, turn crankshaft (1) as necessary for access. b. Using 11/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off.
9.	Connecting rod (11) and crankshaft (1)	Connecting rod bearing cap (8) with lower bearing shell (12)	a. Using plastic-face hammer, tap to unseat. b. Take off. Keep each cap and shell set together for proper placement during installation.
10.	Crankshaft (1)	Connecting rod (11) and attached parts	Push away until connecting rod screws (13) are clear of crankshaft.



TA237980

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
11. Cylinder block (1)	Ten screws (2) and washers (3)	a. Using 9/16-inch socket and ratchet handle with 112-inch drive, unscrew and take out. b. Get rid of washers (3).	
12. Four main bearing caps (4) and rear main bearing cap (5)	Ten screws (6) and washers (7)	a. Using 13/16-inch socket and ratchet handle with 112-inch drive, unscrew and take out. b. Get rid of washers (7).	
13. Crankshaft (8)	Four main bearing caps (4), three lower bearing shells (9), and lower thrust flange (10)	a. Using main bearing cap remover and slide hammer, take off caps (4) numbered 1, 2, 3, and 4. b. Keep shells (9) and flange (10) together with their respective caps (4).	
14.	Rear main bearing cap (5) and lower bearing shell (11)	a. Using gear puller and gear adapter puller, take off. b. Keep cap (5) and shell (11) together.	
15. Rear bearing	Two seals (12) cap (5)	a. Pull off. b. Get rid of.	
16. Crankshaft (8)	Seal (13)	a. Using seal puller, pull off. b. Get rid of.	



TA237981

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
17. Cylinder block (1)	Crankshaft (8)	Using lifting sling and hoist, and turning as necessary to clear sides of block (1), take out.	
18.	Four upper bearing shells (14) and one upper thrust flange (15)	a. Roll out, tang end first. b. Tag for proper placement during installation.	

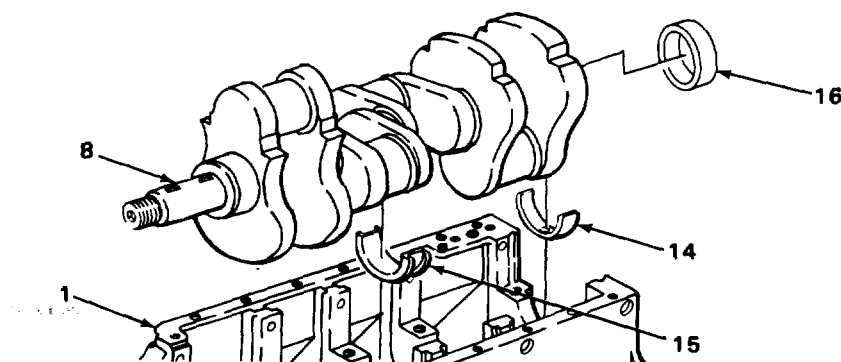
DISASSEMBLY**CAUTION**

Be careful not to nick or scuff the crankshaft flange when removing sleeve.

NOTE

If wear sleeve only shows one wear path, do not do step 19.

19. Crankshaft (8)	Wear sleeve (16)	a. Using 3/8-inch blunt-end drive-pin punch, and ball-peen hammer, mark surface in several places. b. Using plastic face hammer, tap surface until sleeve (16) expands enough to be taken off. c. Take off. d. Get rid of.	



TA237982

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). <u>WARNING</u> Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
20.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.	
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed. <u>CAUTION</u> Because of heat treatment, no attempt should be made to regrind journals for use of undersize bearings. Grinding will cause tiny cracks at the fillet areas which will lead to crankshaft breakage and serious damage to the engine.			
21.	Crankshaft (1)	a. Look for cracks, scratches, nicks, and score marks. b. Look at keyway for cracks and wear. c. Look at journals for discoloration caused by overheating. If crankshaft has been overheated, heat treatment has been destroyed and crankshaft must be replaced. d. Using micrometer, measure journals. Main journal diameter must be 3.1235 - 3.1245 inches (79.34 - 79.36 mm). Connecting rod journals diameters must be 2.753 - 2.754 inches (69.93 - 69.95 mm).	

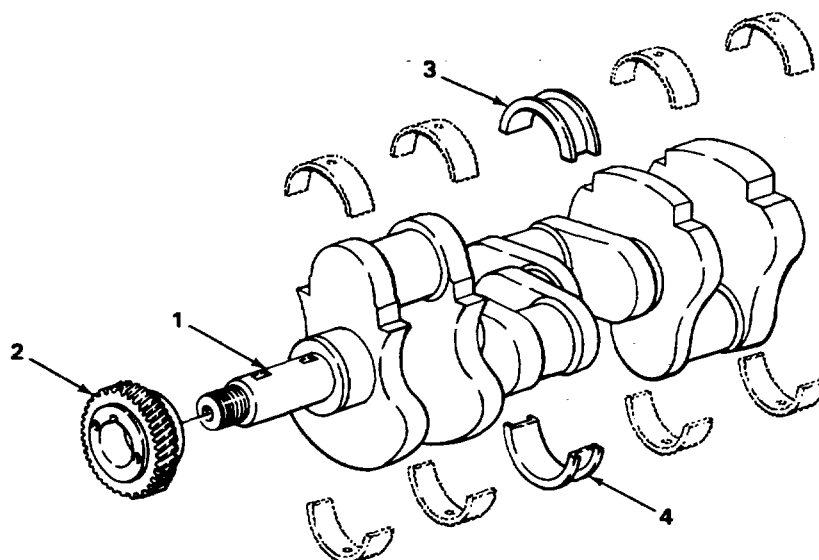
CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT- CONTINUED**NOTE**

If crankshaft timing gear is damaged and must be replaced, also replace camshaft gear and fuel injection pump gear.

22.	Crankshaft timing gear (2)	Look for broken, chipped, nicked, or worn teeth.
23.	All bearing shells and upper and lower thrust flanges (3) and (4)	Look for scoring, deep scratches, and other signs of wear.



TA237983

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION

NOTE

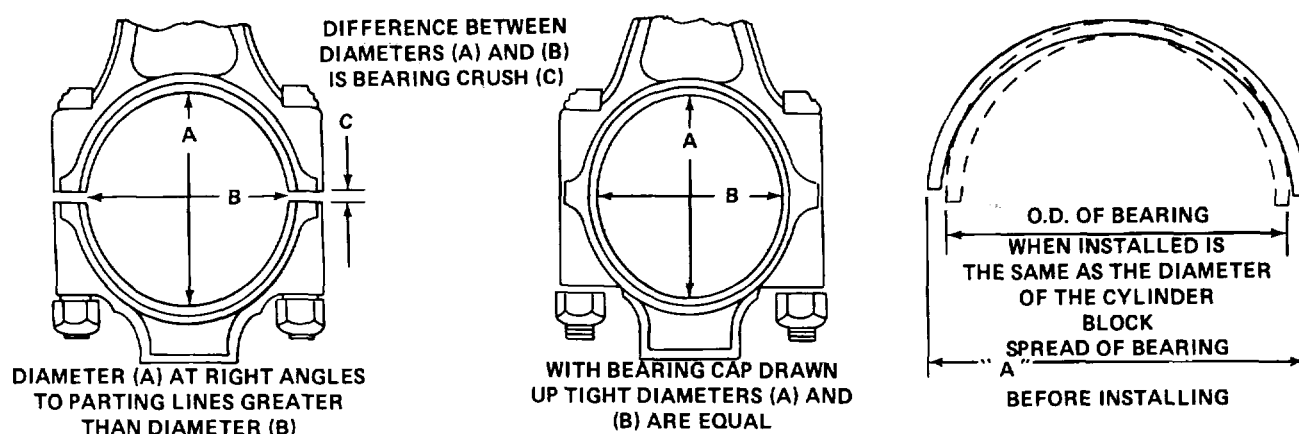
During inspection, the crankshaft and bearing shells may have appeared to be satisfactory for installation. In the following steps, measurements will be taken to assure that the parts are within limits and may be found to be defective. If new bearing shells are installed and tolerances are not met the crankshaft will be replaced.

When installing new crankshaft, use all new bearing shells and thrust flanges, bearing shells used in this engine are select fit and require no line reaming. When re-installing used crankshaft and bearing shells, install old shells in the same locations from which they were removed.

It is important that bearing shells fit tightly. The bearing manufacturer makes the diameter at right angles to the parting line slightly larger than the actual diameter of the bore into which they are assembled. When the assembly is drawn tight, bearings are compressed, assuring a positive contact between bearing back and the bore. The increased diameter is called bearing crush.

CAUTION

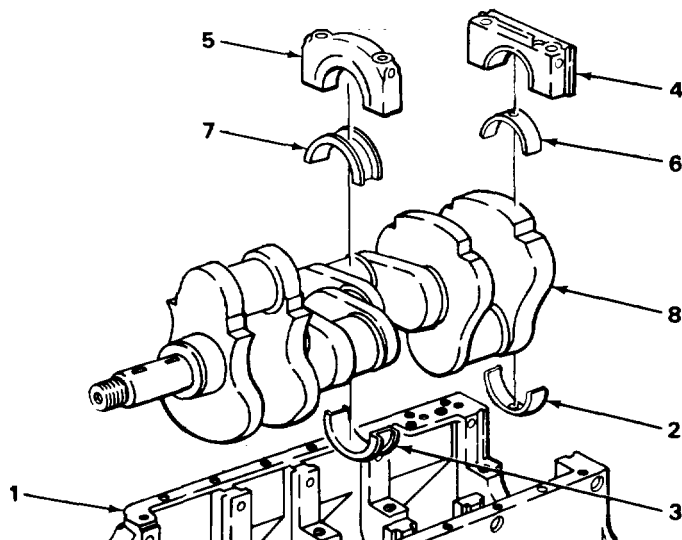
Do not file, lap, or otherwise rework the bearing caps or block in order to reduce clearance. Reworking will result in out-of-round bores, shell distortion, and will destroy the bearing crush.



TA237984

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
24. Cylinder block (1)	Four upper bearing shells (2) and upper thrust flange (3)	a. Using clean, dry rags, wipe away any dirt or dust on bearing bores, shells (2), and flange (3). b. Apply clean engine oil to block bores and both sides of shells (2) and flange (3). c. Roll shells (2) and flange (3) into position, tang last, so that tangs engage and oil holes line up.	
25. Rear main bearing cap (4) and four main bearing caps (5)	Four lower bearing shells (6) and thrust flange (7)	a. Using clean, dry rags, wipe away any dirt or dust on caps (4) and (5), shells (6), and flange (7). b. Apply clean engine oil to parts. c. Roll shells (6) and flange (7) into position, tang last, so tangs engage.	
26. Cylinder block (1)	Crankshaft (8)	a. Apply clean engine oil to journals. b. Using lifting sling and hoist, and turning as necessary to clear sides of block, lower into position.	



TA237985

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED		
27. Crankshaft (1)	Rear main bearing cap (2) and four main bearing caps (3)	Place in position so numbers on caps (2) and (3) face the right side of engine.
28. Rear main bearing cap (2) and four main bearing caps (3)	Ten new washers (4) and screws (5)	a. Apply clean engine oil to screw threads, washers, and underside of screwheads. b. Screw in until snug using 13/16-inch socket and ratchet handle with 1/2-inch drive. Do not torque at this time. c. Using plastic-face hammer tap each cap (2) and (3) until rear machined surface of cap is flush with block machined surface. d. Using 13/16-inch socket and torque wrench with 112-inch drive, tighten screws (5) to 110 - 115 ft-lb (149 - 156 N m) of torque.
29. Cylinder block (6)	Ten new washers (7) and screws (8)	a. Screw in until snug using 9/16-inch socket and ratchet handle with 1/2-inch drive. b. Tighten to 40 - 50 ft-lb (54 - 61 N m) of torque.

NOTE

Steps 30 thru 37 will check bearing cap and shell to crankshaft main journal clearance. Repeat the steps for all bearing caps. If any bearing shell-to-journal clearance is out of tolerance given, replace crankshaft.

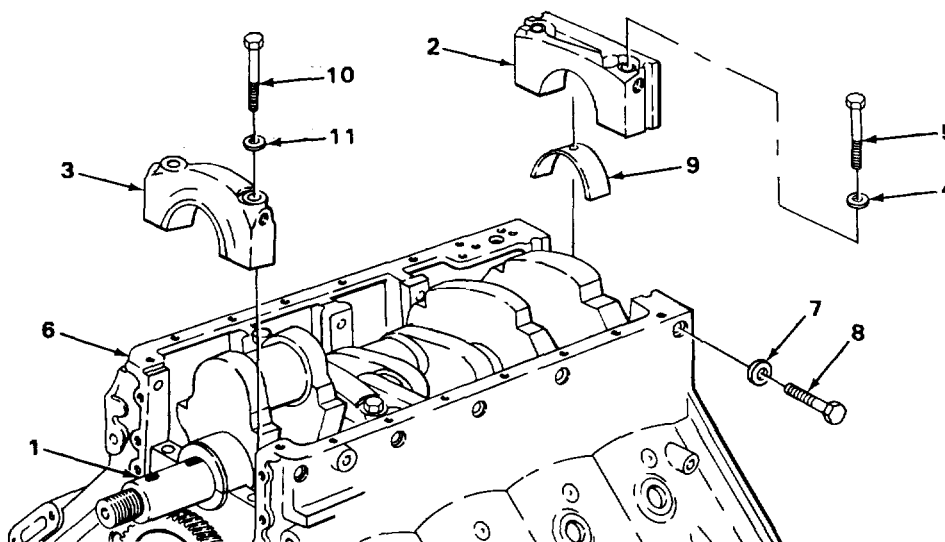
All main bearing caps must be installed and torqued to specification.

Do not turn crankshaft while checking clearance.

30.	Two screws (8) and washers (7)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
31. One main bearing cap (3)	Two screws (5) and washers (4)	Using 13/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
32. Crankshaft (1)	One main bearing cap (3) with lower bearing shell (9)	a. Put on plastic gage tape (page 2-46). b. Put cap (3) with shell (9) in position on journal. c. Using plastic-face hammer, tap cap (3) to seat onto block (6).	
33. One main bearing	Two washers (4) cap (3)	Screw in until snug. and screws (5)	
34. Cylinder block (6)	Two washers (7) and screws (8)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, screw in until snug. b. Tighten to 40-50 ft-lb (54-61 N m) of torque using 9/16-inch socket and torque wrench with 1/2-inch drive.	
35. One main bearing cap (3)	Two screws (10) and washers (11)	a. Using 13/16-inch socket and torque wrench with 1/2-inch drive, tighten to 110-115 ft-lb (149-156 N m) of torque. b. Using 13/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	



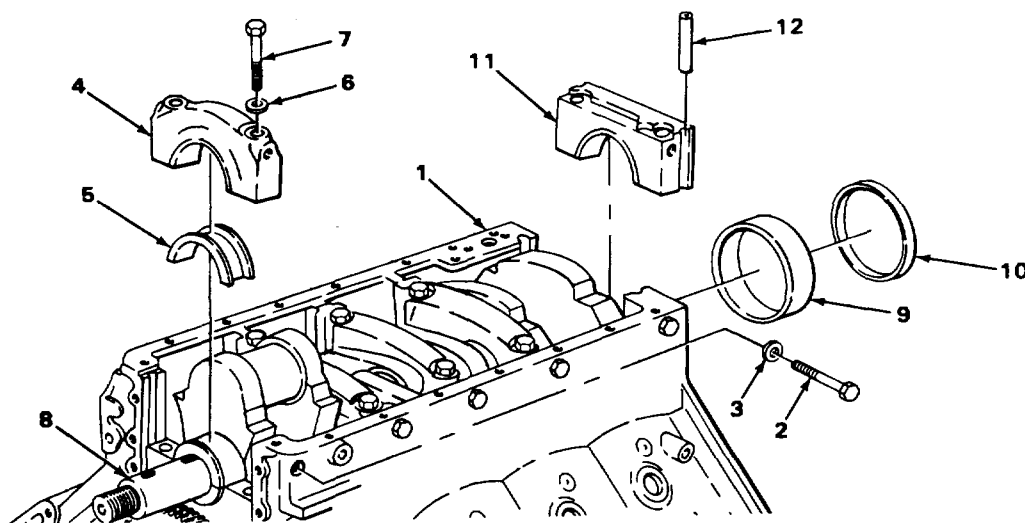
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CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
36.	Cylinder block (1)	Two screws (2) and washers (3)	Using 9/16-inch socket and ratchet handle with 11/2-inch drive, unscrew and take off.
37.	One main bearing cap (4) and lower bearing shell (5)	a. Take off. b. Do not touch plastic gage tape. c. Using plastic gage tape envelope, measure widest point of tape (page 2-46). The reading indicates bearing clearance in thousandths of an inch. Main bearing clearance must be 0.0013 - 0.0043 inch (0.033-0.109 mm). d. If clearance does not meet given limits, replace crankshaft. e. Take off tape. f. Put shell (5) and cap (4) back in place using plastic-face hammer to tap in place.	
38.	One main bearing cap (4)	Two washers (6) and screws (7)	Screw in until snug using 13/16-inch socket and ratchet handle with 11/2-inch drive.
39.	Cylinder block (1)	Two washers (3) and screws (2)	Screw in until snug using 9/16-inch socket and ratchet handle with 1/2-inch drive.
40.	One main bearing cap (4)	Two screws (7)	Tighten to 1 - 115 ft-lb (149 - 56 N m) of torque using 13/16-inch socket and torque wrench with 1/2-inch drive.
41.	Cylinder block (1)	Two screws (2)	Tighten to - 50 ft-lb (54 - 61 N m) of torque using 9/16-inch socket and torque wrench with 1/2-inch drive.
42.	Crankshaft (8)		Using dial indicator, check end play. If end play is not 0.004 - 0.010 inch (0.102 - 0.254 mm) replace crankshaft.

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
43. Crankshaft (8)	New wear sleeve (9)	- Install two guide studs into crankshaft flange. - Apply clean engine oil to flange. - Position sleeve (9) on flange, large chamber toward rear of crankshaft (8). - Using camshaft oil seal and sleeve installer tool and plastic-face hammer, drive on sleeve (9) until installer seats against block.	
44.	New oil seal (10)	- Apply clean engine oil to sleeve (9) and seal (10). - Position seal (10) over sleeve (9). - Using crankshaft oil seal and sleeve installer tool and plastic-face hammer, drive on until seal (10) is flush with block.	
45 Rear main bearing cap (11)	Two new seals (12)	- Apply clean engine oil. - Push in using main bearing cap seal installer tool. - Using pocket knife, cut off excess seal material flush with bottom of cap (11) and block (4).	



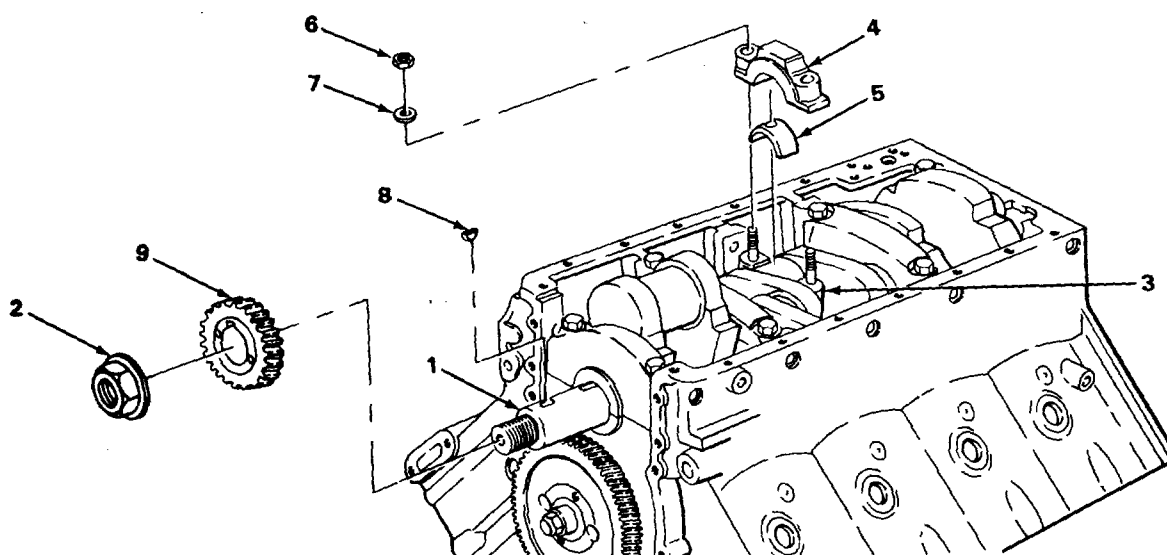
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CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
46.	Crankshaft (1)	Crankshaft pulley nut (2)	Screw on, and tighten using 2-inch open-end wrench.
NOTE Connecting rods and their caps are numbered for proper placement. All connecting rod bearing caps are installed the same way. Repeat steps 47 thru 49 for each cap.			
47.	Connecting rod (3) and attaching parts		Using 2-inch open-end wrench, turn crankshaft until rod (3) is lined up with rod journal.
48.			a. Make sure cap (4) is the correct one for location. b. Using plastic-face hammer, tap into place.
49.	Connecting rod bearing cap (4)	Two nuts (6) and washers (7)	a. Screw on until snug using 11/16-inch socket and ratchet handle with 1/2-inch drive. b. Tighten to 53 - 57 ft-lb (72 - 77 N m) of torque using 11/16-inch socket and torque wrench with 1/2-inch drive. c. Release torque load to zero. d. Using 11/16-inch socket and ratchet handle with 1/2-inch drive, tighten. e. Tighten again to 53 - 57 ft-lb (72 - 77 N m) of torque using 11/16-inch socket and torque wrench with 1/2-inch drive. f. Using 11/16-inch socket and ratchet handle with 1/2-inch drive, turn each nut (6) an additional one-sixth turn, or one flat of the nut (6).
50.	Crankshaft (1)	Woodruff key (8)	Using ball-peen hammer, tap in.
51.	Crankshaft timing gear (9)		a. Apply clean engine oil to inside diameter.
			b. Line up keyway and timing mark.

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

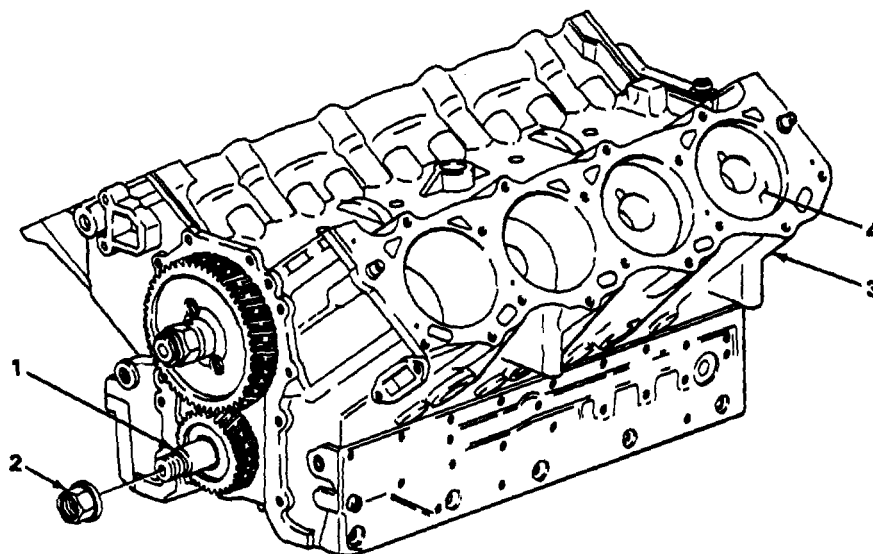
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
52.	Crankshaft pulley nut (2)	a.	Using 2-inch open-end wrench, turn crankshaft (1) until timing marks line up.
		b.	Using 2-inch open-end wrench, unscrew nut (4) and take off.
53.	Crankshaft timing gear (9)	a.	Place in position. Make sure timing marks line up.
		b.	Using installer tool, press on gear (9) until firmly seated against shoulder.
54.	Crankshaft pulley nut (2)		Screw on, and tighten using 2-inch open-end wrench.



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CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
55. Crankshaft (1)	Crankshaft pulley nut (2)	Using 2-Inch open-end wrench, unscrew and take off.	
56. Cylinder block (3)	Eight pistons (4)	Remove eight holddown clamps.	

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Install engine oil pump (page 2-208).
2. Install cylinder heads (page 2-102).
3. Install front crankcase cover (page 2-197).
4. Install flywheel housing (page 2-137).

TASK ENDS HERE

TA237989

CRANKSHAFT PULLEY

This task covers:

a. Removal (page 2-131)	c. Inspection/Replacement (page 2-132)
b. Cleaning (page 2-132)	d. Installation (page 2-132)

INITIAL SETUP**Tools**

Bar, breaker
 Hammer, ball-peen, machinist's
 Handle, ratchet, 3/4-inch drive
 Installer, pulley
 Puller, mechanical gear
 Punch, drive-pin, 3/8-Inch
 Socket, 3/4-inch drive, 2-Inch
 Wrench, torque, 3/4-inch drive,
 0 - 600 ft-lb capacity

Materials/Parts

Oil, engine (Item 32, appendix B)

Materials/Parts - Continued

Rags, wiping (Item 42, appendix B)
 Solvent, drycleaning (Item 49, appendix B).

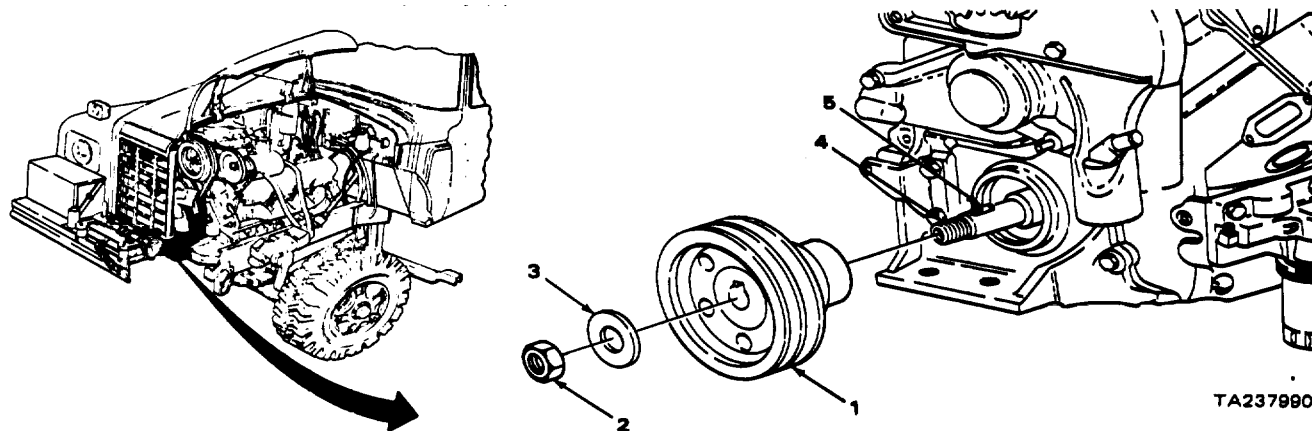
Personnel Required

One

Equipment Condition

Radiator fan shroud removed
 (TM 9-2320-269-20-1).
 Drive belts removed (TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. with	Crankshaft pulley (1)	Pulley nut (2) and washer (3)	Using 2-Inch socket, ratchet handle 3/4-inch drive, and breaker bar, unscrew and take off.
2.	Crankshaft (4) pulley (1)	Crankshaft	Using gear puller, pull off.



CRANKSHAFT PULLEY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

3. inch	Crankshaft (1)	Woodruff key (2)	Using ball-peen hammer and 3/8-inch drive-pin punch, tap out.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

4.	Crankshaft pulley (3)	a. Clean with clean rags dampened with drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

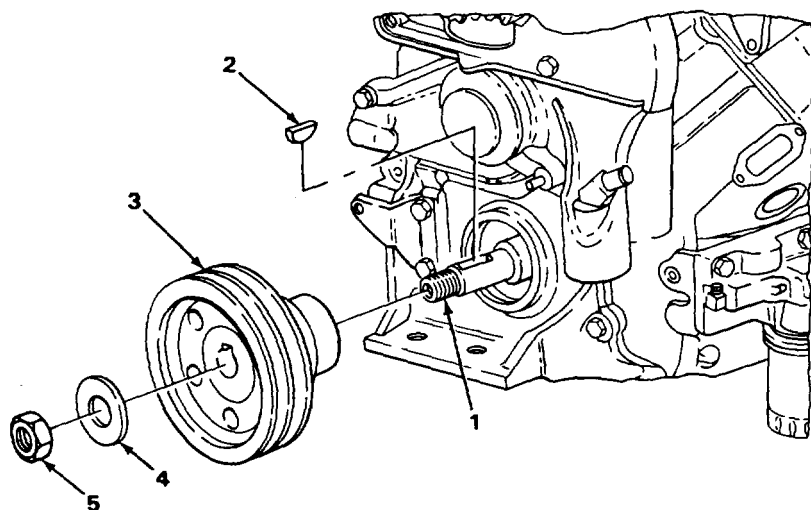
5.	Crankshaft pulley (3)	a. Look for cracks and breaks. b. Look for deteriorated rubber.

INSTALLATION

6.	Crankshaft (1)	Woodruff key (2)	Using ball-peen hammer, tap into
place.			
7.	Crankshaft pulley (3)	a.	Apply clean engine oil to inside diameter.
		b.	Using pulley installer, put on and support.

CRANKSHAFT PULLEY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
8. 2-inch drive.	Crankshaft pulley (3)	Washer (4) and nut (5)	a. Screw on until snug using socket and handle with 3/4-inch
		b.	Tighten to 260 - 290 ft-lb (353 - 393 N m) of torque using 2-inch socket and torque wrench with 3/4-inch drive.
		c.	Release pulley (3).

**NOTE**

FOLLOW-ON MAINTENANCE:

1. Install drive belts (TM 9-2320-269-20-1).
2. Install radiator fan shroud (TM 9-2320-269-20-1).

TASK ENDS HERE

FLYWHEEL

This task covers:

- a. Removal (page 2-134)
- b. Cleaning (page 2-135)
- c. Inspection/Replacement (page 2-135)
- d. Installation (page 2-136)

INITIAL SETUP

Tools

Bar, breaker, 18-inch
 Face, Inserted hammer, medium-plastic
 Hammer, ball-peen, machinist's, 3-lb
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Holder, Inserted hammer-face
 Punch, drive-pin, 3/16-inch
 Socket, 1/2-Inch drive, 3/4-inch
 Socket, 3/4-inch drive, 2-inch
 Tire Iron, curved-spoon type, 24-inch
 Wrench, torque, 1/2-inch drive,
 0-200 ft-lb capacity

Materials/Parts

Pin (as required)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

Two

Equipment Condition

Engine uncoupled from transmission
 (page 2-52).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. ratchet handle take out. move.	Reinforcement ring (1)	Seven screws (2)	Using 3/4-inch socket and with 1/2-inch drive, unscrew and It may be necessary for an assis- tant to use 2-inch socket, ratchet handle with 3/4-inch drive, and breaker bar on crankshaft pulley nut so that crankshaft will not
2.	Crankshaft (3) (1) and flywheel (4)	Reinforcement ring	Pull off.
3.	Crankshaft (3) and flywheel housing (5)	Adapter plate (6)	Using curved tire Iron, pry off.
4. and	Adapter plate (6)	Pin (7)	a. Using 3/16-inch drive-pin punch 3-lb ball-peen hammer, drive out. b. Get rid of.

FLYWHEEL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

5.	All metal parts	a. Clean in cleaning solvent. b. Wipe dry with clean, dry rags.

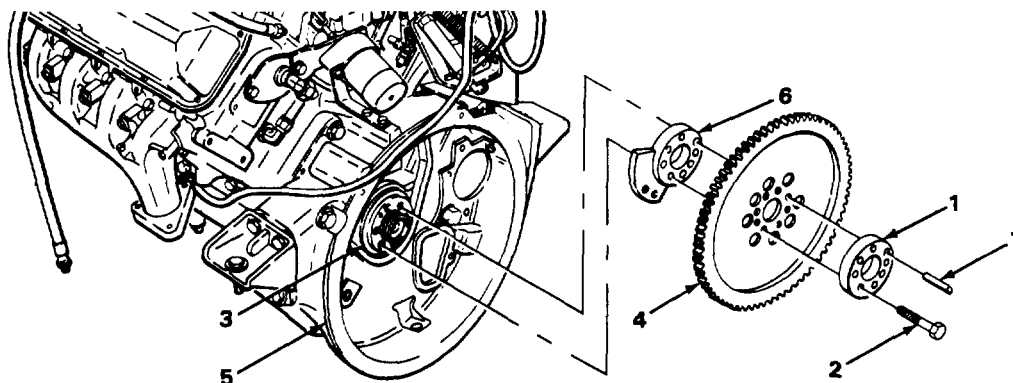
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

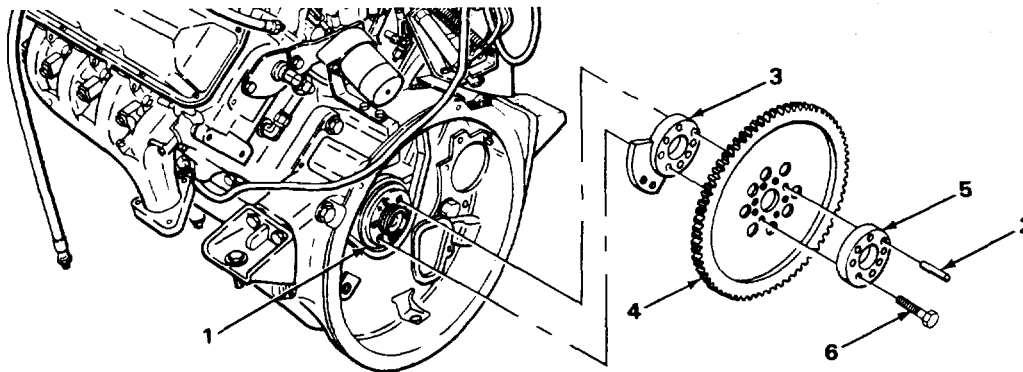
Replace damaged or defective parts as needed.

6.	Flywheel (4)	a. Look for cracks, breaks, and distortion. b. Look for broken, chipped, and nicked gear teeth.
7.	Reinforcement ring (1) and adapter plate (6)	Look for cracks, breaks, and distortion.



FLYWHEEL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
8.	Crankshaft (1)	New pin (2)	Using 3-lb ball-peen hammer, tap in.
9.	Adapter plate (3)	Using plastic-face hammer, lightly tap on.	
10.	Flywheel (4)	Put on.	
11.	Flywheel (4) ring (5)	Reinforcement	Put on.
12. 3/4-inch inch	Reinforcement ring (5)	Seven screws (6)	a. Screw in until snug using socket and torque wrench with 1/2-inch drive. b. Tighten to 149 - 156 ft-lb (202 - 212 N m) of torque using 3/4-inch socket and torque wrench with 1/2-inch drive.

**NOTE**

FOLLOW-ON MAINTENANCE: Couple engine to transmission (page 2-52).

TASK ENDS HERE

FLYWHEEL HOUSING

This task covers:

a. Removal (page 2-137) b. Disassembly (page 2-138) c. Cleaning (page 2-138)	d. Inspection/Replacement (page 2-138) e. Assembly (page 2-139) f. Installation (page 2-139)

INITIAL SETUP

Tools

Face, inserted hammer, soft-plastic
Handle, ratchet, 112-inch drive
Hoist, with lifting sling
Holder, inserted hammer-face
Socket, 1/2-inch drive, 13/16-inch
Wrench, pliers

Materials/Parts

Gasket, flywheel housing
Pin, dowel (two required, as needed)

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)

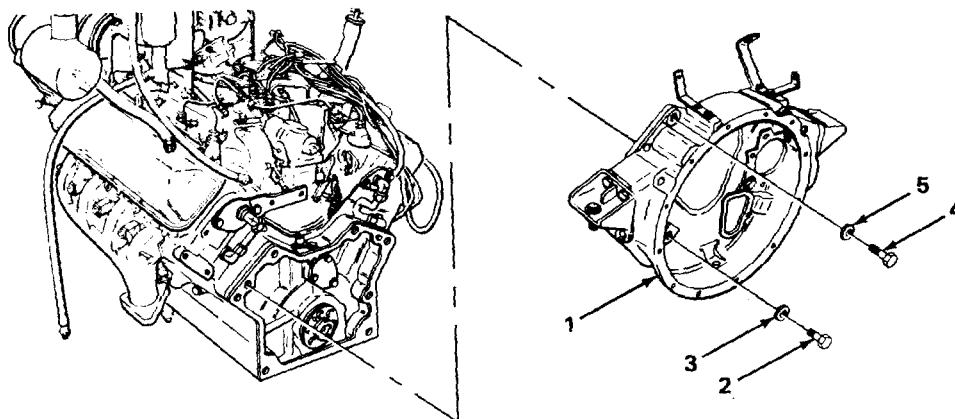
Personnel Required

One

Equipment Condition

Starting motor removed
(TM 9-2320-269-20-1).
Flywheel removed (page 2-134).

LOCATION	ITEM	ACTION	REMARKS
1. lifting sling and hoist. ratchet unscrew and	Flywheel housing (1) washers (3)	Two screws (2) and b.	a. Attach Using 13116-inch socket and handle with 1/2-inch drive, take out.
2.	Two screws (4) and washers (5)		Using 13116-inch socket and ratchet handle with 112-inch drive, unscrew and take out.



FLYWHEEL HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
3. ratchet handle	Flywheel housing (1) and washers (3)	Two screws (2)	Using 13/16-Inch socket and with 112-inch drive, unscrew and take out.
4. on clean housing	Cylinder block (4) and gasket (5)	Flywheel housing (1)	a. Using hoist, lift off and set workbench. It may be necessary to tap loose using plastic-face hammer. b. Get rid of gasket (5). c. Take off lifting equipment.

DISASSEMBLY

NOTE

Do not take out dowel pins unless they are damaged.

5.	Two dowel pins (6)	a. Using pliers wrench, pull out. b. Get rid of.

CLEANING

NOTE

For more Information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

6.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

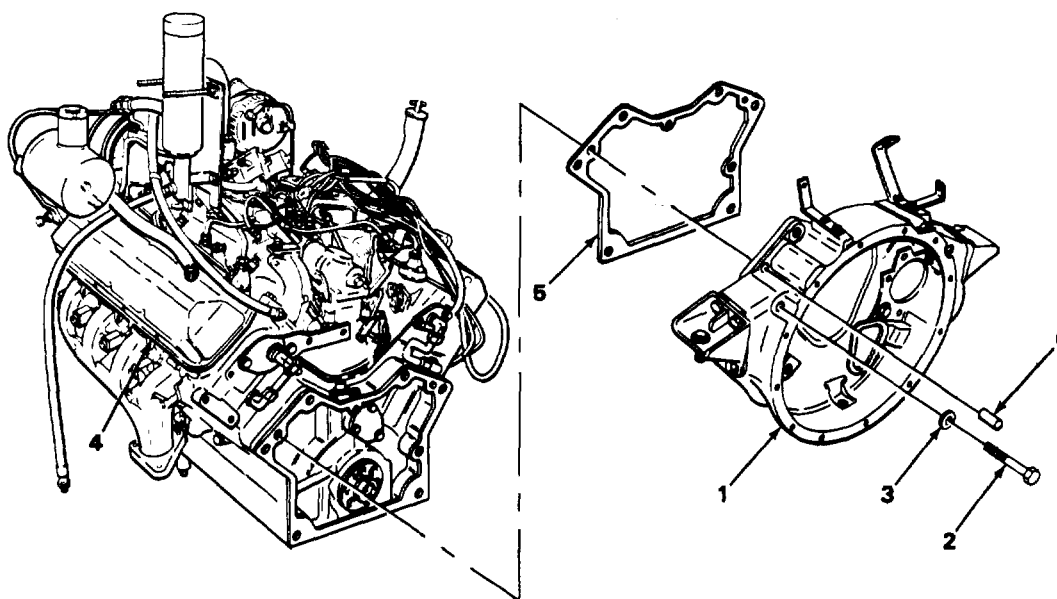
NOTE

For more Information on how to Inspect parts, go to General Maintenance Instructions (page 2-46),

Replace damaged or defective parts as necessary.

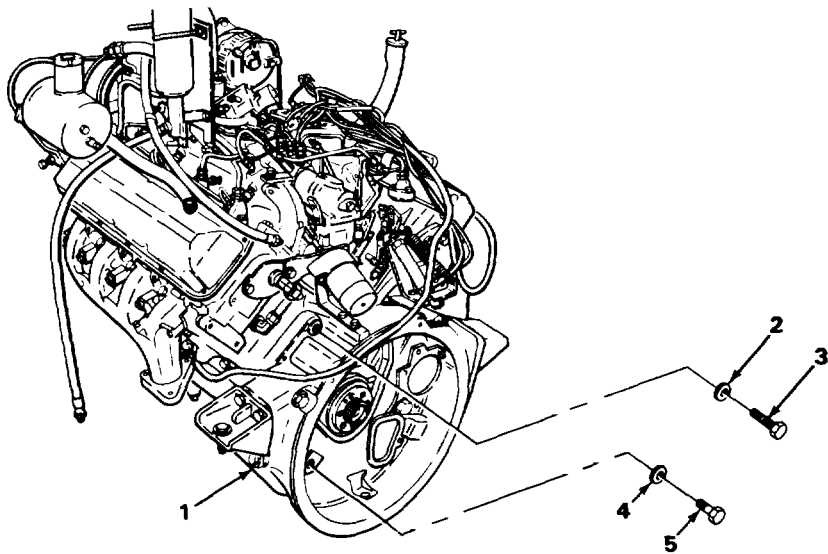
FLYWHEEL HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
7.	Flywheel housing (1)	a. Look for cracks, breaks, and large dents. b. Look for damaged threads.	
ASSEMBLY			
NOTE			
Do not do step 8 unless dowel pins were removed.			
8.	Flywheel housing (1) pins (6)	Two new dowel	Using plastic-face hammer, tap In.
INSTALLATION			
9.	Cylinder block (4) flywheel housing (1)	New gasket (5) and b. Using lifting equipment, put in position.	a. Attach lifting equipment.
10.	Flywheel housing (1)	Two washers (3) and screws (2) drive.	Screw In, and tighten using 13/16-inch socket and ratchet handle with 112-inch



FLYWHEEL HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
11. inch	Flywheel housing (1) and screws (3)	Two washers (2)	Screw in, and tighten using 13/16- socket and ratchet handle with 1/2-inch drive.
12.	Two washers (4) and screws (5)		Screw in, and tighten using 13/16-inch socket and ratchet handle with 1/2-inch drive



NOTE

FOLLOW-ON MAINTENANCE:

- 1. Install flywheel (page 2-134).
- 2. Install starting motor (TM 9-2320-269-20-1).

TASK ENDS HERE

PISTONS AND CONNECTING RODS

This task covers:

a. Removal (page 2-142) b. Disassembly (page 2-147) c. Cleaning (page 2-148)	d. Inspection/Replacement/Repair (page 2-148) e. Assembly (page 2-154) f. Installation (page 2-155)

INITIAL SETUP

Tools

Brush, wire scratch
 Caliper, micrometer, ID, 2 to 3-inch range
 Caliper, micrometer, ID, 3 1/2 to 5-inch range
 Caliper, micrometer, OD, 3 1/2- to 5-inch range
 Caps, vise jaw
 Clamp, piston holddown (eight required)
 Cleaner, ring groove
 Compressor, piston ring
 Compressor, reciprocating air, power driven
 Cord, heavy, 3-ft
 Expander, piston ring
 Face, inserted hammer, medium-plastic
 Fixture, alinement checking
 Gage, thickness
 Gage, perfect circle ring, number one (1/8 x 15 degree)
 Goggles, safety
 Gun, air blow
 Handle, hammer, wooden
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Holder, inserted hammer-face
 Hose, assembly, rubber
 Machine, honing
 Pliers, snapping
 Press, arbor, hand-operated
 Reamer, cylinder bore ridge
 Scale, spring tension
 Sleeve, piston pin bushing installer
 Socket, 11/2-inch drive, 11/2-inch
 Socket, 1/2-inch drive, 11/16-inch
 Socket, deep well, 3/4-inch drive, 2-inch

Tools - Continued

Stand, overhaul
 Vise, machinist's
 Wrench, torque, 1/2-inch drive
 0 - 150 ft-lb capacity

Materials/Parts

Cloth, crocus (item 7, appendix B)
 Nuts, connecting rod screws (two required)
 Oil, engine (item 32, appendix B)
 Particle solution, fluorescent (item 38, appendix B); or fluorescent penetrant, fluorescent (item 39, appendix B); and developer, fluorescent penetrant (item 16, appendix B); or magnetic powder (item 40, appendix B); or solution (item 47, appendix B)
 Rags, wiping (item 42, appendix B)
 Ring set (one set for each piston being serviced)
 Solvent, drycleaning (item 49, appendix B)
 Tape, plastic gage (item 53, appendix B)
 Washers, connecting rod screws (two required)

Personnel Required

One

Equipment Condition

Engine uncoupled (page 2-52).
 Cylinder heads removed (page 2-102).
 Engine oil pump removed (page 2-208).

PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

NOTE

All pistons and connecting rods are maintained the same way. One piston and connecting rod is shown. Repeat procedure for each piston rod and connecting rod to be worked on.

REMOVAL

1. from	Cylinder block (1)	Cylinder bore (2)	Using clean, dry rag, wipe carbon upper inner surface.
2. handle with	Crankshaft pulley (3)	Crankshaft (4)	Using 2-inch socket and ratchet 3/4-inch drive, turn until piston (5) is at bottom of its travel.
3. travel.	Cylinder block (1)	Cylinder bore (2)	Look for ridge at top of piston ring

NOTE

If there is no ridge on top edge of bore, skip steps 4 thru 7, and go on to step 8.

4.	Cylinder block (1)	Piston (5)	Using clean, dry rag, completely cover top to collect cuttings.

CAUTION

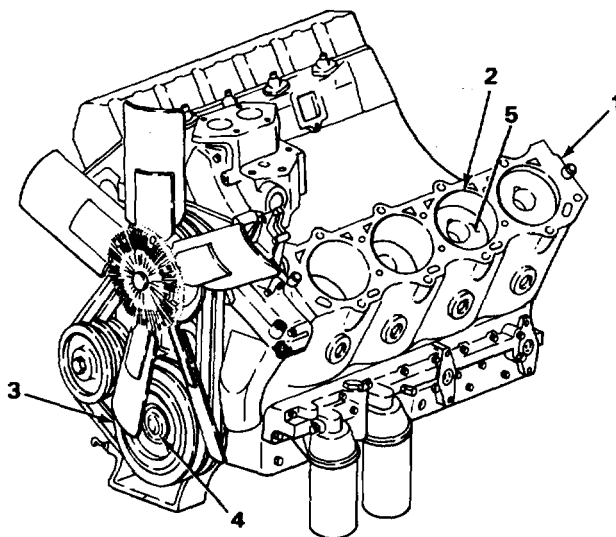
Be careful not to let any cuttings get between cylinder block bore and piston. Parts could be scratched during piston removal.

5. remove	Cylinder block (1)	Cylinder bore (2)	Using cylinder bore ridge reamer, ridge.
6. ratchet	Crankshaft pulley (3)	Crankshaft (4)	Using 2-Inch deep well socket and handle with 3/4-inch drive, turn until piston (5) is at top of its travel.
7.	Cylinder block (1)	Piston (5)	Carefully take off rag with cuttings.

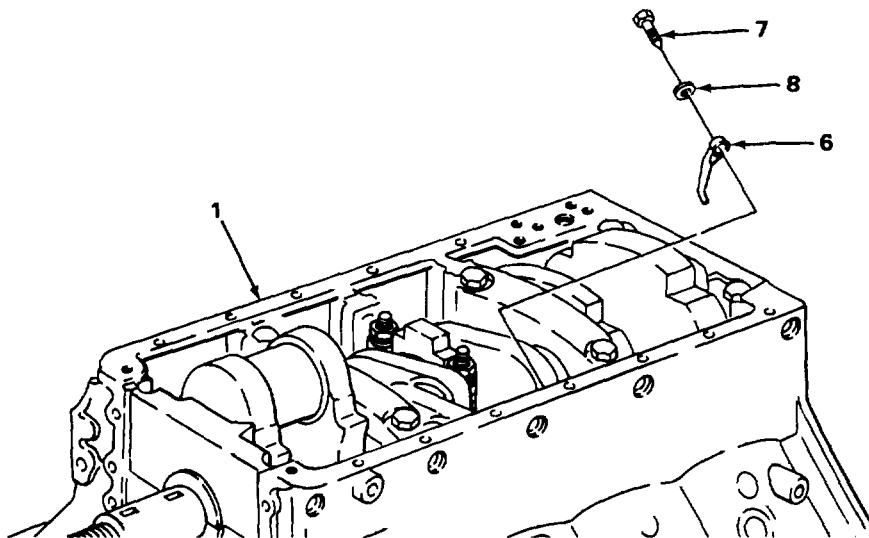
PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED



8. handle	Piston cooling nozzle (6)	Screw (7) and washer (8)	Using 1/2-inch socket and ratchet with 1/2-inch drive, unscrew and take out.
9.	Cylinder block (1) nozzle (6)	Piston cooling	Take off.

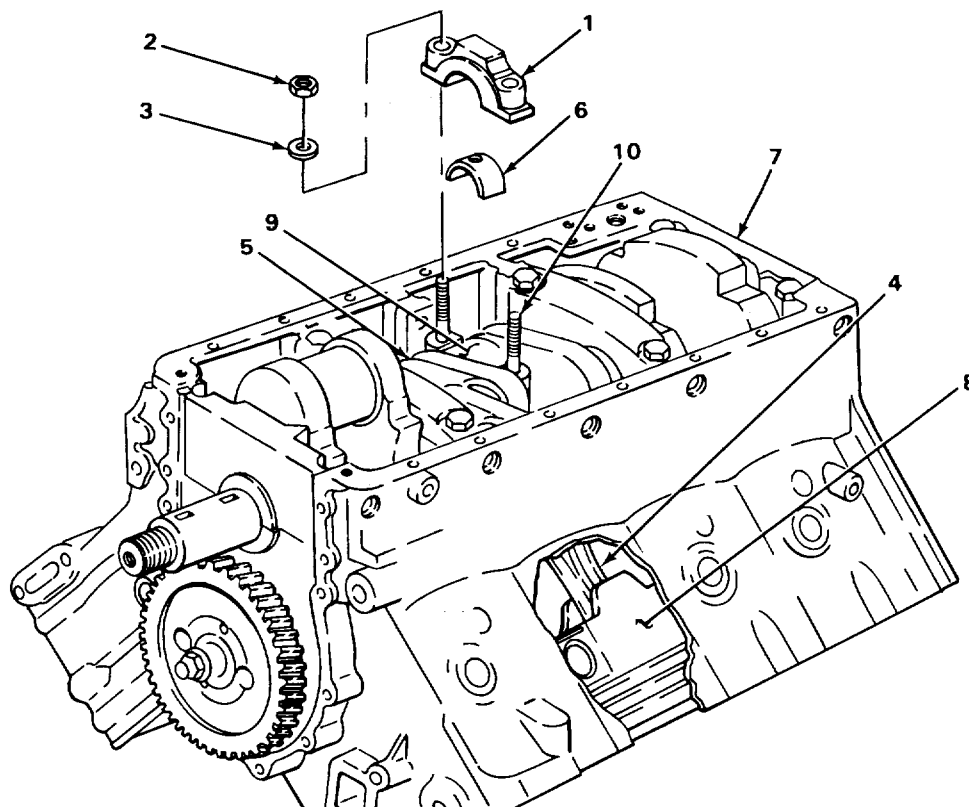


PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
<u>CAUTION</u>			
Do not allow piston and connecting rod assembly to drop out through top of cylinder block while checking clearance. Parts could be damaged and would have to be installed before clearance check could continue.			
<u>NOTE</u>			
Connecting rods and their bearing caps are numbered for proper placement during assembly. Always keep parts together.			
Connecting rod crankshaft bearing-to-crankshaft journal clearance is measured the same way for all connecting rod crankshaft bearings. One bearing is shown.			
10. ratchet handle	Connecting rod bearing cap (1)	Two nuts (2) and washers (3)	Using 11/16-inch socket and with 1/2-inch drive, unscrew and take off.
11. wipe oil off	Connecting rod (4) and crankshaft (5) lower bearing shell (6)	Connecting rod bearing cap (1) with lower shell (6).	a. Take off. b. Using clean, dry rags,
12. oil off con-	Cylinder block (7)	Crankshaft (5)	a. Using clean, dry rag, wipe necting rod bearing journal. b. Rotate connecting rod bearing journal 30 degrees from bottom dead center. c. Place a 1.20 inch (30.48 mm) length of plastic gage tape across connecting rod bearing journal, 0.25 inch (6.35 mm) off-center, in line with length of crankshaft (5) (page 2-46).
13. end.	Piston (8) and connecting rod (4) with attached parts	Pull toward connecting rod journal of crankshaft (5) until upper shell (9) seats firmly.	Make sure that shell is properly positioned in connecting rod
14. with to	Connecting rod (4) and crankshaft (5) lower bearing shell (6)	Connecting rod bearing cap (1) with number on rod (4).	Place in position over plastic tape cylinder identification number next

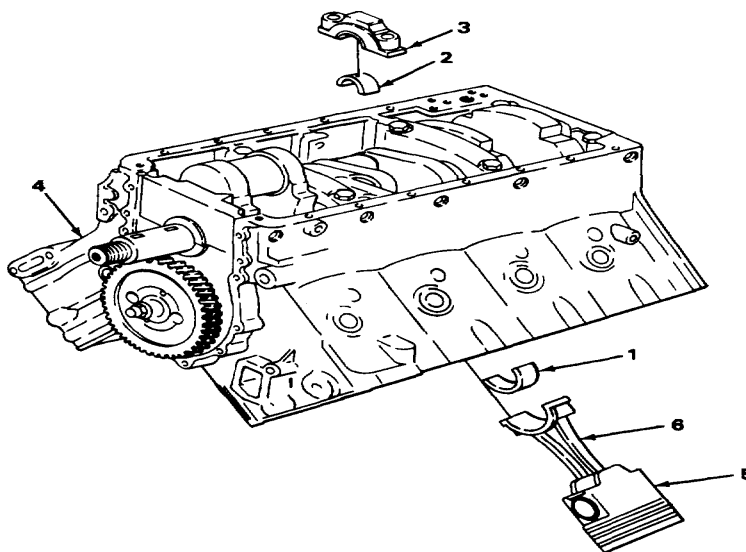
PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
15. and torque on	Two connecting rod screws (10)	Two washers (3) and nuts (2)	a. Using 11/16-inch socket wrench with 1/2-inch drive, screw until snug. Tighten to 55 ft-lb (75 N m) of torque. b. Using same socket and torque wrench, turn each nut an additional one-sixth turn (one flat on nut). c. Using 11/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off. d. Get rid of washers (3) and nuts (2).
16. be stuck to either	Connecting rod (4) and crankshaft (5) lower bearing shell (6)	Connecting rod bear- ing cap (1) with	a. Take off. Plastic tape will bearing shell or crankshaft journal. b. Using markings on plastic gage envelope, measure width of plastic gage strip at its widest point (page 2-46).



PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
16. clear-	Continued	c.	Write down bearing-to-journal ance.
shells			If clearance is not within 0.0019-0.0044 Inch (0.048-0.112 mm), upper and lower bearing
		d.	(5) and (7) must be replaced. If plastic gage is wider at one end than at the other, the difference be- tween measurements at each end is approximate bearing-to-journal clear- ance taper.
17. during	Bearing cap (3) shell (2)	Lower bearing	Roll out, tang end first. Keep each bearing cap and shell together for proper placement
			Installation.
18.	Cylinder block (4) connecting rod (6) with attached parts	Piston (5) and	Push out through top. Piston and rod assembly will not come out from bottom of block.

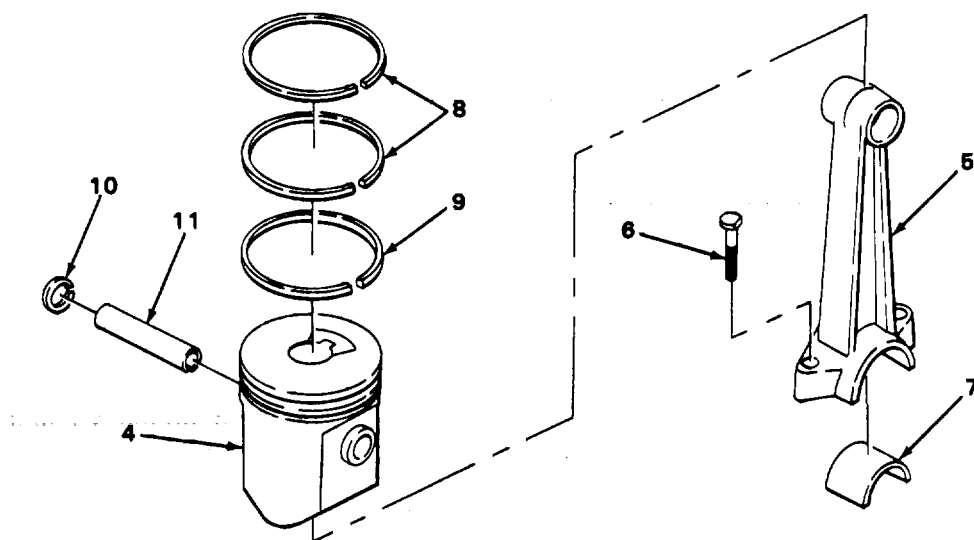


PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
19. out.	Connecting rod (5)	Two screws (6)	Using plastic-face hammer, take
20.	Upper bearing shell (7)	Roll out, tang end first.	
21. piston (4)	Piston (4)	Connecting rod (5)	Position In vise with jaw caps, up.
22.	Two compression rings (8) and one oil ring (9)	a. Using piston ring expander, take off. b. Get rid of.	
23.	Two retaining rings (10)	a. Using snapping pliers, take out. b. Get rid of.	
24.	Piston pin (11)	Push out.	
25.	Connecting rod (5)	Piston (4) a. Take off. b. Take connecting rod (5) out of vise.	

NOTE

Do not remove piston pin bushing unless inspection indicates that replacement is necessary (step 42).



PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

26.	All parts	a. Clean in drycleaning solvent. b. Using compressed air, blow dry.	
27. from	Piston (1)	a. Using wire brush, clean carbon top. b. Using ring groove cleaner, clean carbon from second and third ring grooves. c. Using heavy cord soaked in drycleaning solvent, clean carbon from top groove.	

INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace parts that are not within specified limits, or which are defective and cannot be repaired.

28.	Piston (1)	Look for scoring, discoloration due to overheating, visible cracks, and damaged ring grooves.	
29.	Piston (1) and connecting rod (2)	Look for cracks not normally visible by using magnetic particle method, fluorescent magnetic particle method or fluorescent penetrant method.	

PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT/REPAIR - CONTINUED

30.	Piston (1)	If only slightly scored and otherwise in good condition, clean up scoring with crocus cloth.

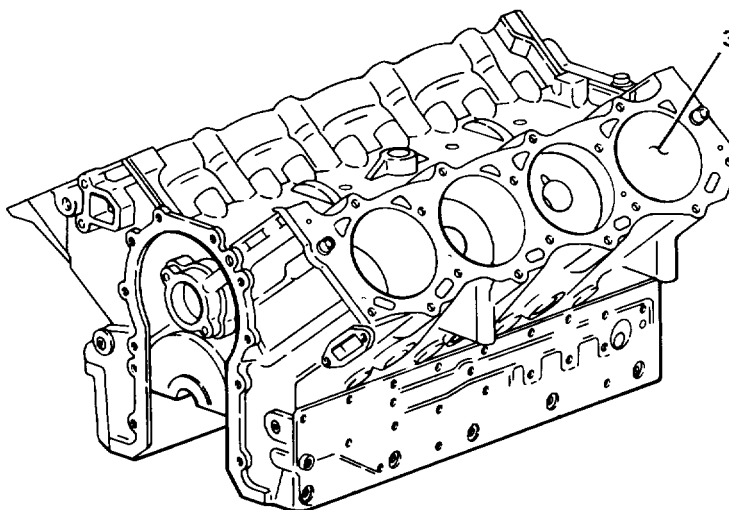
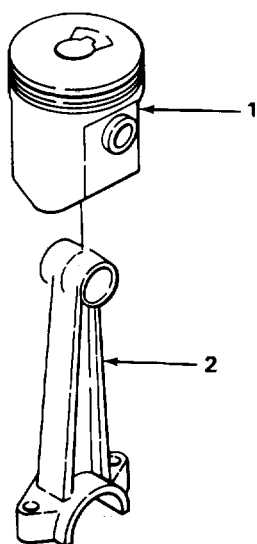
NOTE

Piston and cylinder block measurements should be taken at room temperature of 72°F (22°C).

31.	Piston (1)	Using outside micrometer caliper with 3 1/2 to 5-inch range, measure and write down piston skirt diameter.
32.	Cylinder block bore (3)	Using inside micrometer caliper with 3 1/2- to 5-inch range, measure and write down bore diameter.

Normal new cylinder block bore diameter is 4.5 inches (114.3

mm).



PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
33.	Piston (1) and cylinder block bore (2)	a.	To figure piston-to-bore clearance, subtract piston diameter measurement from bore inside diameter measurement.
for			Normal piston-to-bore clearance
			new parts is 0.006 to 0.007 Inch (0.15 to 0.18 mm).
		b.	Using thickness gage free of nicks and bends, and spring scale, check piston-to-bore clearance in four places, 90 degrees apart, while holding piston (1) upside down in bore.
thickness			Actual clearance is 0.001 inch (0.0254 mm) greater than
from			of gage that can be withdrawn
with			between piston (1) and bore (2)
			a 6 lb (2.7216 kg) pull.

CAUTION

Do not try to change the gap clearance of chrome faced rings by filing the ends of the rings. Chrome plating will be damaged.

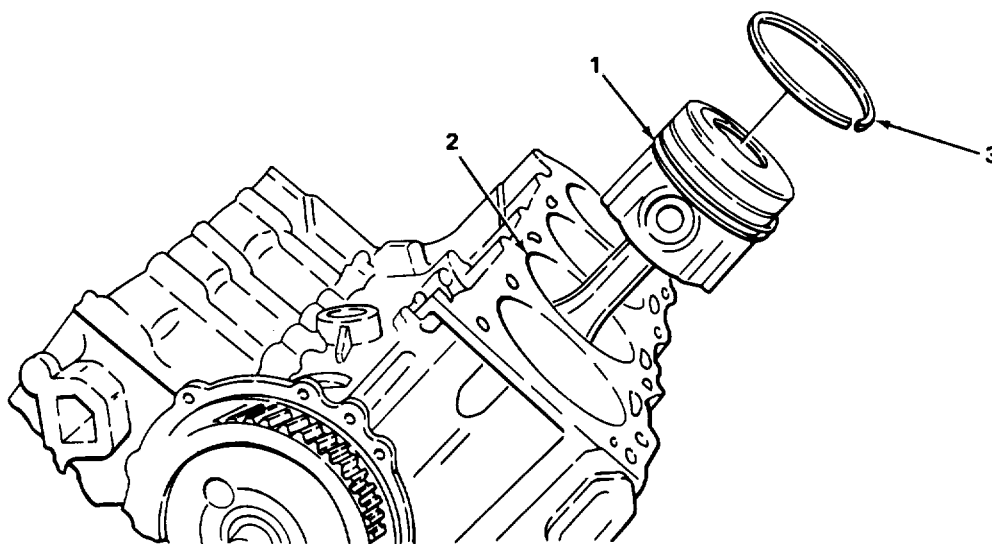
NOTE

Always use new piston rings whenever a piston has been removed for inspection or replacement.

34.	New piston rings (3)	a.	Check ring gap in cylinder bore (2) by inserting rings (3) one at a time into cylinder bore (2), pushing ring down far enough to be in normal area of ring travel, and using top of piston (1) to keep ring (3) parallel with top of bore (2).
		b.	Using thickness gage, measure ring gap between ends of ring (3).
			See Repair and Replacement Standards (page 1-6) for ring gap limits.

PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
34.	Continued rings (3)	New piston	c. Take ring (3) out of bore (2). d. If ring gap is too small, try another size. e. Fit and check again each ring (3) in bore in which it is used, and mark ring accordingly. f. Check ring-to-groove clearance by inserting edge of ring (3) into proper ring groove of piston (1). g. Using thickness gage, check clearance between top or bottom of ring (3) and side of groove. See Repair and Replacement Standards (page 1-6) for ring-to-groove limits. h. Take ring (3) out of ring groove.
35.	Piston (1)		a. Check top keystone-type compression ring groove for wear by inserting perfect circle piston ring gage, number one (1/8 x 15 degree), into groove. b. If one or both shoulders of the gage touch the side of the piston, piston must be replaced.

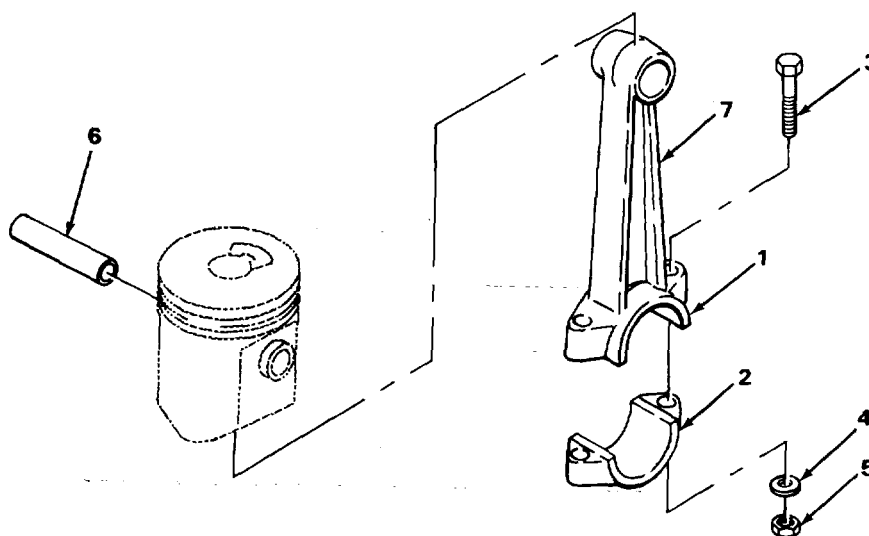


PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
<u>CAUTION</u>			
Because of special heat treatment and hardening of connecting rods, do not try to straighten or bend rod in any way. This will cause tiny cracks in the hardened surface and will eventually lead to rod breakage.			
36.	Connecting rod (1)	Using alinement checking fixture, check for straightness.	Piston pin bore and connecting bearing bore must be parallel to within 0.0005 inch (0.0127 mm).
rod			rod is bent, replace it.
37.	Connecting rod (1)	Bearing cap (2)	Put in place.
38.	Bearing cap (2) and	Two new screws (3),	a. Screw in until snug.
Tighten to 55 ft-11/16-inch	connecting rod (1)	washers (4), and	lb (75 N m) of torque using
	nuts (5)	socket and torque wrench with 1/2-inch drive.	
		b. Using same socket and torque wrench, turn each nut (5) one-sixth turn, one flat on nut (5).	
39.	Connecting rod (1) with bearing cap (2) attached	a. Using 2 to 3 inch range inside micrometer, caliper, measure bore diameter at several places.	Diameter must be 2.9455 to
2.9460			inches (74.816 to 74.828 mm).
		b. Using micrometer check bore for out-of-round.	Maximum out-of-round allowed
is			0.0005 inch (0.0127 mm).
		c. Using micrometer check bore taper at several places.	Maximum allowable taper is
0.0005			inch (0.0127 mm).
		d. Check bearing shell surfaces for smoothness without evidence of uneven bearing contact or movement of shells in the bore.	

PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
39.	Continued		e. If connecting rod bearing bore does not pass the above inspections, connecting rod must be replaced.
40.	Connecting rod (1) and bearing cap (2)	Two nuts (5), Using 11116-inch socket and ratchet handle washers (4), and with 112-inch drive, unscrew and screws (3)	
41.	Piston pin (6)	a. Look for cracks, scratches, and b. Look for chips and gouges in snapping grooves. c. If pin (6) is damaged, replace it.	
42.	Piston pin bushing (7) and piston pin (6)	a. Check pin (6) for scratches, wear, and out of round. b. Insert pin (6) through bushing (7) and check for fit. c. If bushing (7) is damaged and needs replacing, using arbor press, press out. d. Get rid of bushing (7). e. Position connecting rod (1) in press, large chamfer side of bushing bore, facing down.	



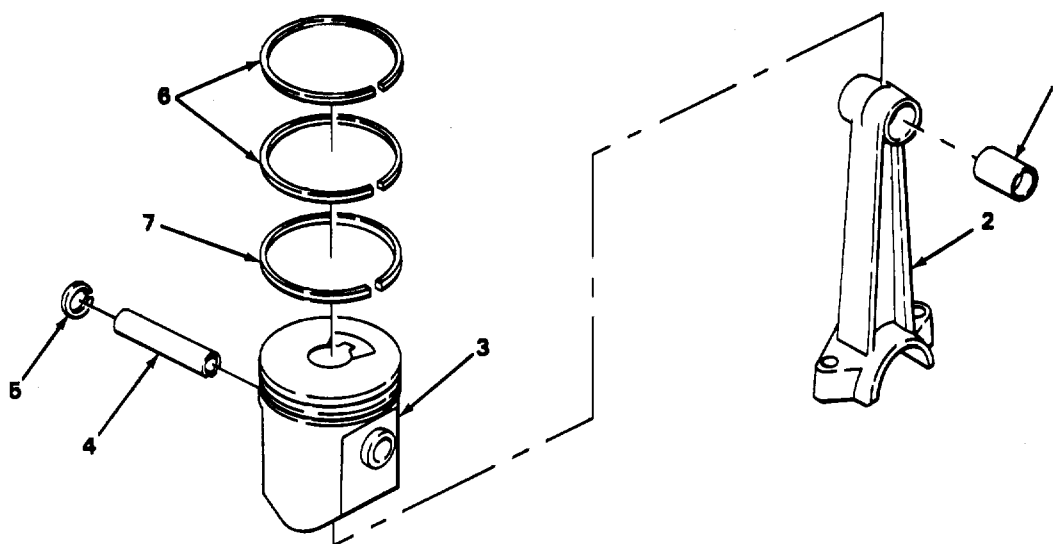
PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
42. bush-	Continued	f.	Lubricate outside diameter of new ing (1) with clean engine oil.
		g.	Line up split In bushing (1) on a horizontal plane with connecting rod (2) balance boss.
		h.	Using arbor press and Installer sleeve, press In bushing (1) until the shoulder of the Installer sleeve Is seated against rod (2).
		i.	Using honing machine, hone new bush- Ing (1) to give a hand-push piston pin fit.
ASSEMBLY			
NOTE			
It Is Important that the connecting rod and piston be assembled correctly so that when the piston Is Installed In the cylinder block, the large, chamfered side of each rod Is located against the crankshaft face. The chamfer provides clearance for the crankshaft fillet.			
43. caps.	Connecting rod (2)	Piston (3)	a. Position rod (2) In vise with jaw b. Put piston In position so that rod (2) bearing shell tangs will be toward the snout side (or side marked TOP) of the piston (3).
44.	Connecting rod (2) and piston (3)	Piston pin (4) a. b. Slide In.	Lubricate with clean engine oil.
45. on.	Piston pin (4) rings (5)	Two new retaining b. Take rod (2) out of vise.	a. Using snapping pliers, put
CAUTION			
Do not spread piston rings more than necessary to slip over piston. Rings could be over-stressed and cause oil leakage.			
46. engine oil.	Piston (3) rings (6) and one new oil ring (7)	Two new compressiona. b. Using ring expander, put on. c. Stagger ring gaps.	Lubricate with clean

PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED



INSTALLATION

47.
vertical posi-

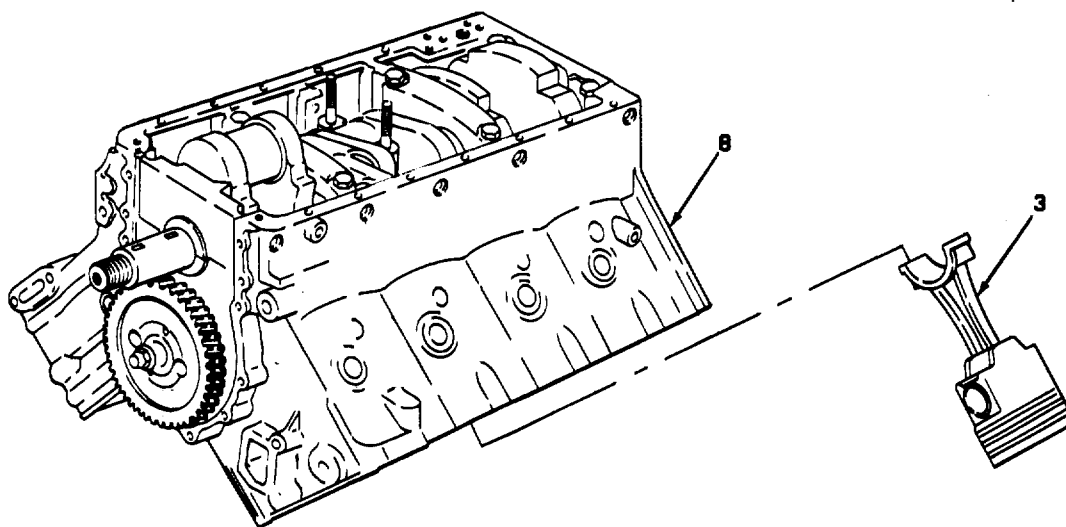
Piston (3)

Cylinder block (8)

a. Rotate overhaul stand to

tion to keep piston and connecting rod assembly from sliding back out after Installation.

b. If any piston and connecting rod assemblies are already Installed and attached to crankshaft and are newly Installed, use holddown clamps.

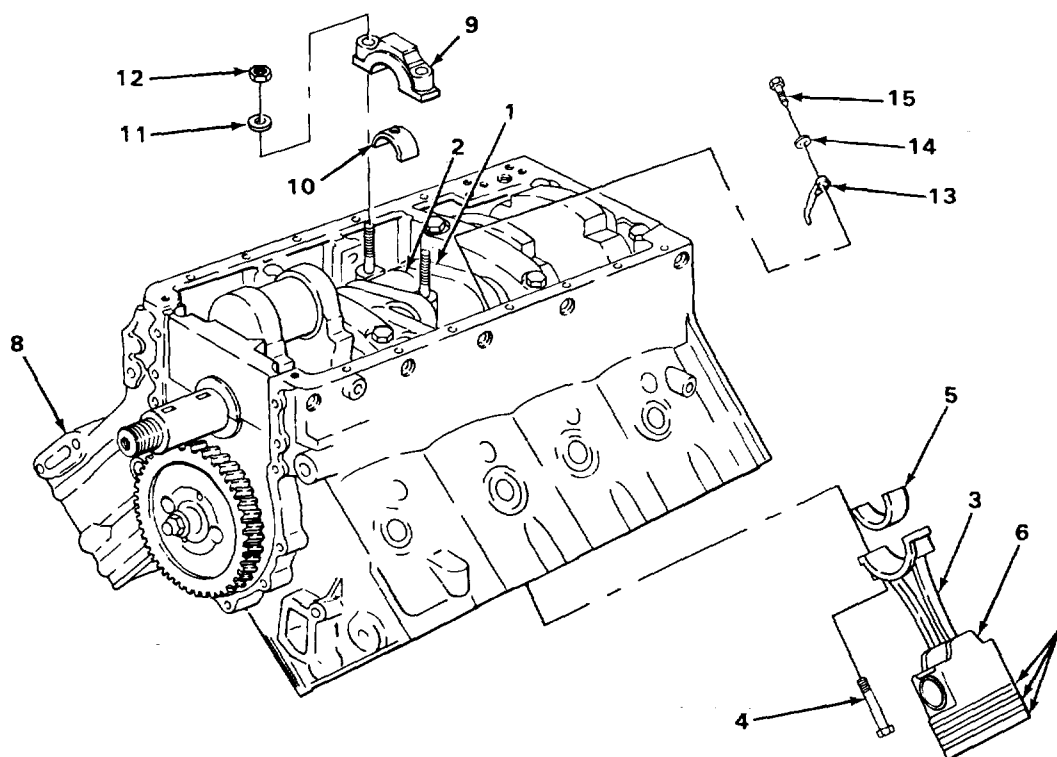


PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
48. ratchet handle	Crankshaft (1) ing journal (2)	Connecting rod bear-	a. Using 2-inch socket and with 3/4-inch drive, rotate crankshaft (1) until journal is at bottom of travel. b. Wipe clean with clean, dry rags. c. Lubricate with clean engine oil.
49. clean.	Connecting rod (3)	Two screws (4)	a. Make sure threads are b. Insert.
50.	Upper bearing shell (5)	a.	Place in position so tang on shell (5) fits into groove. b. Lubricate with clean engine oil.
51.	Piston (6)	Piston ring set (7)	Lubricate with clean engine oil.
52. compressor lubricated	Cylinder block (8) connecting rod (3)	Piston (6) with	a. Using piston ring on the inside with clean engine oi, insert skirt of piston (6) into bore until com- pressor is snug against bore. b. Using wooden hammer handle, lightly tap on top of piston (6) until it clears ring compressor.
53. seated.	Connecting rod (3)	Pull toward crankshaft journal (2) until shell (5) seats firmly.	Make sure shell is properly
54. into groove.	Bearing cap (9) shell (10)	Lower bearing	a. Put in place so tang fits b. Lubricate with clean engine oil.
55.	Connecting rod (3) and crankshaft connecting rod bearing journal (2)	Bearing cup (9) with bearing shell (10)	Put in place with cylinder identifying number next to number on rod (3). Numbers must match.
56. clean.	Two screws (4) (11) and nuts (12)	Two new washers	a. Make sure threads are b. Lubricate all threads with clean engine oil. c. Screw on until snug. d. Using 11/16-inch socket and torque wrench with 1/2-inch drive, tighten alternately to 55 ft-lb (75 N m) of torque. e. Release torque load to zero.

PISTONS AND CONNECTING RODS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
56.	Continued	f. Retighten to specified torque. g. Turn nut (12) an additional one-sixth turn or one flat of the nut (12).	
57.	Cylinder block (8) nozzle (13)	Piston cooling	Put in position.
58.	Piston cooling nozzle (13)	Washer (14) and screw (15)	a. Screw in until snug. b. Using 1/2-inch socket and torque wrench with 1/2-inch drive, tighten to 12 - 15 ft-lb(16 - 20 N m).



NOTE

FOLLOW-ON MAINTENANCE:

1. Install cylinder heads (page 2-102).
2. Install engine oil pump (page 2-208).
3. Couple engine (page 2-52).

TASK ENDS HERE

TA238005

INTAKE AND EXHAUST VALVES

This task covers:

a. Removal (page 2-158) b. Cleaning (page 2-160) d. Installation (page 2-163)	c. Inspection/Replacement/Repair (page 2-160)
-

INITIAL SETUP**Tools**

Apron, rubber
 Brush, fine wire
 Compressor, reciprocating air, power driven
 Compressor, valve spring
 Face, inserted hammer, soft-plastic
 Gloves, rubber
 Goggles, safety
 Gun, air blow
 Holder, Inserted hammer-face
 Hose, air compressor

Materials/Parts

Compound, carbon cleaning (item 11, appendix B)

Materials/Parts - Continued

Oil, engine (item 32, appendix B)
 Pencil
 Seal, valve stem (one required for each valve to be serviced)
 Spring and damper assembly (one required for each valve to be serviced)

Personnel Required

One

Equipment Condition

Cylinder head removed (page 2-102).

LOCATION	ITEM	ACTION	REMARKS

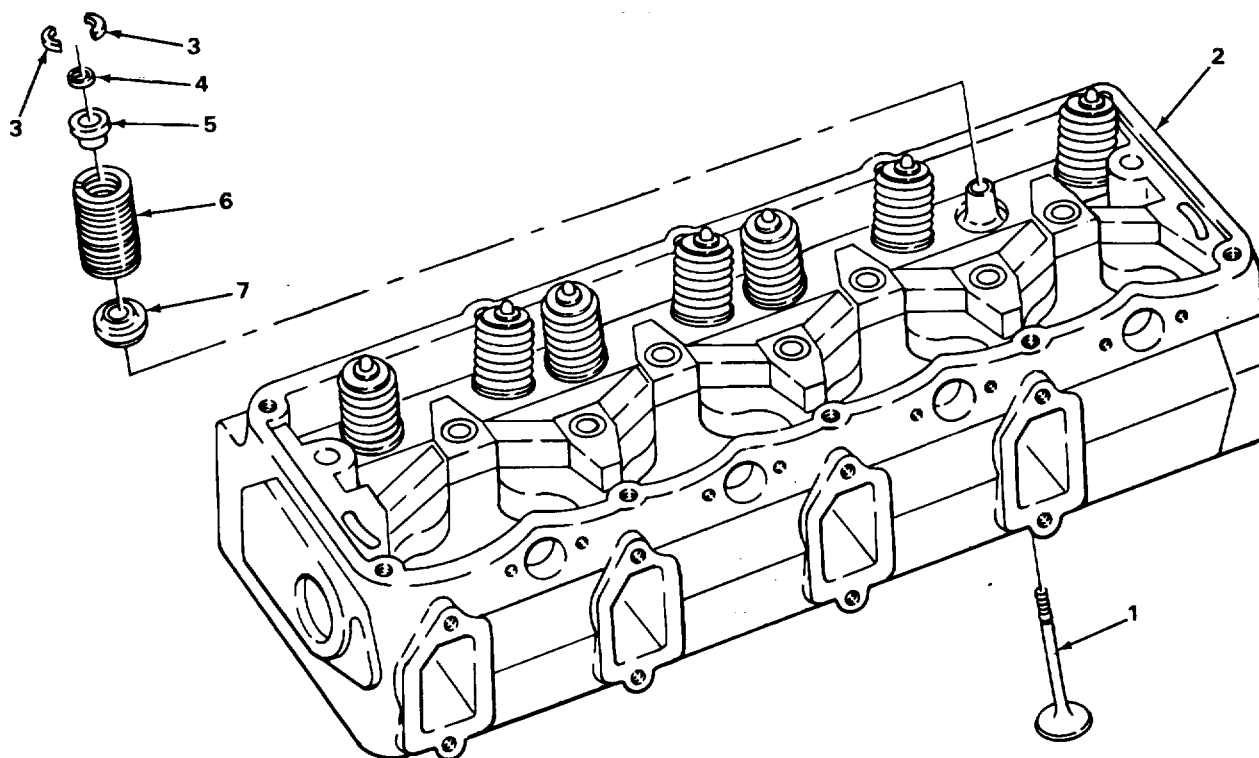
REMOVAL**NOTE**

Intake and exhaust valves are maintained the same way except for grinding dimensions as noted In Inspection/Replacement/Repair procedures. One valve is covered. Repeat task as necessary for other valves.

Keep all parts together so that they may be reinstalled in their proper position.

INTAKE AND EXHAUST VALVES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
1. vertical hammer	Valve (1) and cylinder head (2)	Two valve spring retainers (3) b.	a. Place cylinder head (2) in position. Using valve spring compressor, take off retainers (3). It may be necessary to tap end of valve with soft plastic-face to loosen retainers.
2.	Valve stem seal (4), valve spring cup (5), valve spring and damper assembly (6), and valve rotator cup assembly (7)	a. Release spring compressor. b. Take out parts. c. Get rid of stem seal (4) and spring and damper assembly (6).	
3.	Cylinder head (2)	Valve (1)	Take out.



INTAKE AND EXHAUST VALVES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

WARNING

Carbon cleaning compound is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin it can cause very serious burns. Be sure to wear safety goggles or lenses, rubber apron and rubber gloves. If accidentally splashed in eyes or on skin, flush with clean, cool water and refer to First Aid Manual, FM 21-11. Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

4.	All valve parts	a. Soak parts in carbon cleaning compound. b. Using fine wire brush, clean off all carbon. c. Rinse in clean water. d. Blow dry with compressed air.

INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace parts that are not within specified limits, or which are defective and cannot be repaired.

5.	Two valve spring retainers (1)	Look for cracks and breaks.
6.	Valve rotator cup assembly (2)	Turn by hand, and check for rough or irregular operation.
7.	Valve spring cup (3)	Look for cracks and breaks.
8.	Valve seat insert (4), intake valve (5), and exhaust valve (6)	a. Look for cracks, burrs, ridges, and pitting. b. Mark face of valve (5), all around with pencil. c. Put valve (5) or (6) in cylinder head (7).

INTAKE AND EXHAUST VALVES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
8. Continued	d.	Rotate valve (5) or (6) one complete revolution.	
		e. Take out valve (5) or (6), and check insert (4) for low spots.	
			Low spots will not have any pencil mark showing.
		f. If valve seat insert (4) requires replacement see Cylinder Head Repair (page 2-102).	
		g. If inspection shows valve (5) or (6) and valve seat insert (4) need to be ground, or new part is used, send cylinder head (6) with valves (5) or (6), with Table IV-1. (pages 2-161 and 2-162) to machine shop.	

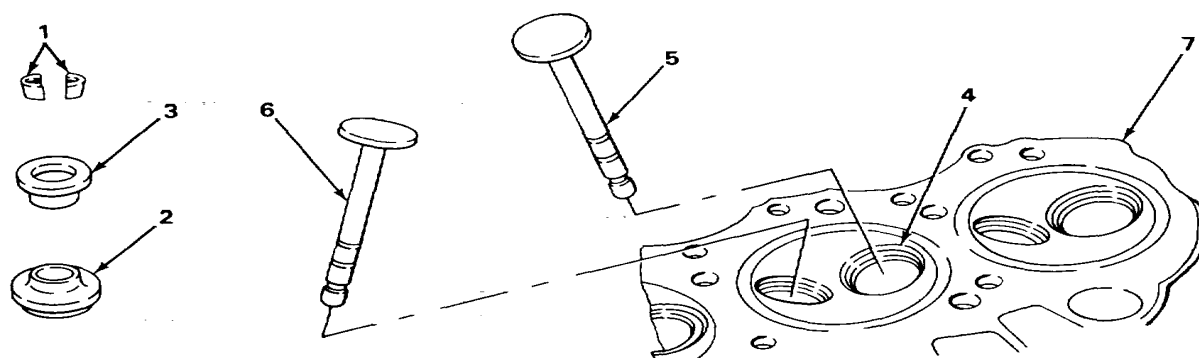


TABLE IV-1

INTAKE AND EXHAUST VALVE SPECIFICATIONS

INTAKE VALVES

Valve lift	0.455 in (11.56 mm)
Stem diameter	0.3725 - 0.3730 in (9.461 - 9.474 mm)
Clearance in guide	0.0008 - 0.0023 in (0.020 - 0.054 mm)
Face angle	45°
Seat angle	45°
Seat width	0.080 - 0.090 in (2.03 - 2.29 mm)

TA238007

INTAKE AND EXHAUST VALVES - CONTINUED

TABLE IV-1

INTAKE AND EXHAUST VALVE SPECIFICATIONS

INTAKE VALVES - CONTINUED

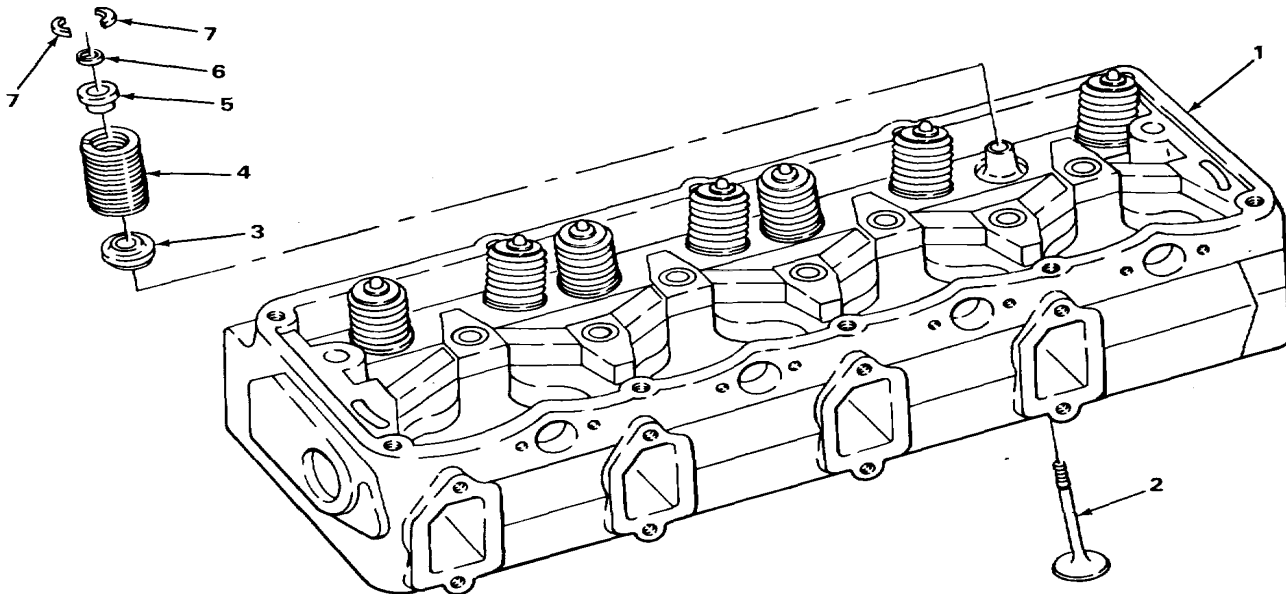
Maximum allowable seat runout	0.002 in (10.05 mm)
Seat insert and counterbore data:	
Standard:	
Insert, OD	2.204 - 2.205 in (55.98 - 56.00 mm)
Counterbore diameter	2.200 - 2.202 in (55.88 - 55.93 mm)
0.002 in (0.05 mm) oversize:	
Insert, OD	2.206 - 2.207 in (56.03 - 56.06 mm)
Counterbore diameter	2.202 - 2.204 in (55.93 - 55.98 mm)
0.030 in (0.762 mm) oversize:	
Insert, OD	2.234 - 2.245 in (56.74 - 56.77 mm)
Counterbore diameter	2.230 - 2.232 in (56.64 - 56.69 mm)
Valve head recession (below cylinder head face):	
Minimum	0.027 in (0.69 mm)
Maximum	0.047 in (1.19 mm)

EXHAUST VALVES

Valve lift	0.465 in (11.81 mm)
Stem diameter	0.3720 - 0.3725 in (9.449 - 9.461 mm)
Clearance in guide	0.0013 - 0.0028 in (0.033 - 0.071 mm)
Face angle	450
Seat angle	450
Seat width	0.080 - 0.090 in (2.03 - 2.29 mm)
Maximum permissible seat runout	0.002 in (0.05 mm)
Seat insert and counterbore data:	
Standard:	
Insert, outside diameter	1.950 - 1.951 in (49.53 - 49.55 mm)
Counterbore diameter	1.946 - 1.948 in (49.43 - 49.48 mm)
0.002 in (0.05 mm) oversize:	
Insert, OD	1.952 - 1.953 in (49.58 - 49.61 mm)
Counterbore diameter	1.948 - 1.950 in (49.48 - 49.53 mm)
0.015 in (0.381 mm) oversize:	
Insert, OD	1.965 - 1.966 in (49.91 - 49.94 mm)
Counterbore diameter	1.961 - 1.963 in (49.81 - 49.86 mm)
0.030 in (0.763 mm) oversize:	
Insert, OD	1.980 - 1.981 in (50.29 - 50.32 mm)
Counterbore diameter	1.976 - 1.978 in (50.19 - 50.24 mm)
Valve head recession (below cylinder head face):	
Minimum	0.042 inch (1.07 mm)
Maximum	0.062 inch (1.57 mm)

INTAKE AND EXHAUST VALVES - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION		
9. Cylinder head (1)	Valve (2)	a. Position head (1) in vertical position. b. Make sure valve (2) is clean. c. Apply clean engine oil to stem and face. d. Put into seat to which it was checked.
10 .	Valve rotator cup assembly (3), new spring and damper assembly (4), valve spring cup (5), and new valve stem seal (6)	Put in place.
11.	Two valve spring retainers (7)	Using valve spring compressor, compress assembly (4) and put in.



NOTE

FOLLOW-ON MAINTENANCE: Install cylinder head (page 2-102).

TA238008

TASK ENDS HERE

TA238008

ROCKER ARMS

This task covers:

a. Removal (page 2-164)	e. Assembly (page 2-168)
b. Disassembly (page 2-165)	f. Installation (page 2-168)
c. Cleaning (page 2-166)	g. Rocker Arm-to-Valve Tip Clearance Adjustment (page 2-170)
d. Inspection/Replacement/Repair page 2-167)	

INITIAL SETUP

Tools

Caliper, micrometer, ID
Compressor, reciprocating air, power driven
Face, inserted hammer, soft-plastic
Gage, thickness
Gage, ribbon
Goggles, safety
Gun, air blow
Handle, ratchet, 3/8-inch drive
Handle, ratchet, 1/2-inch drive
Handle, ratchet, 3/4-inch drive
Holder, inserted hammer-face
Hose, air compressor
Pins, cotter (two required)
Press, arbor, hand-operated
Screwdriver, flat-tip, 3/16-inch
Socket, 3/8-inch drive, 7/16-inch
Socket, 1/2-inch drive, 9/16-inch
Socket, 3/4-inch drive, 2-inch
Spring, 12-inch

Tools - Continued

Wrench, open-end, 9/16-inch
Wrench, torque, 112-inch drive, 0 - 150 ft-lb capacity

Materials/Parts

Cloth, emery (item 8, appendix b)
Locknut, rocker arms (eight required)
Lockwasher, oil supply bracket
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Cylinder head covers removed (left and right sides) (pages 2-175 and 2-180).

LOCATION	ITEM	ACTION REMARKS

NOTE

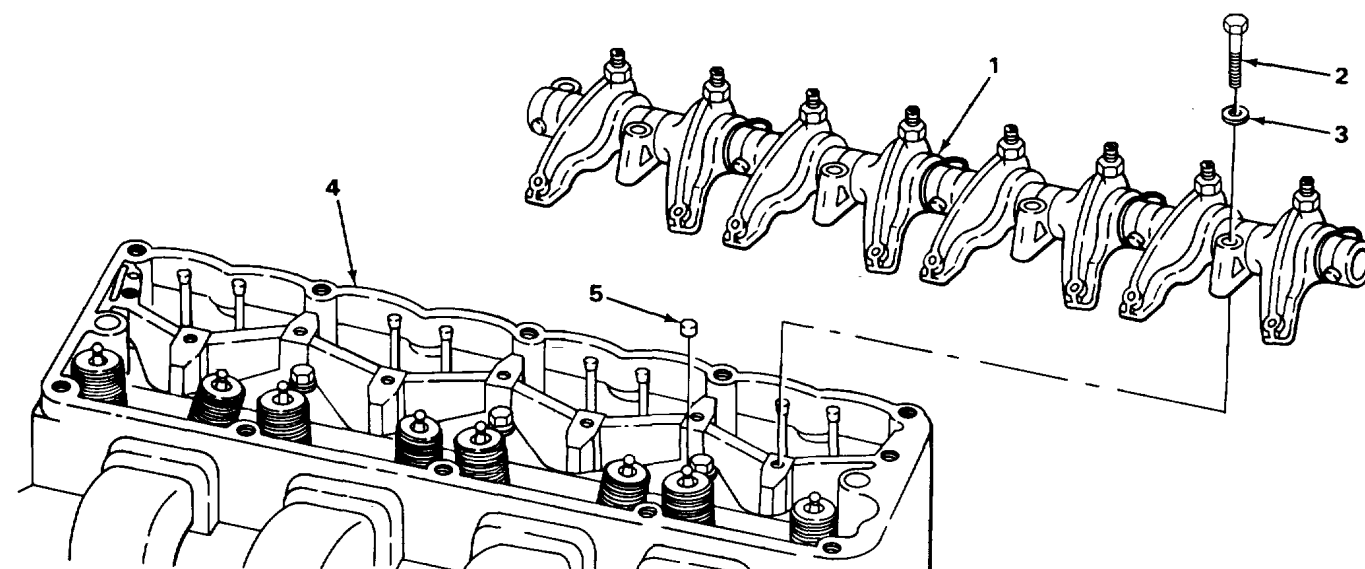
Both rocker arms are maintained the same way. One rocker arm is covered. Repeat as needed for other arm.

REMOVAL

1. Rocker arm assembly (1)	Nine screws (2) and washers (3)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
2. Cylinder head (4)	Rocker arm (1) and eight valve caps (5)	Lift off.

ROCKER ARMS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		



DISASSEMBLY

NOTE

There are four different shapes of rocker arms used in each complete rocker arm assembly. Each rocker arm is stamped with the cylinder number and the letters INT or EX for identification. During disassembly, keep parts in order so they may be placed in their original position, if in satisfactory condition.

3. Rocker arm shaft (6)	Eight rocker arm brackets (7) and eight rocker arms (8), (9), (10), and (11)	Starting from end opposite oil feed support, use plastic-face hammer to tap loose and then slide off. Keep parts in order.

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ROCKER ARMS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED		
4. Eight rocker arms (1), (2), (3), and (4)	Eight locknuts (5)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off. b. Get rid of.
5.	Eight adjusting screws (6)	Using 3/16-inch flat-tip screwdriver, unscrew through bottom and take off.
6. Oil supply bracket (7)	Screw (8) and a. lockwasher (9)	Using 7/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (9).
7. Rocker arm shaft (10)	) Oil supply bracket (7)	Using arbor press, take off.

CLEANING

NOTE

For more Information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

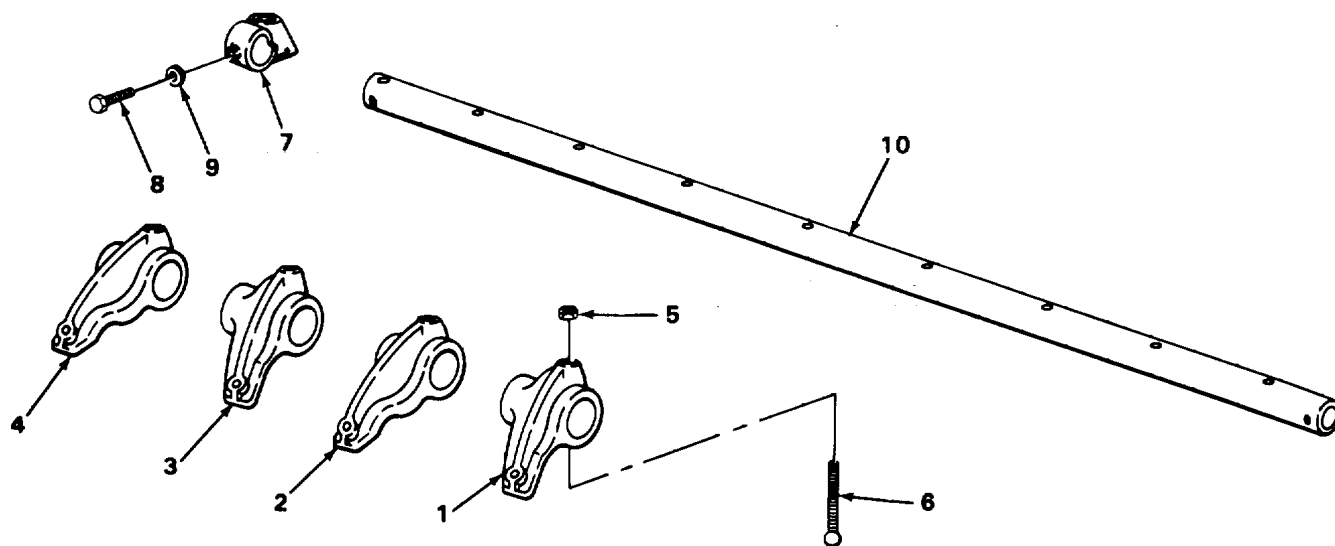
NOTE

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

8.	All metal parts	a. Clean in drycleaning solvent. Make sure oil passages are clean. b. Blow dry with compressed air.

ROCKER ARMS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT/REPAIR		
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.		
9.	Rocker arm shaft (10)	a. Look for cracks, breaks, and bends. b. Look for wear from rocker arms.
10.	Eight rocker arms (1), (2), (3), and (4)	a. Look at contact pad surface for wear from valve caps. b. If pad is worn, resurface pad using emery cloth but do not remove more than 0.0010 inch (0.025 mm) of material. c. Look for scoring and wear in bores. d. Using Inside micrometer check inside diameter. Diameter must be 0.8661 - 0.860 inch (21.999 - 22.022 mm). e. Using ribbon gage, check rocker arm-to-shaft running clearance. Clearance must be 0.0011 - 0.0045 Inch (25.286 - 25.298 mm).



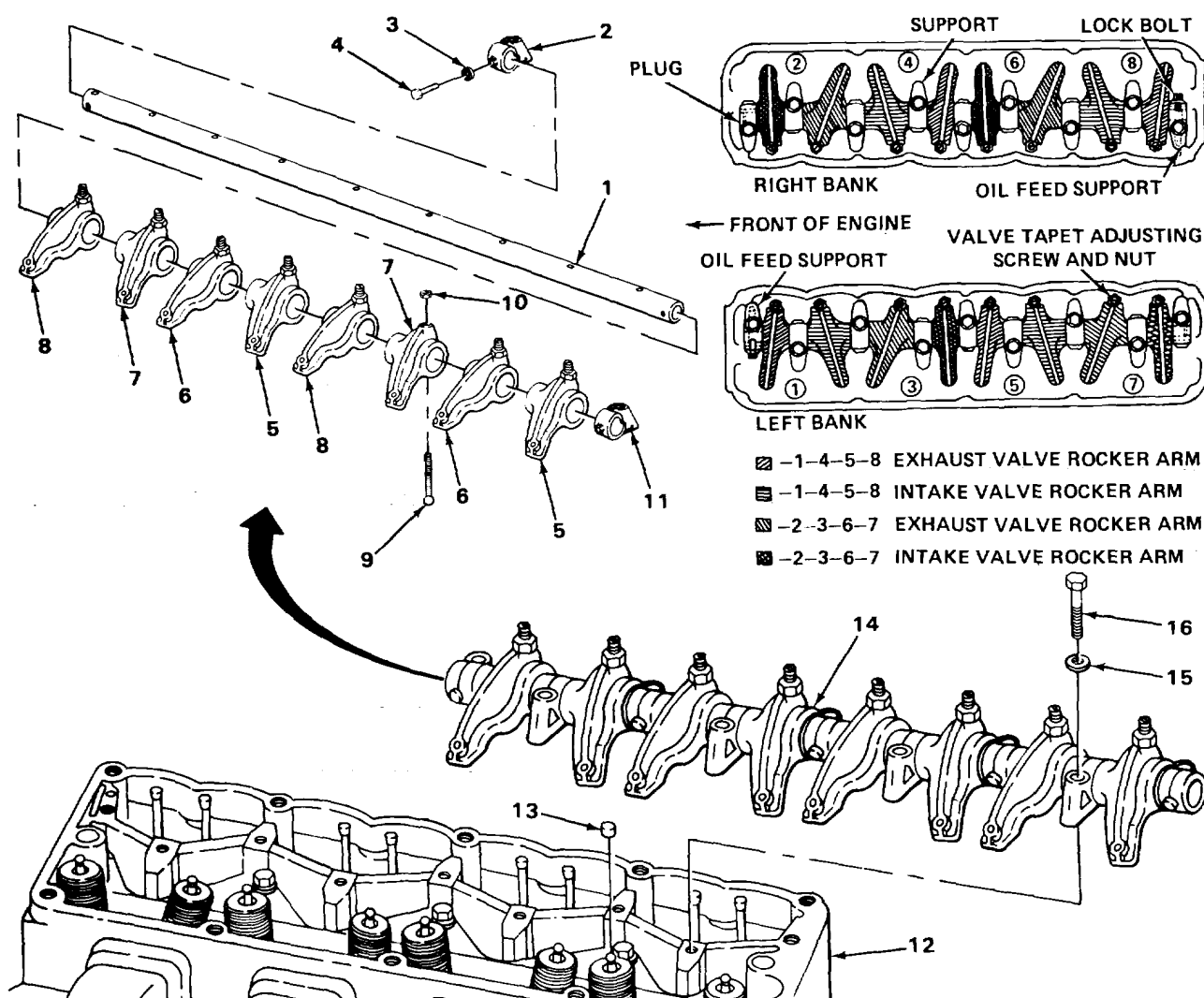
TA238010

ROCKER ARMS - CONTINUED

LOCATION		ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
11.		All threaded parts	Look for stripped, gouged, and damaged threads.
ASSEMBLY			
12.	Rocker arm shaft (1)	Oil supply bracket (2)	a. Line up oil holes. b. Using arbor press, press on until oil holes are indexed.
13.	Oil supply bracket (2)	New lockwasher (3) and screw (4)	Screw in, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch drive.
14.	Eight rocker arms (5), (6), (7), and (8)	Eight adjusting screws (9)	Using 3/16-inch flat-tip screwdriver, screw in from bottom, until about 1/2 inch (12.7 mm) shows above the top of arms.
15.	Eight adjusting screws (9)	Eight nuts (10)	Screw on two or three turns.
16.	Rocker arm shaft (1)	Eight rocker arms (5), (6), (7), and (8) and brackets (11)	a. With arms (5), (6), (7), and (8) and brackets (11) in proper order, and oil feed holes facing down, slide on using plastic-face hammer if needed. Oil feed holes in right rocker arm shaft assembly will be toward the rear, and oil feed holes in the left rocker arm shaft assembly will be toward the front of the engine. b. Using spring and two cotter pins, hold
assembly together for installation.			
INSTALLATION			
17 .	Cylinder head (12)	Eight valve caps (13) and rocker arm assembly (14)	a. Place in position. b. Take off cotter pins and spring.

ROCKER ARMS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED		
18. Eight rocker arm brackets (11)	Nine washers (15) and screws (16)	a. Screw in until snug. b. Tighten evenly to 30 - 35 ft-lb (42 - 47 N m) of torque using 9/16-inch socket and torque wrench with 1/2-inch drive,



TA238011

ROCKER ARMS - CONTINUED

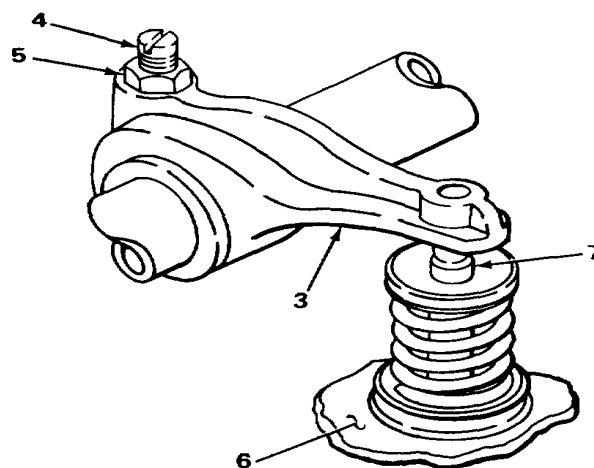
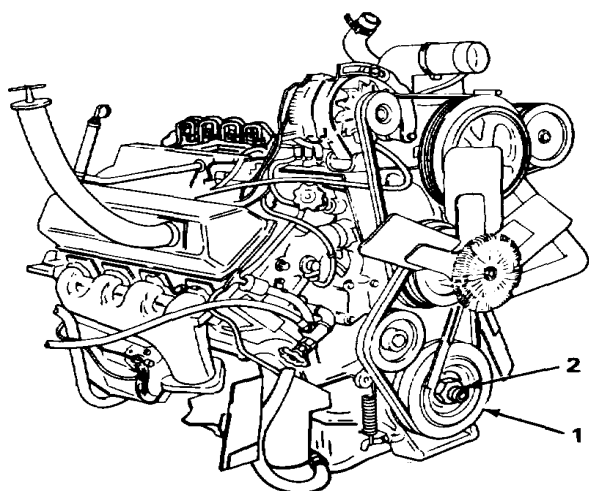
LOCATION	ITEM	ACTION REMARKS
ROCKER ARM-TO-VALVE TIP CLEARANCE ADJUSTMENT		
<u>WARNING</u>		
This adjustment may be made with engine installed in the vehicle. Be sure that ignition key is removed from ignition switch. Be sure that fuel shutoff valve is held in the off position. When manually rotated, the diesel engine could start accidentally and cause serious injury to personnel.		
NOTE		
As viewed from the driver's seat, the right bank of cylinders is numbered 2, 4, 6, and 8 with number 2 cylinder being at the front. Similarly, the left bank of cylinders is numbered 1, 3, 5, and 7 with number 1 being at the front. Firing order is: 1-8-7-3-65-4-2.		
Each cylinder and its valves must be adjusted. One intake valve and one exhaust valve is shown. Repeat procedure for all cylinders and valves in firing order.		
19.	Crankshaft pulley (1) Pulley nut (2)	Using 2-inch socket and ratchet handle with 3/4-inch drive, rotate crankshaft in operating direction until number 1 intake valve just starts to open at the number 6 cylinder.
20.	Rocker arm (3) Screw (4) and nut (5)	3/16-inch flat-tip screwdriver, loosen.
21.	Cylinder head (6) Intake valve (7) and rocker arm (3)	a. Using thickness gage, measure gap between valve (7) and arm (3). Measurement must be 0.014 inch (0.36 mm). b. If measurement is not 0.014 inch (0.36 mm), go to step 22. c. If measurement is 0.014 inch (0.36 mm), go to step 23.
22.	Rocker arm (3) Screw (4) Using 3/16-inch flat-tip screwdriver and	thickness gage, screw in or out until distance between arm (3) and valve (7) is 0.014 inch (0.36 mm).

ROCKER ARMS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ROCKER ARM-TO-VALVE TIP CLEARANCE ADJUSTMENT - CONTINUED		
23. Screw (4)	Nut (5)	a. Using 9/16-inch open-end wrench and 3/16-inch flat-tip screwdriver, tighten. Do not allow screw to turn. Clearance will be affected and you will have to adjust the clearance again. b. Repeat steps 21 thru 23a for exhaust valve clearance. Rocker arm-to-exhaust valve clearance must be 0.016 inch (0.41 mm). c. Adjust all rocker arms in the sequence shown below.

ROCKER ARM-TO-VALVE TIP CLEARANCE ADJUSTMENT SEQUENCE

- No. 1 intake valve just opening, adjust valves on no. 6 cylinder
- No. 8 intake valve just opening, adjust valves on no. 5 cylinder
- No. 7 intake valve just opening, adjust valves on no. 4 cylinder
- No. 3 intake valve just opening, adjust valves on no. 2 cylinder
- No. 6 intake valve just opening, adjust valves on no. 1 cylinder
- No. 5 intake valve just opening, adjust valves on no. 8 cylinder
- No. 4 intake valve just opening, adjust valves on no. 7 cylinder
- No. 2 intake valve just opening, adjust valves on no. 3 cylinder



TA238012

ROCKER ARMS - CONTINUED

ROCKER ARM - TO - VALVE TIP CLEARANCE ADJUSTMENT - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE: Install cylinder head covers (left and right sides) (pages 2-175 and 2-180).

TASK ENDS HERE

VALVE LIFTER RODS AND TAPPET VALVE ASSEMBLIES

This task covers:

- a. Removal (page 2-172)

b. Cleaning (page 2-173)
- c. Inspection/Replacement (page 2-174)

d. Installation (page 2-174)

INITIAL SETUP

Tools

Remover and installer, tappet

Personnel Required

One

Materials/Parts

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)

Equipment Condition

Rocker arms removed (page 2-164).

LOCATION		ITEM	ACTION REMARKS

NOTE

There are 16 valve lifter rods and tappet valve assemblies. This procedure covers one each. Repeat for all rods and tappet assemblies.

REMOVAL

NOTE

Before removing rods and tappets, note their position and record. After removal, keep rods and their companion tappets together so that they may be reinstalled together into the same location;

1. Cylinder head (1)

Valve lifter rod (2)

Note location and take out.

VALVE LIFTER RODS AND TAPPET VALVE ASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
2. Cylinder block (3)	Cylinder head	Remove (page 2-102).
3.	Tappet cover	Remove (page 2-182).
4. Cylinder block (3)	Tappet valve assembly (4)	Using tappet remover and installer tool, take out.

CLEANING

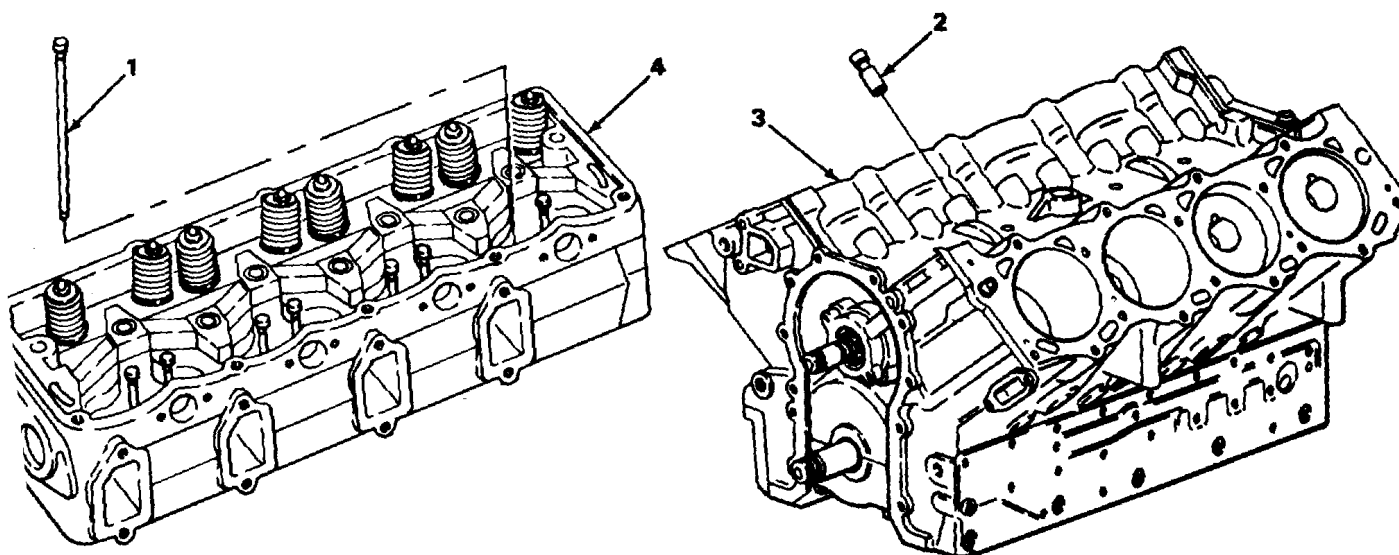
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

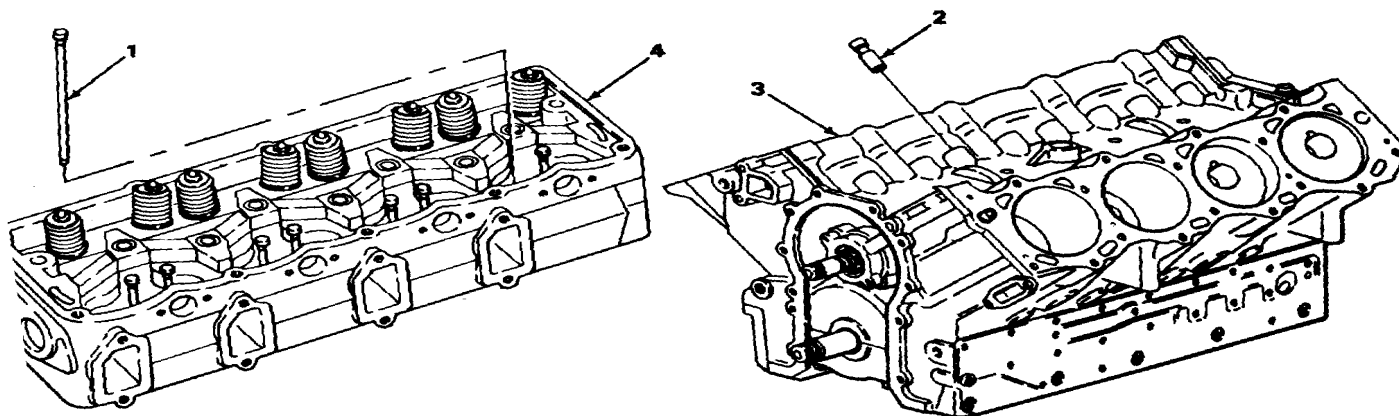
5.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.



TA238013

VALVE LIFTER RODS AND TAPPET VALVE ASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT		
NOTE For more information on how to inspect parts, go to General Maintenance Instructions page (2-46). Replace damaged or defective parts as needed.		
6.	Valve lifter rod (1)	a. Look for bends and breaks. b. Look for cracks. c. Look for wear at tip that seats into tappet assembly.
7.	Tappet valve assembly (2)	a. Look for score marks and other signs of wear. b. Look for signs of discoloration due to overheating.
INSTALLATION		
8. Cylinder block (3)	Tappet valve assembly (2)	Put in using tappet remover and installer tool.
9.	Tappet cover	Install (page 2-182).
10.	Cylinder head	Install (page 2-102).
11. Cylinder head (4)	Valve lifter rod (1)	Put in until seated into tappet.



TA238014

VALVE LIFTER RODS AND TAPPET VALVE ASSEMBLIES - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install rocker arms (page 2-164).

TASK ENDS HERE**CYLINDER HEAD COVER ASSEMBLY - RIGHT SIDE**

This task covers:

a. Removal (page 2-176)	d. Inspection/Replacement (page 2-177)
b. Disassembly (page 2-176)	e. Assembly (page 2-178)
c. Cleaning (page 2-177)	f. Installation (page 2-178)
-

INITIAL SETUP**Tools**

Handle, ratchet, 3/8-inch drive
Screwdriver, flat-tip, 3/16-inch
Socket, 3/8-inch drive, 7/16-inch
Wrench, open-end, 3/4-inch
Wrench, open-end, 7/8-inch
, open-end, 1 1/2-inch

Personnel Required

One

Equipment Condition

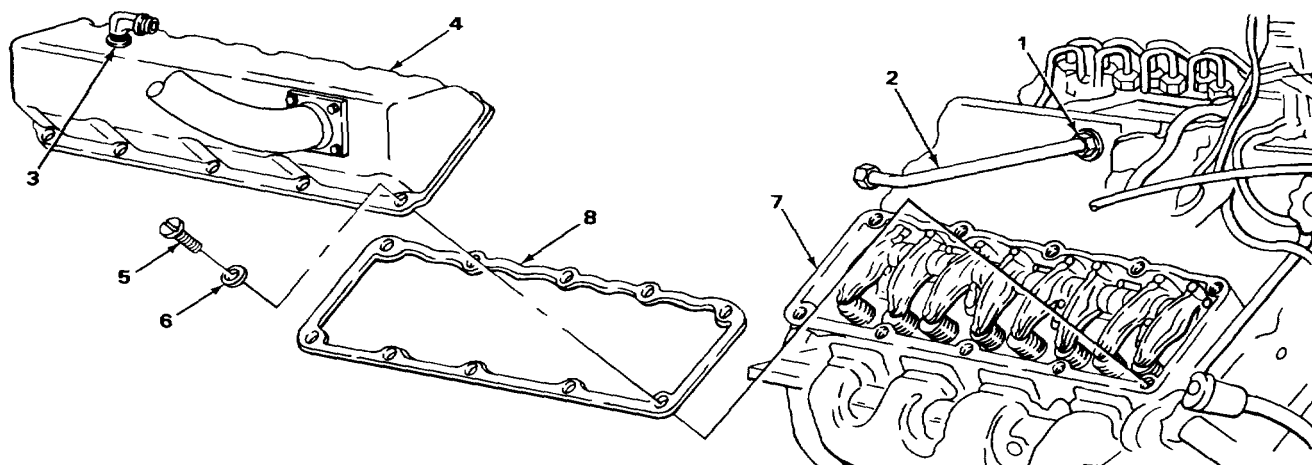
Air cleaner and air cleaner mounting bracket removed (TM 9-2320-269-20-1).

Materials/Parts

Gasket, cylinder head cover
Gasket, oil filter pipe assembly
Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)

CYLINDER HEAD COVER ASSEMBLY - RIGHT SIDE - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL		
1. Adapter (1)	Breather pipe assembly (2)	Using 15/16-inch and 7/8-inch open-end wrenches, unscrew part way.
2. Elbow (3)	Breather pipe assembly (2)	a. Using 15/16-inch and 3/4-inch open-end wrenches, unscrew and take off. b. Move out of the way.
3. Cylinder head cover (4)	Ten screws (5) and washers (6)	Using 3/8-inch flat-tip screwdriver, unscrew and take out.
4. Cylinder head (7)	Cylinder head cover (4) and gasket (8)	a. Take off. b. Get rid of gasket (8).



DISASSEMBLY

5. Oil filter pipe assembly (9)	Oil filler cap (10)	Unscrew and pull out.
6.	Four screws (11)	Using 7/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
7. Cylinder head cover (4)	Oil filter pipe assembly (9) and gasket (12)	a. Take off. b. Get rid of gasket (12).

CYLINDER HEAD COVER ASSEMBLY - RIGHT SIDE - CONTINUED

LOCATION	ITEM	ACTION REMARKS

DISASSEMBLY - CONTINUED

8.	Elbow (3)	Using 3/4-inch open-end wrench, unscrew and take off.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

9.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

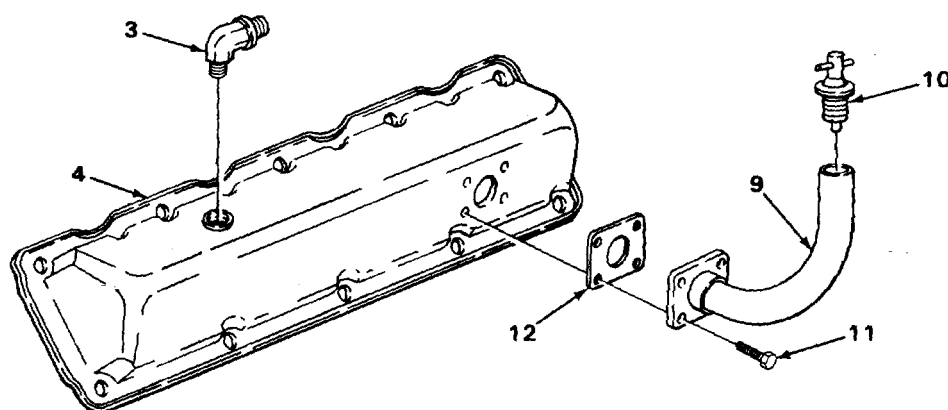
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

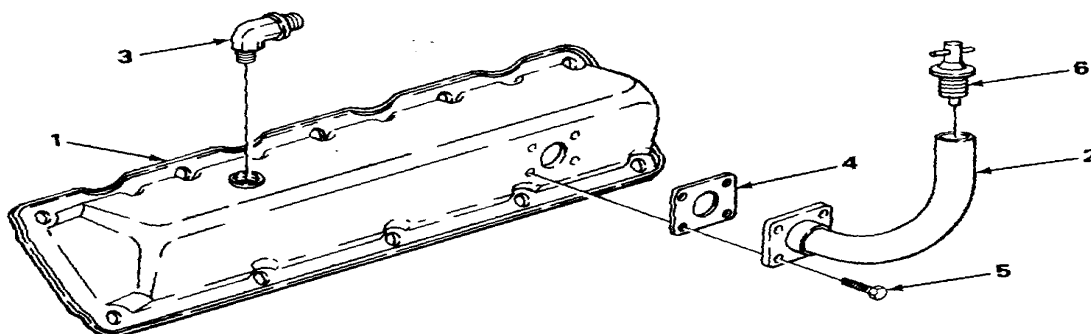
10.	Cylinder head cover (4)	a. Look for dents and cracks. b. Look for bent mounting flanges.



TA238016

CYLINDER HEAD COVER ASSEMBLY - RIGHT SIDE - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
11.	Cylinder head cover (1)	Oil filler pipe assembly (2)	Look for dents, kinks, and sharp bends.
12.		All threaded parts	Look for stripped and gouged threads.
ASSEMBLY			
13.		Elbow (3)	Using 3/4-inch open-end wrench, screw in tighten.
14.		New gasket (4) and oil filler pipe assembly (2)	Put in position.
15.	Oil filler pipe assembly (2)	Four screws (5)	Using 7/16-inch socket and handle with 3/8-inch drive, screw in and tighten.
16.		Oil filler cap (6)	a. Push in. b. Screw in, and tighten. c.



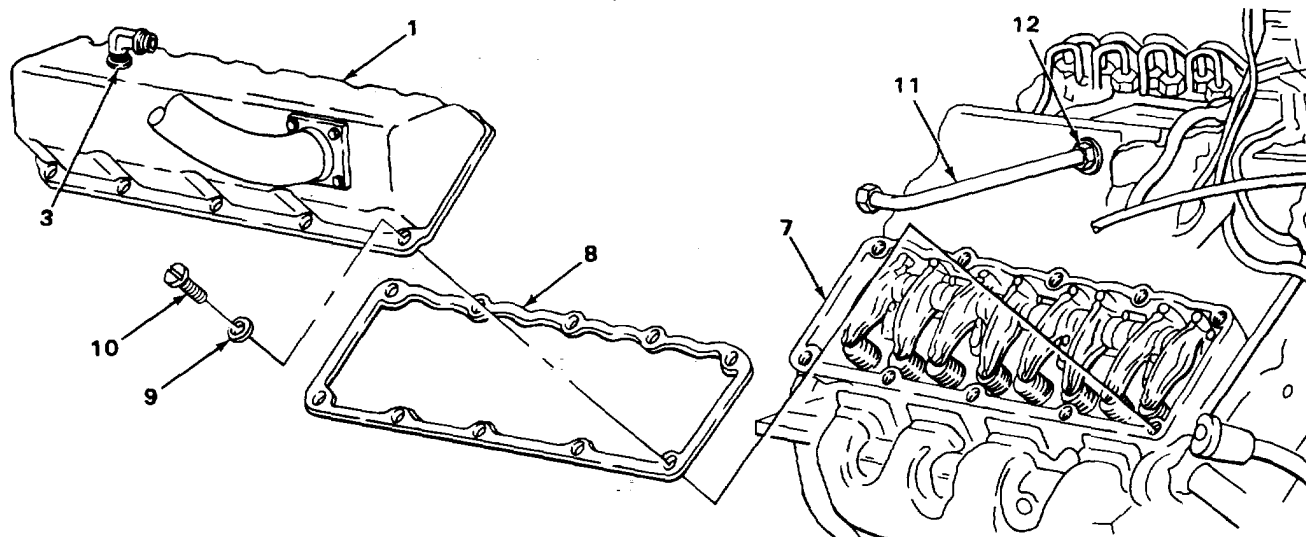
INSTALLATION

17.	Cylinder head (7)	New gasket (8) and cylinder head cover (1)	Put in position.
18.	Cylinder head cover (1)	Ten new washers (9) and screws (10)	Screw in, and tighten using 3/8-inch flat-tip screwdriver.

TA238017

CYLINDER HEAD COVER ASSEMBLY - RIGHT SIDE - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED		
19. Elbow (3)	Breather pipe assembly (11)	a. Move into position. b. Screw on, and tighten using 15/16-inch open-end wrenches.
20. Adapter (12)	Breather pipe assembly (11)	Tighten using 15/16-inch and 7/8-inch open-end wrenches.

**NOTE**

FOLLOW-ON MAINTENANCE: Install air cleaner mounting bracket and air cleaner (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238018

CYLINDER HEAD COVER ASSEMBLY - LEFT SIDE

This task covers:

a. Removal (page 2-180)	c. Inspection/Replacement (page 2-181)
b. Cleaning (page 2-180)	d. Installation (page 2-181)

INITIAL SETUP

Tools

Screwdriver, flat-tip, 3/8-inch

Personnel Required

One

Material/Parts

Gasket, cylinder head cover
Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)

Equipment Condition

Power steering pump and bracket removed
(TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION REMARKS
REMOVAL		
1. Cylinder head cover (1)	Ten screws (2) and washers (3)	Using 3/8-inch flat-tip screwdriver, unscrew and take out.
2. Cylinder head (4)	Cylinder head cover (1) and gasket (5)	a. Take off. b. Get rid of gasket (5).

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

3.	Cylinder head cover (1)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

CYLINDER HEAD COVER ASSEMBLY - LEFT SIDE - CONTINUED

LOCATION	ITEM	ACTION REMARKS

INSPECTION/REPLACEMENT

NOTE

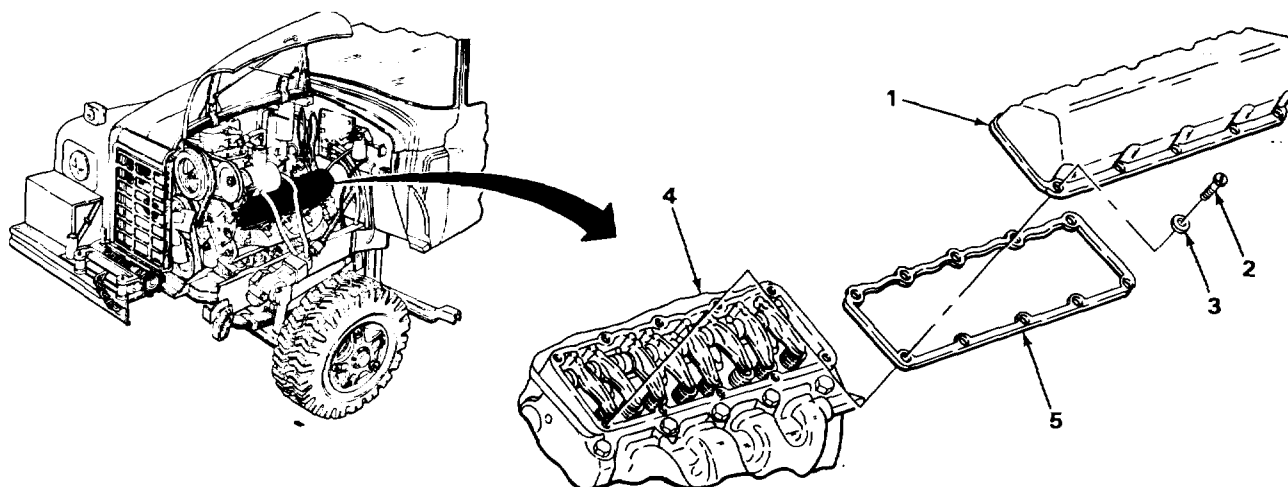
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

4.	Cylinder head cover (1)	a. Look for dents and cracks. b. Look for bent mounting flanges.

INSTALLATION

5. Cylinder head (4)	New gasket (5) and cylinder head cover (1)	Put in position.
6. Cylinder head cover (1)	Ten washers (3) and screws (2)	Screw in, and tighten using 3/8-inch flat-tip screwdriver.

**NOTE**

FOLLOW-ON MAINTENANCE: Install power steering pump bracket (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238019

TAPPET COVER

This task covers:

a. Removal (page 2-182)	c. Inspection/Replacement (page 2-183)
b. Cleaning (page 2-182)	d. Installation (page 2-183)
-

INITIAL SETUP**Tools**

Handle, ratchet, 1/2-inch drive
 Socket, 1/2-inch drive, 1/2-inch

Personnel Required

One

Equipment Condition**Materials/Parts**

Gasket, tappet cover
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Swirl destroyer removed (page 2-236).
 One cylinder head removed (page 2-102).

LOCATION	ITEM	ACTION REMARKS

REMOVAL

1. Tappet cover (1)	Six screws (2) and washers (3)	Using 1/2-inch socket and ratchet handle with 112-inch drive, unscrew and take out.
2. Cylinder block (4)	Tappet cover (1) and gasket (5)	a. Take off. b. Get rid of gasket (5).

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

3.	Tappet cover (1)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

TAPPET COVER - CONTINUED

LOCATION	ITEM	ACTION REMARKS

INSPECTION/REPLACEMENT

NOTE

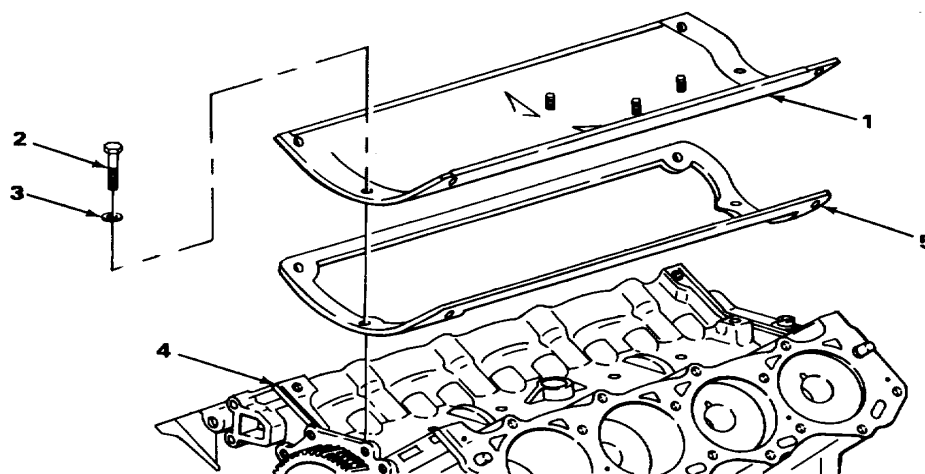
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

4.	Tappet cover (1)	Look for cracks, breaks, dents, and bends.

INSTALLATION

5. Cylinder block (4)	New gasket (5) and tappet cover (1)	Place in position.
6. Tappet cover (1)	Six washers (3) and screws (2)	Screw in, and tighten using 1/2-inch socket and ratchet handle with 1/2-inch drive.

**NOTE**

FOLLOW-ON MAINTENANCE:

1. Install one cylinder head (page 2-102).
 2. Install swirl destroyer (page 2-236).
- TASK ENDS HERE

TA238020

CAMSHAFT

This task covers:

a. Removal (page 2-184)	d. Inspection/Replacement (page 2-186)
b. Disassembly (page 2-185)	e. Assembly (page 2-187)
c. Cleaning (page 2-186)	f. Installation (page 2-188)
-

INITIAL SETUP

Tools

Compressor, reciprocating air, power driven
 Hammer, ball-peen, machinist's
 Handle, ratchet, 112-inch drive
 Handle, ratchet, 3/4-inch drive
 Indicator, dial
 Puller, mechanical gear
 Punch, drive-pin, 1/4-inch
 Remover/installer tool, camshaft
 Socket, 1/2-inch drive, 9/16-inch
 Socket, impact, 3/4-inch drive, 1 7/16-inch
 Wrench, impact, power driven, 3/4-inch drive
 Wrench, open-end, 2-inch
 Wrench, torque, 1/2-inch drive
 Wrench, torque, 3/4-inch drive

Materials/Parts

Gasket, cover plate
 Lockwashers, cover plate (three required)
 Oil, engine (item 32, appendix B)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Front crankcase cover removed (page 2-197).

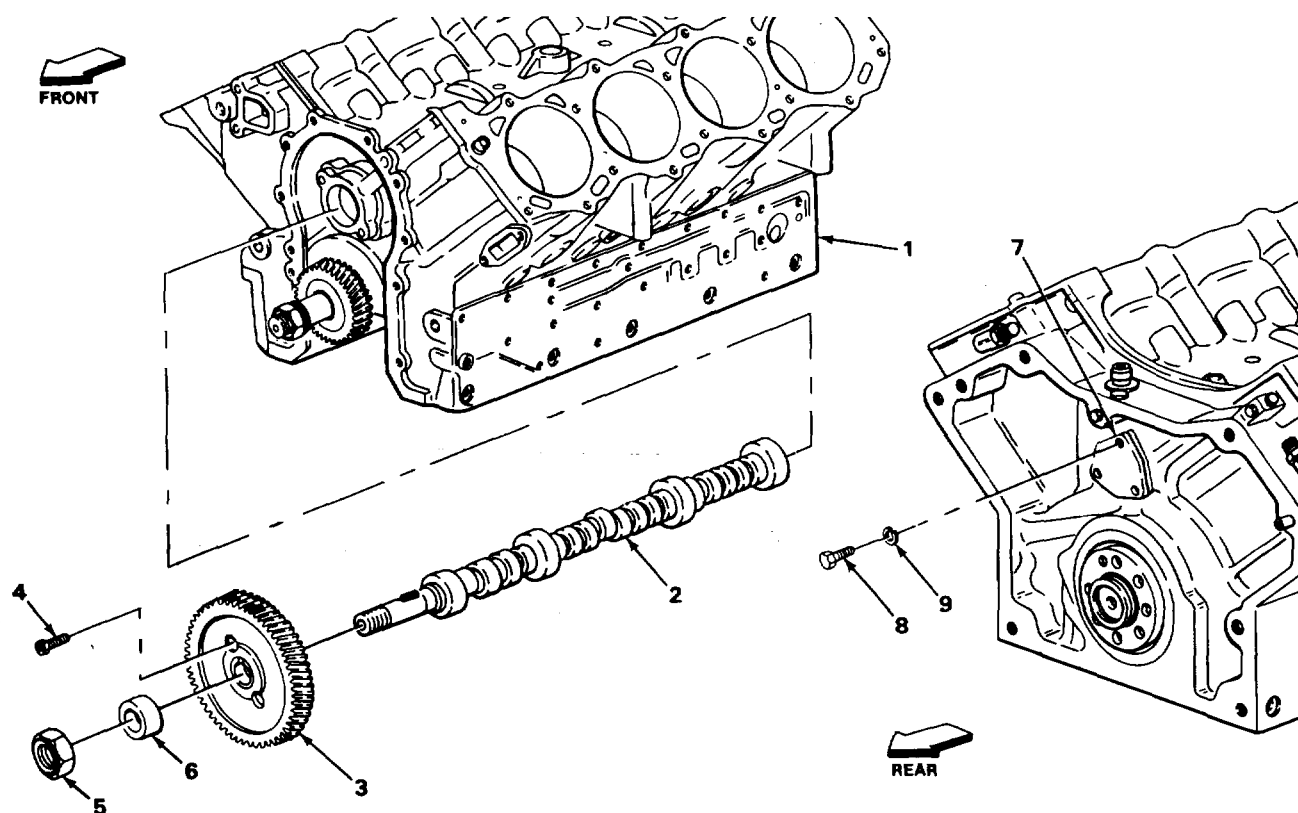
LOCATION	ITEM	ACTION REMARKS
REMOVAL		
1. Cylinder block (1)	Camshaft (2)	Using dial indicator, measure and record end play. If end play is more than 0.0035 to 0.0115 inch (0.089 to 0.292 mm) the camshaft thrust plate must be replaced.
2. Camshaft timing gear (3)	Two screws (4)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.

CAMSHAFT - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
3. Camshaft (2)	Camshaft nut (5) and spacer (6)	a. Wedge clean dry rag between camshaft timing gear (3) and crankshaft timing gear (7). b. Using 1 7/16-inch socket and impact wrench with 3/4-inch drive, unscrew and take off.
4. Camshaft (2)	Camshaft timing gear (3)	Using gear puller, pull off.
5. Cylinder block (1)	Camshaft (2)	Using camshaft remover/installer tool, take out.

DISASSEMBLY

6. Cover plate (7)	Three screws (8) and lockwashers (9)	a. Using 9/16-inch socket and handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (9).



TA238021

CAMSHAFT - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED		
7. Cylinder block (1)	Cover plate (2) and gasket (3)	a. Take off. b. Get rid of gasket (3).
8.	Thrust bearing (4)	Take off.
9.	Woodruff key (5)	Using ball-peen hammer and 1/4-inch drive-pin punch, tap out.

CLEANING

NOTE

For more Information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious Injury or death.

10.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

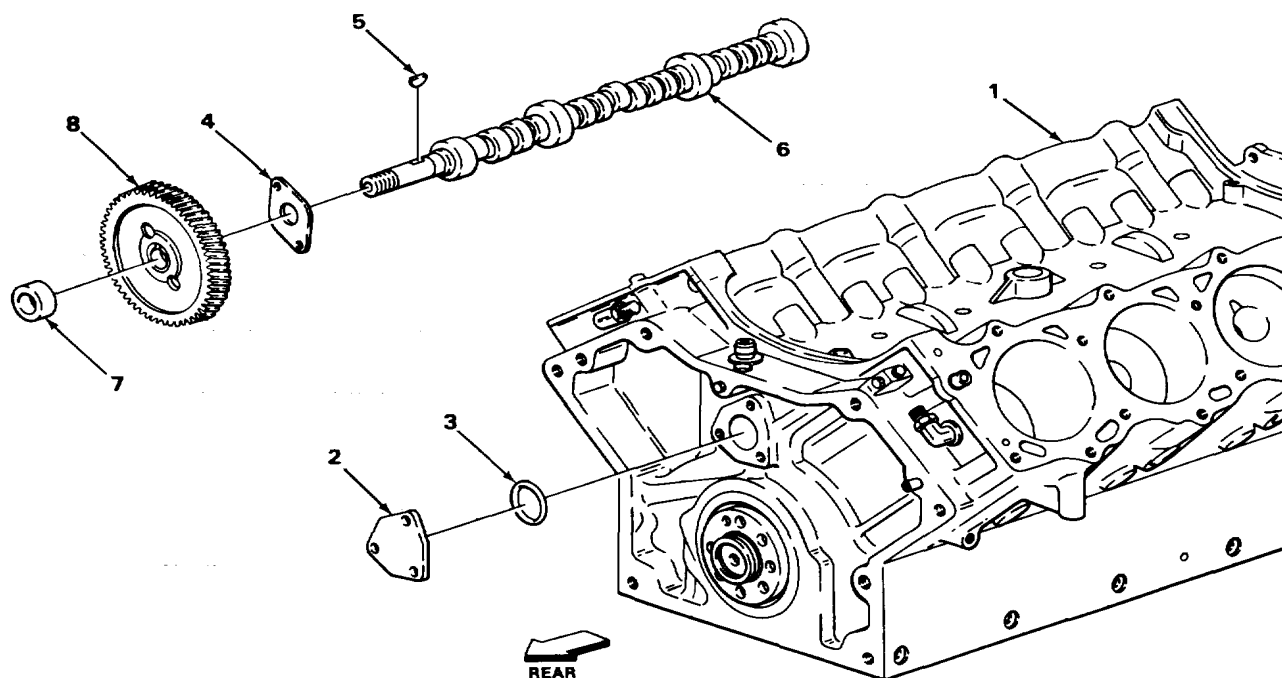
Replace damaged parts as necessary.

Camshaft, crankshaft, and injection pump drive gears are provided in matched sets and should only be installed as sets. If gears are replaced, replace the camshaft also.

11.	Camshaft (6)	a. Look for worn and out-of-round journals. b. Look for worn, chipped, and scored lobes.
12.	Spacer (7)	Look for cracks and wear.

CAMSHAFT - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT - CONTINUED		
13.	Camshaft and crankshaft timing gears	Inspect (page 2-193).
14.	Injection pump drive gear	Inspect (page 2-325).
ASSEMBLY		
15.	Camshaft (6)	Thrust bearing (4)
16.	Woodruff key (5)	Using ball-peen hammer, tap in place.
17.	Camshaft timing gear (8)	a. Lubricate inside diameter with clean engine oil. b. Using arbor press, press on.
18.	Cylinder block (1)	New gasket (3) and cover plate (2)
Place in position.		



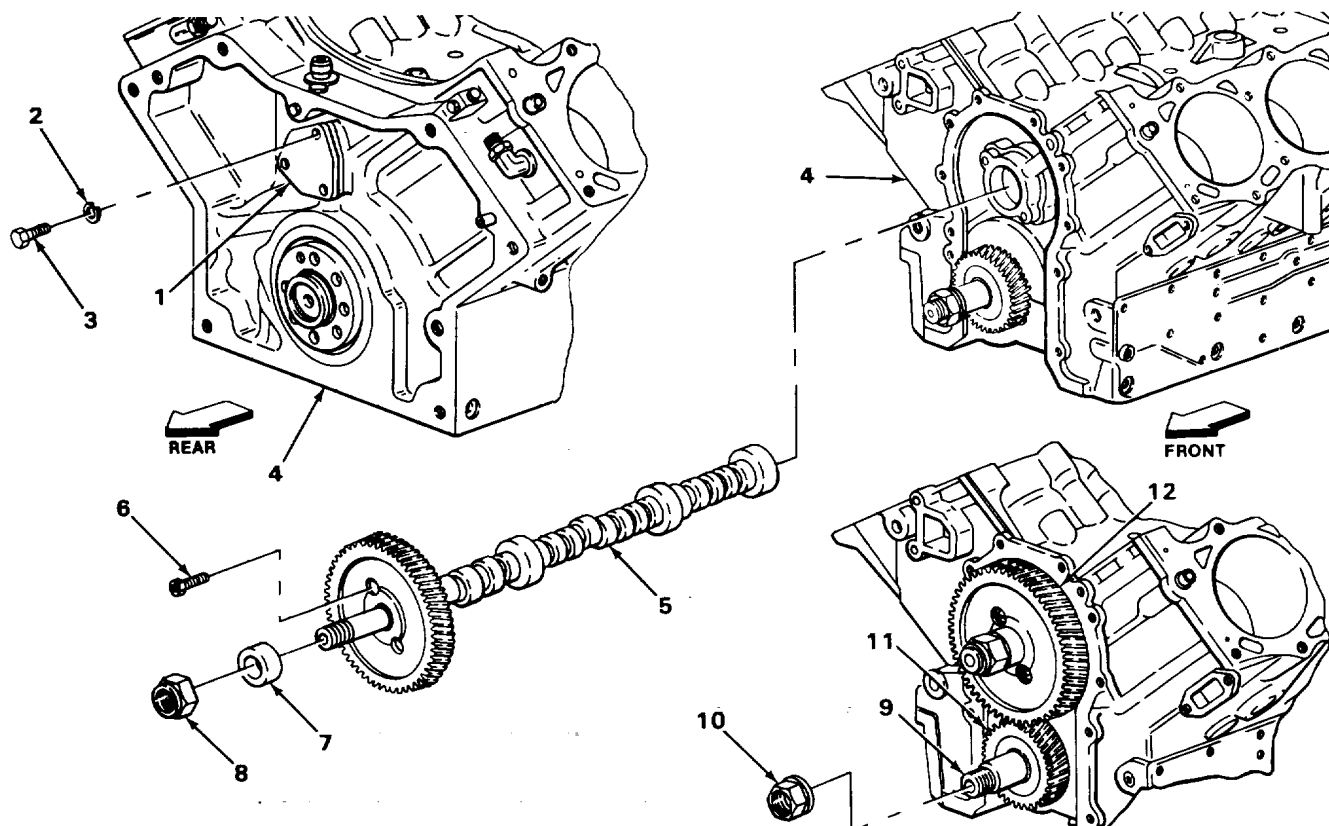
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CAMSHAFT - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
19.	Cover plate (1) Three new lock-washers (2) and screws (3)	Screw in, and tighten, using 9/16-inch socket and handle with 1/2-inch drive.
INSTALLATION		
20.	Cylinder block (4)	Camshaft (5) with attached parts
		a. Install remover/installer tool on the camshaft threads. b. Lubricate lobes, journals, and bearings with clean engine oil. c. Put in position in block (4).
21.	Camshaft (5)	Two screws (6)
		a. Screw in until snug using 9/16-inch socket and ratchet handle with 1/2-inch drive. b. Using 9/16-inch socket and torque wrench with 1/2-inch drive, tighten to 40 - 50 ft-lb (54 - 61 N m) of torque.
22.	Spacer (7) and nut (8)	
		a. Screw in until snug using 1 7/16-inch impact socket and ratchet handle with 3/4-inch drive. b. Using 1 7/16-inch socket and torque wrench with 3/4-inch drive, tighten to 200 - 225 ft-lb (271 - 305 N m) of torque.
23.	Crankshaft (9)	Nut (10)
		a. Using 2-inch open-end wrench, screw on and tighten. b. Using 2-inch open-end wrench, rotate crankshaft (9) to see that timing gears do not bind. If gears bind, go back to removal, take out camshaft, and check for correct assembly of parts. c. Using 2-inch open-end wrench, unscrew and take off.
24.	Cylinder block (4)	Camshaft (5)
		Using dial indicator, check end play. End play must be 0.0035 to 0.0115 inch (0.089 to 0.292 mm).

CAMSHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
25.	Crankshaft timing gear (11)	Camshaft timing gear (12)	a. Using dial indicator, check gear backlash. Backlash must be 0.0005 to 0.0045 inch (0.013 to 0.114 mm). b. If backlash is not correct, add or subtract shims as necessary.



NOTE

FOLLOW-ON MAINTENANCE: Install front crankcase cover (page 2-197).

TASK ENDS HERE

CAMSHAFT BEARINGS

This task covers:

- a. Inspection (page 2-190)
 - b. Removal (page 2-191)
 - c. Installation (page 2-192)
-

INITIAL SETUP

Tools

Camshaft bearing removing and installing tool
 Caliper, micrometer, I D
 Gage, telescopic
 Handle, ratchet, 11/2-inch drive
 Socket, 1/2-Inch drive, 9/16-inch

Materials/Parts

Bearing, camshaft (four required)
 Gasket, camshaft cover plate
 Lockwasher camshaft cover plate (three required)

Personnel Required

One

Equipment Condition

Flywheel housing removed (page 2-137).
 Crankshaft removed (page 2-114).
 Camshaft removed (page 2-184).

LOCATION

ITEM

ACTION REMARKS

INSPECTION

NOTE

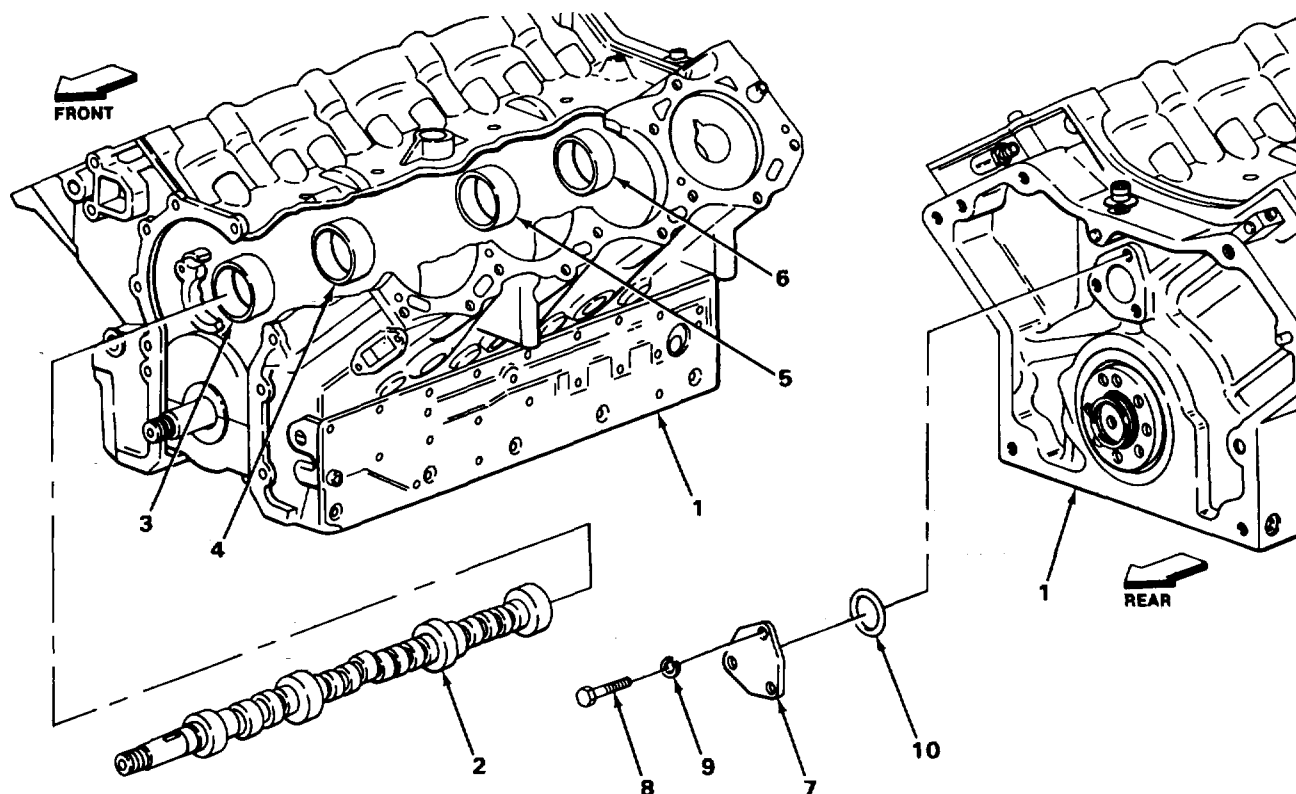
Too much clearance between the camshaft journals and bearings will cause low oil pressure and too much backlash between the camshaft and crankshaft timing gears.

Replace camshaft and/or camshaft bearings if measurements are not within given limits.

1. Cylinder block (1)	Camshaft (2) and four camshaft bearings (3), (4), (5), and (6)	a. Slide camshaft (2) into block through bearings (3),(4),(5), and (6). b. Using telescopic gage and micrometer, check bearings (3),(4),(5), and (6) for wear and proper running clearance. Bearing clearance must be 0.0015 - 0.0035 Inch (0.038 - 0.089 mm). c. Remove camshaft (2).

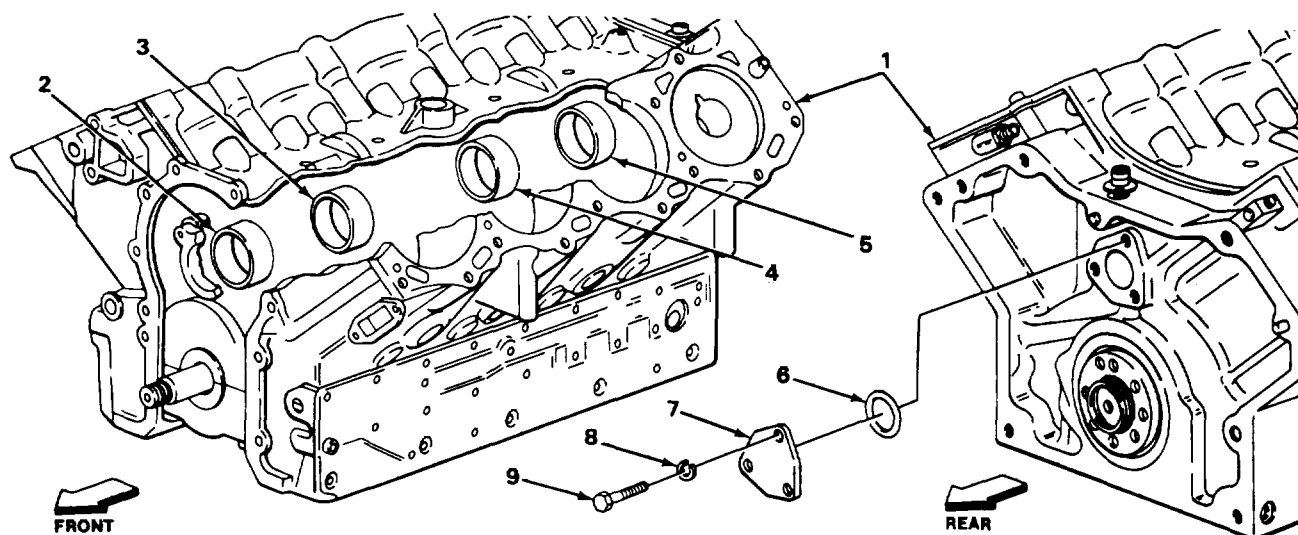
CAMSHAFT BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION - CONTINUED			
1. Continued		d.	Using micrometer, measure inside diameter of each bearing. Front bearing ID should be 2.346 - 2.347 inch (59.58 - 59.61 mm). Second bearing ID should be 2.315 - 2.316 inch (58.80 - 58.83 mm). Third bearing ID should be 2.289 - 2.290 inch (58.14 - 58.17 mm). Rear bearing ID should be 2.246 - 2.247 inch (57.05 - 57.07 mm).
REMOVAL			
2. Camshaft cover plate (7)	Three screws (8) and lockwashers (9)	a.	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
		b.	Get rid of lockwashers (9).
3. Cylinder block (1)	Camshaft cover plate (7) and gasket (10)	a.	Take off.
		b.	Get rid of gasket (10).



CAMSHAFT BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
4. Cylinder block (1)	Four camshaft bearings (2), (3), (4), and (5)	a. Using camshaft bearing removing and installing tool, remove one at a time. b. Get rid of.	
INSTALLATION			
NOTE			
Oil hole drilled through groove in bearing must line up with main bearing oil feed hole.			
Oil hole in groove of rear bearing must line up with oil feeder hole in cylinder block.			
5. Cylinder block (1)	Four camshaft bearings (2), (3), (4), and (5)	Using camshaft bearing removing and installing tool, put in.	
6.	New gasket (6) and camshaft cover plate (7)	Put in place.	
7. Camshaft cover plate (7)	Three new lock-washers (8) and screws (9)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.	



CAMSHAFT BEARINGS - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Install camshaft (page 2-184).
2. Install crankshaft (page 2-114).
3. Install flywheel housing (page 2-137).

TASK ENDS HERE**CRANKSHAFT AND CAMSHAFT TIMING GEARS**

This task covers-

a. Inspection (page 2-194)	d. Inspection/Replacement (page 2-195)
b. Removal (page 2-194)	e. Installation (page 2-196)
c. Cleaning (page 2-194)	

INITIAL SETUP**Tools**

Adapter, camshaft gear installer
 Compressor, reciprocating air,
 power driven
 Handle, ratchet, 3/4-inch drive
 Hose, air compressor
 Indicator, dial
 Installer, camshaft timing gear
 Installer, crankshaft timing gear
 Puller, mechanical gear
 Scribe, machinist's
 Socket, impact, 3/4-inch drive,
 1 7/16-inch
 Wrench, impact, 3/4-inch drive
 Wrench, open-end, 2-inch
 Wrench, torque, 3/4-inch drive

Personnel Required

One

Equipment Condition

Front crankcase cover removed
(page 2-197).

Materials/Parts

Oil, engine (item 32, appendix B)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

CRANKSHAFT AND CAMSHAFT TIMING GEARS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION			
1. Cylinder block (1)	Crankshaft timing gear (2) and camshaft timing gear (3)	Using dial indicator, check gear backlash.	If backlash is more than 0.0005 to 0.0045 inch (0.013 to 0.114 mm) replace timing gear and Injection pump drive gear (page 2-325).
2.	Camshaft timing gear (3)	Using dial indicator, check and record end play.	If end play is more than 0.0035 to 0.0115 inch (0.089 to 0.292 mm) remove camshaft (page 2-184) and replace the camshaft thrust plate.
3. Cylinder block (1)	Crankshaft timing gear (2)	Using dial indicator, check and record end play.	If end play is more than 0.004 to 0.010 inch (0.102 to 0.254 mm), crankshaft thrust bearings or thrust faces are worn and must be replaced (page 2-114).
REMOVAL			
4. Camshaft timing gear (3)	Nut (4)	a. Using scribe, matchmark gears (2) and (3). b. Using 1 7/16-inch socket impact wrench and air compressor, unscrew and take off.	
5. Camshaft (5)	Spacer (6) and camshaft timing gear (3)	a. Using gear puller, pull off. b. If shims are present, tag for installation.	
6. Crankshaft (7)	Crankshaft timing gear (2)	Using gear puller, pull off.	

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

CRANKSHAFT AND CAMSHAFT TIMING GEARS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

7.	Crankshaft timing gear (2) and camshaft timing gear (3)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

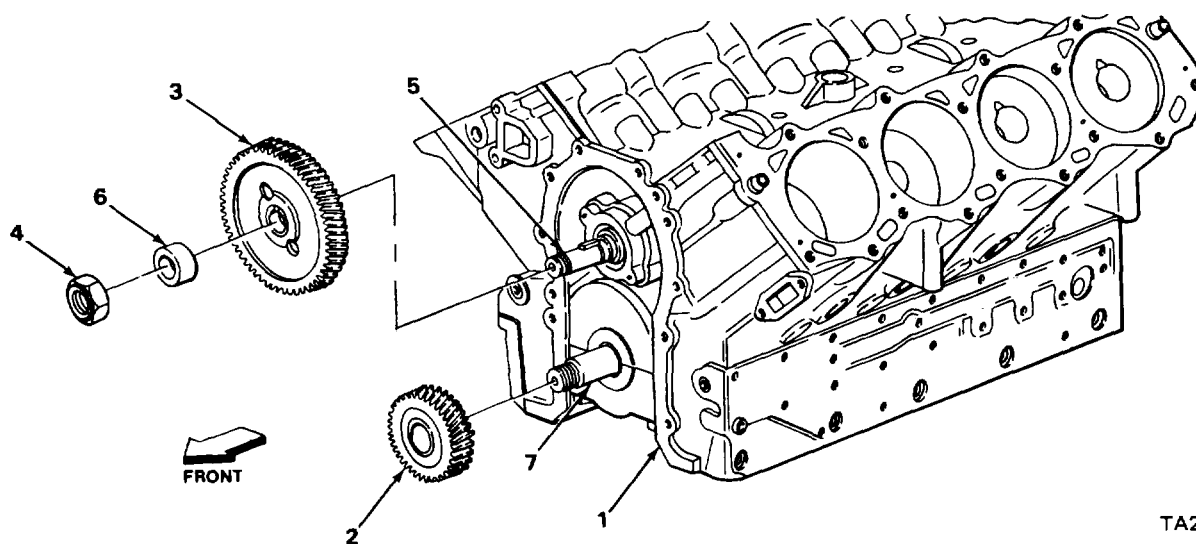
NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

Camshaft, crankshaft, and injection pump drive gears are provided as matched set. If one gear is damaged, replace all gears. If gears are replaced, also replace the camshaft (page 2-184).

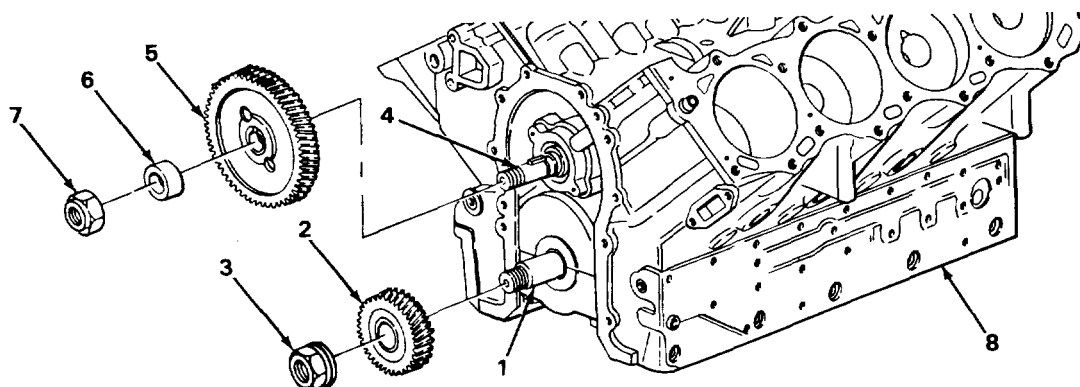
8.	Crankshaft timing gear (2) and camshaft timing gear (3)	a. Look for chipped, nicked, and broken teeth. b. Look for scratched and scored shaft bores. c. Look for bent, chipped, and worn keyways.



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CRANKSHAFT AND CAMSHAFT TIMING GEARS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
9. Crankshaft (1)	Crankshaft timing gear (2)	a. Lubricate inside diameter with clean engine oil. b. Line up keyway and, using camshaft gear installer, put on.	
10.	Nut (3)	a. Screw on, and tighten using 2-inch open-end wrench. b. Using wrench to turn nut (3) and crankshaft (1), line up timing mark on gear so that camshaft gear (5) timing mark will line up.	
11. Camshaft (4)	Camshaft timing gear (5) and spacer (6)	a. Lubricate inside diameter with clean engine oil. b. If shims were present in removal, put in. c. Line up keyway and timing marks and using installer and adapter, put on. c. Rotate crankshaft (1) to make sure gears mesh evenly and do not bind.	
12. Crankshaft (1)	Nut (3)	Using 2-inch open-end wrench, unscrew and take off.	
13. Camshaft (4)	Nut (7)	a. Screw on until snug using 1 7/16-inch impact socket and ratchet handle with 3/4-inch drive. b. Tighten to 200-225 ft-lb (271-305 N m) using 1 7/16-inch impact socket and torque wrench with 3/4-inch drive.	
14. Cylinder block (8)	Crankshaft timing gear (2) and camshaft timing gear (5)	Repeat step 1 to check gear backlash.	



CRANKSHAFT AND CAMSHAFT TIMING GEARS - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install front crankcase cover (page 2-197).

TASK ENDS HERE**FRONT CRANKCASE COVER**

This task covers:

a. Removal (page 2-198)	d. Inspection/Replacement (page 2-200)
b. Disassembly (page 2-198)	e. Assembly (page 2-200)
c. Cleaning (page 2-200)	f. Installation (page 2-200)
-

INITIAL SETUP**Tools**

Extension, 1/2-inch drive, 3-inch
 Face, inserted hammer
 Handle, ratchet, 1/2-inch drive
 Holder, inserted hammer-face
 Puller, seal
 Screwdriver, flat-tip, 1/8-inch
 Socket, 1/2-inch drive, 9/16-inch
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 11/16-inch
 Wrench, open-end, 1 1/8-inch
 Wrench, pipe, 14-inch
 Wrench, torque, 1/2-inch drive

Materials/Parts

Gasket, cylinder block
 Gasket, plate
 Lockwashers crankcase cover
 (11 required)
 Lockwashers, air compressor base
 (three required)

Materials/Parts - Continued

Lockwashers, plate (two required)
 Packing, preformed, air compressor base
 Rags, wiping (item 42, appendix B)
 Seal, oil
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

Two

Equipment Condition

Engine oil pan removed (page 2-203).
 Crankshaft pulley removed (page 2-131).
 Idler pulley arm removed
 (TM 9-2320-269-20-1).
 Water pump to crankcase manifold removed
 (page 2-410).
 Air compressor removed
 (TM 9-2320-269-20-1).
 Fuel injection pump drive removed
 (page 2-325).

FRONT CRANKCASE COVER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
NOTE			
Note screw lengths for installation.			
1.	Front crankcase cover (1)	Two screws (2) and lockwashers (3)	a. Using 9/16-inch socket, 3-inch extension, and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (3).
2.		Two screws (4) and lockwashers (5)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (5).
3.		Two screws (6) lockwashers (7) and bracket (8)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (7).
4.		Screw (9) and lockwasher(10)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwasher (10).
5.		Two screws (11) and lockwashers (12)	a. While assistant holds cover (1), using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off. b. Get rid of lockwasher(12).
6.	Cylinder block (13)	Front crankcase cover (1) and gasket (14)	a. With help from assistant, take off. It may be necessary to tap cover loose with plastic-face hammer. b. Get rid of gasket (14).
DISASSEMBLY			
7.	Front crankcase cover (1)	Three screws (15), lockwashers (16), air compressor base (17) and packing (18)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Using 1/8-inch flat-tip screwdriver, take out packing (18). c. Get rid of lockwashers (16) and packing (18).

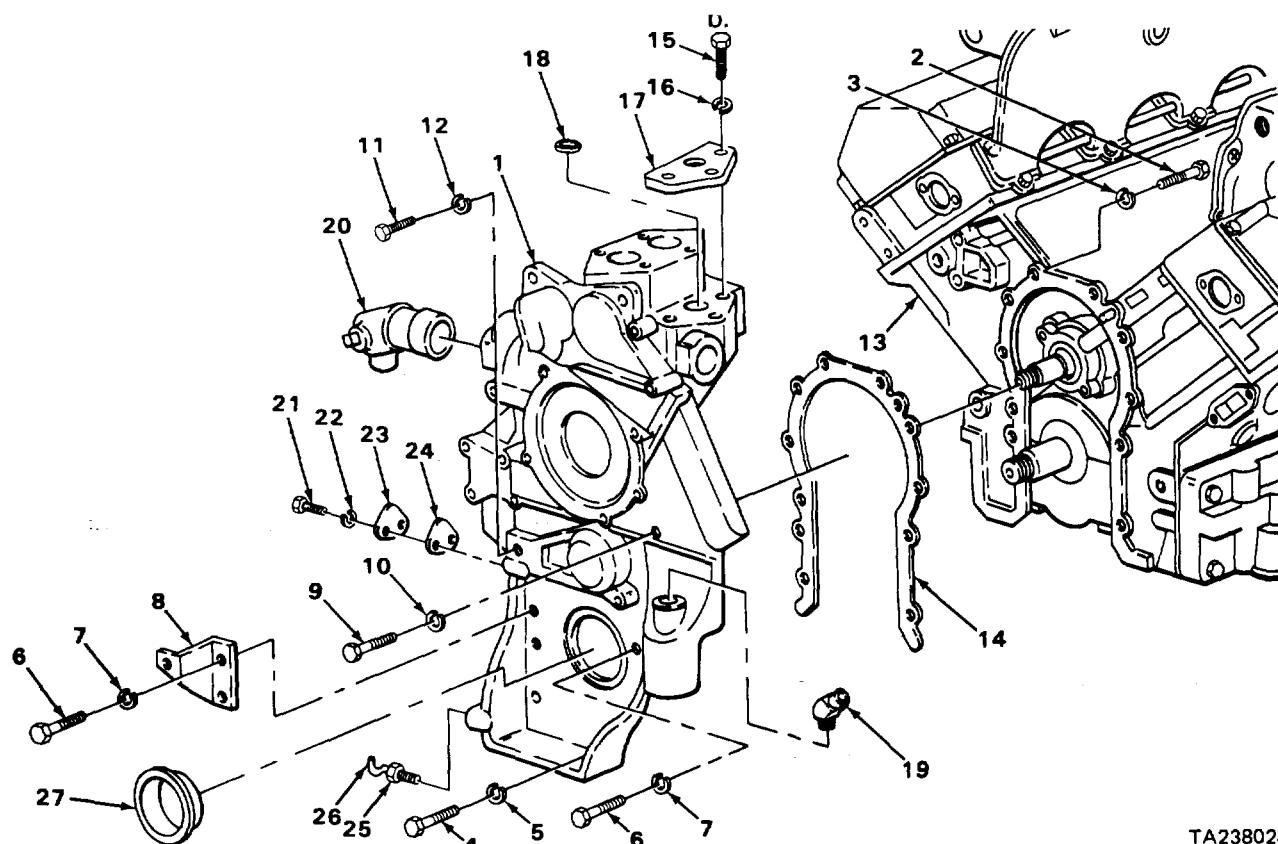
FRONT CRANKCASE COVER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
8.	Front crankcase cover (1)	Elbow (19)	With assistant using 1 1/8-inch open-end wrench, unscrew and take out.
9.		Pipe (20)	Using 14-inch pipe wrench, unscrew and take out.
10.	Two screws (21), lockwashers (22), plate (23) and gasket (24)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (22) and gasket (24).	
11.	Nut (25) and hook (26)	Using 11/16-inch open-end wrench, unscrew and take out.	

CAUTION

Do not remove oil seal unless it needs replacement. Removing seal will ruin it.

12.	Oil seal (27)	a. Using seal puller, pull off.



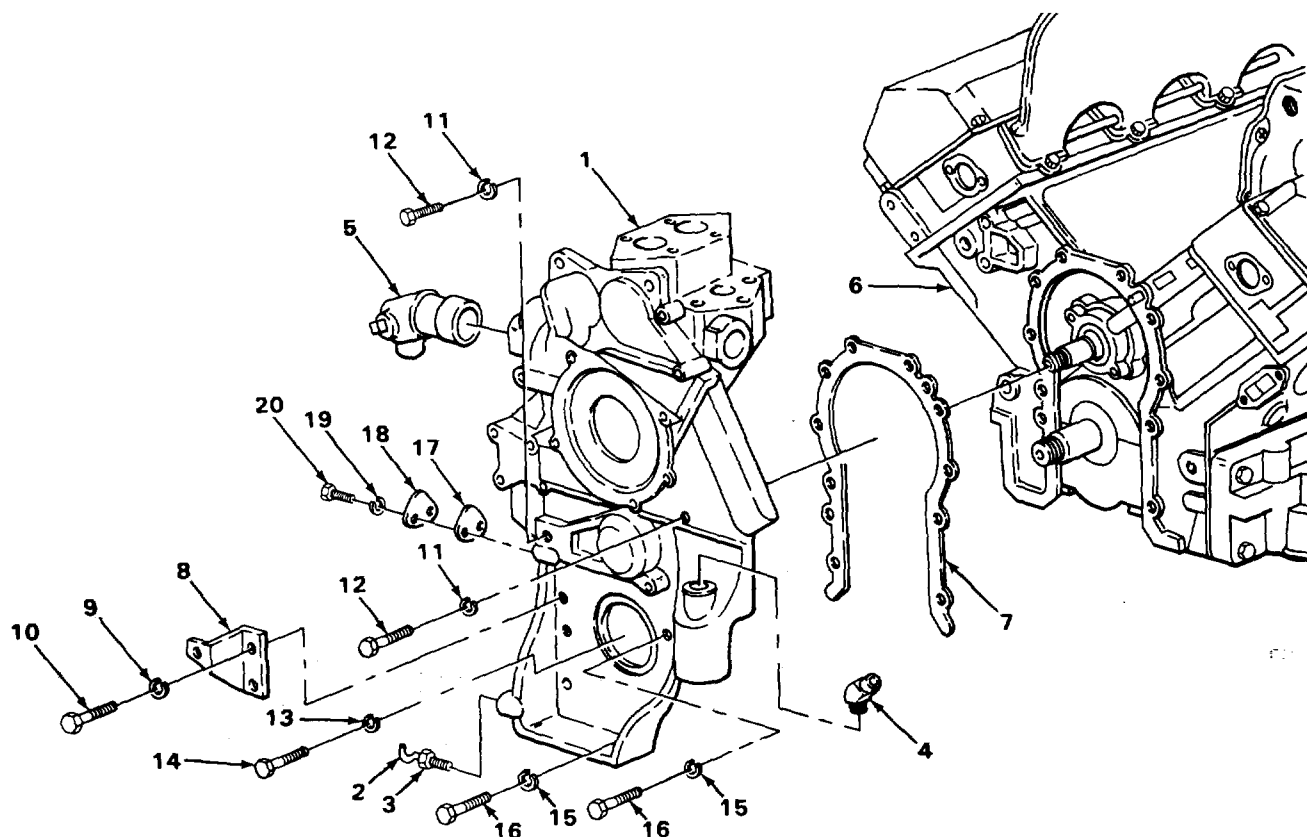
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FRONT CRANKCASE COVER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE			
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).			
WARNING			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
13.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.	
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged parts as needed.			
14.	Front crankcase cover (1)	a. Look for scratches and nicks on seal bore. b. Look for dents and distortion. c. Look for damaged threads.	
ASSEMBLY			
15.	Front crankcase cover (1)	Hook (2) and nut (3)	Screw in, and tighten using 11/16-inch open-end wrench.
16.	Elbow (4)		Screw in, and tighten using 1 1/8-inch open-end wrench.
17.	Pipe (5)		Screw in, and tighten using 14-inch pipe wrench.
INSTALLATION			
18.	Cylinder block (6)	New gasket (7) and front crankcase cover (1)	With help from an assistant, put in position on dowel pins.

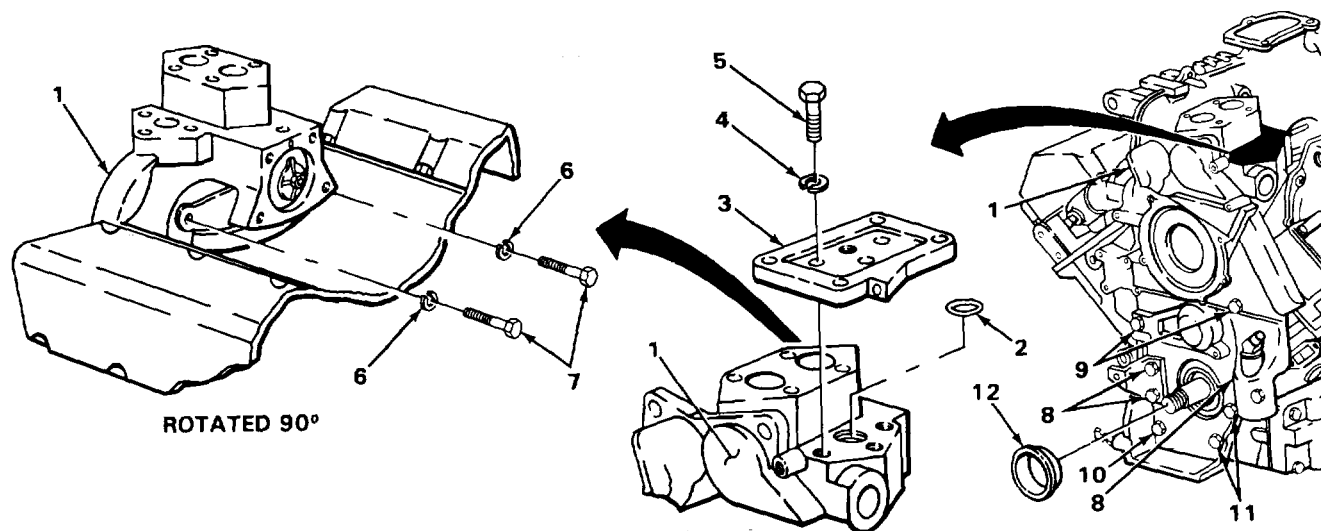
FRONT CRANKCASE COVER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
19. Front crankcase cover (1)	Bracket (8) and two new lockwashers (9) and screws (10)	Screw in until snug.	
20.	Two new lockwashers (11) and screws (12)	Screw in until snug.	
21.	New lockwasher (13) and screw (14)	Screw in until snug.	
22.	Two new lockwashers (15) and screws (16)	Screw in until snug.	
23.	New gasket (17), plate (18), two new lockwashers (19) and screws (20)	a. Put in place. b. Screw in, and tighten using 9/16-inch socket and ratchet handle with 112-inch drive.	



FRONT CRANKCASE COVER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
24. Front crankcase cover (1)	New packing (2), air compressor base (3) three new lockwashers (4) and screws (5)	a. Put in place. b. Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.	
25.	Two new lockwashers (6) and screws (7)	Screw in until snug.	
26.	Nine screws (8), (9), (10), (11), and (7)	Using 9/16-inch socket and torque wrench with 1/2-inch drive, tighten to 25 - 35 ft-lb (34 - 47 N m) of torque.	
27.	New oil seal (12) engine oil.	a. Lubricate cover (1) bore with clean b. Using front cover oil seal installer and plastic-face hammer, drive on. The seal is seated when Inner shoulder on tool contacts the machined surface on cover.	



FRONT CRANKCASE COVER - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Install fuel injection pump drive (page 2-325).
2. Install air compressor (TM 9-2320-269-20-1).
3. Install water pump to crankcase manifold (page 2-410).
4. Install idler pulley arm (TM 9-2320-269-20-1).
5. Install crankshaft pulley (page 2-131).
6. Install engine oil pan (page 2-203).

TASK ENDS HERE**ENGINE OIL PAN**

This task covers:

a. Removal (page 2-204)	c. Inspection/Replacement (page 2-204)
b. Cleaning (page 2-204)	d. Installation (page 2-204)
-

INITIAL SETUP**Tools**

Extension, 3/8-inch drive,
10-inch
Handle, ratchet, 3/8-inch drive
Socket, 3/8-inch drive, 1/2-inch

Materials/Parts

Gasket
Lockwashers (23 required)

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)

Personnel Required

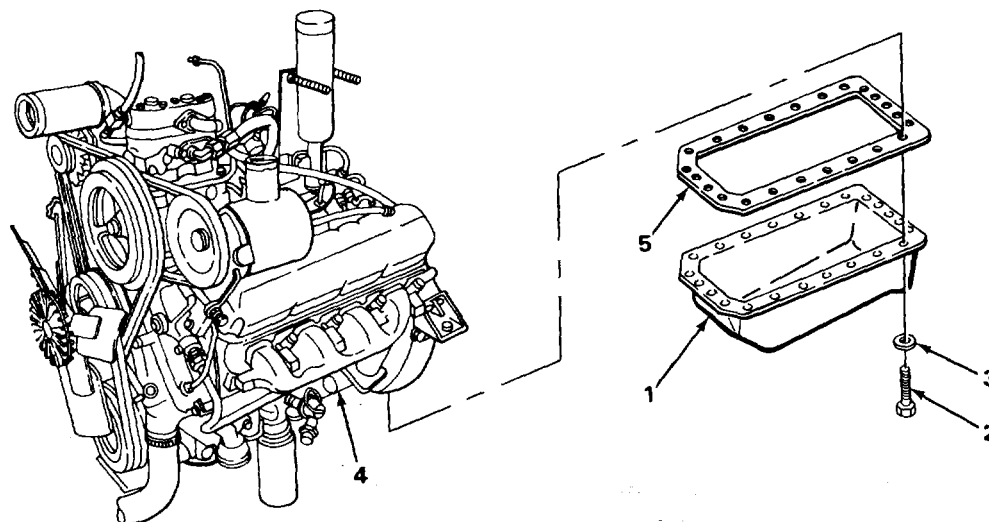
One

Equipment Condition

Engine assembly removed (page 2-52).

ENGINE OIL PAN - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Oil pan (1)	23 screws (2) and lockwashers (3)	a. Using 1/2-inch socket, 10-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (3).
2.	Cylinder block (4)	Oil pan (1) and gasket (5)	a. Take off. b. Get rid of gasket (5).
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). WARNING Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
3.	All metal parts		a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace defective parts as needed.			
4.	Oil pan (1)		a. Look for large dents. b. Look for cracks and breaks. c. Look for bent and cracked mounting flanges that would affect sealing.
INSTALLATION			
5.	Cylinder block (4)	New gasket (5) and oil pan (1)	Place in position.
6.	Oil pan (1)	23 screws (2) and new lockwashers (3)	Screw in, and tighten using 1/2-inch socket, 10-inch extension, and handle with 3/8-inch drive.

ENGINE OIL PAN - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install engine assembly (page 2-52).

TASK ENDS HERE**ENGINE OIL LEVEL GAGE AND TUBE**

This task covers:

a. Removal (page 206)	c. Inspection/Replacement (page 206)
b. Cleaning (page 2-206)	d. Installation (page 2-207)

INITIAL SETUP**Tools**

Handle, ratchet, 112-inch drive
Socket, 1/2-inch drive, 9/16-inch

Materials/Parts

Lockwasher, tube bracket to
cylinder head bracket
Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)

Personnel Required

One

Equipment Condition

Open right side hood (TM 9-2320-260-20-2).

ENGINE OIL LEVEL GAGE AND TUBE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Oil level gage (1)	Tee handle (2)	Turn counterclockwise to loosen.
2.	Oil level gage tube (3)	Oil level gage (1)	Pull out.
3.	Tube bracket (4) to right water outlet (5)	Screw (6) and lockwasher (7)	a. Using 9/16-inch socket and handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwasher (7).
4.	Cylinder block (8)	Oil level gage tube (3)	Pull out.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

5.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean dry rags.

INSPECTION/REPLACEMENT

NOTE

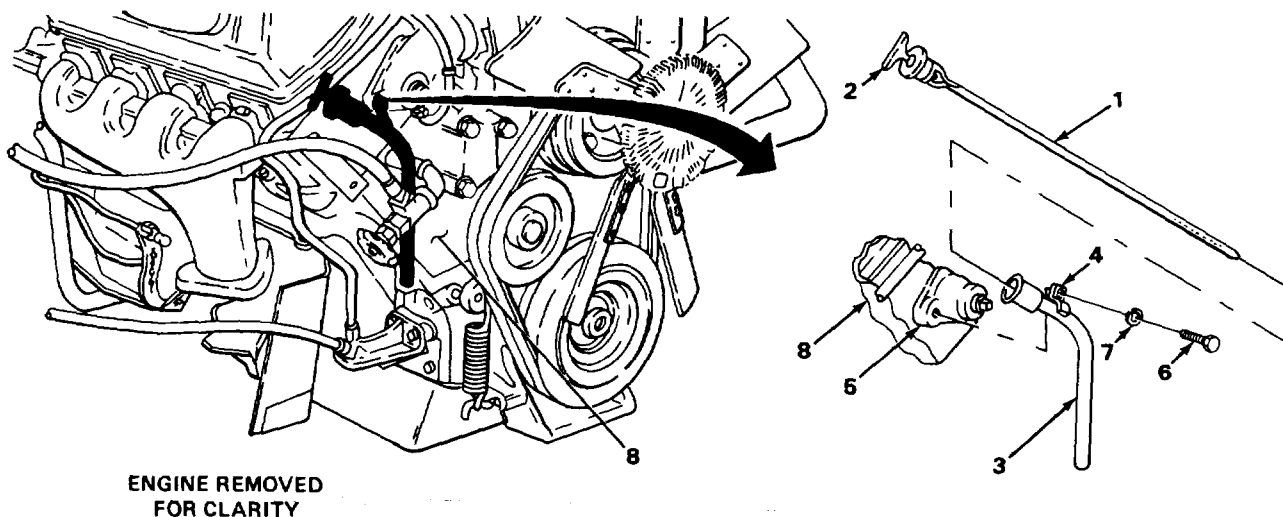
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace defective parts as needed.

6.	Oil level gage (1) and oil level gage tube (3)	Look for cracks and breaks.

ENGINE OIL LEVEL GAGE AND TUBE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
7. Cylinder block (8) tube (3)	Oil level gage	Push in.	
8. Cylinder head bracket (5)	Tube bracket (4)	Put in place.	
9. Tube bracket (4) to right water outlet (5)	New lockwasher (7) and screw (6)	Screw in, and tighten using 9116-inch socket handle with 112-inch drive.	
10. Oil level gage tube (3)	Oil level gage (1)	Slide in.	
11. Oil level gage (1)	Tee handle (2)	Turn clockwise to tighten.	



NOTE

FOLLOW-ON MAINTENANCE: Close right side hood (TM 9-2320-269-20-2).

TASK ENDS HERE

TA238032

ENGINE OIL PUMP

This task covers:

a. Removal (page 2-208)	d. Inspection/Replacement (page 2-212)
b. Disassembly (page 2-209)	e. Assembly (page 2-213)
c. Cleaning (page 2-212)	f. Installation (page 2-216)

INITIAL SETUP

Tools

Caliper, micrometer, OD,
0-2-inch range
Gage, ribbon thickness
Hammer, ball-peen, machinist's
Handle, ratchet, 3/8-inch drive
Indicator, dial
Pliers, snapping
Press, arbor, hand operated
Punch, drive-pin, 118-inch
Rule, machinist's, 18-inch
(two required)
Socket, 3/8-inch drive, 1/2-inch
Socket, 3/8-inch drive, 9/16-inch
Wrench, open-end, 1/2-inch
Wrench, open-end, 9/16-inch .
Wrench, open-end, 1 1/8-inch
Wrench, open-end, 2-inch
Wrench, pipe, 14-inch

Materials/Parts

Gasket, pump body
Gasket, cover (two required)
Lockwashers, cover (four required)
Lockwashers, pump (two required)
Lockwashers, bracket (two required)
Oil, engine, (item 32, appendix B)
Rags, wiping (item 42, appendix B)
Solvent, drycleaning, (item 49, appendix B)

Personnel Required

One

Equipment Condition

Engine oil pan removed (page 2-203).

LOCATION	ITEM	ACTION	REMARKS

REMOVAL

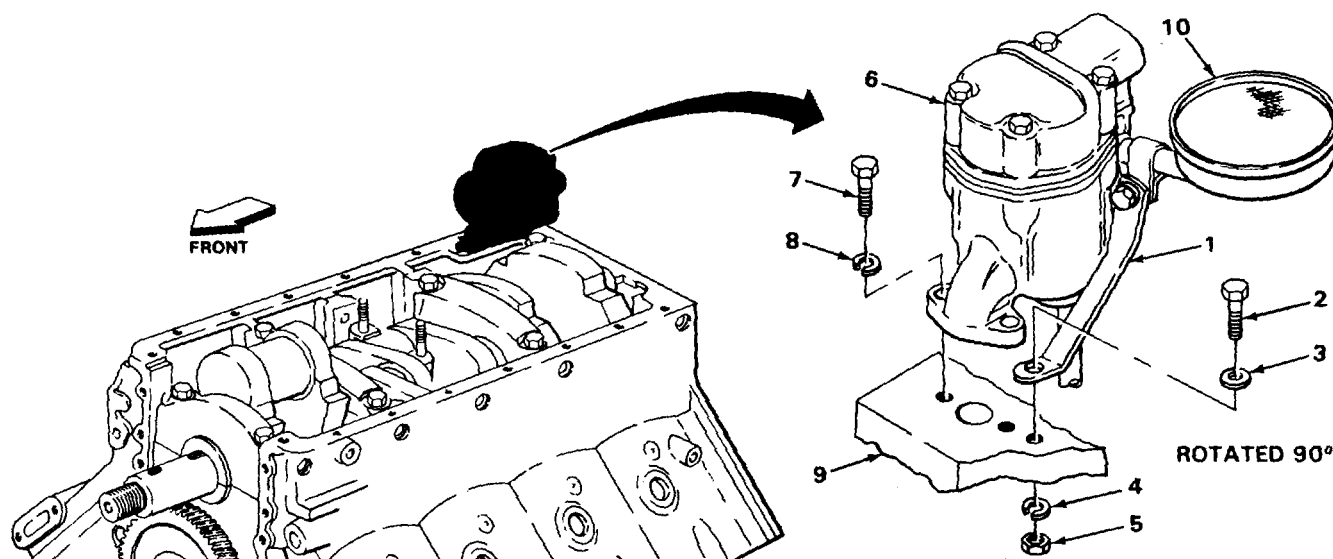
1. Bracket (1)	Screw (2), washer (3), lockwasher (4), and nut (5)	a. With engine bottom facing up, and using 9/16-inch socket and handle with 3/8-inch drive, and 9/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwasher (4). It may be necessary to turn crankshaft using 2-inch open-end wrench to get crankshaft weights out of way.
2. Pump (6)	Two screws (7) and lockwashers (8)	a. Using 9/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (8).

ENGINE OIL PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

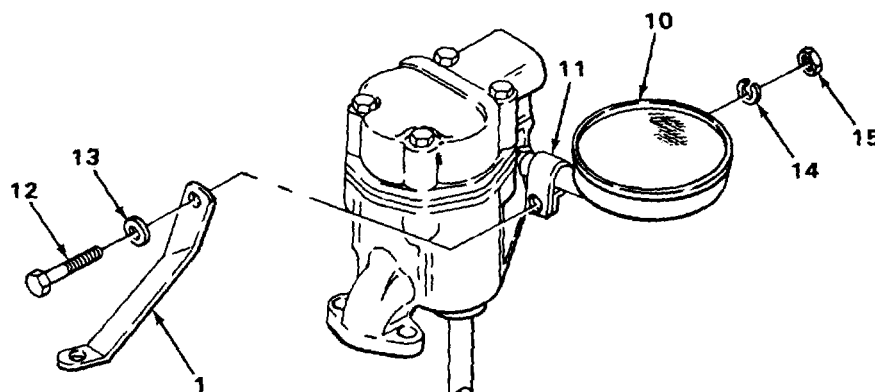
REMOVAL - CONTINUED

3.	Cylinder block (9)	Pump (6) with float assembly (10)	Take off.



DISASSEMBLY

4.	Bracket (1) and clamp (11)	Screw (12), washer (13), lockwasher (14), and nut (15)	a. Using 11/2-inch socket, ratchet handle 3/8-inch drive, and 1/2-inch open-end wrench, unscrew and take off. b. Get rid of lockwasher (14).
5.	Float assembly (10)	Bracket (1)	Take off.

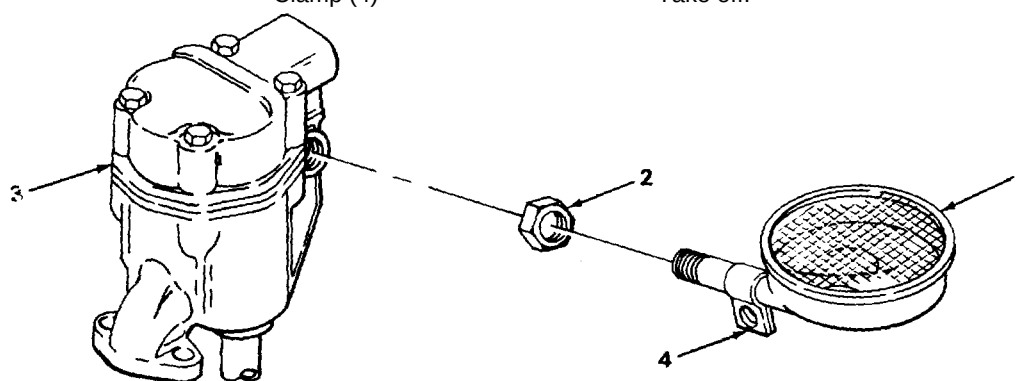


ENGINE OIL PUMP - CONTINUED

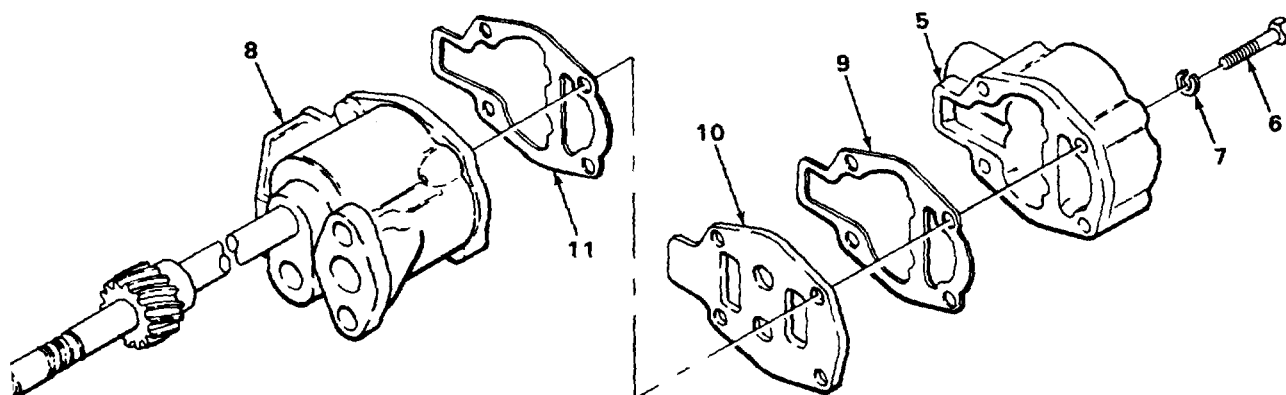
LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

6.	Float assembly (1)	Connector (2)	Using 1 1/8-inch open-end wrench, unscrew to loosen.
7.	Pump body (3)	Float assembly (1)	Using pipe wrench, unscrew and take off.
8.	Float assembly (1)	Connector (2)	Unscrew, and take off.
9.		Clamp (4)	Take off.

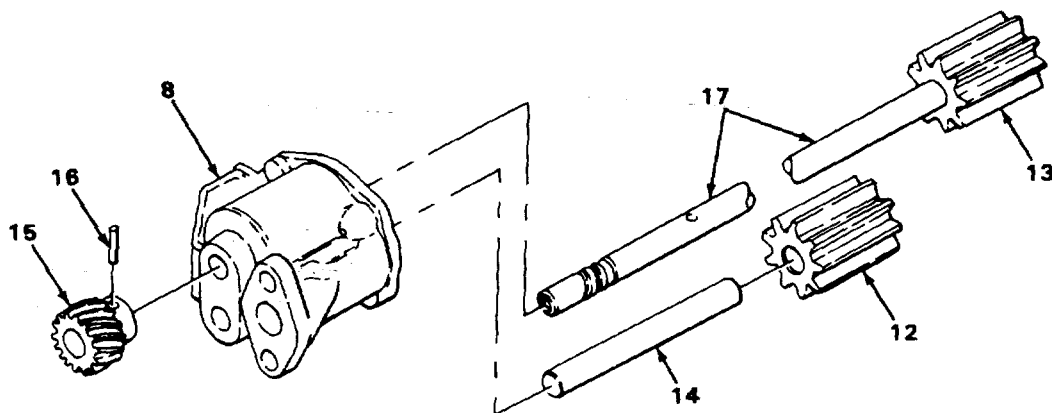


10.	Cover (5)	Four screws (6) and lockwashers (7)	a. Using 11/2-inch socket and handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (7).
11.	Body (8)	Cover(5) and gasket (9)	a. Take off. b. Get rid of gasket (9).
		Spacer plate (10) and gasket (11)	a. Take off. b. Get rid of gasket (11).



ENGINE OIL PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
12. Body (8)	Idler gear (12) and gear (13)	a. Push gears (12) and (13) away from outlet side of body (8). b. While holding gears (12) and (13), use ribbon thickness gage to measure clearance between the outside diameter of gear and body. Clearance must be 0.0014 to 0.0054 inch (0.036 to 0.137 mm). If measurement is not within limits, replace gears. c. Using dial indicator, check backlash between gears (12) and (13). Backlash must be 0.0005 to 0.0065 inch (0.013 to 0.165 mm). If measurement is not within limits, replace gears.	
13. idler shaft (14)	Idler gear (12)	Take out.	
14. Body (8)	Idler shaft (14)	Using arbor press, press off.	
15. Gear (15)	Roll pin (16)	Using ball-peen hammer and 1/8-inch drive-pin punch, drive out.	
16. Shaft (17)	Drive gear (15)	Using arbor press, press out.	
17. Body (8)	Shaft (17) with gear (13)	Pull out.	



ENGINE OIL PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

NOTE

Spring retainers and snaprings are under tension.

18. Cover (1)	Two snaprings (2)	Using snapring pliers, take out.
19.	Two spring retainers (3), springs (4), and relief valves (5)	Take out.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury and death.

20. All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as necessary.

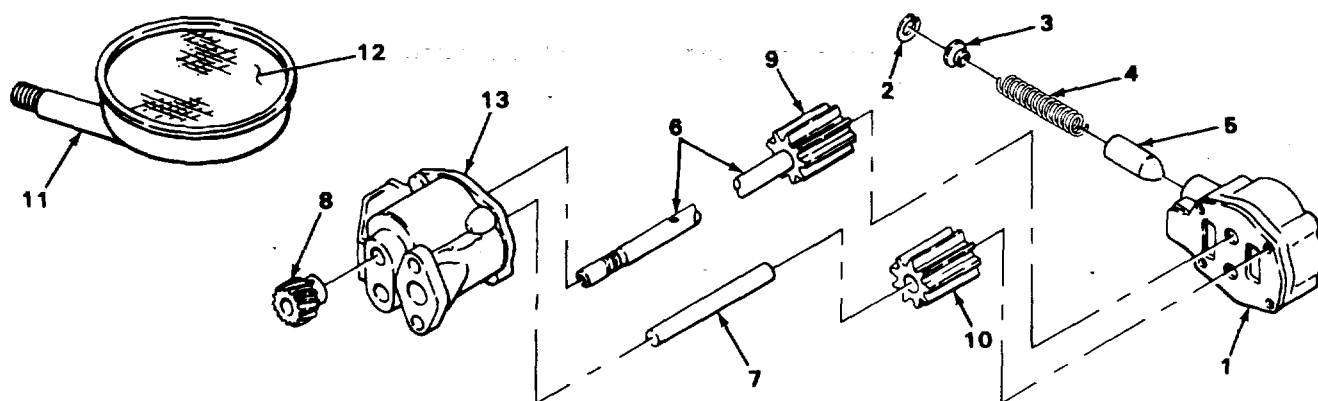
21.	Shaft (6) and idler shaft (7)	a. Look for cracks, breaks, nicks, and bends. b. Using micrometer, measure shaft (6) diameter. Diameter must be 0.4905 - 0.4912-Inch (12.459 - 12.476 mm). c. Using ribbon thickness gage, check shaft (6) clearance in body bore. Clearance must be 0.0013 to 0.003-inch (0.033 to 0.076 mm).

ENGINE OIL PUMP - CONTINUED

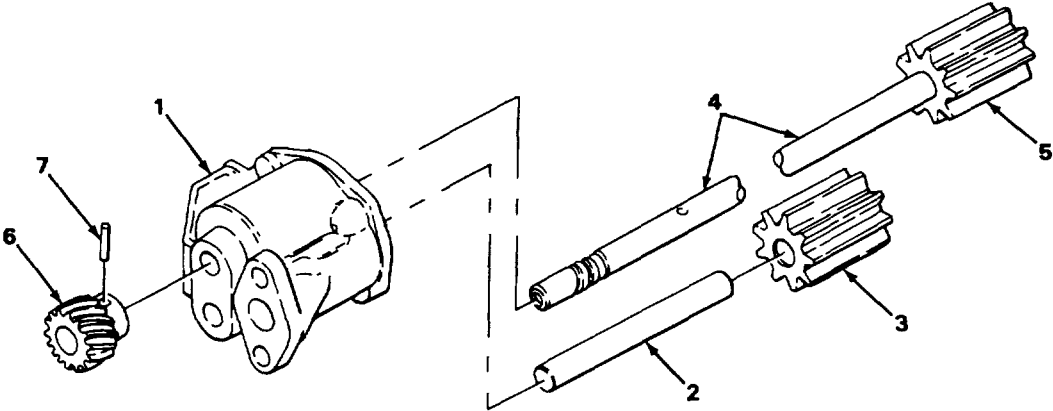
LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
22.	Drive gear (8), gear (9), and idler gear (10)		Look for chipped, nicked, and broken teeth. If any gear is damaged, replace all gears.
23.	Float assembly (11) with screen (12)	a. Look for cracks, breaks, and bends. b. Look for rips, tears, and large holes.	
24.	Cover (1) and body (13)	a. Look for cracks, breaks, and dents. b. Look for score marks and signs of wear.	
25.	Two relief valves (5)	a. Look for scoring, nicks, and cracks. b. Using machinist's rule, measure length and diameter. Length must be 1.53 to 1.59-inch (38.86 to 40.39 mm). Diameter must be 0.744 to 0.745-inch (18.90 to 18.92 mm).	

ASSEMBLY

26. Cover(1)	Two relief valves (5), springs (4), and spring retainers (3)	a. Lubricate all pump parts with clean engine oil. b. Put in.
27.	Two snaprings (2)	a. Push down on retainer (3). b. Using snapring pliers, put on.



ENGINE OIL PUMP - CONTINUED

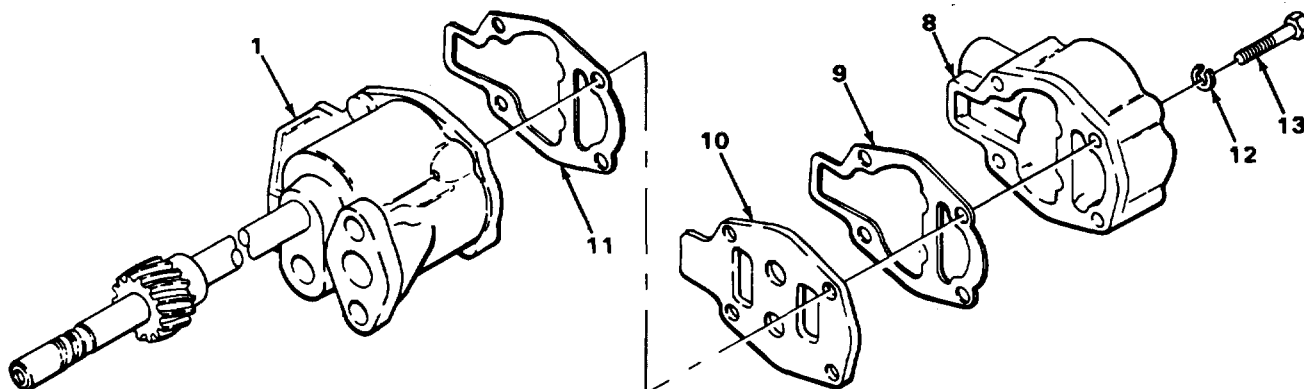
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
28. Body (1)	Idler shaft (2) with idler gear (3)		Using arbor press, press in far enough so that it will be flush with spacer and gasket when they are installed.
29.	Shaft (4) with gear (5)	Put in.	
30. Shaft (4)	Drive gear (6)	a. Line up holes. b. Using arbor press, press on until holes line up.	
31. Drive gear (6)	Roll pin (7)	Using 1 1/8-inch drive-pin punch and ball-peen hammer, tap in.	
			
32. Cover (8)	New gasket (9) and spacer plate (10)	Put in position.	
33. Spacer plate (10)	New gasket (11) and body (1)	Put in position.	
34.	Four new lockwashers (12) and screws (13)	Screw in, and tighten using 1/2-inch socket and ratchet handle with 3/8-inch drive.	

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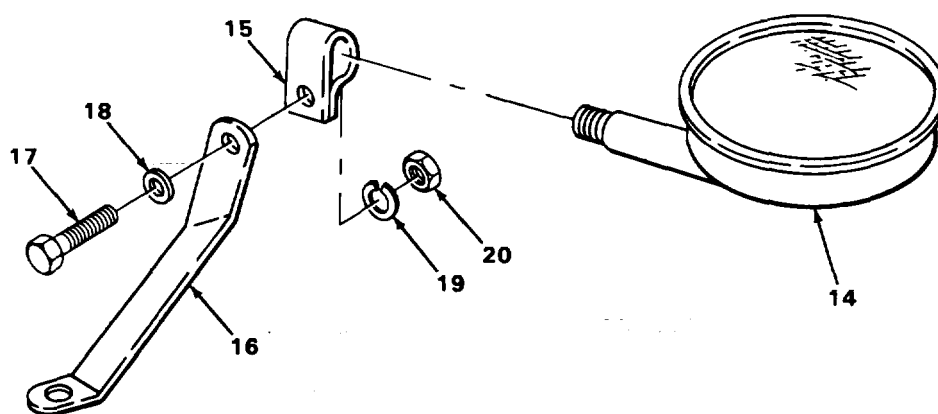
ENGINE OIL PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

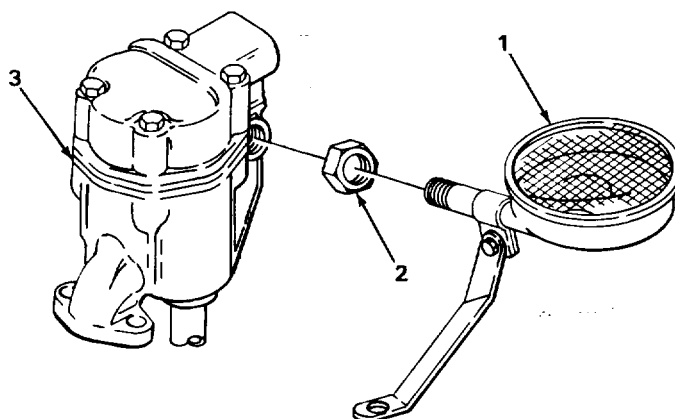


35. Float assembly (14)	Clamp (15)	Put on.
36. Clamp (15)	Bracket (16)	Put on.
37.	Screw (17), washer (18), new lockwasher (19), and nut (20)	Screw on, but do not tighten at this time.



ENGINE OIL PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
38. Float assembly (1)	Connector (2)	Screw on.	
39. Pump body (3)	Float assembly (1)	Screw on.	
40. Float assembly (1)	Connector (2)	Screw on, and tighten using 1 1/8-inch open-end wrench.	

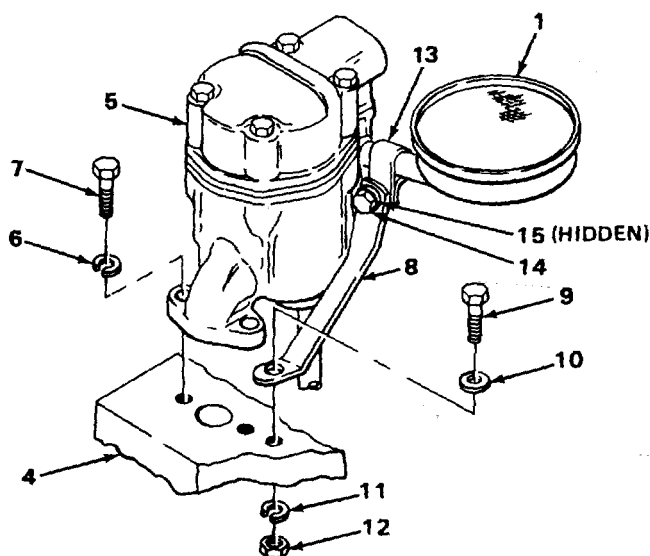


INSTALLATION

41. Cylinder block (4)	Pump (5)	- Place in position. - Lay machinist's rule across oil pan rails. - Using another machinist's rule, measure distance from bottom of first rule to top of screen, on both sides. Pump float assembly (1) must be parallel and 6 1/2 inches (165.1 mm) above oil pan rails. - Take off rule.
42. Pump (5)	Two new lockwashers (6) and screws (7)	Screw in, and tighten using 9/16-inch open-end wrench.
43. Cylinder block (4)	Bracket (8)	Put in position.

ENGINE OIL PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
44. Bracket (8)	Screw (9), washer (10), new lockwasher (11), and nut (12)	Screw in, and tighten using 9/16-inch socket, ratchet handle with 3/8-inch drive, and 9/16-inch open-end wrench.	
45. Bracket (8) and clamp (13)	Screw (14) and nut (15)	Using 1/2-inch socket, ratchet handle with 3/8-inch drive, and 11/2-inch open-end wrench, tighten.	



NOTE

FOLLOW-ON-MAINTENANCE: Install oil pan (page 2-203).

TASK ENDS HERE

TA238040

ENGINE OIL COOLER

This task covers:

a. Removal (page 2-218)	d. Inspection/Replacement (page 2-220)
b. Disassembly (page 2-219)	e. Assembly (page 2-220)
c. Cleaning (page 2-220)	f. Installation (page 2-221)

INITIAL SETUP**Tools**

Extension, socket-wrench, 3-inch
 Handle, ratchet, 318-inch drive
 Socket, 3/8-inch drive, 9/16-inch
 Vise, machinist's
 Wrench, open-end, 1-inch
 Wrench, open-end, 1 11/16-inch
 Wrench, open-end, 1 11/8-inch
 Wrench, pipe

Materials/Parts

Lockwashers (four required)
 Rags, wiping (item 42, appendix B)

Materials/Parts - Continued

Seals, oil (two required)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Left side engine compartment hood raised
 (TM 9-2320-269-20-1).

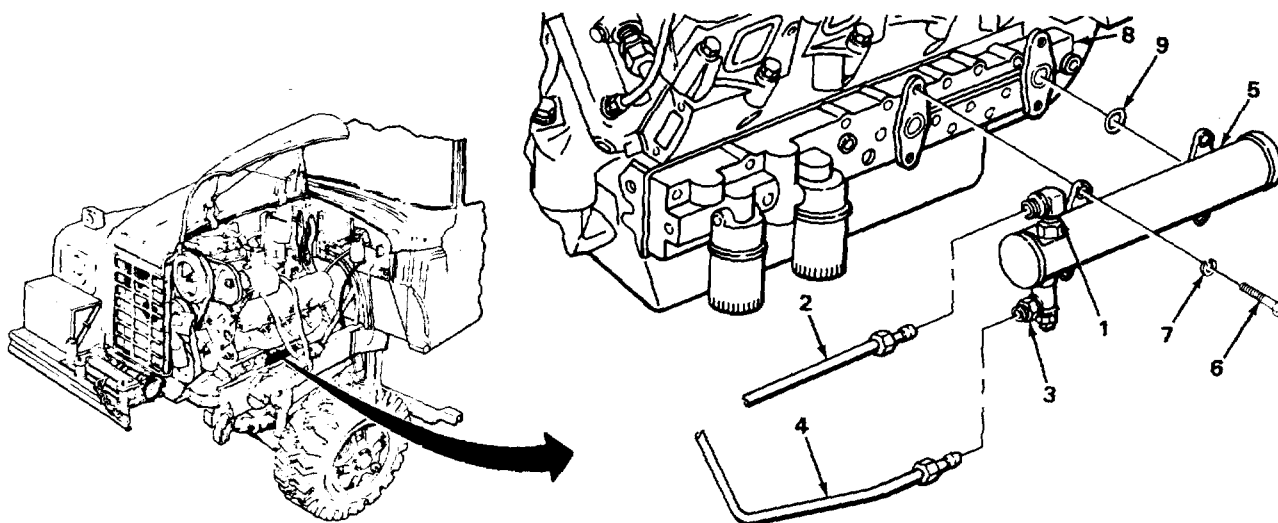
LOCATION	ITEM	ACTION	REMARKS

REMOVAL

1. Elbow (1)	Tube assembly (2)	Using 1 11/16-inch and 1 1/8-inch open-end wrenches, unscrew and take off.
2. Connector (3)	Tube assembly (4)	Using 1 11/8-inch and 1 11/16-inch open-end wrenches, unscrew and take off.
3. Oil cooler assembly (5)	Four screws (6) and lockwashers (7)	a. Using 9/16-inch socket, 3-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (7).
4. Oil cooler bracket assembly (8)	Oil cooler assembly (5)	Take off.
5.	Two seals (9)	a. Take out. b. Get rid of.

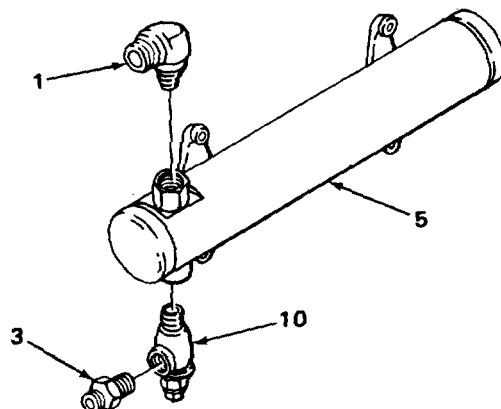
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED



DISASSEMBLY

6. Oil cooler assembly (5)	Elbow (1)	a. Mount assembly (5) in vise. b. Using 1-inch open-end wrench, unscrew and take off.
7. Pipe tee (10)	Connector (3)	Using 1 11/16-inch open-end wrench and pipe wrench, unscrew and take off.
8. Oil cooler assembly (5)	Pipe tee (10)	a. Using pipe wrench, unscrew and take out. b. Take assembly (5) out of vise.



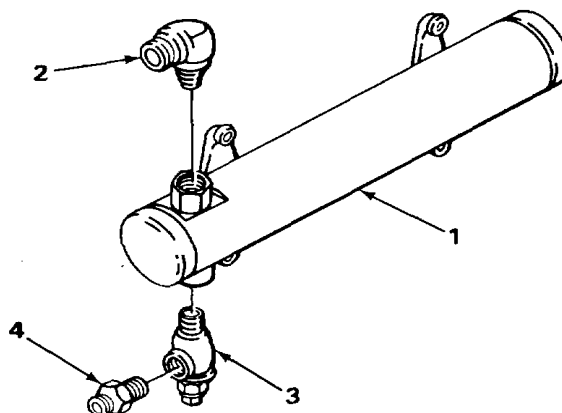
ENGINE OIL COOLER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE			
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).			
WARNING			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
9.	Oil cooler assembly (1)	a. Wipe clean with clean rags dampened with drycleaning solvent. b. Wipe dry with clean, dry rags.	
10.	Elbow (2), pipe tee (3), and connector (4)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.	
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged parts as necessary.			
11.	Oil cooler assembly (1)	Look for cracks, breaks, and dents.	
12.	All threaded parts	Look for stripped and gouged threads.	
ASSEMBLY			
13. Oil cooler assembly (1)	Pipe tee (3)	a. Mount assembly (1) in vise. b. Using pipe wrench, screw in and tighten.	
14. Pipe tee (3)	Connector (4)	Using pipe wrench and 1 1/16-inch open-end wrench, screw on and tighten.	
15. Oil cooler assembly (1)	Elbow (2)	a. Using 1-inch open-end wrench, screw in and tighten. b. Take assembly (1) out of vise.	

ENGINE OIL COOLER - CONTINUED

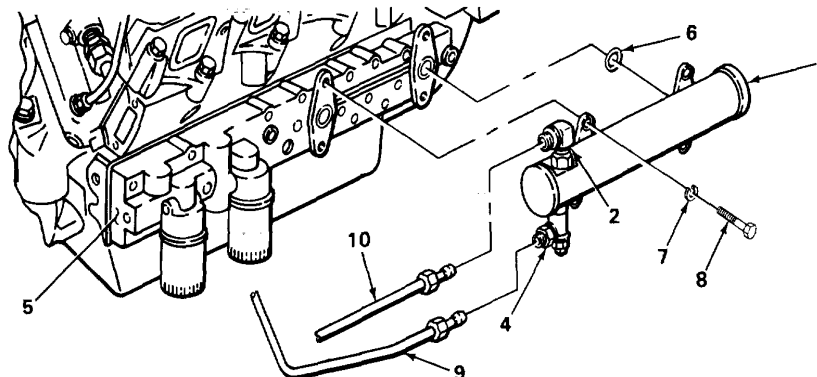
LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED



INSTALLATION

16.	Oil cooler bracket (5)	Two new seals (6)	Put in.
17.		Oil cooler assembly (1)	Put in position.
18.	Oil cooler assembly (1)	Four new lockwashers (7) and screws (8)	Screw in, and tighten using 9/16-inch socket, 3-inch extension, and handle with 3/8-inch drive.
19.	Connector (4)	Tube assembly (9)	Screw on, and tighten using 1 1/16-inch and 1 1/8-inch open-end wrenches.
20.	Elbow (2)	Tube assembly (10)	Screw on, and tighten using 1 1/16-inch and 1 1/8-inch open-end wrenches.



ENGINE OIL COOLER - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Close left side engine compartment hood (TM 9-2320-269-20-1).

TASK ENDS HERE**ENGINE OIL COOLER BRACKET**

This task covers:

a. Removal (page 2-222)	d. Inspection/Replacement (page 2-224)
b. Disassembly (page 2-223)	e. Assembly (page 2-224)
c. Cleaning (page 2-224)	f. Installation (page 2-225)

INITIAL SETUP**Tools**

Handle, ratchet, 3/8-inch drive
 Socket, 3/8-inch drive, 9/16-inch
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 1/2-inch
 Wrench, open-end, 9/16-inch
 (two required)
 Wrench, open-end, 1 1/8-inch

Materials/Parts

Gasket (two required)(TM 9-2320-269-20-1).
 Lockwasher (16 required)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

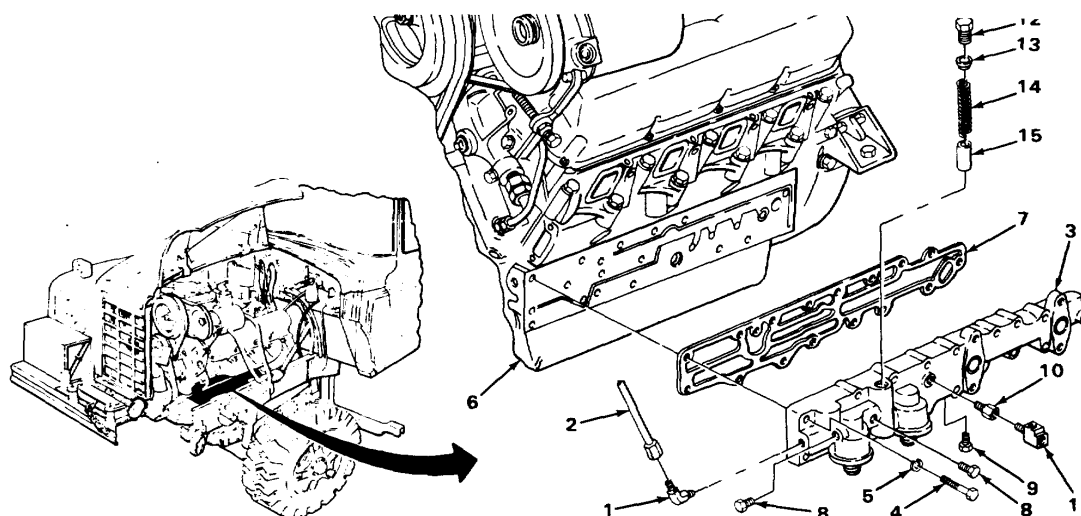
Equipment Condition

Transmission oil pressure sending unit removed
 (TM 9-2320-269-20-1).
 Oil pressure lockout switch removed
 (TM 9-2320-269-20-1).
 Engine oil cooler removed (page 2-218).
 Engine oil filters removed

LOCATION		ITEM	ACTION REMARKS
1.	Elbow (1)	Tube assembly (2)	Using 11/2-inch and 7/16-inch open-end wrenches, unscrew and take off.
2.	Oil cooler bracket (3)	16 screws (4) and lockwashers (5)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take off. b. Get rid of lockwashers (5).

ENGINE OIL COOLER BRACKET - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
3.	Cylinder block (6)	Oil cooler bracket (3) and gasket (7)	a. Take off. b. Get rid of gasket (7).
DISASSEMBLY			
4.	Oil cooler bracket (3)	Two plugs (8)	Using 7/16-inch open-end wrench, unscrew and take out.
5.		Plug (9)	Using 9/16-inch open-end wrench, unscrew and take out.
6.		Elbow (1)	Using 7/16-inch open-end wrench, unscrew and take out.
7.		Nut (10) and elbow (11)	a. Using 9/16-inch open-end wrench, unscrew and take out. b. Using two 9/16-inch open-end wrenches, unscrew and take apart.
8.		Plug (12) and	a. Using 1 1/8-inch open-end wrench, gasket (13) unscrew and take out. b. Get rid of gasket (13).
9.		Spring (14) and valve (15)	Take out.



ENGINE OIL COOLER BRACKET - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

NOTE

For more Information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

10.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

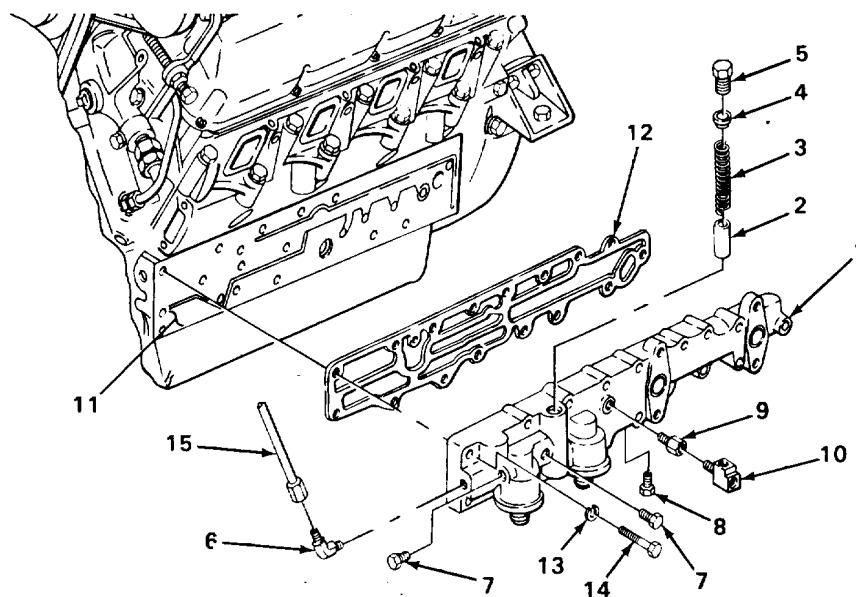
11.	Oil cooler bracket (1)	a. Look for cracks, breaks, and dents. b. Look for bent mounting flanges.

ASSEMBLY

12.	Oil cooler bracket (1)	Valve (2) and spring (3)	Put in.
13.		New gasket (4) and plug (5)	Screw in, and tighten using 1 1/8-inch open-end wrench.
14.		Elbow (6)	Using 7/16-inch open-end wrench, screw in and tighten.
15.		Two plugs (7)	Using 7/16-inch open-end wrench, screw in and tighten.
16.		Plug (8)	Using 9/16-inch open-end wrench, screw in and tighten.
17.		Nut (9) and elbow (10)	a. Screw together, and tighten using two 9/16-inch open-end wrenches.

ENGINE OIL COOLER BRACKET - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
17.	Continued	b.	Screw in, and tighten using 9/16-inch open-end wrench.
INSTALLATION			
18.	Cylinder block (11)	New gasket (12) and oil cooler bracket (1)	Place in position.
19.	Oil cooler bracket (1)	16 new lockwashers (13) and screws (14)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.
20.	Elbow (6)	Tube assembly (15)	Screw in, and tighten using 1/2-inch and 7/16-inch open-end wrenches.



NOTE

FOLLOW-ON MAINTENANCE:

1. Install oil pressure lockout switch (TM 9-2320-269-20-1).
2. Install transmission oil pressure sending unit (TM 9-2320-269-20-1).
3. Install engine oil cooler (page 2-218).
4. Install engine oil filters (TM 9-2320-269-20-1).TA238044

TASK ENDS HERE

INTAKE MANIFOLDS

This task covers:

a. Removal (page 2-226)	d. Inspection/Replacement (page 2-229)
b. Disassembly (page 2-228)	e. Assembly (page 2-230)
c. Cleaning (page 2-229)	f. Installation (page 2-230)

INITIAL SETUP**Tools**

Handle, ratchet, 3/8-inch drive
 Screwdriver, flat-tip, 1/4-inch
 Socket, 3/8-inch drive, 9/16-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 1/2-inch
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 7/8-inch
 Wrench, open-end, 15/16-inch

Materials/Parts

Gasket, intake manifold
 Lockwasher, cable bracket

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Fuel injection pump removed (page 2-278).
 Ether starting aid and bracket removed
 (page 2-374) (left side intake manifold
 only).

LOCATION	ITEM	ACTION	REMARKS

NOTE

This procedure covers left side intake manifold except where noted.

REMOVAL

1. Intake manifold (1)	Screen (2)	Take off.
2. Cable bracket (3)	Screw (4) and lock-washer (5)	a. Using 9/16-inch open-end wrench, unscrew and take off. b. Get rid of lockwasher (5).

INTAKE MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

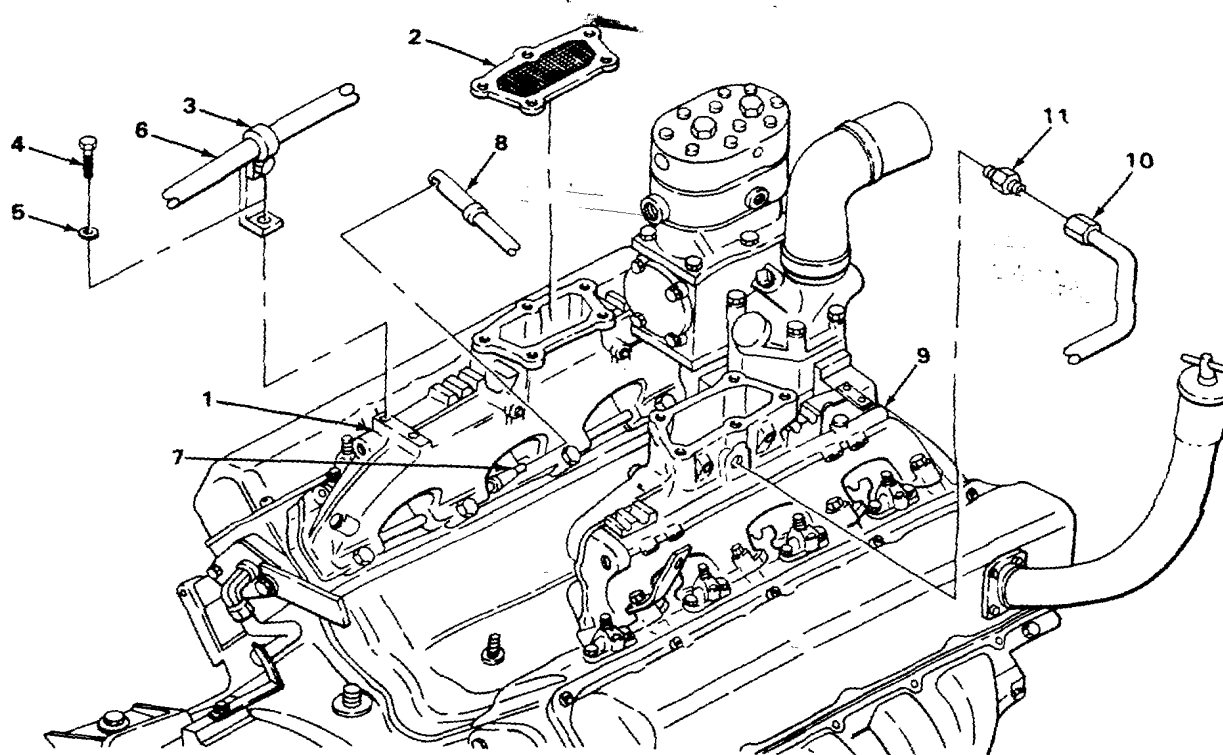
REMOVAL - CONTINUED

3.	Intake manifold (1)	Cable bracket (3) with tachometer drive cable (6)	Move away from.
4.	Swirl destroyer ball (7)	Ball joint (8)	a. Pull off. b. Move away from.

NOTE

Step 5 only applies to right side intake manifold.

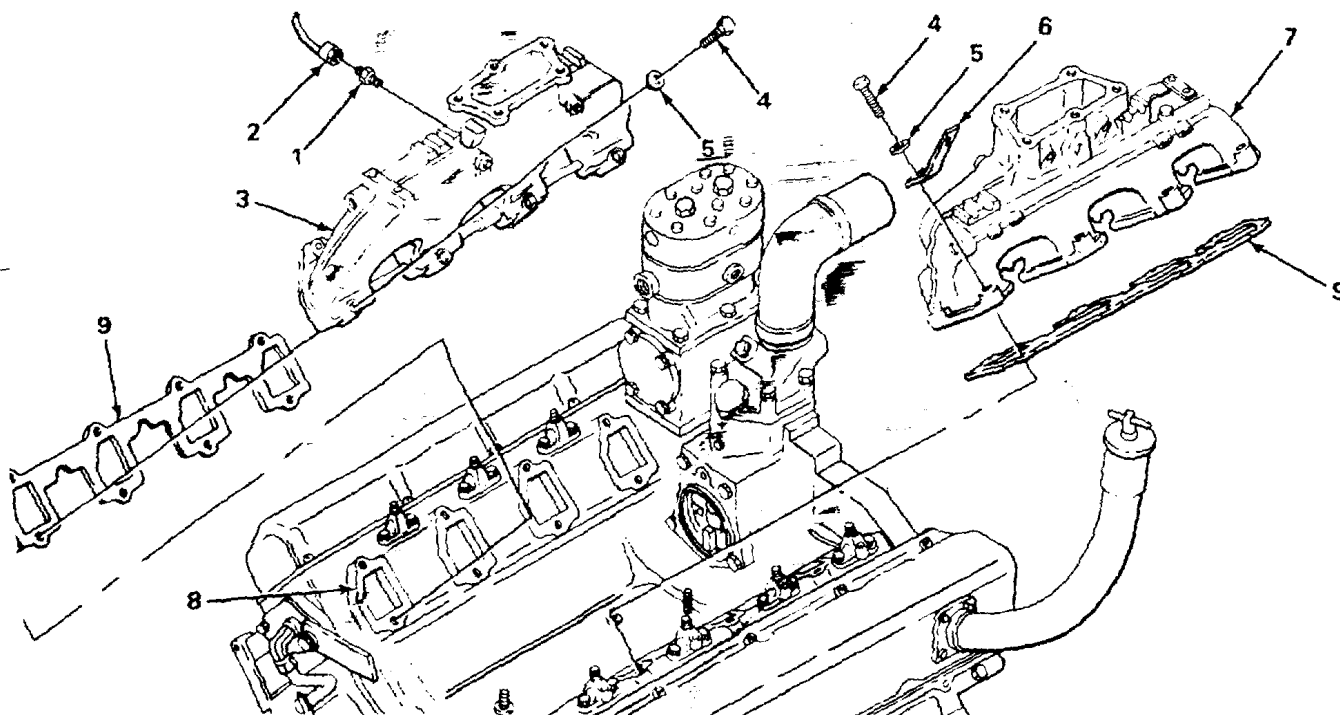
5.	Right side intake manifold (9)	Tube (10) and adapter (11)	a. Using 7/8-inch and 15/16-inch open. end wrenches, unscrew and take off tube (10). b. Using 7/8-in open-end wrench, unscrew and take out adapter (11).



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INTAKE MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6.	Adapter (1)	Ether start tube (2)	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take out.
7.	Intake manifold (3)	adapter (1)	Using 3/8-inch open-end wrench, unscrew and take out.
8.		Eight screws (4), washers (5), and two extension clips (6) on right - side intake manifold (7)	Using 5/16-inch socket and ratchet handle with 3/8-inch drive and 9/16-inch open-end wrench, unscrew and take out. On right side intake manifold, there are only six mounting screws.
9.	Cylinder head (8)	Intake manifolds (3 and 7) and gaskets (9)	a. Lift of. b. Get rid of gaskets (18).



DISASSEMBLY

10.	Intake manifold (3)	Elbow (10)	Using 7/16-inch open-end wrench, unscrew and take off.
11.	Four adapters(11)		Using 1/2-inch open-end wrench, unscrew and take off.

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INTAKE MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
12.	Swirl destroyer shaft (12)		Using 1/4-inch flat-tip screwdriver, pry out.
13.	Swirl destroyer shaft (12)	Six bushings (13)	Pull out.
14.	Intake manifold (3)	Plug (14)	Using 9/16-inch open-end wrench, unscrew and take out.

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

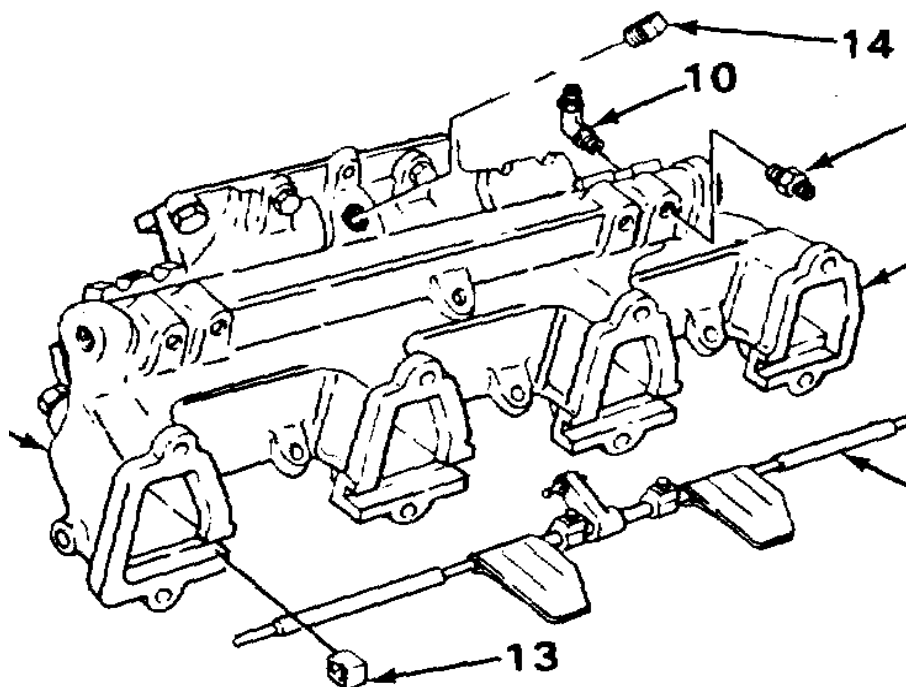
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

15. All metal parts
- Clean in drycleaning solvent.
 - Wipe dry with clean, dry rags.

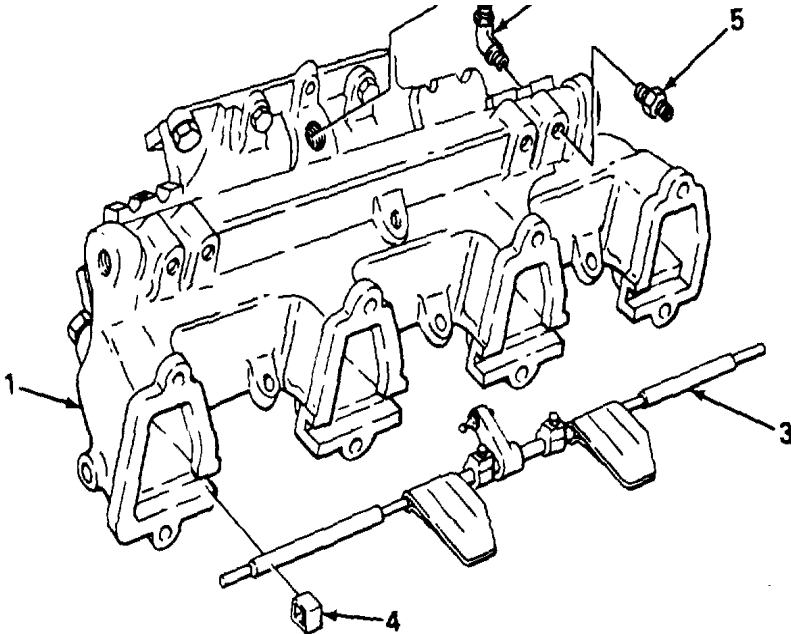
INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as necessary.



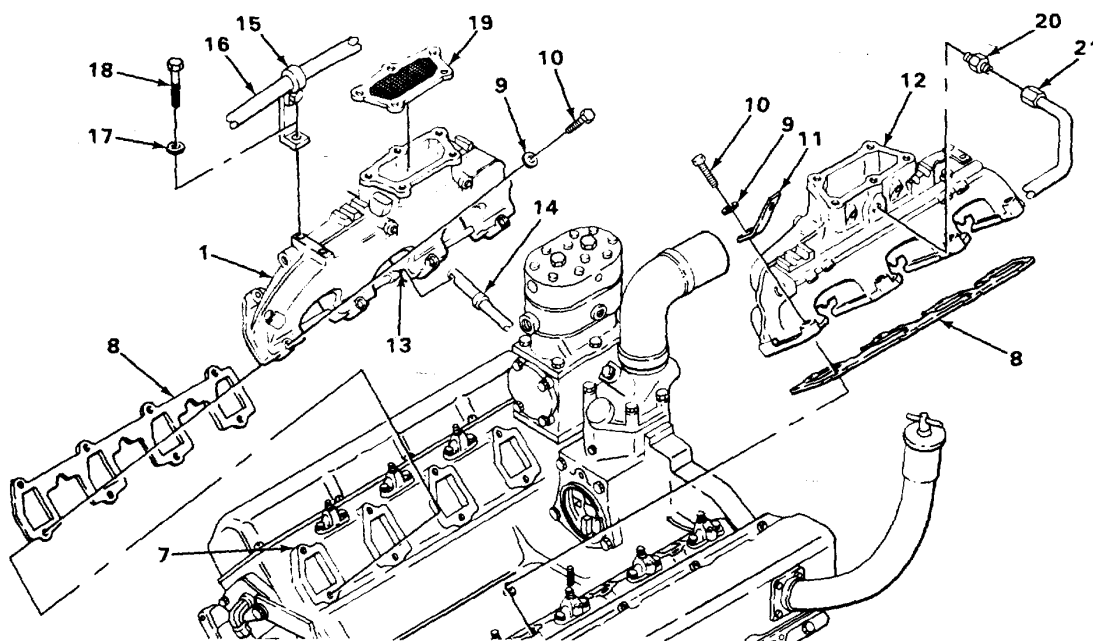
INTAKE MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
16.	Intake manifold (1)	a. Look for cracks and breaks. b. Place manifold (1) on flat surface and check for warpage.	
ASSEMBLY			
17.	Intake manifold (1)	Plug (2)	Screw in, and tighten using 9/16-inch open-end wrench.
18.	Swirl destroyer shaft (3)	Six bushings (4)	Put in position, split facing up. Bushings with smaller inside diameter are positioned at middle of shaft. Four larger diameter bushings are positioned at either end on shaft.
19.	Intake manifold (1)	Swirl destroyer shaft (3)	Put in place. Bushings should be flush with manifold.
20.		Four adapters (5)	Screw in, and tighten using 1/2-inch open-end wrench.
21.		Elbow (6)	Screw in, and tighten using 7/16-inch open-end wrench.
			
INSTALLATION			
22.	Cylinder head (7)	New gasket (8) and	Place In position. intake manifold (1)

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INTAKE MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
23.	Intake manifold (1)	Eight washers (9), screws (10), and two extension clips (11) on right side intake manifold (12)	Screw in, and tighten using 9/16-inch ratchet handle with 3/8-inch drive and 9/16-inch open-end wrench.
24.	Swirl destroyer ball (13)	Ball joint (14)	Snap on.
25.	Intake manifold (1)	Cable bracket (15) with tachometer drive cable (16)	Put in position.
26.	Cable bracket (15)	New lockwasher (17) and screw (18)	Screw in, and tighten using 9/16-inch open-end wrench.
27.	Intake manifold (1)	Screen (19)	Put in place.
28.	Right side intake manifold (12)	Adapter (20) and tube (21)	a. Screw in, and tighten adapter (20) using 7/8-inch open-end wrench. b. Screw on, and tighten tube (21) using 7/8-inch and 15/16-inch open-end wrenches.



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INTAKE MANIFOLDS - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Install fuel injection pump (page 2-278).
2. Install ether starting aid and bracket (2-374).

TASK ENDS HERE**EXHAUST MANIFOLDS**

This task covers:

a. Removal (page 2-233)	d. Inspection/Replacement (page 2-234)
b. Disassembly (page 2-234)	e. Assembly (page 2-234)
c. Cleaning (page 2-234)	f. Installation (page 2-235)

INITIAL SETUP**Tools**

Extension, 318-inch drive, 6-inch
 Handle, ratchet, 1/2-inch drive
 Screwdriver, flat-tip, 3/8-inch
 Socket, deep-well, 1/2-inch drive,
 9/16-inch
 Socket, 112-inch drive, 3/4-inch
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 3/8-inch

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition**Materials/Parts**

Gasket (four required)
 Lockplates (five required)

Left or right side engine compartment hood
 open (TM 9-2320-269-20-1).

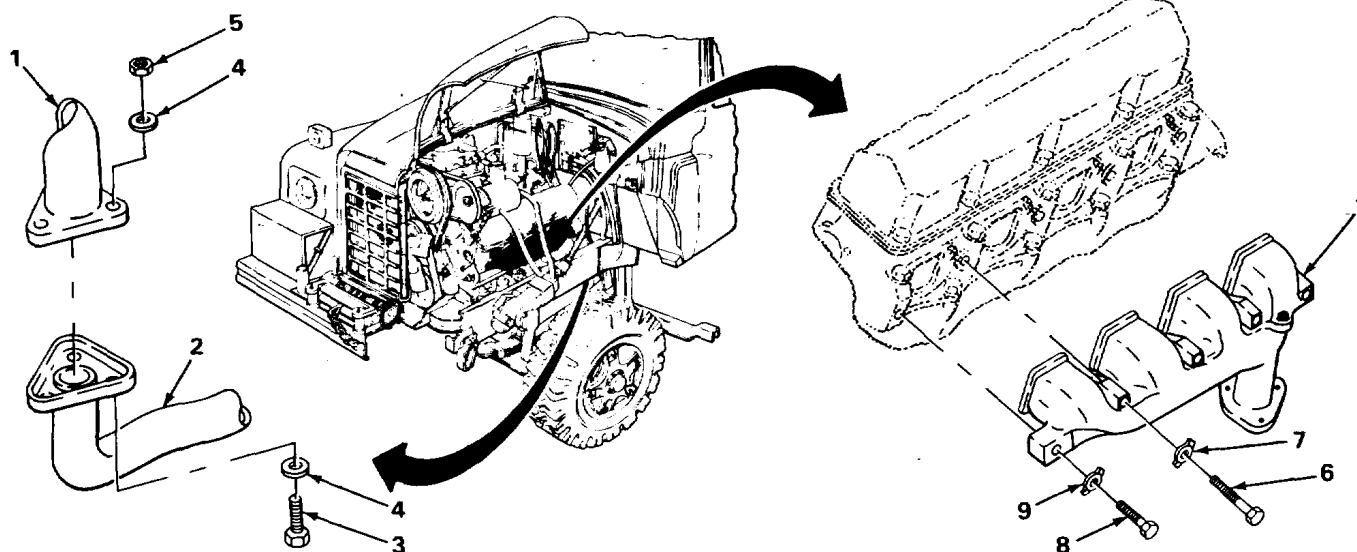
LOCATION	ITEM	ACTION	REMARKS

NOTE

This procedure covers left side exhaust manifold. Procedure is the same for right side.

EXHAUST MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
NOTE If engine has been removed from vehicle and mounted on overhaul stand, skip steps 1 and 2 and begin removal at step 3.			
1.	Exhaust manifold (1) and exhaust pipe (2)	Three screws (3), six washers (4), and nuts (5)	Using 9/16-inch deep well socket, ratchet handle with 1/2-inch drive, 6-inch extension, and 9/16-inch open-end wrench, unscrew and take out.
2.	Exhaust manifold (1)	Exhaust pipe (2)	Move away from.
3.		Three screws (6) and lock plates (7)	a. Using 3/8-inch flat-tip screwdriver, flatten tab. b. Using 3/4-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. c. Get rid of lockplates (7).
4.		Two screws (8) and	a. Using 3/8-inch flat-tip screwdriver, lock plates (9) flatten tab. b. Using 9/16-inch deep well socket and ratchet handle with 1/2-inch drive, unscrew and take out. c. Get rid of lock plates (9).



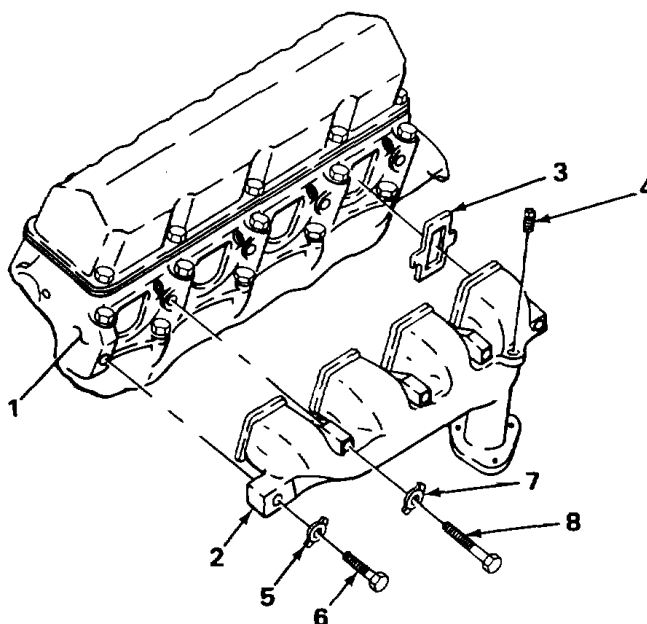
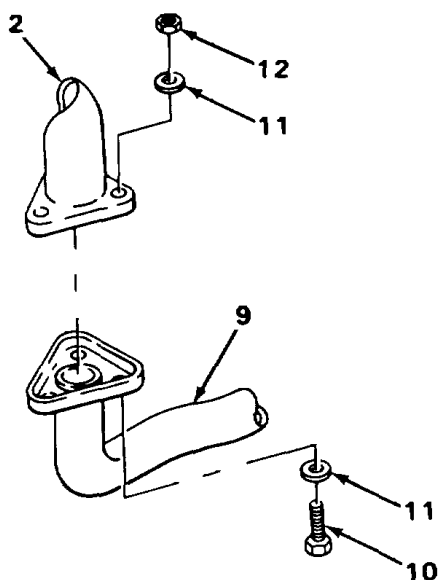
TA238050

EXHAUST MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
5.	Cylinder head (1)	Exhaust manifold (2) and four gaskets (3)	a. Take off. b. Get rid of gaskets (3).
DISASSEMBLY			
6.	Exhaust manifold (2)	Plug (4)	Using 3/8-inch open-end wrench, unscrew and take out.
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). <u>WARNING</u> Solvent burns easily. Solvent fumes can explode. Do not smoke or allow flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
7.	All metal parts		a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.
INSPECTION/REPLACEMENT			
NOTE For more Information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged parts as necessary.			
8.	Exhaust manifold (2)		Look for cracks, breaks, and dents.
ASSEMBLY			
9.	Exhaust manifold (2)	Plug (4)	Screw in, and tighten using 3/8-inch open-end wrench.

EXHAUST MANIFOLDS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
10.	Cylinder head (1)	Four new gaskets (3) and exhaust manifold (2)	Put in position.
11.		Two new lock plates (5) and screws (6)	a. Screw in, and tighten using 9/16-inch deep well socket and ratchet handle with 112-inch drive. b. Using 3/18-inch flat-tip screwdriver, pry up tab.
12.		Three new lock plates (7) and screws (8)	a. Screw in, and tighten using 3/4-inch socket and ratchet handle with 112-inch drive. b. Using 3/8-inch flat-tip screwdriver, pry up tab.
NOTE If engine has been removed from vehicle, do not do steps 13 and 14.			
13.		Exhaust pipe (9)	Put in position.
14.	Exhaust manifold (2) and exhaust pipe (9)	Three screws (10), six washers (11), and nuts (12)	Screw together, and tighten using 9/16-inch deep well socket, and ratchet handle with 1/2-inch drive, and 9/16-inch open-end wrench.



EXHAUST MANIFOLDS - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Close left or right side engine compartment hood (TM 9-2320-269-20-1).

TASK ENDS HERE**SWIRL DESTROYER**

This task covers:

a. Removal (page 2-236)	d. Inspection/Replacement (page 2-240)
b. Disassembly (page 2-237)	e. Assembly (page 2-241)
c. Cleaning (page 2-240)	f. Installation (page 2-244)

INITIAL SETUP**Tools**

Gage, thickness
 Handle, ratchet, 3/8-inch drive
 Pliers, slip-joint, angle-nose
 Screwdriver, flat-tip, 1/4-inch
 Socket, deep well, 3/8-inch drive,
 1 1/2-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch

Materials/Parts

Cotter pin, lever and yoke
 Lockwashers, mounting strip
 (three required)
 Rags, wiping (item 42, appendix B)

Materials/Parts - Continued

Self-locking nuts (two required)
 Solvent, drycleaning (item 49, appendix B)
 Washers, teflon (four required)

Personnel Required

One

Equipment Condition

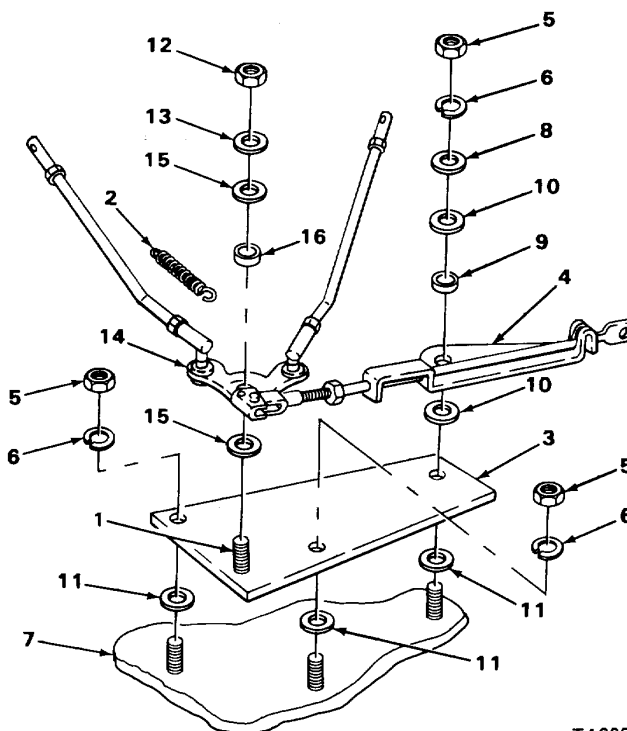
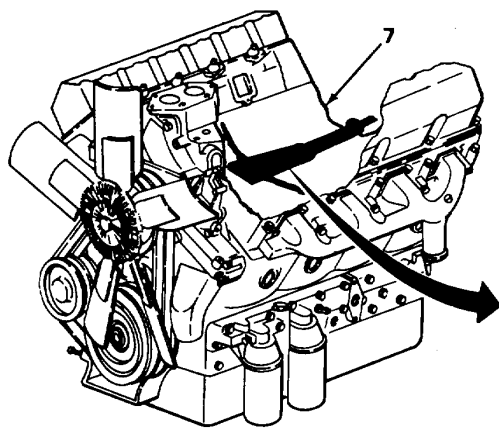
Intake manifolds removed
 (page 2-226).

LOCATION	ITEM	ACTION	REMARKS

REMOVAL

1.	Stud (1)	Spring (2)	Unhook.
2.	Mounting strip (3) and cable bracket (4)	Three nuts (5) and lockwashers (6)	a. Using 1/2-inch deep well socket and ratchet handle with 3/8-inch drive, unscrew and take off. b. Get rid of lockwashers (6).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
3.	Tappet cover (7)	Mounting strip (3), washer (8), spacer (9), and two teflon washers (10)	a. Take off. b. Get rid of washers (10).
4.		Three washers (11)	Take off.
DISASSEMBLY			
5.	Stud (1)	Nut (12) and washer (13)	Using 112-inch deep well socket and ratchet handle with 3/8-inch drive, unscrew and take off.
6.	Mounting strip (3)	Lever (14) with parts, cable bracket (4), two teflon washers (15), and spacer (16)	a. Take off. b. Get rid of washers (15).
7.	Lever(14)	Spring (2)	Unhook and take off.



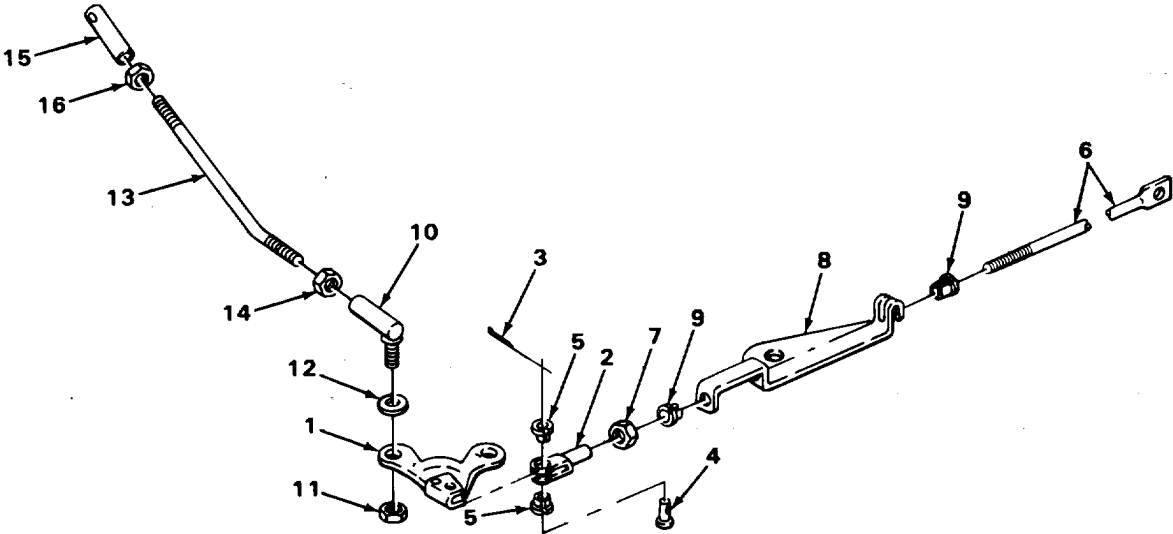
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SWIRL DESTROYER - CONTINUED

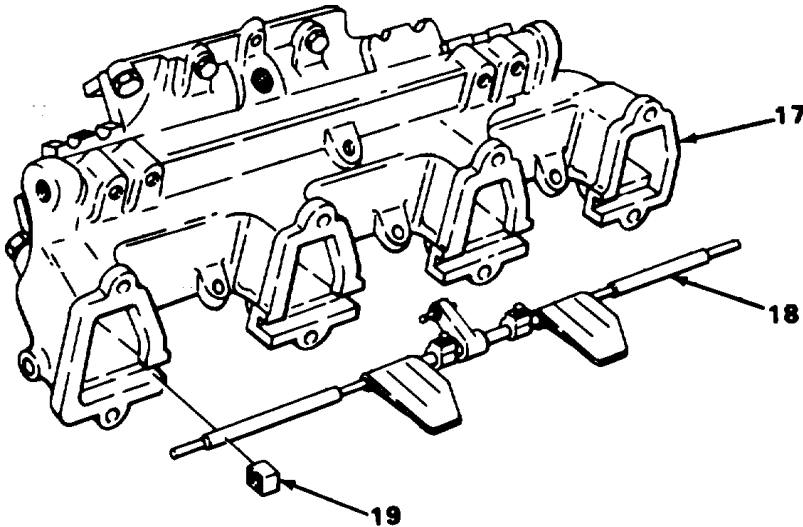
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
8.	Lever (1) and yoke (2)	Cotter pin (3), pin (4), and two split washers (5)	a. Using angle-nose slip-joint pliers, straighten pin (3), and pull out. b. Pull out pin (4). c. Get rid of cotter pin (3).
9.	Lever (1)	Yoke (2) with control rod (6)	Take off.
10.	Control rod (6)	Nut (7)	a. Count and record number of exposed threads. b. Using 3/8-inch open-end wrench, loosen.
11.		Yoke (2) and nut (7)	Unscrew and take off.
12.	Cable bracket (8)	Control rod (6) Pull out. and two split washers (9)	
13.	Lever (1) and two ball joints (10)	Two self-locking nuts (11)	a. Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take off. b. Get rid of nuts (11).
14.	Lever (1)	Two ball joints (10) and washers (12)	Take off.
NOTE Steps 15 thru 18 cover one swirl destroyer shaft and intake manifold. Repeat for other shaft and manifold.			
15.	Two actuating rods (13)	Four nuts (14)	a. Count number of exposed threads at each end of each rod (13) and record. b. Using 7/16-inch and 3/8-inch open-end wrenches, unscrew.
16		Four ball joints (10) and (15) and four nuts (16)	Unscrew and take off.

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED



17.	Intake manifold (17)	Shaft assembly (18) out.	Using 1/4-inch flat-tip screwdriver, pry out.
18.	Shaft assembly (18)	Six rubber bushings (19)	Pull out.



SWIRL DESTROYER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

19.	Shaft assembly (1)	Two sleeve spacers (2)	Slide off.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

20.	All metal parts	a. Clean in cleaning solvent. b. Wipe clean with clean, dry rags.

INSPECTION/REPLACEMENT

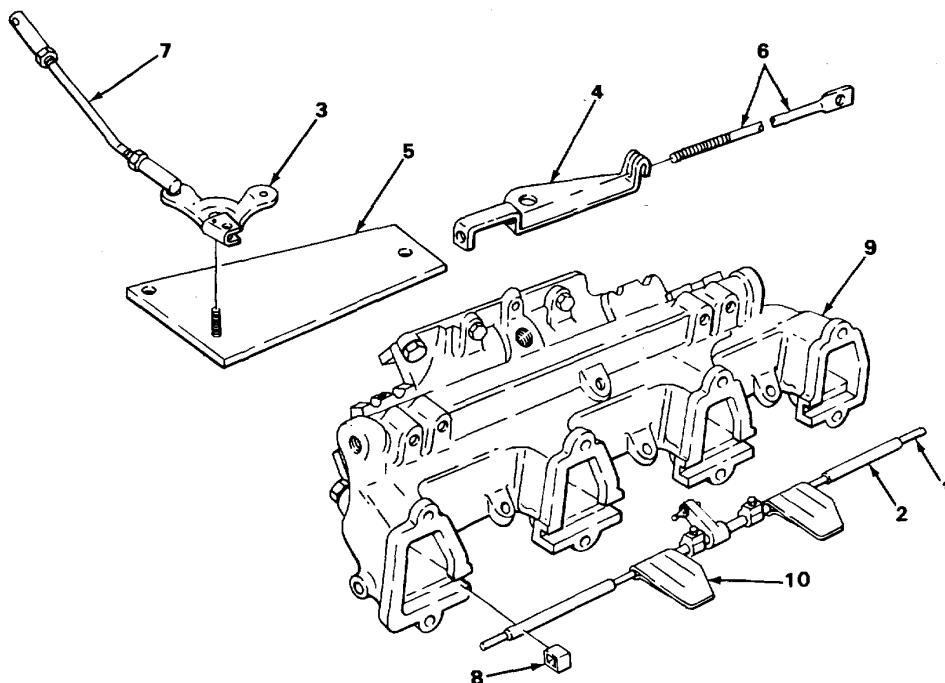
NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as necessary.

21.	Shaft assembly (1)	a. Look for bends and cracks. b. Look for broken welds on plates.
22.	Lever (3), cable bracket (4), and mounting strip (5)	Look for cracks, dents, and breaks.
23.	Control rod (6) and two actuating rods (7)	Look for cracks, breaks, and stripped threads.

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
24.	Shaft assembly (1) Two sleeve spacers (2)	Slide on.	
25.	Six rubber bushings (8)	Put on, split facing up. Note that four bushings have larger inside diameter and are used over sleeves, while two bushings have smaller inside diameter and are used directly on the shaft, at the middle.	
26.	Intake manifold (9) Shaft assembly (1) with bushings (8)	a. Put in place. b. Turn shaft (1) so that plates (10) are in closed position and touch side of manifold (9). c. Using thickness gage, measure clear- ance between plate (10) and mani- fold (9). Clearance should be 0.005 inch (0.12 mm). d. If clearance is not 0.005 inch (0.12 mm), do step 27. e. If clearance is within tolerance given, go on to step 28.	

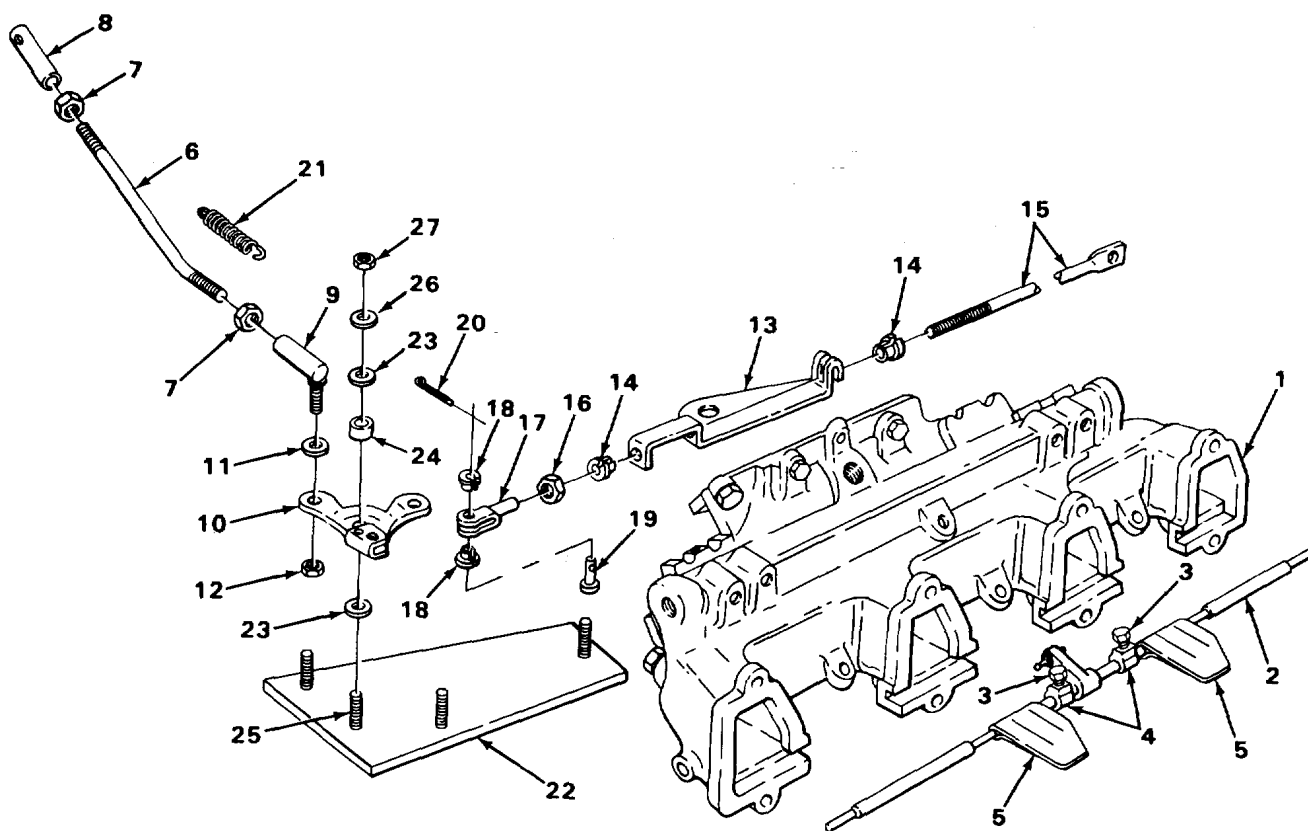


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SWIRL DESTROYER - CONTINUED

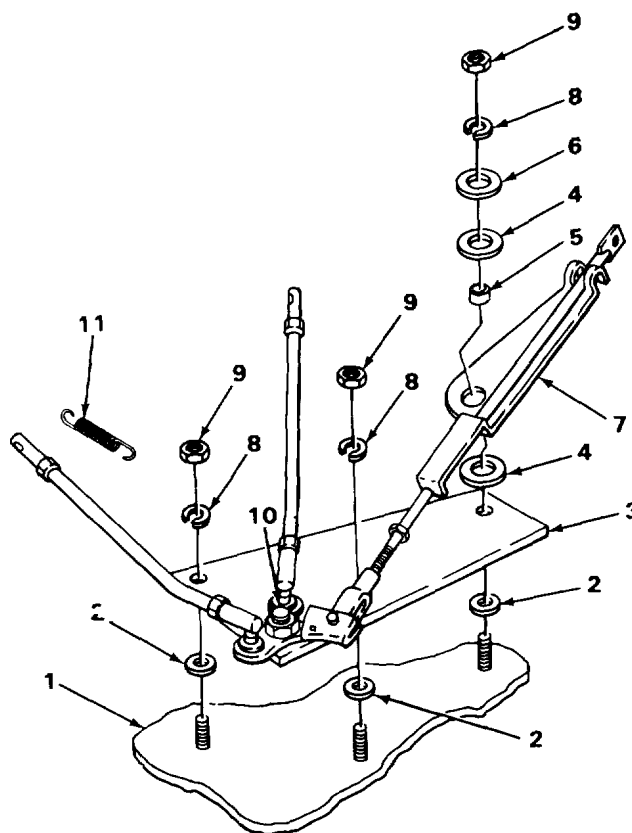
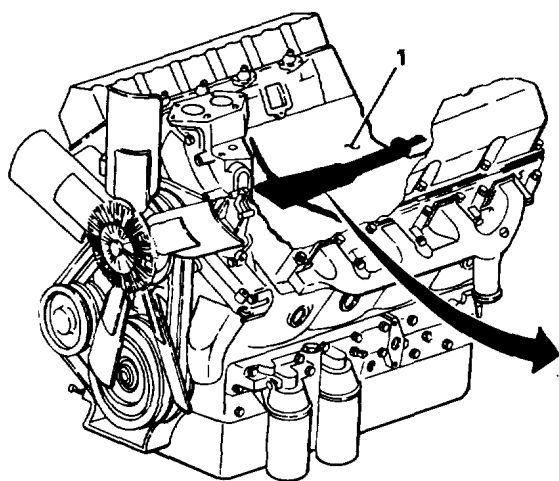
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
27.	Intake manifold (1) and shaft assembly (2)	Two setscrews (3) and two collars (4)	a. Using 7/16-inch open-end wrench, loosen screws (3). b. Move shaft (2) and use 0.005-inch (0.12-mm) thickness gage to fix correct clearance between plate (5) and manifold (1). c. Adjust collars (4) against manifold (1), allowing shaft (2) to turn freely while still maintaining 0.005 inch (0.12 mm) clearance between plate (5) and manifold (1).
28.	Two actuating rods (6)	Four nuts (7)	Screw on, leaving same number of exposed threads as recorded in step 15a.
29.		Four ball joints (8) and (9)	Screw on to nut (7).
30.		Four nuts (7) and ball joints (8) and (9)	Tighten using 7/16-inch and 3/8-inch open-end wrenches.
31.	Lever (10)	Two ball joints (9) Put in position. and washers (11)	
32.	Lever (10) and two ball joints (9)	Two new self-locking nuts (12)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.
33.	Cable bracket (13)	Two split washers (14) and control rod (15)	Put through.
34.	Control rod (15)	Nut (16)	Screw on, leaving same number of exposed threads as recorded in step 10a.
35.		Yoke (17)	Screw on to nut (16).
36.		Nut (16)	Using 3/8-inch open-end wrench, tighten.
37.	Lever (10)	Yoke (17) and two split washers (18)	Put in position.
38.	Lever (10) and yoke (17)	Pin (19)	)Put through.

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY- CONTINUED			
39.	Pin (19)	New cotter pin (20)	a. Put in. b. Using angle-nose slip-joint pliers, separate and bend ends back over pin (19).
40.	Lever (10)	Spring (21)	Put on.
41.	Mounting strip (22)	Two new teflon washers (23), spacer (24), and lever (10) with cable bracket (13)	Put in position.
42.	Stud (25)	Washer (26) and nut (27)	Screw on, and tighten using 1/2-inch deep well socket and ratchet handle with 3/8-inch drive.



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LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
43.	Tappet cover (1)	Three washers (2)	Put in position over studs.
44.	Mounting strip (3),	Put in position over studs. two new teflon washers (4), spacer (5) and washer (6)	
45.	Mounting strip (3) and cable bracket (7)	Three new lock- washers (8) and nuts (9)	Screw on, and tighten using 1/2-inch deep well socket and ratchet handle with 1/2-inch drive.
46.	Stud (10)	Spring (11)	Hook.



NOTE

FOLLOW-ON MAINTENANCE: Install intake manifolds (page 2-226).

TASK ENDS HERE

Section V. FUEL SYSTEM

	Page		Page
Ether Start Control Cable	2-369	Fuel Supply Lines	2-259
Ether Starting Aid	2-374	Fuel Tank	2-331
Ether Supply Lines	2-384	Governor	2-334
Filter Heads	2-361	Injection Pump Drive	2-325
Fuel Injection Pump.....	2-278	Injection Pump Mounting	
Fuel Injectors	2-245	Brackets	2-317
Fuel Return Lines	2-270		

FUEL INJECTORS

This task covers:

a. Removal (page 2-246)	d. Cleaning/Inspection (page 2-251)
b. Testing (page 2-248)	e. Assembly (page 2-253)
c. Disassembly (page 2-249)	f. Installation (page 2-255)

INITIAL SETUP**Tools**

Extension, 3/8-inch drive, 3-inch
 Handle, ratchet, 3/8-inch drive
 Handle, ratchet, 1/2-inch drive
 Holding fixture, injector
 Pliers, slip-joint
 Pump, nozzle test
 Socket, 3/8-inch drive, 1/2-inch
 Socket, deep well, 1/2-inch drive,
 7/8-inch, 12-point
 Screwdriver, flat-tip, 1/8-inch
 Tool set, nozzle cleaning:
 cleaning needles
 special chamber scraper
 seat scraper
 wood polishing stick
 Vise, machinist's
 Vise, pin
 Wrench, open-end, 1/2-inch
 Wrench, open-end, 11/16-inch
 Wrench, torque, 3/8-inch-drive
 Wrench, torque, 1/2-inch drive

Materials/Parts

Cap, dust (two required)
 Fuel, diesel, No. 2 (item 17, appendix B)
 Gasket, injector holder cap
 Lockwashers (three required)
 Packing, fuel injector
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)
 Shim set, adjusting
 Tag, marking (item 50, appendix B)
 Tallow, mutton (item 51, appendix B)

Personnel Required

One

Equipment Condition

Air cleaner removed with engine in vehicle
 (TM 9-2320-269-20-1).
 Left-side hood panel raised with engine in
 vehicle (TM 9-2320-269-20-1).
 Fuel supply lines removed for removal of
 all injectors (page 2-259).
 Fuel return lines removed for removal of
 all injectors (page 2-270)

LOCATION	ITEM	ACTION	REMARKS

REMOVAL

NOTE

This procedure is for the front left side injector (number one cylinder), the other seven are removed in a similar way. If lines are removed, go to step 8.

WARNING

Diesel fumes can explode. If welding of fuel tank is necessary, always work in well-ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.

CAUTION

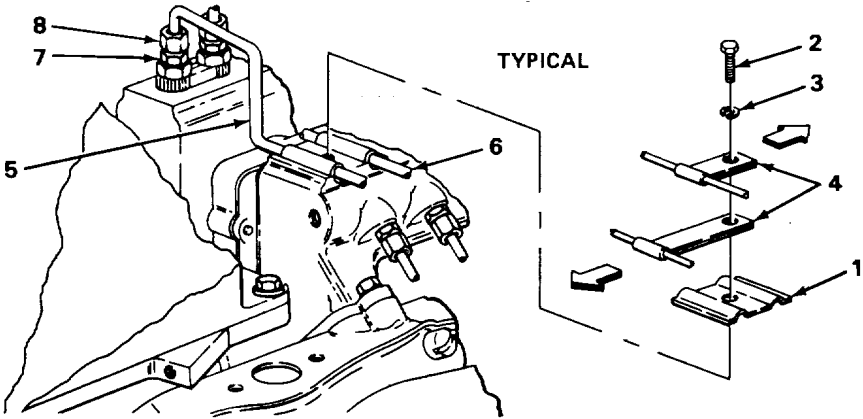
Before removing lines or injectors, clean all parts with No. 2 diesel fuel and rags to avoid getting dirt or debris into engine causing equipment damage.

1.	Clamp (1)	Screw (2) and lockwasher (3)	a. Using 1/2-inch socket, 3-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (3).

NOTE

If the number one or three injector is not being removed, go to step 3.

2.		Two clamps (4)	Move aside.
3.	Two pipes (5) and (6)	Clamp (1)	Take off.
4.	Retainer (7)	Nut (8)	Using 11/16-inch open-end wrench, unscrew part way.



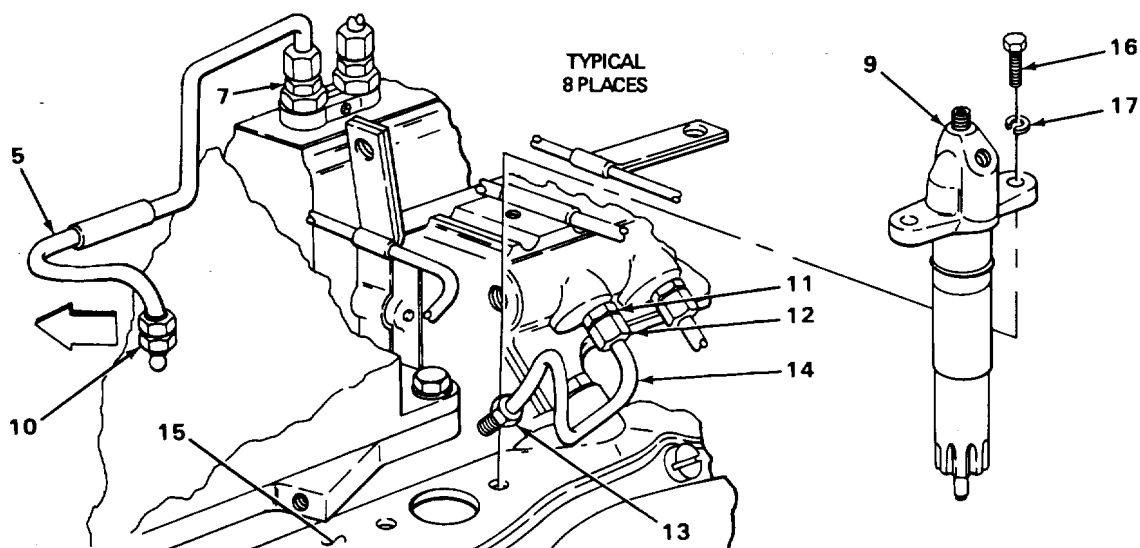
FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
5.	Injector (9)	Nut (10) and pipe (5)	a. Using 11/16-inch open-end wrench, unscrew nut (10). b. Pull pipe (5) free and turn aside.
6.	Adapter (11) and injector (9)	Nuts (12) and (13) and pipe (14)	a. Using 1/2-inch open-end wrench, unscrew nuts (12) and (13). b. Pull pipe (14) free and turn aside.
7.	Retainer (7) and adapter (11)	Pipes (5) and (14)	Cover open ends with dust caps.
8.	Injector (9) and cylinder head (15)	Two screws (16) and lockwashers (17)	a. Using 1/2-inch socket, 3-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (17).

CAUTION

The injector is damaged easily, do not hit against hard objects.

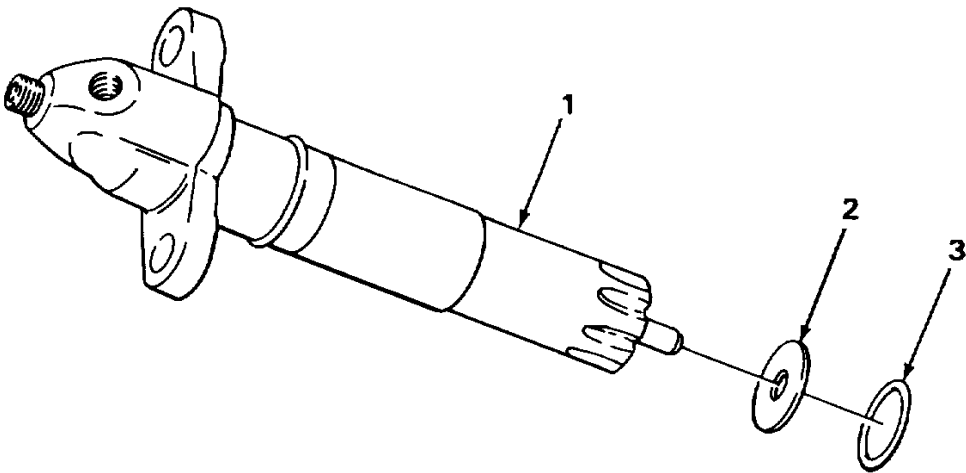
9.	Cylinder head (15)	Injector (9)	a. Using slip-joint pliers, take out and put in numbered holding fixture or tag with engine position if removing more than one. b. Cover head (15) with clean rag.



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FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
10.	Injector (1)	Gasket (2)	a. Take off. b. Get rid of.
11.		Packing (3)	a. Using 1/8-inch flat-tip screwdriver, take off. b. Get rid of.



TESTING

WARNING

Keep away from injector tip when testing. Fuel spraying from nozzle tip is under high pressure and can penetrate skin, causing infection.

12.	Injector (1)	a. Connect to nozzle test pump filled with clean No. 2 two diesel fuel, and operate pump until fuel sprays from from tip (4). b. Operate nozzle test pump, and check fuel spray pattern and opening pressure. c. If spray pattern is irregular or opening pressure is below 2500 psi (17237.5 kPa), repair or replace as needed.

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LOCATION	ITEM	ACTION	REMARKS

TESTING - CONTINUED

12. Continued
- d. If fuel runs from leak-off port (5) when spraying, repair or replace as needed.

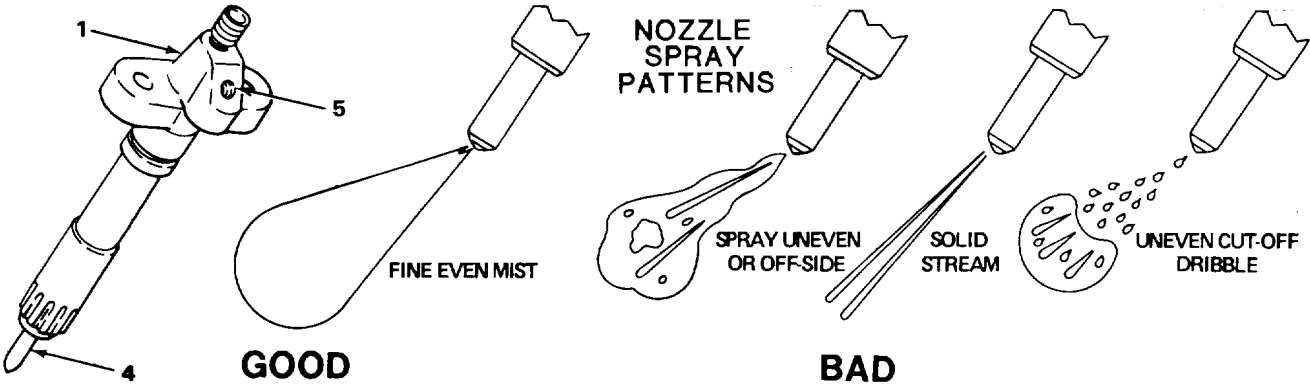
e. Using clean rag, wipe tip (4) dry.

f. Build pump pressure to 500 psi (3447.5 kPa) less than pressure found in step b, and hold for 10 seconds.

g. A slight wetness is permitted on tip (4).

If droplets form, repair or replace as needed.

h. Disconnect nozzle test pump.



DISASSEMBLY

CAUTION

The injector is damaged easily. Do not clamp directly in vise.2-249

Parts of the injector are machined and polished, do not scratch with tools, and always work on a clean, smooth wooden surface.

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LOCATION	ITEM	ACTION	REMARKS

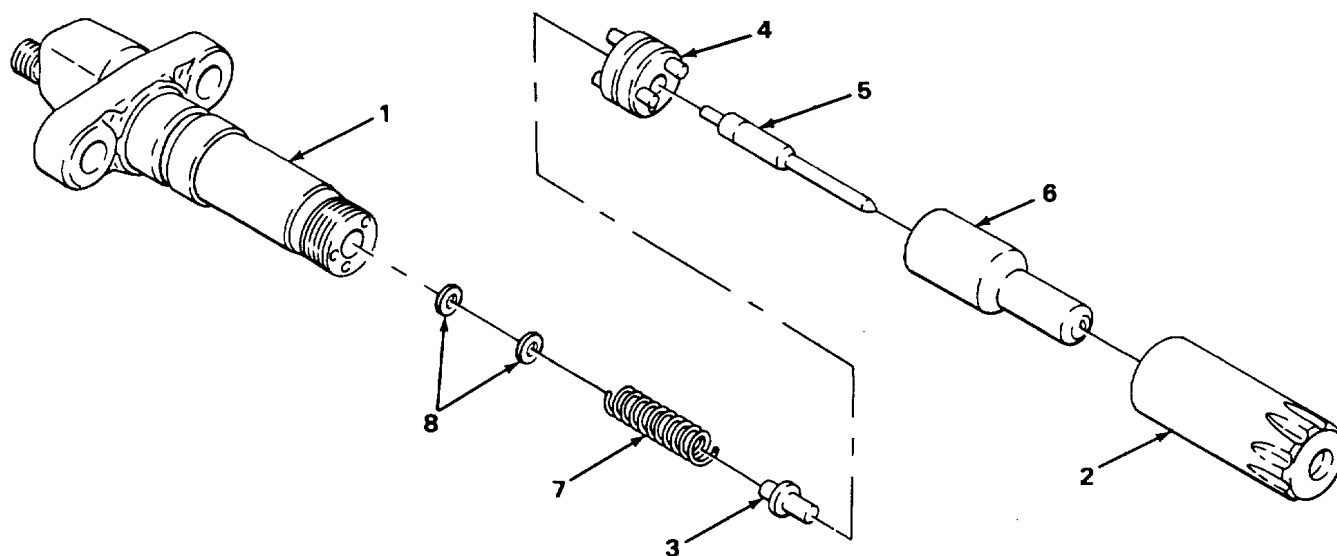
DISASSEMBLY - CONTINUED

13.	Body (1)	Nut (2)	a. Using rags, wipe clean. b. Using holding fixture, mount body(1) in machinist's vise. c. Using 12-point 7/8-inch deep well socket and ratchet handle with 1/2-inch drive, unscrew nut (2) part way. d. Take out of machinist's vise. e. Slowly unscrew nut (2) and take off.

NOTE

It may be necessary to soak body and nut in diesel fuel to remove parts.

14.	Nut (2)	Seat (3), plate (4), valve (5), and nozzle (6)	Take out.
15.	Body (1)	Spring (7) and two shims (8)	Take out.



TA238061

FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING/INSPECTION

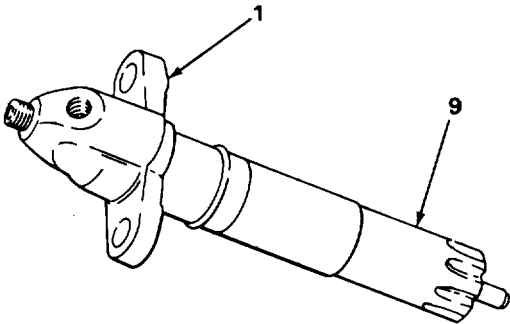
NOTE

For more information on how to clean and inspect parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to follow these precautions could cause serious injury or death.

16.	Body (1)	Injector (9)	a. Clean in drycleaning solvent. Rinse with clean No 2 diesel fuel. Using clean, dry rags, wipe dry.
		b.	
		c.	



17.		a.	Check for cracks and broken parts.
		b.	Check for stripped or gouged threads.

FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING/INSPECTION - CONTINUED

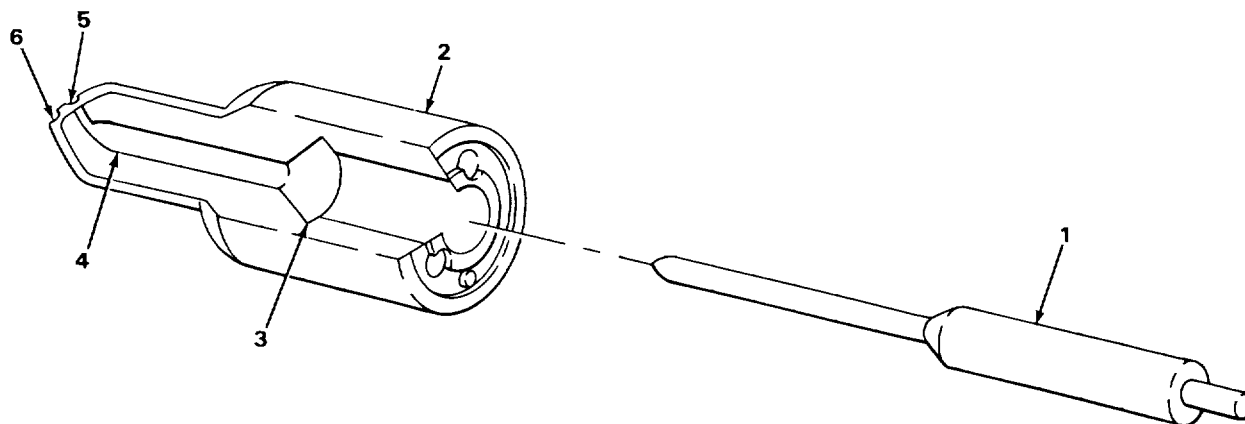
WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

CAUTION

Do not use hard or sharp tools, emery cloth or crocus cloth, grinding compound, or abrasives of any kind when cleaning injector parts. Machined surfaces are damaged easily.

18.	All parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.
19.	Valve (1)	Using mutton tallow, remove carbon.
20	Nozzle (2)	a. Using special chamber scraper, clean pressure chamber (3). b. Using special seat scraper, clean valve seat (4). c. Using 0.017-inch (0.42-mm) needle and pin vise, clean spray hole (5). d. Using 0.015-inch (0.37-mm) needle and pin vise, clean spray hole (6). e. Using polishing stick, polish valve seat (4).



FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING/INSPECTION - CONTINUED			
<u>WARNING</u> Diesel fumes can explode. If welding of fuel tank is necessary, always work in well ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.			
21.	All parts b.	a. Rinse in No. 2 diesel fuel. Wipe dry, with clean, dry rags.	
22.	All parts b. c.	a. Check for cracks. Check for scoring and wear. Check for stripped or gouged threads.	
ASSEMBLY			

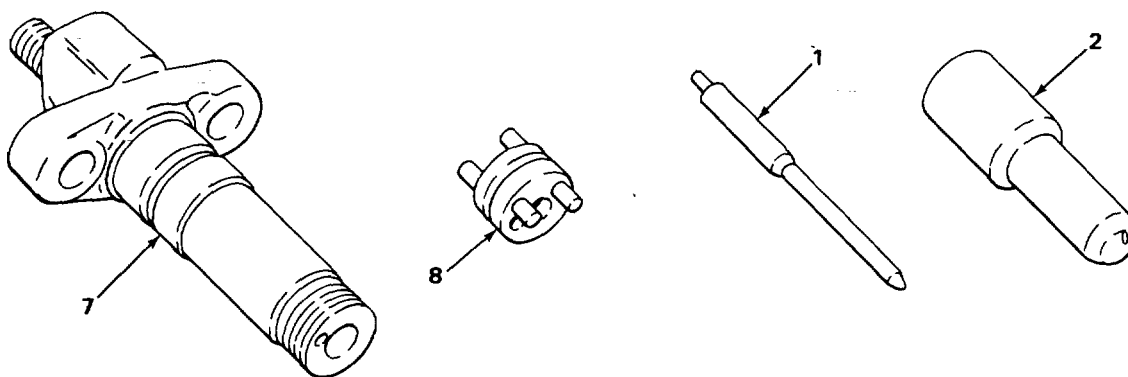
WARNING

Diesel fumes can explode. If welding of fuel tank is necessary, always work in well ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.

CAUTION

The injector is damaged easily, do not clamp directly in vise.

23. Body (7) plate (8), valve (1), and nozzle (2)
- Coat with clean No.2 diesel fuel.
 - Using holding fixture, mount body (7) in vise.



FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

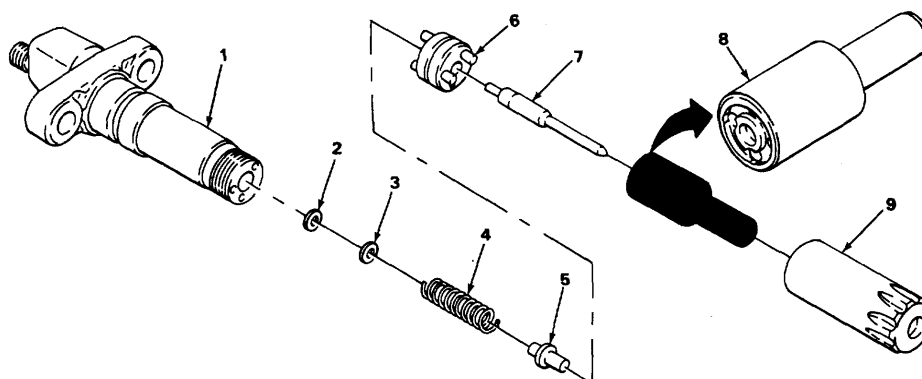
ASSEMBLY - CONTINUED

CAUTION

Parts of the injector are machined and polished, do not scratch with tools. Machined surfaces are damaged easily and will damage other parts.

Be sure parts fit together properly to avoid damage to injector.

24.	Body (1) (3) and spring (4)	Two shims (2) and	Put in.
25	Spring (4) plate (6)	Seat (5) and	Put on.
26	Plate (6) nozzle (8)	Valve (7) and	Put on, and hold.
27	Body (1)	Nut (9) b. c.	a Screw on finger tight. Using 12-point 7/8-inch deep-well socket and torque wrench with 1/2-inch drive, tighten to 45-65 ft-lb (61 - 88 Nm) of torque. Take injector and fixture out of vise.



FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
28.	Injector (10)	a Repeat steps 12 and 13. b. c. d.	If opening pressure is not 2800 + 50 psi (19306 + 344 kPa), repeat steps 14 thru 17 and add or remove adjusting shims to raise or lower opening pressure as needed. If spray pattern is irregular, repeat steps 14 thru 24. If adjustment or cleaning was needed, repeat steps 25 thru 29.

INSTALLATION

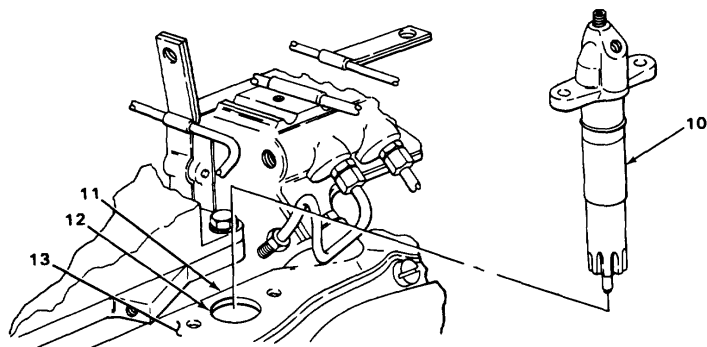
WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to follow these precautions could result in serious Injury or death.

CAUTION

The Injector must seat flush for proper operation. Do not clean mating surfaces with tools.

29.	Cylinder head (11) and mating surface (13)	Injector bore (12)	a Take off rag. b Wipe clean with clean rags dampened with drycleaning solvent.



FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

WARNING

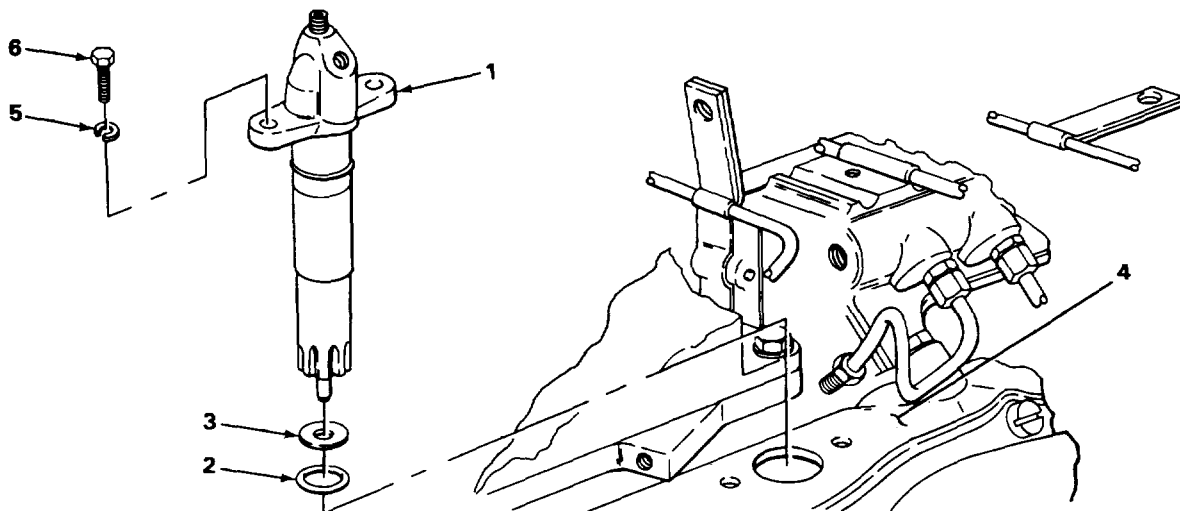
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

30.	Injector (1) and gasket (3)	New packing (2) put on.	Coat with fresh No 2 diesel fuel and

NOTE

If more than one injector is being installed, check fixture number or tag number to ensure injector is installed in original position.

31.	Cylinder head (4)	Injector (1) b.	a. Take out of holding fixture. Put in place.
32.	Injector (1) (5) and screws (6)	Two new lockwashers b. Using 1/2-inch socket and torque	a. Screw in until snug. wrench with 3/8-inch drive, tighten alternately to 15 ft-lb (20 - 34 N m) of torque.

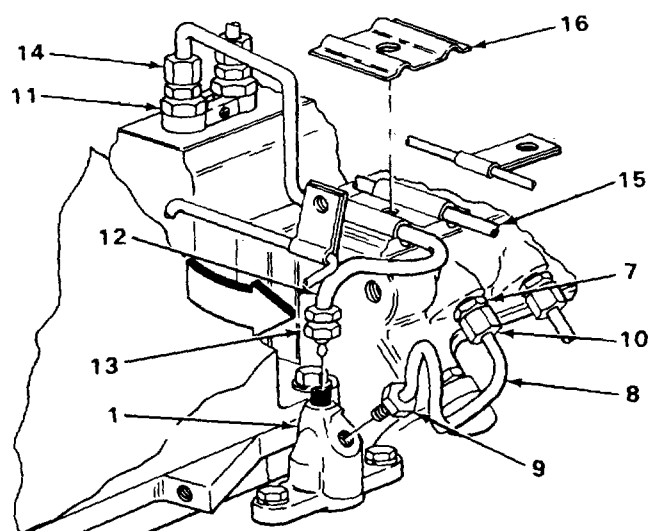


FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
33.	Injector (1) and adapter (7)	Pipe (8) and nuts (9) and (10)	a Take off dust cap. b Screw on, and tighten using 1/2-inch open-end wrench.
34	Injector (1) and retainer (11)	Pipe (12) and nuts (13) and (14)	a Take off dust cap. b Screw on, and tighten using 11/16-inch open-end wrench.
35	Two pipes (12) and (15)	Clamp (16)	Put on.

NOTE

If lines are removed, go to FOLLOW-ON MAINTENANCE (page 2-253).

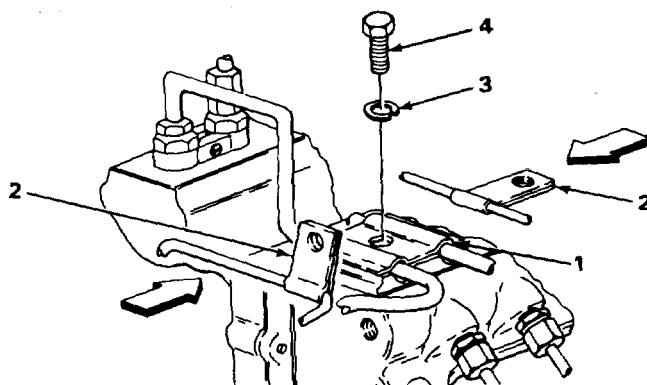


FUEL INJECTORS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

36.	Clamp (1)	Two clamps (2)	Put on.
37.	New lockwasher (3) and screw (4)	Screw In, and tighten using 1/2-inch socket, 3-inch extension and ratchet handle with 3/8-inch drive.	



NOTE

FOLLOW-ON MAINTENANCE:

1	Install fuel return lines (page 2-270).
2	Install fuel supply lines (page 2-259).
3	If engine is installed, start engine (TM 9-2320-269-10) and check that all cylinders fire.
4	Check lines and fittings for proper idle.
5	Shut down engine (TM 9-2320-269-10).
6	If engine is installed, install air cleaner (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238069

FUEL SUPPLY LINES**This task covers:**

- a. Removal (page 2-259) b. Installation c. Cleaning / Inspection (page 2-265)

INITIAL SETUP:**Tools**

Extension, 3/8-inch drive, 3-inch
 Extension, 3/8-inch drive, 10-inch
 Handle, ratchet, 3/8-inch drive
 Pan, drain
 Screwdriver, fiat-tip, 1/4-inch
 Socket, 3/8-inch drive, 1/2-inch
 Socket, 3/8-inch drive, 9/16-inch
 Wrench, crowfoot attachment, 3/8-inch
 drive, 11/16-inch
 Wrench, open-end, 11/16-inch

Materials/Parts

Cap, dust (six required)
 Fuel, diesel, No 2 (item 17, appendix B)
 Lockwasher, clamp (two required)
 Rags, wiping (item 42, appendix B)
 Tag, marking (item 50, appendix B)

Personnel Required

One

Equipment Condition

Air cleaner removed with engine in vehicle
 (TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS

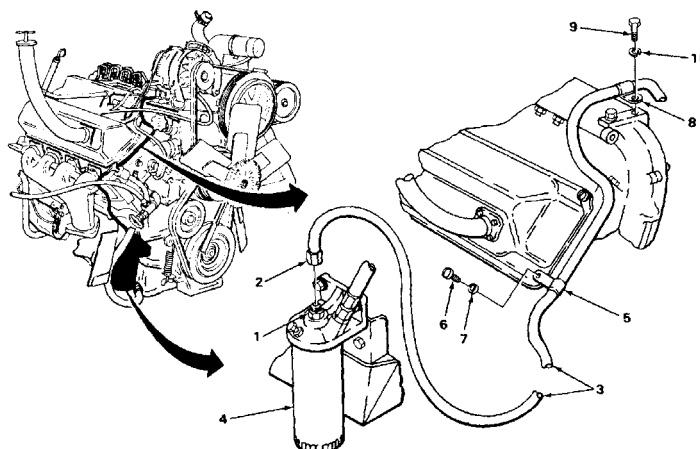
REMOVAL**NOTE**

This procedure is for the fuel supply pump, fuel injection pump, and fuel injector front left side (number one cylinder) supply line. The other seven injector supply lines are removed in a similar way.

2-259

FUEL SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
1. Adapter (1)	Nut (2) and pipe (3) b. c.	a. Put drain pan under filter (4). Using 11/16-inch open-end wrench, unscrew nut (2) and pull pipe (3) free. Get rid of drained fluid (page 2-46).	
2. Clamp (5) spacer (7)	Screw (6) and unscrew and take out.	Using 1/4-inch flat-tip screwdriver,	
3. Clamp (8) lockwasher (10)	Screw (9) and tension, and ratchet handle with 3/8- inch drive, unscrew and take out. b.	a. Using 9/16-inch socket, 3-inch ex- tension, and ratchet handle with 3/8- inch drive, unscrew and take out. Get rid of lockwasher (10).	



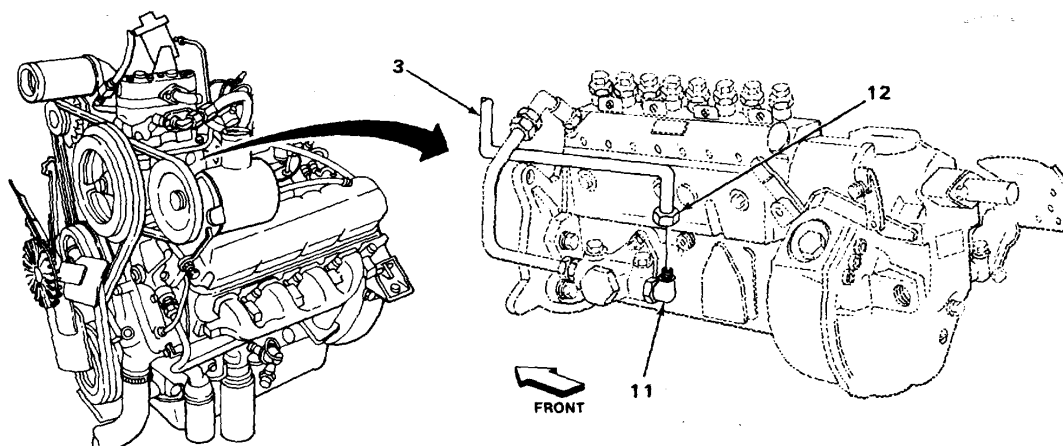
4. Elbow (11) pipe (3)	Nut (12) and inch extension and ratchet handle with b.	a. Using 11116-inch crowfoot wrench, 10- inch extension and ratchet handle with 3/8-inch drive, unscrew. Pull pipe (3) free.	

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FUEL SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

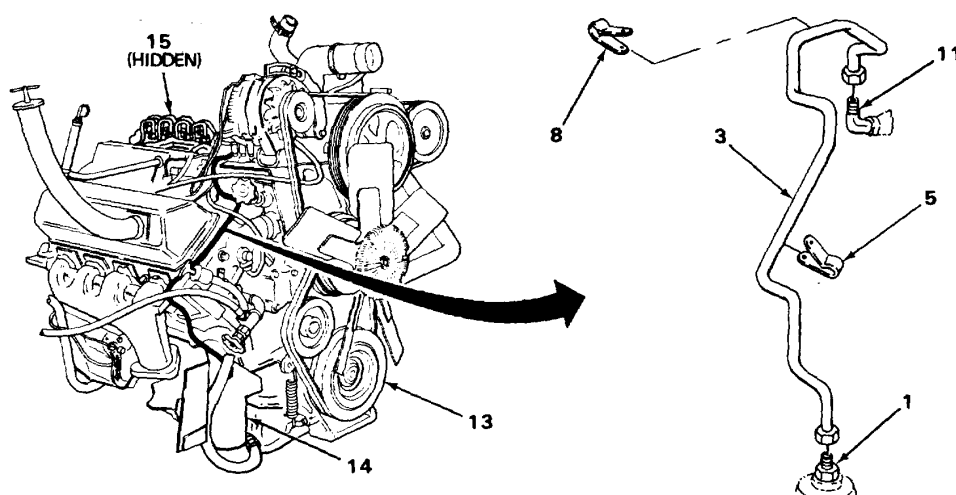
REMOVAL - CONTINUED



5. Engine (13)
6. Pipe (3)
7. Filter (14) and fuel supply pump (15)

- Pipe (3)
- Clamps (5) and (8)
- Adapter (1) and elbow (11)

Take out.
Spread open and take off.
Cover with dust caps.



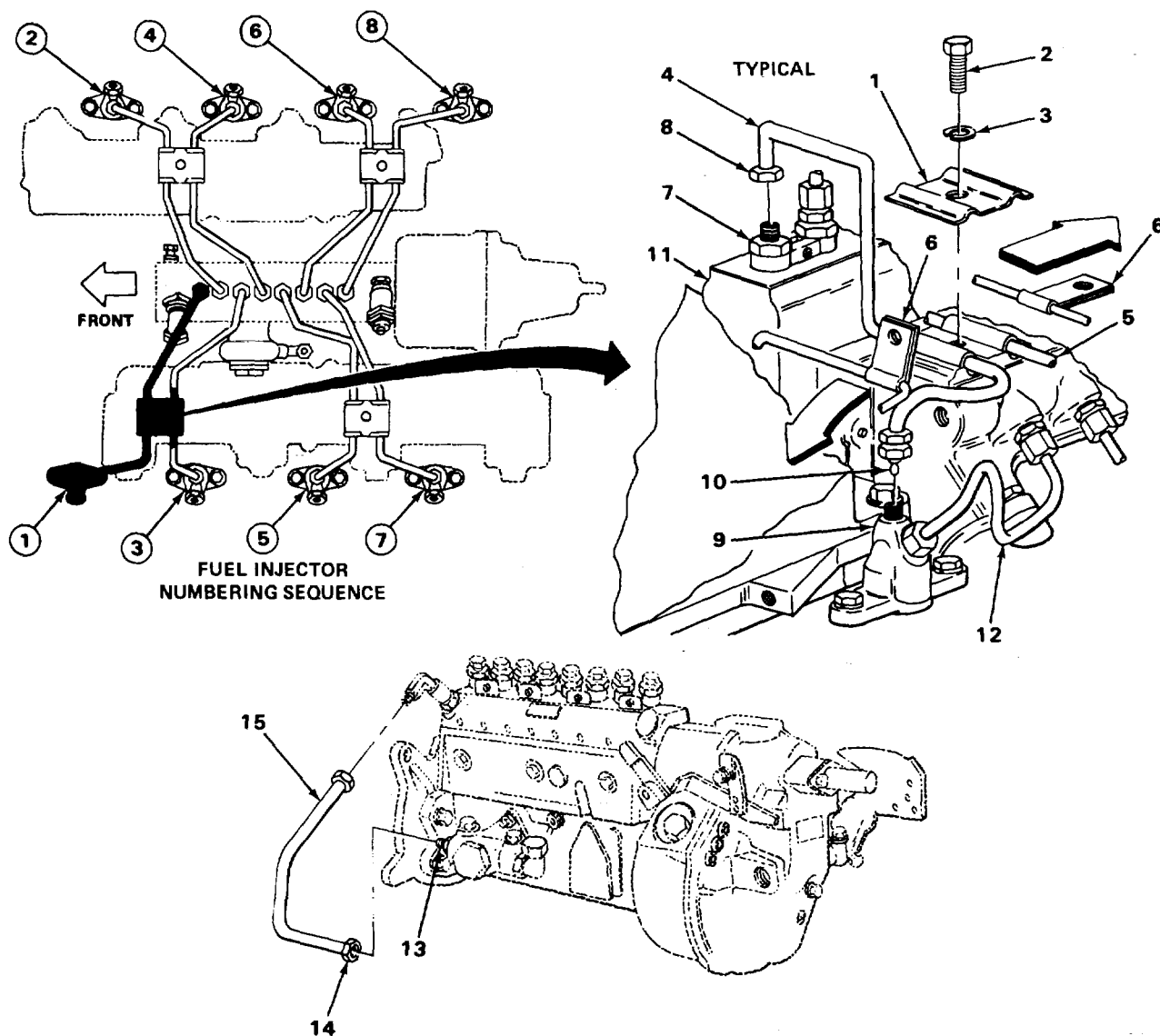
FUEL SUPPLY LINES - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
REMOVAL- CONTINUED				
8	Clamp (1) lockwasher (3)	Screw (2) and tension, and ratchet handle with 3/8- inch drive, unscrew and take out. b	a	Using 112-inch socket, 3-Inch ex- Get rid of lockwasher (3).
9	Two pipes (4) and (5)	Two clamps (6)		Move aside.
NOTE				
If more than one pipe is being removed, tag with injector number.				
10	Clamp (1)	Take off.		
11	Retainer (7) pipe (4)	Nut (8) and screw and pull free.		Using 11/16-inch open-end wrench, un-
12	Injector (9) pipe (4)	Nut (10) and unscrew and pull free. b Take out pipe (4).	a	Using 11/16-inch open-end wrench,
13	Fuel injection pump (11) and cylinder head (12)	Retainer (7) and injector (9)		Cover with dust caps.
14	Engine	Fuel injection pump		Remove (page 2-278).
15	Adapter (13) pipe (15)	Nut (14) and unscrew and pull free.		Using 11116-inch open-end wrench,

FUEL SUPPLY LINES - CONTINUED

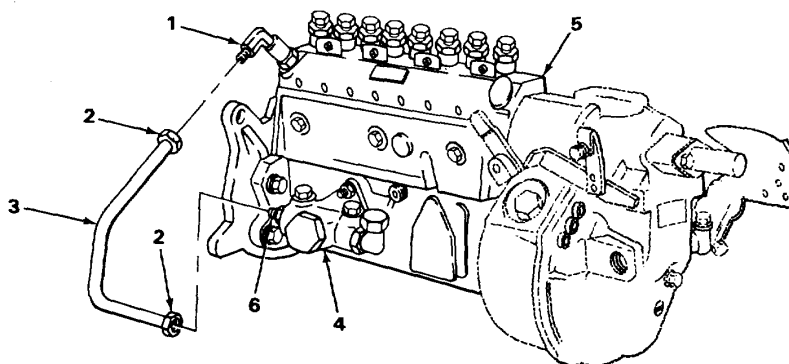
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED



FUEL SUPPLY LINES - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
REMOVAL - CONTINUED				
16	Elbow (1) pipe (3)	Nut (2) and unscrew and pull free.	a	Using 11/16-inch open-end wrench,
17	Fuel supply pump (4) and fuel injection pump (5)	b Adapter (6) and elbow (1)		Take out pipe (3). Cover with dust caps.



CLEANING/INSPECTION

WARNING

Diesel fumes can explode. If welding of fuel tank is necessary, always work in well ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.

NOTE

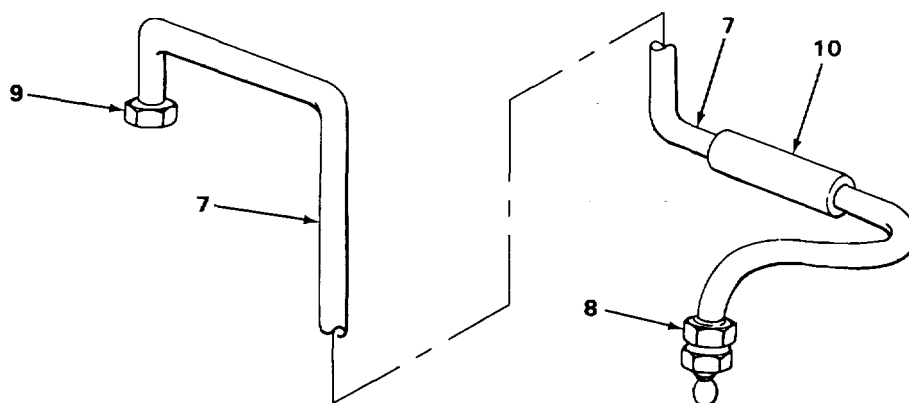
For more information on cleaning and inspecting parts, go to General Maintenance Instructions (page 2-46). Replace damaged parts as necessary.

18	All parts	a Clean with fresh No. 2 diesel fuel. b Wipe dry with clean rags.
19	Pipe (7)	Check for cracks, dents, and pinched areas.
20	Nuts (8) and (9)	a Check for stripped and gouged threads. b Check for rounding off of points.
21	Rubber parts (10)	Check for cracks, brittleness, and wear attns.

FUEL SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING/INSPECTION - CONTINUED



INSTALLATION

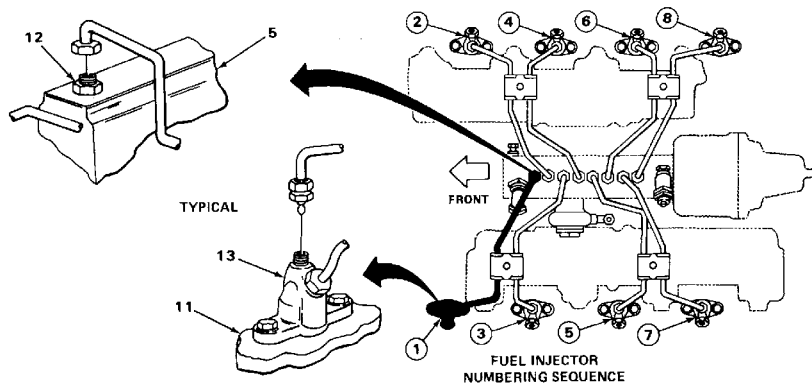
NOTE

If more than one injector line is being installed, check marking from removal and install in original position.

22 Fuel injection pump (5) and cylinder head (11)

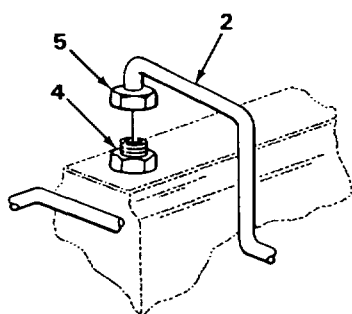
Retainer (12) and injector (13)

Take off dust caps.

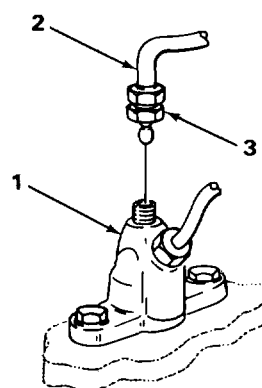


FUEL SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
23	Injector (1)	Pipe (2) and nut (3)	Screw on until snug.
24	Retainer (4) nut (5)	Pipe (2) and	Screw on until sug.
25	Injector (1) and retainer (4)	Two nuts (3) and (5) wrench.	Tighten using 11/16-inch open-end



TYPICAL



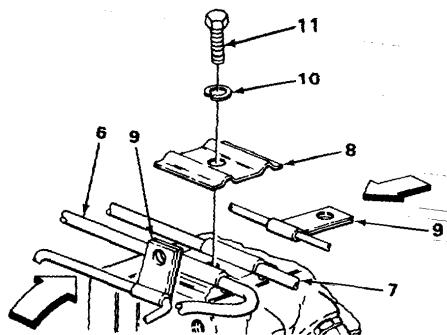
26	Two pipes (6) and (7)	Clamp (8)	Put on.
27	Clamp (8)	Two clamps (9)	Put on.
28	New lockwasher (10) and screw (11)	Screw in, and tighten using 1/2-inch socket, 3-inch extension, and ratchet handle with 3/8-inch drive.	

TA238075

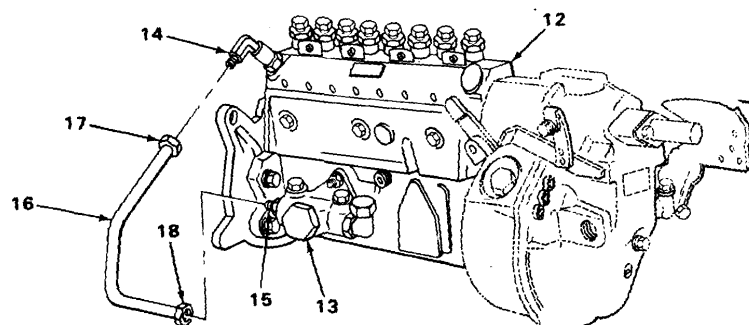
FUEL SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



29	Fuel injection pump (12) and fuel supply pump (13)	Elbow (14) and adapter (15)	Take off dust caps. -
30	Elbow (14) nut (17)	Pipe (16) and	Screw on until snug.
31	Adapter (15) nut (18)	Pipe (16) and	Screw on until snug.
32	Elbow (14) and adapter (15)	Two nuts (17) and (18)	Tighten using 11/16-inch open-end wrench.

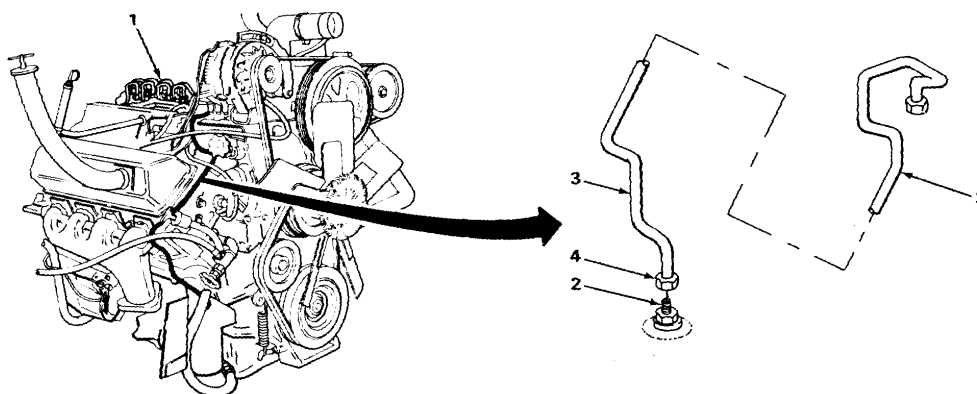


FUEL SUPPLY LINES - CONTINUED

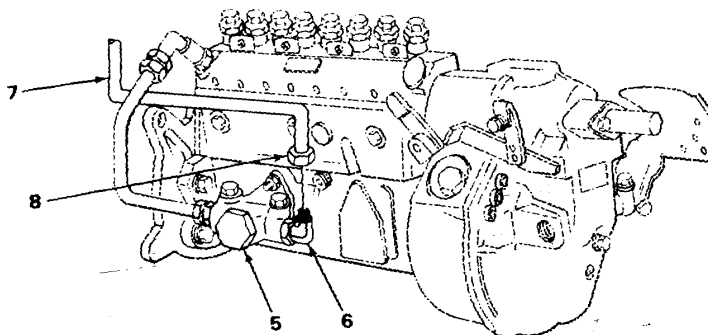
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

33	Engine pump (1)	Fuel injection	Install (page 2-278).
34	Adapter (2)	Take off cap.	
35	Adapter (2) nut (4)	Pipe (3) and	Screw on until snug.

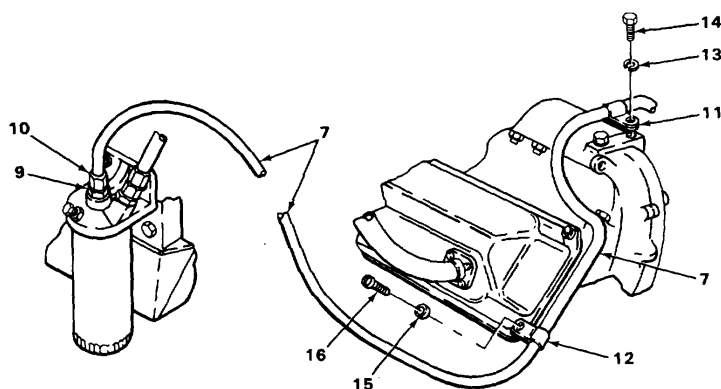


36.	Fuel supply pump (5)	Elbow (6)	Take off dust cap.
37.	Elbow (6) nut (8)	Pipe (7) and crowfoot wrench, 10-inch extension, and ratchet handle with 3/8-inch drive.	Screw on, and tighten using 11/16-inch



FUEL SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
38	Adapter (9)	Nut (10) wrench.	Tighten using 11/16-inch open-end
39	Pipe (7) and (12)	Two clamps (11)	Put on, and slide into place.
40	Clamp (11) (13) and screw (14)	New lockwasher inch socket, 3-inch extension and ratchet handle with 3/8-inch drive.	Screw in, and tighten using 9/16-inch
41	Clamp (12) screw (16)	Spacer (15) and flat-tip screwdriver.	Screw in, and tighten using 1/4-inch

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Start engine (TM 9-2320-269-10), and check lines for leaks if in vehicle.
2. Shut down engine (TM 9-2320-269-10) 2-269
3. Install air cleaner (TM 9-2320-269-20-1) if in vehicle.
4. Close left side hood panel (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238078

FUEL RETURN LINES**This task covers:**

a. Removal	c. Inspection	e. Pre-Load Check of Bearing
b. Disassembly	d. Reassembly	f. Installation

INITIAL SETUP:**Tools**

Handle, ratchet, 318-inch drive
 Socket, 3/8-inch drive, 9/16-inch
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 11/2-inch
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 5/8-inch
 Wrench, open-end, 11/16-inch
 (two required)
 Wrench, open-end, 3/4-inch

Materials/Parts

Cap, dust (two required for each
 line being removed)
 Fuel, diesel, No. 2 (item 17,
 appendix B)
 Lockwasher

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
 Tag, marking (item 50, appendix B)

Personnel Required

One

Equipment Condition

Air cleaner removed if engine is installed
 (TM 9-2320-269-201).
 Left side hood panel raised for removal
 of left cylinder injector lines
 (TM 92320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS

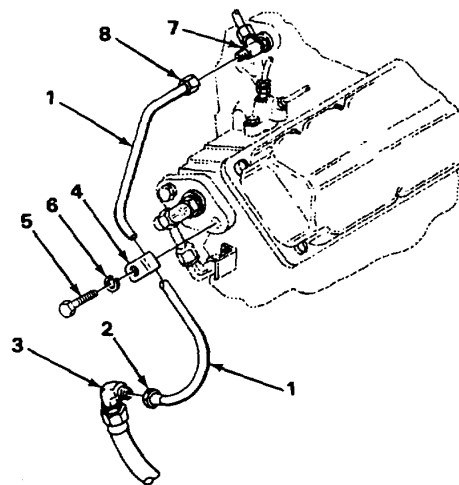
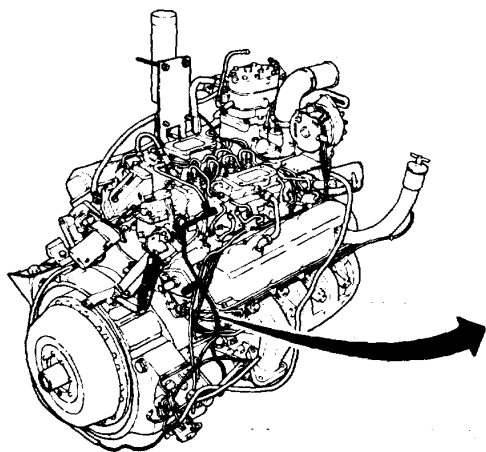
REMOVAL**NOTE**

These procedures are for the removal, cleaning, inspection, and installation of the fuel tank, Injection pump, manifold return lines and right-rear (number eight cylinder) Injector leak-off line. The other seven injector lines are replaced in a similar way.

If the engine has been removed, skip step 1.

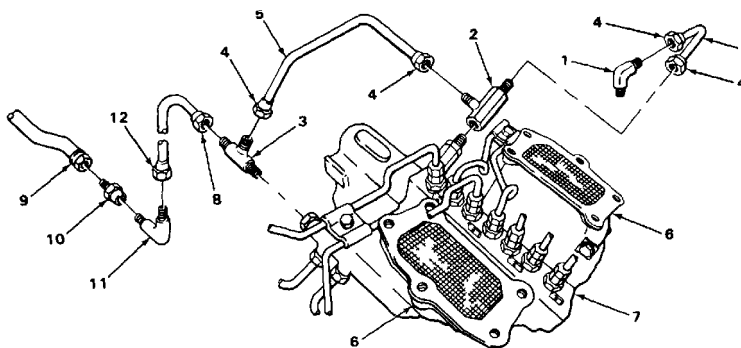
FUEL RETURN LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
1. Pipe (1) and elbow (3)	Nut (2) end wrenches, unscrew and take off. b.	a. Using 9/16-inch and 5/8-inch open- end wrenches, unscrew and take off. b. Cover elbow (3) with dust cap.	
2. Clamp (4) lockwasher (6)	Screw (5) and handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (6).	a. Using 9/16-inch socket and ratchet take out. b. Get rid of lockwasher (6).	
3. Pipe (1)	Clamp (4)	Spread open, and take off.	
4. Fitting (7) pipe (1)	Nut (8) and unscrew nut (8). b. c.	a. Using 5/8-inch open-end wrench, Pull pipe (1) free and take out. Cover fitting (7) with dust cap.	



FUEL RETURN LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
5	Fittings (1), (2), or (3)	Four nuts (4) and two pipes (5) b. c.	a. Using 5/8-inch open-end wrench, unscrew nuts (4). Pull pipe (5) free, and take out. Tag pipes (5).
6	Fittings (1), (2), or (3)	If not being removed, cover with dust caps.	
7	Two manifolds (6) or pump (7)	Fittings (1), (2), or (3) b. c. d.	a. Using 7/16-inch open-end wrench, unscrew and take out fitting (1). Using 11/16-inch open-end and 3/4-inch wrenches, unscrew and take out fitting (2). Using 5/8-inch open-end wrench, unscrew nut (8) if needed. Using 9/16-inch and 11/16-inch open-end wrenches, unscrew and take out fitting (3).
8	Hose (9) elbow (11)	Coupling (10) and wrenches, unscrew hose (9) from b. c.	a. Using two 11/16-inch open-end coupling (10) and take off if in vehicle. Using 9/16-inch and 5/8-inch open-end wrenches, unscrew nut (12). Using 9/16-inch and 11/16-inch open-end wrenches, unscrew and take apart coupling (10) from elbow (11).



FUEL RETURN LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
NOTE			
If more than one injector leak-off line is being removed, tag with injector number to aid installation.			
9	Injector (13)	Nut (14) unscrew.	Using 1/2-inch open-end wrench,
10	Adapter (15) pipe (17)	Nut (16) and unscrew nut (16). b	a Using 1/2-inch open-end wrench, Pull pipe (17) free, and take out.
11	Manifold (18)	Adapter (15) and take out.	Using 1/2-inch open-end wrench, unscrew

CLEANING/INSPECTION

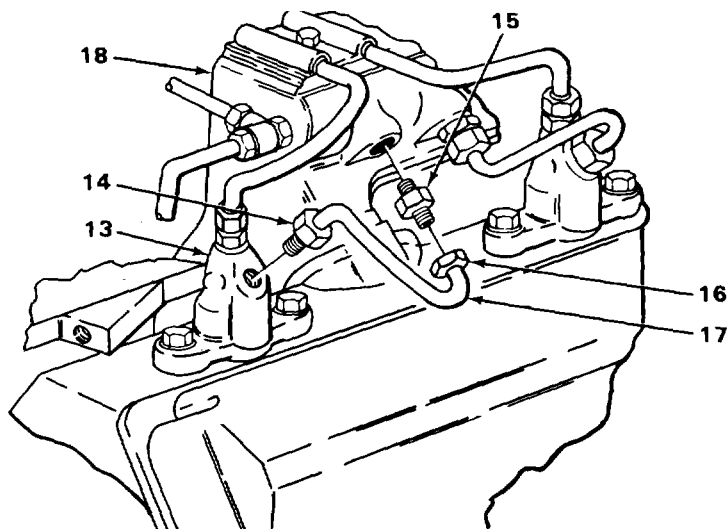
WARNING

Diesel fumes can explode. If welding of fuel tank is necessary, always work in well ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.

NOTE

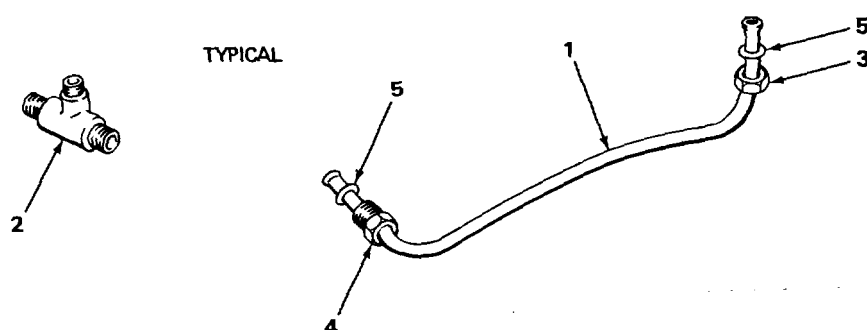
For more information on cleaning and inspecting parts, go to General Maintenance Instructions (page 2-46).

12. All parts
- Clean with fresh No. 2. Diesel fuel.
 - Wipe dry with clean rags.



FUEL RETURN LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING/INSPECTION - CONTINUED			
13	Pipe (1) and fittings (2)	Check for cracks, dents, and pinched areas.	
14	Nuts (3) and (4)	a. Check for stripped and gouged threads. b. Check for rounding off of points.	
15	Rubber parts (5)	Check for cracks, brittleness, and wear patterns.	



INSTALLATION

NOTE

If more than one injector leak-off line is being installed, check tag marks from removal and replace in original position.

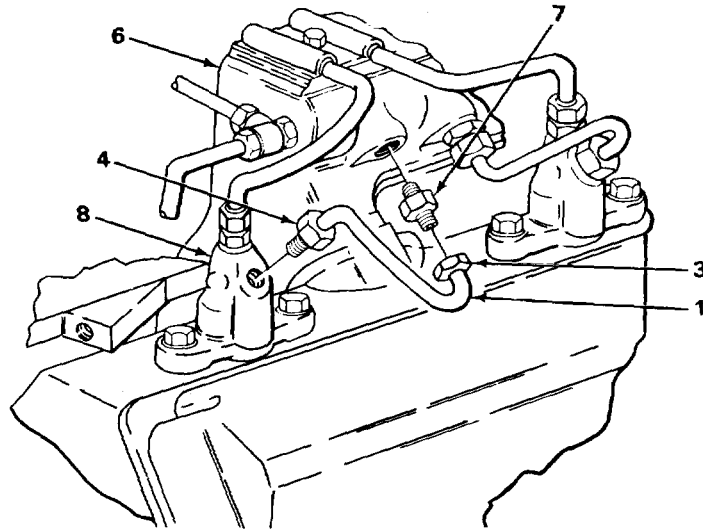
16	Manifold (6)	Adapter (7) open-end wrench.	Screw in, and tighten using 1/2-inch
17	Adapter (7) nut (3)	Pipe (1) and	Screw on finger tight.
18	Injector (8) nut (4) 1/2-inch open-end wrench.	Pipe (1) and b. Screw in nut (4), and tighten using	a. Seat pipe (1) into injector (8).
19	Adapter (7)	Nut (3)	Tighten using 11/2-inch open-end wrench.

FUEL RETURN LINES - CONTINUED

TM 55-1905-220-14-8

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



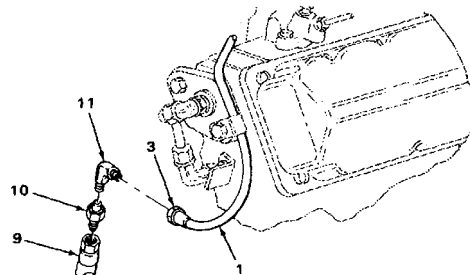
20 Hose (9)
elbow (11)

Coupling (10) and
and tighten using 9/16-inch and 11/16-

a Screw coupling (10) into elbow (11),
inch open-end wrenches.

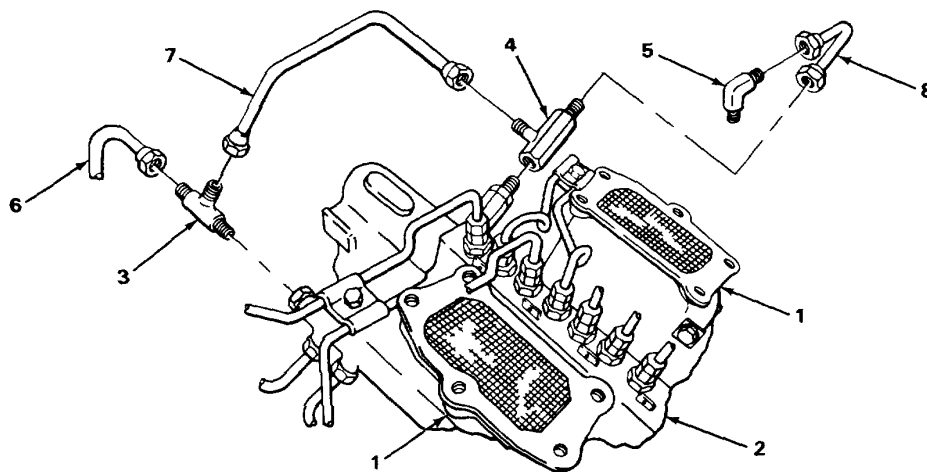
b. Using 9/16-inch and 5/8-inch open-
end wrenches, seat pipe (1) into
elbow (11), and screw on and tighten
nut (3) if pipe (1) was not removed.

c Using two 11/16-inch open-end
wrenches if in vehicle, screw coupling
(10) into hose (9) and tighten.



FUEL RETURN LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
21	Two manifolds (1) and pump (2)	Fittings (3), (4) and (5)	a Screw in fitting (3), and tighten using 9/16-inch and 11/16-inch open-end wrenches. b Screw in fitting (4), and tighten using 11/16-inch and 3/4-inch open-end wrenches. c Screw in fitting (5), and tighten using 7/16-inch open-end wrench.
22	Fitting (3) and (7)	Two pipes (6) open-end wrench.	Screw on, and tighten using 5/8-inch
23	Fitting (4)	Pipe (7) b	a Take off dust caps if in place. Screw on, and tighten using 5/8-inch open-end wrench.
24	Fittings (4) and (5)	Pipe (8)	Screw on, and tighten using 5/8-inch open-end wrench.



25	Fitting (9) nut (11)	Pipe (10) and	Screw on until snug.

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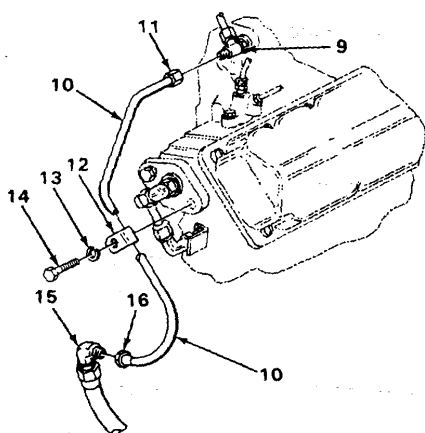
FUEL RETURN LINES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
26	Pipe (10)	Clamp (12)	Put on, and press together.
27	Clamp (12) and screw (14)	New lockwasher (13) 9/16-inch socket and ratchet handle with 3/8-inch drive.	Screw in, and tighten using
28	Fitting (9)	Nut (11)	Tighten using 5/8-inch open-end wrench.

NOTE

If the engine is not in the vehicle, go to FOLLOW-ON MAINTENANCE.

29	Hose and elbow (15)	Pipe (10) and nut (16)	Screw on, and tighten using 9/16-inch and 5/8-inch open-end wrenches.

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Start engine (TM 9-2320-269-10) and check for leaks if in vehicle.
2. Shut down engine (TM 9-2320-269-10).
3. Install air cleaner (TM 9-2320-269-20-1) if in vehicle.
4. Close left side hood panel (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238085

FUEL INJECTION PUMP

This task covers:

a. Removal (page 2-279)	e. Assembly (page 2-297)
b. Disassembly (page 2-284)	f. Adjustment (page 2-308)
c. Cleaning (page 2-294)	g. Installation (page 2-311)
d. Inspection/Replacement/Repair (page 2-295)	
-

INITIAL SETUP

Tools

Adapter kit, fuel injection pump,
 International Harvester
 Bit, hex key, 3/8-inch drive, 6-mm
 Bit, hex key, 3/8-inch drive, 10-mm
 Bit, screwdriver, flat-tip, 3/8-inch
 drive, 5/16-inch
 Brush, wire
 Cap, vise jaw
 Extension, 3/8-inch drive, 6-inch
 Face, inserted hammer, medium-plastic
 Gage, camshaft protrusion
 Handle, hinged, 3/8-inch drive
 Handle, ratchet, 3/8-inch drive
 Holder, camshaft
 Holder, inserted hammer-face
 Holder, tappet, pump (eight required)
 Holding fixture
 Indicator, dial
 Knife, putty
 Micrometer, depth
 Pliers, diagonal cutting
 Press, arbor, hand-operated
 Puller, mechanical
 Remover and installer, barrel plunger
 Remover and installer, tappet
 Screwdriver, flat-tip, 11/8-inch
 Screwdriver, flat-tip, 3/16-inch

Tools - Continued

Screwdriver, 1/4-inch
 Screwdriver, 3/8-inch
 Socket, 3/8-inch drive, 9/16-inch
 Socket, 3/8-inch drive, 11/16-inch
 Socket, 3/8-inch drive, 10-mm
 Socket, 3/8-inch drive, 22-mm
 Socket, deep well, 3/8-inch drive, 7/8-inch
 Socket, deep well, 3/8-inch drive, 22-mm
 Tester, fuel-injection pump
 Universal joint, socket-wrench, 3/8-inch
 drive, 9/16-inch
 Vise, machinist's
 Wrench, crowfoot attachment, 19-mm
 Wrench, holder, pump drive-flange
 Wrench, open-end, 3/8-inch (two required)
 Wrench, open-end, 7/16-inch (two required)
 Wrench, open-end, 1/2-inch
 Wrench, open-end, 5/8-inch
 Wrench, open-end, 11/16-inch
 Wrench, open-end, 8-mm (two required)
 Wrench, open-end, 10-mm
 Wrench, open-end, 11-mm
 Wrench, open-end, 19-mm
 Wrench, open-end, 22-mm
 Wrench, torque, 3/8-inch drive
 0 - 150 in-lb capacity

FUEL INJECTION PUMP - CONTINUED**INITIAL SETUP - CONTINUED****Materials/Parts**

Compound, sealing, nonhardening
(item 13, appendix B)
Crocus cloth (item 7, appendix B)
Element, fuel filter (eight required)
Fuel, diesel, No.2
(item 17, appendix B)
Gasket, bushing, oil inlet
Gasket, bolt, cover (three required)
Gasket, copper
Gasket, supply pump
Gasket, valve, fuel (eight required)
Gasket, valve, overflow
Gasket, valve retainer (eight required)
Locknut, 3/8-inch (two required)
Lockwasher, governor strap bracket
Lockwasher, governor strap
Lockwasher, support and pump
Lockwasher, clamp and strap (two required)
Lockwasher, brace and pump (two required)
Lockwasher, pump to manifold (two required)
Lockwasher, pump to crankcase (two required)
Lockwasher, supply pump to pump (three required)
Lockwasher, pump adapter to pump (four required)
Lockwasher, bracket to pump (two required)
Lockwasher, camshaft nut
Lockwasher, coupling to pump (four required)
Lockwasher, bearing retainer (four required)
Lockwasher, bracket bolt
Packing, bearing retainer
Pins, cotter
Rags, wiping (item 42, appendix B)
Shims, camshaft bearing
Washer (two required)

Personnel Required

One

Equipment Condition

Air cleaner removed (TM 9-2320-269-20-1).
Fuel supply lines removed (page 2-259).
Fuel return lines removed (page 2-270).
Engine cover removed
(TM 9-2320-269-20-2).
Transmission cover removed
(TM 9-2320-269-20-2).

LOCATION	ITEM	ACTION	REMARKS

REMOVAL**NOTE**

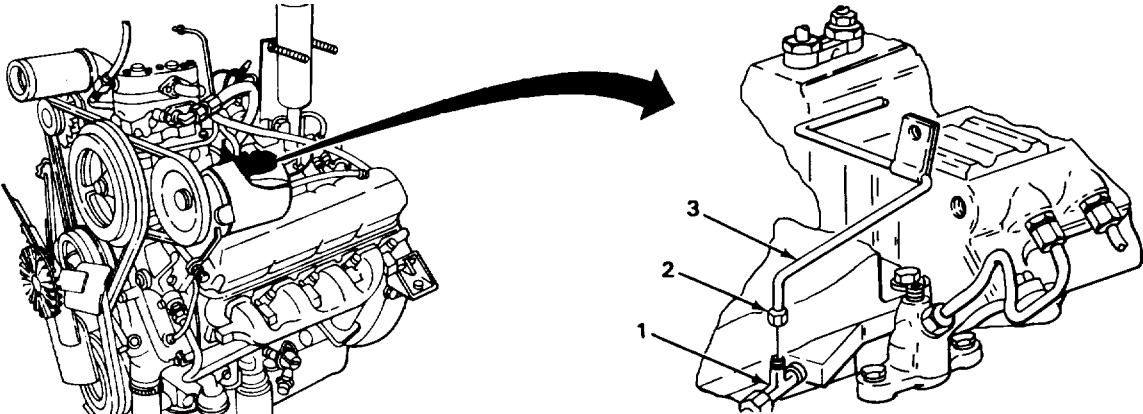
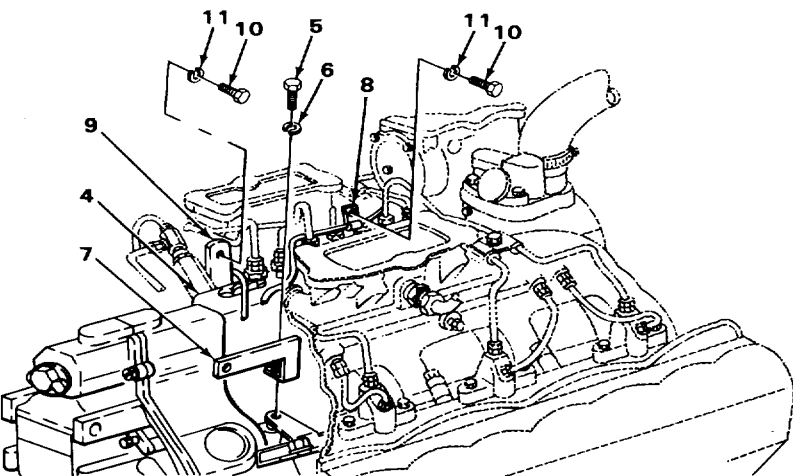
If engine has been removed from vehicle, skip steps 1 thru 14 and begin removal at step 15.

FUEL INJECTION PUMP - CONTINUED

TM 55-1905-220-14-8

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
1. Adapter (1)	Cable (2)	Unscrew and take out.	
2. Screw (3) chain (5)	Locknut (4) and wrenches, unscrew and take off. b.	a. Using two 3/8-inch open-end Get rid of locknut (4).	
3. Cable (6) clip (8)	Screw (7) and unscrew and take out screw (7). b.	a. Using 1/4-inch flat-tip screwdriver, Take off clip (8).	
4. Screw (9)	Nut (10) 3/8-inch open-end wrench, unscrew part way.	Using 1/4-inch flat-tip screwdriver and 3/8-inch open-end wrench, unscrew part way.	
5. Bracket (11)	Cable (6)	Take out.	
6. Screw (12) washer (14)	Nut (13) and unscrew and take off.	Using two 7/16-inch open-end wrenches,	
7. Governor lever(15) screw (12)	Bracket (16) and b. Take out screw (12).	a. Takeoff bracket (16).	
8. Ball joint (17)	Nut (18) wrenches, unscrew and take off.	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take off.	
9. Governor lever (15) and washer (19)	Ball joint (17)	Take out.	
10. Screw (20) lockwasher (22)	Nut (21) and wrenches, unscrew and take off. b.	a. Using two 7/16-inch open-end Get rid of lockwasher (22).	
11. Bracket (23) cable (24)	Screw (20) and	Take out.	
12. Governor lever (15)	Two springs (25)	Take out.	
13. Clevis (26)	Cotter pin (27) b.	a. Using diagonal cutting pliers, take out. Get rid of.	
14. Governor lever (15)	Clevis (26)	Take out.	

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
16.	Fitting (1) pipe (3) and pull free.	Nut (2) and	Using 1/2-inch open-end wrench, unscrew
			
17.	Fuel injection pump (4)	Screw (5), lock- washer (6), and support (7)	a. Using 9/16-inch socket, 6-inch exten- sion, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (6).
18.	Clamp (8) and strap (9)	Two screws (10) and lockwashers (11)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (11).
			
19.	Brace (12)	Two screws (13), lockwashers (14), and four washers (15)	a. Using 9/16-inch socket, 6-inch exten- sion, and ratchet handle with 3/8- inch drive, unscrew and take out.

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

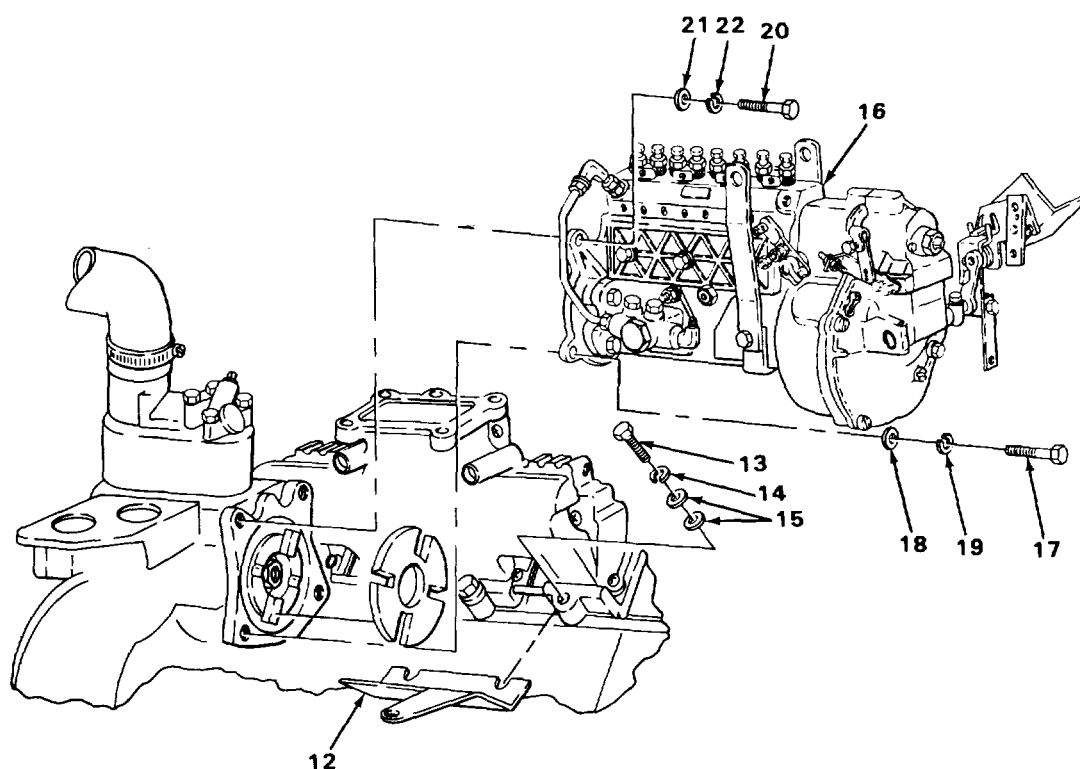
REMOVAL - CONTINUED

19.	Continued	b.	Get rid of lockwashers (14).
20.	Fuel injection pump (16)	Brace (12)	Take out.

CAUTION

Before removing fuel injection pump, wipe pump and crankcase cover clean with clean No. 2 diesel fuel and rags to avoid getting dirt into crankcase which may damage engine.

21.	Two screws (17), washers (18), and lockwashers (19)	a. Using 9/16-inch hinged socket, 6-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (19).
22.	Two screws (20), washers (21), and lockwashers (22)	a. Using 9/16-inch universal joint socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (22).

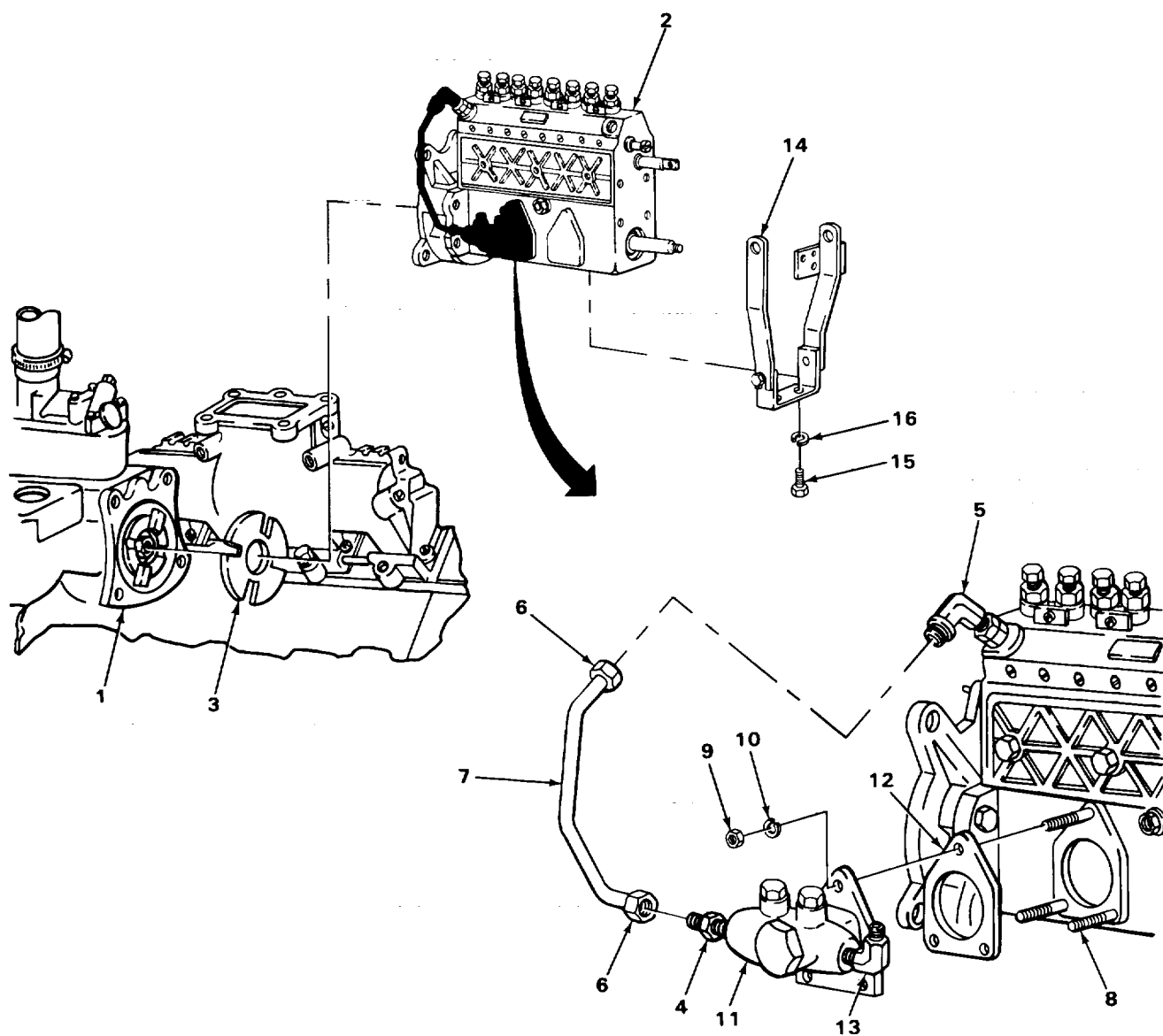


FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
23. Crankcase cover (1)	Fuel injection pump (2) and drive disc (3)	a. Pull free and take out. It may be necessary to tap pump with plastic-face hammer. b. Set disc (3) aside.
DISASSEMBLY		
24. Adapter (4) and elbow (5)	Two nuts (6)	Using 11/16-inch open-end wrench, unscrew and take off.
25.	Pipe (7)	Pull free and take out.
26. Three studs (8)	Three nuts (9), lockwashers (10), and supply pump (11)	a. Using 10-mm open-end wrench, unscrew and take off. b. Get rid of lockwashers (10). c. Take off pump (11).
27.	Gasket (12)	a. Using putty knife, take off. b. Get rid of.
28. Supply pump (11)	Adapter (4)	a. Put pump (11) in vise with jaw caps. b. Using 11/16-inch open-end wrench, unscrew and take out.
29.	Elbow (13)	a. Using 5/8-inch open-end wrench, unscrew and take out. b. Take pump (11) out of vise.
30. Bracket (14)	Two screws (15) and lockwashers (16)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (16).
31. Fuel injection pump (2)	Bracket (14)	Take off.

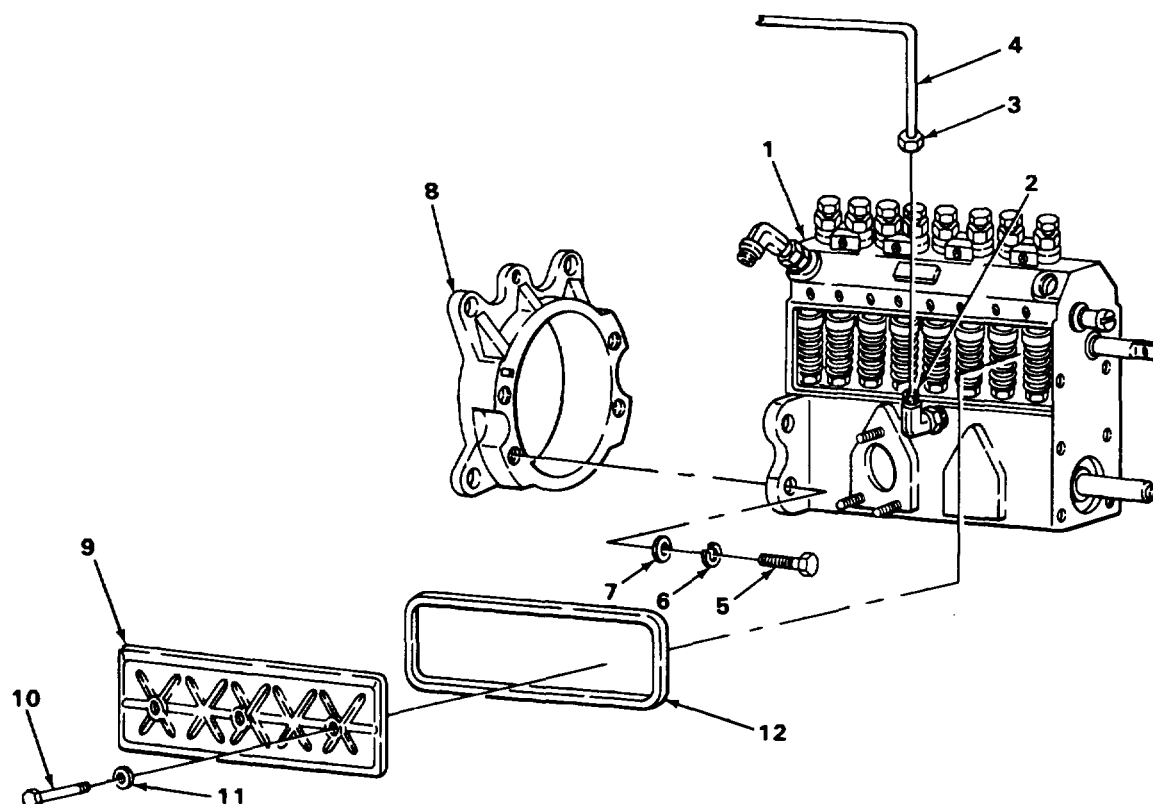
FUEL INJECTION PUMP - CONTINUED

DISASSEMBLY - CONTINUED



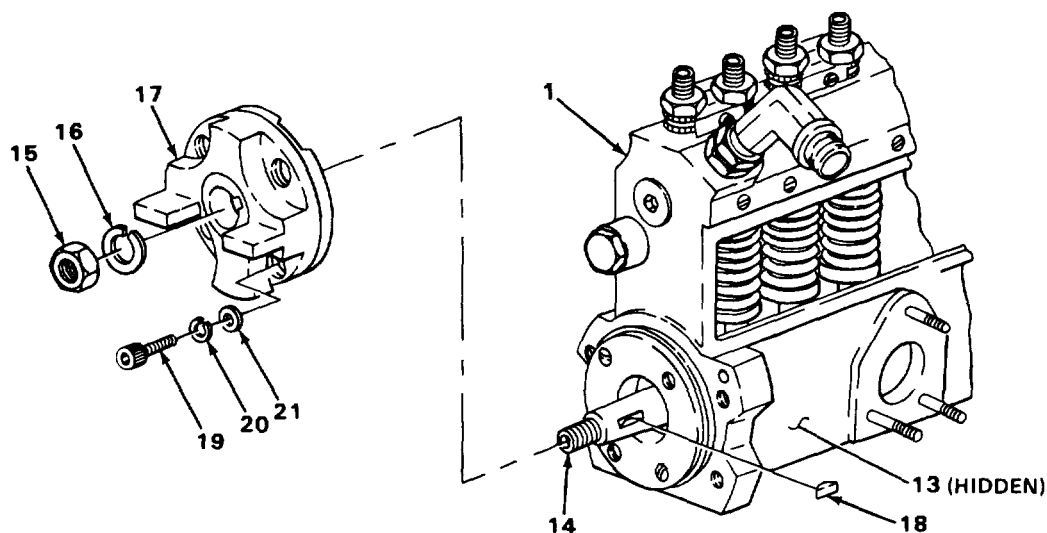
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
32. Fuel injection pump (1)	Governor	Disassemble (page 2-334).	
33. Elbow (2)	Nut (3) and pipe (4)	a. Using 1/2-inch open-end wrench, unscrew nut (3). b. Take out pipe (4).	
34. Fuel injection pump (1)	Four screws (5), lockwashers (6), and washers (7)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (6).	
35.	Injection pump adapter (8)	Using plastic-face hammer, tap to loosen and take off.	
36. Side cover (9)	Three screws (10) and washers (11)	Using 10-mm socket and ratchet handle with 3/8-inch drive, unscrew and take out.	
37. Fuel injection pump (1)	Side cover (9) and gasket (12)	a. Take off. b. Get rid of gasket (12).	



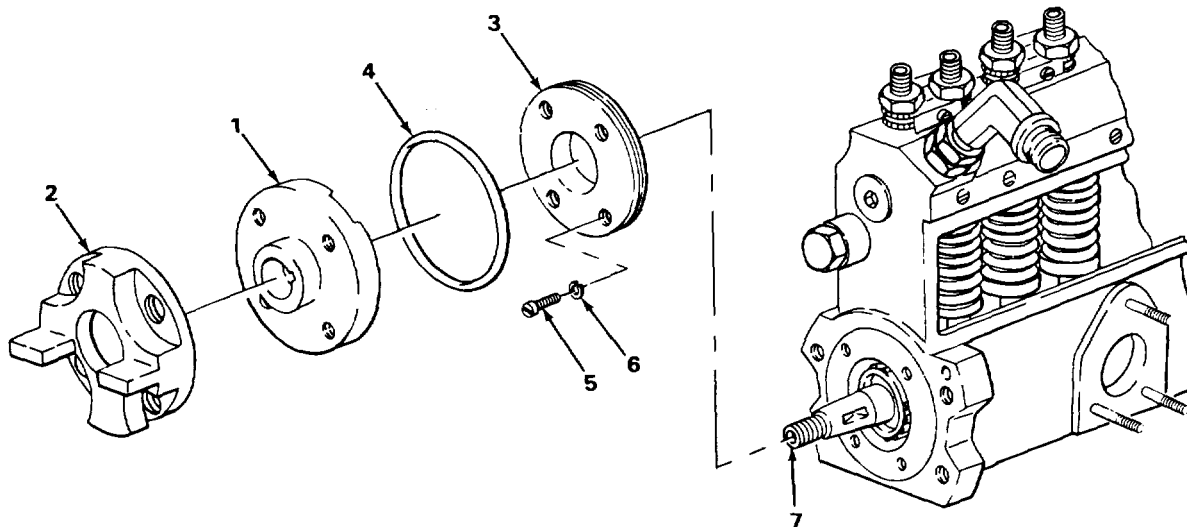
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
38. Fuel injection pump (1)	Eight lifter sleeves (13)	a. Using drive flange holding wrench, turn camshaft (14) to raise one sleeve (13). b. Put in tappet holder. c. Repeat for remaining sleeves (13).	
CAUTION			
Many of the screws used in the fuel injection pump are torqued or held with sealing compound. Be careful not to damage them when removing.			
39. Camshaft (14)	Nut (15) and lockwasher (16)	a. Using drive flange holding wrench, 22-mm socket, and hinged handle with 3/8-inch drive, unscrew and take off. b. Get rid of lockwasher (16).	
40.	Coupling (17) and woodruff key (18)	a. Using mechanical puller, take off coupling (17). b. Take out key (18).	
41. Coupling (17)	Four screws (19), lockwashers (20), and washers (21)	a. Put coupling (17) in vise with soft jaws. b. Using 6-mm hex key bit and hinged handle with 3/8-inch drive, unscrew and take out. c. Get rid of lockwashers (20). d. Take couplings (17) out of vise.	



FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
42. Coupling plate (1)	Coupling (2)	Take off.	
43. Bearing retainer (3)	Packing (4)	a. Using 1/8-inch flat-tip screwdriver, take out. b. Get rid of.	
44.	Four screws (5) and lockwashers (6)	a. Using 3/8-inch drive 5/16-inch flat-tip screwdriver bit and hinged handle, unscrew and take out. b. Get rid of lockwashers (6).	
45. Camshaft (7)	Bearing retainer (3)	Using mechanical puller, take off.	



46.	Fuel injection pump (8)	a. Loosen holding fixture and turn on side. b. Tighten holding fixture.
47. Fuel injection pump (8)	Two screws (9) and washers (10)	a. Using 3/8-inch drive, 5/16-inch flat-tip screwdriver bit and hinged handle, unscrew and take out. b. Get rid of washers (10).

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

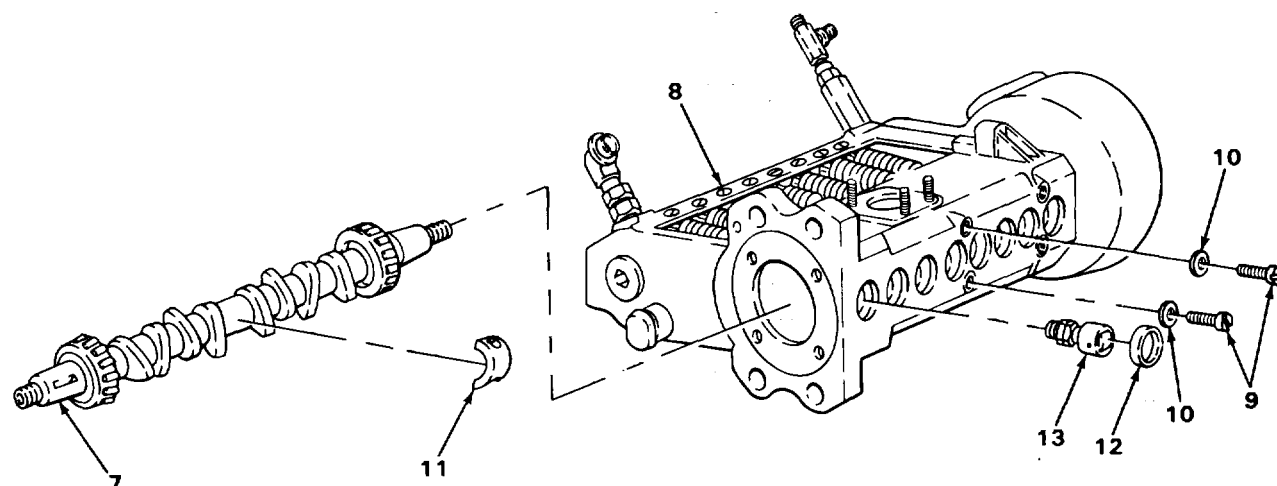
DISASSEMBLY - CONTINUED

CAUTION

Some injection pump parts are machined and highly polished. Do not scratch or hit with tools. Always work on a clean wooden surface.

When removing parts, do not touch machined surfaces. Keep all parts in order to install in original position, and keep wet with clean diesel fuel.

48.	Fuel injection pump (8)	Camshaft (7) and bearing bracket (11)	Take out.
49.	Eight covers (12)		Using 3/8-inch drive 11/16-inch socket and plastic-face hammer, drive into pump (8) and take out.
50.	Eight lifter sleeves (13)		a. Using tappet removing tool, push up one sleeve (13) and take out tappet holding tool. b. Take out sleeve (13). c. Repeat a thru c for remaining sleeves (13).

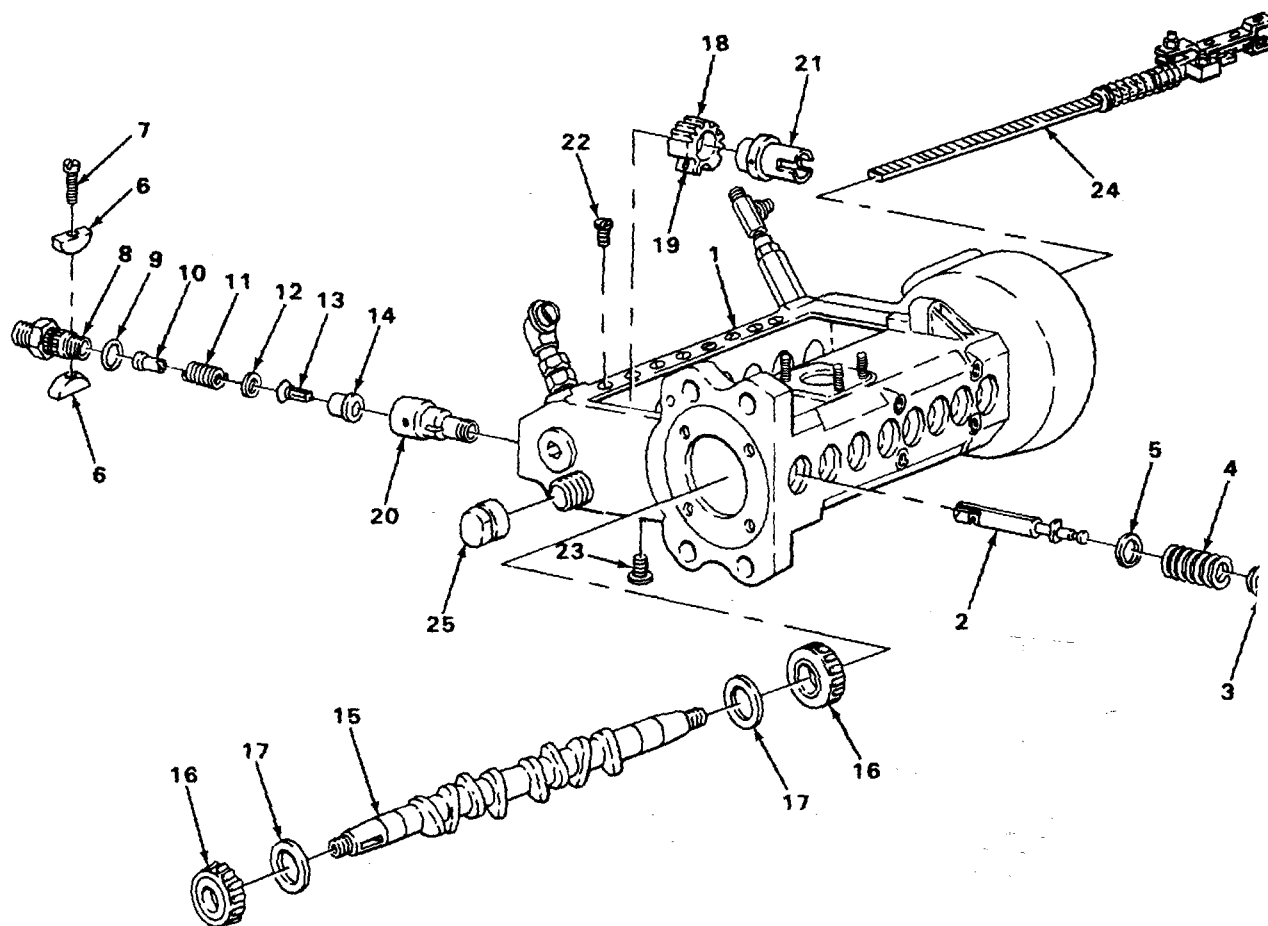


FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED		
51. Fuel injection pump (1)	Eight pistons (2)	Using barrel plunger remover tool, take out.
52.	Eight lower spring seats (3), valve springs (4), and upper spring seats (5)	Take out.
53. Eight clamps (6)	Four screws (7)	Using 3/8-inch flat-tip screwdriver, unscrew and take out.
54. Fuel injection pump (1)	Eight clamps (6)	Take off.
55.	Eight valve retainers (8)	Using 7/8-inch deep socket and hinged handle with 3/8-inch drive, unscrew and take out.
56. Eight valve retainers (8)	Eight retainer gaskets (9)	a. Take off. b. Get rid of.
57. Fuel injection pump (1)	Eight fuel filter elements (10), fuel valve springs (11), gaskets (12), delivery valves (13), and valve bodies (14)	a. Take out. b. Get rid of filter elements (10) and gaskets (12).
58. Camshaft (15)	Two bearings (16) and shims (17)	Using arbor press, press off.
59. Eight valve gears (18)	Eight screws (19)	Using 3/16-inch flat-tip screwdriver unscrew part way.
60. Eight barrels (20)	Eight sleeves (21) and gears (18)	a. Slide out sleeves (21). b. Take out gears (18).
61. Fuel injection pump (1)	Eight screws (22)	Using 3/8-inch drive 5/16-inch flat-tip screwdriver bit and hinged handle, unscrew and take out.
62. Eight barrels (20)	Push out.	

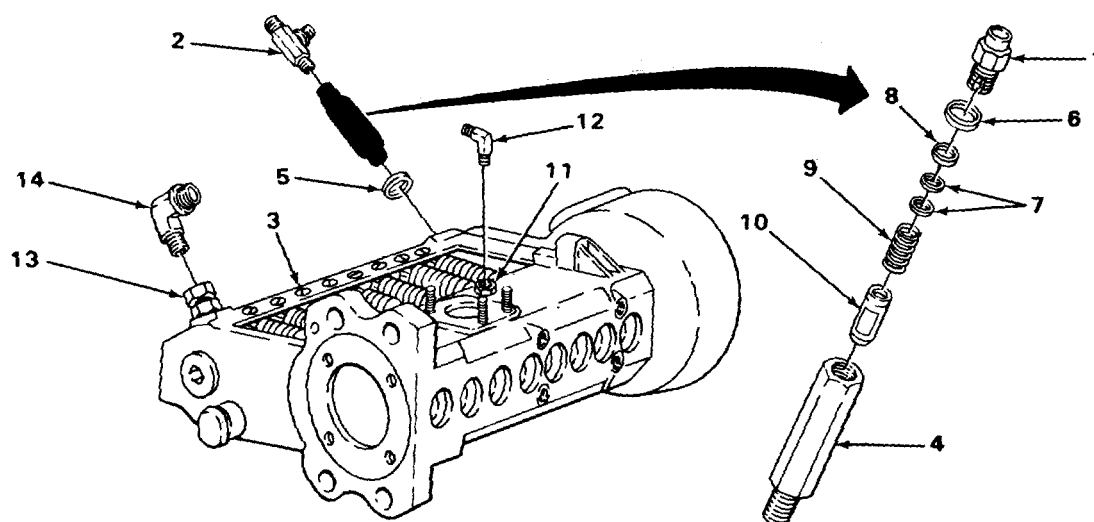
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
63.	Screw (23)	Using 3/8-inch flat-tip screwdriver, unscrew and take out.	
64.	Control rack (24)	Take out.	
65.	Cap (25)	Using 19-mm crowfoot attachment wrench and hinged handle with 3/8-inch drive, unscrew and take out.	



FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
66. Bypass outlet (1)	Elbow (2)	Using 11/16-inch and 19-mm open-end wrenches, unscrew and take out.	
67. Fuel injection pump (3)	Overflow valve (4) and gasket (5)	a. Using 22-mm deep socket and hinged handle with 3/8-inch drive, unscrew and take out. b. Get rid of gasket (5).	
68. Overflow valve (4)	Bypass outlet (1) and gasket (6)	a. Using 19-mm and 22-mm open-end wrenches, unscrew and take off. b. Get rid of gasket (6).	
69.	Three shims (7), washer (8), spring (9), and relief valve (10)	Take out.	
70. Oil inlet bushing (11)	Elbow (12)	Using 1 1/2-inch and 19-mm open-end wrenches, unscrew and take out.	
71. Pump fitting (13)	Elbow (14)	Using 5/8-inch and 19-mm open-end wrenches, unscrew and take out.	



FUEL INJECTION PUMP - CONTINUED

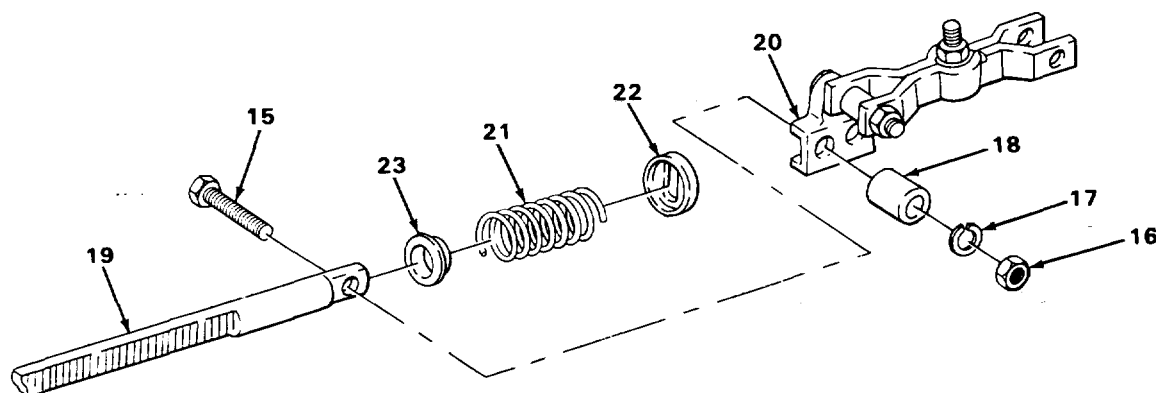
LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

NOTE

If the governor housing has been removed, go to step 76.

72. Bracket bolt (15)	Nut (16), lockwasher (17), and spacer (18)	a. Using two 8-mm open-end wrenches, unscrew and take off. b. Get rid of lockwasher (17).
73. Control rack (19)	Governor bracket (20)	Take off.
74.	Bracket bolt (15)	a. Hold spring (21) down. b. Take out bolt (15).
75.	Spring seat (22), governor spring (21), and spring ring (23)	Take off.



NOTE

The bleeder bushing, oil inlet bushing, pump fitting; and closing cap are held in place with sealing compound. If these parts are not leaking, skip steps 76 thru 79.

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
76.	Fuel injection pump (1)	Bleeder bushing (2)	Using 11-mm open-end wrench, unscrew and take out.
77.		Oil inlet bushing (3) and gasket (4)	a. Using 19-mm open-end wrench, unscrew and take out. b. Get rid of gasket (4).
78.		Pump fitting (5) and gasket (6)	a. Using 19-mm open-end wrench, unscrew and take out. b. Get rid of gasket (6).
79.		Closing cap (7)	Using 10-mm hex key bit and hinged handle, with 3/8-inch drive, unscrew and take out.
80.		Fuel injection pump (1)	Take out of holding fixture.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

Many of the fuel injection pump parts are machined to fit. clean all parts and assemblies separately, and keep fall assemblies together to insure proper placement and operation.

81.	Fuel Injection pump (1)	All gasket surfaces	Using putty knife, clean away old gasket material.
82.		All threaded parts	Using wire brush, clean away old sealing compound.

WARNING

Diesel fumes can explode. If welding of fuel tank is necessary, always work in well-ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.

83.		All parts	a. Wash in clean No. 2 diesel fuel. b. Using clean rags, wipe dry all parts except machined parts.
84.		All bearings	Clean (TM 9-214).

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

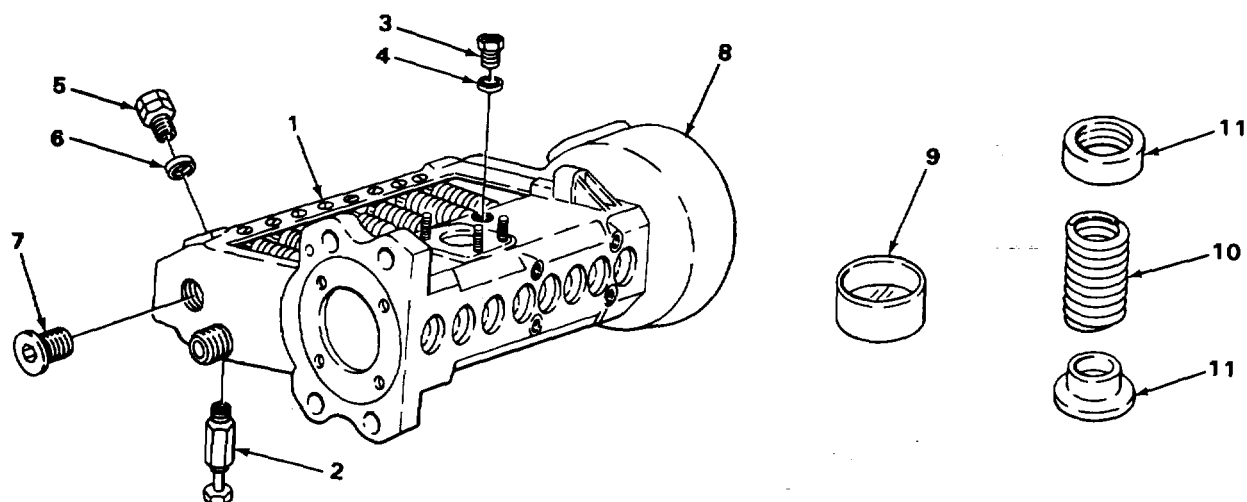
INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

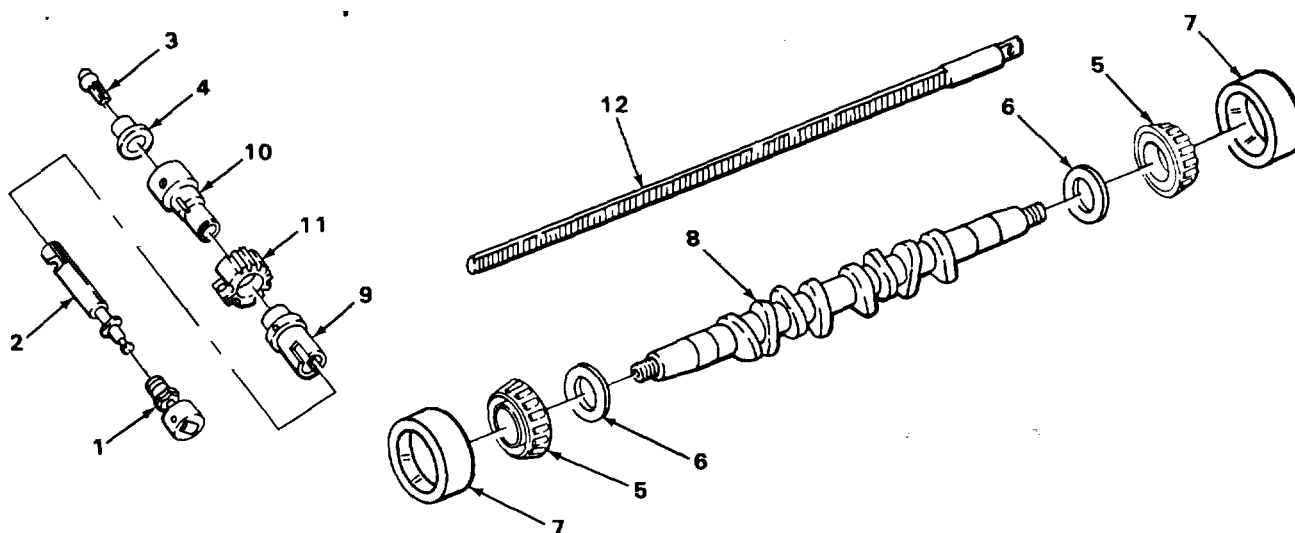
Replace damaged or defective parts as necessary.

85.	All gasket surfaces	a. Look for scratches and chips. b. Smooth with crocus cloth, and clean with No. 2 diesel fuel or replace parts as needed.
86.	All threaded parts	Look for stripped parts.
87. Fuel injection pump (1)	Pump housing (8)	Look for cracks, chips, and stripped threads.
88.	Covers (9)	Look for cracks and dents.
89.	Springs (10)	Look for cracks and rust.
90.	Spring keepers (11)	Look for wear and bends.



FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
91. Fuel injection pump	Barrels (1), pistons (2), delivery valves (3), and bodies (4)	Look for wear and scratches.	
92.	Bearings (5)	Inspect (TM 9-214).	
93.	Shims (6) and races (7)	Look for scratches and cracks. If bearings, races and shims are damaged, replace as sets.	
94.	Camshaft (8)	Look for wear, cracks, and grooves around bearings.	
95.	Control sleeves (9) and lifter sleeves (10)	a. Look for wear and scratches. b. Smooth with crocus cloth, and clean with No. 2 diesel fuel, or replace as needed.	
96.	Valve gears (11) and control rack (12)	a. Look for wear, cracks, and burrs on teeth. b. Smooth with crocus cloth, and clean with No. 2 diesel fuel, or replace as needed.	



FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY

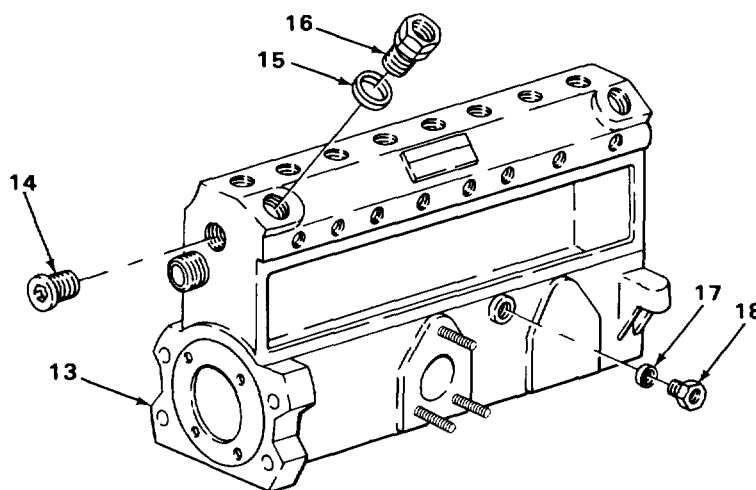
CAUTION

Parts of the fuel injection pump are machined and polished. Do not scratch or hit with tools to insure proper operation and avoid early wear of parts.

NOTE

If the closing cap, pump fitting, oil inlet bushing, or bleeder bushing were not removed, go to step 102.

97.	Fuel injection pump (13)	Mount upright in holding fixture.
98.	Fuel injection pump (13)	Closing cap (14) a. Coat threads with sealing compound. b. Screw in and tighten using 10-mm hex key bit with 3/8-inch drive and ratchet handle.
99.	New gasket (15) and pump fitting (16)	a. Coat threads with sealing compound. b. Screw in and tighten using 19-mm open-end wrench.
100.	New gasket (17) and oil inlet bushing (18)	a. Coat threads with sealing compound. b. Screw in and tighten using 19-mm open-end wrench.



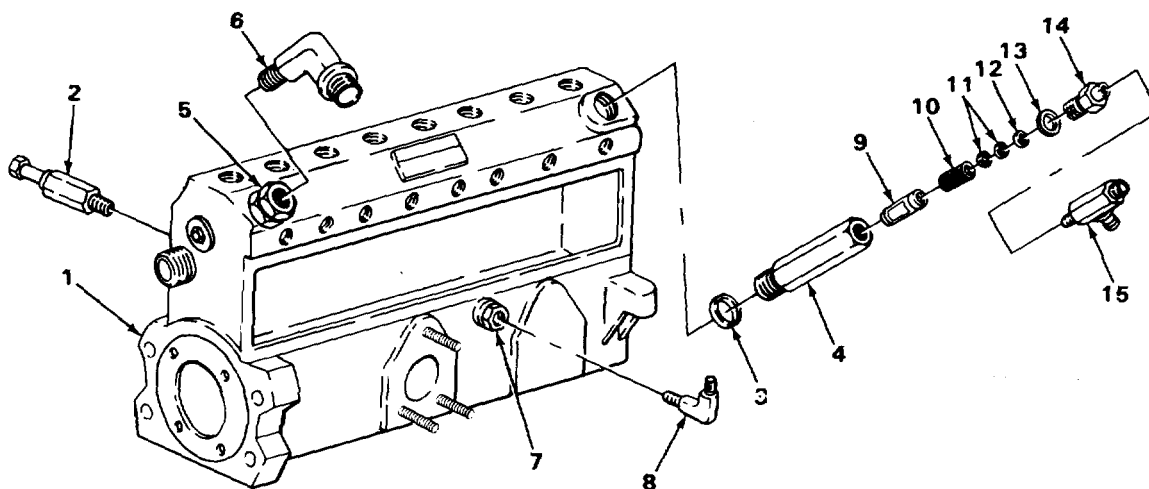
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
101. Fuel injection pump (1)	Bleeder bushing (2)	a. Coat threads with sealing compound. b. Screw in and tighten using 11-mm open-end wrench.
102.	New gasket (3) and overflow valve (4)	Screw In and tighten to - 25 ft-lb (24.4 - 33.9 N m) using 22-mm deep well socket and torque wrench with 3/8-inch drive.
103. Pump fitting (5)	Elbow (6)	a. Coat threads with sealing compound. b. Screw in and tighten using 5/8-inch and 19-mm open-end wrenches.
104. Oil inlet bushing (7)	Elbow (8)	a. Coat threads with sealing compound. b. Screw in and tighten using 1/2-inch and 19-inch open-end wrenches.
105. Overflow valve (4)	Relief valve (9), springs (10), 'b two shims (11), and washer (12)	Put in.
106.	New gasket (13) and bypass outlet (14)	Screw in and tighten using 19-mm and 22-mm open-end wrenches.
107. Bypass outlet (14)	Elbow (15)	Screw in and tighten using 11/16-inch and 19-mm open-end wrenches.

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

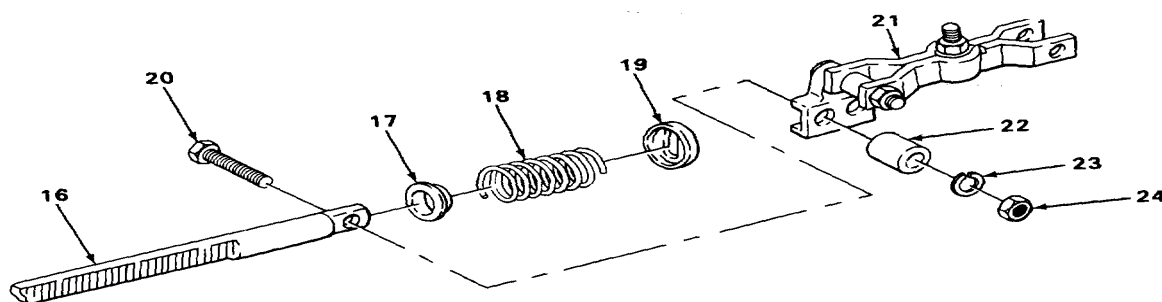
ASSEMBLY - CONTINUED



NOTE

If governor housing was removed, go to step 112.

108. Control rack (16)	Spring ring (17), governor spring (18), and spring seat (19)	Put on, and hold down.
109.	Bracket bolt (20)	Put through.
110. Bracket bolt (20)	Governor bracket (21)	Put on, and let spring (18) up.
111.	Spacer (22), new lockwasher (23), and nut (24)	Screw on, and tighten using two 8-mm open-end wrenches.



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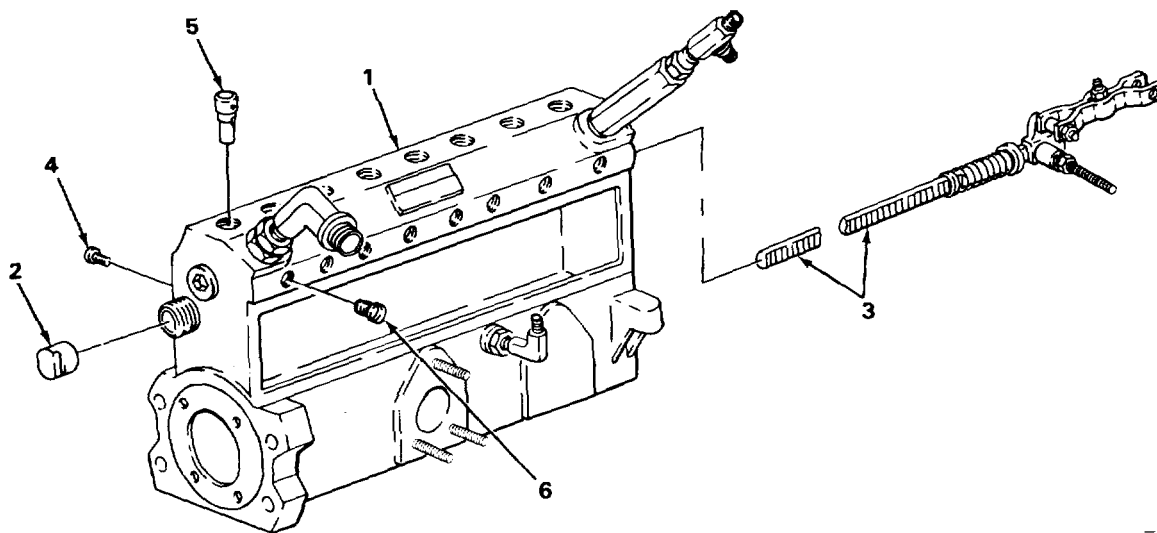
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
112. Fuel injection pump (1)	Cap (2)	Screw in, and tighten to 7 ft-lb (9.5 N m) of torque using 19 mm crowfoot wrench and torque wrench with 3/8-inch drive.	
113.	Control rack (3)	Put in.	
114.	Screw (4)	a. Screw in and tighten using 3/8-inch flat-tip screwdriver. b. Be sure rack (3) moves freely.	

CAUTION

To avoid scratching machined surfaces when installing parts, be sure barrels are wet with clean No. 2 diesel fuel.

115.	Eight barrels (5)	Put in.
116.	Eight screws (6)	a. Coat threads with sealing compound. b. Screw in and tighten using 5/16-inch flat-tip screwdriver bit with 3/8-inch drive and hinged handle.



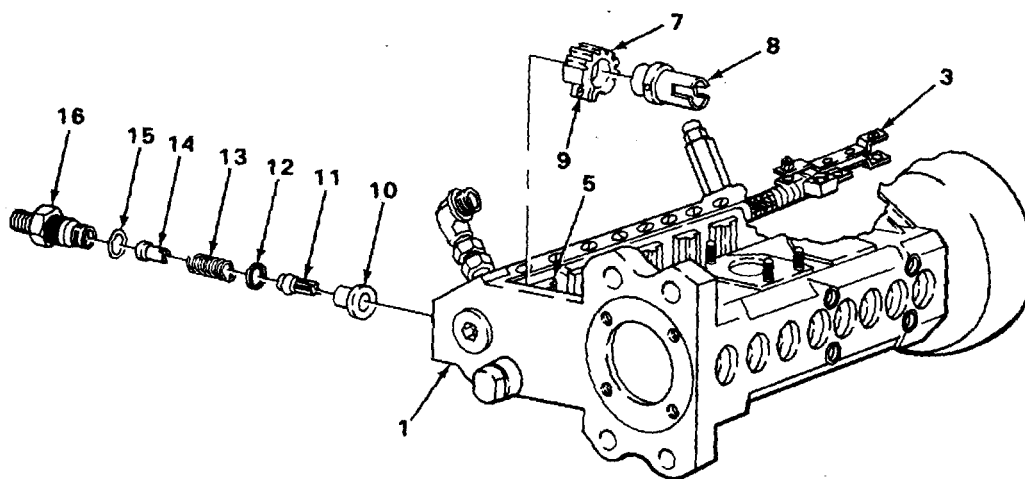
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
117.	Fuel injection pump (1)	a. Loosen holding fixture, and turn pump (1) on side. b. Tighten holding fixture.	
118. Eight barrels (5)	Eight valve gears (7) and sleeves (8)	Put in.	
119. Eight valve gears (7)	Eight screws (9)	a. Using 3/16-inch flat-tip screwdriver, tighten one at a time, checking control rack (3) movement each time. b. Replace any gears (7) causing rack (3) to bind.	

CAUTION

To avoid scratching machined surfaces when installing, and to insure proper sealing of gaskets, make sure all parts are wet with clean No. 2 diesel fuel.

120. Fuel injection pump (1)	Eight valve bodies (10), delivery valves (11), new gaskets (12), fuel valve springs (13), and new fuel filter elements (14)	Put in.	
121.	Eight new retainer gaskets (15) and valve retainers (16)	Screw in and tighten to - 25 ft-lb (29.8 - 33.9 N m) of torque using 7/8-inch deep well socket and torque wrench with 3/8-inch drive.	

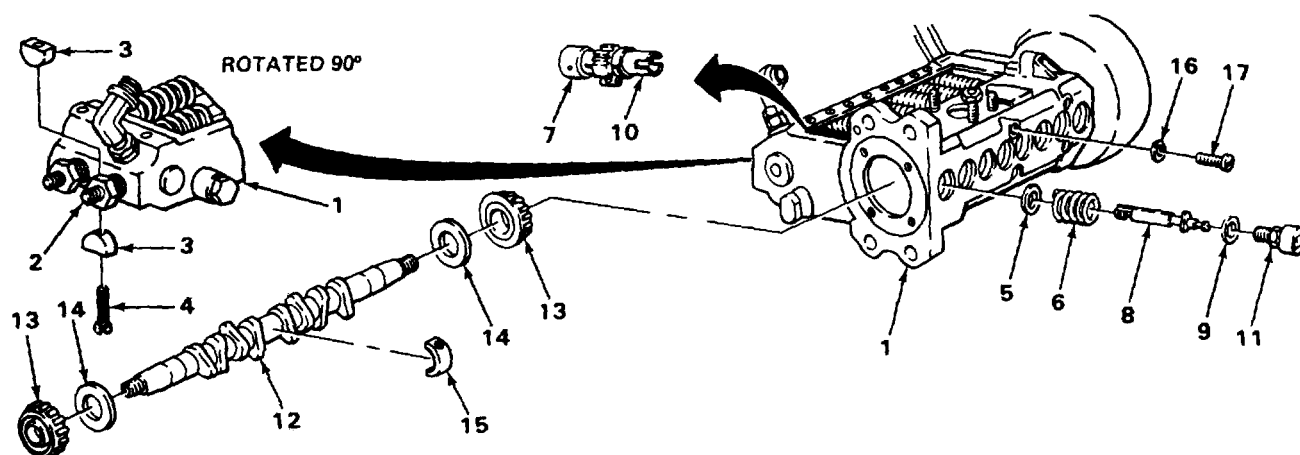


FUEL INJECTION PUMP - CONTINUED

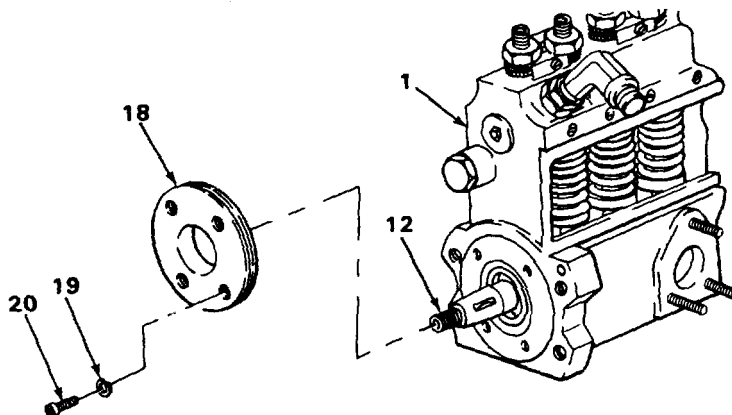
LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
122. Fuel injection pump (1)	Eight valve retainers (2)	a. Using 7/8-inch deep well socket and hinged handle with 3/8-inch drive, unscrew part way. b. Using 7/8-inch deep well socket and torque wrench with 3/8-inch drive, tighten to 22 - 25 ft-lb (29.8 - 33.9 N m). c. Repeat steps a and b.
123.	Eight clamps (3)	Hold in place.
124. Eight clamps (3)	Four screws (4)	Screw in and tighten using 3/8-inch flat-tip screwdriver.
125. Fuel injection pump (1)	Eight upper spring seats (5) and valve springs (6)	Put in.
126. Eight barrels (7)	Eight pistons (8) and lower spring seats (9)	a. Using barrel plunger installer tool, put pistons (8) in with marked tang facing out. b. Using plunger installer tool, put seats (9) in with open end facing inward. c. Seat piston (8) into control sleeve (10) using plunger installer tool.
127. Fuel injection pump (1)	Eight lifter sleeves (11)	a. Using tappet installing tool, push piston (8) up and put in one sleeve. b. Hold in place using tappet holding tool. c. Take out tappet installing tool. d. Repeat a thru c for remaining sleeves (10).
128. Camshaft (12)	Two bearings (13) and shims (14)	Using arbor press, press on.
129.	Bearing bracket (15)	a. Coat with grease to hold in place. b. Put on.
130. Fuel injection pump (1)	Camshaft (12)	Put in.

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
131.	Two new washers (16) and screws (17)	a. Coat threads with sealing compound. b. Screw in and tighten using 5116-inch flat-tip screwdriver bit and ratchet handle with 3/8-inch drive.	
132.	Fuel injection pump (1)	a. Loosen holding fixture. b. Turn pump (1) upright, and tighten holding fixture.	



133. Bearing retainer (18) a. Coat with sealing compound.
b. Hold against pump (1).
134. Four new lockwashers (19) and screws (20) Screw in part way to locate retainer (18).
135. Bearing retainer (18) Using plastic-face hammer, tap into place while turning camshaft (12).

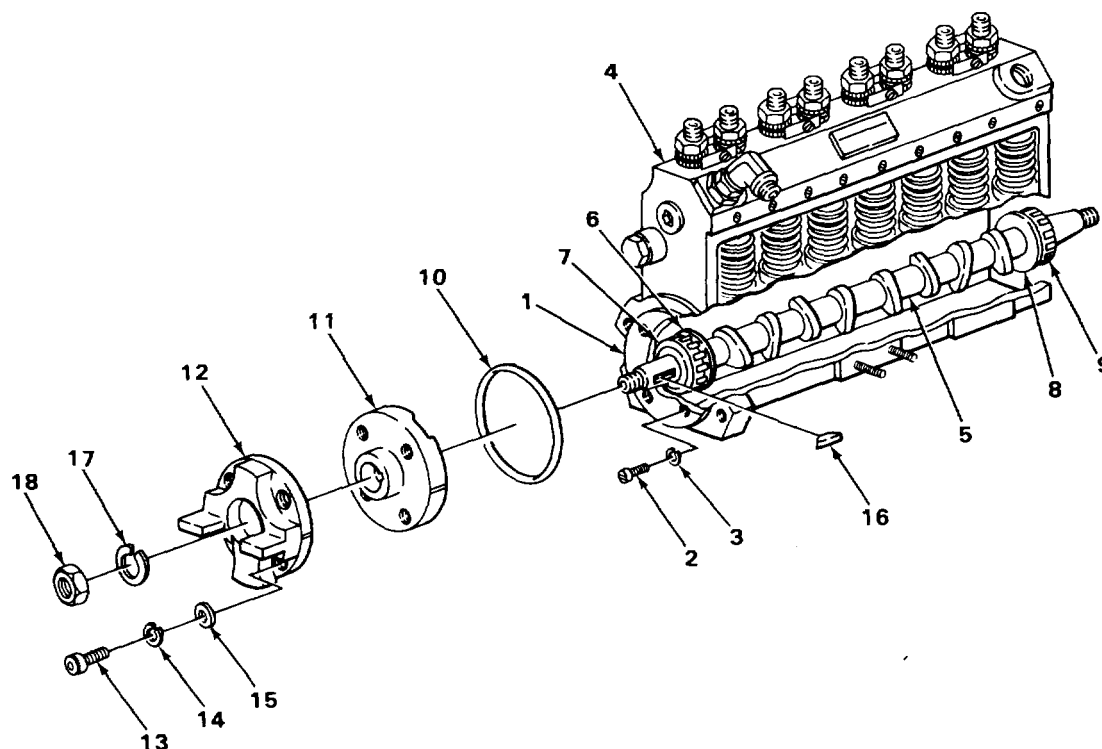


FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
136. Bearing retainer (1)	Four screws (2) and lockwashers (3)	Using 5/16-inch flat-tip screwdriver bit and hinged handle with 3/8-inch drive, tighten.
137. Fuel injection pump (4)	Camshaft (5), shims (6), and bearing (7)	- Check for 0.00- 0.0024-inch (0.02 - 0.06-mm) end play using camshaft holding tool and dial indicator. - If end play is correct, go to step 138. - If end play is incorrect, remove camshaft (5) (steps 41 thru 48). - Using arbor press, put on or take off shims (6) as needed from behind front bearing (7). - Install camshaft (5) (steps 128 thru 135). - Recheck end play (step 9).
138.	Camshaft (5), shims (8), and bearing (9)	- Check for 0.8 - 0.877-inch (20.7 - 22.2-mm) protrusion using camshaft protrusion gage and depth micrometer. - If protrusion is correct, go to step 135. - If protrusion is incorrect, remove camshaft (5) (steps 41 thru 48). - Put on or take shims (8) as needed from behind rear bearing (9) using arbor press. - Using arbor press, put on or take off the same thickness of shims (6) from behind front bearing (7). - Install camshaft (5) (steps 128 thru 135). - Recheck end play (step 9). - Recheck protrusion.
139. Bearing retainer (1)	New packing (10)	- Apply clean No. 2 diesel fuel. - Put on.

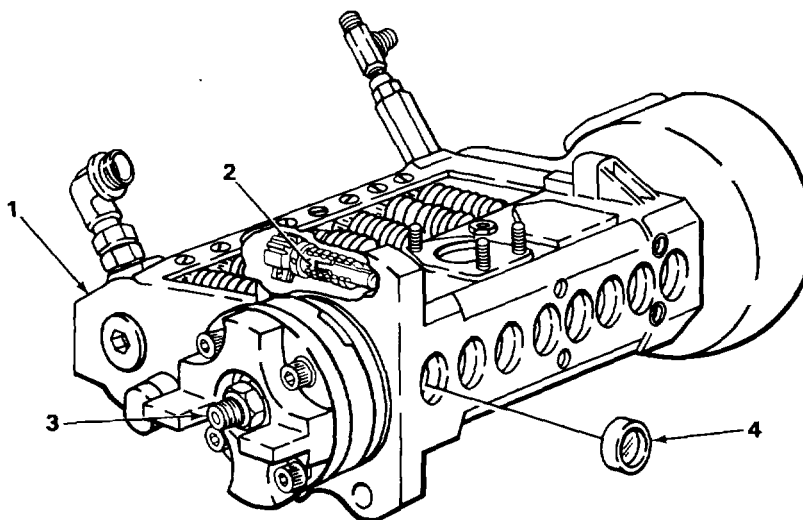
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
140. Coupling plate (11)	Coupling (12)	a. Mount plate (11) in vise with jaw caps. b. Set coupling (12) on plate (11) alining mating marks.	
141. Coupling (12)	Four screws (13), new lockwashers (14) and washers (15)	a. Screw in and tighten to - 25 ft-lb (24.4-33.9 N m) using 6-mm hex key socket and torque wrench with 3/8-inch drive. b. Remove coupling (12) from vise.	
142. Camshaft (5)	Woodruff key (16) and coupling (12)	Put in.	
143.	New lockwasher (17) and nut (18)	Screw on and tighten nut (18) to 60 - 70 ft-lb (81.3-97.6 N m) using 22-mm socket annd torque wrench with 3/8-inch drive.	



FUEL INJECTION PUMP - CONTINUED

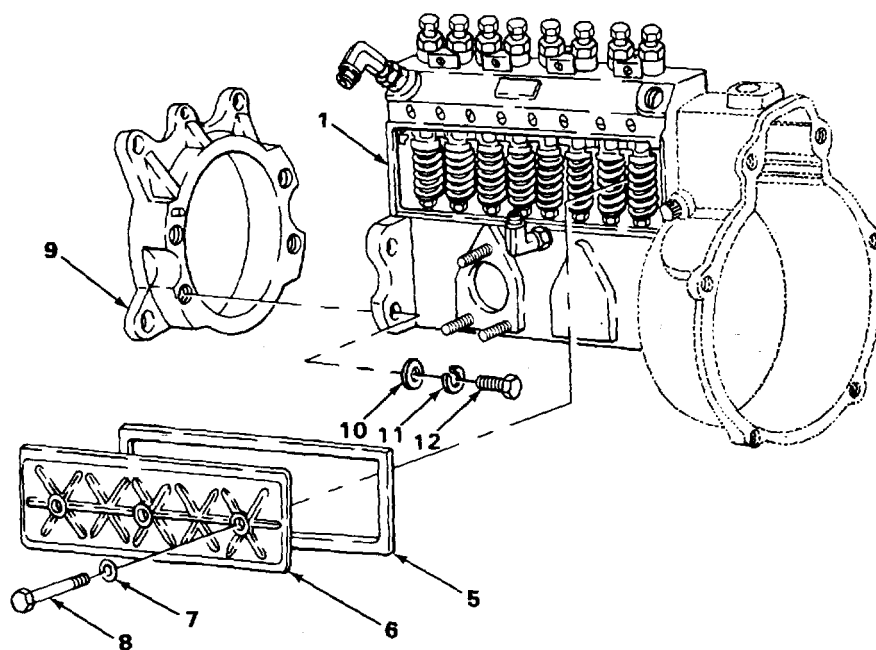
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
144.	Fuel injection pump (1)	a. Loosen holding fixture and turn pump (1) on side. b. Tighten holding fixture.	
145. Fuel injection pump (1)	Eight lifter sleeves (2)	a. Using drive flange holding wrench to turn camshaft (3), raise one sleeve (2). b. Take out tappet holder. c. Repeat for remaining sleeves (2).	
146.	Eight covers (4)	a. Apply thin coat of sealing compound. b. Using 11/16-inch socket and plastic-face hammer, tap below lower edge of chamfer in pump (1).	



147.	Fuel injection pump (1)	a. Loosen holding fixture, and turn pump (1) upright. b. Tighten holding fixture.	
148. Fuel injection pump (1)	New gasket (5) and side cover (6)	Put on, and hold in place.	

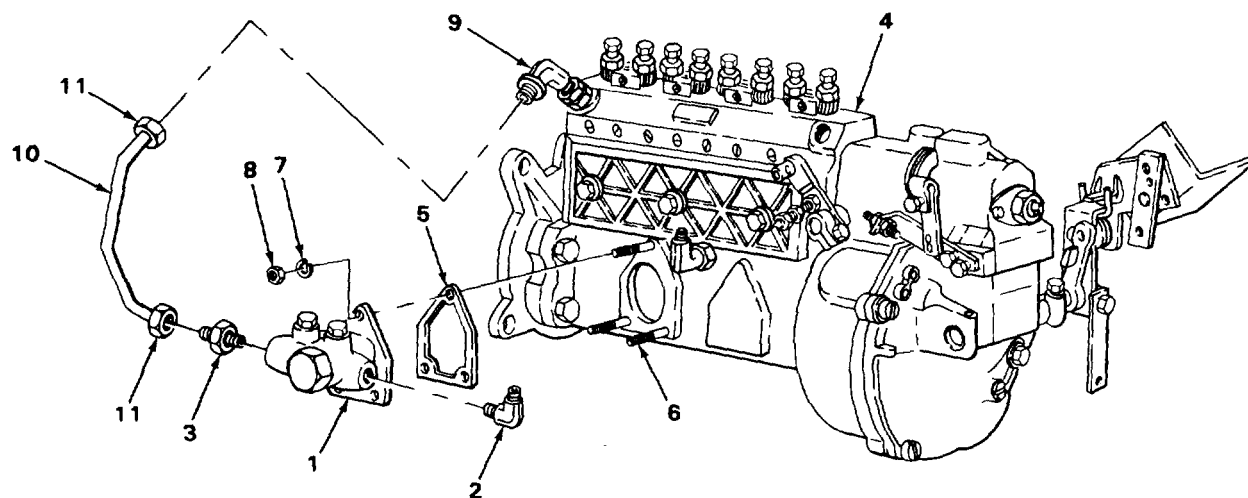
FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
149. Side cover (6)	Three new gaskets (7) and screws (8)	Screw in and tighten using 10-mm socket and torque wrench with 3/8-inch drive.	
150. Fuel injection pump (1)	Injection pump adapter (9)	Put on.	
151.	Four washers (10), new lock-washers (11), and screws (12)	Screw in and tighten to - 35 ft-lb (33.9-47.5 N m) of torque using 9/16-inch socket and torque wrench with 3/8-inch drive.	
152.	Governor	Assemble (page 2-334).	



FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
153. Fuel supply pump (1)	Elbow (2)	a. Put pump (1) in vise with jaw caps. b. Screw in and tighten using 5/8-inch open-end wrench.	
154.	Adapter (3)	a. Screw in and tighten using 11/16-inch open-end wrench. b. Take pump (1) out of vise.	
155. Fuel injection pump (4)	New gasket (5) and supply pump (1)	Put on, and hold.	
156. Three studs (6)	Three new lock-washers (7) and nuts (8)	Screw on and tighten using 10-mm open-end wrench.	
157. Elbow (9) and adapter (3)	Pipe (10) and two nuts (11)	Screw on and tighten using 11/16-inch open-end wrench.	



ADJUSTMENT

158.	Fuel injection pump	Using fuel-injection pump tester adapter kit, and calibration chart, calibrate (TM 9-4910-387-14).

FUEL INJECTION PUMP - CONTINUED

CALIBRATION CHART

Supply pressure	3 - 5 psi (21 - 35 kPa)
Transfer pump pressure	28 psi (193 kPa) minimum at 1500 rpm
Test nozzle opening pressure	2300 $\pm$ 75 psi (15858 $\pm$ 517 kPa)
Pump rotation (viewed from drive end)	Clockwise
Firing order	1-8-7-3-6-5-4-2
Initial timing	32 degrees $\pm$ 1 degree BTDC
	Number one piston on compression stroke - crankshaft
	Damper timing mark and pointer indexed
Minimum engine speed (LO-idle)	600 - 650 rpm (no load)
Maximum engine speed (HI-idle)	3200 - 3350 rpm
Injection pump number	498496-C91

Check	RPM	Specifications
1. Prestroke Setting	O	0.0787 in. (2.00 mm) Lift to port closure of #1 plunger at 0.4212 inch (10.7 mm) rack position
2. Pump Camshaft Phasing	-	45 degrees $\pm$.5 degrees between cylinders 1-8-7-3-6-5-4-2
3. Preliminary Governor Cutoff; Rack Position (Accelerator Lever in Full Forward Position with Hi-Idle Stop Screw Removed)		
a)	1500-1600	No change in rack position between 1500 and 1600 rpm (record)
b)	1600-1800	Governor cutoff (rack position change) should occur between 1600 and 1800 rpm (record)
4. Governor Cutoff; Rack Position (Accelerator Lever in Full Forward Position with Hi-idle Stop Screw Installed)	1500-1550	No change in rack position (record)
5. Hi-Idle Rack Position	1635	0.3346 inch (8.5 mm) maximum
6. Maximum Fuel Setting		
a) Rack Position (Ref)	1500	0.4213 inch (10.7 mm)
b) Delivery (Avg) cu inch/stroke (cu mm/stroke)	1500	472 - 378 inch (66 - 63 mm)

FUEL INJECTION PUMP - CONTINUED

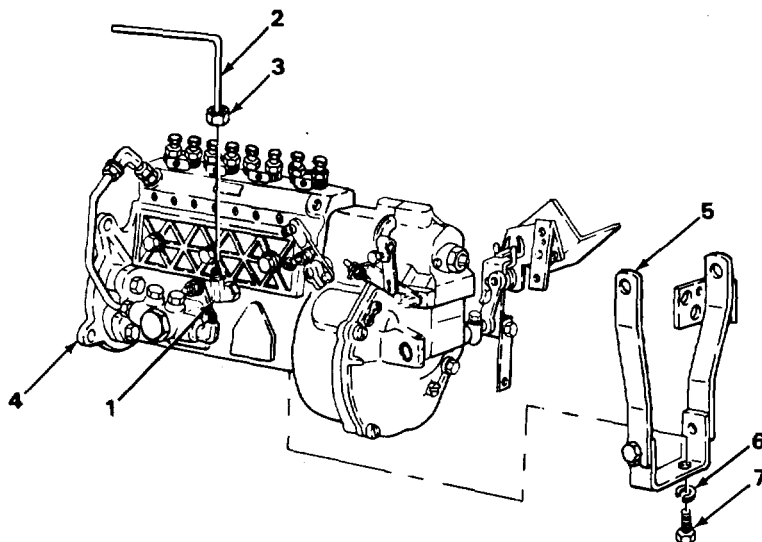
ADJUSTMENT - CONTINUED

CALIBRATION CHART (Continued)

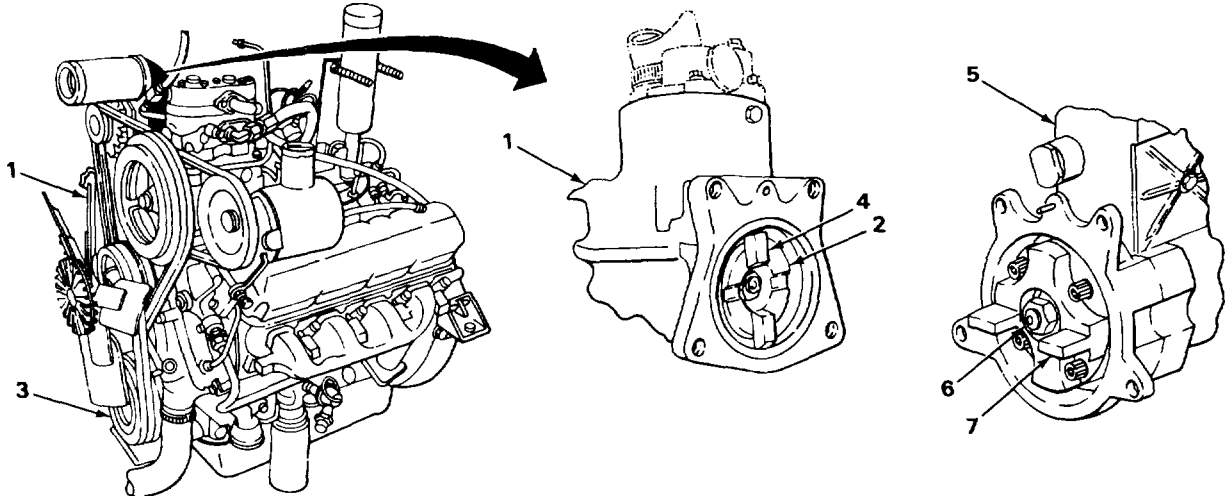
Check	RPM	Specifications
6. Continued		
c) Balance (Max Spread) cu inch/stroke (cu mm/ stroke)	1500	+ 180 inch (3mm) -300 inch (5mm) From Avg
7. Torque Compensation		
End of Torque Compensation; Rack Position		
1)	950	-----
2)	600	Same as 6 a
8. Enter Excess Fuel: Rack Position	100	Rack position should be 0.7480 - 0.8268 inch (19 - 21 mm)
9. Exit Excess Fuel; Rack Position	250	+ 0.0039 inch (+ 0.1 mm) -0.0000 inch (-0.0 mm) from 7d.2
10. Transitions; Ave. Delivery cu inch/stroke (cu mm/stroke)		
a) Cylinders 1-4-6-7	300	60 - 90 inch (1 - 15 mm)
b) Cylinders 2-3-5-8	300	198 - 240 inch (33 - 40 mm)
11. LO-Idle Rack Position	300	0.2362 inch (Ref) (6.0 mm)
12. Start Fuel Quantity:		
a) Cylinders 1-4-6-7	100	0.0000 inch (0.0 mm)
b) Cylinders 2-3-5-8 cu Inch/stroke (cu mm/ stroke)	100	8100 - 6720 inch (135 - 112 mm)
13. Fuel Shutoff, Rack Position	0	0.0394 inch (1.0 mm) maximum
14. Pump Drive Tang Adjustment at Lift-To-Port Closure of #1 Plunger	0	Drive tangs must be horizontal with punch marks facing transfer pump
	2-310	

FUEL INJECTION PUMP - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
INSTALLATION				
NOTE If the fuel injection pump was removed for access, go to step 161. If only the fuel supply pump was replaced, go to step 161.				
159.	Elbow (1)	Pipe (2) and nut (3)	Screw on, and tighten using 112-inch open-end wrench.	
160.	Fuel injection pump (4)	Bracket (5)	Put on.	
161.	Bracket (5)	Two new lockwashers (6) and screws (7)	Screw in, and tighten to 20-25 ft-lb (21.1-33.9 N m) of torque using 9/16-inch socket and torque wrench with 3/8-inch drive.	



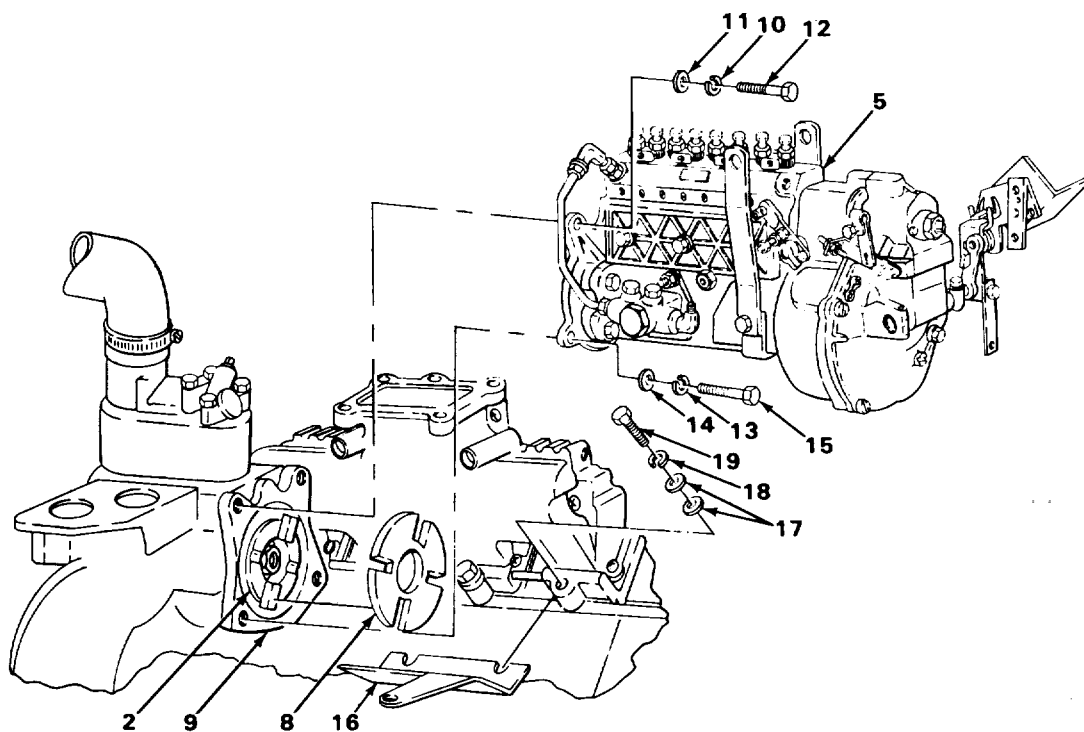
FUEL INJECTION PUMP - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED				
162.	Front crankcase cover (1) and drive hub (2)	Pulley (3) and marked tang (4)	Rotate engine until pulley (3) shows top dead center and tang (4) is straight up.	
163.	Fuel injection pump (5)	Camshaft (6) and coupling tangs (7)	a. Check static timing (TM 9-4910-387-14). b. Rotate camshaft (6) until tangs (7) are straight across, and camshaft mark is at 10-o'clock position.	
				
164.	Drive hub (2)	Drive disc (8)	Put on.	
165.	Drive hub (2) and crankcase cover (9)	Fuel injection pump (5)	Align pump (5), and put on.	
166.	Fuel injection pump (5)	Two new lockwashers (10), washers (11), and screws (12)	Screw in, and tighten using 9/16-inch hinged socket and ratchet handle with 3/8-inch drive.	
167.		Two new lockwashers (13), washers (14), and screws (15)	Screw in, and tighten using 9/16-inch hinged socket, 16-inch extension, and ratchet handle with 3/8-inch drive.	

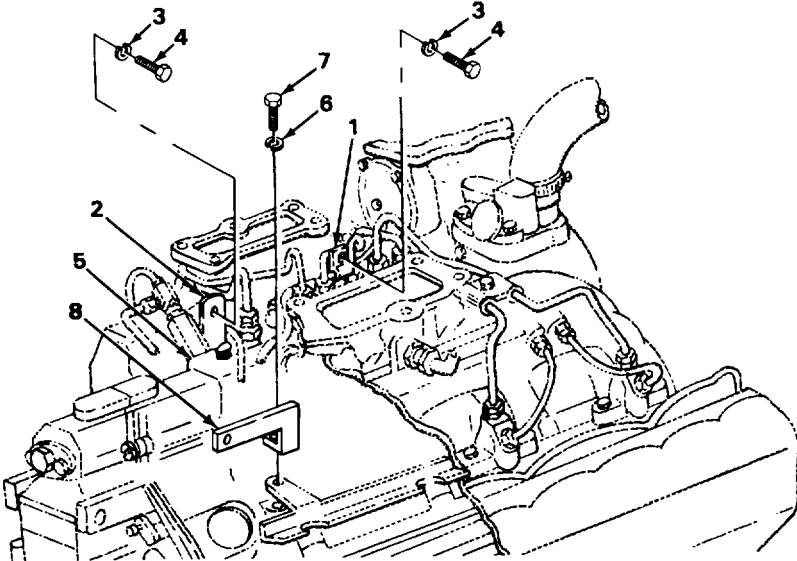
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FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
168.	Brace (16)	Put on.	
169.	Brace (16)		Screw in, and tighten using 9/16-inch socket, 6-inch extension, and ratchet handle with 3/8-inch drive.

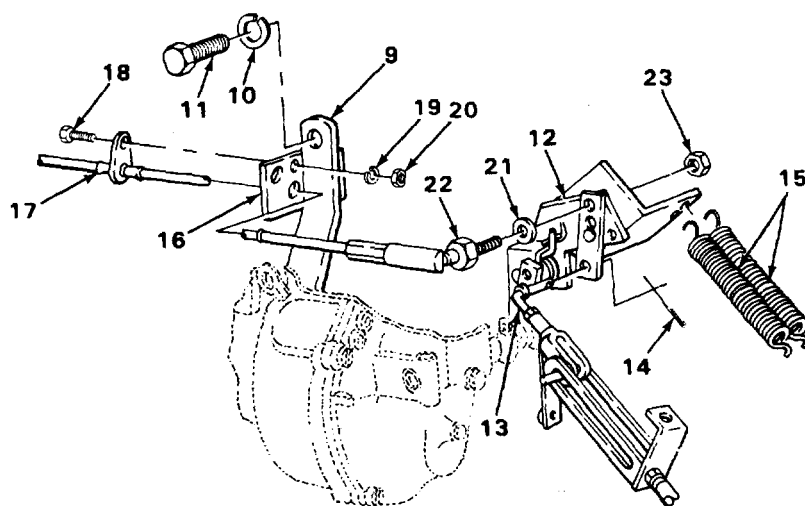


FUEL INJECTION PUMP - CONTINUED

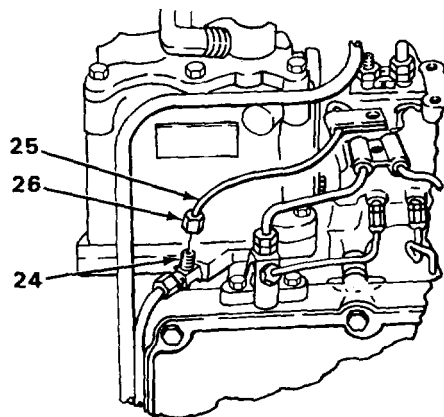
	LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED				
170.	Clamp (1) and strap (2)	Two new lockwashers (3) and screws (4)	Screw in, and tighten using 9/16-Inch socket and ratchet handle with 3/8-inch drive.	
171.	Fuel injection pump (5)	New lockwasher (6), screw (7), and support (8)	Screw in, and tighten using 9/16-inch socket, 6-inch extension, and ratchet handle with 3/8-inch drive.	
				
172.	Strap (9)	New lockwasher (10) and screw (11)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.	
173.	Governor lever (12)	Clevis (13)	Put in.	Be sure spring is in place.
174.	Clevis (13)	New cotter pin (14)	Using diagonal cutting pliers, put in and bend over.	
175.	Governor lever (12)	Two springs (15)	Hook in.	
176.	Bracket (16)	Cable (17) and screw (18)	Put in.	
177.	Screw (18)	New lockwasher (19) and nut (20)	Screw on, and tighten using two 7/16-inch open-end wrenches	

FUEL INJECTION PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
178.	Governor lever (12)	Washer (21) and ball joint (22)	Put through.
179.	Ball joint (22)	Nut (23)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.



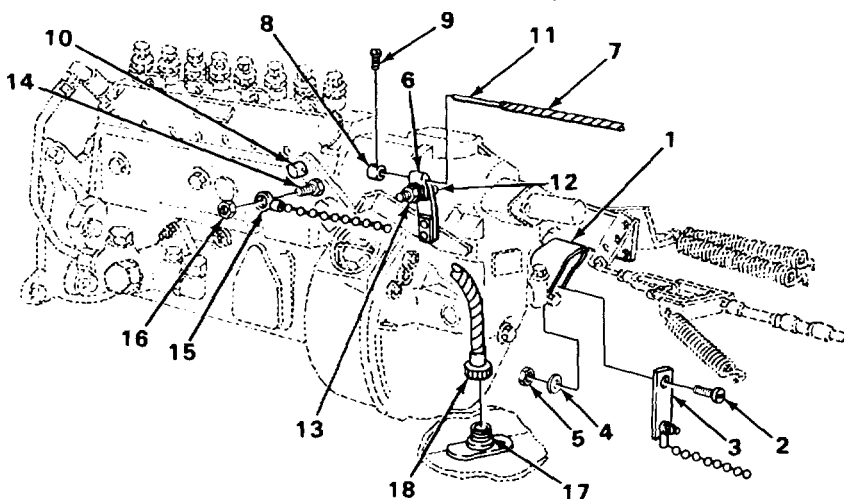
180.	Fitting (24)	Pipe (25) and nut (26)	Screw on, and tighten using 1/2-inch open-end wrench.



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FUEL INJECTION PUMP - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED				
181.	Governor lever (1)	Screw (2) and bracket (3)	Put bracket (3) on.	
182.	Screw (2)	Washer (4) and nut (5)	Screw on, and tighten using two 7/16-inch open-end wrenches.	
183.	Bracket (6)	Cable (7)	Put in.	
184.	Cable (7)	Clip (8) and screw (9)	a. Push lever (10) all the way forward. b. Pull inner cable (11) all the way out of cable (7). c. Put inner cable (11) through lever (10). d. Put clip (8) on inner cable (11) against lever (10). e. Screw in, and tighten screw (9) using 1/4-inch flat-tip screwdriver,	
185.	Screw (12)	Nut (13)	Tighten using 1/4-inch flat-tip screwdriver.	
186.	Screw (14)	Chain (15) and locknut (16)	Screw on, and tighten using two 3/8-inch open-end wrenches.	
187.	Adapter (17)	Cable (18)	Screw on, and tighten.	



FUEL INJECTION PUMP - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Install fuel return lines (page 2-270).
2. Install fuel supply lines (page 2-259).
3. Install air cleaner (TM 9-2320-269-20-1).
4. Install transmission cover (TM 9-2320-269-20-2).
5. Install engine cover (TM 9-2320-269-20-2).

TASK ENDS HERE**INJECTION PUMP MOUNTING BRACKETS**

This task covers:

a. Removal (page 2-318)	c. Inspection/Replacement (page 2-321)
b. Cleaning (page 2-321)	d. Installation (page 2-322)

INITIAL SETUP**Tools**

Extension, 3/8-inch drive, 6-inch
 Handle, ratchet, 3/8-inch drive
 Socket, 3/8-inch drive, 9/16-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch
 (two required)
 Wrench, open-end, 9/16-inch

Materials/Parts

Lockwasher, support to brace
 Lockwasher, brace to pump (two required)
 Lockwasher, strap to bracket (two required)
 Lockwasher, strap bracket and cable
 Lockwasher, strap
 Lockwasher, strap to bracket

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
 Solvent, dry-cleaning (item 49, appendix B)

Personnel Required

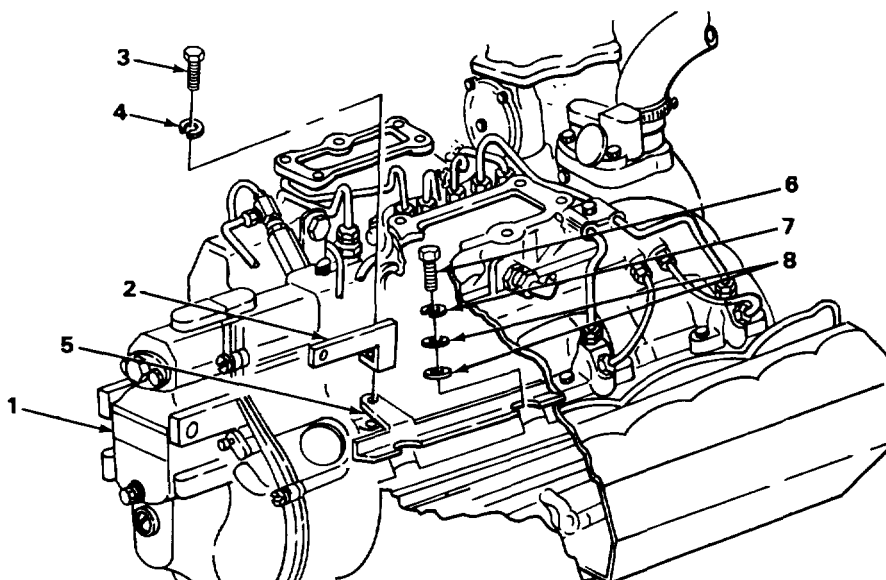
One

Equipment Condition

Air cleaner removed (TM 9-2320-260-20-1).

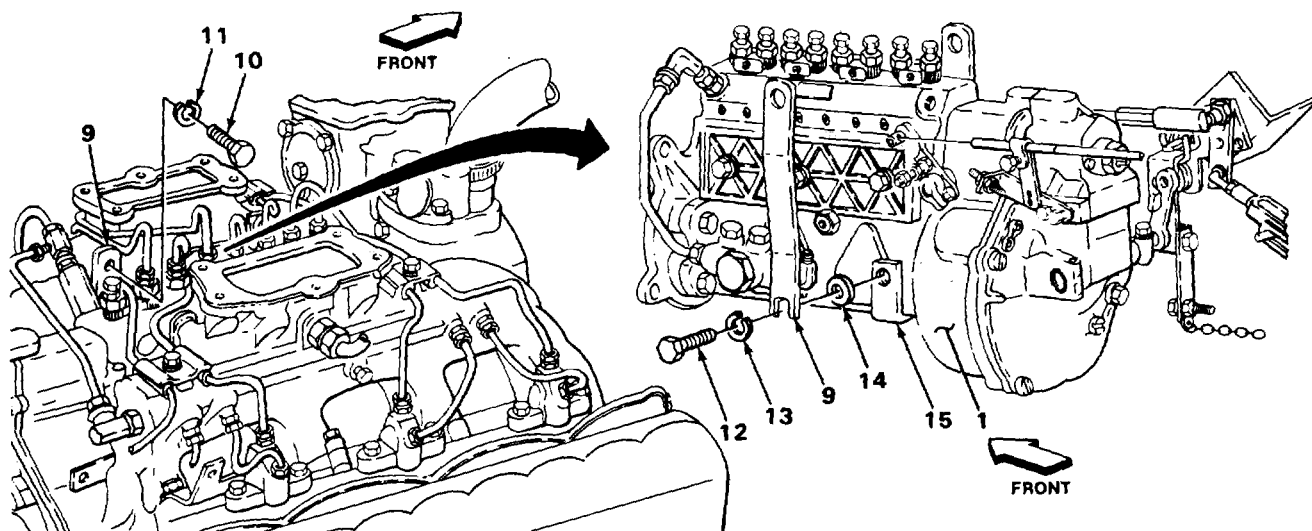
INJECTION PUMP MOUNTING BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Fuel injection pump (1)	Remove (page 2-259).	
2.	Support (2)	a. Using 9/16-inch socket, 6-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out.	
3.	Brace (5)	b. Get rid of lockwasher (4). Take out.	
4.	Two screws (6), lockwashers (7), and four washers (8)	a. Using 9/16-inch socket, 6-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out.	
5.	Fuel injection pump (1)	b. Get rid of lockwashers (7). Take out.	



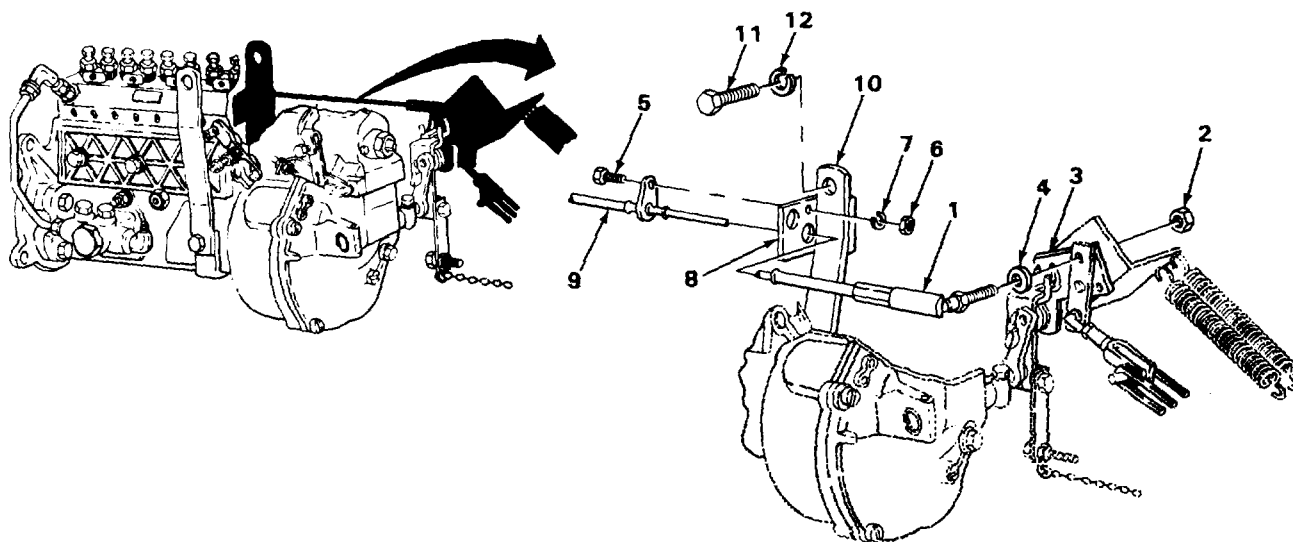
INJECTION PUMP MOUNTING BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6.	Fuel injection pump (1)	Number 5 and 7 injector supply lines	Remove (page 2-259).
7.	Strap (9)	Screw (10) and lockwasher (11)	a. Using 9/16-inch socket, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (11).
8		Screw (12), lockwasher (13), and washer (14)	a. Using 9/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwasher (13).
9.	Bracket (15)	Strap (9)	Take out.



INJECTION PUMP MOUNTING BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
10.	Fuel injection pump	Number 6 and 8 injector supply lines	Remove (page 2-259).
11.	Ball joint (1)	Nut (2)	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take off.
12.	Governor lever (3)	Ball joint (1) and washer (4)	Take out.
13.	Screw (5)	Nut (6) and lockwasher (7)	a. Using two 7/16-inch open-end wrenches, unscrew and take off. b. Get rid of lockwasher (7).
14.	Bracket (8)	Screw (5) and cable (9)	Take out.
15.	Strap (10)	Screw (11) and lockwasher (12)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.



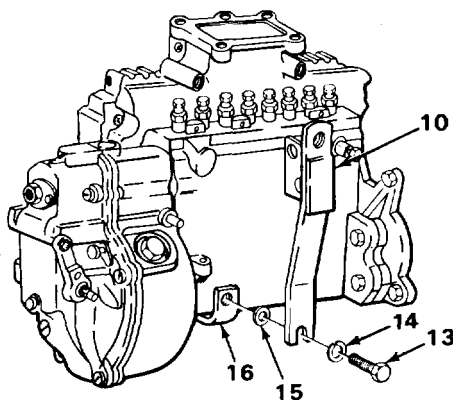
16.	Strap (10)	Screw (13), lockwasher (14), and washer (15)	a. Using 9/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwasher (14).
17.	Bracket (16)	Strap (10)	Take out.

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INJECTION PUMP MOUNTING BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED



CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

18	All parts	a. Clean in drycleaning solvent. b. Wipe dry with clean rags.

INSPECTION/REPLACEMENT

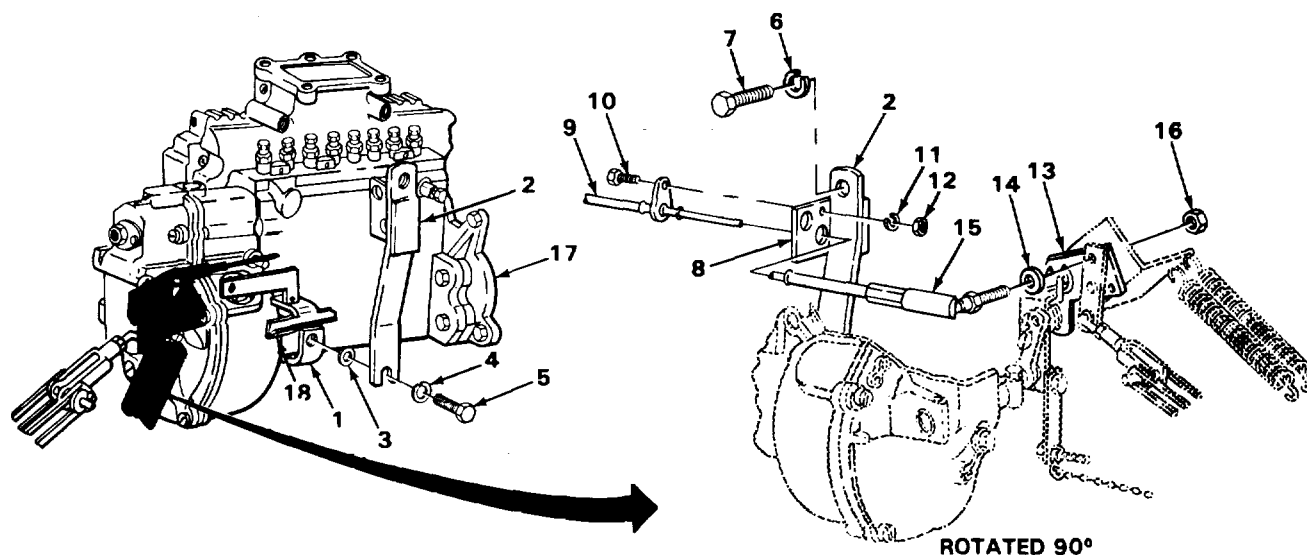
NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

19	All metal parts	a. Check for cracks and wear. b. Replace as needed.
20	All threaded parts	a. Check for stripped threads or rounded heads. b. Replace as needed.

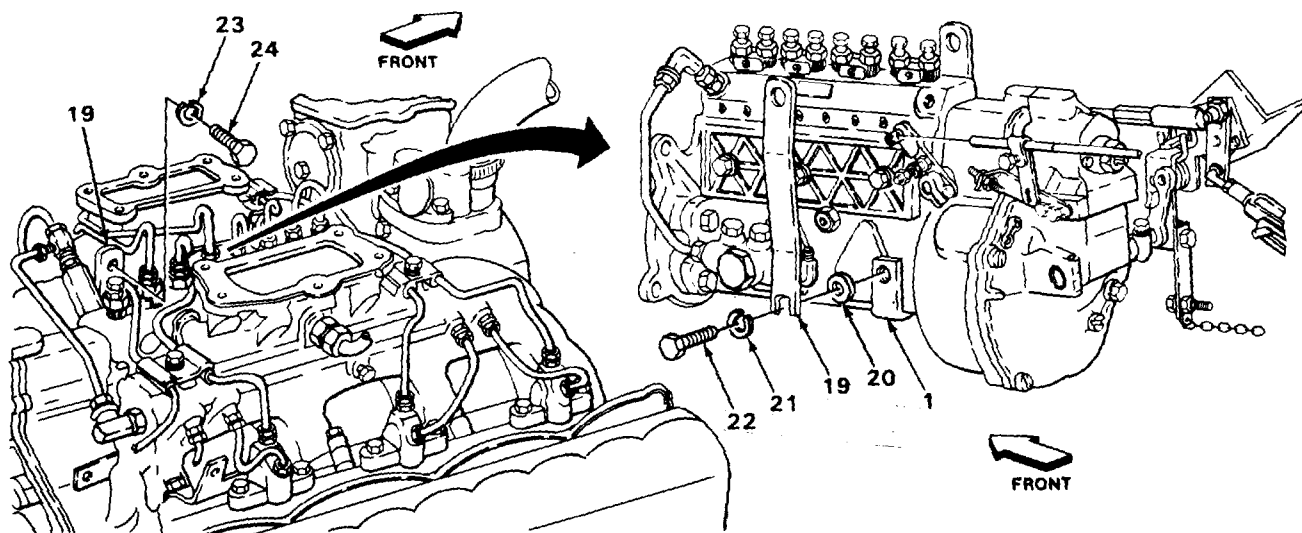
INJECTION PUMP MOUNTING BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
21	Bracket (1)	Strap (2)	Hold in place.
22	Strap (2)	Washer (3), new lockwasher (4), and screw (5)	Screw in part way.
23		New lockwasher (6) and screw (7)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.
24		Screw (5)	Tighten using 9/16-inch open-end wrench.
25	Bracket (8)	Cable (9) and screw (10)	Put in place.
26	Screw (10)	New lockwasher (11) and nut (12)	Screw on, and tighten using two 7/16-inch open-end wrenches.
27	Governor lever (13)	Washer (14) and ball joint (15)	Put in place.
28	Ball joint (15)	Nut (16)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.
29	Fuel injection pump (17)	Number 6 and 8 injector supply lines	If brace or support (18) were not removed, install (page 2-259).



INJECTION PUMP MOUNTING BRACKETS - CONTINUED

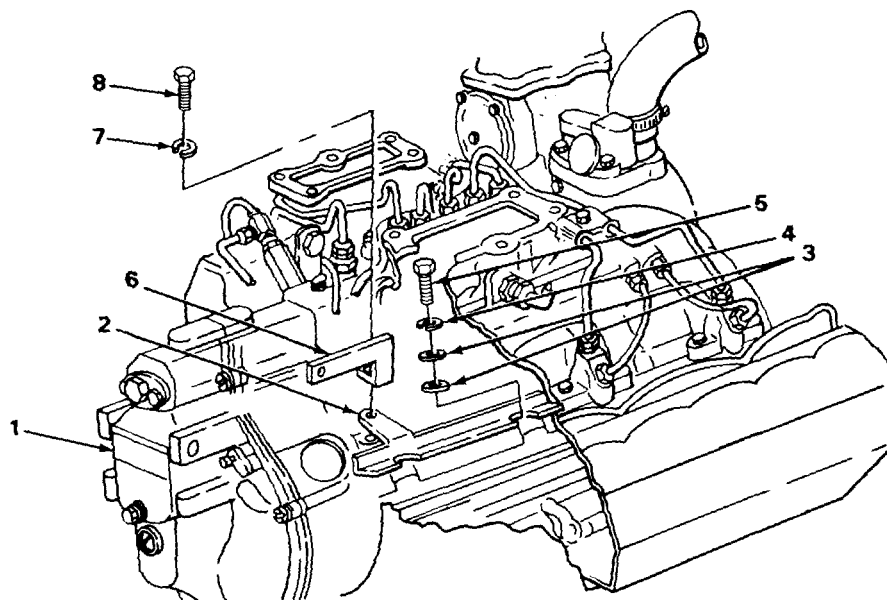
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
30.	Bracket (1)	Strap (19)	Hold in place.
31.	Strap (19)	Washer (20), new lockwasher (21), and screw (22)	Screw in part way.
32.		New lockwasher (23) and screw (24)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.
33.		Screw (22)	Tighten using 9/16-inch open-end wrench.
34.	Fuel injection pump	Number 5 and 7 injector supply lines	Install (page 2-259).



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INJECTION PUMP MOUNTING BRACKETS - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED				
35.	Fuel injection pump (1)	Brace (2)	Hold in place.	
36.	Brace (2)	Four washers (3), two new lock-washers (4), and screws (5)	Screw in part way.	
37.	Brace (2)	Support (6)	Put in place.	
38.	Support (6)	New lockwasher (7) and screw (8)	Screw in, and tighten using 9116-inch socket, 6-inch extension, and ratchet handle with 318-inch drive.	
39.	Brace (2)	Two screws (5)	Tighten using 9116-inch socket, 6-inch extension, and ratchet handle with 318-inch drive.	
40.	Fuel injection pump (1)	Number 6 and 8 injector supply lines	Install (page 2-259).	



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INJECTION PUMP MOUNTING BRACKETS - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install air cleaner (TM 9-2320-269-20-1).

TASK ENDS HERE**INJECTION PUMP DRIVE**

This task covers:

a. Removal (page 2-326)	e. Assembly (page 2-328)
b. Disassembly (page 2-326)	f. Installation (page 2-328)
c. Cleaning (page 2-326)	g. Adjustment (page 2-328)
d. Inspection/Replacement (page 2-327)	
-

INITIAL SETUP**Tools**

Driftpin, brass, 5/16-inch
 Driftpin, brass, 1/2-inch
 Face, inserted hammer, medium-plastic
 Fixture, locating, drive-flange
 Hammer, ball-peen, hand, machinist's
 Handle, hinged, 112-inch drive
 Holder, inserted hammer-face
 Pliers, snapping
 Press, arbor, hand-operated
 Remover set, bearing (SE-1905 or
 SE-2098)
 Socket, 1/2-inch drive, 1/2-inch
 Socket, 1/2-inch drive, 15-16-inch
 Wrench, torque, 112-inch drive

Materials/Parts

Lockwasher, drive gear to drive shaft
 (three required)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

Two

Equipment Condition

Water pump removed (page 2-400).
 Fuel injection pump removed (page 2-278).

INJECTION PUMP DRIVE - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
REMOVAL				
1.	Injection pump drive hub (1)	Nut (2)		Using 15/16-inch socket and hinged handle with 1/2-inch drive, unscrew and take off.
2.	Injection pump drive shaft (3)	Drive hub (1)		Take off.
3		Washer (4) and two grip springs (5)		Take off.
4.	Injection pump drive gear (6)	Three screws (7) and lockwashers (8)	a	Using 1/2-inch socket and hinged handle with 1/2-inch drive, unscrew and take off.
			b.	Get rid of lockwashers (8).
5.	Injection pump drive shaft (3)	Drive gear (6)		With assistant, put 5/16-inch brass drift-pin through back of front crankcase cover and push gear (6) off shaft (3).
6		Snapping (9)		Using snapping pliers, take off.
7.	Front crankcase cover (10)	Drive shaft (3)		Using ball-peen hammer and 1/2-inch brass driftpin, tap out.
DISASSEMBLY				
8.	Injection pump drive shaft (3)	Front bearing (11)		Using arbor press, take off.
9.	Front crankcase cover (10)	Rear bearing (12) hammer, tap out.		Using 1/2-inch driftpin and ball-peen
CLEANING				

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

INJECTION PUMP DRIVE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

10 All metal parts

- a. Clean in drycleaning solvent.
- b. Using clean, dry rags, wipe dry.

INSPECTION/REPLACEMENT

NOTE

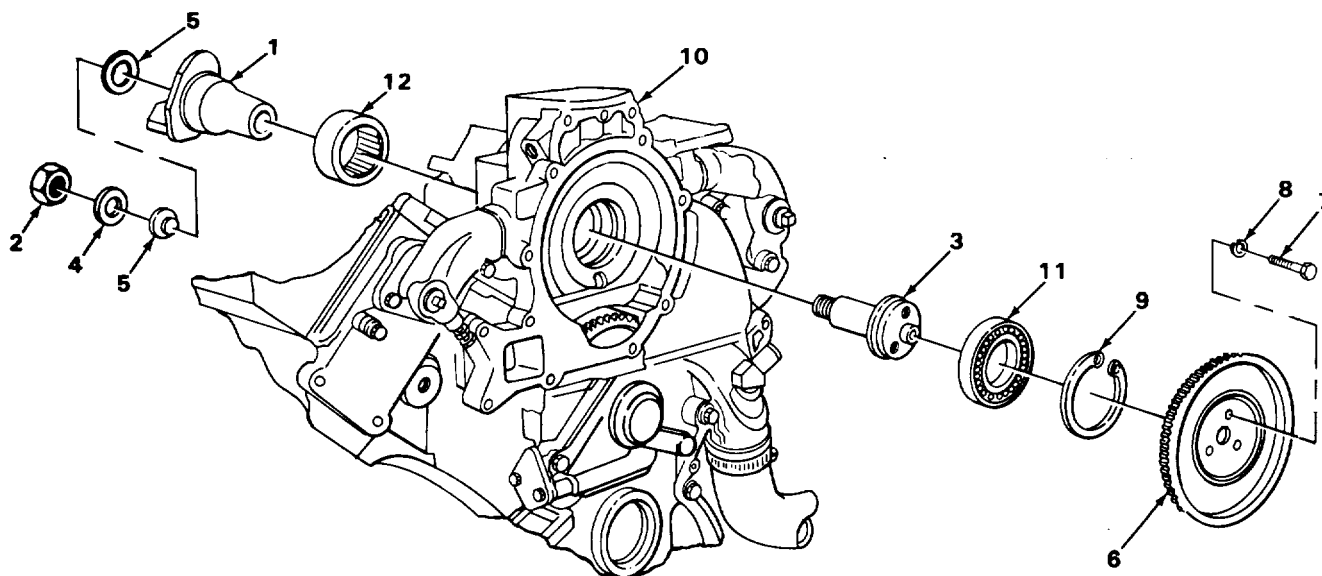
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

11 All metal parts
and bearings

- a. Check for cracks and wear.
- b. Replace as needed.

12 All threaded parts

- a. Check for stripped threads and round heads.
- b. Replace as needed.



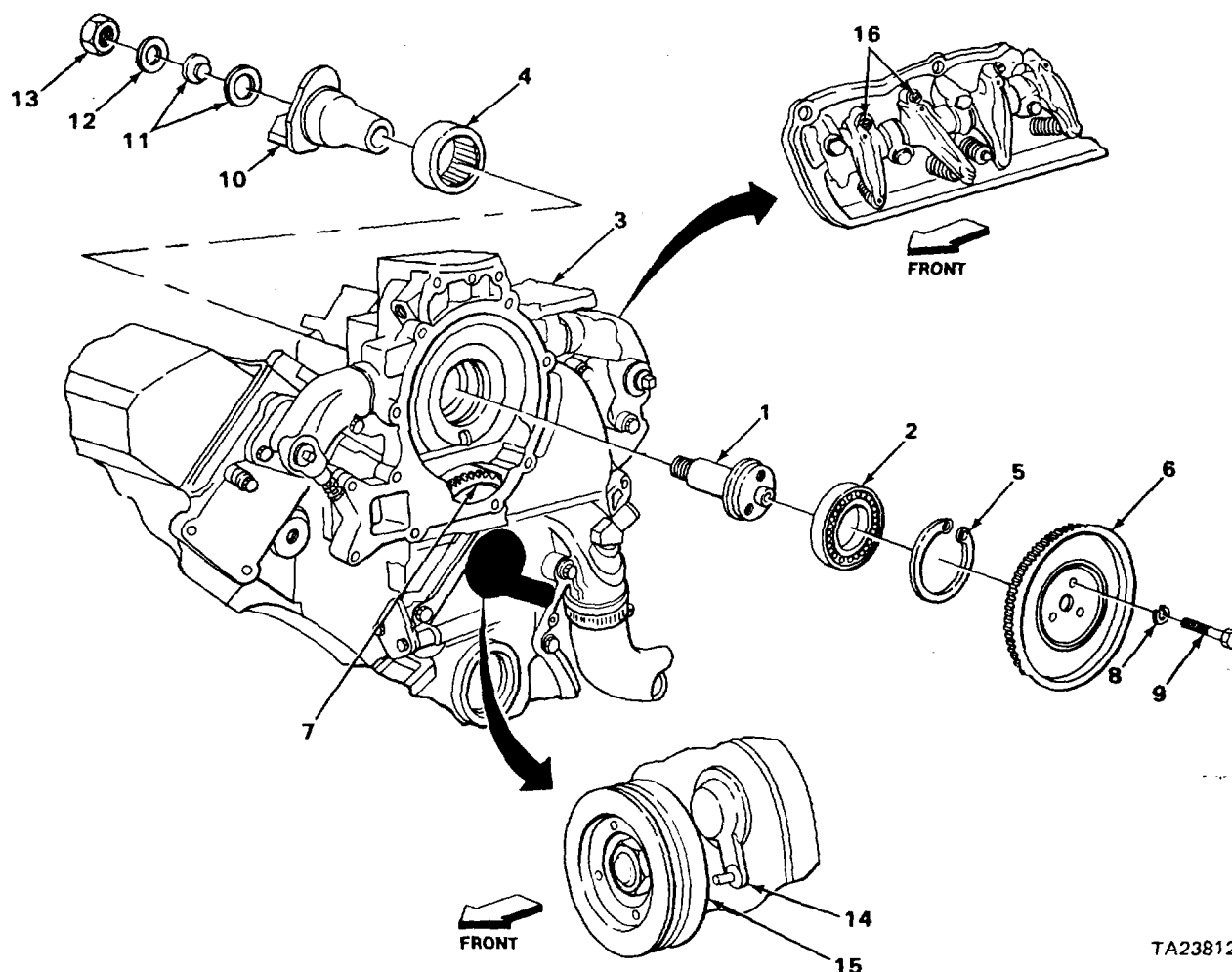
TA238121

INJECTION PUMP DRIVE - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
13.	Injection pump drive shaft (1)	Front bearing (2)	Using arbor press, put on.
14.	Front crankcase cover (3)	Rear bearing (4)	a. Using 5 5/8-inch (14.287-cm) adapter from bearing remover set, put bearing on installer. b. Tap into cover (3) using plastic-face hammer until adapter is flush against cover (3).
INSTALLATION			
15		Injection pump drive shaft (1)	Put in.
16.	Injection pump drive shaft (1)	Snapring (5)	Put on using snapring pliers.
17		Injection pump drive gear (6)	a. Line up with camshaft gear (7), and put on. b. Turn drive shaft (1) until holes line up with drive gear (6). c. Tap on using plastic-face hammer.
18		Three new lock-washers (8) and screws (9) drive.	Screw in, and tighten to 20-25 ft-lb (27-34 N m) of torque using 1/2-inch socket and torque wrench with 1/2-inch
19.	Injection pump drive shaft (1)	Injection pump drive hub (10)	Put on.
20		Two grip springs (11) and washer (12)	Put on.
21.	Injection pump drive hub (10)	Nut (13)	Screw on part way.
ADJUSTMENT			
22.	Engine	Left side cylinder head cover	Remove (page 2-180).

INJECTION PUMP DRIVE - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
ADJUSTMENT - CONTINUED				
NOTE Always rotate engine in direction of normal rotation.				
23		Pointer (14), index (15), and two rocker arms (16)		With assistant, rotate engine until pointer (14) shows top dead center, and rocker arms (16) are at rest.
24.	Injection pump drive shaft (1)	Fuel injector pump		Remove (page 2-278).
25.	Injection pump drive shaft (1)	Nut (13) and injection pump drive hub (10)	a	Using 15/16-inch socket and hinged handle with 1/2-inch drive, unscrew nut (13) part way.
			b.	Pull hub (10) off part way.



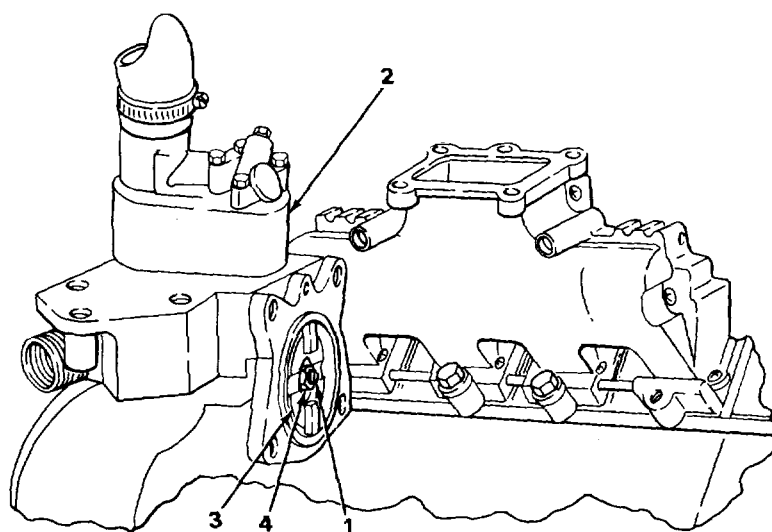
TA238122

2-329

TA238122

INJECTION PUMP DRIVE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
26. Injection pump drive shaft (1) and front crank-case cover (2)	Injection pump drive hub (3) and nut (4)	a Rotate hub (3) until marked tang is straight up. b Install drive flange locating fixture on cover (2). c Using 15/16-inch socket and torque wrench with 112-inch drive, tighten to 70 - 80 ft-lb (95 - 108 N m) of torque. d Remove locating fixture.	
27. Engine	Left side cylinder head cover	Install (page 2-180).	

**NOTE**

FOLLOW-ON MAINTENANCE:

1. Install fuel injection pump (page 2-278).
2. Install water pump (page 2-400).

TASK ENDS HERE

FUEL TANK

This task covers:

- a. Cleaning (page 2-331)
- b. Inspection/Replacement (page 2-332)
- c. Repair (page 2-332)

INITIAL SETUP

Tools	Personnel Required
Jack, dolly-type	Two
Plug, pipe, 9/16-inch (two required)	
Plug, pipe, 7/8-inch	Equipment Condition
Wrench, open-end, 9/16-inch	
Wrench, open-end, 7/18-inch	Fuel tank removed (TM9-2320-269-20-1).
Materials/Parts	
Fuel, diesel No. 2 (item 17, appendix B)	
Rags, wiping (item 42, appendix B)	

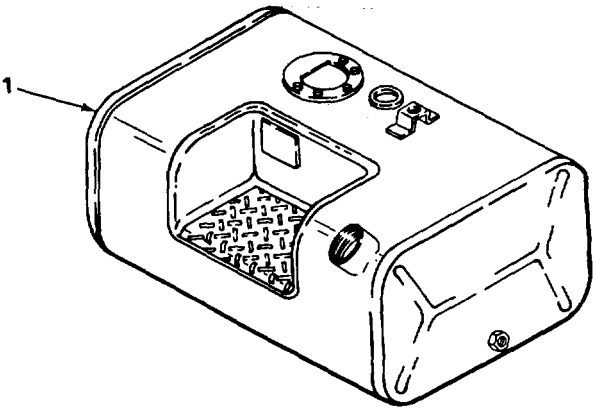
LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING
Diesel fumes can explode. Do not smoke or allow open flame nearby when servicing the fuel tank. Failure to follow these precautions could cause serious injury or death.

1.
- Fuel tank (1)
- a. Clean with No. 2 diesel fuel.
b. Wipe dry with clean, dry rags.



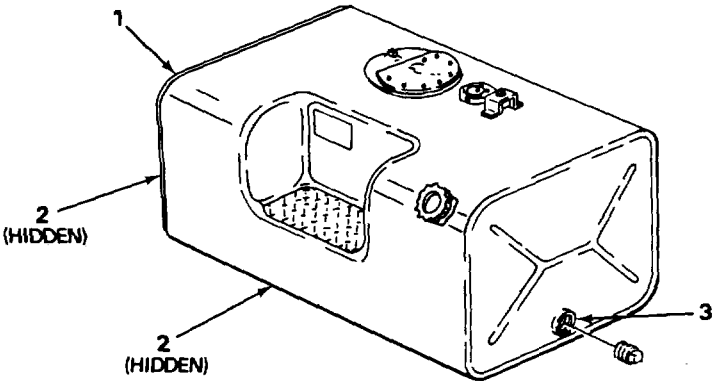
2-331

FUEL TANK - CONTINUED

		ACTION	REMARKS
LOCATION	ITEM		
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
2	Fuel tank (1)	a. Check for cracks, dents, and stripped threads. b. Replace as needed.	
3	Fuel tank (1) and three mounting holes (2) and (3)	a. Using 9/16-inch open-end wrench, screw 9/16-inch plugs into holes (2) and tighten. b. Using 7/8-inch open-end wrench, screw 7/8-inch plug into hole (3) and tighten.	
4	Fuel tank (1)	a. With assistant, set on jack. b. Fill with water and check for leaking welds. c. If leaking, go to repair.	
5	Fuel tank (1) and mounting hole (3)	a. Using dolly jack, and with help from assistant, move to drain site. b. Using 7/8-inch open-end wrench, unscrew and take plug out of hole (3). c. Let drain, and with help from assistant, take off dolly jack.	
6	Fuel tank (1) and two mounting holes (2)	a. Using 9/16-inch open-end wrench, unscrew and take out plugs. b. Go to FOLLOW-ON MAINTENANCE (page 2-333).	
REPAIR			
WARNING Diesel fumes can explode. If welding is necessary, always work in a well-ventilated area and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.			
7	Fuel tank (1)	Fix leaking welds (TM 9-237).	

FUEL TANK - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REPAIR - CONTINUED			
8	Fuel tank (1) and mounting hole (3)	a. Using dolly jack, and with help from assistant, move to drain site. b. Using 7/8-inch open-end wrench, unscrew and take plug out of hole (3). c. Let drain, and with assistant, take off jack.	
9	Fuel tank and two mounting holes (2)	a. Using 9/16-inch open-end wrench, unscrew and take out plugs of holes (2). b. Allow tank (1) to dry.	



NOTE
FOLLOW-ON MAINTENANCE: Install fuel tank (TM 9-2320-269-20-1).

TASK ENDS HERE

GOVERNOR

This task covers:

- a. Disassembly (page 2-335)
- b. Cleaning (page 2-346)
- c. Inspection/Replacement (page 2-346)
- d. Assembly/Adjustment (page 2-346)

INITIAL SETUP

Tools

Bit, screwdriver, flat-tip,
 1/2-inch drive, 3/16-inch
 Bit, screwdriver, flat-tip,
 1/2-inch drive, 15/16-inch
 Brush, wire
 Bushing, trial spacer (two required)
 Extension, 3/8-inch drive, 3-inch
 Extension, 11/2-inch drive, 3-inch
 Face, inserted hammer, hard-plastic
 Fixture, holding, fuel injection pump
 Hammer, ball-peen, machinist's
 Handle, hinged, 11/2-inch drive
 Handle, ratchet, 3/8-inch drive
 Holder, inserted hammer-face
 Key, socket-head screw, 10-mm
 Knife, putty
 Micrometer, depth
 Pan, drain
 Pliers, diagonal cutting
 Pliers, round-nose, long
 Pliers, slip-joint
 Pliers, soft jaw
 Press, arbor, hand-operated
 Puller, flyweight
 Punch, straight, blunt-end, 5/16-inch
 Remover tool, flyweight damper
 Screwdriver, flat-tip, 1/8-inch
 Screwdriver, flat-tip, 11/4-inch
 Screwdriver, flat-tip, 5/16-inch
 Screwdriver, flat-tip, 3/16-inch
 Socket, 3/16-inch drive, 9/16-inch
 Socket, 3/16-inch drive, 6-mm
 Socket, 3/8-inch drive, 8-mm
 Socket, 3/16-inch drive, 10-mm
 Socket, 3/8-inch drive, 12-mm
 Socket, 3/8-inch drive, 21-mm
 Vise, machinist's
 Wrench, drive-flange holding
 Wrench, governor-spring adjusting
 Wrench, holding, camshaft
 Wrench, open-end, 8-mm (two required)

Tools - Continued

Wrench, open-end, 10-mm (two required)
 Wrench, pliers
 Wrench, torque, 1/2-inch drive,
 0-175 ft-lb capacity

Materials/Parts

Bolt, governor, with two nuts, washers,
 and lockwashers
 Compound, sealant, non-hardening (item 13,
 appendix B)
 Crocus cloth (item 7, appendix B)
 Fuel, diesel, No. 2 (item 17, appendix B)
 Gasket, control-rack stop
 Gasket, governor cover (two required)
 Gasket, governor housing (two required)
 Gasket, governor housing plug
 Gasket, governor plug (two required)
 Lockplates, governor bushing (two required)
 Lockwasher, bracket bolt
 Lockwasher, bracket-to-pump (two
 required)
 Lockwasher, flange (two required)
 Lockwasher, governor cam bracket
 Oil, engine (item 32, appendix B)
 Packing, governor (two required)
 Pin, cotter (four required)
 Rags, wiping (item 42, appendix B)
 Seal, oil, governor cover
 Seal, securing bar
 Tag, marking (item 50, appendix B)
 Washer, retaining, governor bolt
 Wire, sealing (item 58, appendix B)

Personnel Required

Two

Equipment Condition

Fuel injection pump removed (page 2-278).

GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY

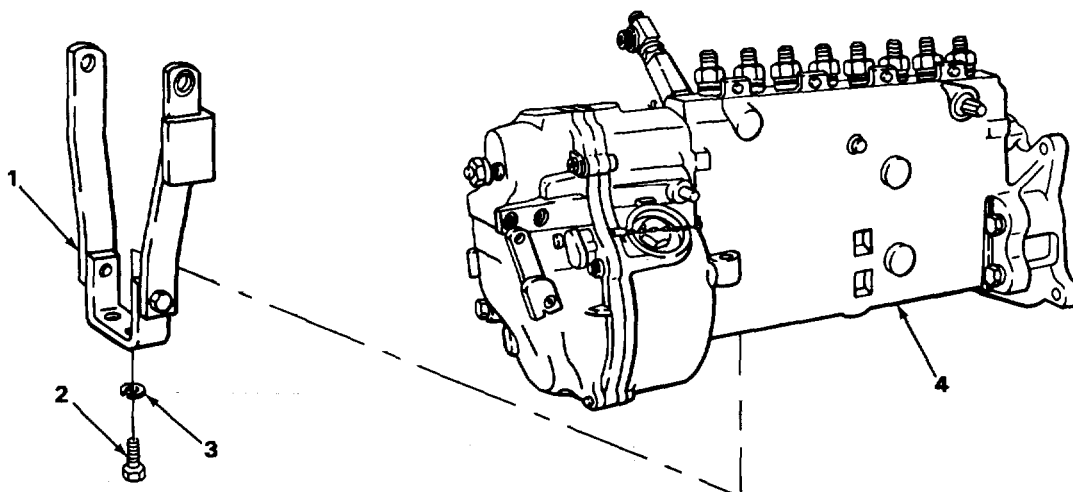
CAUTION

Parts of the governor are machined and polished, do not scratch with tools and always work on a clean, wooden surface.

NOTE

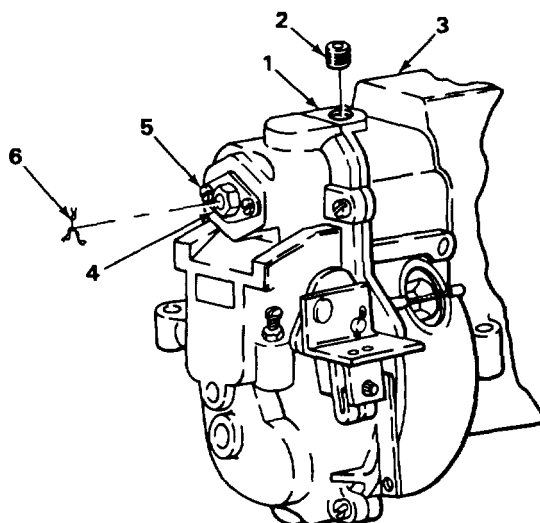
If mounting brackets have been removed, go to step 3.

1.	Bracket (1)	Two screws (2) and lockwashers (3)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (3).
2.	Fuel injection pump (4)	Bracket (1)	Take off.



GOVERNOR - CONTINUED

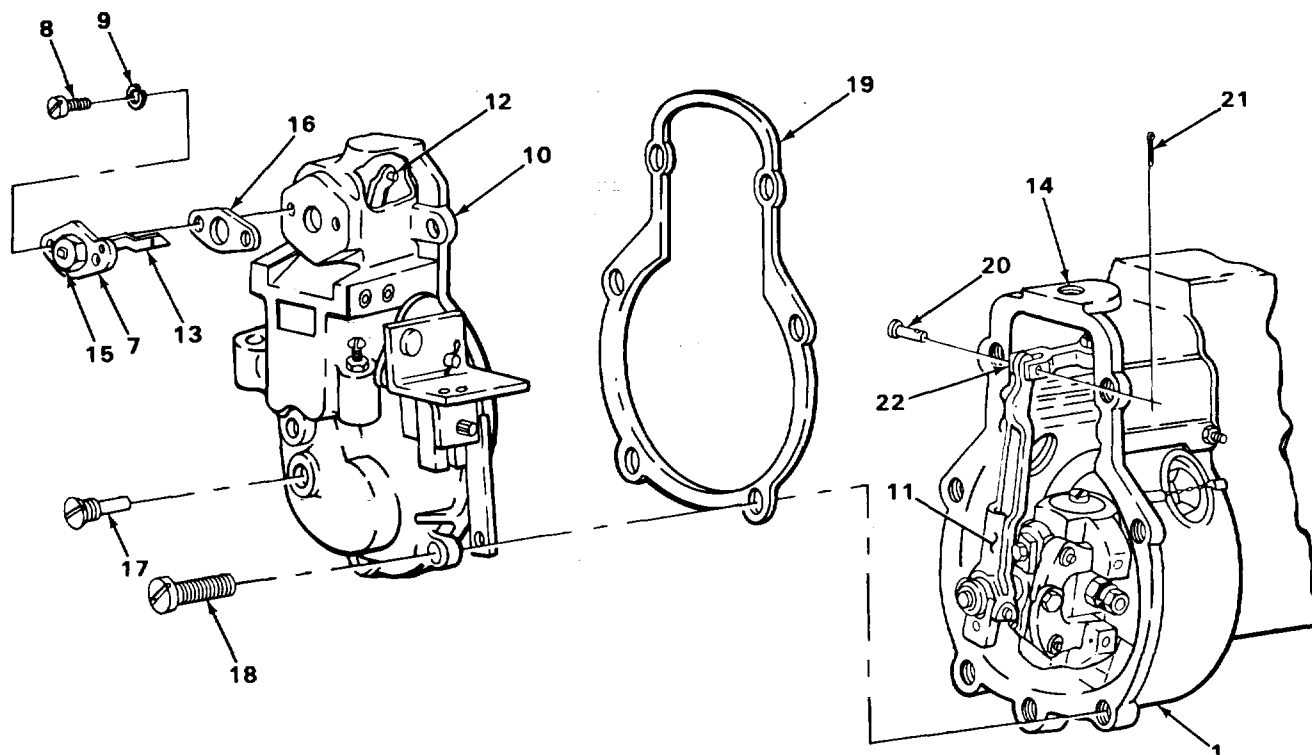
LOCATION		ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED				
3.	Governor housing (1)	Plug (2)	Using 10-mm socket-head screw key, unscrew and take out.	
4.	Fuel injection pump (3)	Governor housing (1) b. Get rid of fluid (page 2-46).	a. Drain into pan.	
5		Fuel injection pump (3)	Using holding fixture, mount in vise.	
6.	Adjusting screw (4) and mounting	Seal wire (6) b. Get rid of.	a. Using diagonal cutting pliers, cut off.	



7.	Flange (7)	Two screws (8) and lockwashers (9)	a. Using 1/4-inch flat-tip screwdriver, unscrew and take out. b. Get rid of lockwashers (9).	
8.	Governor cover (10)	Governor lever (11)	Move back to idle position.	
9.	Rocker arm pin (12)	Stop shackle (13)	Using 1/8-inch flat-tip screwdriver, reach through hole (14) and move shackle (13) off pin (12).	

GOVERNOR - CONTINUED

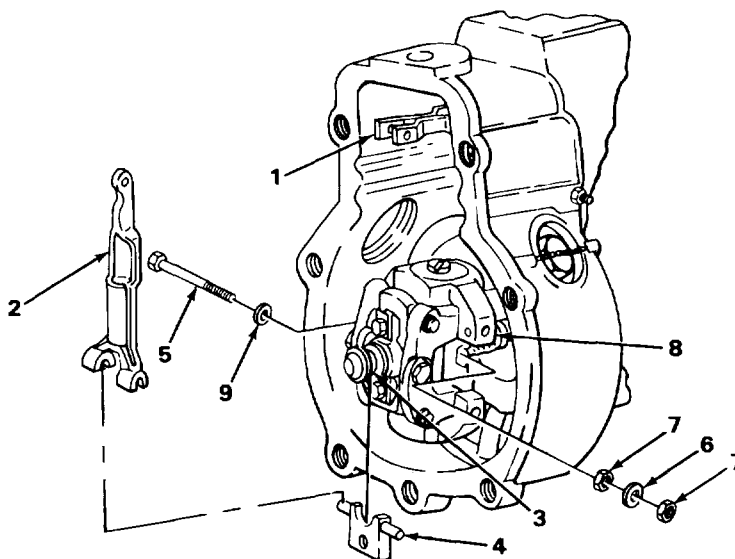
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
10.	Governor cover (10) Control rack stop (15) and gasket (16)	a. Turn clockwise, and take out. b. Take out screwdriver. c. Take out. d. Get rid of gasket (16).	
11	Governor screw (17)	Using 3/8-inch flat-tip screwdriver, unscrew and take out.	
12	Six screws (18)	Using 1/4-inch flat-tip screwdriver, unscrew and take out.	
13.	Governor housing (1) Governor cover (10) and gasket (19)	a. Take off, moving lever (11) back and forth. b. Get rid of gasket (19).	
14.	Pin (20)	a. Using diagonal cutting pliers, take out. b. Get rid of.	
15.	Governor link (22)	Take out.	



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GOVERNOR - CONTINUED

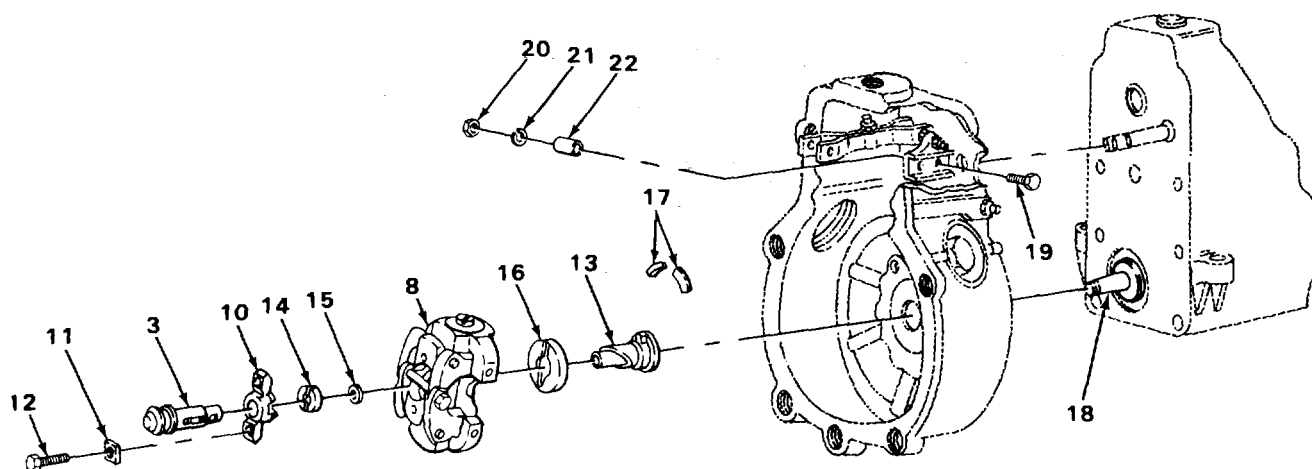
	LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED				
16	Governor link (1)	Governor lever (2)	Pull out and down.	
17	Adjusting pin (3)	Governor lever (2) and guide (4)	Take out.	
18.	Governor bolt (5)	Retaining washer (6) and two nuts (7)	a. Using 1/8-inch flat-tip screwdriver, bend lockwasher (6) flat. b. Using two 10-mm open-end wrenches, unscrew and take off. c. Get rid of.	
19.	Flyweight (8)	Governor bolt (5) and washer (9)	a. Turn flyweight (8) so bolt (5) is up and down, and take out. b. Get rid of.	



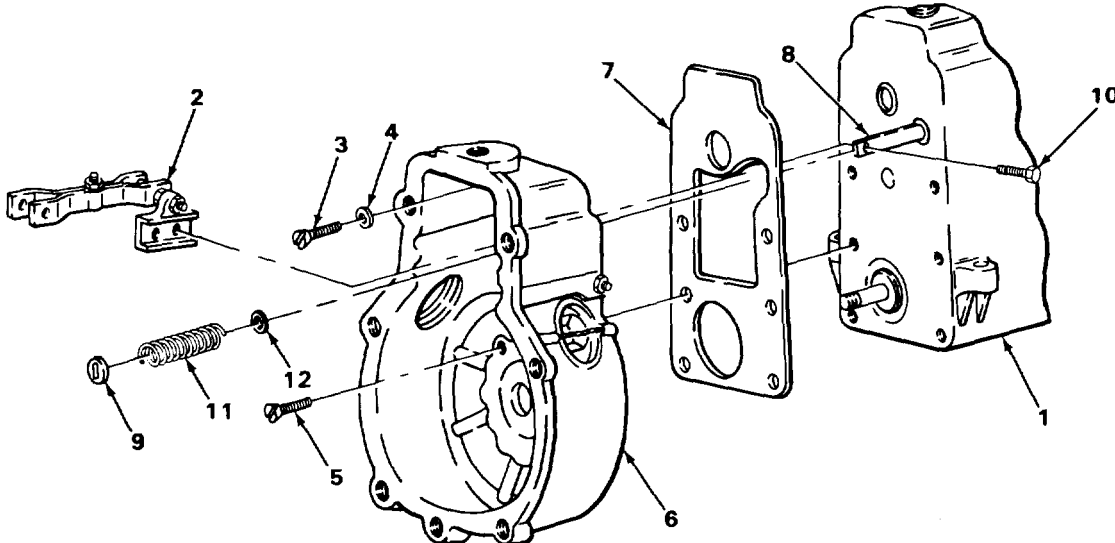
20	Adjusting pin (3)	Take out.	
21.	Governor bushing (10)	Two lockplates (11) and screws (12)	a. Using 1/8-inch flat-tip screwdriver bend lockplates (11) flat. b. Using 10-mm open-end wrench, unscrew and take out. c. Get rid of lockplates (11).

GOVERNOR - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED				
22	Flyweight (8)	Bushing (10)	Take out.	
23	Governor hub (13)	Governor nut (14)		With aid of assistant using 15/16-inch flat-tip screwdriver bit, 3-inch extension, hinged handle with 1/2-inch drive, and camshaft holding wrench, unscrew and take off.
24		Flyweight (8) shims (15)	Using flyweight puller, take off.	
25		Retainer (16) and four bumpers (17)	Using soft jaw pliers, pry retainer (16) up and take out.	
26.	Camshaft (18)	Governor hub (13)	Using flyweight damper removing tool, take off.	
27.	Bracket bolt (19)	Nut (20), lockwasher (21), and spacer (22)	a. Using two 8-mm open-end wrenches, unscrew and take off. b. Get rid of lockwasher (21).	

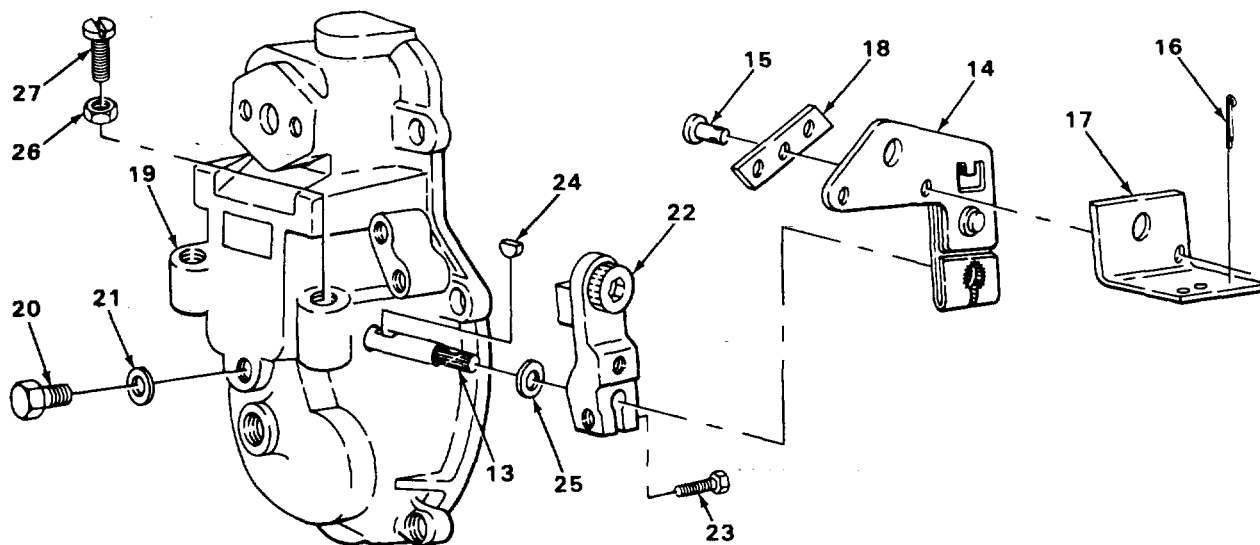


GOVERNOR - CONTINUED

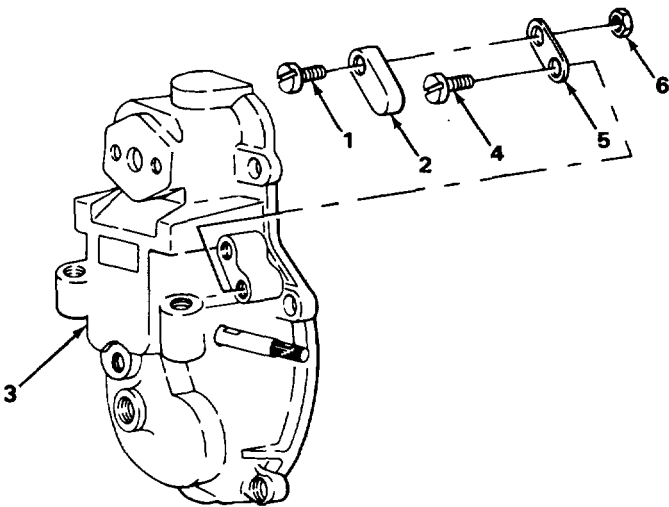
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
28.	Fuel injection pump (1)	Governor bracket (2)	Take off.
29		Screw (3) and washer (4)	Using 5/16-inch flat-tip screwdriver, unscrew and take out.
30		Six screws (5), governor housing (6), and gasket (7)	a. Using 3/8-inch flat-tip screwdriver, bit with 1/2-inch drive, 3-inch extension and hinged-handle with 1/2-inch drive, unscrew and take out screws (5). b. Take off housing (6), tapping with plastic-hammer. c. Take off and get rid of gasket (7).
31.	Control rack (8)	Spring seat (9), bracket bolt (10), governor spring (11) and spring ring (12)	a. Hold spring seat (9) down. b. Take out bolt (10). c. Let seat (9) up, and take off spring (11) and ring (12).
			
32.	Governor shaft (13)	Governor lever (14)	Using 1/4-inch flat-tip screwdriver, take off.
33.	Pin (15)	Cotter pin (16)	Using diagonal cutting pliers, take out and get rid of.

GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
34.	Governor lever (14)	Plate (17), pin (15), and bracket (18)	Take out.
35.	Governor cover (19)	Plug (20) and gasket (21)	a. Using 12-mm socket and ratchet handle with 3/8-Inch drive, unscrew and take out. b. Get rid of gasket (21).
36.	Control lever (22)	Screw (23)	Using 10-mm open-end wrench, unscrew and take out.
37.	Governor shaft (13)	Control lever (22) and woodruff key (24)	Take off.
38.	Governor cover (19)	Oil seal (25)	a. Using 1/8-inch flat-tip screwdriver, take out. b. Get rid of.
39.		Nut (26) and screw (27)	Using 3/8-inch flat-tip screwdriver and 10-mm open-end wrench, unscrew and take out.

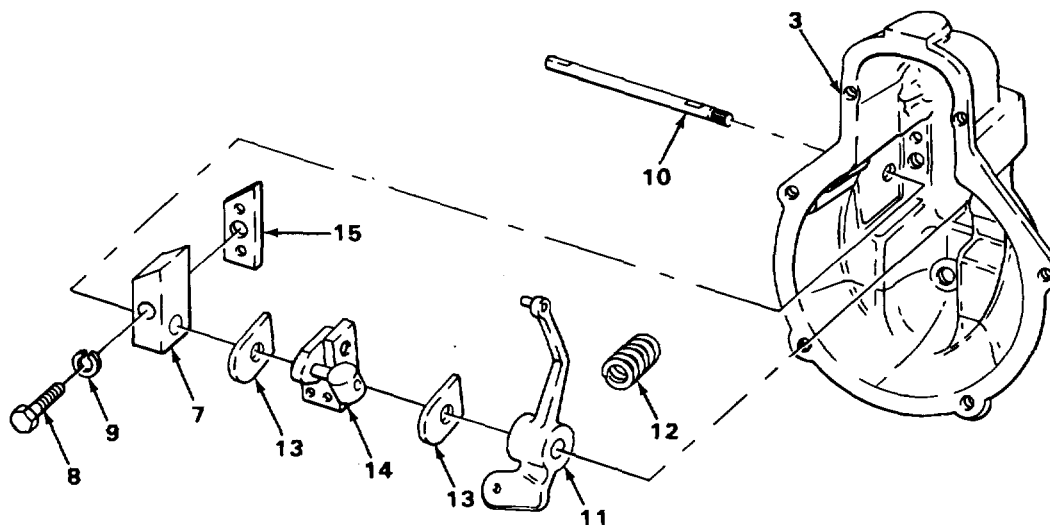


GOVERNOR - CONTINUED

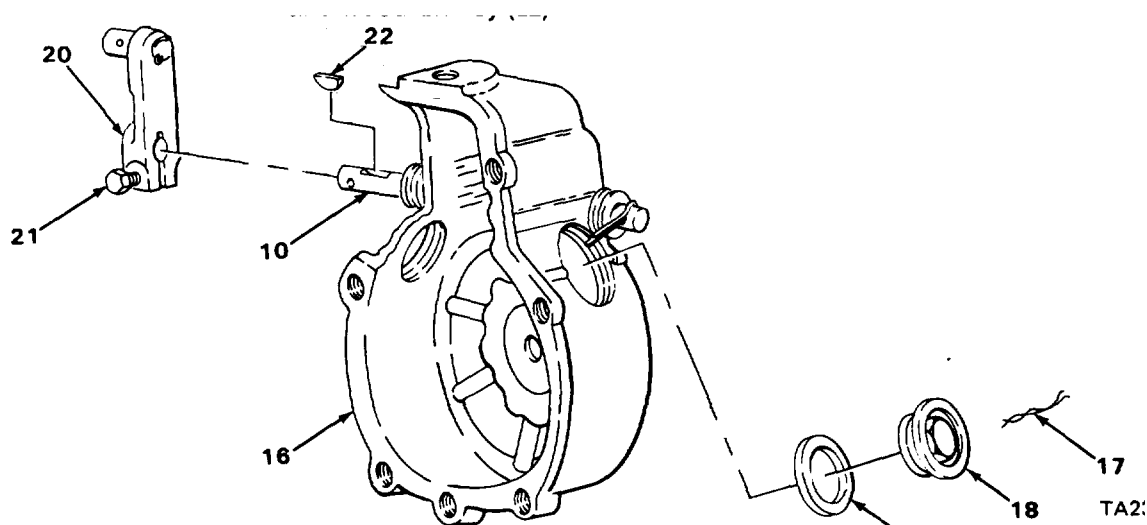
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
40.	Governor stop screw (1)	a. Using long round-nose pliers, break off. b. Get rid of.	
41.	Governor cover (3)	Using slip-joint pliers and wrench pliers, unscrew and take out.	
			
42.	Governor cam bracket (7)	a. Using 10-mm socket, 3-inch extension, and ratchet handle with 3/8-inch drive, b. Get rid of lockwasher (9).	
43.	Governor cover (3)	Pull shaft (10) out part way, and take off	
44.	Governor shaft (10), lever (11) and spring (12).	Tap with ball-peen hammer and 5/16-Inch straight punch if needed. Pull shaft (10) out farther, and take out washers (13) and lever (14).	
45.	Two washers (13) and sliding lever (14)	Take out.	
46.	Cam bracket (7)	Take out.	
	Bracket shim (15)		

GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

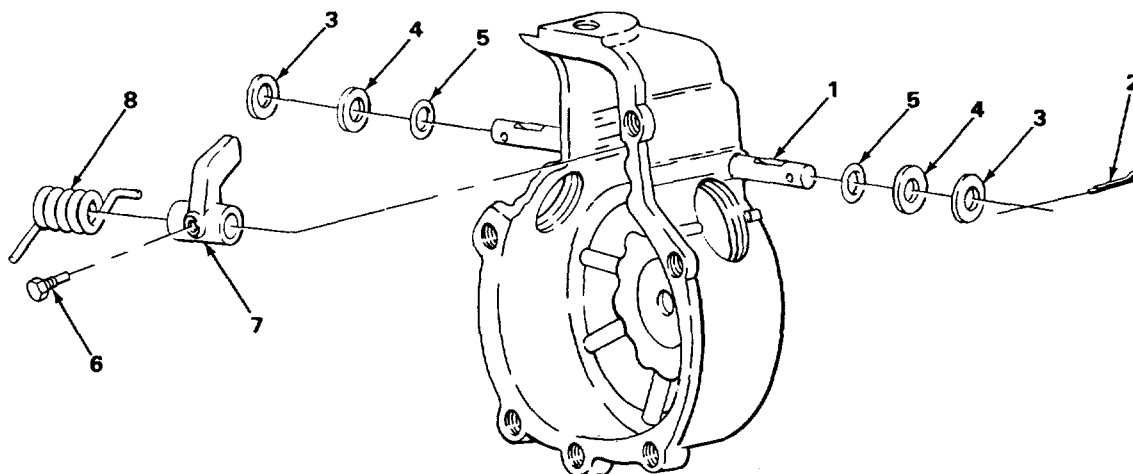
DISASSEMBLY - CONTINUED

47.	Governor housing (16)	Sealing wire (17)	a. Using diagonal cutting pliers, cut off. b. Get rid of.
48.	Plug (18) and gasket (19)	Bolt (21)	a. Using 21-mm socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of gasket (19).
49.	Actuating lever (20)	Actuating lever (20) and woodruff key (22)	Using 8-mm socket and ratchet handle with 3/8-inch drive, unscrew part way. Take off.
50.	Governor shaft (10)		



GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
51. Governor shaft (1)	Two cotter pins (2)	a. Using diagonal cutting pliers, take out. b. Get rid of.	
52.	Two shims (3), washers (4), and packings (5)	a. Using 1/8-inch flat-tip screwdriver, pry out. b. Get rid of packings (5).	
53.	Screw (6)	Using 6-mm socket and ratchet handle with 3/8-inch drive, unscrew and take out while holding lever (7) in place.	
54. Governor stop	Spring (8) lever (7)	Using 1/8-inch flat-tip screwdriver, lift off.	
55. Governor housing (5)	Governor shaft (1) and spring (8)	Pull shaft (1) out part way, and take out spring (8).	
56.	Governor shaft (1) and stop lever (7)	Pull shaft (1) out, and take out lever (7).	



GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

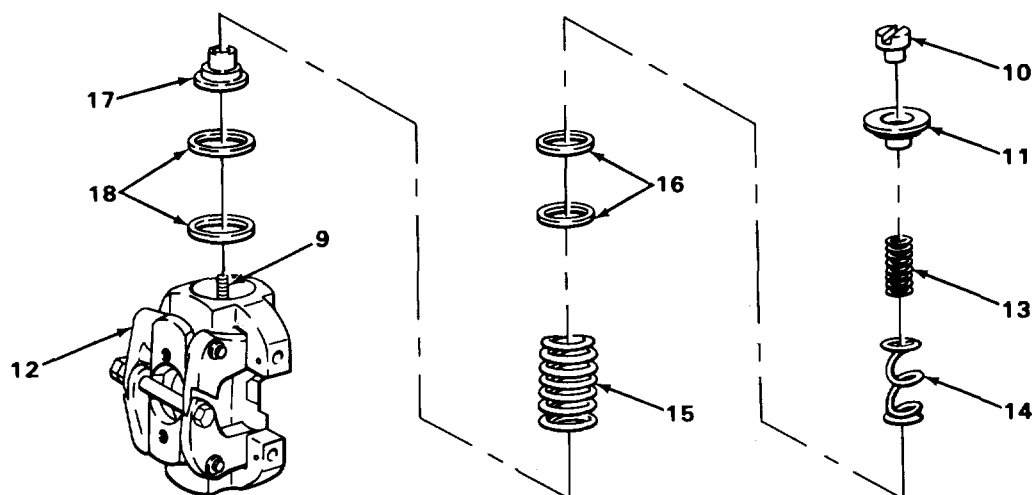
WARNING

Governor springs are under pressure. Release slowly. Parts can fly out striking you and others causing injury.

NOTE

Tag governor springs when removing to insure installing in original positions.

57.	Flyweight post (9)	Cylinder nut (10) and outer spring seat (11)	Using governor spring adjusting wrench, unscrew and take out nut (10) while holding seat (11) in place. Let up slowly, and take out.
58.		Outer spring seat (11)	
59.	Governor flyweight (12)	Two maximum speed springs (13) and (14) and idle spring (15)	a. Take out. b. Tag.
60.		Two washers (16), spring seat (17), and two shims (18)	a. Turn flyweight (12) over, tap with plastic-face hammer to jar loose, and let slide out. It may be necessary to fill with clean diesel fuel to loosen parts. b. Repeat steps 56 thru 59 for opposite side of flyweight (12).

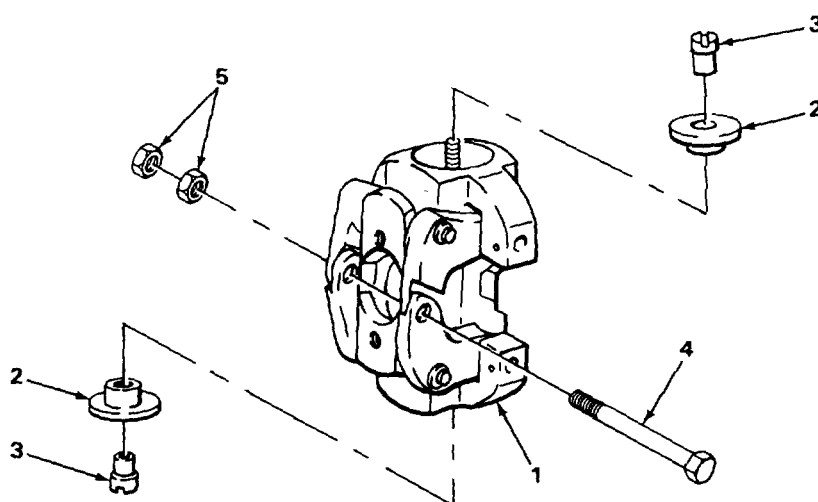


GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). WARNING Diesel fumes can explode. If welding of fuel tank is necessary, always work in well-ventilated area, and keep tank full of water at all times. Failure to follow these precautions could cause serious injury or death.			
61.	All parts	a. Using putty knife, clean off old gasket material. b. Using wire brush, clean all threads. c. Wash in clean diesel fuel. d. Wipe dry with clean, dry rags.	
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Flyweight springs are color-coded. If replacing, always use same color code to insure proper operation.			
62.	All parts	a. If cracked or worn, replace. b. If threads are stripped, replace. c. If gasket surfaces are scratched or warped, smooth with crocus cloth or replace as needed. d. If sliding parts are burred, binding, or loose, smooth with crocus cloth or replace as needed. e. If bearing races are grooved or scratched, replace using press.	
ASSEMBLY/ADJUSTMENT			
63. Governor flyweight (1)	Two spring seats (2) and cylinder nuts (3)	a. Put in seats (2) and two trial spacer bushings. b. Screw on nuts (3) until snug.	
64. New governor bolt	Screw on until snug. (4) and two nuts (5)		

GOVERNOR - CONTINUED

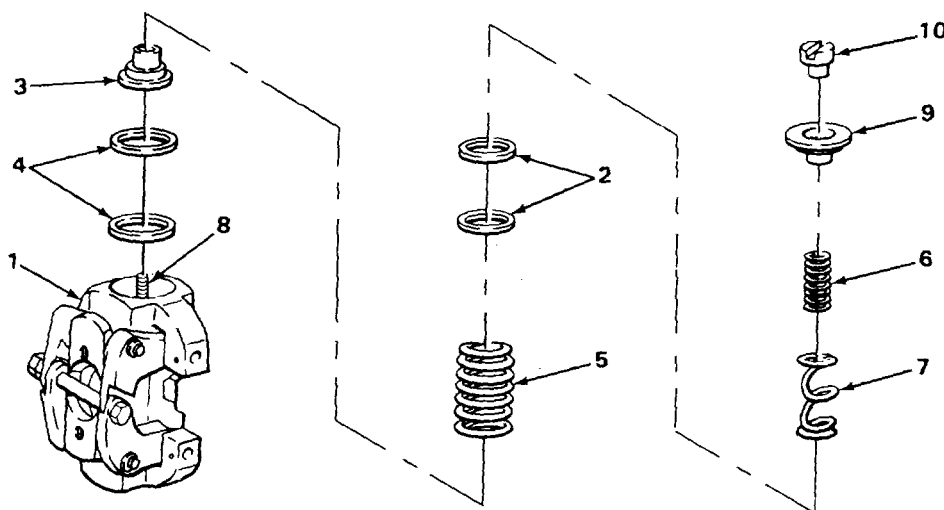
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
65.	Governor flyweight (1)	Push on center of governor bolt (4), and check rocking movement of flyweight.	
NOTE			
Once proper size spring seats are found, do not mix with old ones.			
66.	Governor flyweight (1)	a. Unscrew, and take off nuts (3). b. Take out trial spacers and seats (2). c. If flyweight (1) movement was uneven, repeat steps 62 thru 65 using different size spring seats (2) until movement is even.	
67.	Two nuts (5) and	Unscrew, and take off. governor bolt (4)	



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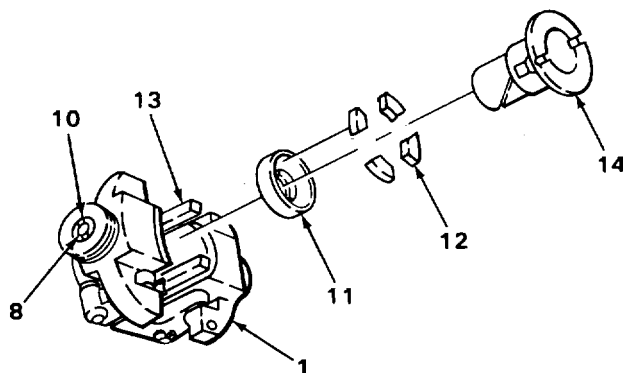
GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
NOTE			
When assembling the flyweight, always install shims and washers as shown, they will be changed as needed when adjusting the fuel injection pump.			
Check tags before installing springs to insure proper operation.			
68. Governor flyweight (1)	Two washers (2), spring seat (3), and shim (4)	Put in.	
69.	Idle spring (5) and two maximum speed springs (6) and (7)	a. Take off tags. b. Put in.	
70. Flyweight post (8)	Outer spring seat (9) and cylinder nut (10)	a. Put on seat (9), and press down. b. Screw on nut (10) part way. c. Repeat steps 67 thru 69 for opposite side of flyweight (1).	



GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
NOTE The cylinder nuts are waved on the bottom and must be turned until they seat to insure not working loose during operation.			
71. Two flyweight posts (8)	Two cylinder nuts (10)	Using governor spring adjusting wrench and depth micrometer, screw on nuts (10) until post (8) protrusion is not more than 0.001-inch (2.5 mm) and is the same on both sides.	
NOTE Before installing bumpers, coat them with clean engine oil.			
72. Governor flyweight (1)	Retainer (11) and four bumpers (12)	a. Put retainer (11) over flyweight tabs (13). b. Put bumpers (11) in against flyweight tabs (13).	
73.	Governor hub (14)	Put through flyweight (1), between bumpers (12). Tap into place with plastic-face hammer if needed.	



GOVERNOR - CONTINUED

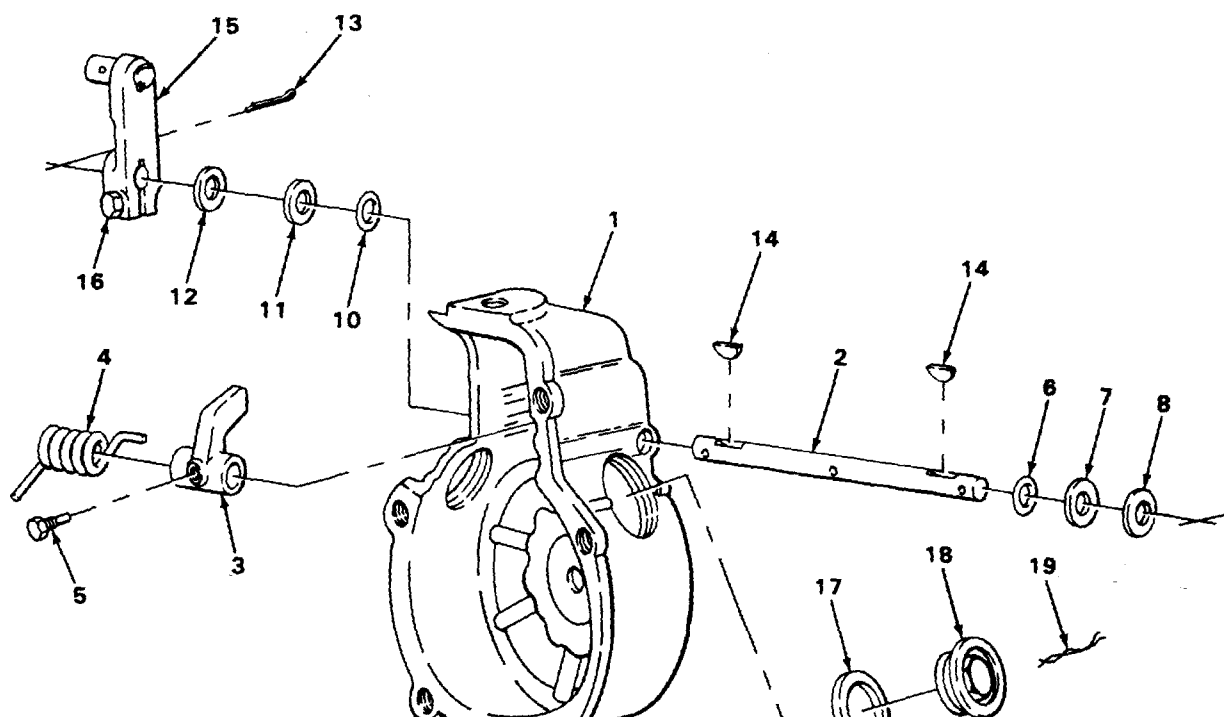
LOCATION	ITEM	ACTION REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED		
74. Governor housing (1)	Governor shaft (2) and stop lever (3)	Put shaft (2) through part way, and put lever (3) on.
75.	Governor shaft (2) and spring (4)	Put spring (4) on, and put shaft (2) through housing (1).
76. Governor stop	Screw (5) lever (3)	Using 6-mm socket, 3-inch extension, and ratchet handle with 3/8-inch drive, hold lever (3) in place and screw in and tighten.
77. Governor shaft (2)	Spring (4) and stop-lever (3)	Using 1/8-inch flat-tip screwdriver, lift spring (4) and hook over lever (3).
78.	New packing (6), washer (7), and shim (8)	a. Apply clean engine oil to packing (6). b. Put on.
79.	New cotter pin (9)	Put through, and bend over using diagonal cutting pliers.
80.	New packing (10), washer (11), shim (12) and new cotter pin (13)	a. Apply clean engine oil to packing (10). b. Put on. c. Put pin (13) through, and bend over using diagonal cutting pliers.
81.	Two woodruff key (14) and actuating lever (15)	Put in.
82. Actuating lever (15)	Bolt (16)	Using 8-mm socket and ratchet handle with 3/8-inch drive, tighten.
83. Governor housing (1)	New gasket (17) and plug (18)	Using 21-mm socket and ratchet handle with 3/8-inch drive, screw in and tighten.

GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY/ADJUSTMENT - CONTINUED

84. Sealing wire (19) Put in (page 2-46).



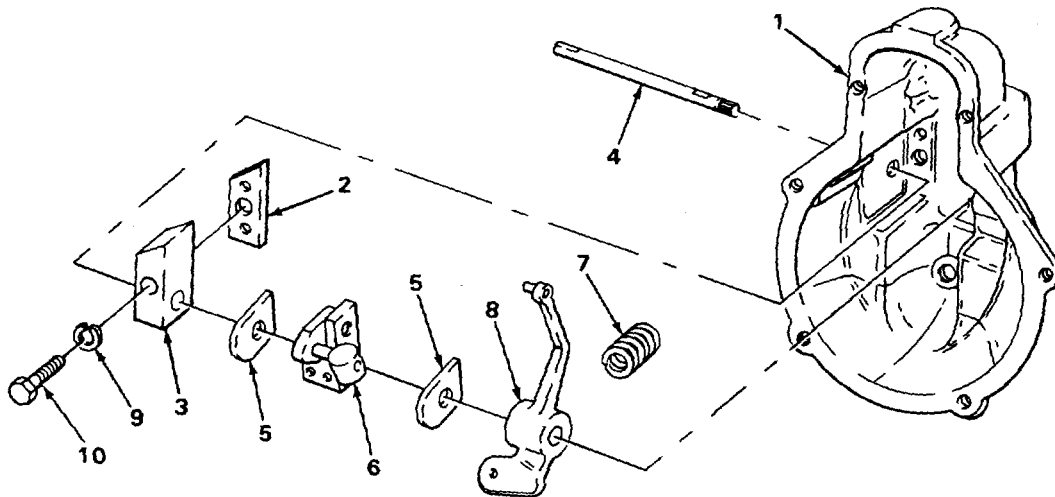
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GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
85.	Governor cover (1)	Bracket shim (2)	Put in.
86.		Cam bracket (3) and shaft (4)	a. Put bracket (3) in. b. Put shaft (4) through part way.
87.		Two washers (5) and sliding lever (6)	a. Put one washer (5) on. b. Slide shaft (4) in, and put on lever (6) and last washer (5).
88.		Spring (7) and rocker lever (8)	a. Hold spring (7) in place. b. Put lever (8) on, and slide shaft (4) through cover (1).
89.	Governor cam bracket (3)	New lockwasher (9) and screw (10)	Using 10-mm socket, 3-inch extension, and ratchet handle with 318-inch drive, screw in and tighten.

NOTE

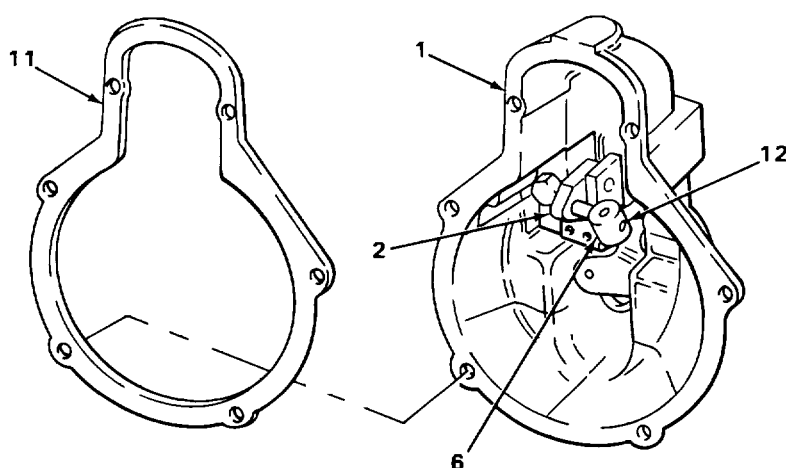
The cam bracket adjustment is a basic setting and may be changed as needed when adjusting the fuel injection pump.



90.	Governor cover (1)	New gasket (11)	Put on.

GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
91. Sliding lever (6)	Guide pin (12)	Move lever (6) until pin (12) is bottomed in cover (1).	
92.	Governor cover (1), guide pin (12) and shim (2)	a. Using depth micrometer, measure the distance from pin (12) to surface of gasket (11). b. If the measurement was not 0.847-0.863-inch (21.5 - 21.9 mm), repeat steps 40 thru 44, put in or take out shims (2) as needed, and repeat steps 85 thru 91.	

**NOTE**

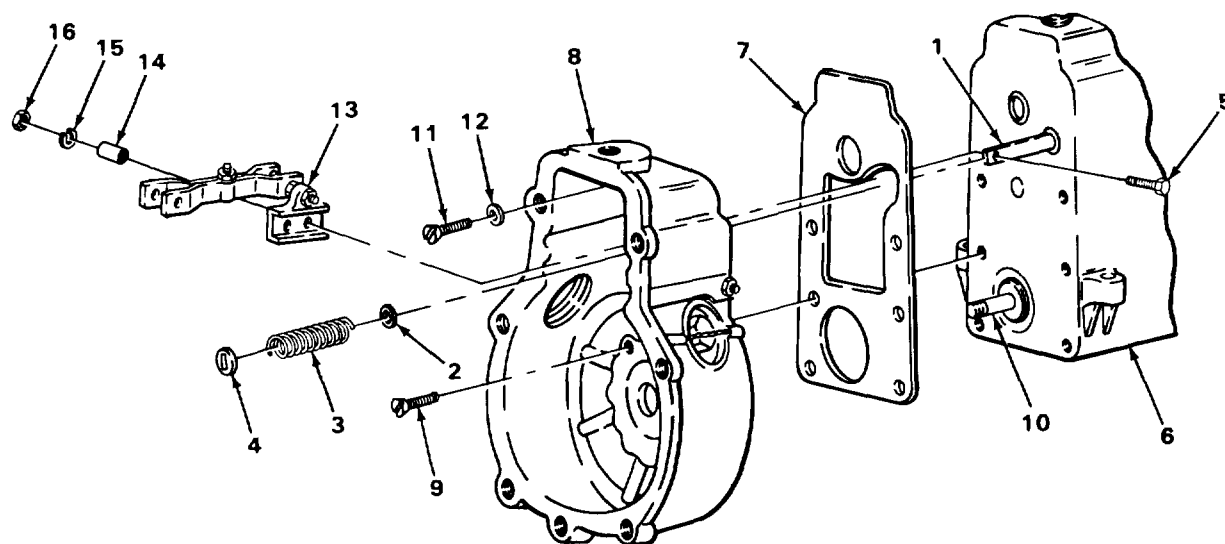
If governor housing was not removed, go to step 96.

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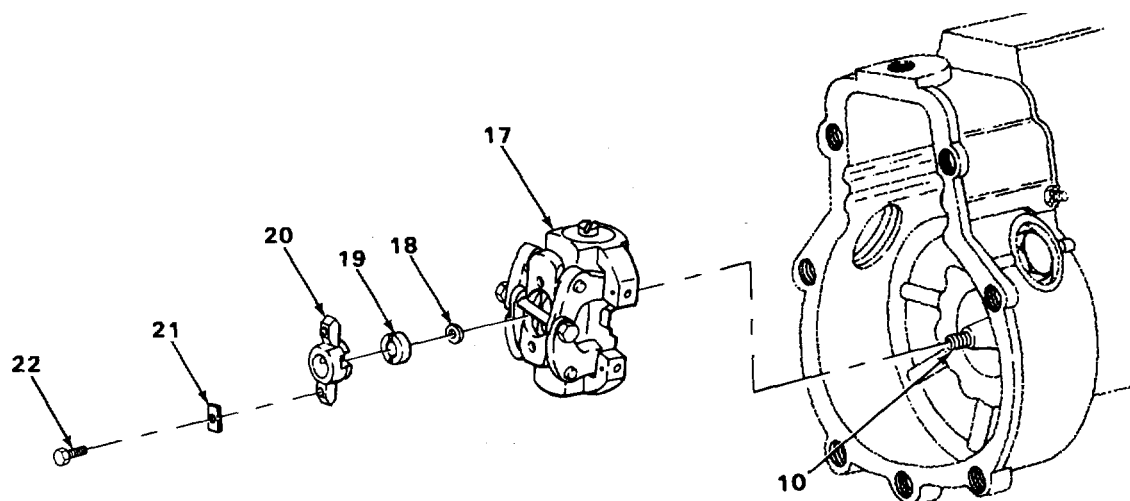
GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT- CONTINUED			
93. Control rack (1)	Spring ring (2), governor spring (3), spring seat (4), and bracket bolt (5)	a. Put ring (2), spring (3), and seat (4) on rack (1). b. Push seat (4) down, and put bolt (5) through.	
94. Fuel injection pump (6)	Gasket (7), governor housing (8), and six screws (9)	a. Put on part way. b. Screw in screws (9) part way. c. While assistant turns camshaft (10) with drive flange holding wrench, alternately tighten screws (9) using 3/8-inch flat-tip screwdriver bit, 3-inch extension, and hinged handle with 1/2-inch drive.	
95. Governor housing (8)	Screw (11) and washer (12)	Screw in, and tighten using 5/16-inch flat-tip screwdriver.	
96.	Six screws (9)	Stake in place using ball-peen hammer and 5/16-inch blunt-end punch.	
97. Bracket bolt (5)	Governor	Push seat (4) down, and put on. bracket (13)	
98.	Spacer (14), new lockwasher (15), and nut (16)	Using two 8-mm open-end wrenches, screw on and tighten.	



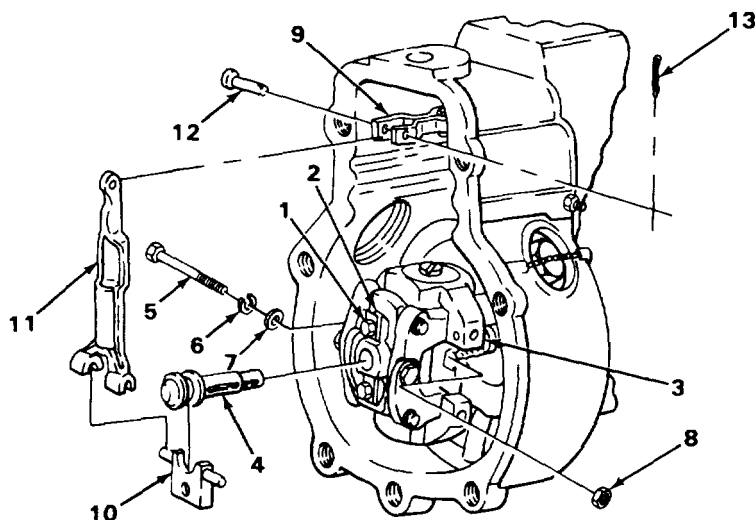
GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT			
99. Camshaft (10)	Flyweight (17)	Put on.	
100.	Shim (18) and governor nut (19)	a. Put in shim (18). b. With aid of assistant, screw on nut 37-43 ft-lb (50.2 - 58.3 N m) of torque using 15116-inch flat-tip screwdriver bit, 3-inch extension, torque wrench with 112-inch drive, and drive flange holding wrench.	
101.	Flyweight (17) and shim (18)	a. Turn flyweight (17) side-to-side on camshaft (10). b. If flyweight (17) has too much play, repeat step 23 and add shims (18). c. Repeat steps 98 and 24.	
102. Flyweight (17)	Governor bushing (20)	Put on.	
103. Governor bushing (20)	Two new lock plates (21) and screws (22)	Using 10-mm open-end wrench, screw in and tighten.	



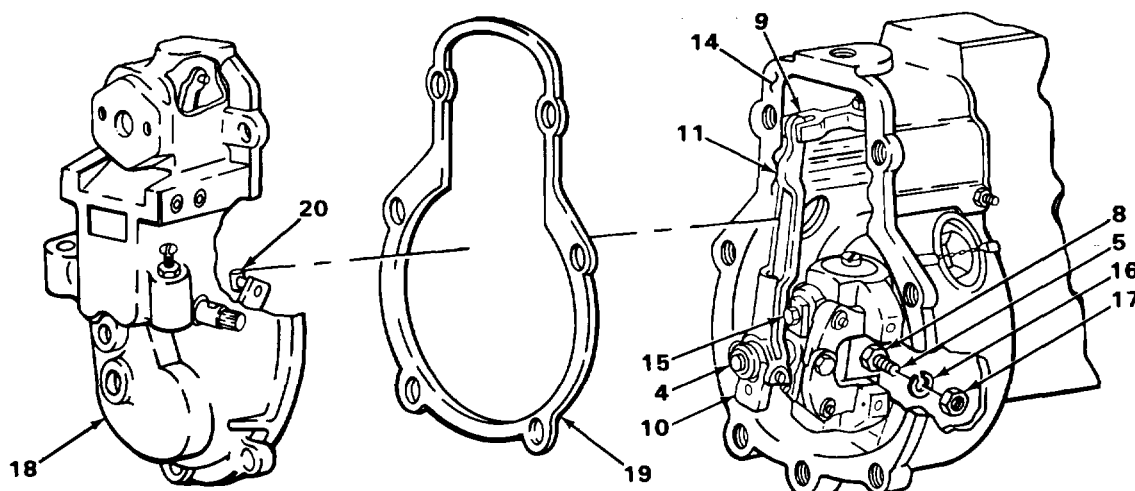
GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
104. Two governor bushing screws (1)	Two new lock-plates (2)	Using 1/8-inch flat-tip screwdriver, bend up against screws (1). Put in.	
105. Flyweight (3)	Adjusting pin (4)		
106.	New governor bolt (5), new lockwasher (6), washer (7), and nut (8)	a. Turn flyweight (3), and put bolt (5), with washer (6) through. b. Screw on nut (8).	
107. Adjusting pin (4) and governor	Guide (10) and governor lever (11)	a. Hold guide (9) against pin (4). b. Hook lever (10) into guide (9), and lift into link (8).	
108. Governor link (9)	Pin (12)	Put through.	
109. Pin (12)	New cotter pin (13)	Using diagonal cutting pliers, put through and bend over.	



GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT- CONTINUED			
110.	Governor link (9) and adjusting pin (4)	a. Using depth micrometer, measure distance from back of guide (10) to surface of governor housing (14). b. Using 10-mm open-end wrench, turn screw (15) in to lower or out to raise measurement if measurement was not 1.539 - 1.509-inch (39.09 - 38.32 mm). c. Repeat steps 104 thru 109 as needed.	
111. Governor bolt (5)	New retaining washer (16) and nut (17)	a. Using two 10-mm open-end wrenches, screw on and tighten. b. Using slip-joint pliers, bend washer (16) against nuts (8) and (17). Move in and out to check for binding.	
112.	Governor link (9)	a. Coat guide pin (20) with clean engine oil.	
113. Governor housing (14)	Governor cover (18) with gasket (19)	b. Put cover with gasket (19) on, sliding guide pin (20) into governor lever (11).	

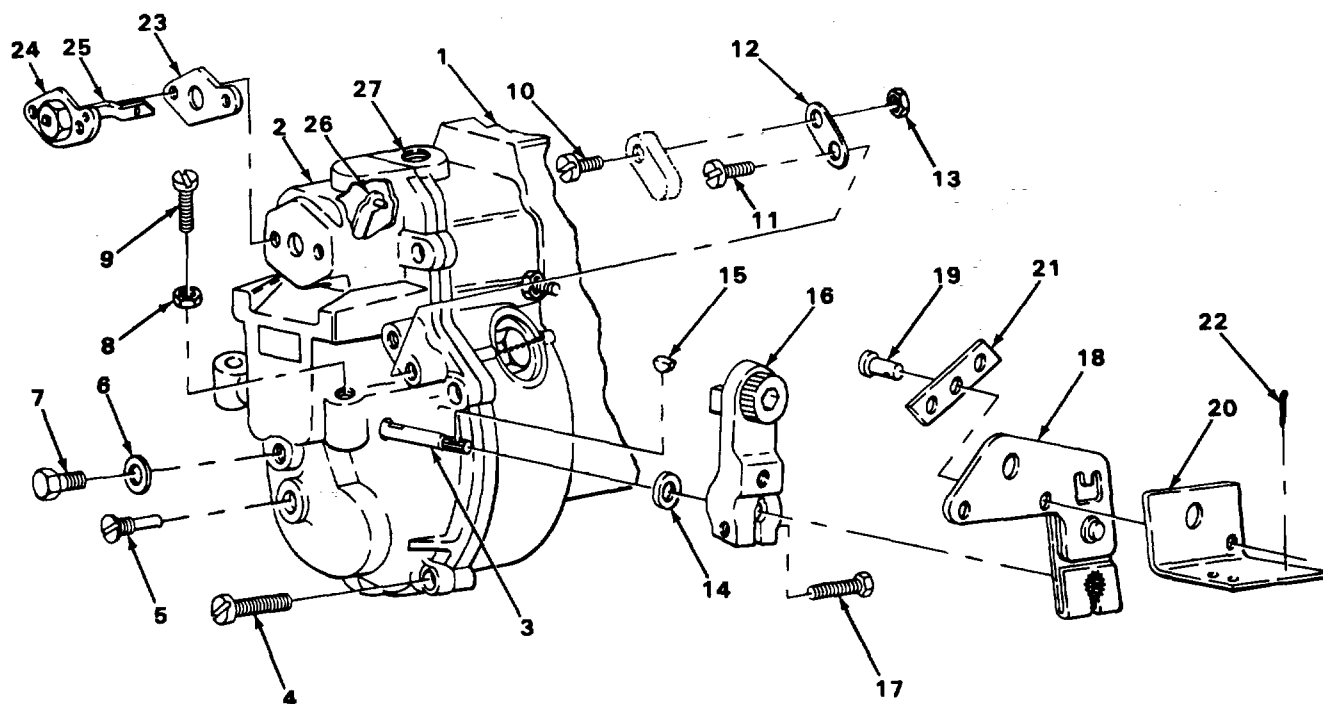


GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED		
114. Governor housing (1)	Governor cover (2)	Put on, turning governor shaft (3) back and forth.
115. Governor cover (2)	Six screws (4)	Using 1/4-inch flat-tip screwdriver, screw in and tighten.
116.	Governor screw (5)	a. Coat with nonhardening sealing compound. b. Using 3/8-inch flat-tip screwdriver, screw in and tighten.
117.	New gasket (6) and plug (7)	Using 12-mm socket and ratchet handle with 3/8-inch drive, screw in and tighten.
118.	Nut (8) and screw (9)	Screw in part way.
119.	Stop screw (10), bar screw (11), securing bar (12), and nut (13)	Using 1/8-inch flat-tip screwdriver, screw in part way.
120. Governor cover (2)	New oil seal (14)	a. Coat with clean engine oil. b. Put on.
121. Governor shaft (3)	Woodruff key (15)	Put in.
122. Control lever (16)	Put on.	
123. Control lever (16)	Screw (17)	Using 10-mm open-end wrench, screw in and tighten.
124. Governor lever (18)	Pin (19), plate (20), and bracket (21)	Put in.
125. Pin (19)	New cotter pin (22)	Using diagonal cutting pliers, put through and bend over.
126. Governor shaft (3)	Lever (18)	Put lever (18) on.

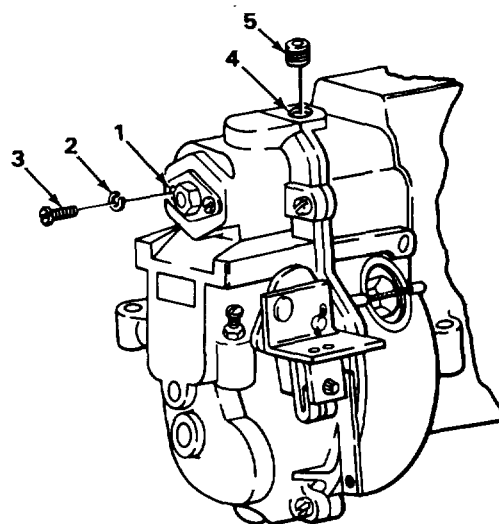
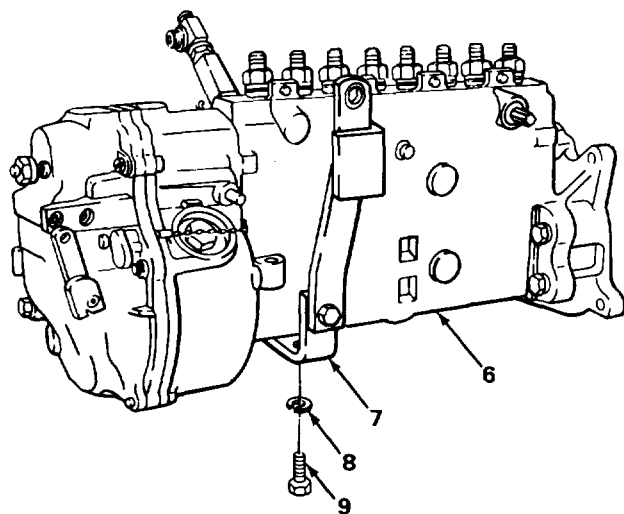
GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
127. Governor cover (2)	Governor lever (18)	Move all the way back.	
128.	New gasket (23) and control rack stop (24)	a. Put gasket (23) on stop (24). b. Hold stop (24) turned 45 o counter- clockwise from installed position. c. Put in part way.	
129.	Governor lever (18)	Move to straight up position.	
130. Stop shackle (25)	Rocker arm pin (26) and control rack stop (24)	a. Reach through hole (27) with 118-inch flat-tip screwdriver. b. Guide rocker arm pin (26) into shackle (25) while turning stop (24) clockwise to installed position. c. Take out screwdriver.	
131. Governor cover (2)	Control rack stop (24)	Push into place.	



GOVERNOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY/ADJUSTMENT - CONTINUED			
132. Flange (1)	Two new lockwashers (2) and screws (3)	Using 11/4-inch flat-tip screwdriver, screw in and tighten, screw in part way.	
133. Governor housing (4)	Plug (5)		
134. Fuel injection pump (6)	Bracket (7)	a. Take out of vise and holding fixture. b. Adjust (page 2-278). Put on.	
135. Fuel injection pump (6)	Two new lockwashers (8) and screws (9)	Using 9/16-inch socket and ratchet handle with 3/8-inch drive, screw in and tighten.	

**NOTE**

FOLLOW-ON MAINTENANCE: Install fuel injection pump (page 2-278).

TASK ENDS HERE

FILTER HEADS

This task covers:

a. Primary Filter Head Removal (page 2-362) b. Primary Filter Head Disassembly (page 2-362) c. Secondary Filter Head Removal (page 2-363) d. Secondary Filter Head Disassembly (page 2-364)	e. Cleaning (page 2-364) f. Inspection/Replacement (page 2-365) g. Secondary Filter Head Assembly (page 2-365) h. Secondary Filter Head Installation (page 2-366) i. Primary Filter Head Assembly (page 2-367) j. Primary Filter Head Installation (page 2-367)

INITIAL SETUP

Tools

Extension, 3/8-inch drive,
3-inch
Handle, ratchet, 3/8-inch drive
Knife, putty
Socket, 3/8-inch drive,
9/16-inch
Wrench, open-end, 3/8-inch
Wrench, open-end, 7/16-inch
Wrench, open-end, 9/16-inch
Wrench, open-end, 3/4-inch
Wrench, open-end, 5/8-inch
Wrench, open-end, 11/16-inch
(two required)

Materials/Parts

Cap, dust, 3/4-inch (three required)
(item 4, appendix B)
Cap, dust, 11/16-inch (item 3,
appendix B)
Lockwasher, primary filter base
(two required)
Lockwasher, secondary filter base
(three required)

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)
Tag, marking (item 50, appendix B)

Personnel Required

One

Equipment Condition

Fuel filters removed (TM 9-2320-269-201).
Right side hood panel raised
(TM 9-2320-269-20-1).

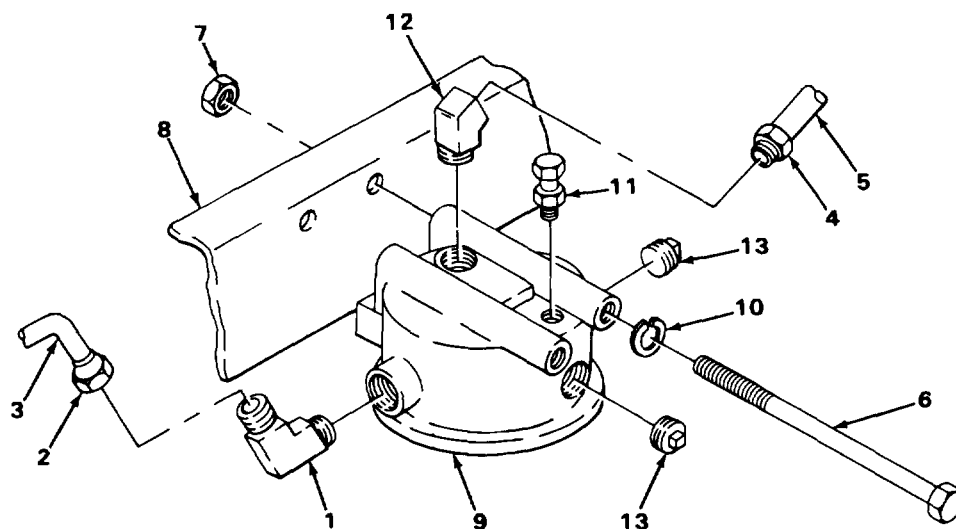
FILTER HEADS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
PRIMARY FILTER HEAD REMOVAL		
1. Elbow (1)	Nut (2) and pipe (3)	a. Using 3/4-inch and 11/16-inch open-end wrenches, unscrew and pull free. b. Cover pipe (3) with dust cap.
2. Coupling (4)	Line (5)	a. Using 5/8-inch and 3/4-inch open-end wrenches, unscrew and take off. b. Cover line (5) with 3/4-inch dust cap.
3. Two screws (6)	Two nuts (7)	Using 9/16-inch socket, 3-inch extension, ratchet handle with 3/8-inch drive, and 9/16-inch open-end wrench, unscrew and take off.
4. Frame (8)	Primary filter base (9), two screws (6),	a. Take off. b. Get rid of lockwashers (10) and lockwashers (10)
PRIMARY FILTER HEAD DISASSEMBLY		
5. Primary filter base (9)	Air bleeder cock (11)	Using 7/16-inch open-end wrench, unscrew and take out.
6.	Two elbows (1) and (12)	Using 11/16-inch open-end wrench, unscrew and take out.
7.	Two plugs (13) and take out.	Using 3/8-inch open-end wrench, unscrew
8. Elbow (12)	Coupling (4)	Using 5/8-inch and 11/16-inch open-end wrenches, unscrew and take out.

FILTER HEADS - CONTINUED

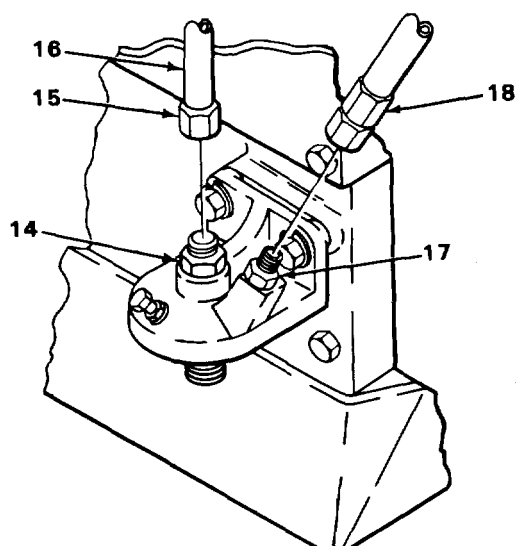
LOCATION	ITEM	ACTION	REMARKS

PRIMARY FILTER HEAD DISASSEMBLY - CONTINUED



SECONDARY FILTER HEAD REMOVAL

9. Coupling (14) 10. Coupling (17)	Nut (15) and pipe (16) Line (18)	a. Using two 11/16-inch open-end wrenches, unscrew and take off. b. Cover pipe (16) with dust cap. a. Using 5/8-inch and 3/4-inch open-end wrenches, unscrew and take off. b. Cover line (18) with dust cap.



FILTER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
SECONDARY FILTER HEAD REMOVAL - CONTINUED			
11. Engine (1)	Three screws (2), lockwashers (3), and secondary filter base (4)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Take off. c. Get rid of lockwashers (3).	
SECONDARY FILTER HEAD DISASSEMBLY			
12. Secondary filter base (4)	Air bleeder cock (5)	Using 7/16-inch open-end wrench, unscrew and take out.	
NOTE			
Tag couplings with position to insure proper installation.			
13.	Coupling (6)	Using 5/8-inch open-end wrench, unscrew and take out.	
14.	Elbow (7)	Using 11/16-inch open-end wrench, unscrew and take out.	
15. Elbow (7)	Coupling (8)	Using 5/8-inch and 11/16-inch open-end wrenches, unscrew and take out.	
CLEANING			
NOTE			
For more information on how to clean parts, go to General Maintenance Instructions, (page 2-46).			
16.	Gasket surfaces	Using putty knife, clean away dirt and gasket material.	
WARNING			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
17.	All parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.	

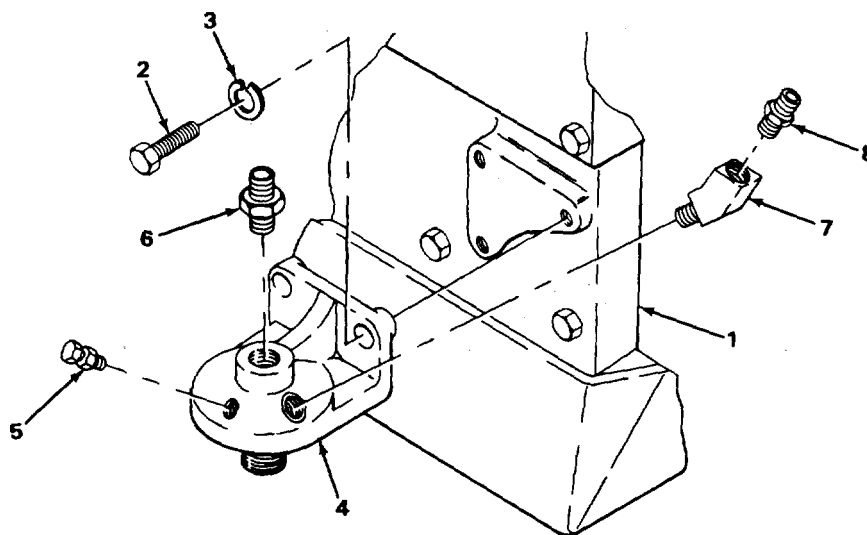
FILTER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
18.	All parts	a. Check for cracks, broken parts, and wear. b. Replace as needed.	
19.	All gasket surfaces	a. Check for scratches and grooves. b. Replace as needed.	
SECONDARY FILTER HEAD ASSEMBLY			
20.	All threaded parts	a. Check for stripped or gouged threads. b. Replace as needed.	

NOTE

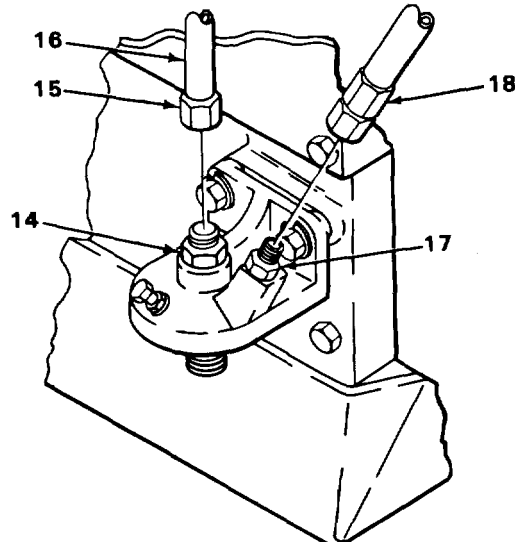
Be sure to check tag markings and take off before installing couplings to insure proper installation.

21.	Elbow (7)	Coupling (8)	Using 5/8-inch and 11/16-inch open-end wrenches, screw in and tighten.
22.	Secondary filter	Elbow (7) base (4)	Using 11/16-inch open-end wrench, screw in and tighten.



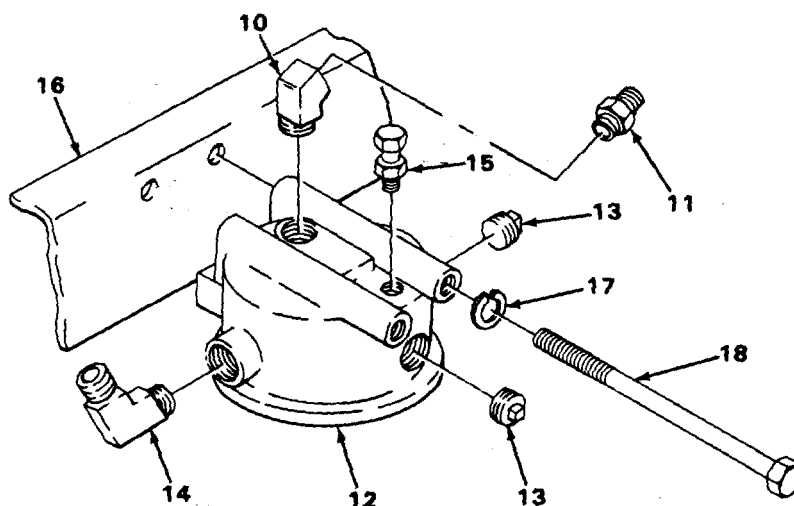
FILTER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
SECONDARY FILTER HEAD ASSEMBLY - CONTINUED			
23. Secondary	Coupling (2) filter base (1)	Using 5/8-inch open-end wrench, screw in and tighten.	
24.	Air bleeder cock (3)	Using 7/16-inch open-end wrench, screw in and tighten.	
SECONDARY FILTER HEAD INSTALLATION			
25.	Three new lock-washers (4) and screws (5)	a. Place base (1) in position. b. Screw in, and tighten screws (5) using 9/16-inch socket and ratchet handle with 3/8-inch drive.	
CAUTION			
Be sure fuel lines seat properly to avoid leaks and damage to lines.			
26. Coupling (6)	Line (7)	a. Take off dust cap. b. Screw on, and tighten using 5/8-inch and 3/4-inch open-end wrenches.	
27. Coupling (2)	Pipe (8) and nut (9)	a. Take off dust cap. b. Screw on, and tighten using two 11116-inch open-end wrenches.	



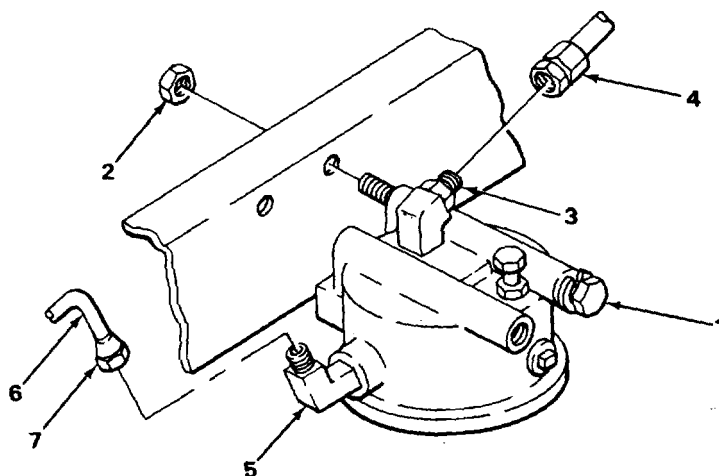
FILTER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
PRIMARY FILTER HEAD ASSEMBLY			
28.	Elbow (10)	Coupling (11)	Using 5/8-inch and 1 1/16-inch open-end wrenches, screw in and tighten.
29.	Primary filter	Two plugs (13)	Using 3/8-inch open-end wrench, screw in and tighten.
30.		base (12)	Using 1 1/16-inch open-end wrench, screw in and tighten.
31.		Two elbows (10) and (14)	Using 7/16-inch open-end wrench, screw in and tighten.
		Air bleeder cock (15)	
PRIMARY FILTER HEAD INSTALLATION			
32.	Frame (16)	Two new lockwashers (17), screws (18), and primary filter base (12)	Hold base (12), against frame (16) and push screws (18) through.



FILTER HEADS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
PRIMARY FILTER HEAD INSTALLATION - CONTINUED			
33.	Two screws (1) Two nuts (2)	Screw on, and tighten using 9/16-inch socket, 3-inch extension, ratchet handle with 3/8-inch drive, and 9/16-inch open-end wrench.	
CAUTION Be sure fuel lines seat properly to avoid leaks and damage to lines.			
34.	Coupling (3) Line (4)	a. Take off dust cap. b. Screw on, and tighten using 5/8-inch and 3/4-inch open-end wrenches.	
35.	Elbow (5) Pipe (6) and nut (7)	a. Take off dust cap. b. Screw on, and tighten using 3/4-inch and 11/16-inch open-end wrenches.	

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Close right side hood panel (TM 9-2320-269-20-1).
2. Install fuel filters (TM 9-2320-269-20-1).

TASK ENDS HERE

ETHER START CONTROL CABLE

This task covers:

a. Removal (page 2-369) b. Cleaning (page 2-371)	c. Inspection/Replacement (page 2-371) d. Installation (page 2-371)

INITIAL SETUP**Tools**

Chisel, cold, hand, 3/8-inch
 Hammer, ball-peen, machinist's,
 1-lb
 Key, socket head screw, 5/16-inch
 Screwdriver, flat-tip, 1/4-inch
 Wrench, open-end, 7/16-inch

Materials/Parts

Rags, wiping (item 42, appendix B)

Personnel Required

One

Equipment Condition

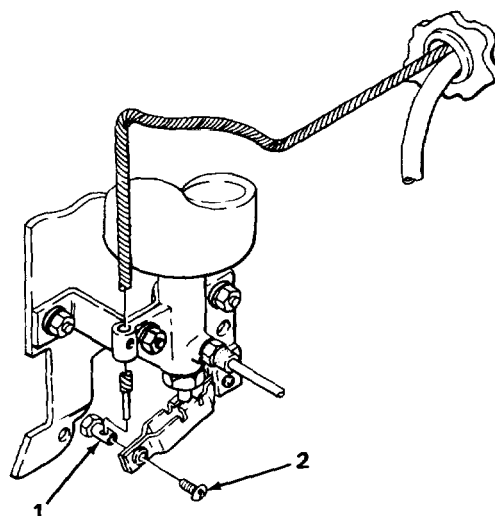
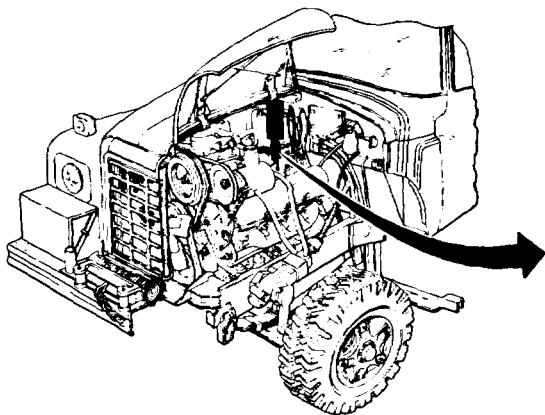
Left side hood panel raised
 (TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS

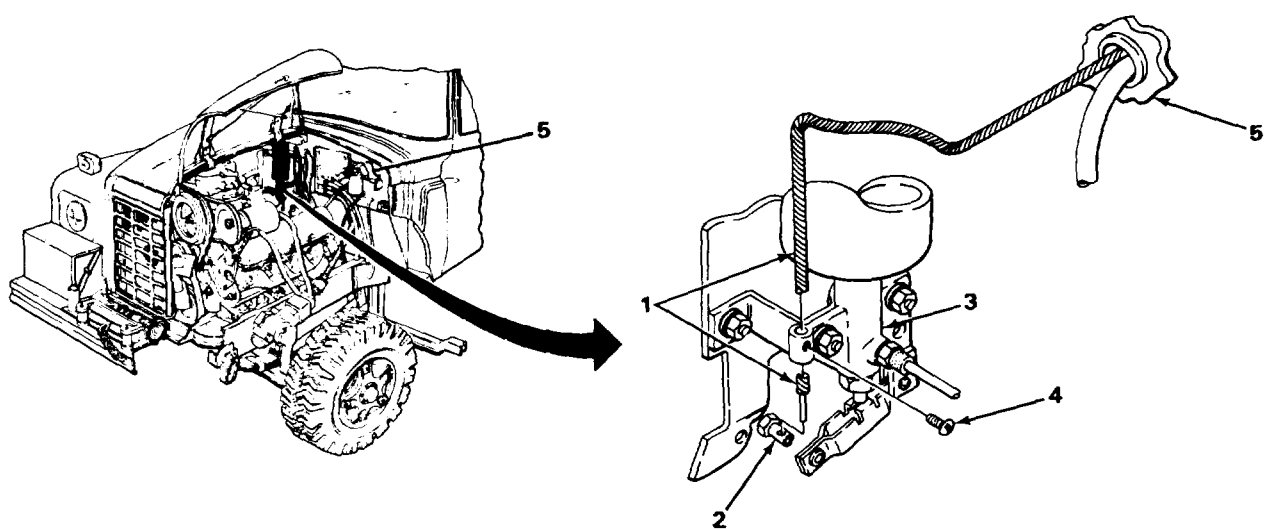
REMOVAL**WARNING**

Ether fumes are flammable under pressure and can explode. To avoid serious injury or death, do not smoke, allow open flame nearby, or hit the ether cartridge with tools.

1. Cable stop (1)	Screw (2)	Using 7/16-inch open-end wrench and 1/4-inch flat-tip screwdriver, unscrew and take out.

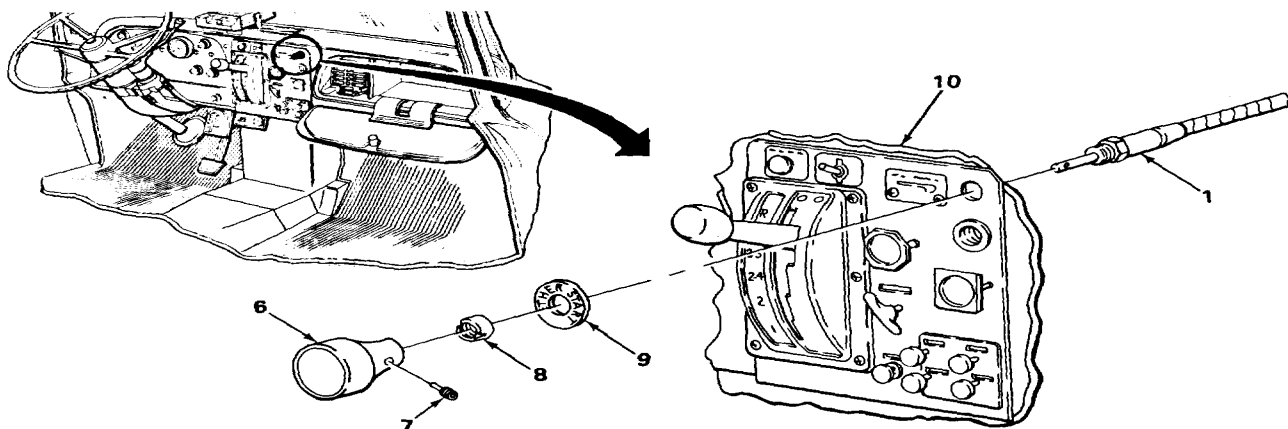


ETHER START CONTROL CABLE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
2.	Control cable (1)	Cable stop (2)	Take off.
3.	Fuel valve (3)	Screw (4) and control cable (1)	a. Using 11/4-inch flat-tip screwdriver, unscrew and take out screw (4). b. Take out cable (1). Take out.
4.	Firewall (5)	Control cable (1)	
			
5.	Control knob (6)	Setscrew (7)	Using 5/64-inch socket head screw key, unscrew and take out.
6.	Control cable (1)	Control knob (6)	Take off.
7.		Nut (8)	Using ball-peen hammer and cold hand chisel, unscrew and take off.
8.		Escutcheon (9)	Take off.
9.	Dash panel (10)	Control cable (1)	Push through.

ETHER START CONTROL CABLE - CONTINUED

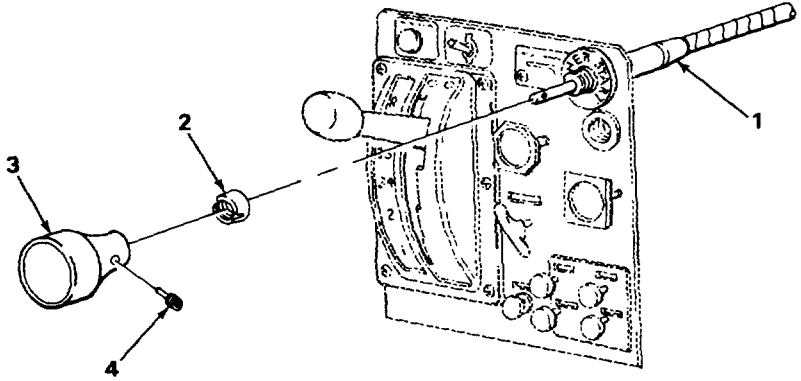
LOCATION	ITEM	ACTION REMARKS
CLEANING		
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).		
10.	All parts	Using clean, dry rags, wipe-clean.
INSPECTION/REPLACEMENT		
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).		
11.	Control cable (1)	a. Check for broken casing, sharp bends, and frayed ends. b. Replace as needed.
12.	All threaded parts	a. Check for stripped and gouged threads. b. Replace as needed.
INSTALLATION		
13.	Dash panel (10)	Control cable (1)
14.	Control cable (1)	Escutcheon (9)



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ETHER START CONTROL CABLE - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED			
15.	Control cable (1)	Nut (2)	Screw on, and tighten using ball-peen hammer and cold hand chisel.
16.		Control knob (3)	Put on.
17.	Control knob (3)	Setscrew (4)	Screw in, and tighten using 5/64-inch socket head screw key.
18.	Control cable (1)	Control knob (3)	Push in all the way.

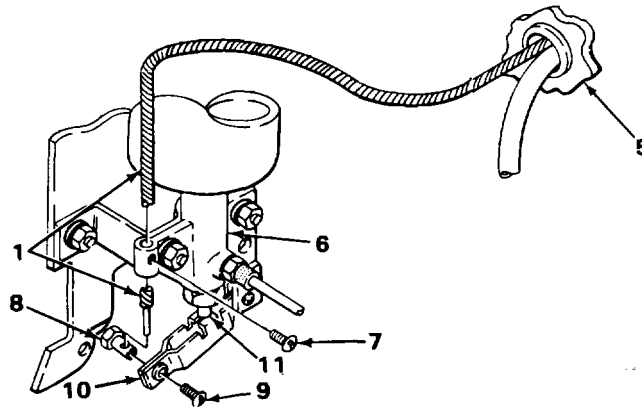


19 .	Firewall (5)	Control cable (1)	Put through.
20.	Fuel valve (6)	Control cable (1) and screw (7)	a. Put cable (1) in. b. Screw in screw (7) part way.
21.	Control cable (1)	Cable stop (8)	Put on.
22.	Cable stop (8)	Screw (9)	Screw in, and tighten using 7/16-inch open-end wrench and 1/4-inch flat-tip screwdriver.
23.	Fuel valve (6)	Control cable (1) and screw (7)	a. Pull cable (1) up until lever (10) touches rod (11). b. Tighten screw (7) using 1/4-inch flat-screwdriver.

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ETHER START CONTROL CABLE - CONTINUED

INSTALLATION - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE: Close left side hood panel (TM 9-2320-269-20-1).

TASK ENDS HERE

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ETHER STARTING AID

This task covers:

a. Removal (page 2-374)	e. Assembly (page 2-380)
b. Disassembly (page 2-376)	f. Installation (page 2-382)
c. Cleaning (page 2-378)	
d. Inspection/Replacement (page 2-379)	

INITIAL SETUP**Tools**

Handle, ratchet, 318-inch drive
 Knife, pocket
 Pliers, long round-nose
 Pliers, slip-joint
 Screwdriver, flat-tip, 1/8-inch
 Screwdriver, flat-tip, 1/4-inch
 Socket, deep well, 3/8-inch drive,
 9/16-inch C
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch
 (two required)
 Wrench, open-end, 1/2-inch
 (two required)
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 3/4-inch

Materials/Parts

Fuel, diesel, No. 2
 (item 17, appendix B)
 Gasket, fuel valve
 Gasket, release valve

Materials/Parts - Continued

Lockwasher, upper mounting bracket
 (two required)
 Lockwasher, tank clamp (two required)
 Lockwasher, fuel valve (two required)
 Lockwasher, tank mounting bracket
 (two required)
 Packing, cap
 Packing (two required)
 Packing, valve rod (two required)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)
 Tape, teflon sealing (item 55, appendix B)
 Washer, release valve rod

Personnel Required

One

Equipment Condition

Left side hood panel raised
 (TM 9-2320-269-20-1).

LOCATION

ITEM

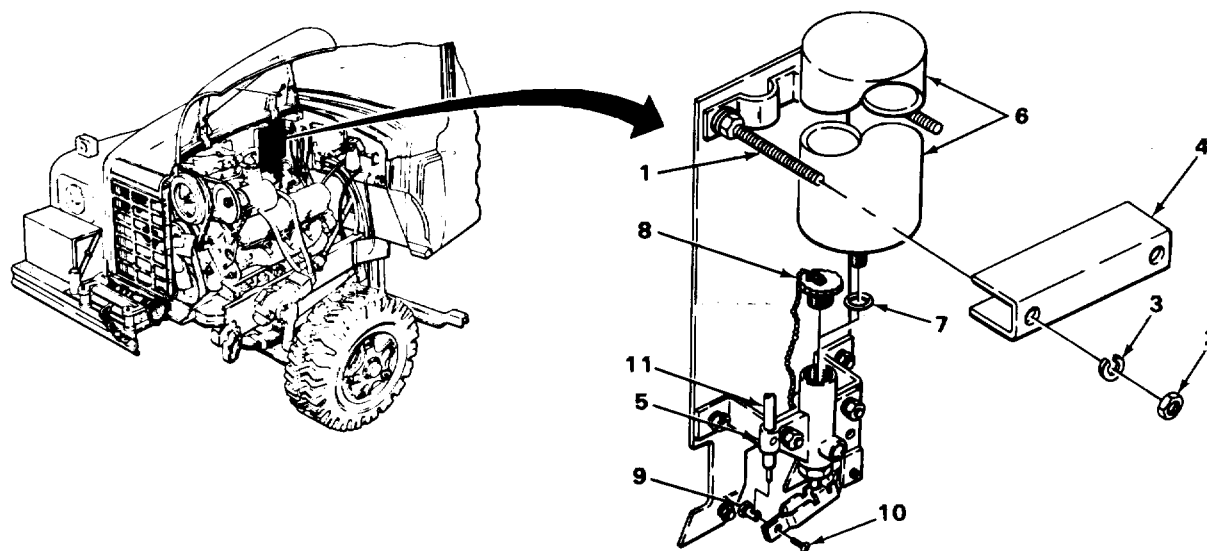
ACTION
REMARKS

REMOVAL**WARNING**

Ether fumes are flammable under pressure and can explode. To avoid serious Injury or death, do not smoke, allow open flame nearby, or hit the ether cartridge with tools.

ETHER STARTING AID - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
1. Two studs (1)	Two nuts (2) and lockwashers (3)	a. Using two 1/2-inch open-end wrenches, unscrew and take off. b. Get rid of lockwashers (3).
2.	Tank clamp (4)	Take off.
3. Fuel valve (5)	Ether cartridge (6) and gasket (7)	a. Unscrew, and take off cartridge (6). b. Take out, and get rid of gasket (7).
4.	Cap (8)	Screw on.
5. Cable stop (9)	Screw (10)	Using 7/16-inch open-end wrench and 1/4-inch flat-tip screwdriver, unscrew and take out.
6. Control cable (11)	Cable stop (9)	Take off.



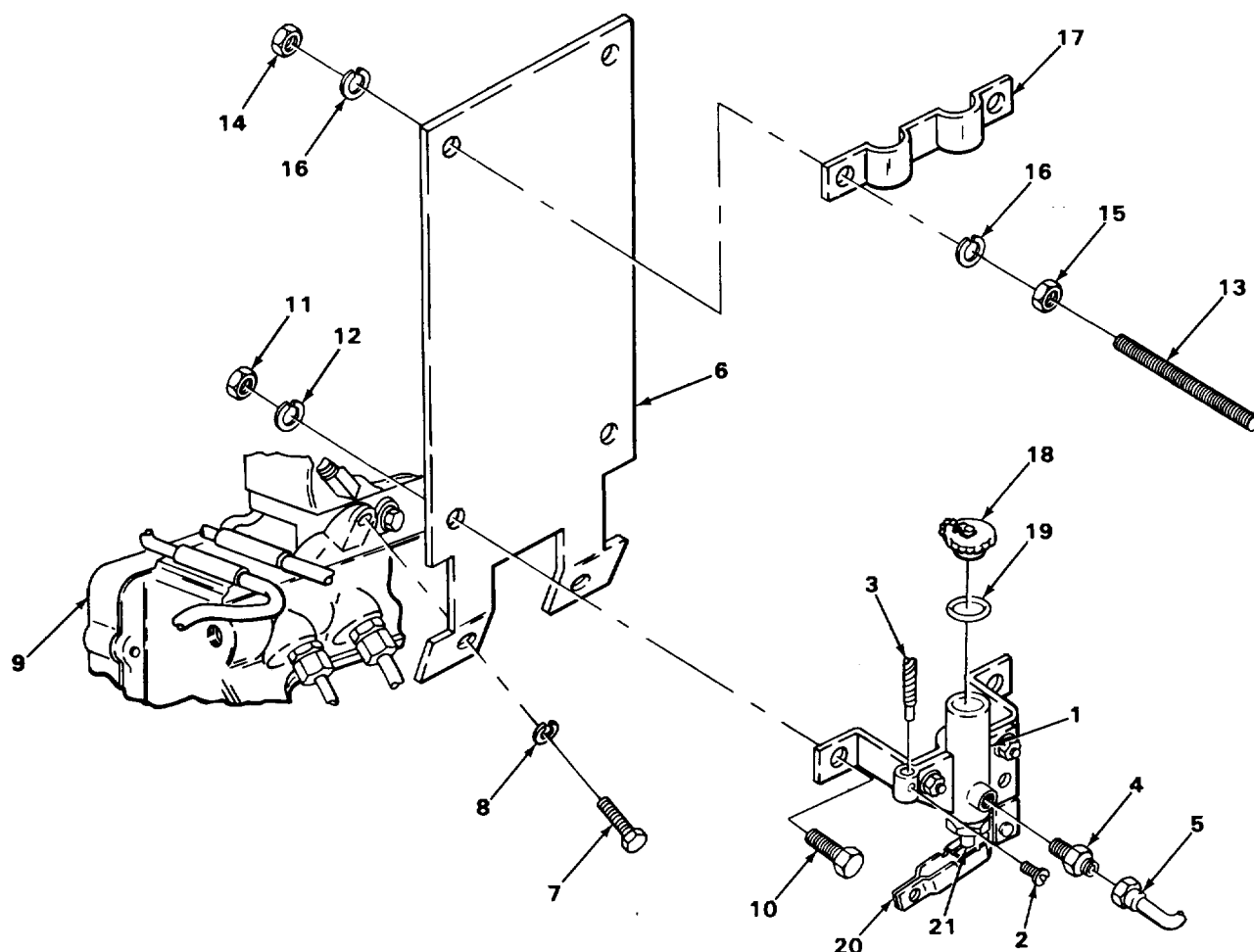
TA238159

ETHER STARTING AID - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
7. Fuel valve (1)	Screw (2)	Using 1/4-inch flat-tip screwdriver, unscrew and take out.
8.	Control cable (3)	Take out.
9. Coupling (4)	Tube (5)	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take off.
10. Fuel valve (1)	Coupling (4)	Using 7/16-inch open-end wrench, unscrew and take off.
11. Upper mounting bracket (6)	Two screws (7) and lockwashers (8)	a. Using 9/16-inch deep well socket and ratchet handle with 3/8-inch drive and 9/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (8).
12. Intake manifold (9)	Upper mounting bracket (6)	Take off.
DISASSEMBLY		
13. Two screws (10) and fuel valve (1)	Two nuts (11) and lockwashers (12)	a. Using two 7/16-inch open-end wrenches, unscrew and take off. b. Get rid of lockwashers (12).
14. Upper mounting bracket (6)	Fuel valve (1)	Take off.
15. Fuel valve (1)	Two screws (10)	Take out.
16. Two studs (13)	Two nuts (14) and (15) and lockwashers (16)	a. Using two 1/2-inch open-end wrenches, unscrew and take off. b. Get rid of lockwashers (16).
17. Upper mounting bracket (6)	Two studs (13) and tank mounting bracket (17)	Take out.

ETHER STARTING AID - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED		
18. Fuel valve (1)	Cap (18) and gasket (19)	a. Unscrew, and take off. b. Using long round-nose pliers, take out. c. Get rid of gasket (19).
19.	Lever (20)	Using slip-joint pliers, bend up tabs (21) and move aside.



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ETHER STARTING AID - CONTINUED

LOCATION		ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED			
20.	Fuel valve (1)	Cap (2) and packing (3)	a. Using long round-nose pliers, unscrew and take out. b. Get rid of packing (3).
21.		Release valve rod (4)	Take out.
22.		Spring (5) and washer (6)	Take out.
23.		Nut (7) and washer (8)	Using 3/4-inch open-end wrench, unscrew and take out.
24.	Nut (7)	Two packings (9)	a. Using 1/8-inch flat-tip screwdriver, take out. b. Get rid of.
25.	Release valve rod (4)	Clip (10)	Using long round-nose pliers, take off.
26.		Two packings (11)	a. Using pocket knife, take off. b. Get rid of.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious Injury or death.

27.	All parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

ETHER STARTING AID - CONTINUED

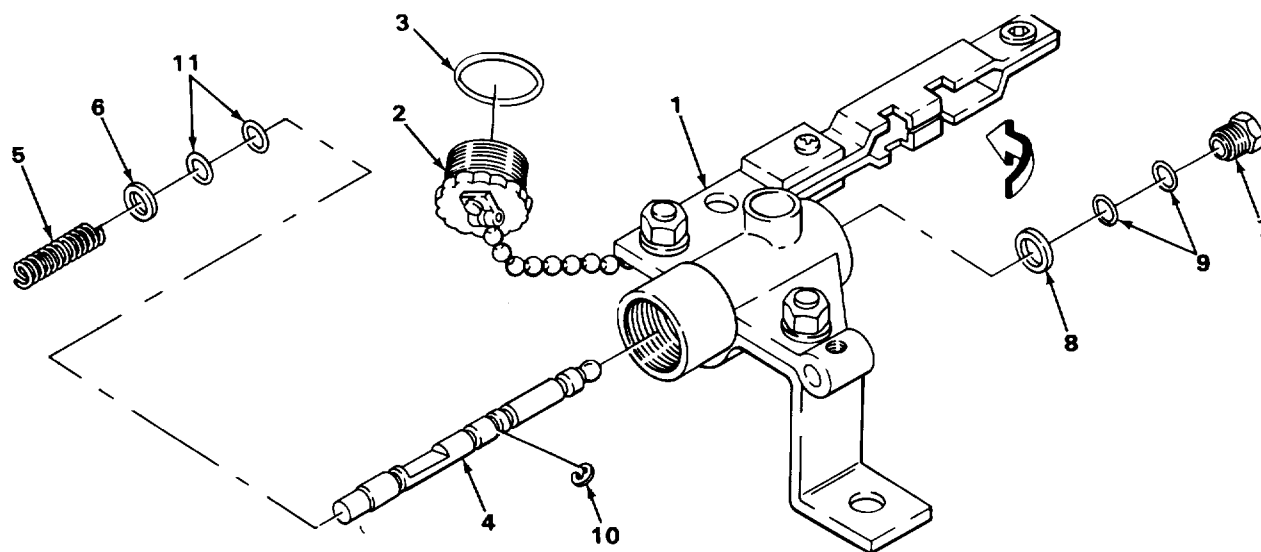
LOCATION	ITEM	ACTION REMARKS

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

28.	All parts	a. Check for cracked and bent parts. b. Replace as needed.
29.	All threaded parts	a. Check for stripped and gouged threads. b. Replace as needed.
30.	All sliding parts	a. Check for scratches and grooves. b. Replace as needed.



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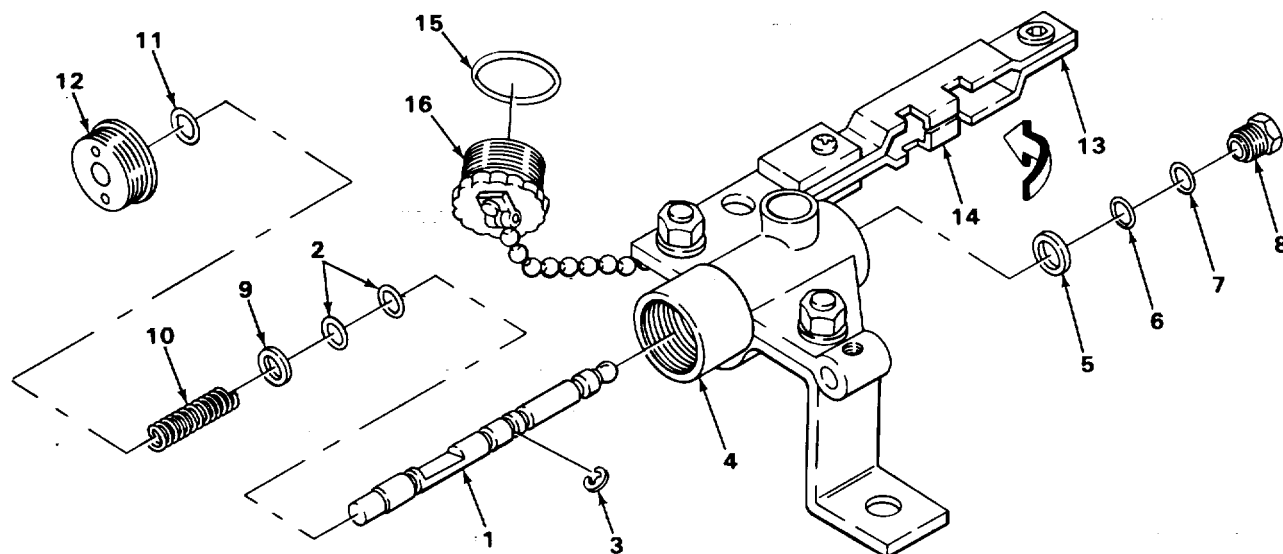
ETHER STARTING AID - CONTINUED

LOCATION		ITEM	ACTION REMARKS
ASSEMBLY			
31.	Release valve rod (1)	Two new packings (2)	a. Coat with No. 2 diesel fuel. b. Put on.
32.		Clip (3)	Put on using long round-nose pliers.
33.	Fuel valve (4)	Release valve rod (1)	Put in.
34.	Release valve rod (1)	New washer (5) and packing (6)	a. Push rod (1) into valve (4). b. Put on washer (5). c. Coat packing (6) with No. 2 diesel fuel, and put on.
35.		New packing (7) and nut (8)	a. Coat packing (7) with No. 2 diesel fuel, and put on. b. Using 3/4-inch open-end wrench, screw in and tighten.
36.	Fuel valve (4)	Washer (9) and spring (10)	Put in.
37.		New packing (11) and cap (12)	a. Coat packing (11) with No. 2 diesel fuel, and put on. b. Using long round-nose pliers, screw in and tighten.
38.		Lever (13)	a. Hold over release valve rod (1). b. Bend tabs (14) down over release valve rod (1).
39.		New washer (15) and cap (16)	Screw on.

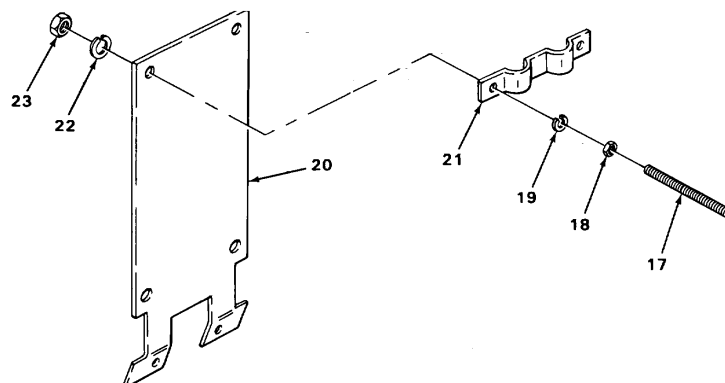
ETHER STARTING AID - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

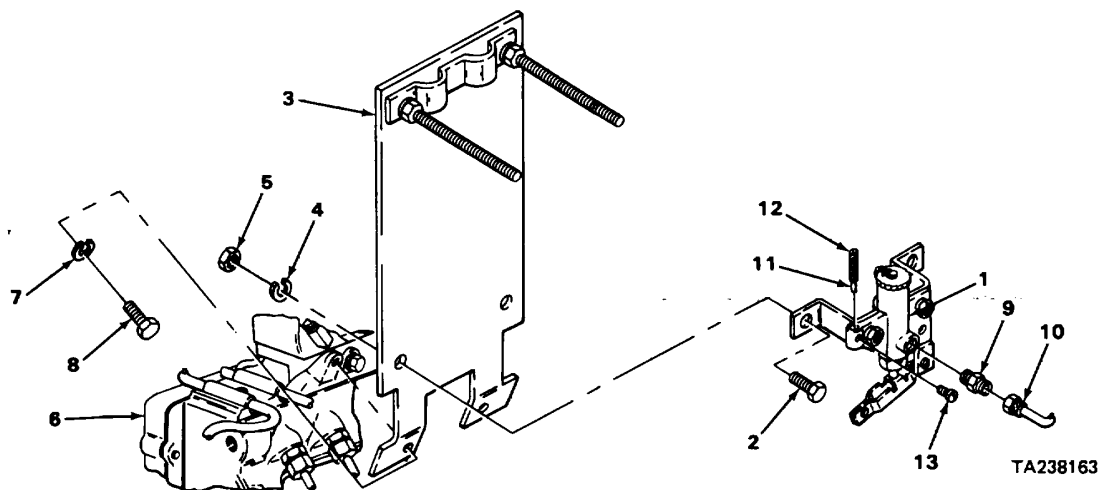


40.	Two studs (17)	Two nuts (18) and new lockwashers (19)	a. Screw on nuts (18) part way. b. Put lockwashers (19) on.
41.	Upper mounting bracket (20)	Tank mounting bracket (21) and two studs (17)	a. Put tank bracket (21) on mounting bracket (20). b. Put studs (17) through.
42.	Two studs (17)	Two new lockwashers (22) and nuts (23)	Screw on until even with ends of studs (17).
43.		Two nuts (18)	Using two 1/2-inch open-end wrenches, screw on and tighten.



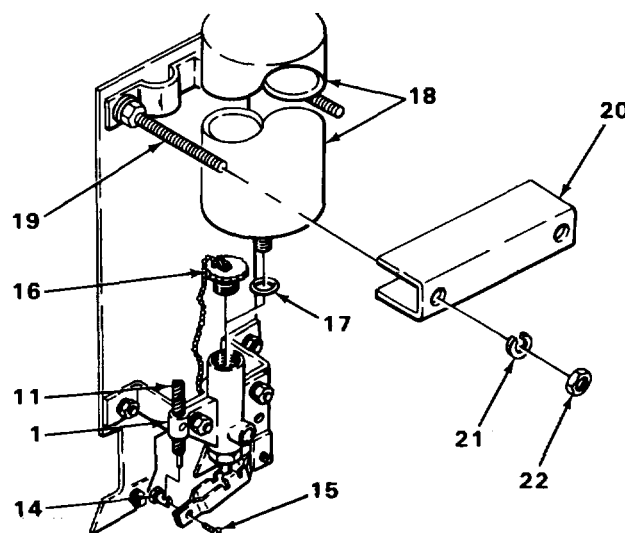
ETHER STARTING AID - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
INSTALLATION			
44.	Fuel valve (1)	Two screws (2)	Put in.
45.	Upper mounting bracket (3)	Fuel valve (1)	Put on.
46.	Two screws (2)	Two new lockwashers (4) and nuts (5)	Screw on, and tighten nuts (5) using two 7/16-inch open-end wrenches.
47.	Intake manifold (6)	Upper mounting bracket (3)	Hold in place.
48.	Upper mounting bracket (3)	Two new lockwashers (7) and screws (8)	Screw in, and tighten using 9/16-inch deep well socket, ratchet handle with 3/8-inch drive, and 9/16-inch open-end wrench.
49.	Fuel valve (1)	Coupling (9)	a. Wrap threads with teflon tape (page 2-46). b. Using 7/16-inch open-end wrench, screw in and tighten.
50.	Coupling (9)	Tube (10)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.
51.	Fuel valve (1)	Control cable (11)	Put in until edge of outer cable (12) is even with valve (1).
52.		Screw (13)	Screw in, and tighten using 11/4-inch flat-tip screwdriver.



ETHER STARTING AID - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED		
53. Control cable (11)	Cable stop (14)	Put on.
54. Cable stop (14)	Screw (15)	Screw in, and tighten using 7/16-inch open-end wrench and 1/4-inch flat-tip screwdriver.
55. Fuel valve (1)	Cap (16)	Unscrew, and take out.
56.	New gasket (17) and ether cartridge (18)	Screw in, and tighten.
57. Two studs (19)	Tank clamp (20)	Put on.
58.	Two new lockwashers (21) and nuts (22)	Screw on, and tighten nuts (22) using two 1/2-inch open-end wrenches.



NOTE

FOLLOW-ON MAINTENANCE: Close left side hood panel (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238164

ETHER SUPPLY LINES

This task covers:

a. Removal (page 2-384)	c. Inspection/Replacement (page 2-386)
b. Cleaning (page 2-385)	d. Installation (page 2-386)
-

INITIAL SETUP

Tools

Extension, 3/8-inch drive, 3-inch,
Handle, ratchet, 3/8-inch drive
Socket, 3/8-inch drive, 1/2-inch
Wrench, open-end, 3/8-inch
(two required)
Wrench, open-end, 7/16-inch

Materials/Parts - Continued

Solvent, drycleaning (item 49, appendix B)
Tape, teflon, sealing (item 55, appendix B)

Personnel Required

One

Equipment Condition

Left side hood panel raised
(TM 9-2320-269-20-1).
Air cleaner removed (TM 9-2320-269-20-1).

Materials/Parts

Lockwasher, clamp (two required)
Rags, wiping (item 42, appendix B)

LOCATION	ITEM	ACTION REMARKS

REMOVAL

WARNING

Ether fumes are flammable under pressure and can explode. To avoid serious injury or death, do not smoke, allow open flame near, or hit ether cartridge with tools.

1. Coupling (1) and fitting (2)	Tube (3)	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take out.
2. Two intake manifold connectors (4)	Two tubes (5)	Using two 3/8-inch open-end wrenches, unscrew and take off.
3. Two clamps (6)	Two screws (7) and lockwashers (8)	a. Using 11/2-inch socket, 3-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (8).
4.	Two tubes (5) and fitting (2)	a. Take out. b. Take off clamps (6).

LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED		
5. Fitting (2)	Two tubes (5)	Using 3/8-inch and 7/16-inch open-end wrenches, unscrew and take off.
6. Two intake manifolds (9)	Two intake manifold connectors (4)	Using 7/16-inch open-end wrench, unscrew and take out.

CLEANING

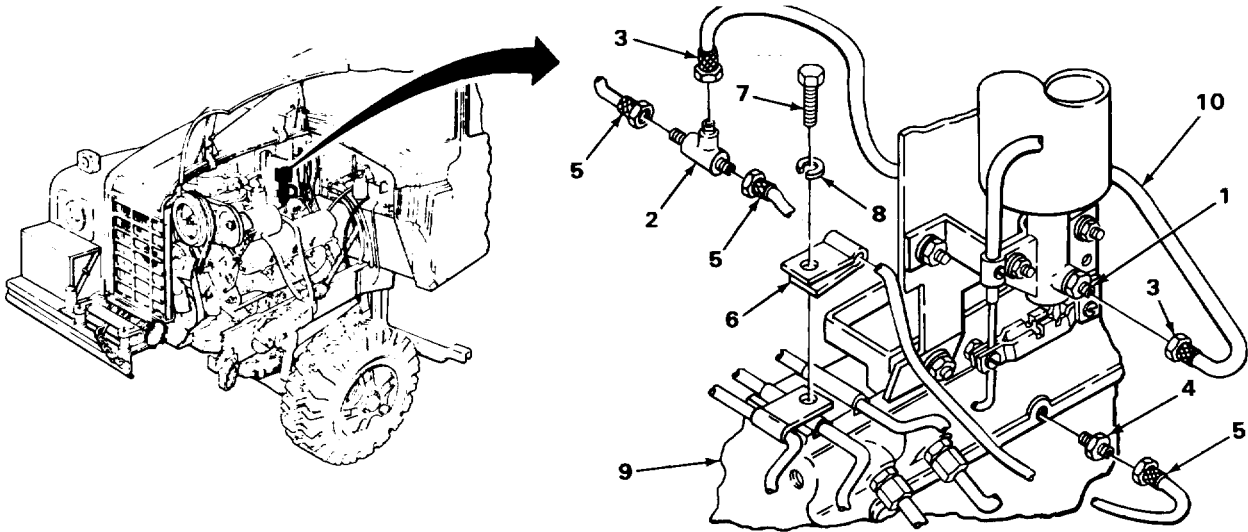
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

7.	Fitting (2) and two intake manifold connectors (4)	a. Clean in drycleaning solvent. b. Wipe dry with clean rags.
8.	Three tubes (3) and (5)	Using clean rags, wipe clean.



(1)

TA238165

ETHER SUPPLY LINES - CONTINUED

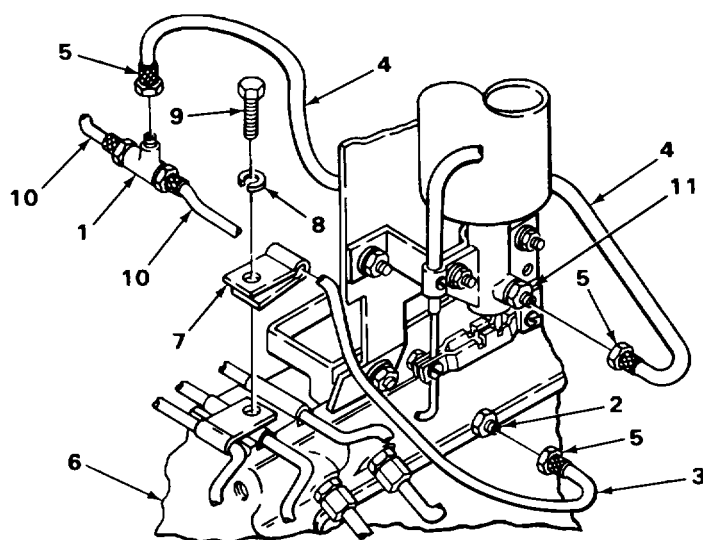
LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT		
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).		
9.	Fitting (1) and two intake manifold connectors (2)	a. Check for cracks and stripped and gouged threads. b. Replace as needed.
10.	Three tubes (3) and (4)	a. Check for cracks, sharp bends, and wear. b. Check six nuts (5) for stripped and gouged threads. c. Replace as needed.
INSTALLATION		
11. Two intake manifolds (6)	Two intake manifold connectors (2)	a. Wrap threads with teflon tape (page 2-46). b. Screw on, and tighten using 7/16-inch open-end wrench.
12. Fitting (1)	Two tubes (3)	Screw on, and tighten using two 3/8-inch open-end wrenches.
13. Two intake manifolds (6)	Two tubes (3) and fitting (1)	a. Put on clamps (7). b. Put in place.
14. Two clamps (7)	Two new lockwashers (8) and screws (9)	Screw in part way.
15. Two intake manifold connectors (2)	Two tubes (10)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.
16. Two clamps (7)	Two screws (9)	Tighten using 1/2-inch socket, 3-inch extension, and ratchet handle with 3/8- inch drive.

ETHER SUPPLY LINES - CONTINUED

LOCATION	ITEM	ACTION REMARKS

INSTALLATION - CONTINUED

17.	Fitting (1) and coupling (11)	Tube (4)	Screw on, and tighten using 3/8-inch and 7/16-inch open-end wrenches.



NOTE

FOLLOW-ON MAINTENANCE:

1. Install air cleaner (TM 9-2320-269-20-1).
2. Close left hood panel (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238166

Section VI. COOLING SYSTEM

	Page		Page
Left Water Outlet	2-391	Water Pump	2-400
Radiator.....	2-388	Water Pump-to-Crankcase	
Right Water Outlet	2-395	Manifold	2-410
Water Outlet	2-388	Water Pump Puller	2-407

RADIATOR

This task covers:

Testing and Repair (page 2-388)

INITIAL SETUP

Equipment Condition

Radiator removed (TM 9-2320-269-20-1).

TESTING AND REPAIR**NOTE**

The procedures for testing and repairing the radiator can be found in TM 750-254.

TASK ENDS HERE**WATER OUTLET**

This task covers:

a. Disassembly (page 2-389)	c. Inspection/Replacement (page 2-390)
b. Cleaning (page 2-389)	d. Assembly (page 2-390)
-

INITIAL SETUP**Tools**

Vise, machinist's
Wrench, open-end, 9/16-inch
Wrench, open-end, 11/16-inch

Materials/Parts

Rags, wiping (item 42, appendix B)
Solvent, drycleaning
(item 49, appendix B)

Personnel Required

One

Equipment Condition

Thermostats removed (TM 9-2320-269-20-1).

WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY		
1. Water outlet (1)	Plug (2)	a. Secure outlet (1) in vise. b. Using 9/16-inch open-end wrench, unscrew and take out.
2.	Nipple (3)	a. Using 11/16-inch open-end wrench, unscrew and take out. b. Take outlet (1) out of vise.

CLEANING

NOTE

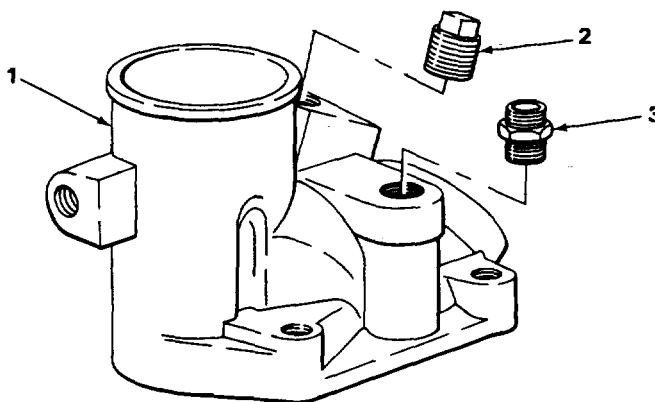
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

All metal parts

- a. Clean in drycleaning solvent.
- b. Wipe dry with clean, dry rags.



WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS

INSPECTION/REPLACEMENT

NOTE

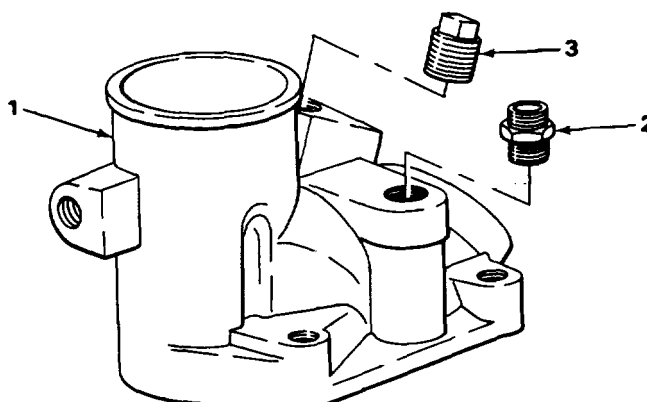
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as necessary.

4.	All metal parts	a. Look for cracks and breaks. b. Look for damaged threads.

ASSEMBLY

5.	Water outlet (1)	Nipple (2)	a. Secure outlet (1) in vise. b. Screw in, and tighten using 11/16-inch open-end wrench.
6.		Plug (3)	a. Screw in, and tighten using 9/16-inch open-end wrench. b. Take outlet (1) out of vise.



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WATER OUTLET - CONTINUED**ASSEMBLY - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install thermostats (TM 9-2320-269-20-1).

TASK ENDS HERE**LEFT WATER OUTLET**

This task covers:

a. Removal (page 2-392)	d. Inspection/Replacement (page 2-393)
b. Disassembly (page 2-392)	e. Assembly (page 2-393)
c. Cleaning (page 2-392)	f. Installation (page 2-394)
-

INITIAL SETUP**Tools**

Handle, ratchet, 3/8-inch drive
Pliers, slip-joint
Socket, deep well, 3/8-inch drive,
9/16-inch
Vise, machinist's
Wrench, open-end, 5/8-inch
Wrench, open-end, 1 1/16-inch
Wrench, open-end, 1 1/8-inch

Materials/Parts

Gasket, left water outlet
Lockwashers (three required)
Packing, preformed (two required)

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Fan assembly and modulated fan drive assembly
removed (TM 9-2320-269-20-1).
Power steering pump removed (page 1099).

LEFT WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL		
1. Left water outlet (1)	Three screws (2) and lockwashers (3)	a. Using 9/16-inch deep well socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (3).
2. Adapter (4)	Water pipe assembly (5)	Using 1 1/16-inch and 1 1/8-inch open-end wrenches, unscrew and take off.
3. Front crankcase cover (6) and left cylinder head (7)	Left water outlet (1) and gasket (8)	a. Take off. b. Get rid of gasket (8) Gasket may stay on head.
DISASSEMBLY		
4. Left water outlet (1)	Water pipe (9) and two packings (10)	a. Put outlet (1) in vise. b. Slide out. c. Using slip-joint pliers, take out packings (10). d. Get rid of packings (10).
5.	Pipe plug (11)	Using 5/8-inch open-end wrench, unscrew and take out.
6.	Adapter (4)	a. Using 1 1/16-inch open-end wrench, unscrew and take out. b. Take outlet (1) out of vise.
CLEANING		

NOTE

For more Information on how to clean parts, go to General Maintenance Instructions (page 2-46).

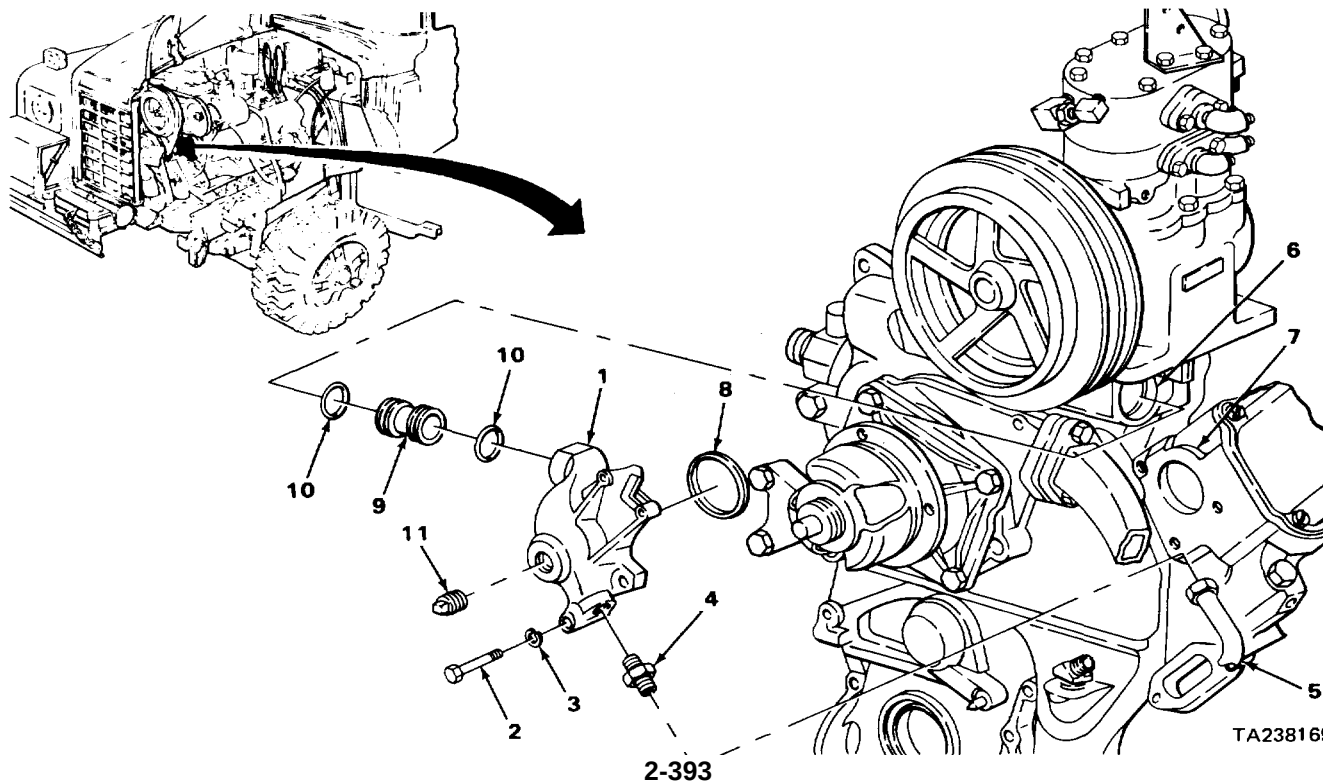
WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

7.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

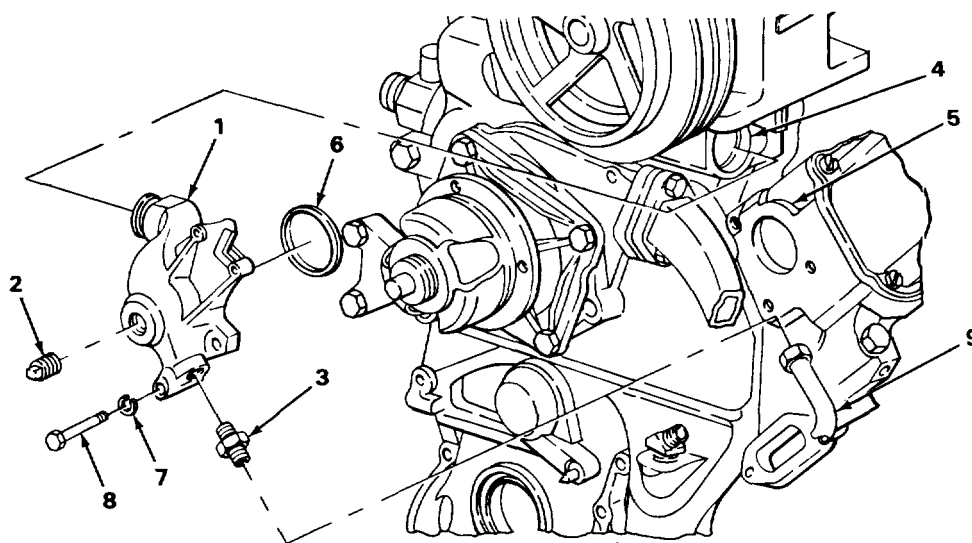
LEFT WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT		
NOTE		
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).		
Replace damaged or defective parts as necessary.		
8.	Left water outlet (1) and water pipe (9)	Look for cracks, breaks, and large dents.
9.	All threaded parts threads.	Look for stripped, gouged, and nicked threads.
ASSEMBLY		
10. Water pipe (9)	Two new packings (10)	Put on.
11. Left water outlet (1)	Water pipe (9)	a. Put outlet (1) in vise. b. Slide in.



LEFT WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
12. Left water outlet (1)	Pipe plug (2)	Using 5/8-inch open-end wrench, screw in and tighten.
13.	Adapter (3)	a. Using 1 1/16-inch open-end wrench, screw in and tighten. b. Take outlet (1) out of vise.
INSTALLATION		
14. Front crankcase cover (4) and left cylinder head (5)	New gasket (6) and left water outlet (1)	Put in position.
15. Left water outlet (1)	Three new lock-washers (7) and screws (8)	Screw in, and tighten using 9/16-inch deep well socket and ratchet handle with 3/8-inch drive.
16. Adapter (3)	Water pipe assembly (9)	Screw on, and tighten using 1 11/16-inch ' and 1 1/18-inch open-end wrenches.



LEFT WATER OUTLET - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Install power steering pump (page 2-1099).
2. Install fan assembly and modulated fan drive assembly (TM 9-2320-269-20-1).

TASK ENDS HERE

RIGHT WATER OUTLET

This task covers:

a. Removal (page 2-396)	d. Inspection/Replacement (page 2-397)
b. Installation (page 2-396)	e. Assembly (page 2-398)
c. Cleaning (page 2-396)	f. Installation (page 2-398)

INITIAL SETUP**Tools**

Handle, ratchet, 3/8-inch drive
 Pliers, slip-joint
 Socket, 3/8-inch drive, 7/16-inch
 Socket, 3/8-inch drive, 9/16-inch
 Vise, machinist's
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 3/4-inch

Materials/Parts

Gasket, right water outlet
 Lockwashers, right water outlet
 (two required)
 Packing, preformed (two required)

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Right hood raised (TM 9-2320-269-20)1.
 Engine air inlet duct removed
 (TM 9-2320-269-20-1).
 Coolant drained (TM 9-2320-269-20-1).

RIGHT WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS
REMOVAL		
1. Wire clip bracket (1)	Screw (2), nut (3), and wire clip (4)	Using 7/16-inch socket, ratchet handle with 3/8-inch drive, and 7/16-inch open-end wrench, unscrew and take off.
2. Right water outlet (5)	Two screws (6), lockwashers (7), wire clip bracket (1) and oil level	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take off. b. Get rid of lockwashers (7). gage assembly (8)
3. Front crankcase cover (9) and right cylinder head (10)	Right water outlet (5) and and gasket (11)	a. Take off. b. Get rid of gasket (11).
4. Right water outlet (5) and sending unit (12)	Nut (13) and wire lead (14)	Using 7/16-inch open-end wrench, unscrew and take off.
DISASSEMBLY		
5. Right water outlet (5)	Water pipe (15) and two packings (16)	a. Put outlet (5) in vise. b. Slide out. c. Take off packings (16). d. Get rid of packings (16).
6.	Sending unit (12)	Using 3/4-inch open-end wrench, unscrew and take out.
7.	Pipe plug (17)	a. Using 9/16-inch open-end wrench, unscrew and take out. b. Take outlet (5) out of vise.

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

RIGHT WATER OUTLET - CONTINUED

LOCATION	ITEM	ACTION REMARKS

CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

8.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

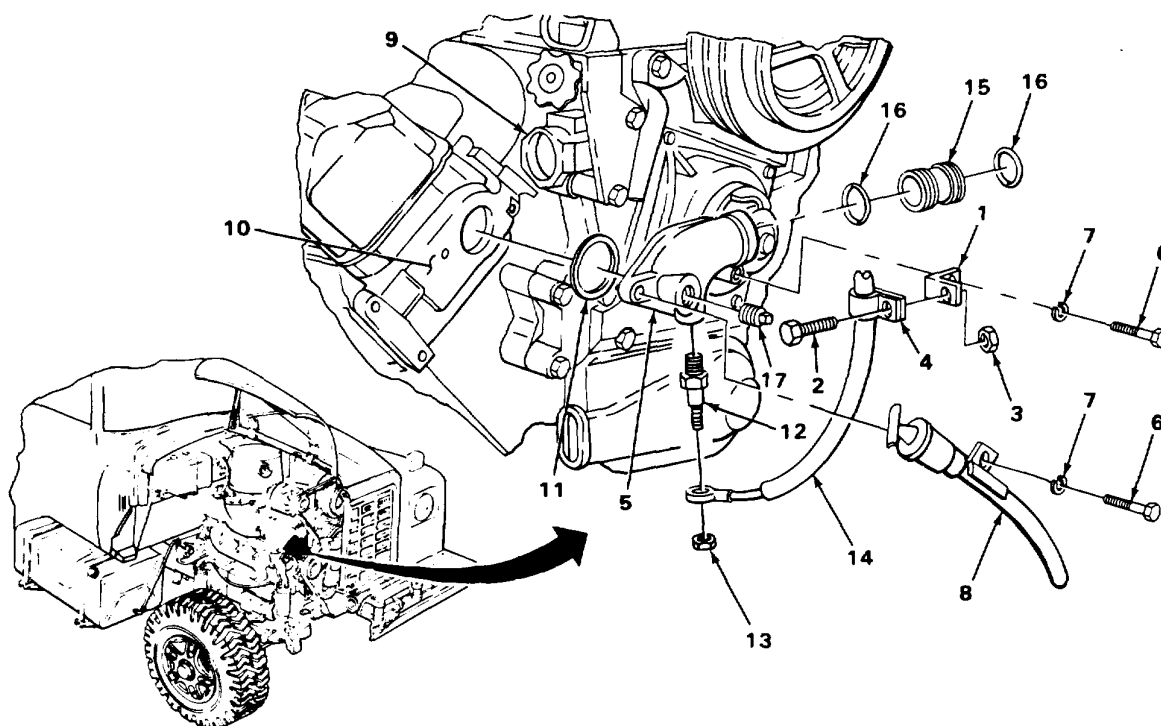
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as necessary.

9.	All threaded parts	Look for stripped, gouged, and nicked threads.

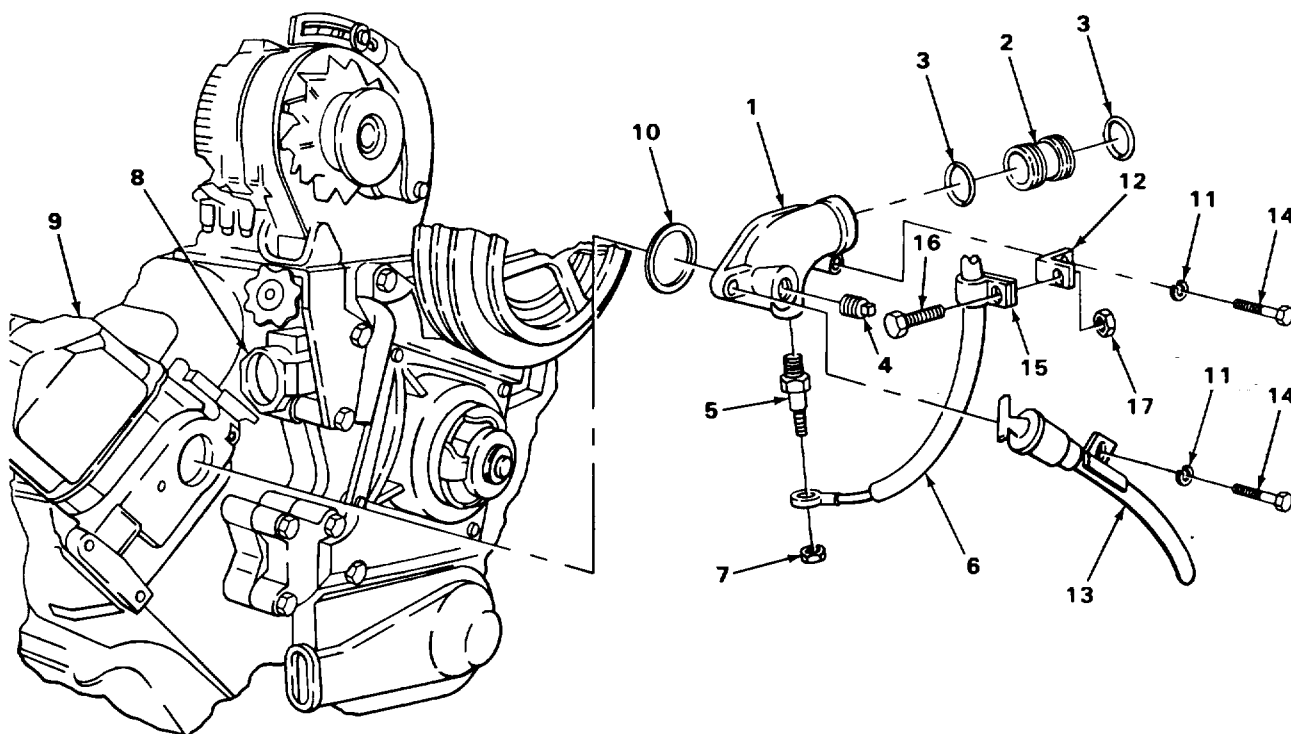


RIGHT WATER OUTLET - CONTINUED

LOCATION		ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT- CONTINUED			
10.		Right water outlet (1)	Look for cracks, breaks, and dents.
ASSEMBLY			
11.	Water pipe (2)	Two new packings (3)	Put on.
12.	Right water outlet (1)	Water pipe (2)	a. Put outlet (1) in vise. b. Slide in pipe (2) with two packings (3).
13.		Pipe plug (4)	Using 9/16-inch open-end wrench, screw in and tighten.
14.		Sending unit (5)	Using 3/4-inch open-end wrench, screw in and tighten.
INSTALLATION			
15.	Right water outlet (1) and sending unit (5)	Wire lead (6) and nut (7)	Screw on, and tighten using 7/16-inch open-end wrench.
16.	Front crankcase cover (8) and right cylinder head (9)	Right water outlet (1) and new gasket (10)	Put in position.
17.	Right water outlet (1)	Two new lockwashers (11), wire clip bracket (12), oil level gage assembly (13), and screws (14)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.
18.	Wire clip bracket (12)	Wire clip (15), screw (16), and nut (17)	Screw on, and tighten using 7/16-inch open-end wrench, 7/16-inch socket, and ratchet handle with 3/8-inch drive.

RIGHT WATER OUTLET - CONTINUED

INSTALLATION - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE:

1. Fill cooling system (TM 9-2320-269-20-1).
2. Install engine air inlet duct (TM 9-2320-269-20-1).
3. Lower right hood (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238172

WATER PUMP

This task covers:

a. Removal (page 2-400)	d. Inspection/Replacement (page 2-403)
b. Disassembly (page 2-402)	e. Assembly (page 2-404)
c. Cleaning (page 2-402)	f. Installation (page 2-405) 1

INITIAL SETUP

Tools

Driftpin, brass, 1/2-inch
 Gage, thickness
 Hammer, ball-peen, machinist's
 Hammer, rubber
 Handle, ratchet, 3/8-inch drive
 Key, socket-head, screw, 7/32-inch
 Key, socket-head, screw, 3/16-inch
 Pliers, snapping
 Press, arbor, hand-operated
 Socket, 3/8-inch drive, 1/2-inch
 Socket, 3/8-inch drive, 9/16-inch
 Stop, shim, 0.060-inch (1.47-mm)
 Wrench, open-end, 1/2-inch

Materials/Parts

Gasket, water pump body (two required)
 Gasket, water pump housing

Materials/Parts - Continued

Lockwasher, water pump body
 (eight required)
 Lockwasher, water manifold
 (two required)
 Rags, wiping (item 42, appendix B)
 Seal, water pump
 Sealant, gasket (item 44, appendix B)
 Seat, water pump seal
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

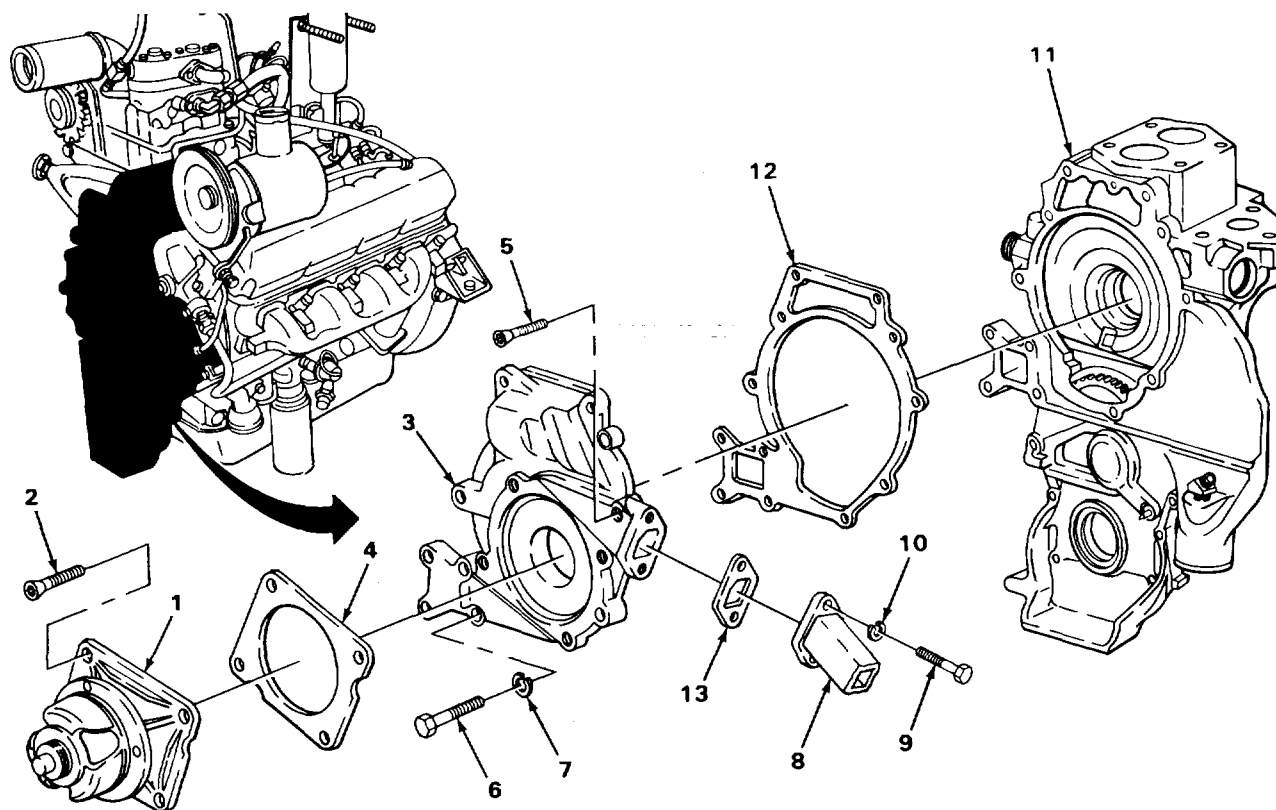
Equipment Condition

Water pump pulley removed (page 2-407).

		ACTION REMARKS
LOCATION	ITEM	
REMOVAL		
1. Water pump housing (1)	Four screws (2)	Using 3/16-inch socket-head screw key, unscrew and take out.
2. Water pump body (3)	Water pump housing (1) and gasket (4)	a. Using rubber hammer, tap to loosen, and take off. b. Get rid of gasket (4).
3.	Screw (5)	Using 7/32-inch socket-head screw key, unscrew and take out.

WATER PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
4.	Eight screws (6) and lockwashers (7)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (7).	
5. Water manifold (8)	Two screws (9) and lockwashers (10)	a. Using 11/2-inch open-end wrench, 1/2-inch socket, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (10).	
6. Front crankcase cover (11)	Water pump body (3) and two gaskets (12) and (13)	a. Using rubber hammer, tap to loosen, and take off. b. Get rid of gaskets (12) and (13).	



TA238173

CRANKSHAFT AND MAIN BEARINGS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
7.	Shaft (1) with bearing assembly (2)	Pulley hub assembly (3)	Using arbor press, press out.
8.	Water pump housing (4)	Snapring (5)	Using snapring pliers, take out.
9.		Impeller (6) and shaft (1) with bearing assembly (2)	Using arbor press, press out.
10.	Impeller (6)	Water pump seal seat (7) and bushing (8)	a. Take out. Note three dots or a groove for identification at assembly. b. Get rid of seat (7).
11.	Water pump housing (4)	Water pump seal (9)	a. Using 112-inch brass driftpin and ball-peen hammer, drive out. b. Get rid of seal (9).

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

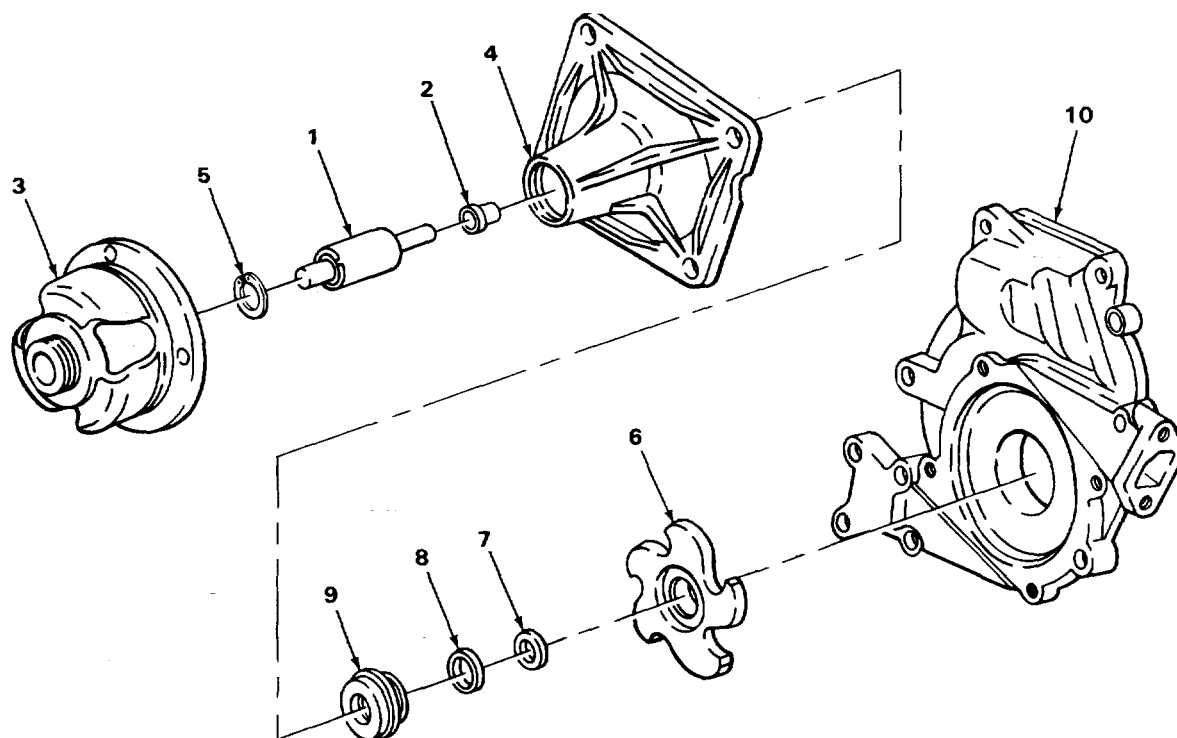
WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious Injury or death.

12.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

WATER PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged or defective parts as necessary.			
13.	Pulley hub (3), water pump housing (4), water pump body (10), and impeller (6)	Look for cracks, nicks, and gouges.	
14.	Shaft (1) with bearing assembly (2)	Look for cracks, nicks, gouges, and loose bearing.	
15.	All threaded parts	Look for stripped, nicked, and gouged threads.	



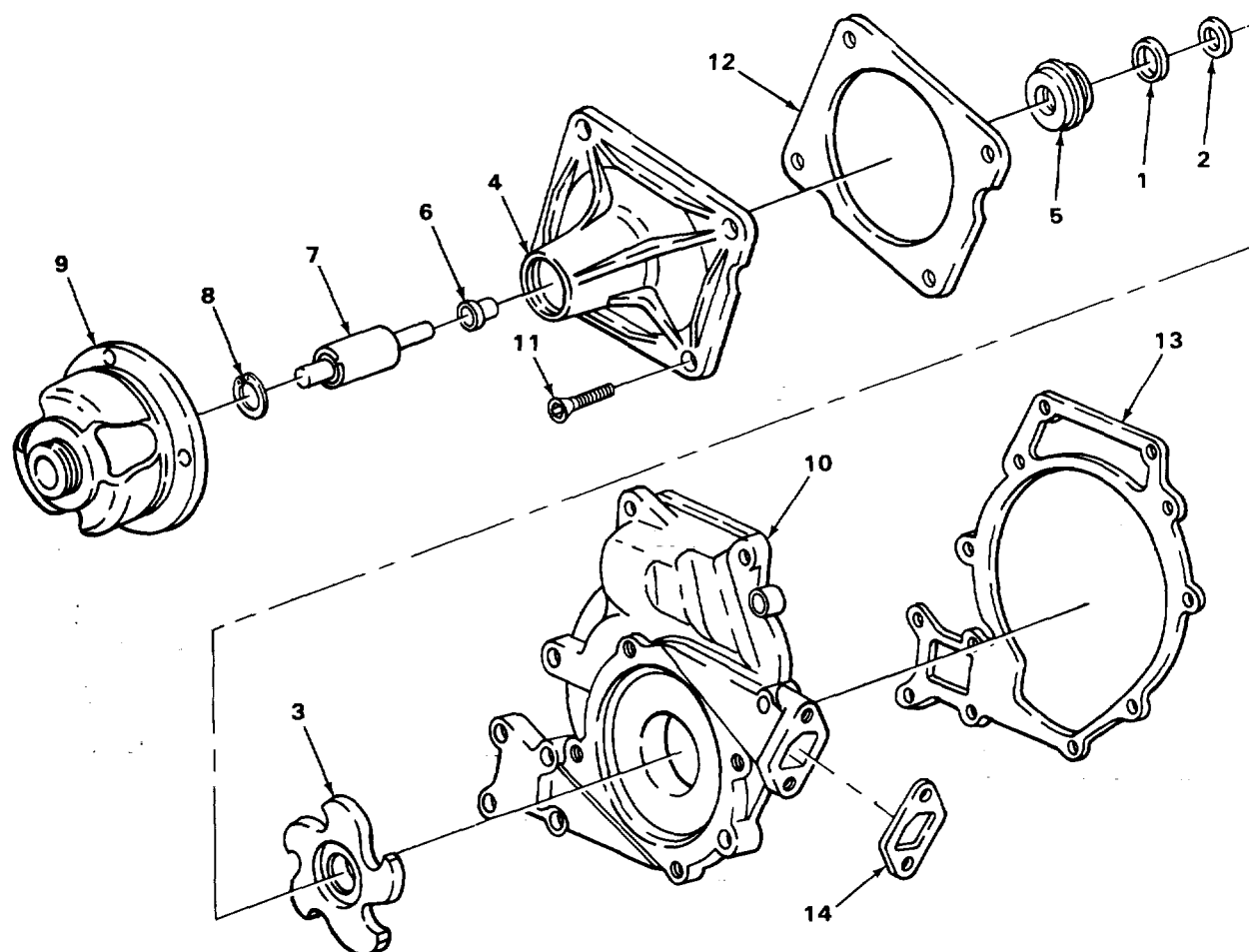
TA238174

WATER PUMP - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY		
16. Bushing (1)	New water pump seal seat (2)	a. Note marks, either three dots or a groove. b. Put in.
17. Impeller (3)	Bushing (1) and water pump seal seat (2)	Put in.
18. Water pump housing (4)	New water pump seal (5)	Using arbor press, press in.
19.	Shaft (6) with bearing assembly (7)	Using arbor press, press in until bearing (7) bottoms.
20.	Snapring (8)	Using snapring pliers, put in.
21. Shaft (6) with bearing assembly (7)	Pulley hub (9)	Using arbor press, press on.
22.	Impeller (3) with bushing (1) and water pump seal seat (2)	Using 0.060-inch (1.47-mm) shim stop and arbor press, press in.
23. Water pump body (10)	Water pump housing (4)	Put in.
24. Water pump housing (4)	Two screws (11)	a. Screw in, and tighten using 3/16-inch socket-head screw key. b. Using thickness gage, measure and record clearance between housing (4) and body (10). c. Using 3/16-inch socket-head screw key, unscrew and take out.
25. Water pump body (10)	Water pump housing (4)	Take out.
26. Shaft (6)	Impeller (3)	a. Add 0.010 to 0.020 inch (0.254 to 0.508 mm) running clearance to recorded clearance from step 24. b. Subtract combined clearances from the 0.060-inch (1.47-mm) shim stop thickness, and record the difference.

WATER PUMP - CONTINUED

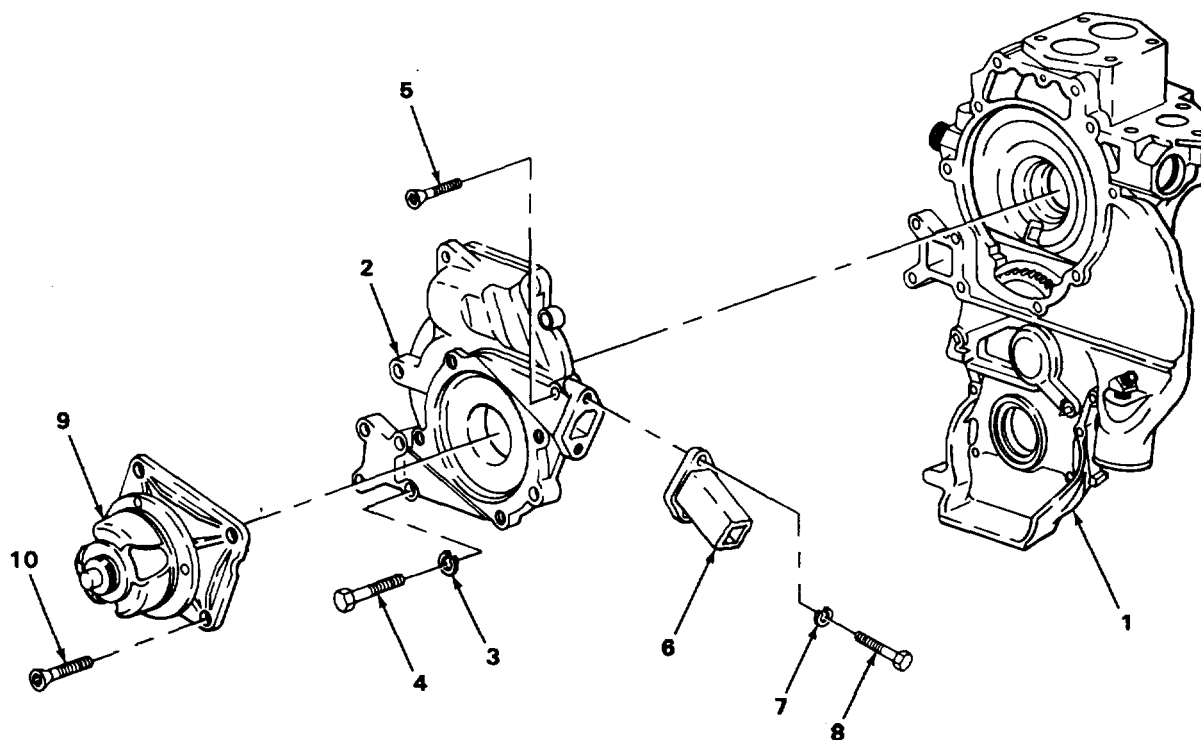
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
26.	Continued	c.	Choose shims to match the recorded difference.
		d.	Using arbor press, press on correct thickness shim.
INSTALLATION			
27.	Water pump housing (4)	New gasket (12)	a. Apply gasket sealant. b. Put on.
28.	Water pump body (10)	Two new gaskets (13) and (14)	a. Apply gasket sealant. b. Put on.



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WATER PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
29. Front crankcase cover (1)	Water pump body (2)	Place in position.	
30. Water pump body (2)	Eight new lockwashers (3) and screws (4)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.	
31.	Screw (5)	Screw in, and tighten using 7/32-inch socket-head screw key.	
32. Water manifold (6)	Two new lockwashers (7) and screws (8)	Screw in, and tighten using 1/2-inch open-end wrench, 1/2-inch socket, and ratchet handle with 3/8-inch drive.	
33. Water pump body (2)	Water pump housing (9)	Place in position.	
34. Water pump housing (9)	Four screws (10)	Screw in, and tighten using 3/16-inch socket-head screw key. Be sure long screw is on bottom.	



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WATER PUMP - CONTINUED

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE: Install water pump pulley (page 2-407).

TASK ENDS HERE

WATER PUMP PULLEY

This task covers:

a. Removal (page 2-408)	c. Inspection/Replacement (page 2-408)
b. Cleaning (page 2-408)	d. Installation (page 2-409)

INITIAL SETUP

Tools

Handle, ratchet, 3/8-inch drive
Socket, 3/8-inch drive, 1/2-inch

Materials/Parts

Lockwashers, water pump pulley
(four required)
Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)

Personnel Required

One

Equipment Condition

Fan assembly and modulated fan drive assembly
removed (TM 9-2320-269-20-1).
Alternator drive belts removed
(TM 9-2320-269-20-1).

WATER PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. Water pump pulley (1)	Four screws (2) and lockwashers (3)	a. Using 1/2-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (3).	
2. Water pump pulley hub (4)	Water pump pulley (1)	Take off.	

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

3.	Water pump pulley (1)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT**NOTE**

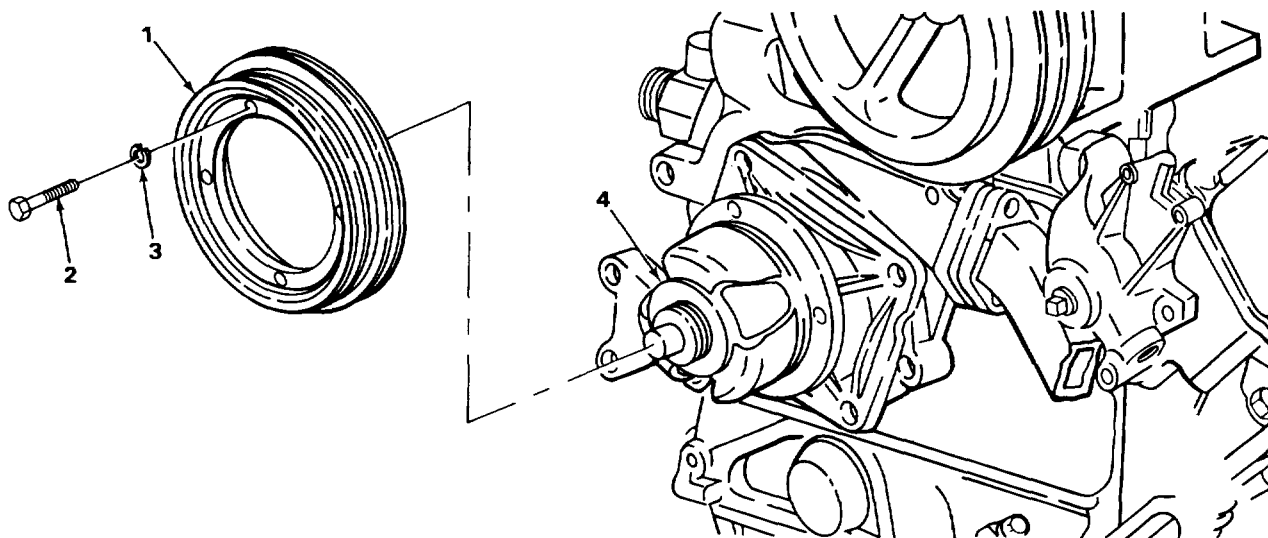
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as necessary.

4.	Water pump pulley (1)	a. Look for cracks, breaks, nicks, and gouges. b. Look for highly polished belt grooves.
5.	All threaded parts	Look for stripped, nicked, and gouged threads.

WATER PUMP - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
6. Water pump pulley hub (4)	Water pump pulley (1)	Put in position.	
7. Water pump pulley (1)	Four new lockwashers (3) and screws (2)	Screw in, and tighten using 1/2-inch socket and ratchet handle with 3/8-inch drive.	

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Install alternator drive belts (TM 9-2320-269-20-1).
2. Install fan assembly and modulated fan drive assembly (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238177

WATER PUMP-TO-CRANKCASE MANIFOLD

This task covers:

a. Removal (page 2-410)	d. Inspection/Replacement (page 2-412)
b. Disassembly (page 2-411)	e. Assembly (page 2-412)
c. Cleaning (page 2-412)	f. Installation (page 2-413)
-

INITIAL SETUP**Tools**

Handle, ratchet, 3/8-inch drive
 Pail, utility, 12-quart
 Socket, 3/8-inch drive, 9/16-inch
 Vise, machinist's
 Wrench, open-end, 11/2-inch
 Wrench, open-end, 11/16-inch
 (two required)
 Wrench, open-end, 1-inch
 Wrench, open-end, 11/8-inch

Materials/Parts

Gasket, body outlet
 Gasket, cross-over

Materials/Parts - Continued

Lockwasher, cylinder block (two required)
 Lockwasher, water pump body (two required)
 Rags, wiping (item 42, appendix B)
 Sealant, gasket (item 44, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

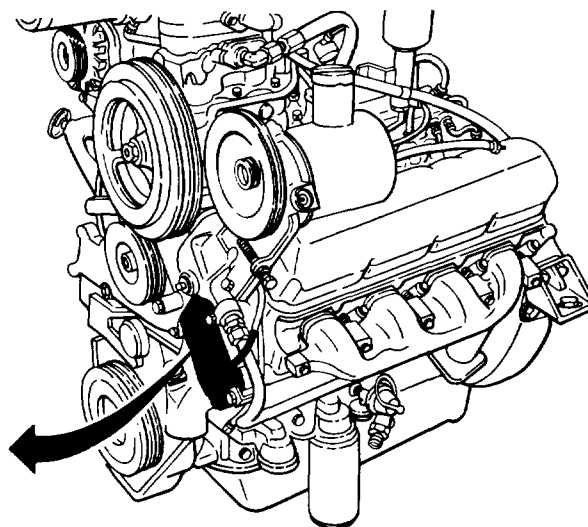
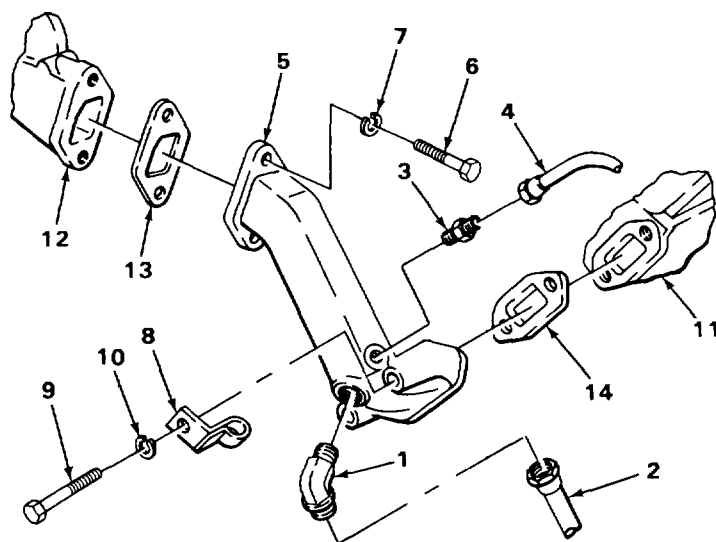
Equipment Condition

Fan assembly and modulated fan drive assembly removed (TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	
		REMARKS	
1. Elbow (1)	Water pipe (2)	a. Put pail underneath to catch draining fluid. b. Using 1-inch and 1 1/8-inch open-end wrenches, unscrew and take off. c. Allow fluid to drain. d. Get rid of fluid (page 2-46).	
2. Connector (3)	Water pipe (4)	Using two 11/16-inch open-end wrenches, unscrew and take off.	
3. Water pump-to-crankcase manifold (5)	Two screws (6) and lockwashers (7)	a. Using 1/2-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (7).	

WATER PUMP-TO-CRANKCASE MANIFOLD - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
4.	Water pump-to-crankcase manifold (5) and extension clip (8)	Two screws (9) and lockwashers (10)	a. Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take off. b. Get rid of lockwashers (10).
5.	Cylinder block (11) and water pump body (12)	Water pump-to-crankcase manifold (5) and two gaskets (13) and (14)	a. Take off. b. Get rid of gaskets (13) and (14).
DISASSEMBLY			
6.	Water pump-to-crankcase manifold (5)	Elbow (1)	a. Put manifold (5) in vise. b. Using 1-inch open-end wrench, unscrew and take off.
7.	Connector (3)		a. Using 11/16-inch open-end wrench, unscrew and take off. b. Take manifold (5) out of vise.



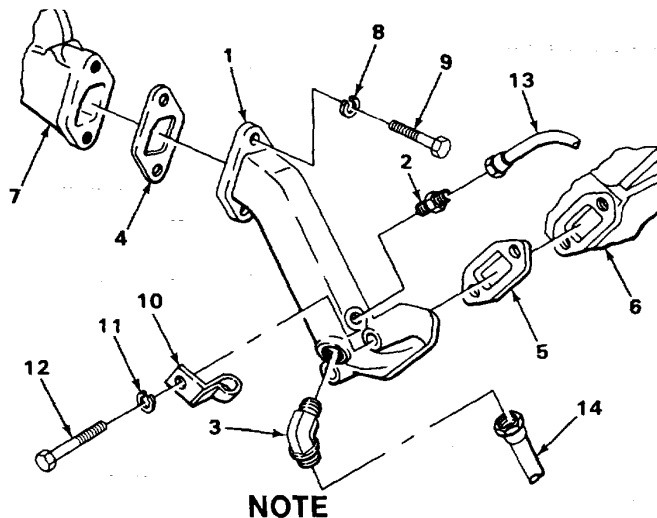
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WATER PUMP-TO-CRANKCASE MANIFOLD - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). WARNING Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
8.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.	
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as necessary.			
9.	Water pump-to-crankcase manifold (1)	Look for cracks, breaks, and large dents.	
10.	All threaded parts	Look for stripped or gouged threads.	
ASSEMBLY			
11.	Water pump-to-crankcase manifold (1)	a. Put manifold (1) in vise. b. Using 11/16-inch open-end wrench, screw in and tighten.	
12.	Elbow (3)	a. Using 1-inch open-end wrench, screw in and tighten. b. Take manifold (1) out of vise.	

WATER PUMP-TO-CRANKCASE MANIFOLD - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
13.	Water pump-to-crankcase manifold (1)	Two new gaskets (4) and (5)	a. Apply gasket sealant. b. Put on.
14.	Cylinder block (6) and water pump body (7)	Water pump-to-crankcase manifold (1)	Place in position.
15.	Water pump-to-crankcase manifold (1)	Two new lockwashers (8) and screws (9)	Screw in, and tighten using 1/2-inch open-end wrench.
16.	Water pump-to-crankcase manifold (1) and extension clip (10)	Two new lockwashers (11) and screws (12) drive.	Screw in, and tighten using 9/16-inch socket and handle with 3/8-inch drive.
17.	Connector (2)	Water pipe (13)	Screw on, and tighten using two 11/16-inch open-end wrenches.
18.	Elbow (3)	Water pipe (14)	Screw on, and tighten using 1-inch and 1 1/8-inch open-end wrenches.



FOLLOW-ON MAINTENANCE: Install fan assembly and modulated fan drive assembly (TM 9-2320-269-20-1).

TASK ENDS HERE

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Section VII. ELECTRICAL SYSTEM

Page	Page
Alternator 2-414	Main Wiring Harness..... 2-525
Antilock Control Modules.....2-498	Relay Box..... 2-602
Antilock Wiring Harness 2-481	Starting Motor..... 2-428
Body Lights Wiring Harness 2-593	Stoplight Switch Wiring Harness..... 2-567
Cab Mounted Lights Wiring Harnesses.....2-560	Submerged Fuel Pump Wiring Harness 2-554
Console Tachometer and Outrigger Hydraulic Solenoid Wiring Harness.....2-572	Taillight and Marker Wiring Harness 2-512
Engine Wiring Harness.....2-470	12-Volt Trailer Harness 2-519
Front Wiring Harness 2-462	24-Volt Converter System Wiring Harness 2-501

This task covers:

a. Disassembly (page 2-415)	d. Assembly (page 2-421)
b. Cleaning (page 2-449)	e. Voltage Regulator Testing (page 2-426)
c. Inspection/Replacement/Repair (page 2-420)	
-

INITIAL SETUP**Tools**

Arbor, arbor press, 29132-inch diameter
 Caps, vise jaw
 Collar, arbor press, 1 7/16-inch
 Compressor, reciprocating air, power driven
 Driftpin, brass, 1/4-inch
 Face, inserted hammer, medium-plastic
 Goggles, safety
 Gun, air blow
 Hammer, ball-peen, machinist's, 2-oz
 Handle, speeder, 1/4-inch drive
 Holder, inserted, hammer-face
 Hose, air compressor
 Key, socket-head, screw, 5/16-inch
 Lathe, engine
 Press, arbor, hand operated
 Screwdriver, flat-tip, 3/16-inch
 Scribe, machinist's
 Socket, 1/4-inch drive, 1/4-inch
 Socket, 11/4-inch drive, 11/16-inch

Tools - Continued

Socket, 1/4-inch drive, 5/16-inch
 Socket, 1/4-inch drive, 7/16-inch
 Stand, test, automotive starter and generator
 Test fixture, alternator
 Vise, machinist's
 Wire, stiff, 12-inch
 Wrench, box-end, offset, 15/16-inch
 Wire, .0937-inch (2.38-mm) diameter
 Materials/Parts
 Bearing, slipring and end frame
 Bearing, drive end frame
 Cloth, polishing (400 grit) (item 9, appendix B)
 Grease, GAA (item 20, appendix B)
 Oil, OE/HDO 30 (item 34, appendix B)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)
 Spring, brush (two required)

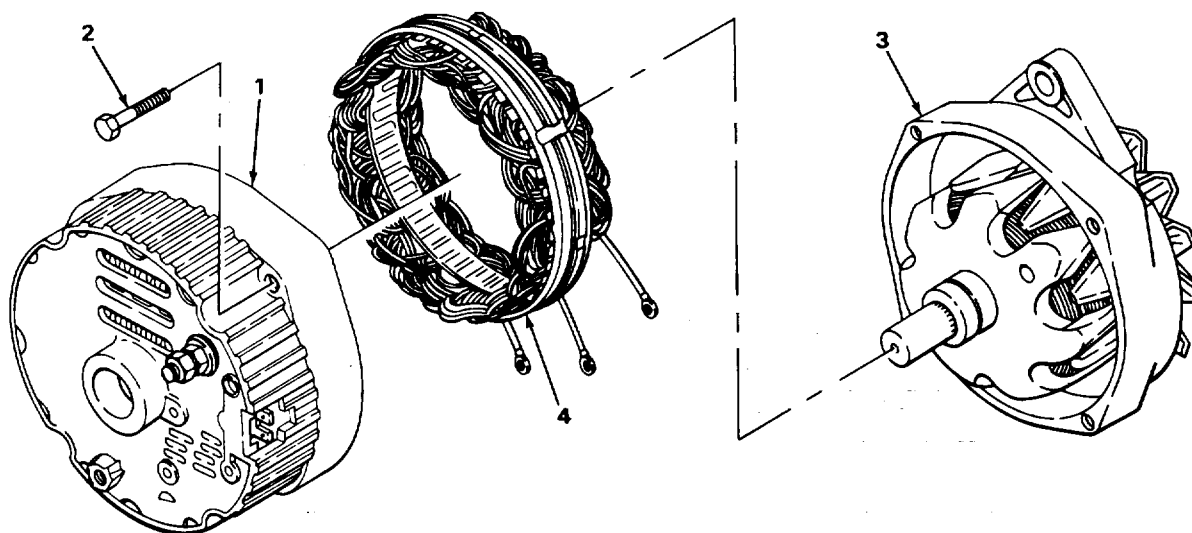
ALTERNATOR - CONTINUED**INITIAL SETUP - CONTINUED**

Personnel Required

One
Equipment Condition

Alternator removed (TM 9-2320-269-20-1).

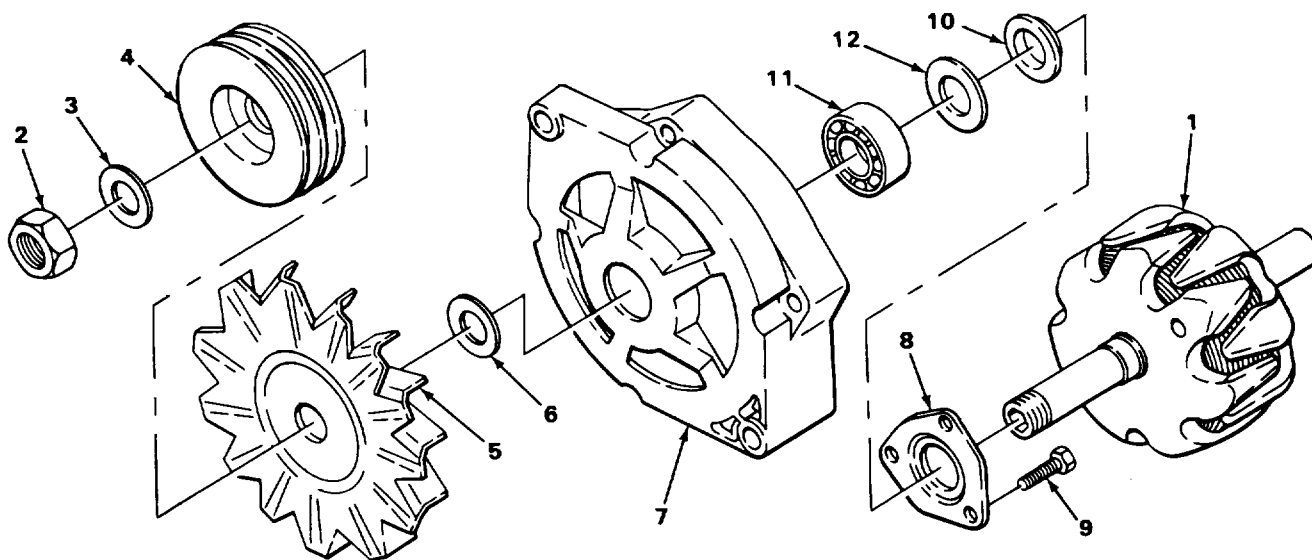
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
1. Slipring end frame (1)	Four screws (2)	a. Using scribe, matchmark frame sections (1) and (3). b. Using 5/16-inch socket and speeder handle with 1/4-inch drive, unscrew and take out.	
2. Drive end frame (3)	Slipring end frame (1) and field coil (4)	a. Using 3/16-inch flat-tip screwdriver, pry apart. b. Take off.	Brush may pop up.



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ALTERNATOR - CONTINUED

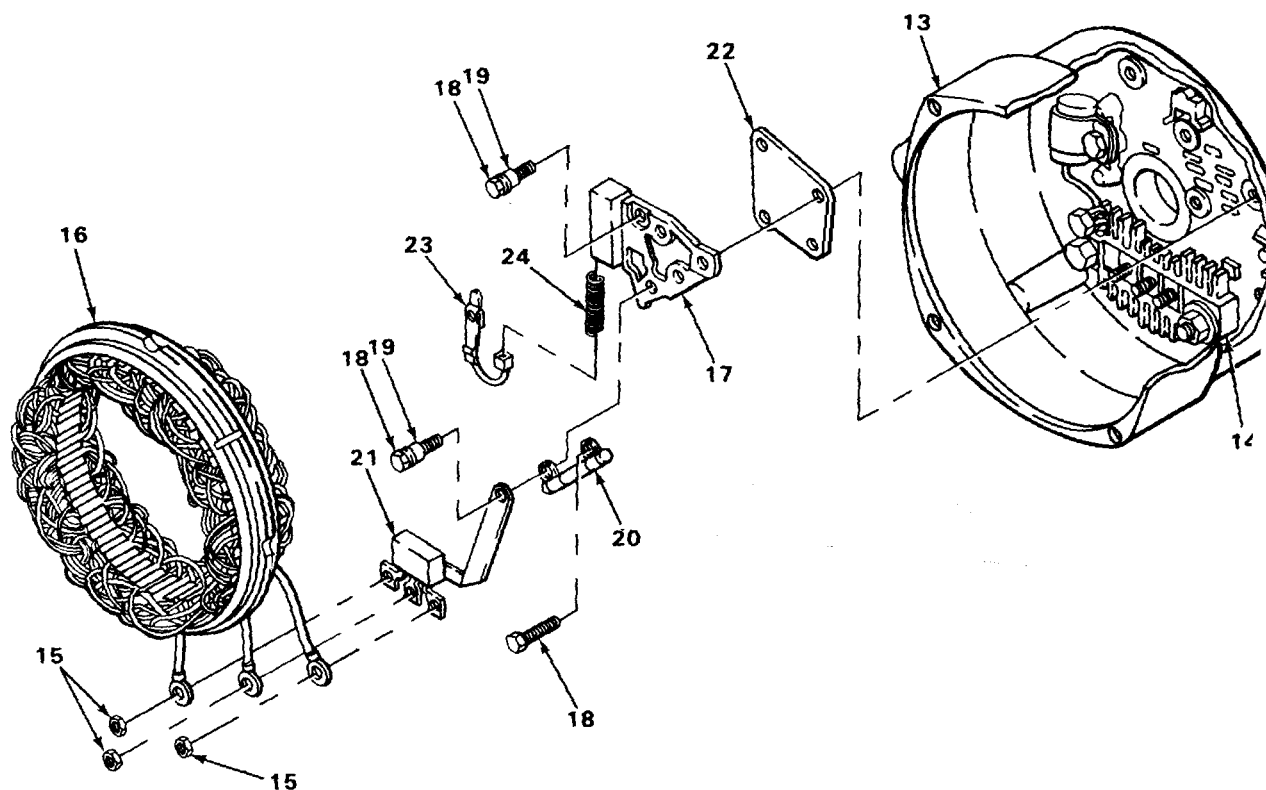
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
3.	Rotor assembly (1)	Nut (2)	Using 15/16-inch offset box-end wrench and 5/16-inch key, unscrew and take off.
4.		Washer (3), pulley (4), fan (5), and collar (6)	Take off.
5.	Drive end frame (7)	Rotor assembly (1)	Using plastic-face hammer, tap lightly on threaded end of shaft and take out.
6.	Retainer (8)	Three screws (9)	Using 5/16-inch socket and speeder handle with 1/4-inch drive, unscrew and take out.
7.	Drive end frame (7)	Retainer (8)	Take off.
8.	Retainer (8)	Seal (10)	a. Take out. b. Get rid of.
9.	Drive end frame (7)	Bearing (11)	a. Using 1/4-inch-diameter brass driftpin and 2 oz. ball-peen hammer, tap out. b. Get rid of.
10.		Spacer (12)	Take off.



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ALTERNATOR - CONTINUED

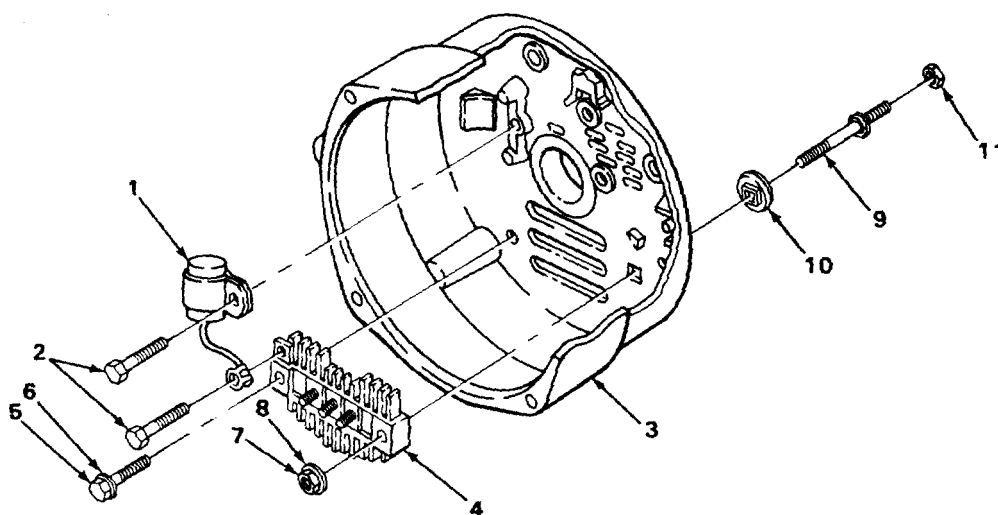
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
11.	Slipring end frame (13) rectifier bridge (14)	Three nuts (15)	Using 11/32-inch socket, speeder handle with 11/4-inch drive, unscrew and take off.
12.	Slipring end frame (13)	Stator (16)	Take out.
13.	Brush holder assembly (17)	Three screws (18), two insulators (19) and resistor (20)	Using 1/4-inch socket, speeder handle with 1/4-inch drive, unscrew and take out. Do not take insulators off screws.
14.	Slipring end frame (13)	Diode trio (21), brush holder assembly (17), voltage regulator (22), two brushes (23) and springs (24)	a. Take off. b. Get rid of brushes (23).



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ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
15.	Capacitor (1)	Two screws (2)	Using 1/4-inch socket, speeder handle with 11/4-inch drive, unscrew and take off.
16.	Slipring end frame (3)	Capacitor (1)	Take out.
17.	Rectifier bridge (4)	Screw (5) and washer (6)	Using 1/4-inch socket, speeder handle with 1/4-inch drive, unscrew and take out.
18.		Nut (7) with washer (8)	Using 7/16-inch socket, speeder handle with 1/4-inch drive, unscrew and take off.
19.	Slipring end frame (3)	Rectifier bridge (4)	Take out.
20.	Slipring end frame (3)	Terminal (9)	Pull out.
21.	Terminal (9)	Insulator (10), and nut (11)	Unscrew, and take off.



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ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
22. Slipping end frame (3)	Bearing (12)	a. Put frame (3) on arbor press, with rear face down. b. Using arbor press, press out. c. Get rid of bearing (12).	

CLEANING**NOTE**

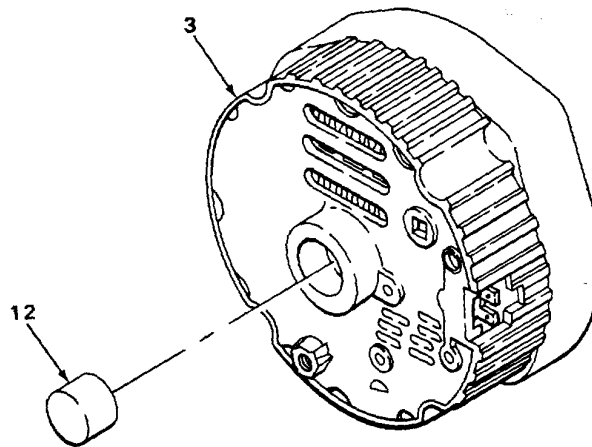
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

23.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Dry with compressed air.
24.	All electrical parts	a. Remove loose particles with low pressure compressed air. b. Wipe with clean rag dampened with drycleaning solvent.



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ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
25.	Bearings	Clean (TM 9-214).	
26.	Rotor (1)	Clean slipring surfaces (2) with 400 grain polishing cloth.	Rotor must be turned while polishing to prevent flat spots on the sliprings.

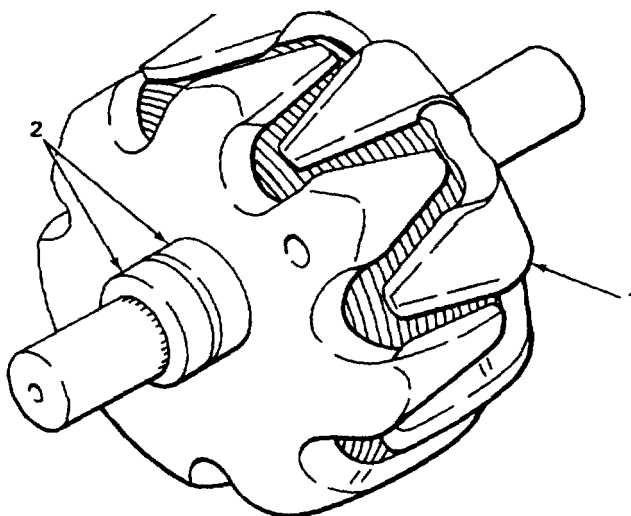
INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace defective parts, as needed.

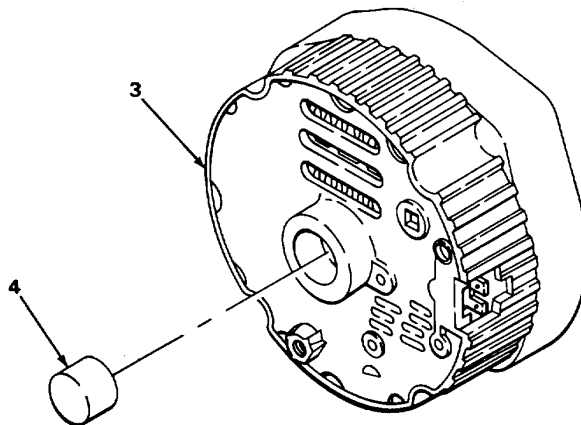
27.	All parts	Look for cracks or damage.	
28.	Rotor (1)	Look for bent shaft ends and badly worn or out-of-round sliprings (2).	Repair rough out-of-round sliprings by turning them on a lathe. Remove only enough material to make smooth and round. Use 400 grain or polishing cloth.



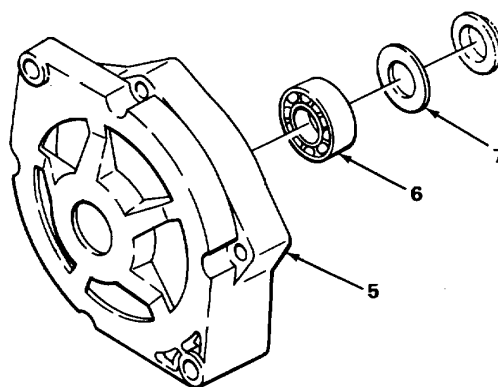
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ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
29. Slipring end frame (3)	New bearing (4)	a. Put frame (3) on arbor press with rear face down. b. Put bearing (4) in position, in bore. c. Using a 29/32-inch arbor, press in flush with edge of bore.	



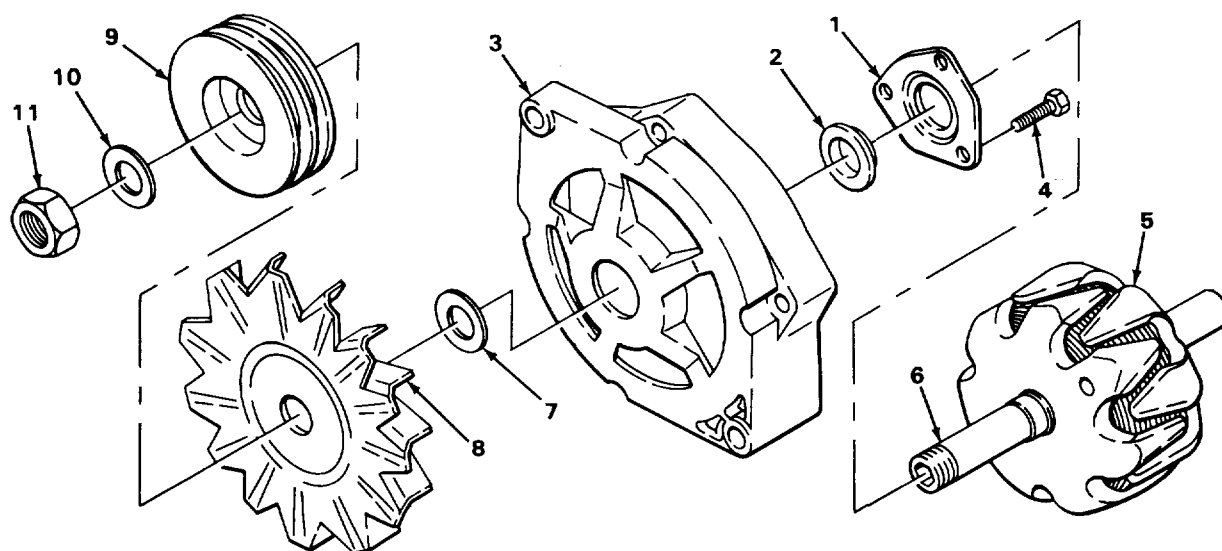
30. Drive end frame (5)	New bearing (6)	a. Position frame (5) on arbor press, inner side up. b. Using 1 7/16 collar that fits outer race, press in to bottom of bore. c. Grease bearing (6).	
31. New bearing (6)	Spacer (7)	Put in place.	



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ALTERNATOR - CONTINUED

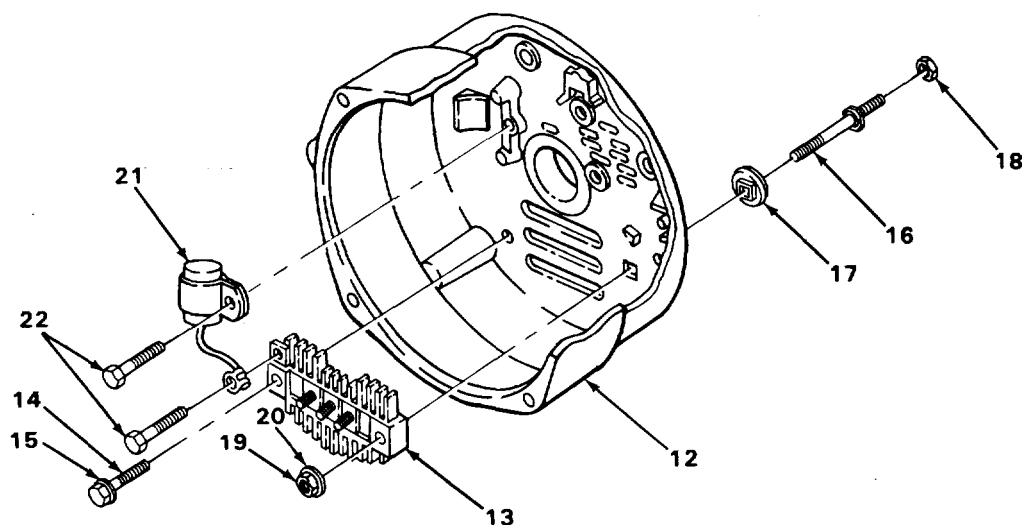
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
32.	Bearing retainer (1)	New seal (2)	a. Put in position. b. Using 2 oz. ball-peen hammer, tap into place. c. Lubricate lip of packing with oil.
33.	Drive end frame (3)	Bearing retainer (1)	Put in position.
34.	Bearing retainer (1)	Three screws (4)	Using 5/16-inch socket and speeder handle with 1/4-inch drive, alternately screw in and tighten.
35.	Rotor (5)	Drive end frame (3)	Put in position.
36.	Rotor shaft (6)	Collar (7), fan (8), pulley (9), and washer (10)	Put in position.
37.	Nut (11)		a. Put shaft (6) in soft-jawed vise. Do not clamp on sliprings. b. Screw on until snug. c. Using 15/16-inch offset box-end wrench, screw on and tighten.



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ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
38.	Slipring end frame (12)	Rectifier bridge (13)	Put in position.
39.	Rectifier bridge (13)	Screw (14) and washer (15)	Screw in, but do not tighten.
40.	Terminal (16)	Insulator (17)	Put on.
41.		Nut (18)	Screw on, but do not tighten.
42.	Slipring end frame (12)	Terminal (16)	Push through hole in frame (12) and bridge (13).
43.	Terminal (16)	Nut (19) with washer (20)	Screw on, and tighten using 7/16-inch socket and speeder handle with 1/4-inch drive.
44.	Rectifier bridge (13)	Screw (14)	Tighten using 1/4-inch socket and speeder handle with 1/4-inch drive.
45.	Slipring end frame (12) and rectifier bridge (13)	Capacitor with lead (21)	Put in position.
46.	Capacitor and lead (21)	Two screws (22)	Screw in, and tighten using 1/4-inch socket and speeder handle with 1/4-inch drive.



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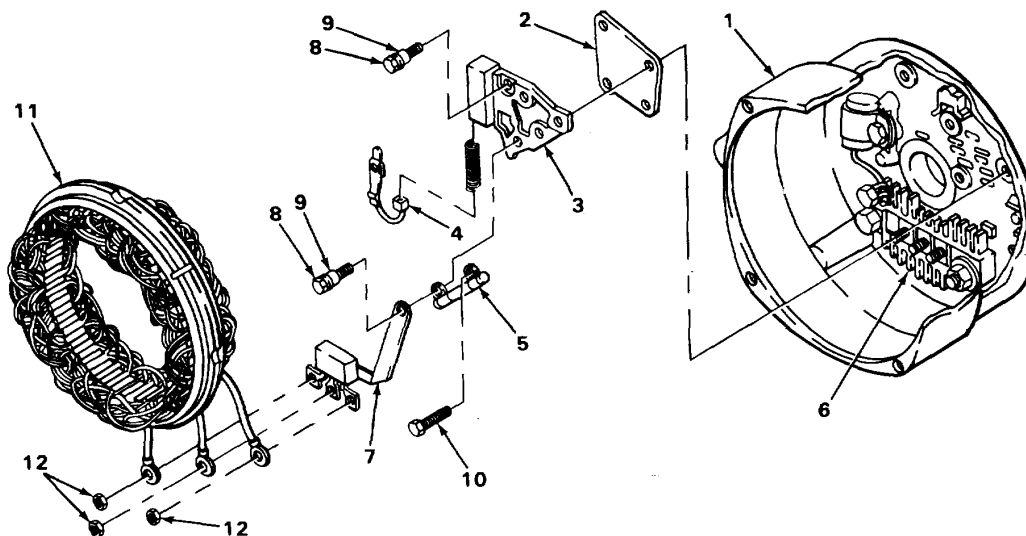
ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
47. Slipring end frame (1)	Voltage regulator (2)	Put in position.
48. Brush holder (3)	Two brush assemblies (4)	Put in position
49. Voltage regulator (2)	Brush holder (3)	Put in position.
50. Brush holder (3)	Resistor (5)	Put in position.
51. Rectifier bridge (6)	Diode trio (7)	Put in position.
52. Brush holder (3) and diode trio (7)	Two screws (8) and insulators (9)	Put in.
53.	Screw (10)	Put in.
54.	Three screws (8) and (10)	Tighten using 1/4-inch socket and speeder handle with 1/4-inch drive.
55. Slipring end frame (1)	Stator(11)	a. Put in position. b. Put three stator leads on three studs in bridge (6).
56. Rectifier bridge (6)	Three nuts (12)	Screw on, and tighten using 11132-inch socket and speeder handle with 1/4-inch drive.
57. Brush holder (3)	Two springs (13)	Put in place.
58.	Two brushes (4)	a. Push in. b. Put wire through hole, brushes (4), and holder (3).

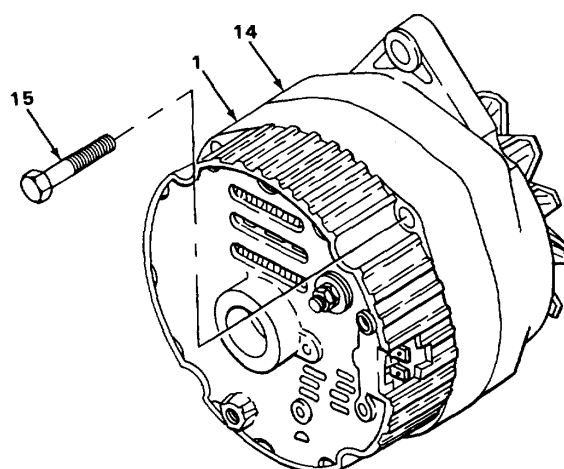
ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED



59.	Slipring end frame (1)	Drive end frame (14)	a. Aline scribe marks. b. Put together.-
60.	Four screws (15)		a. Screw in, and tighten using 15/16-inch socket, and speeder handle with 1/4-inch drive. b. Pull out wire.



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ALTERNATOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

VOLTAGE REGULATOR TESTING

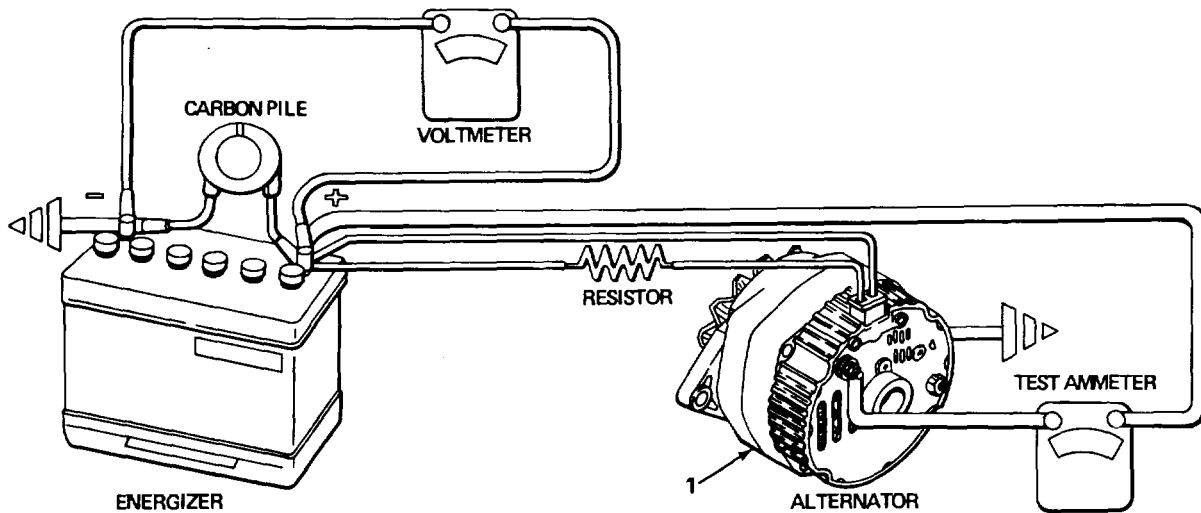
NOTE

The voltage regulator is a solid-state unit mounted inside the alternator assembly. There are no adjustments to the voltage regulator. The voltage regulator can be checked to see if it is performing properly by performing the following procedure.

61.	Alternator assembly (1)	a. Put on test stand. b. Make connections, as shown below. c. Do not connect carbon pile lead.

NOTE

The ground polarity of the battery and the alternator must be the same. Battery must be fully charged. Use a 10-ohm resistor, rated at six watts or more, between alternator number one terminal and battery.



62.	Alternator assembly	a. Slowly increase alternator speed. b. Read and record voltage. c. If voltage increases above 15.5 volts, check for grounded brush lead clip d. If the brush lead clip is not grounded, disassemble alternator and install new voltage regulator (page 2-414). e. If the voltage recorded is not above 15.5 volts, connect the carbon pile lead. f. Operate alternator at moderate rate of speed.

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ALTERNATOR - CONTINUED

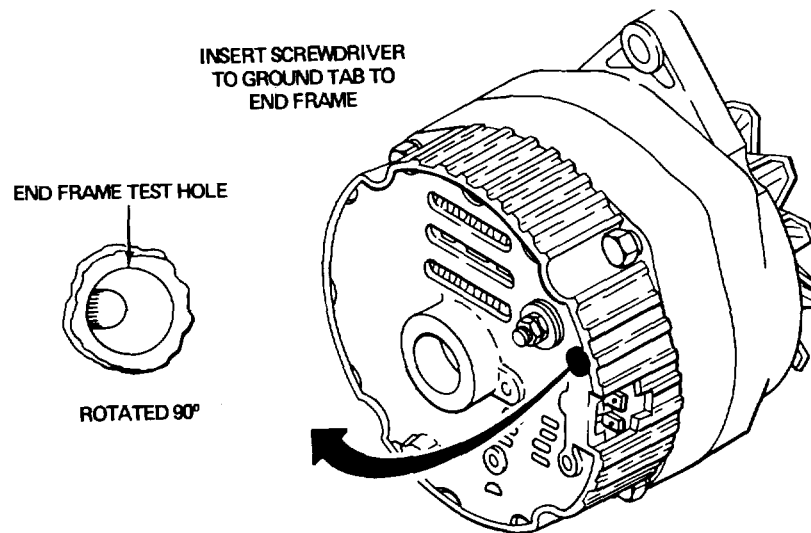
LOCATION	ITEM	ACTION	REMARKS

VOLTAGE REGULATOR TESTING - CONTINUED

62. Continued

- g. Adjust carbon pile to get maximum current output.
- h. If current output is within 10 percent of 61 amps, the rated output, the alternator components are good.
- i. If current output is not within 10 percent of 61 amps, keep battery loaded with carbon pile and ground alternator field.

Ground the field by Inserting screwdriver in test hole.



NOTE

The tab is located within three-fourths of an inch of the rear face of the frame. Do not force screwdriver deeper than one inch into the hole.

- j. Operate alternator at moderate rate of speed and adjust carbon pile to get maximum output.
- k. If the output is within 10 percent of 61 amps, replace voltage regulator.

NOTE

FOLLOW-ON MAINTENANCE: Install alternator (TM 9-2320-269-20-1).

TASK ENDS HERE

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STARTING MOTOR

This task covers:

a. No-Load Test (page 2-429)	e. Assembly (page 2-446)
b. Disassembly (page 2-432)	f. Adjustment (page 2-459)
c. Cleaning (page 2-442)	
d. Inspection/Replacement and Testing (page 2-442)	
-

INITIAL SETUP

Tools

Battery, storage, 12-volt
 Bit, drill, 23/64-inch
 Bit, key, socket-head screw, 3/8-inch drive, 7/32-inch
 Bit, screwdriver, cross-tip, 1/2-inch drive, number four
 Bit, screwdriver, flat-tip, 112-inch drive, 15/16-inch
 Blade, hacksaw
 Cable, jumper (three required)
 Caliper, micrometer
 Caps, vise jaw
 Compressor, reciprocating air, power driven
 Extension, 3/8-inch drive, 3-inch
 Gage, thickness
 Gun, air blow
 Hammer, ball-peen, machinist's, 2-oz
 Handle, ratchet, 3/8-inch drive
 Handle, ratchet, 1/2-inch drive
 Handle, speeder, 1/4-inch drive
 Hose, air compressor
 Key, socket-head screw, 3/16-inch
 Pliers, snapping
 Punch, drive-pin, 5/32-inch
 Rule, steel, machinist's, 6-inch
 Screwdriver, flat-tip, 1/8-inch
 Screwdriver, flat-tip, 1/6-inch
 Screwdriver, flat-tip, 3/16-inch (two required)
 Screwdriver, flat-tip, 1/4-inch
 Screwdriver, flat-tip, 3/8-inch
 Scribe, machinist's
 Socket, 1/4-inch drive, 5/16-inch
 Socket, 3/8-inch drive, 7/16-inch, 6 point
 Socket, 1/2-inch drive, 3/4-inch

Tools - Continued

Socket, deep well, 3/8-inch drive, 1/2-inch
 Test fixture, armature
 Test stand, automotive generator and starter
 Vise, machinist's
 Wrench, box-end, 7/16-inch
 Wrench, box-end, 3/4-inch
 Wrench, torque, 3/8-inch drive, 0-200 in-lb capacity

Materials/Parts

Detergent, non-sudsing (item 15, appendix B)
 Gasket, field frame plug (two required)
 Gasket, lever housing plug
 Grease, oil soluble (item 21, appendix B)
 Lockwasher, terminal connector
 Lockwasher, solenoid terminal connector
 Lockwasher, drive housing (five required)
 Lockwasher, end plate (four required)
 Lockwasher, end plate terminal connector
 Nut, self-locking, plunger
 Packing, preformed, lever housing
 Packing, preformed, lever shaft (two required)
 Packing, preformed, end plate
 Packing, preformed, drive housing
 Rags, wiping (item 42, appendix B)
 Sandpaper, number 00 (item 43, appendix B)
 Seal, lever housing, armature shaft
 Solvent, drycleaning (item 49, appendix B)
 Tag, marking (item 50, appendix B)
 Tape, pressure sensitive (item 54, appendix B)

STARTING MOTOR - CONTINUED

INITIAL SETUP - CONTINUED

Personnel Required

Two

Equipment Condition

Starter motor removed
(TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS

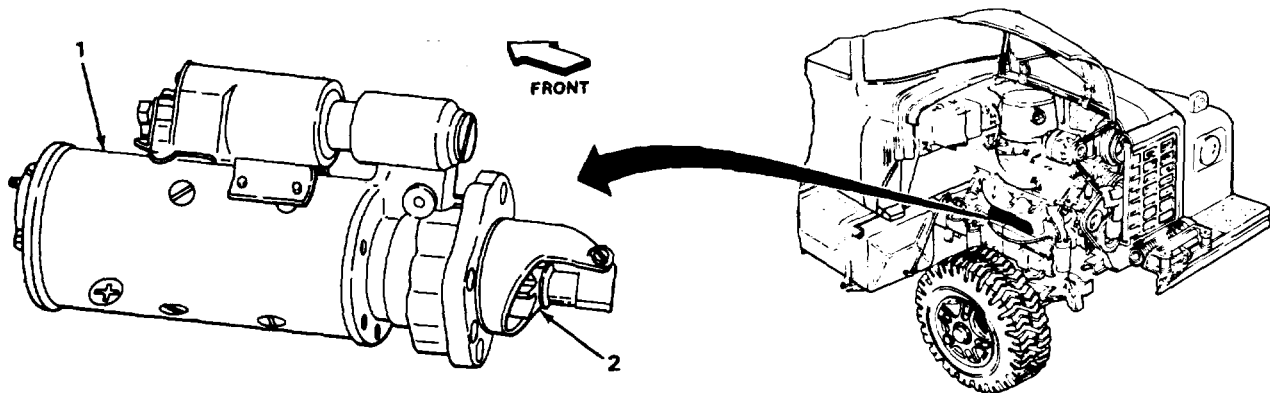
NO-LOAD TEST

NOTE

This test should be performed to find cause of starter motor failure. Inspection and testing done after disassembly may also show defects within the motor.

The following test should be performed again after the motor is assembled and adjusted to make sure it is working properly.

1. Starting motor (1) Pinion gear (2)
 - a. Using 3/8-inch flat-tip screwdriver, pry on pinion gear (2) to turn it.
 - b. If gear (2) turns hard, disassemble motor (1) and look for cause.
 - c. If gear (2) turns easily, perform NO-LOAD TEST as described.



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STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

NO-LOAD TEST - CONTINUED**WARNING**

Make battery connections first. Disconnect battery connection last. Sparking battery terminal connections may cause battery to explode causing serious injury.

CAUTION

Never operate starting motor more than 30 seconds at one time, and each time let it cool for two minutes. Overheating can cause serious damage to the motor.

2.	Starting motor (1)	a. Put starting motor (1) on test stand and connect tachometer. b. Connect ammeter and carbon pile in series with positive battery post and positive starter solenoid post (2). c. Connect starting motor ground terminal (3) to negative battery post. d. Connect red voltmeter lead to positive solenoid post (2), and black lead to starting motor ground terminal (3). e. Adjust carbon pile until voltmeter reads nine volts. f. Connect jumper to solenoid positive post (2). g. Touch jumper to solenoid start switch tab (4). h. Read ammeter. Ammeter should read 120 to 150 amps. i. Read tachometer. Starting motor should run 3,000 to 4,500 rpm. j. Take off jumper cable.

STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

NO-LOAD TEST - CONTINUED

NOTE

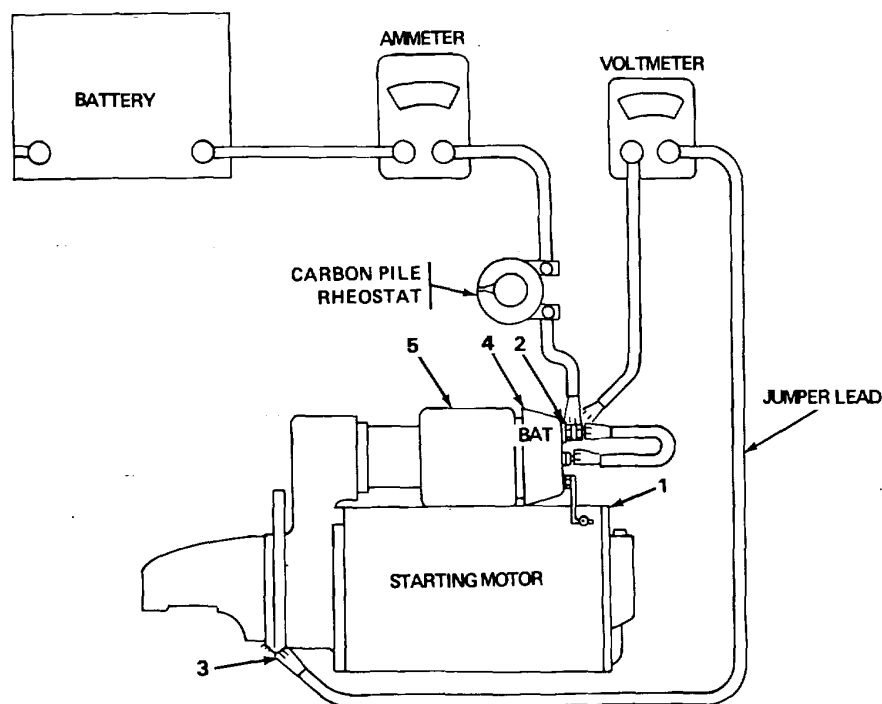
Low rpm reading and high ammeter reading could mean too much friction on armature shaft, also tight, dirty, or worn bearings, bent armature shaft, or loose pole shoes, which would allow armature to drag.

No operation and low current draw could mean an open field current, open armature coils, poor contact between brushes and commutator, or high insulation between commutator bars.

Low no-load speed and low-current draw could mean poor connections inside motor, defective leads, or dirty commutator.

High free-speed and high-current draw could mean shorted field coils.

3.	Starting motor (1) and solenoid switch assembly (5)	a. Disconnect all leads and test equipment. b. Remove motor (1) from test stand.



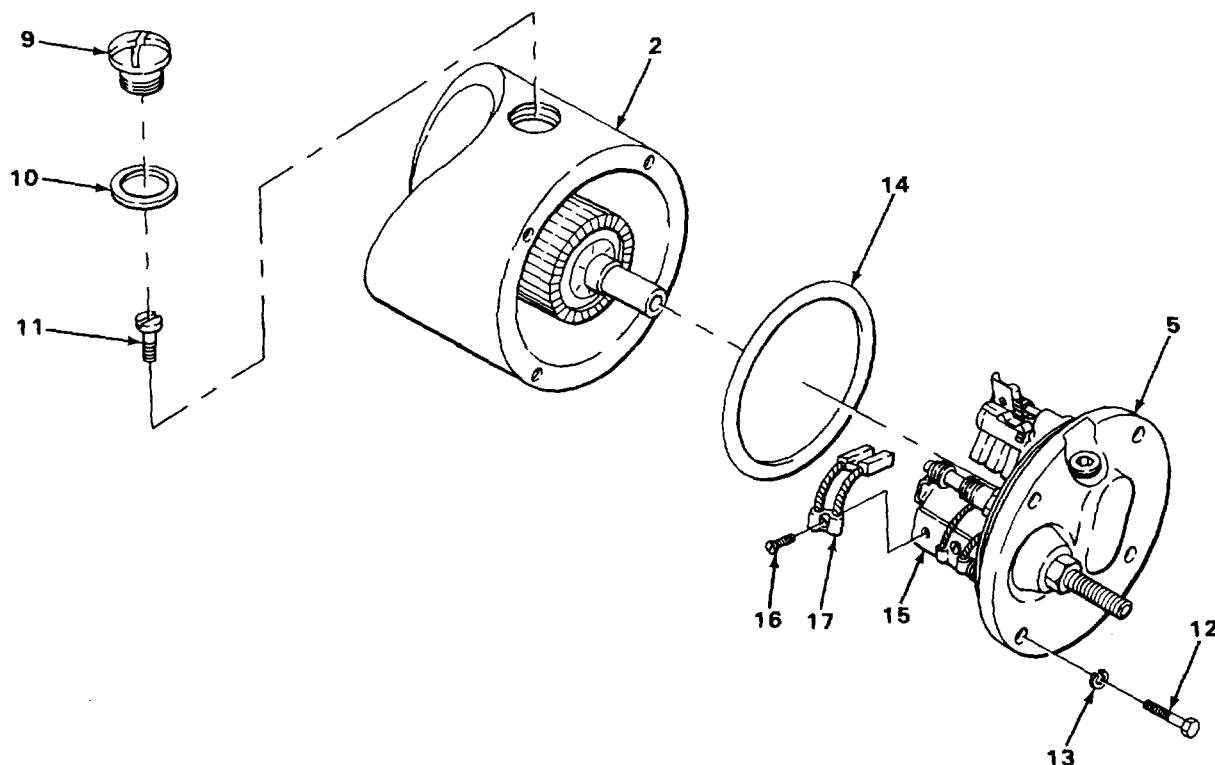
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STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
4.	Starting motor (1) lever housing (3), and drive housing (4)	Field frame (2), lever housing (3), and drive housing (4).	Using scribe, mark field frame (2).
5. ratchet	End plate (5) (7), and lead (8)	Nut (6), lockwasher handle with 1/2-inch drive, unscrew and take off. b. Get rid of lockwasher (7).	a. Using 3/4-inch socket and
6. screwdriver bit and	Field frame (2) and gaskets (10)	Two brush plugs (9) ratchet handle with 11/2-inch drive, unscrew and take out. b. Get rid of gaskets (10).	a. Using 15/16-inch
7.	Two brush connecting screws (11)	Using 1/4-inch flat-tip screwdriver, un- screw and take out.	
8. and ratchet	End plate (5) and lockwashers (13)	Four screws (12) handle with 3/8-inch drive, unscrew and take off. b. Get rid of lockwashers (13).	a. Using 7/16-inch socket

STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
9. 5/32-	Field frame (2) packing (14)	End plate (5) and inch drive-pin punch, loosen and take off.	Using 2-oz ball-peen hammer and Hold in armature if it starts to come out with end plate.
10.	End plate (5)	Packing (14) a. b.	Using 1/8-inch flat-tip screwdriver, take off. Get rid of.
11. un-	Four brush assemblies (15)	Six brush wire screws (16)	Using 1/4-inch flat-tip screwdriver, screw and take out.
12. and its	End plate (5)	Eight brushes (17)	Take out, and tag each brush (17) screw hole in the end plate (5).

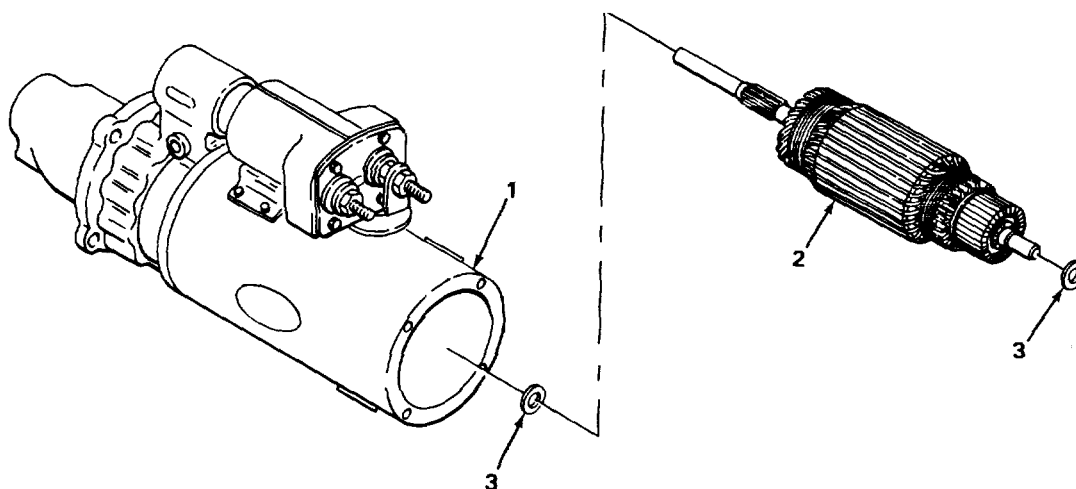


STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

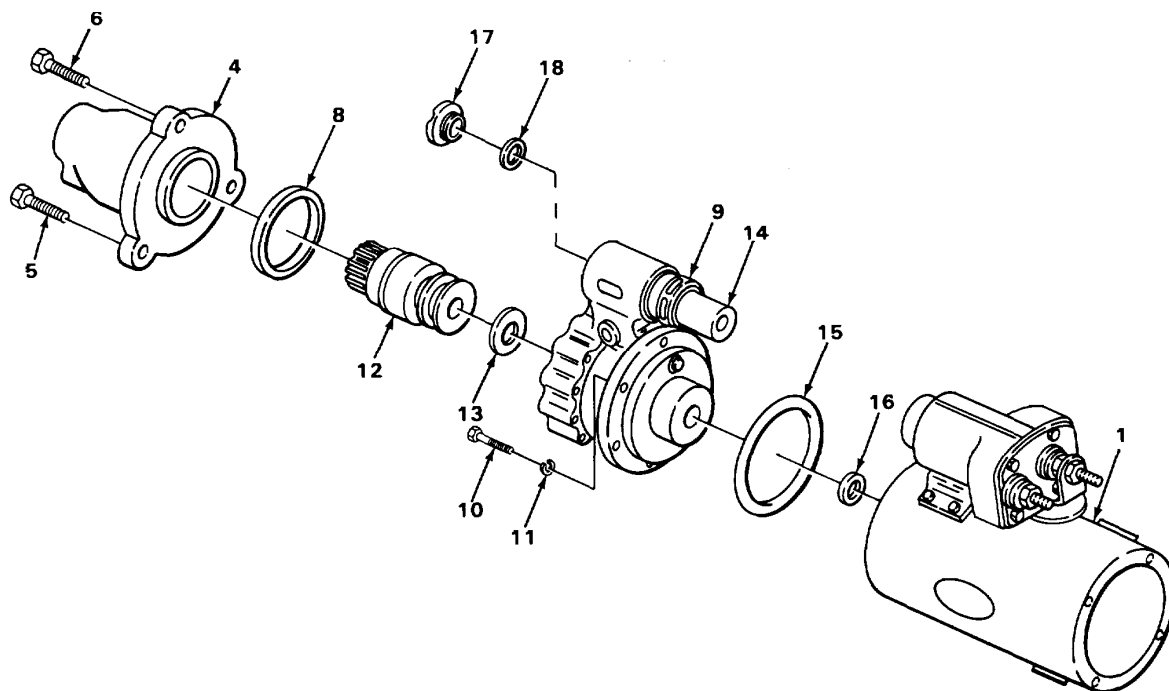
13.	Field frame (1)	Armature (2) Take out.
14.	Armature (2) washers (3)	Two thrush- Take off.



15. key bit,	Drive housing (4) and screw (6)	Five screws (5) 3-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. Note hole where short screw was located.
16.	Lever housing (7)	Drive housing (4) Take off.
17.	Drive housing (4)	Packing (8) a. Using 1/8-inch flat-tip screwdriver, pry up and take off. b. Get rid of packing (8).
18.	Solenoid boot (9)	Using 1/4-inch flat-tip screwdriver, loosen.

STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
19.	Five screws (10) and lockwashers (11)	a. Using 7/16-inch box-end wrench, unscrew and take out. b. Get rid of lockwashers (11).	
20.	Field frame (1)	Lever housing (7)	Take off.
21.	Drive clutch (12) and spacer (13)	Pull plunger(14) forward, and take out.	
22.	Lever housing (7)	Packing (15) a. Secure housing (1) in vise with jaw caps. b. Using 1/8-inch flat-tip screwdriver, pry up and take off. c. Get rid of.	
23.	Seal (16)	a. Using 3/8-inch flat-tip screwdriver, pry out. b. Get rid of.	
24.	Housing plug (17) and gasket (18)	a. Secure housing (7) in vise. b. Using 15/16-inch flat-tip screwdriver	



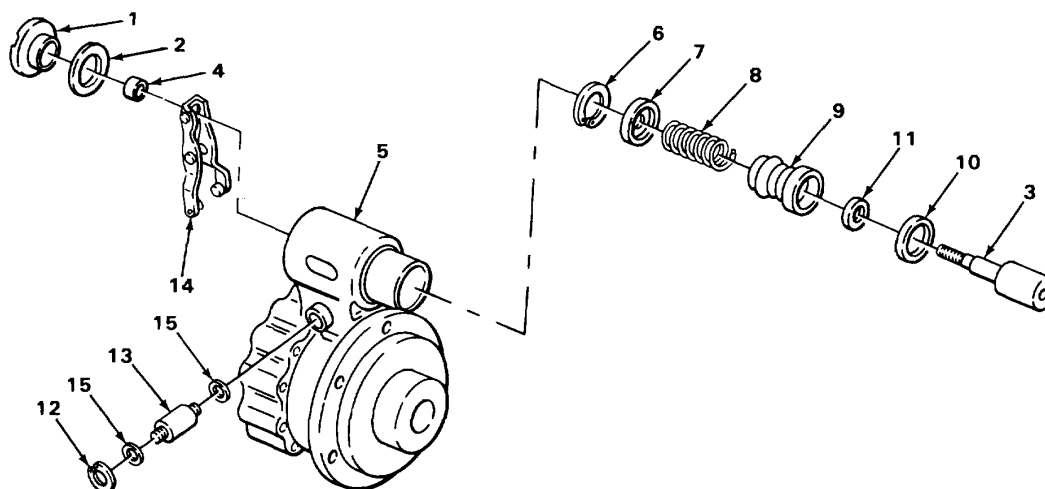
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
25.	Housing plug (1)	Gasket (2)	a. Using 1/8-inch flat-tip screwdriver, pry up and take off. b. Get rid of.
26. socket and	Plunger (3)	Self-locking nut (4)	a. Using 1/2-inch deep well ratchet handle with 3/8-inch drive, unscrew and take off. b. Get rid of.
27.	Lever housing (5) attached parts	Plunger (3) with	Take out.
28. and spring (8).	Plunger (3)	Retaining ring (6)	a. Push down retainer (7) b. Using snapping pliers, take off.
29.	Retainer (7) and spring (8)	Slide off.	
30.	Boot (9) and retainer (10)	Take off.	
31.	Boot (9)	Washer (11)	Take out.
32.	Lever housing (5)	Retaining ring (12)	Using snapping pliers, take off.
33.	Lever shaft (13)	Take out.	
34.	Shifter lever (14)	a. Take out. b. Take housing (5) out of vise.	
35. screwdriver,	Lever shaft (13)	Two packings (15)	a. Using 1/8-inch flat-tip pry up and take off. b. Get rid of.

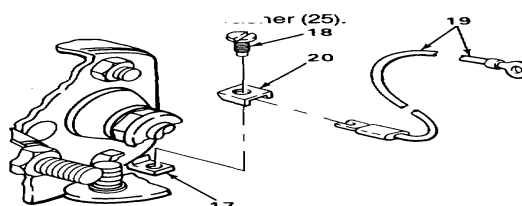
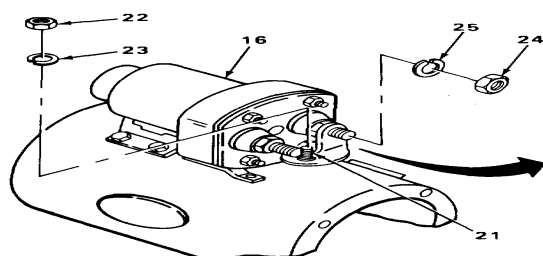
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED



36. speeder	Solenoid switch assembly (16) and terminal (17)	Screw (18), lead (19), and clamp (20)	Using 5/16-inch socket and handle with 1/4-inch drive, unscrew and take off.
37. unscrew	Terminal connector (21)	Nut (22) and a. lockwasher (23)	Using 3/4-inch socket and ratchet handle with 11/2-inch drive, and take off. b. Get rid of lockwasher (23).
38.	Solenoid switch assembly (16)	Nut (24) and a. lockwasher (25)	Using 3/4-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off. b. Get rid of lockwasher (25).

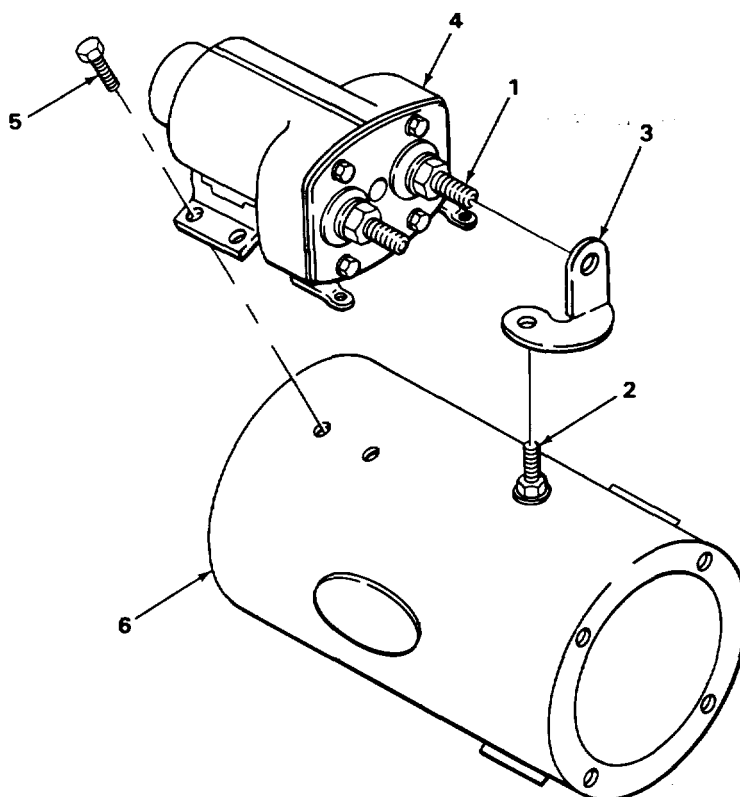


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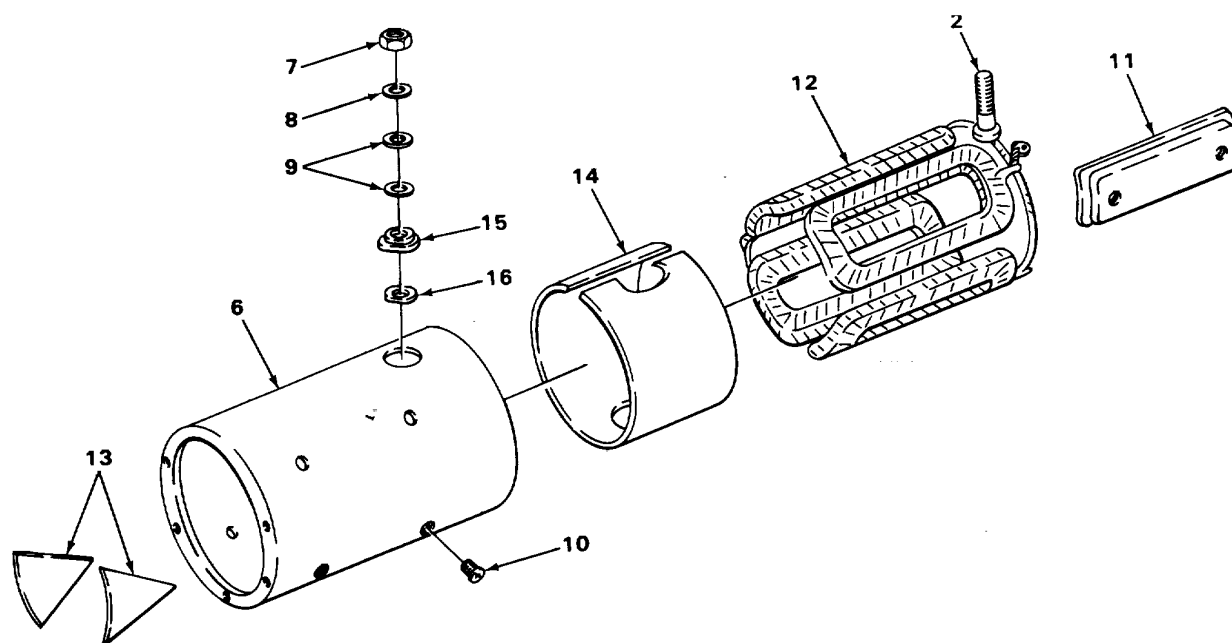
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
39.	Solenoid terminal (1) and terminal (2)	Terminal connector (3)	Take off.
40.	Solenoid switch assembly (4)	Four screws (5)	Using 6-point 7/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
41.	Field frame (6) assembly (4)	Solenoid switch	Take off.



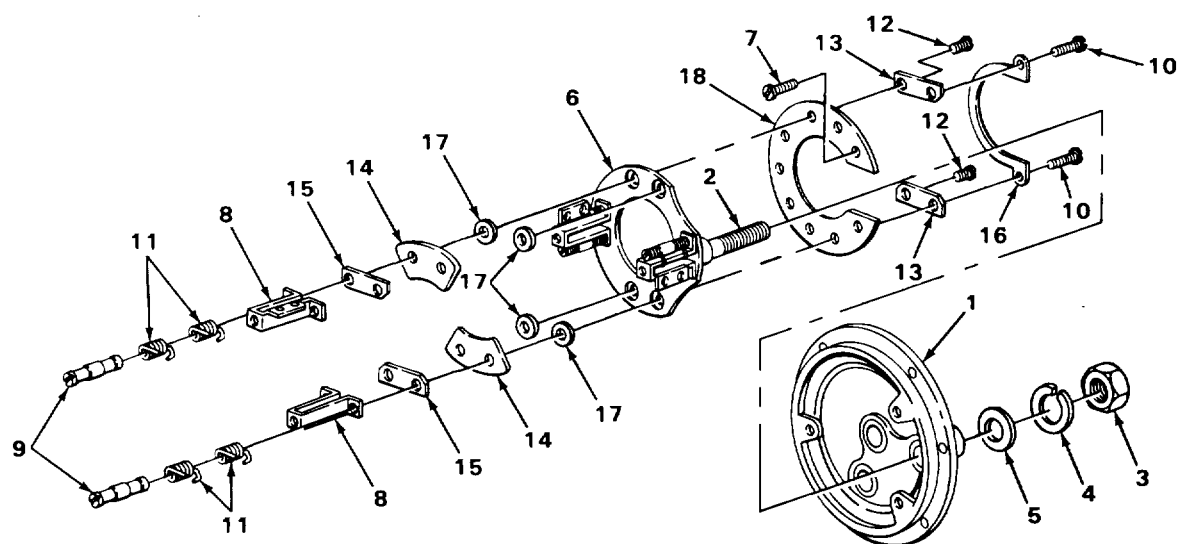
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
42. unscrew	Field frame (6) and terminal (2) insulators (9)	Nut (7), washer (8), and two	Using 3/4-inch box-end wrench, and take off. You may have to use 3/16-inch flat- tip screwdriver to pry up bottom insulator.
43.	Field frame (6) and four pole	Eight screws (10) shoes (11) c.	a. Secure frame (6) in vise. b. Using number four cross-tip screw- driver bit and 1/2-inch drive ratchet handle, unscrew and take out. c. Take frame (6) out of vise.
44.	Terminal (2)	Push in.	
45.	Field coils (12) and two Insulator papers (13)	Take out.	
46.	Insulator paper (14)	Take out.	
47.	Terminal (2) (15) and washer (16)	Insulator gasket	Take off.



STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
48. wrench,	End plate (1) and terminal (2)	Nut (3), lockwasher (4) and washer (5) b. Get rid of lockwasher (4).	a. Using 3/4-inch box-end unscrew and take off.
49.	Brush plate (6)	Three screws (7)	Using 3/16-inch flat-tip screwdriver, unscrew and take out.
50.	End plate (1)	Brush plate (6)	Take off.
51. two	Two insulated brush holders (8) (10), and four springs (11)	Two spring holders (9), blue screws (9), unscrew and take out.	With help of assistant, and using 3/16-inch flat-tip screwdrivers, un-
52. unscrew	Brush plate (6) insulated brush holders (8), plates (13), insulator pads (14), two plates (15), connector (16), four screw insulators (17), and brush plate in- sulator (18)	Two screws (12), and take off. -	Using 3/16-inch screwdriver,

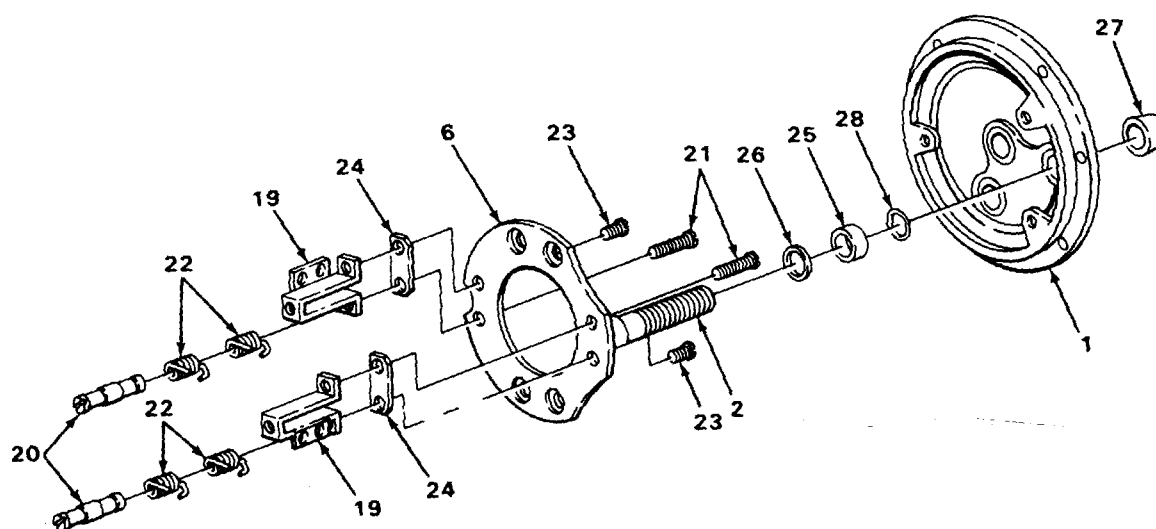


STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
53. two	Two grounded brush holders (19) and four springs (22)	Two spring holders (20), screws (21), unscrew and take out.	With help of assistant, and using 3/16-inch flat-tip screwdrivers, unscrew and take out.
54.	Brush plate (6) (23), grounded brush holders (19), and plates (24)	Two red screws	Using 3/16-inch flat-tip screwdriver, unscrew and take off.
55.	Terminal (2) washer (26)	Insulator (25) and	Twist, and take out.
56.	End plate (1)	Insulator (27)	Twist, and take out.
57.	Packing (28) b. Get rid of.	a. Take out.	

NOTE

Do not remove pipe plugs in end plate, lever housing, and drive housing at this time.



STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death to personnel and to equipment.

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

58.	Solenoid switch assembly (1), armature (2), field frame (3), and drive clutch (4)	a. Wipe clean with clean rag dampened with drycleaning solvent. b. Wipe dry with clean, dry rag.
59.	Commutator (5)	a. Lightly clean with number 00 sandpaper. b. Take off dust with low pressure compressed air.
60.	Eight brushes (6)	Clean with clean, dry rag.
61.	Field coils (7)	Wipe clean with non-sudsing detergent.
62.	All other metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rag.

INSPECTION/REPLACEMENT AND TESTING

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace defective parts as necessary.

63.	Drive housing (8)	a. Look for cracks or breaks.

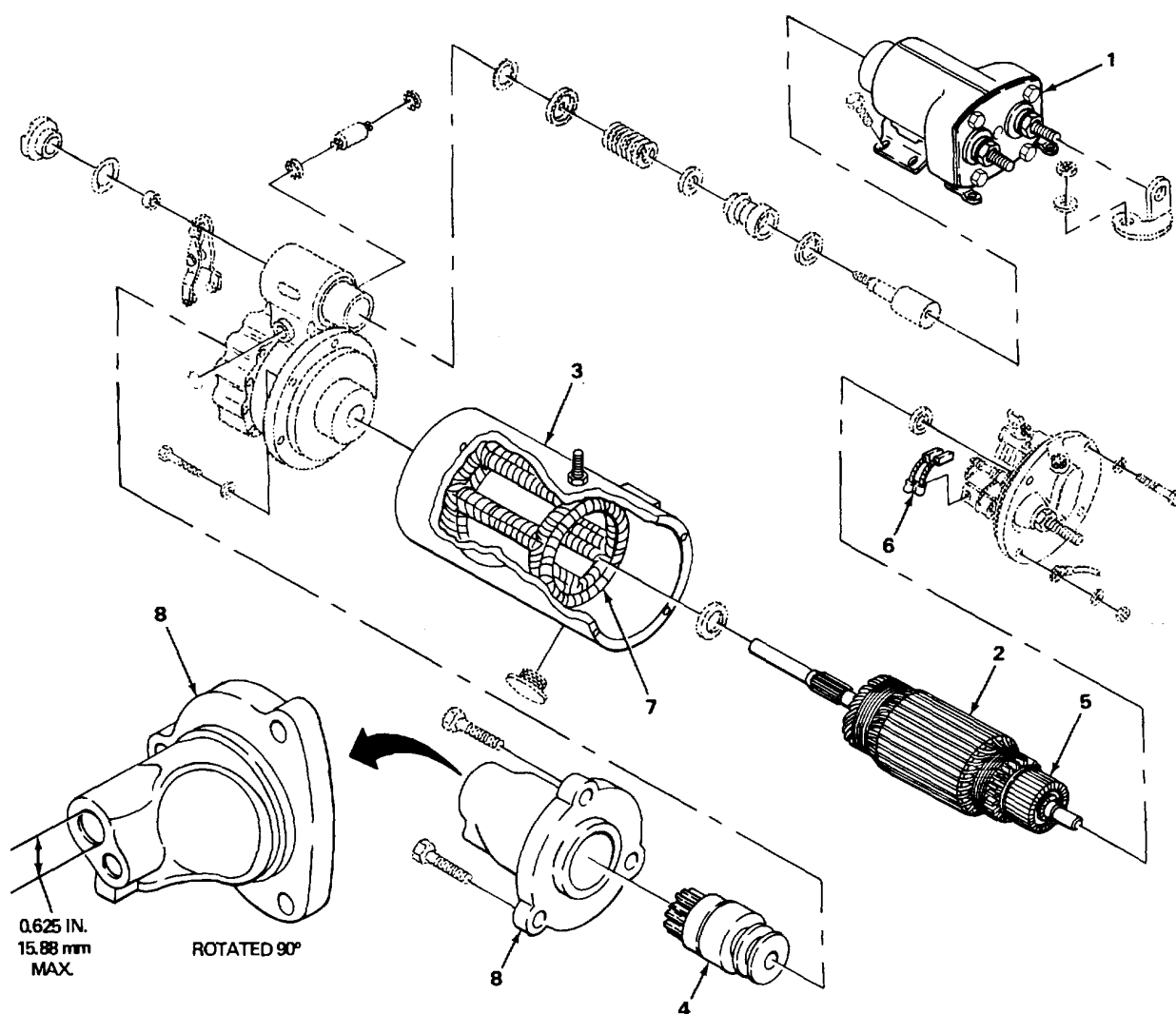
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT AND TESTING - CONTINUED

63.	Continued	b. Look for damaged threads. c. Look for scored and scratched bushing. d. Using caliper check diameter of bushing Maximum diameter is 0.625 inch (15.88 mm).

64.	Drive clutch (4)	Check for broken, nicked and badly worn teeth.

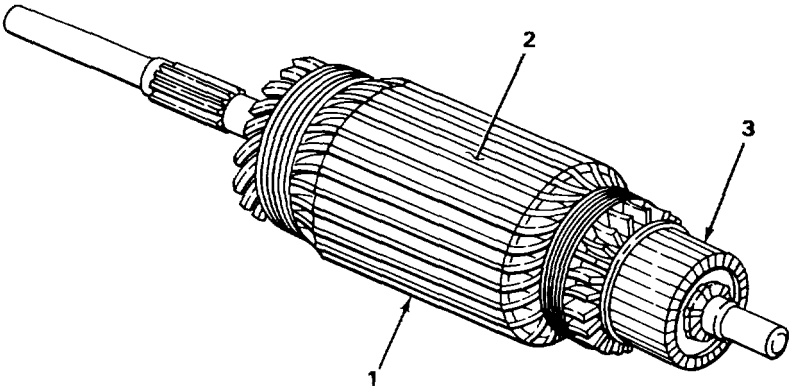


STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT AND TESTING - CONTINUED

65.	Armature (1) commutator (3)	Core (2) and a. b. Touch one test probe to com- mutator (3).	Put armature (1) on test fixture.
66.	Armature (1)	a. Hold hacksaw blade against armature (1). b. Slowly rotate armature (1).	If blade vibrates, armature is shorted and must be replaced.

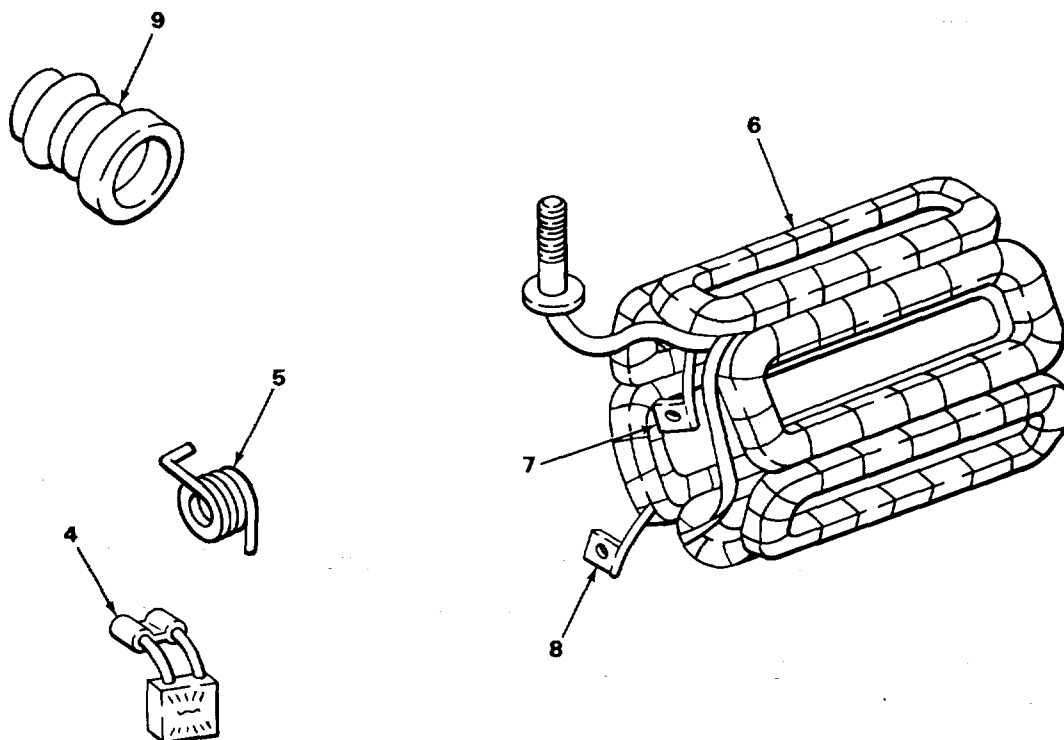


67.	Eight brush assemblies (4) and springs (5)	a. Check for cracks and breaks. b. Using machinist's rule, check brush length.	Brushes worn to length of 0.3750-inch (9.53 mm) or less should be replaced. Always springs and brushes as a set. If brush assembly fails Inspection, replace all eight assemblies.

replace
one

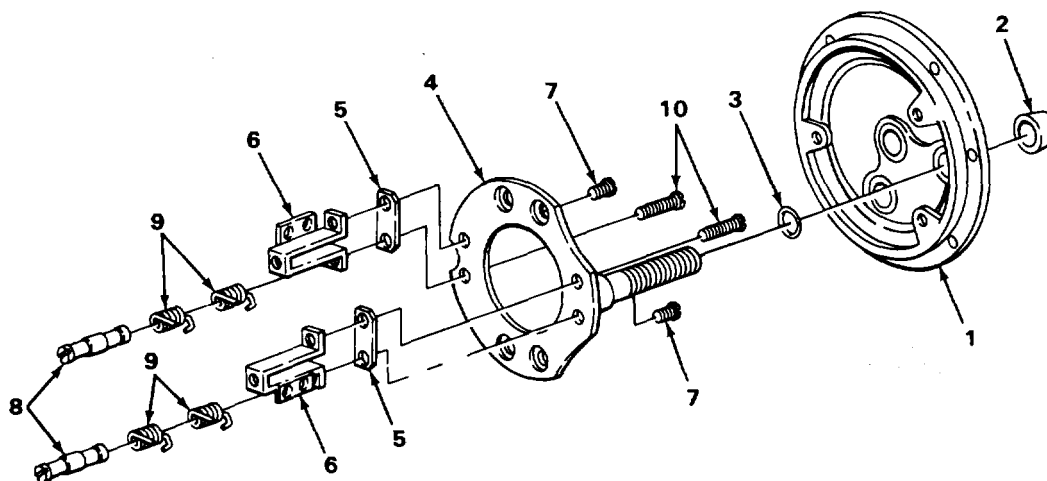
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT AND TESTING - CONTINUED			
68. one lead of	Field coils (6) (7) and (8)	Coil connector	a. Using test stand, attach test lamp to connector (7). b. Attach other lead of test lamp to other connector (8). If lamp does not light, field coil is open and starting motor must be replaced. c. Disconnect test equipment.
69.	Field coils (6)	Inspect for worn or damaged insulation and frayed or pulled apart connectors (7) and (8).	
70.	Solenoid boot (9)	Inspect for tears, cracks, and brittleness.	
71.	All other parts	Check for wear, damage, and defects.	



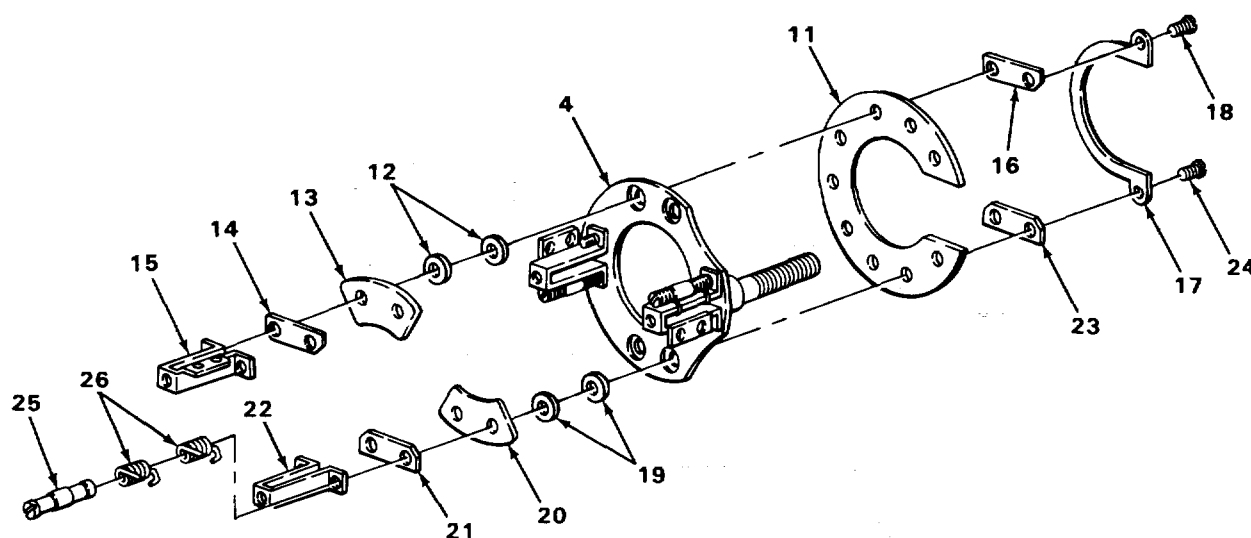
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
72.	End plate (1)	Insulator (2) Put in.	
73.	New packing (3)	Put in.	
74.	Brush plate (4) and grounded brush holders (6)	Two plates (5)	Put in place.
75.	Two red screws (7)	Screw in using 3/16-inch flat-tip screw- driver but do not tighten.	
76.	Two spring holders (8)	Four springs (9)	Put on.
77.	Two brush holders (6)	Two spring holders (8)	Put in place and hook straight end of springs (9) on brush holder (8) and hold.
78.	Brush plate (4)	Two screws (10)	With help of assistant, screw in and tighten using two 3/16-inch flat-tip screwdrivers. Make sure springs don't slip off brush holders.
79.	Two red screws (7)	Tighten using 3/16-inch flat-tip screw- driver.	



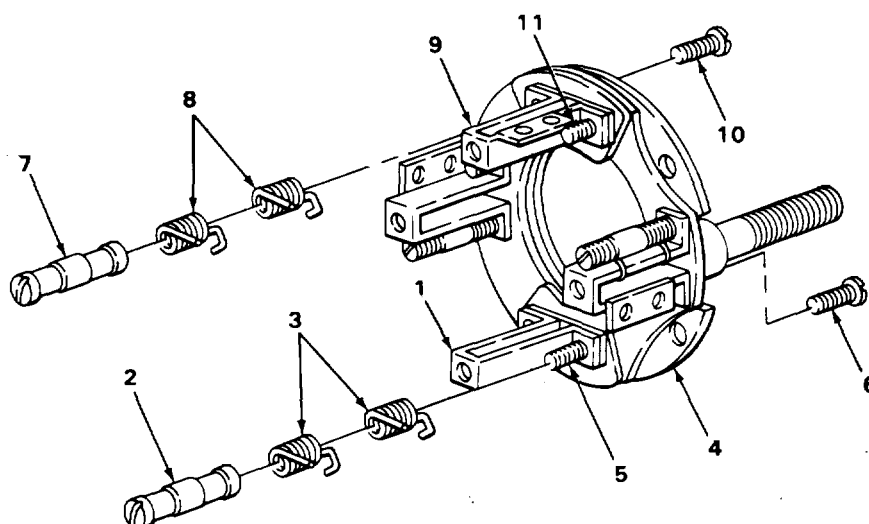
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
80.	Brush plate (4)	Insulator (11)	Put in place, and hold.
81.	Two screw insulators (12)		Put in place.
82.	Insulator pad (13), plate (14), right insulated brush holder (15) and plate (16)		Put in place, and hold.
83.	Connector (17)		Put in place, and hold.
84.	Screw (18)		Screw in, but do not tighten.
85.	Two insulators (19)		Put in place.
86.	Insulator pad (20) plate (21), left insulated brush holder (22) and plate (23)		Put in place, and hold.
87.	Screw (24)		Screw in, but do not tighten.
88.	Spring holder (25)	Two springs (26)	Put on.



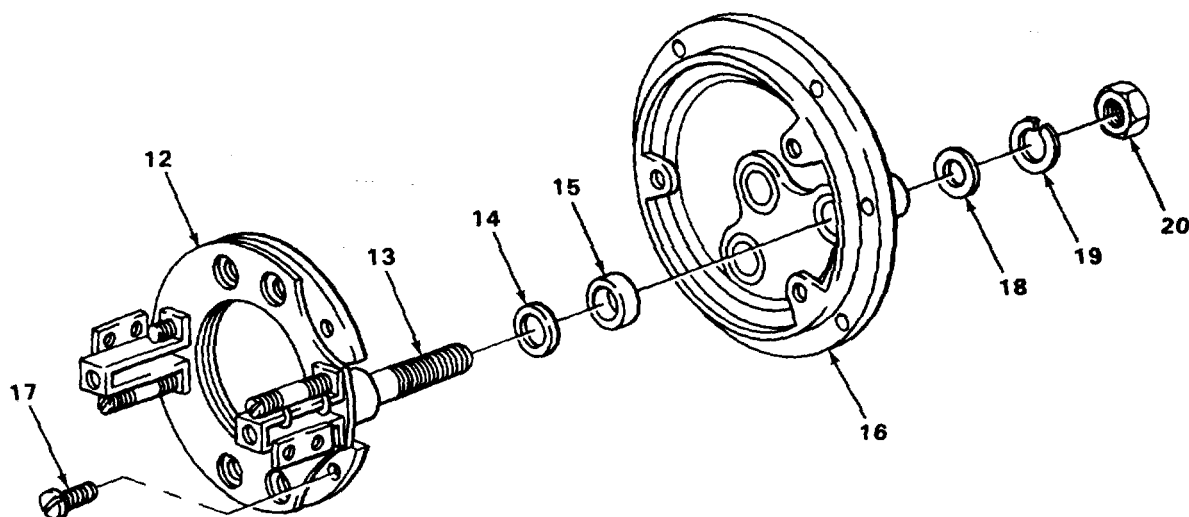
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
89.	Left insulated brush holder (1) hold.	Spring holder (2) and two springs (3)	Put in place, hook straight end of springs (3) on brush holder (1), and
90.	Left insulated brush holder (1) and holder (2)	Connector (4) and blue screw (5)	With help of assistant, screw in and tighten using two 3/16-inch flat-tip screwdrivers. Make sure springs don't slip off brush holder.
91.	Left insulated brush holder (1)	Screw (6)	Tighten using 3/16-inch flat-tip screwdriver.
92.	Spring holder (7)	Two springs (8)	Put in place.
93.	Right insulated brush holder (9)	Spring holder (7) and two springs (8)	Put in place, and hook straight end of springs (8) on brush holder (9).
94.	Brush holder (9) and spring holder (7)	Blue screw (10)	With help of assistant, screw in and tighten using two 3/16-inch flat-tip screwdriver. Make sure springs don't slip off brush holder.
95.	Right insulated brush holder (9)	Screw (11)	Tighten using 3/16-inch flat-tip screwdriver.



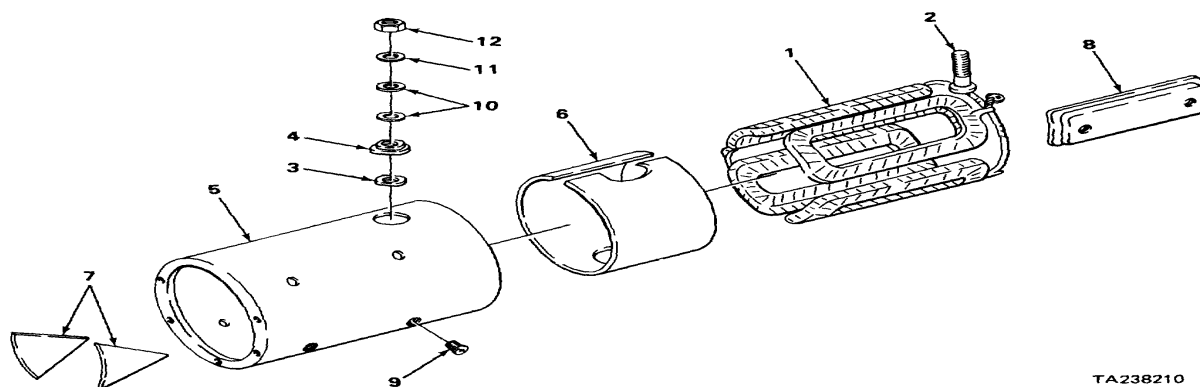
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
96.	Brush plate (12) and terminal (13)	Washer (14) and insulator (15)	Put in place.
97.	End plate (16)	Brush plate (12)	Put in place. Make sure insulator does not fall out.
98. using	Brush plate (12)	Three screws (17)	Screw in, and tighten alternately 3/16-inch flat-tip screwdriver.
99. inch box-	Terminal (13) lockwasher (19), and nut (20)	Washer (18), new end wrench.	Screw on, and tighten using 3/4-



STARTING MOTOR - CONTINUED

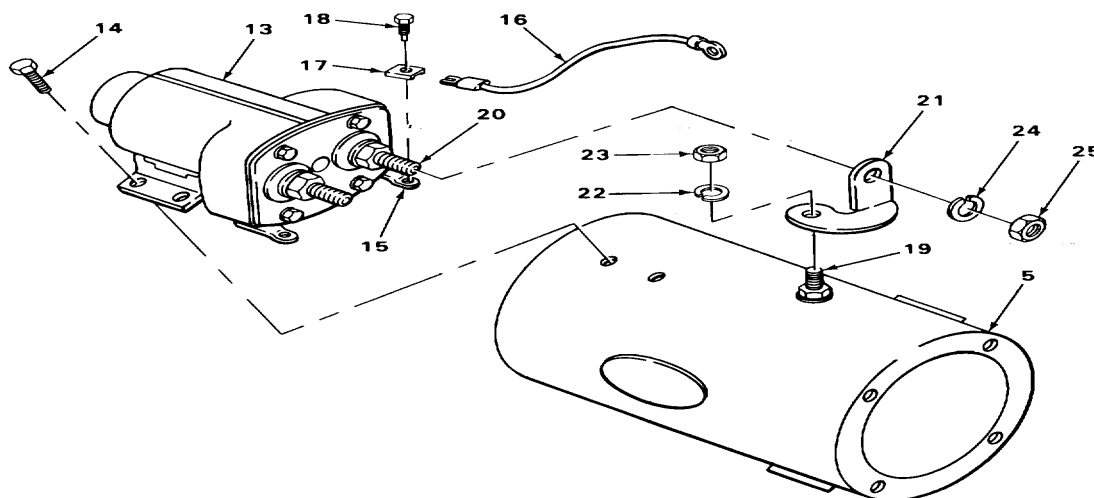
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
100.	Field coils (1) and terminal (2)	Washer (3) and insulator gasket (4)	Put on.
101.	Field frame (5)	Insulator paper (6)	Put in place. Make sure access holes in frame are not covered.
102.	Field coils (1)		Put in place.
103.	Field coils (1)	Terminal (2)	Push up into place on frame (5).
104.	Between field coils (1) and field frame (5)	Two insulator papers (7)	Push into place so connections on rear of coils (1) are isolated from frame (5).
105.	Field frame (5)	Four pole shoes (8)	Put in place. Make sure paper stays in place.
106.	Eight screws (9)		Screw in, and tighten using number four cross-tip screwdriver bit and 112-inch drive ratchet handle.
107.	Terminal (2)	Two insulators (10)	Screw on, and tighten using 3/4-inch box wrench.
	washer (11) and nut (12)		



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STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
108.	Field frame (5) assembly (13)	Solenoid switch	Place in position lining up holes.
109. 3/8-	Solenoid switch assembly (13)	Four screws (14)	Using 6-point 7/16-inch socket and inch drive ratchet handle, screw in and tighten.
110. inch	Solenoid switch assembly (13) and terminal (15)	Lead (16), clamp (17), and screw (18)	Screw in, and tighten using 5/16- inch socket and speeder handle.
111.	Field frame terminal (19) and solenoid terminal (20)	Terminal connector (21)	Put in position.
112. inch	Terminal connector (21)	New lockwasher (22) and nut (23)	Screw on, and tighten using 3/4- socket and ratchet handle with 1/2-inch drive.
113.	New lockwasher (24) and nut (25)	Screw on, and tighten using 3/4-inch socket and ratchet handle with 1/2-inch drive.	

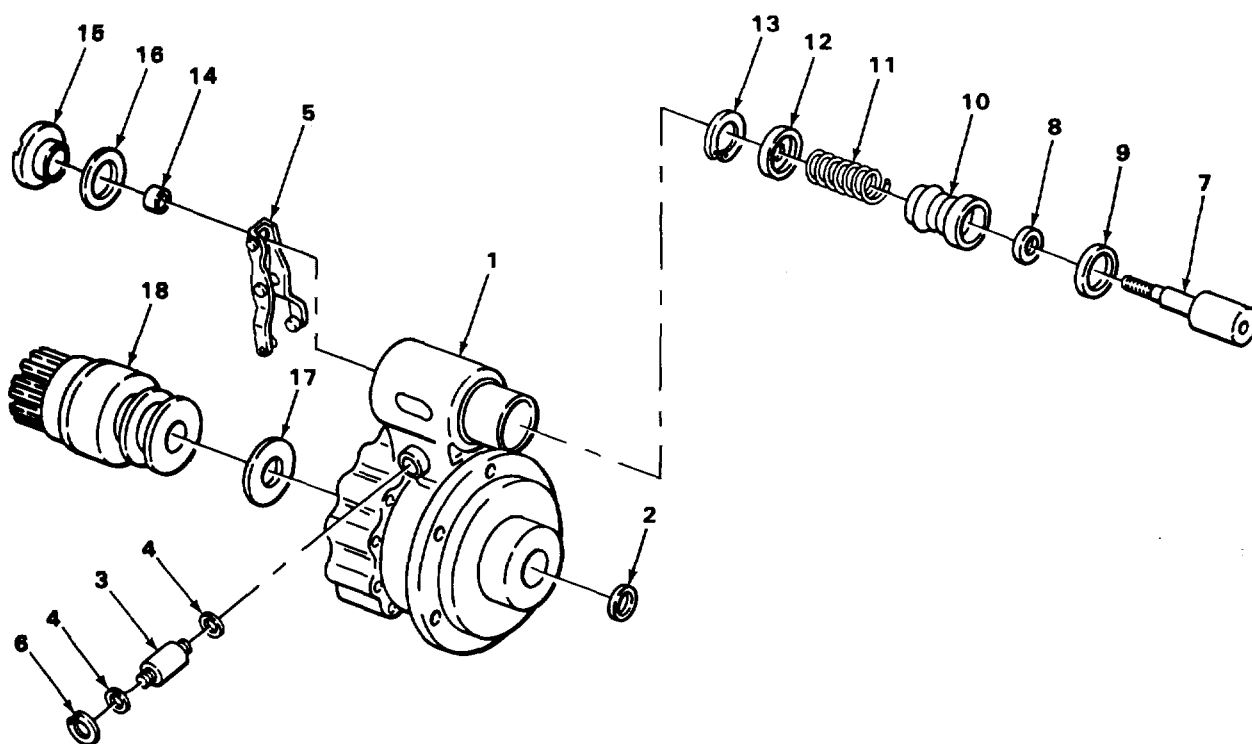


STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
114.	Lever housing (1)	New seal (2)	Using 2-oz ball-peen hammer, tap in until flush with face of housing (1).
115.	Lever shaft (3) packings (4)	Two new	Put on.
116.	Shifter lever (5)	a. Put housing (1) in vise with jaw caps. b. Put lever (5) in place.	
117.	Lever housing (1) and shifter lever (5)	Lever shaft (3) and two new packings (4)	Put in place.
118.	Lever shaft (3)	Retaining ring (6)	Put on using snapping pliers.
119.	Plunger (7) retainer (9), and boot (10)	Washer (8),	Snap on.
120.	Spring (11) and retainer (12)	Slide on.	
121. (12),	Retainer (12)	Retaining ring (13)	Push down spring (11) and retainer and put on using snapping pliers.
122. (5).	Lever housing (1) attached parts	Plunger (7) with	Put in through hole in shifter lever
123. inch deep	Plunger (7) nut (14)	New self-locking	Screw on, and tighten using 1/2- well socket and ratchet handle with 3/8- inch drive.
124.	Housing plug (15)	New gasket (16)	Put on.
125. inch	Lever housing (1) and new gasket (16)	Housing plug (15)	Screw in, and tighten using 15/16- screwdriver bit, and ratchet handle with 1/2-inch drive.

STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
126.	Spacer (17)	Put in place.	
127.	Drive clutch (18)	a. Pull outward on plunger (7), and put in place. b. Make sure lever engages clutch. Take housing (1) out of vise.	



STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
128.	Lever housing (1)	New packing (2)	Put on.
129. position.	Field frame (3)	Lever housing (1)	Line up scribe marks and put in
130. box-end	Lever housing (1)	Five new lockwashers a.	Screw In using 7/16-inch
	(4) and screws (5)	wrench. b.	Tighten to 156 in-lb (18 N m) of torque, using 7/16-inch socket and torque handle with 3/8-inch drive.
131.	Solenoid (6)	Boot (7)	Put in place.
132.	Armature (8)	Thrustwasher (9)	Put in place on commutator end.
133.	Thrustwasher (10)		Put in place on drive clutch end.
NOTE			
If new brushes are to be installed, do steps 134 thru 141. If old brushes are being installed, continue task at step 142.			
134.	Armature (8)	a. Cover commutator (11) with one layer of two sided pressure sensitive tape. b. Cover tape with one layer of sandpaper overlapped slightly at ends.	
135.	Armature (8)	End plate (12)	Put on.
136.	End plate (12)	Eight brushes (13)	Using 3/16-inch flat-tip screwdriver, pry up springs and put in brushes (13) with groove toward screw holes.
137.	Armature (8)	Rotate slowly, several revolutions so brushes (13) are sanded to contour.	
138.	Armature (8)	End plate (12)	Take off.
139. brush	End plate (12)	Eight brushes (13)	Tag brushes and screw holes in holders (14), and take out.

STARTING MOTOR - CONTINUED

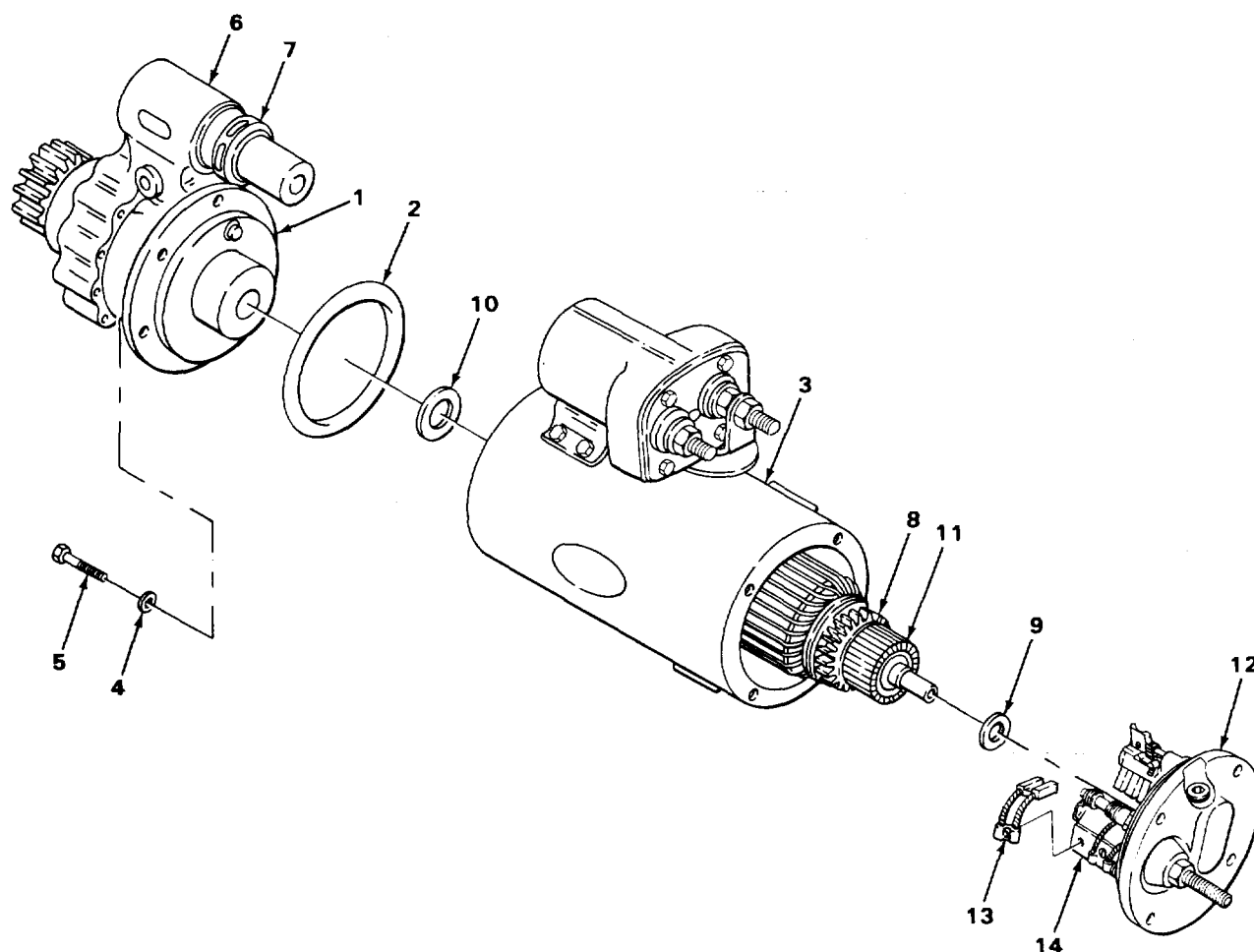
LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

140.	Armature (8)	Take off sandpaper and tape.
141.	Armature (8), brushes (13), and end plate (12)	Using air compressor, hose and air blow gun, get rid of all sandpaper and metal particles.

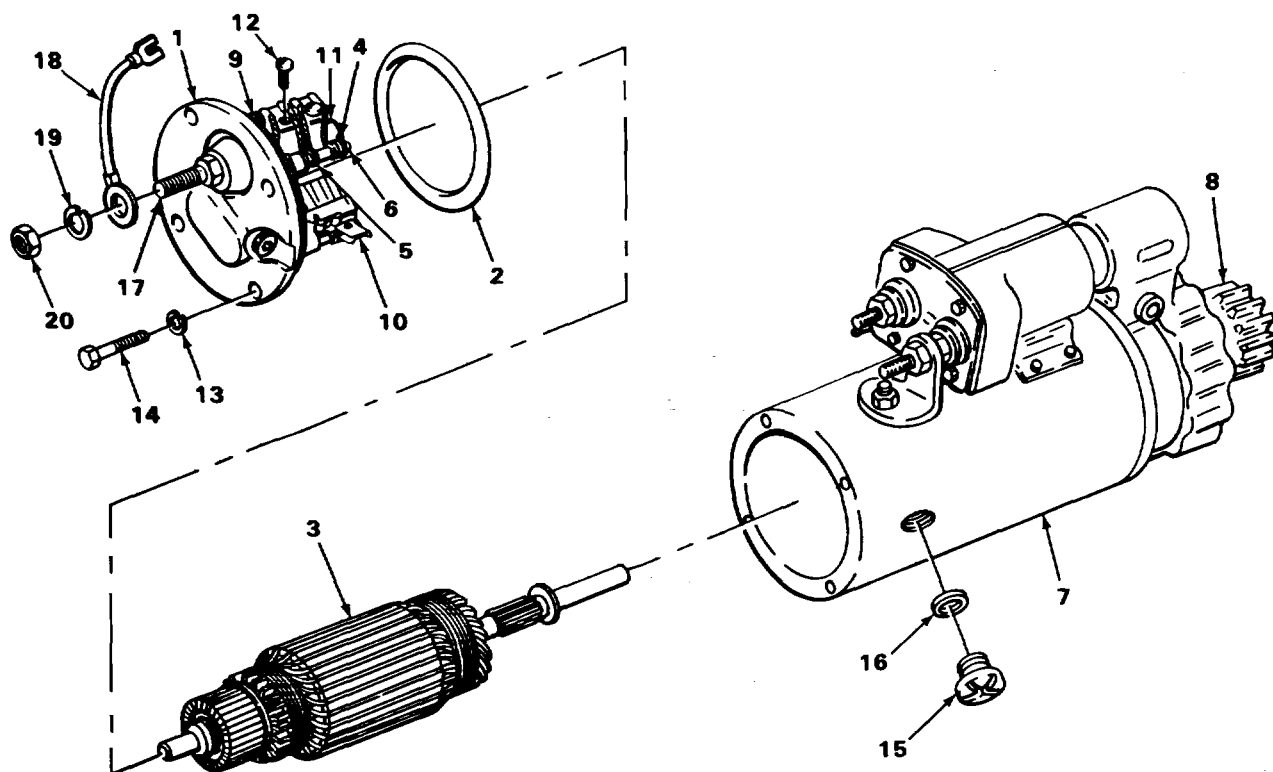


STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
142.	End plate (1)	New packing (2) b. Put in place.	a. Apply oil-soluble grease.
143.	Armature (3)	End plate (1) Put on.	
144.	End plate (1)	Eight brushes (4) pry up springs (5) and put in brushes in order marked on tags, with groove toward screw holes.	Using 3/16-inch flat-tip screwdriver,
145.	Six brushes (4)	Six screws (6) b. Screw in, and tighten using 1/4-inch flat-tip screwdriver.	a. Remove tags. Do not put screws in each rear holes of the two Insulated brush holders.
146. armature (3)	Field frame (7) plate (1) and armature (3)	Assembled end engaging splines in drive clutch (8). Do not allow end plate to slip off of armature.	Noting scribe marks, slide in
147.	Two insulated brush holders (9) leads (11)	Two brush leads (10) Aline holes in brush holder (9). and two field	
148.	Two screws (12)	Screw in, and tighten using 1/4-inch flat-tip screwdriver.	
149. is seated in end	End plate (1) (13) and screws (14)	Four new lockwashers plate bushing and drive clutch splines. b. Screw in, and tighten using 6-point 7/16-inch socket and ratchet handle with 3/8-inch drive.	a. Be sure armature
150.	Two brush plugs (15)	Two new gaskets (16) Put on.	

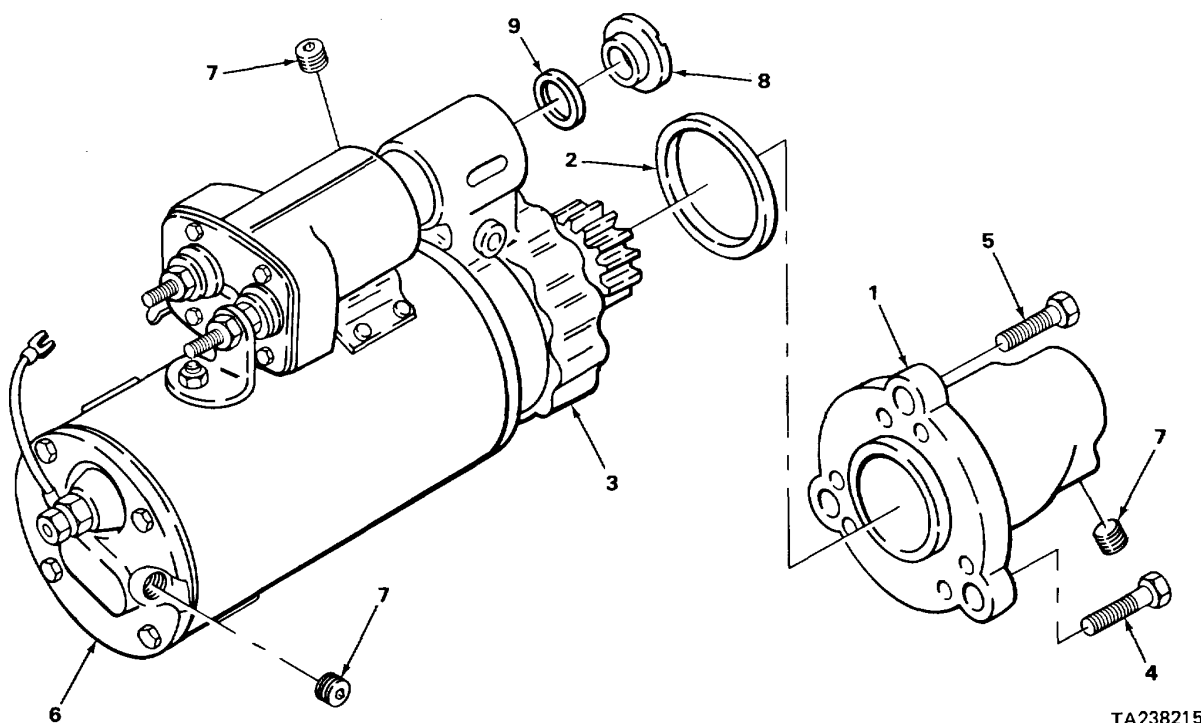
STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
151. inch	Field frame (7)	Two brush plugs (15) Screw in, and tighten using 15/16-	
		screwdriver bit and ratchet handle with	
		1/2-inch drive.	
152.	End plate terminal stud (17)	Lead (18) Put in place.	
153.	New lockwasher (19) and nut (20)	Screw on, and tighten using 3/4-inch socket and ratchet handle with 1/2-inch drive.	



STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
154.	Drive housing (1)	New packing (2)	Put In place.
155.	Lever housing (3)	Note scribe marks, and put in position.	
156.	Five screws (4) and screw (5)	a. Using 7/32-inch key bit, 3-inch extension, and ratchet handle with 3/8-inch drive, screw in and tighten. b. Tighten to 156 in-lb (18 N m) of torque using 7/32-inch key bit, 3-inch extension, and torque wrench with 3/8-inch drive.	
157. head screw	End plate (6), drive housing (1), and lever housing (3)	Three plugs (7)	a. Using 3/16-inch socket-key, unscrew and take out. b. Apply oil to felt. c. Screw in, and tighten using 3/16-inch socket-head screw key.
158.	Lever housing (3) gasket (9)	Plug (8) and Using 15/16-inch screwdriver bit and ratchet handle with 1/2-inch drive, unscrew and take out.	



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STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ADJUSTMENT

WARNING

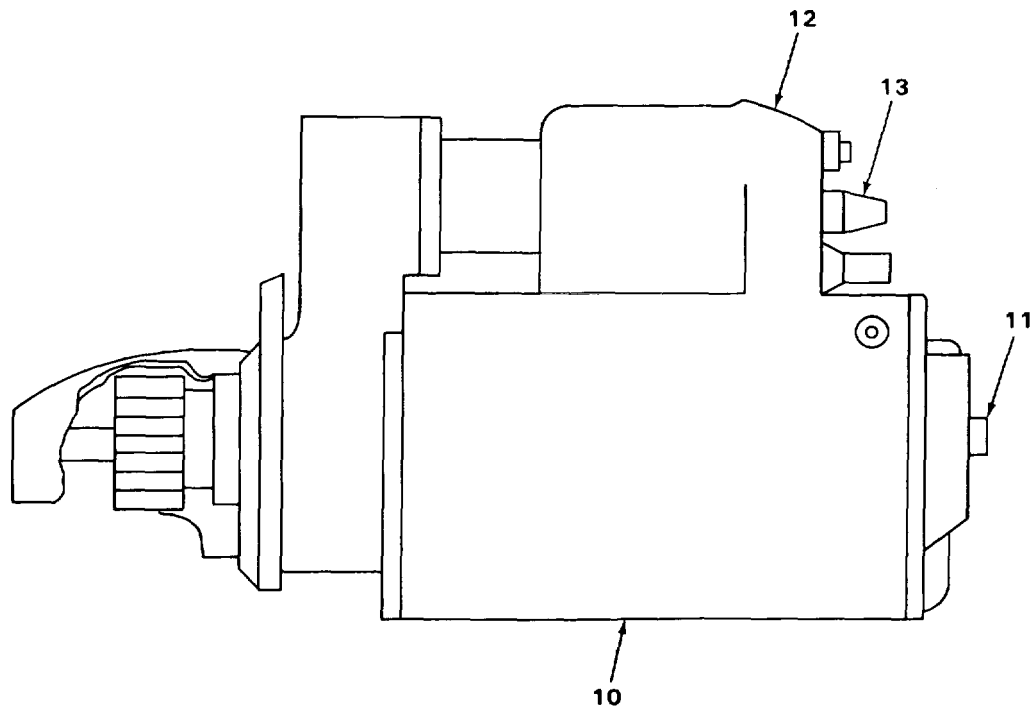
Make battery connections first. Disconnect battery connections last, sparking battery terminal connections may cause battery to explode causing serious injury.

159. negative	Starting motor (10)	Ground terminal (11) a.	Connect jumper cable to battery terminal.
		b.	Connect same jumper cable to starter ground terminal (11).

CAUTION

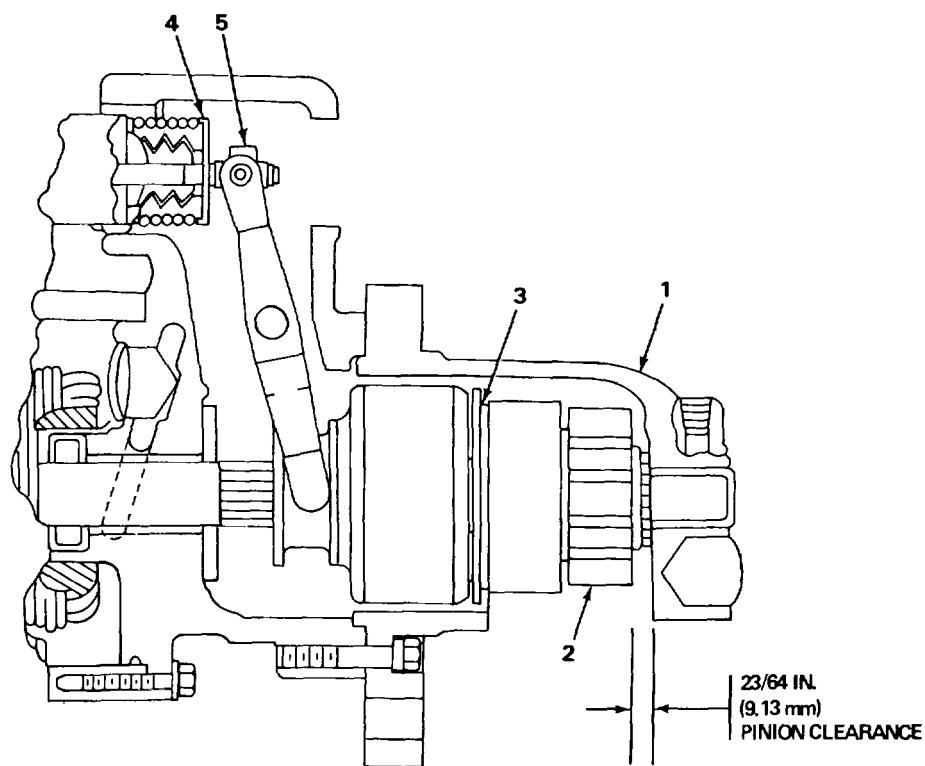
Do not leave starting pinion pushed into cranking position for more than two minutes or solenoid may be damaged.

160. positive	Starting solenoid (12)	Starting switch tab (13) b.	a. Connect jumper cable to battery terminal. b. Connect same jumper cable to tab (13). Starting pinion should move to cranking position.



STARTING MOTOR - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ADJUSTMENT - CONTINUED			
161. clearance. correct, needs	Drive housing (1)	Pinion gear (2)	Using thickness gage, check Clearance should be 23/64-inch (9.13 mm). If clearance is go to step 164. If clearance adjustment, go to step 162.
162.	Drive clutch (3)	Push to take up movement.	
163.	Plunger assembly (4)	Shaft nut (5) Using 1/2-inch deep well socket and ratchet handle with 3/8-inch drive, turn either way to adjust pinion gear (2) clearance to 23/64-inch (9.13-mm) between gear (2) and housing (1).	



STARTING MOTOR - CONTINUED

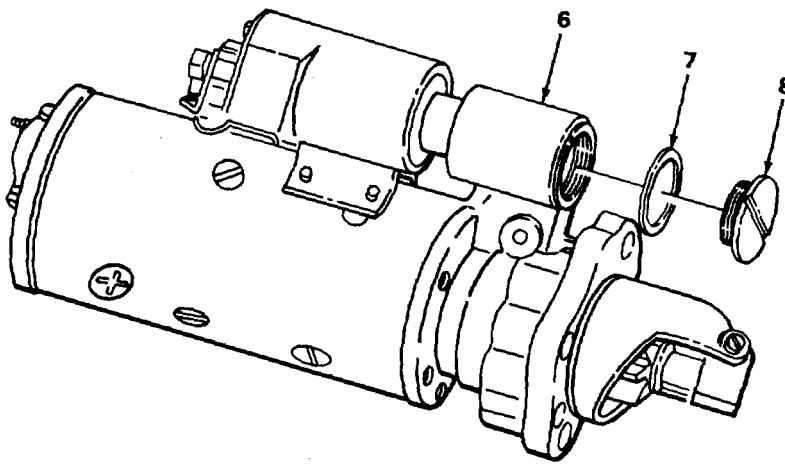
LOCATION	ITEM	ACTION	REMARKS

ADJUSTMENT - CONTINUED

164. Lever housing (6)

Gasket (7) and
plug (8)

- a. Take off jumper cables.
- b. Screw in, and tighten using 15/16-inch screwdriver bit and ratchet handle with 11/2-inch drive.

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Perform No-Load test (page 2-428).
2. Install starting motor (TM 9-2320-269-20-1).

TASK ENDS HERE

FRONT WIRING HARNESS

This task covers:

a. Removal (page 2-462)	c. Inspection/Replacement (page 2-466)
b. Cleaning (page 2-466)	d. Installation (page 2-467)

INITIAL SETUP**Tools**

Handle, ratchet, 318-inch drive
 Screwdriver, flat-tip, 1/4-inch
 Socket, 3/8-inch drive, 7116-inch
 Socket, 3/8-inch drive, 112-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 112-inch
 (TM 9-2320-269-20-1).

Personnel Required

One

Equipment Condition

Battery ground cables disconnected
 (TM 9-2320-269-20-1).
 Left and right side hood panels raised

Materials/Parts

Lockwasher
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)
 Tag, marking (item 50, appendix B)

LOCATION	ITEM	ACTION	REMARKS

REMOVAL**NOTE**

When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

1.	Chassis harness	Bulkhead plug (2) plug (1)	a. Using 1/4-inch flat-tip screwdriver, disengage tab at bottom of plug (2). b. Pull apart. Pull off.
2.	Washer bottle terminal (3)	Connector (4)	
3.	Left headlight lead (5)	Connector (6)	Pull apart.
4.	Left turn signal terminal (7)	Connector (8)	a. Pull apart. b. Pull lead and connector out through grommet in fender wall.

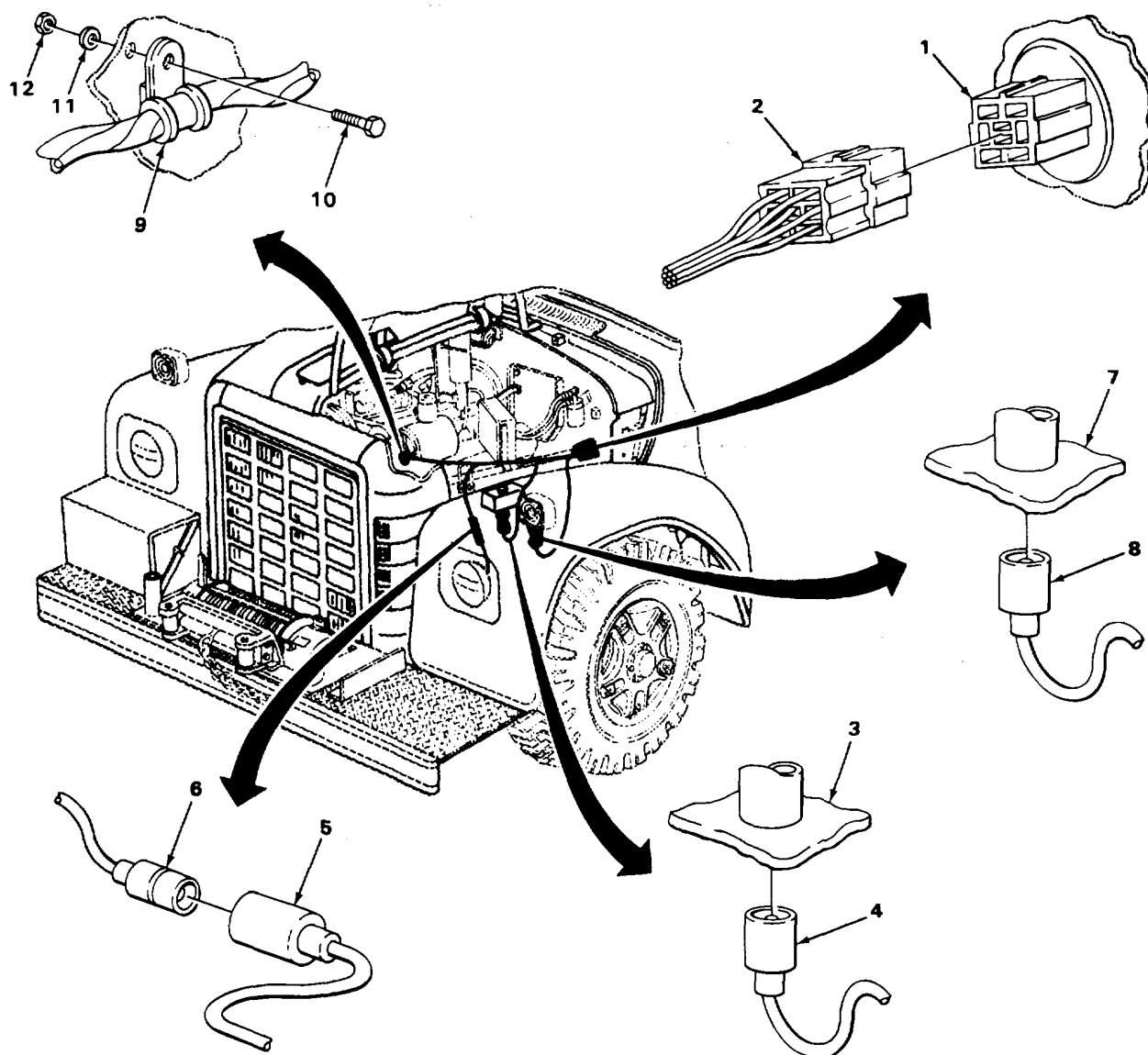
2-462

FRONT WIRING HARNESS - CONTINUED

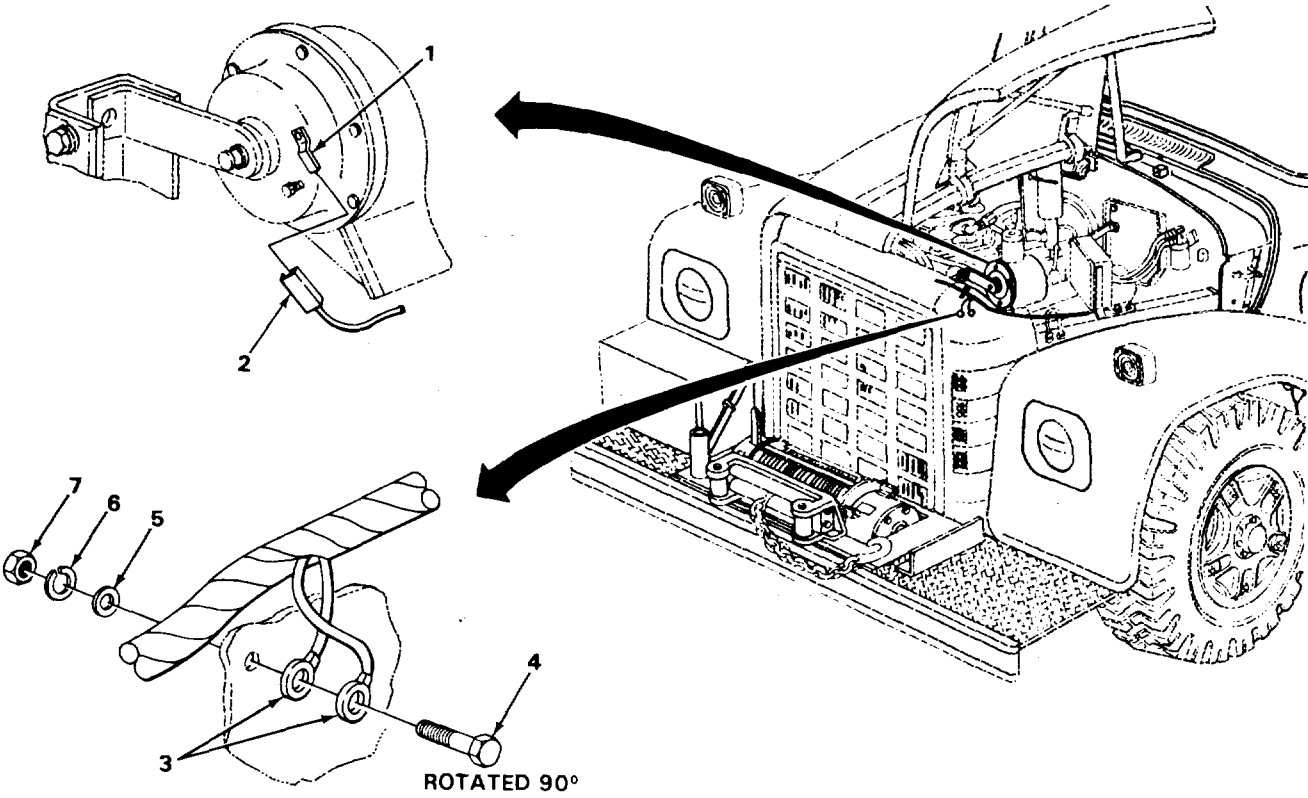
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

5. Two clamps (9)
- Two screws (10), washers (11), and nuts (12)
- Using 7/16-inch socket, ratchet handle with 3/8-inch drive, and 3/8-inch wrench, take off.
 - Take off clamp (9).

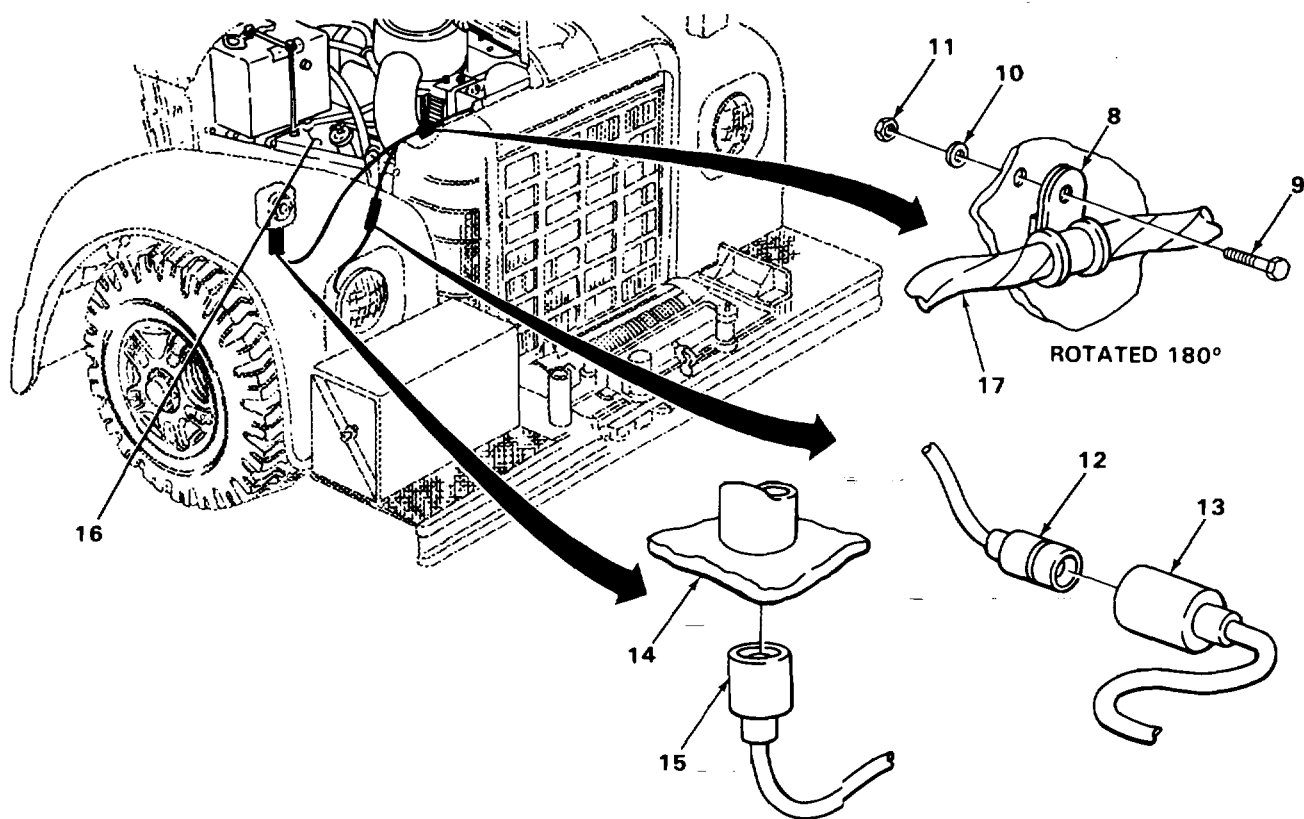


FRONT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6. Horn terminal (1) 7. Two ground lead terminals (3)	Connector (2) Screw (4), washer (5), lockwasher (6), and nut (7)	Pull off. a. Using 1/2-inch socket, ratchet handle with 3/8-inch drive, and 1/2-inch open-end wrench, take off. b. Get rid of lockwasher (6).	
 Diagram illustrating the removal of the horn terminal and ground lead terminals. The top part shows a close-up of the horn terminal (1) being pulled off the connector (2). The bottom part shows the ground lead terminals (3) being rotated 90 degrees. The right part shows the front of the vehicle with the wiring harness and the location of the horn terminal and ground lead terminals.			
8. Clamp (8)	Screw (9), washer (10), and nut (11)	a. Using 7/16-inch socket, ratchet handle with 3/8-inch drive, and 7/16-inch open-end wrench, unscrew and take off. b. Remove clamp (8) from harness.	
9. Right headlight lead (12)	Connector (13)	Pull apart.	

FRONT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
10. Right turn signal	Connector (15)	a. Pull apart.	
	terminal (14)	b. Pull out through grommet in fender wall.	
11. Engine compart- ment (16)	Wiring harness (17)	Take out.	



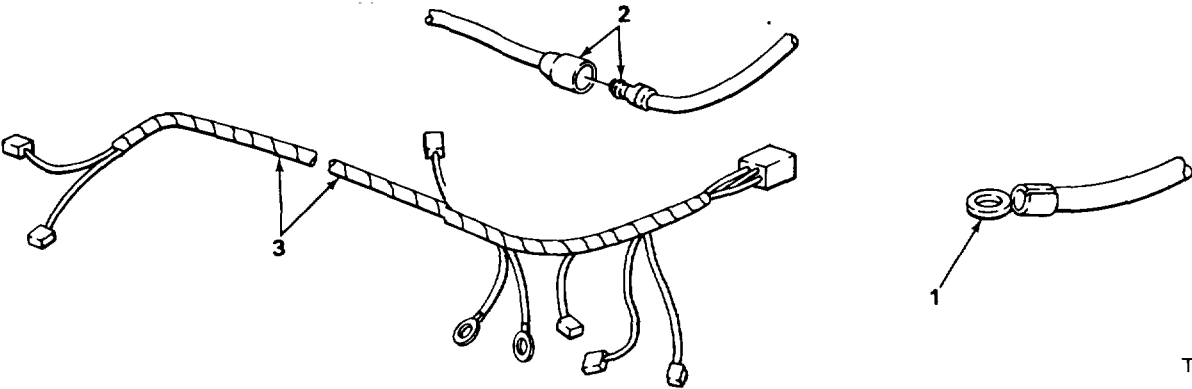
FRONT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).			
WARNING Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
12.	Terminals (1)	Clean with clean rag dampened with dry cleaning solvent.	
13.	Connectors (2)	Wipe clean with clean, dry rag.	
14.	Front wiring harness (3)	a. Wipe clean with rag dampened with water. b. Wipe dry using clean, dry rag.	

INSPECTION/REPLACEMENT

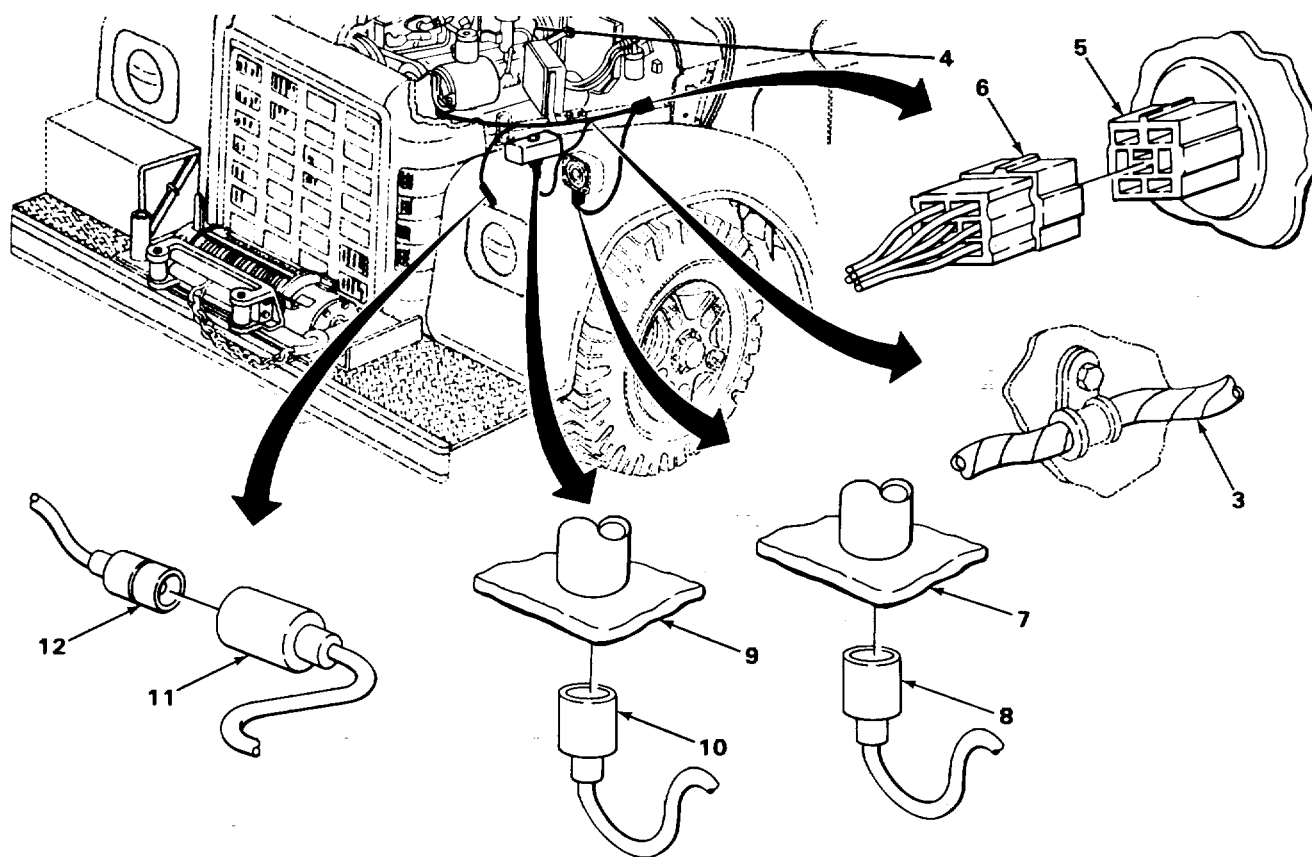
NOTE
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).
Replace damaged or defective parts, as needed.

15.	Front wiring harness (3)	a. Look for cut, burned, and worn insulation. b. Look for broken wires, and replace as necessary.



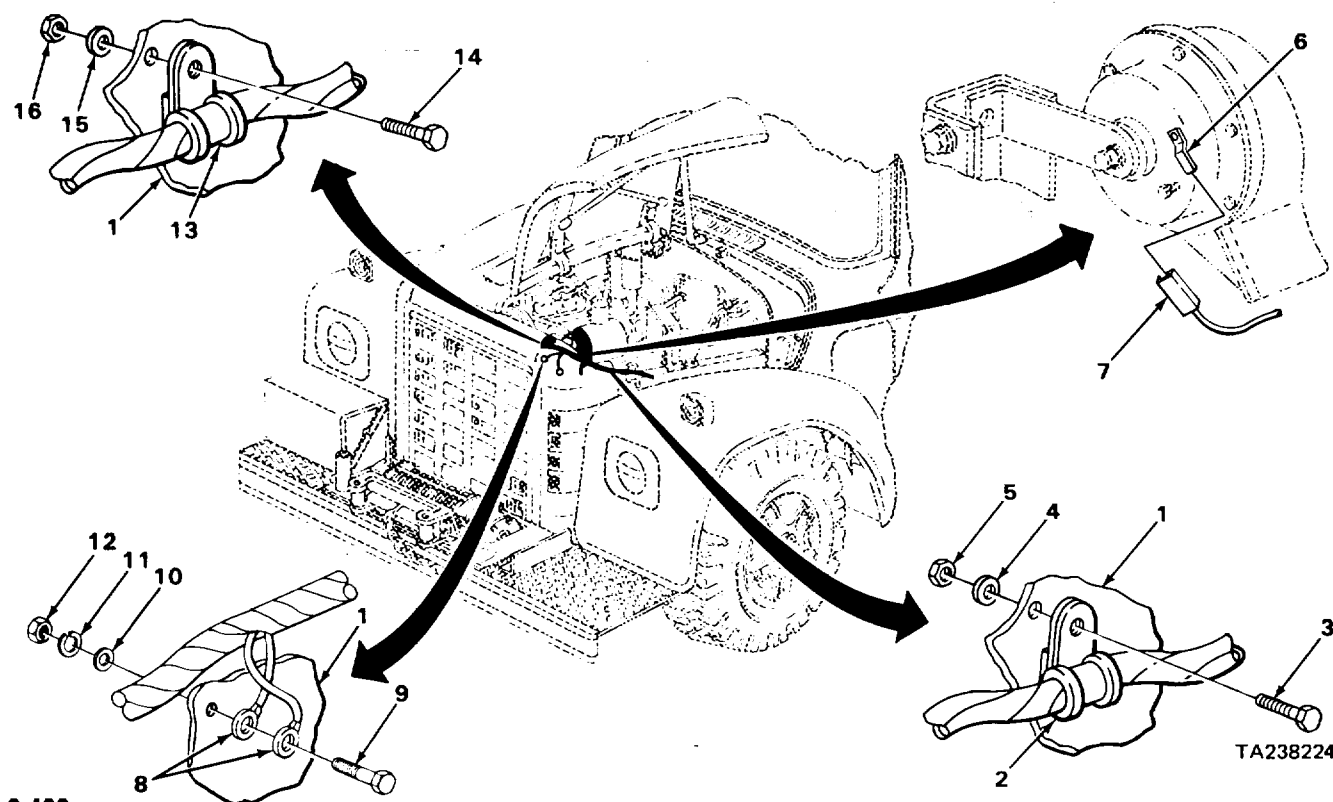
FRONT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
17. Engine compartment (4)	Front wiring harness (3)	Put in position.	
18. Chassis harness plug (5)	Bulkhead plug (6)	Push together.	
19. Left turn signal	Connector (8)	a. Feed through grommet in fender wall. b. Push together.	
20. Washer bottle terminal (9)	Connector (10)	Push on.	
21. Left headlight lead (11)	Connector (12)	Push together.	



FRONT WIRING HARNESS - CONTINUED

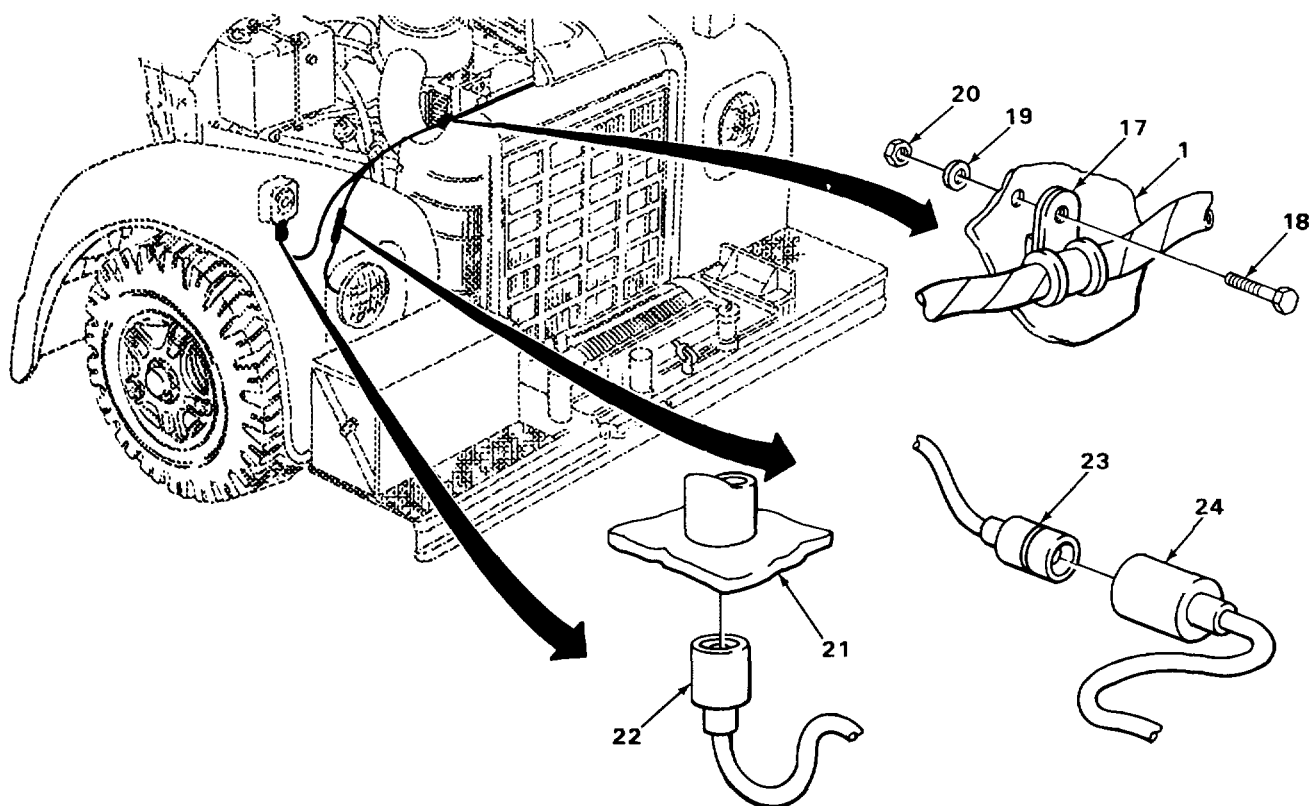
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
22. Radiator frame (1)	Clamp (2)	a. Fit clamp over harness. b. Put in position.	
23. Clamp (2)	Screw (3), washer (4), and nut (5)	Screw on, and tighten using 7/16-inch socket, ratchet handle with 3/8-inch drive, and 7/16-inch open-end wrench.	
24. Horn terminal (6)	Connector (7)	Push on.	
25. Radiator frame (1)	Two ground lead	Aline with hole in frame (1).	
26. Two ground lead terminals (8)	Screw (9), washer (10), new lockwasher (11), and nut (12)	Screw on, and tighten using 1/2-inch socket, ratchet handle with 3/8-inch drive, and 1/2-inch open-end wrench.	
27. Radiator frame (1)	Clamp (13)	a. Fit clamp over harness. b. Put in position.	
28. Clamp (13)	Screw (14), washer (15), and nut (16)	Screw on, and tighten using 7/16-inch socket, ratchet handle with 3/8-inch drive, and 7/16-inch wrench.	



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FRONT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
29. Radiator frame (1)	Clamp (17)	a. Fit over harness. b. Put in position.	
30. Clamp (17)	Screw (18), washer (19), and nut (20)	Screw on, and tighten using 7/16-inch socket, ratchet handle with 3/8-inch drive, and 3/18-inch wrench.	
31. Right turn signal	Connector (22)	a. Feed through grommet in fender wall. b. Push together.	
32. Right headlight	Connector (24)	Push together. lead (23)	



FRONT WIRING HARNESS - CONTINUED

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE:

1. Connect battery ground cables (TM 9-2320-269-20-1).
2. Check operation of lights, turn signals, horn, and window washer (TM 9-2320-269-10).
3. Close left and right side hood panels (TM 9-2320-269-20-1).

TASK ENDS HERE

ENGINE WIRING HARNESS

This task covers:

a. Removal (page 2-471)	c. Inspection/Replacement (page 2-476)
b. Cleaning (page 2-475)	d. Installation (page 2-477)
-

INITIAL SETUP

Tools

Handle, ratchet, 3/8-inch drive
 Screwdriver, flat-tip, 3/8-inch
 Socket, 3/8-inch drive, 7/16-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 1/2-inch
 (two required)
 Wrench, open-end, 3/4-inch
 Wrench, open-end, 7/16-inch

Materials/Parts

Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49,
 appendix B)
 Tag, marking (item 50, appendix B)

Personnel Required

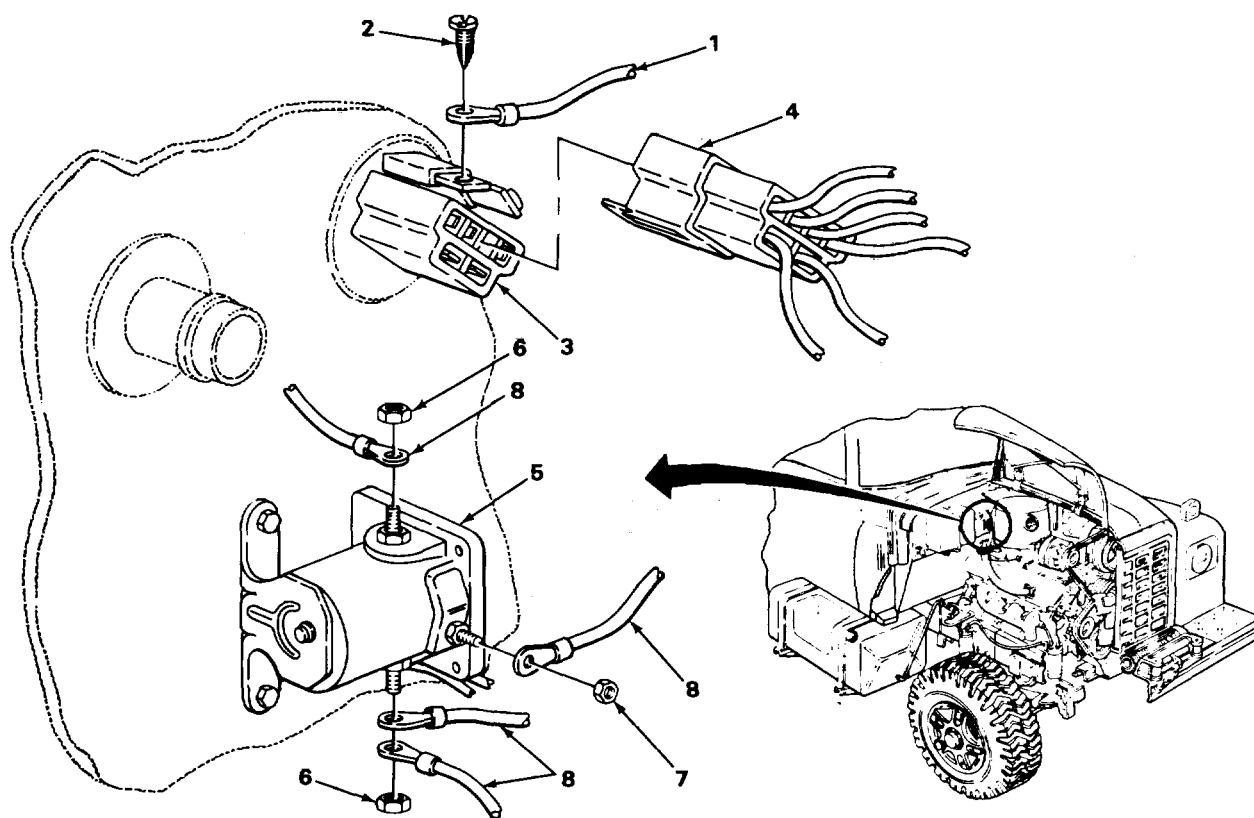
One

Equipment Condition

Battery cables disconnected
 (TM 9-2320-269-20-1).
 Left and right side hood panels raised
 (TM 9-2320-269-20-1).
 Transmission cover removed
 (TM 9-2320-269-20-2).

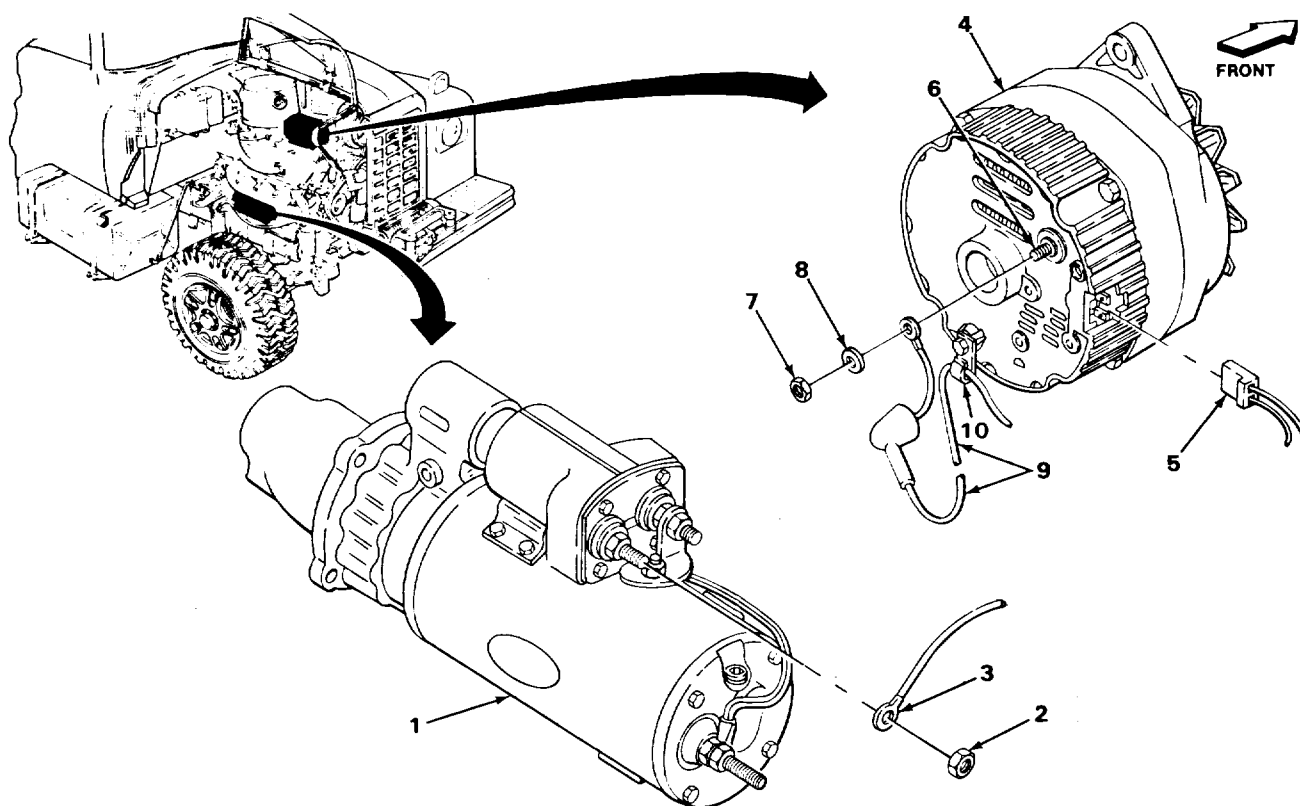
ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
NOTE			
Tag all disconnected wires to make installation easier.			
1.	Harness connector	Screw (2)	Using 3/8-inch flat-tip screwdriver, unscrew and take out.
2.	Main harness	ground wire	lead (1)
3.	Magnetic switch (5)	Engine harness connector (3)	Pull off.
4.		Two nuts (6)	connector (4)
5.		Nut (7)	Using 1/2-inch open-end wrench, unscrew and take off.
6.		Four wires (8)	Using 3/8-inch open-end wrench, unscrew and take off.
7.			Take off.



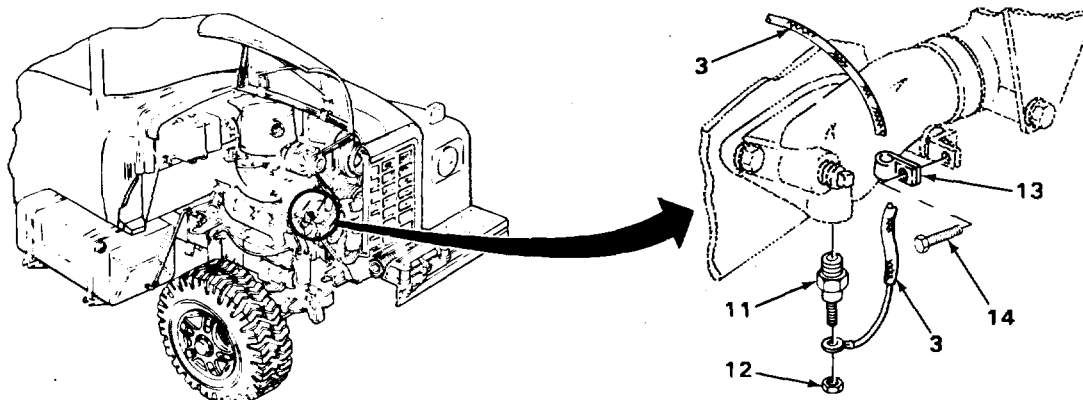
ENGINE WIRING HARNESS- CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6.	Starting motor (1)	Nut (2)	Using 3/4-inch open-end wrench, unscrew and take off.
7.	Wire (3)	Take off.	
8.	Alternator (4)	Connector (5)	Pull off.
9.	Battery terminal (6)	Nut (7) and washer (8)	Using 7/16-inch open-end wrench, unscrew and take off.
10.	Battery wire (9)	Take off.	
11.	Clamp (10)	Battery wire (9)	Take out.

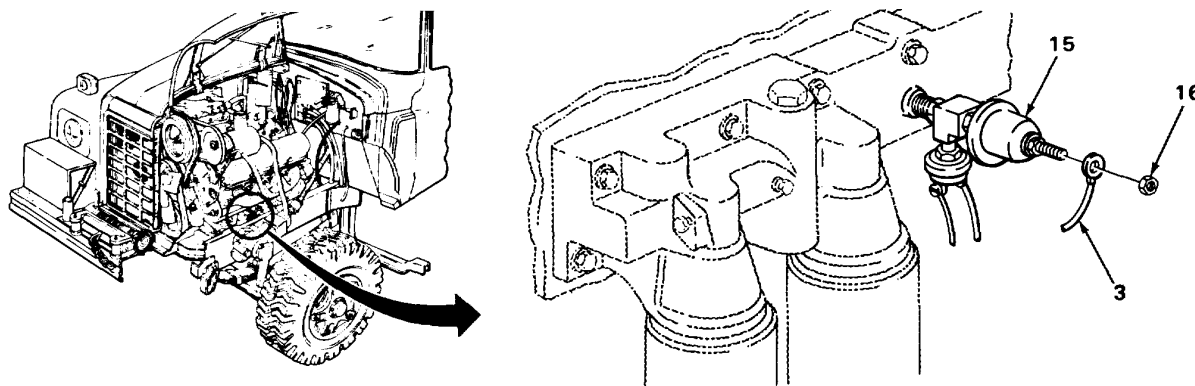


ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
12. Water temperature sending unit (11)	Nut (12)	Using 3/8-inch open-end wrench, unscrew and take off.	
13. Wire (3)	Wire (3)	Take off.	
14. Clamp (13)	Screw (14)	a. Using 7/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Remove clamp from wire.	

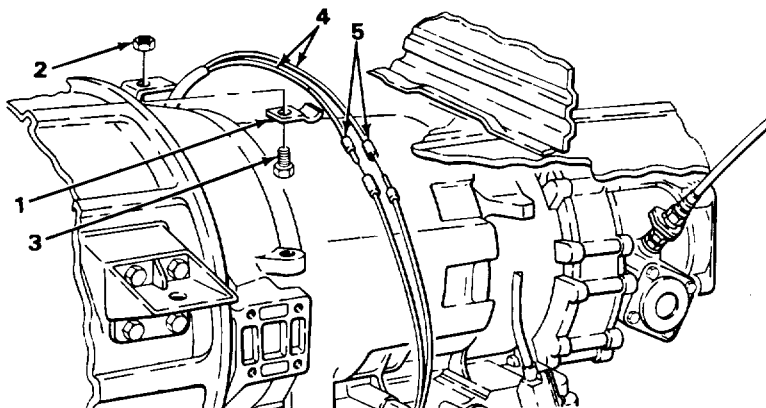


15. Oil pressure sending unit (15)	Nut (16)	Using 3/8-inch open-end wrench, unscrew and take off.	
16. Wire (3)	Wire (3)	Take off.	

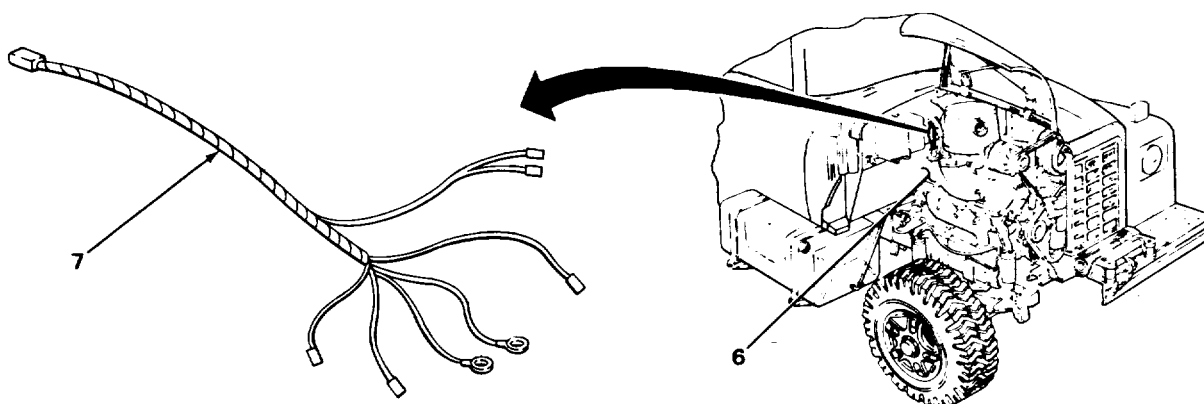


ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
17. Wire clamp (1)	Nut (2)	Using two 112-inch open-end wrenches, unscrew and loosen. Take out.	
18.	screw (3) Neutral start switch wires (4)		
19. Neutral start switch wires (4)	Connectors (5)	Disconnect.	

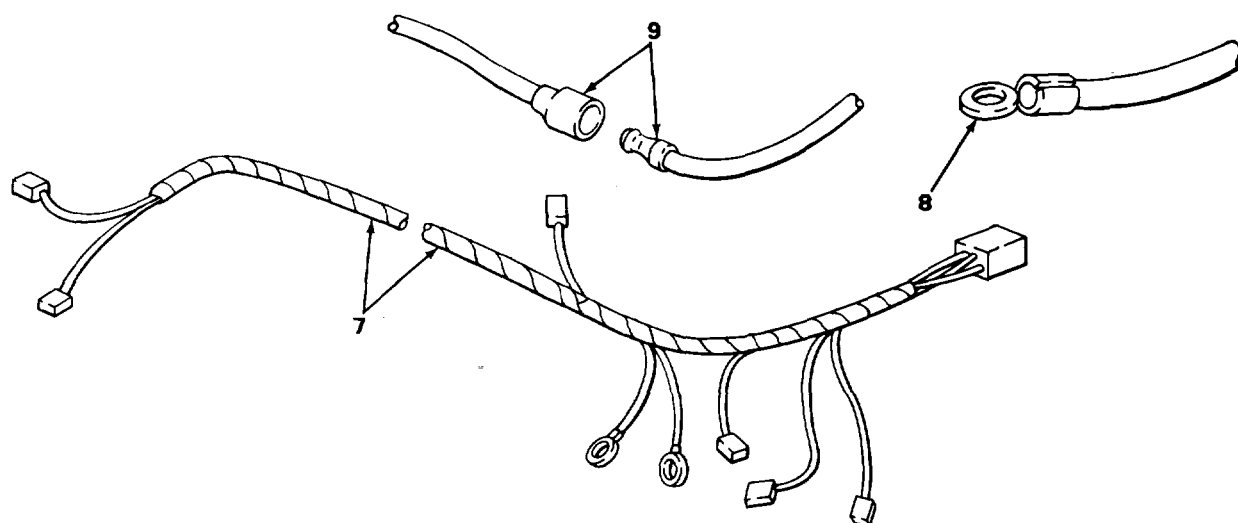


20. Engine (6) Engine wiring harness (7) Take off.



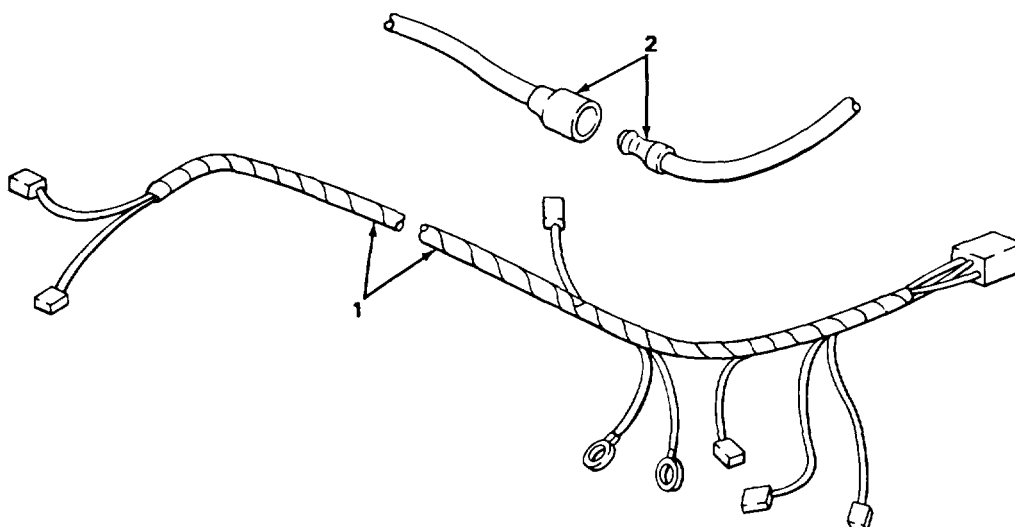
ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE			
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).			
<u>WARNING</u>			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
21.	Terminals (8)	Clean with clean rag dampened with dry-cleaning solvent.	
22.	Push on	Wipe clean with clean, dry rag.	
23.	Engine wiring harness (7)	a. Wipe clean with rag dampened with water. b. Wipe dry using clean, dry rag.	



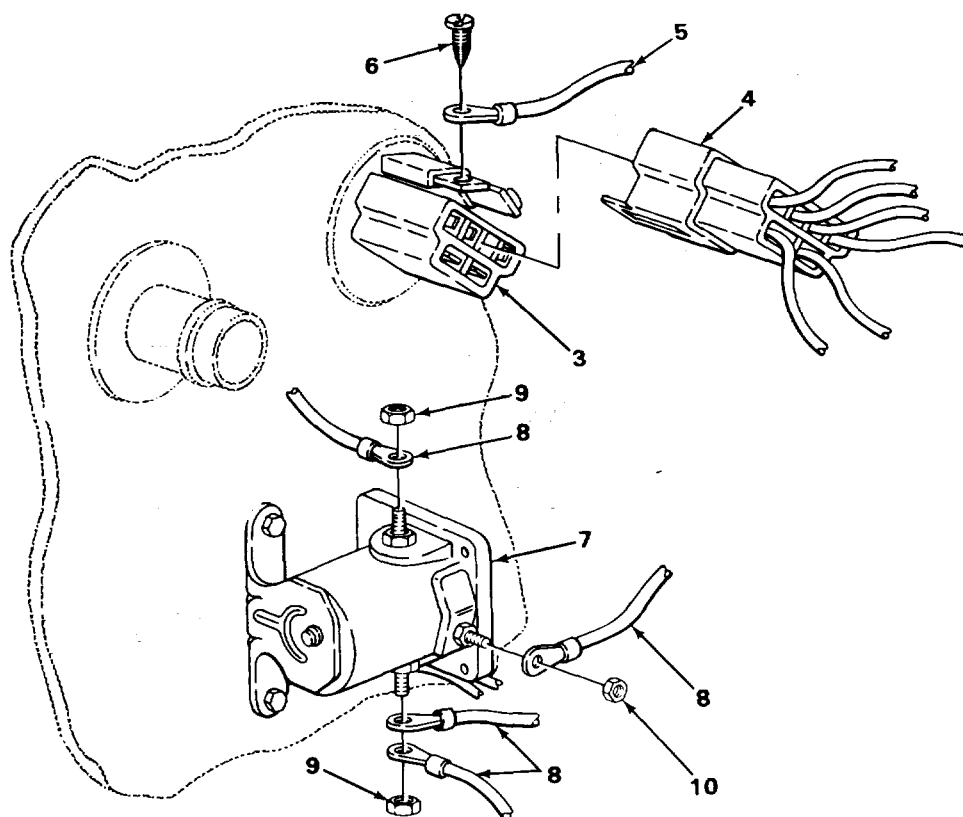
ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts, as needed.			
24.	Engine wiring harness (1)	a. Look for cut, burned, and worn insulation. b. Look for broken wires, and replace as necessary.	
25.	Connectors (2)	Look for missing, broken, and corroded parts and replace as necessary.	



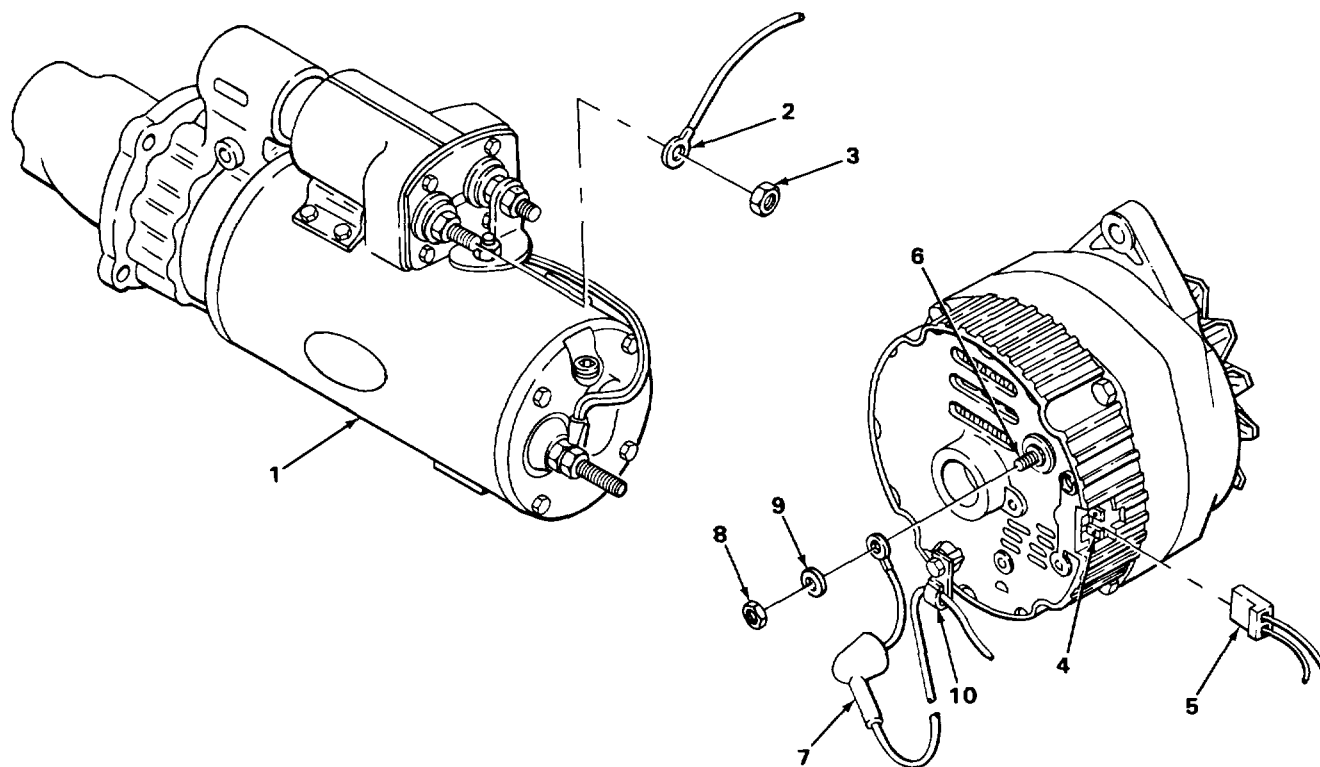
ENGINE WIRING HARNESS- CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
26.	Main harness	Engine harness connector (3)	Push on.
27.		Ground wire terminal (5)	connector (4) Put in position.
28.	Ground wire	Screw (6)	
29.	Magnetic switch (7)	terminal (5)	Screw in, and tighten using 3/8-inch flat-tip screwdriver.
30.		Four wires (8)	Put on terminals, as tagged.
31.		Two nuts (9)	Screw in, and tighten using 1/2-inch open-end wrench.
		Nut (10)	Screw in, and tighten using 3/8-inch open-end wrench.



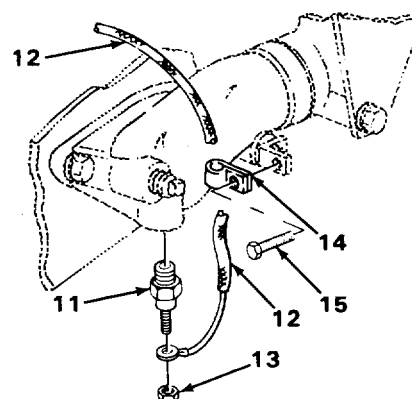
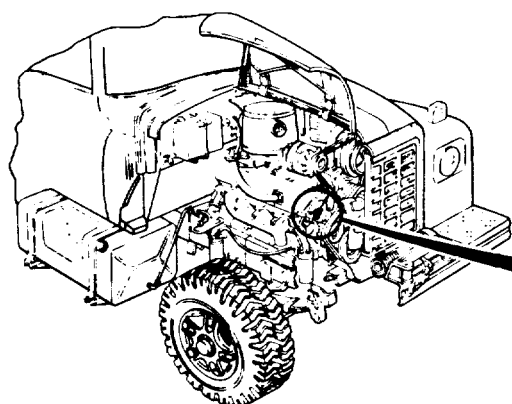
ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
32. Starting motor (1)	Wire (2)	Put on terminal as tagged.	
33.	Nut (3)	Screw on, and tighten using 3/4-inch open-end wrench.	
34. Alternator terminal (4)	Connector (5)	Push on.	
35. Battery terminal (6)	Battery wire (7)	Put on.	
36.	Nut (8) and washer (9)	Screw on, and tighten using 7/16-inch open-end wrench.	
37. Clamp (10)	Battery wire (7)	Put in.	

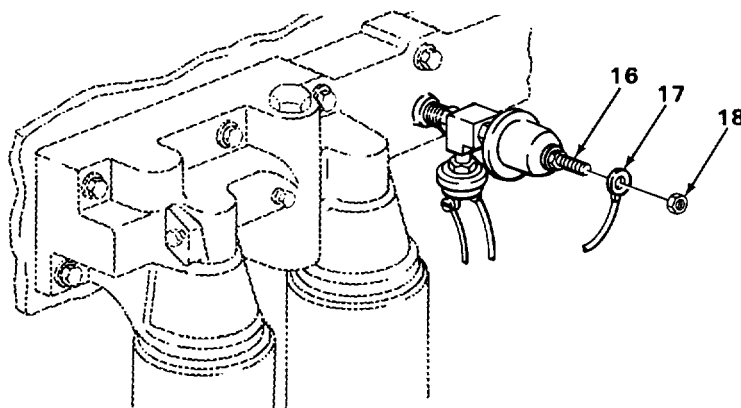


ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
38. Water temperature sending unit (11)	Wire (12)	Put on.	
39.	Nut (13)	Screw on, and tighten using 3/8-inch open end wrench.	
40. Clamp (14)	Screw (15)	a. Put wire (12) in clamp. b. Screw in, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch drive.	

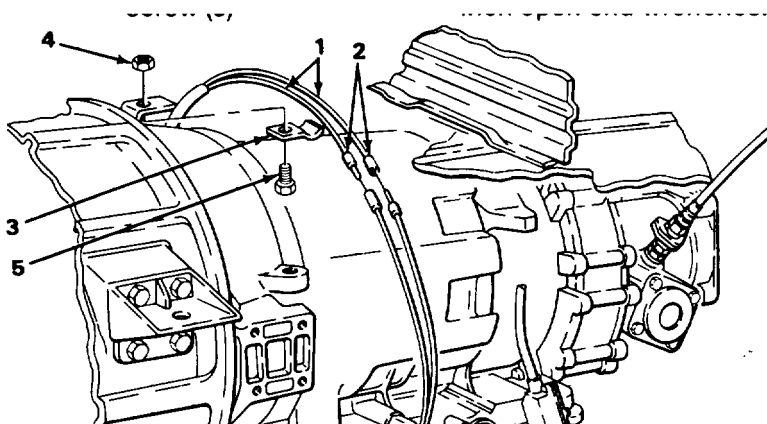


41. Oil pressure sending unit (16)	Wire (17)	Put on.	
42.	Nut (18)	Using 3/8-inch open-end wrench, screw on and tighten.	



ENGINE WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
43. Neutral start	Connectors (2)	Connect wires as tagged during removal.	
44. Wire clamp (3)	Neutral start switch wires (1)	Put in position.	
45.	Nut (4) and screw (5)	Screw in, and tighten using two 1/2-inch open-end wrenches.	

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Connect battery cables (TM 9-2320-269-20-1).
2. Check operation of starting motor, alternator, water temperature sending unit, oil pressure sending unit, and neutral start switch (TM 9-2320-269-10).
3. Close left and right side hood panels (TM 9-2320-269-20-1).
4. Install transmission cover (TM 9-2320-269-20-2).

TASK ENDS HERE

ANTILOCK WIRING HARNESS

This task covers:

a. Removal (page 2-481)	c. Inspection/Replacement (page 2-489)
b. Cleaning (page 2-488)	d. Installation (page 2-490)
-

INITIAL SETUP**Tools**

Handle, speeder, 1/4-inch drive
 Pliers, round-nose, long
 Screwdriver, flat-tip, 3/16-inch
 Screwdriver, flat-tip, 3/8-inch
 Socket, 1/4-inch drive, 3/8-inch
 Wrench, open-end, 5/16-inch
 Wrench, open-end, 7/16-inch (two required)

Materials/Parts

Rags, wiping (item 42, appendix B)

Materials/Parts - Continued

Solvent, dry-cleaning (item 49, appendix B)
 Tag, marking (item 50, appendix B)

Personnel Required

One

Equipment Condition

Battery cables disconnected
 (TM 9-2320-269-20-1).
 Driver's side floormat retainer removed
 (TM 9-2320-269-20-2).

LOCATION	ITEM	ACTION	REMARKS

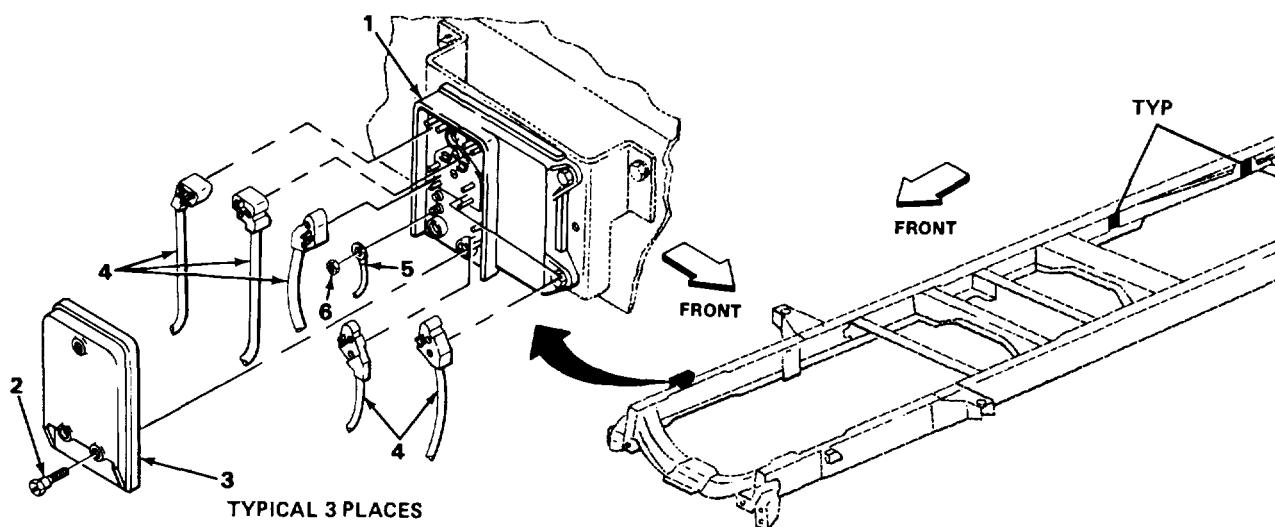
REMOVAL**NOTE**

Steps 1 thru 5 cover front control module disconnect procedures. Repeat steps 1 thru 5 for rear control module cover and harness, and for rear-rear control module cover and harness.

Tag all disconnected wires to make installation easier.

ANTILOCK WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
1. Front control	Three screws (2)	Using 3/8-inch socket and speeder handle with 1/4-inch drive, unscrew until cover is free. Take off.	
2. Front control module (1)	module (1)		
3. Cover (3) and three screws (2)	Cover (3) and three screws (2)	Using long round-nose pliers on raised part of connectors, pull out. Using 5/16-inch open-end wrench, unscrew and take off. Take off.	
4. Connectors (4)	Connectors (4)		
5. Ground lead wire (5)	Nut (6)		
6. Front control module (1)	Ground lead wire (5)		



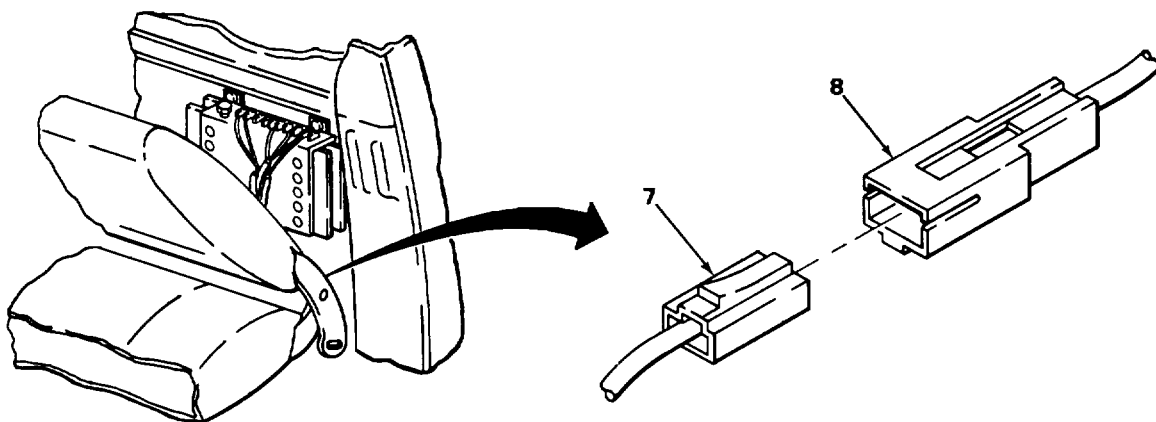
2-482

ANTILOCK WIRING HARNESS - CONTINUED

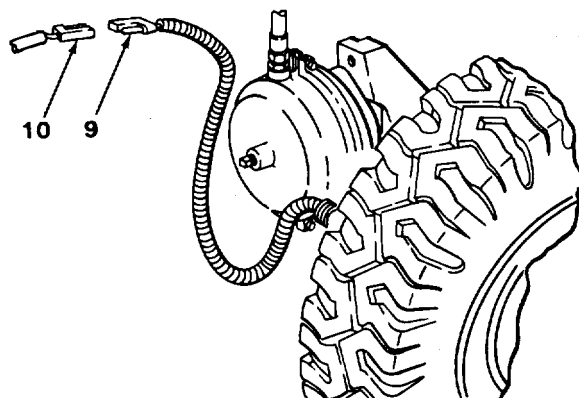
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

6.	Connector (7)	Antilock harness connector (8)	Using 3/16-inch flat-tip screwdriver, pry up on tab and pull apart.



7.	Right front wheel sensor lead connector (9)	Antilock harness connector (10)	Pull apart.

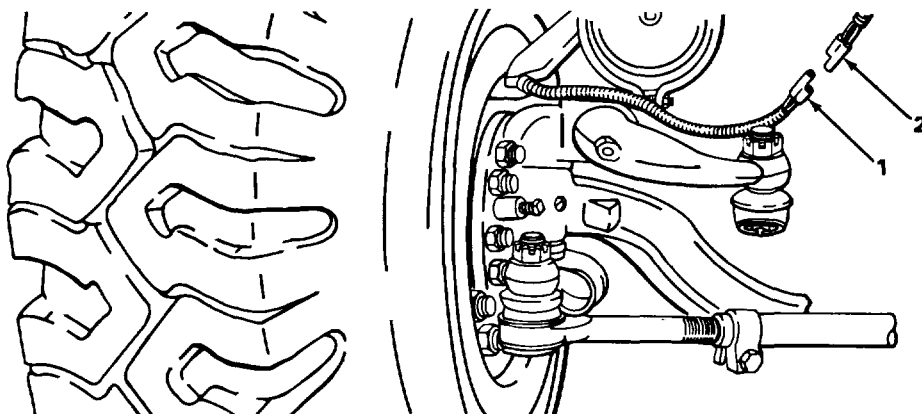


ANTILOCK WIRING HARNESS - CONTINUED

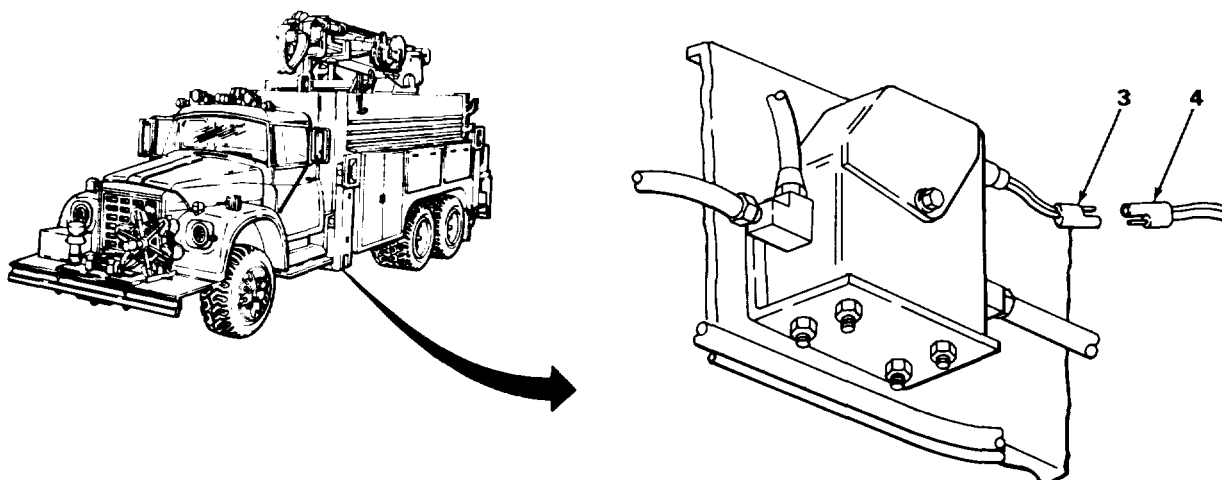
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

8. Left front wheel sensor lead connector (1) Harness connector (2) Pull apart.

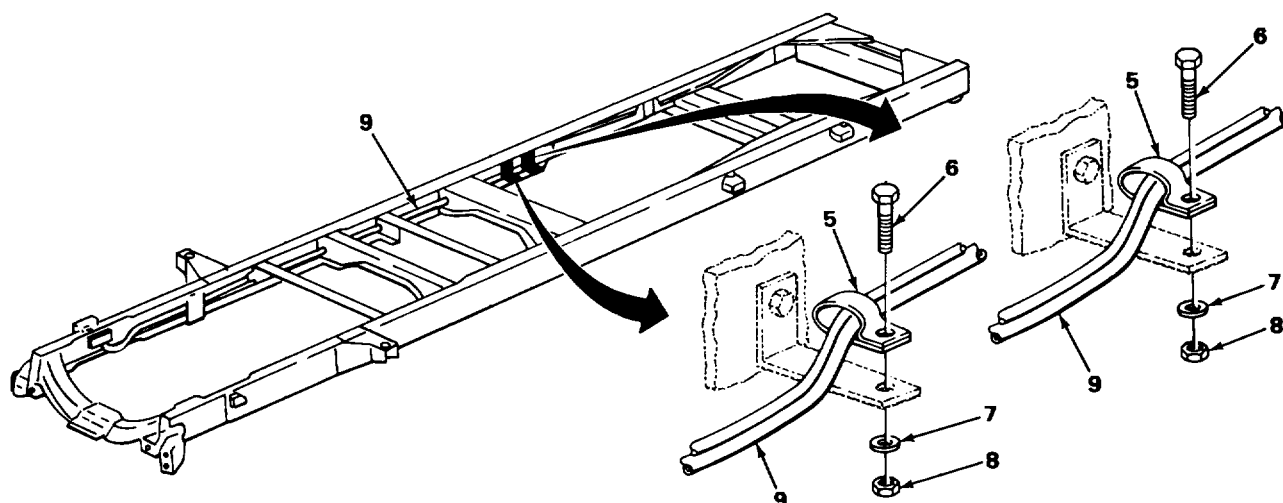


9. Front air control valve connector (3) Harness connector (4) Pull apart.

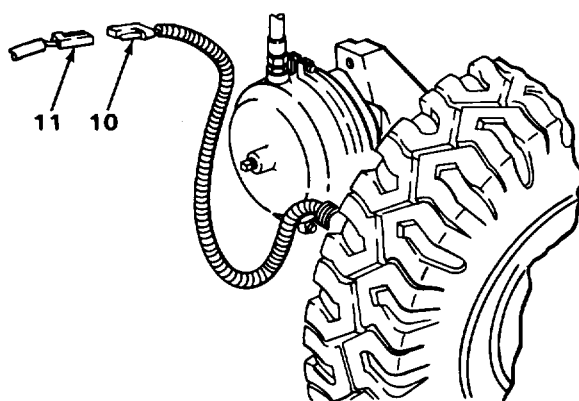


ANTILOCK WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
10.	Two clamps (5)	Two screws (6), washers (7), and nuts (8)	Using two 7/16-inch open-end wrenches, unscrew and take off.
11.	Harness (9)		Using 3/8-inch flat-tip screwdriver, pry clamps (5) apart and take out.



12. Right rear wheel sensor connector (10)
- Harness connector (11)
- Pull apart.

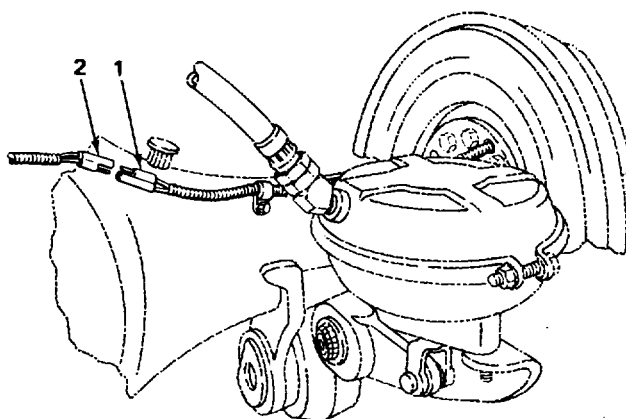


ANTILOCK WIRING HARNESS - CONTINUED

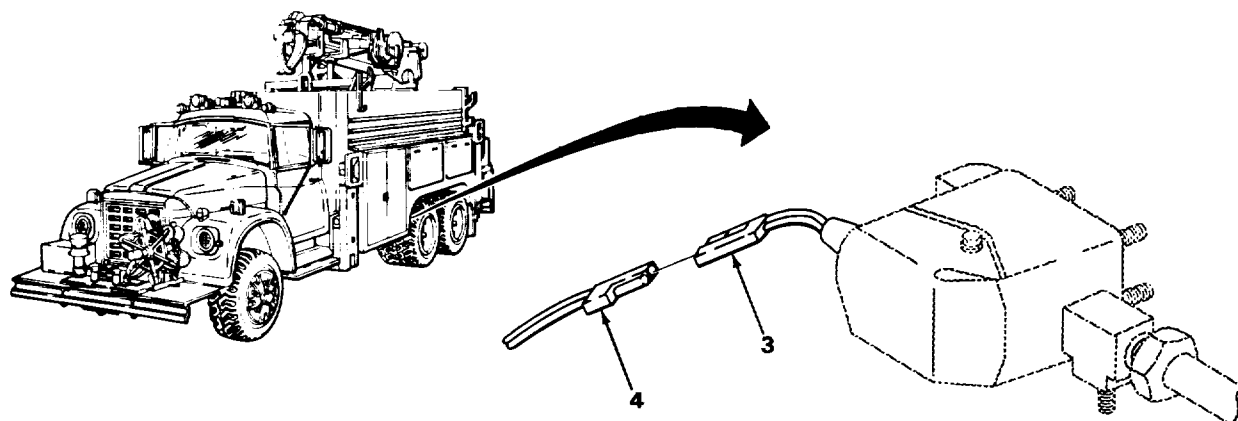
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

13.	Right rear-rear wheel sensor connector (1)	Harness connector (2)	Pull apart.



14.	Rear air control valve connector (3)	Harness connector (4)	Pull apart.



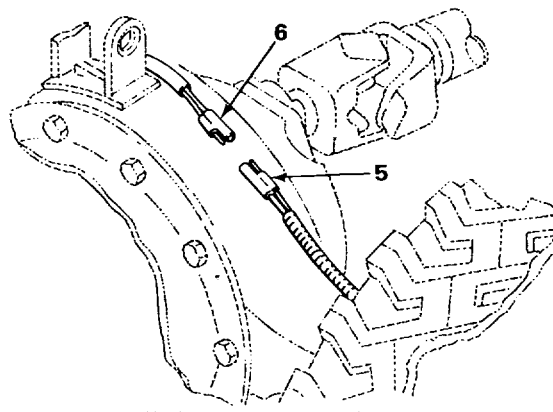
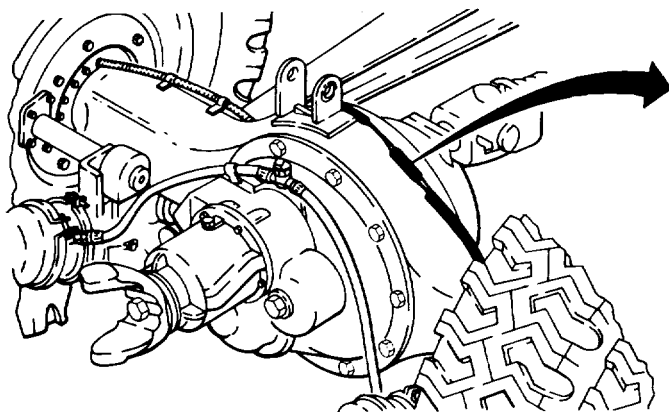
TA238240

ANTILOCK WIRING HARNESS - CONTINUED

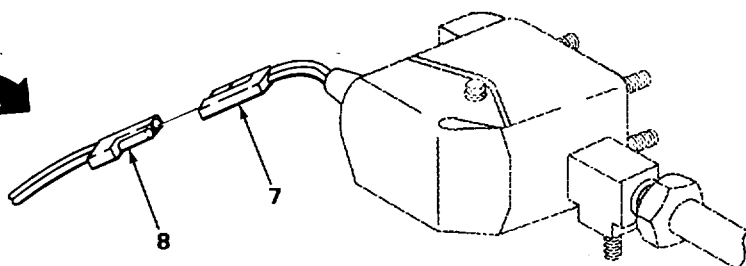
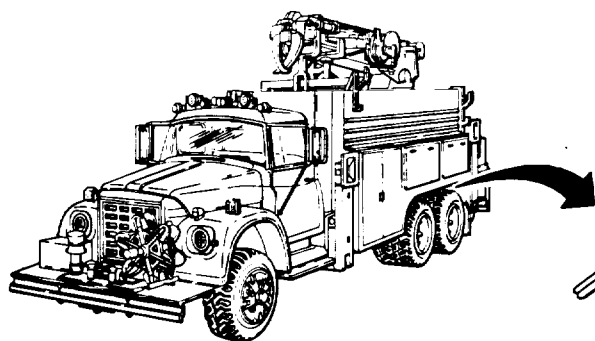
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

15.	Left-rear wheel sensor connector (5)	Harness connector (6)	Pull apart.



16.	Rear-rear air control valve connector (7)	Harness connector (8)	Pull apart.

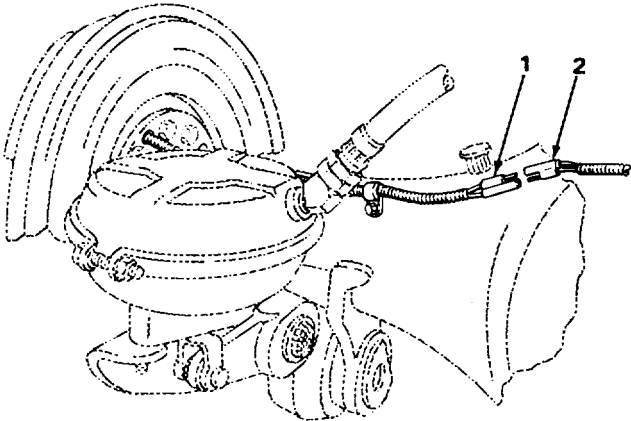


ANTILOCK WIRING HARNESS - CONTINUED

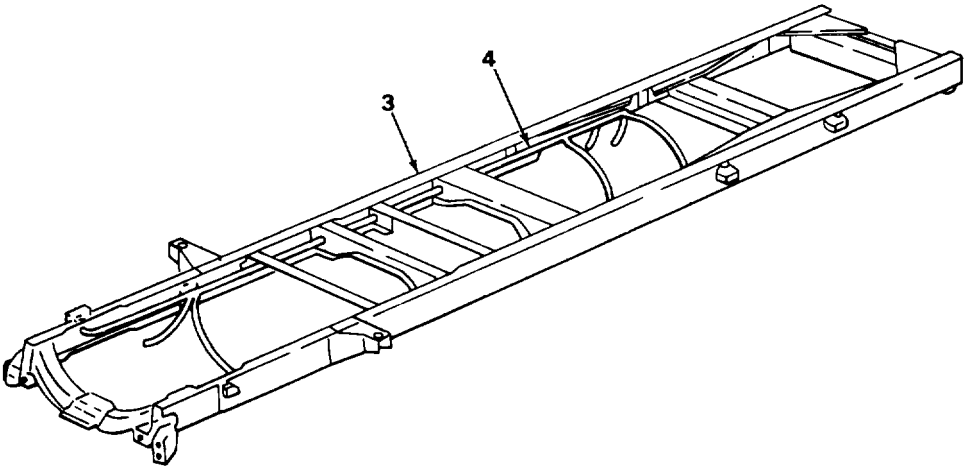
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

17.
- Left rear-rear wheel sensor connector (1)
- Harness connector (2)
- Pull apart.



18.
- Vehicle chassis (3)
- Antilock wiring harness (4)
- Take off



CLEANING

NOTE

For more Information on how to clean parts, go to General Maintenance Instructions (page 2-46).

ANTILOCK WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED**WARNING**

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

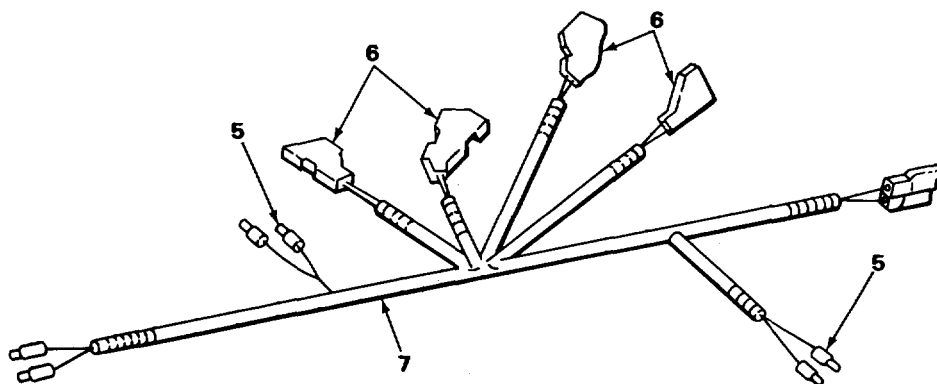
19.	Terminals (5)	Clean with clean rag dampened with dry-cleaning solvent.	
20.	Connectors (6)	Wipe clean with clean, dry rag.	
21.	Wiring harness (7)	a. Wipe clean with rag dampened with water. b. Wipe dry using clean, dry rag.	

INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts, as needed.

22.	Wiring harness (7)	a. Look for cut, burned, and worn insulation. b. Look for broken wires, and replace as necessary.	
23.	Connectors (6)	Look for missing, broken, and corroded parts, and replace as necessary.	

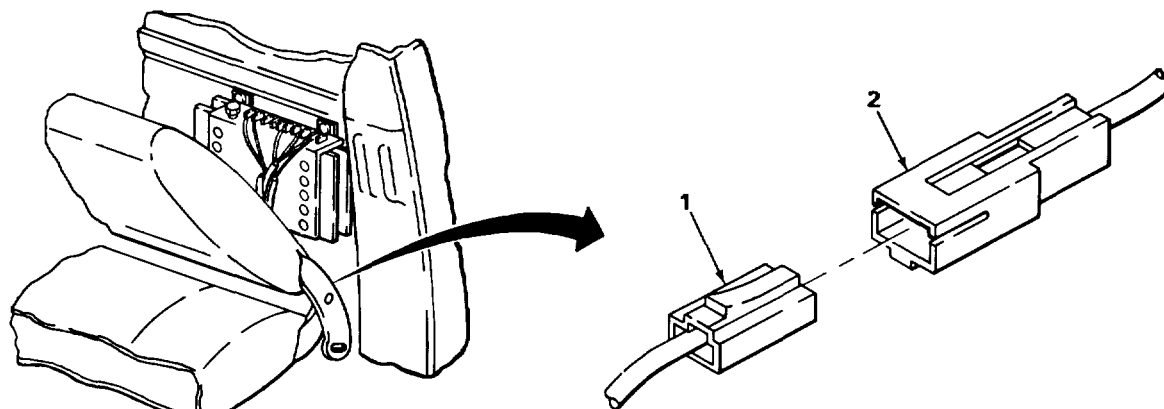


ANTILOCK WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION

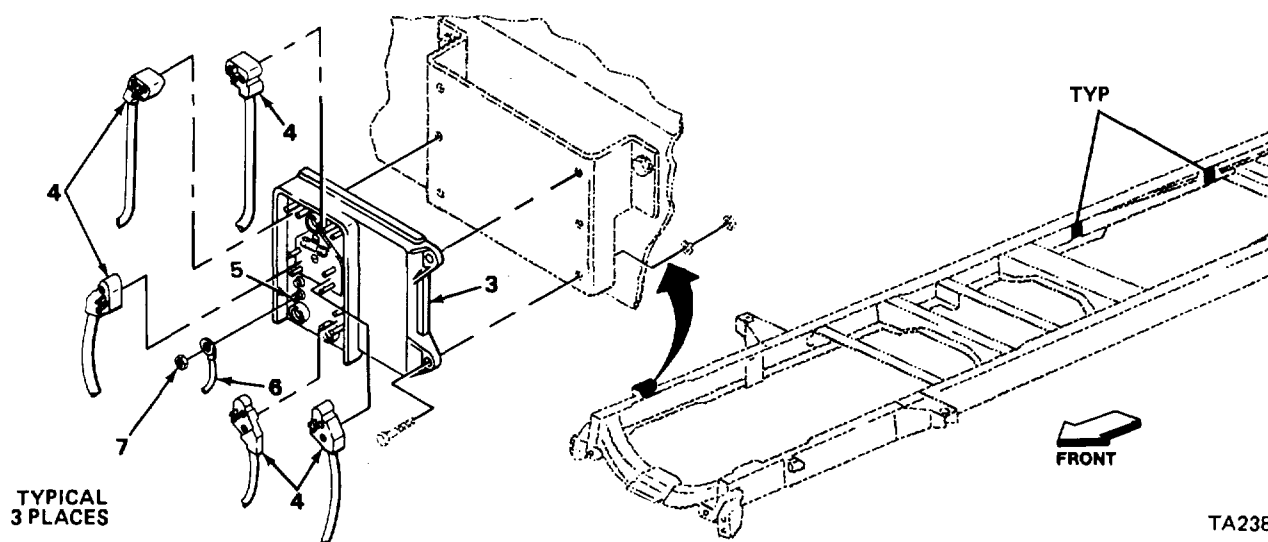
24.	Wiring harness (1)	Connector (2)	Push together.



NOTE

The connections for all three modules are installed the same way. Repeat steps 25 thru 27 for all modules.

25.	Front module (3)	Connectors (4)	Push in position.
26.	Terminal (5)	Ground lead (6)	Put on terminal.
27.	Ground lead (6)	Nut (7)	Screw on, and tighten using 5/16-inch open-end wrench.



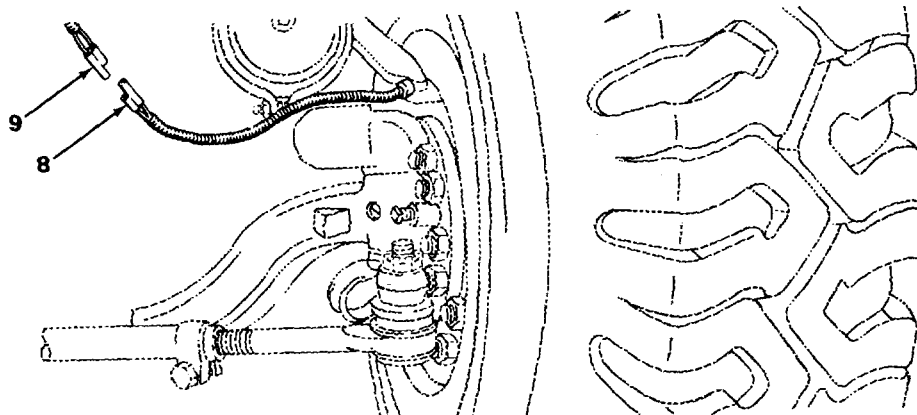
TA238244

ANTILOCK WIRING HARNESS - CONTINUED

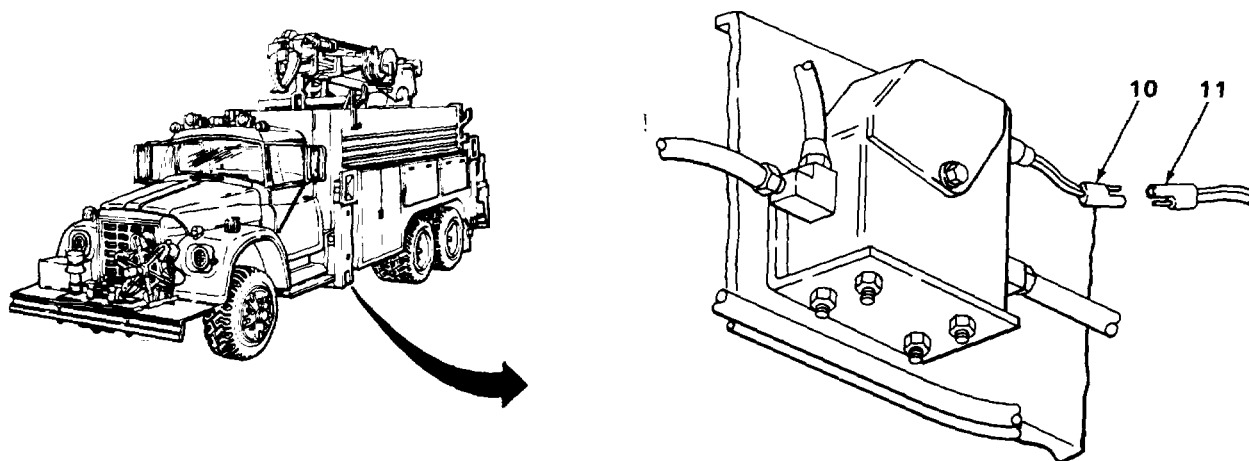
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

28.	Right front wheel sensor lead connector (8)	Harness connector (9)	Push together.



29.	Front air control valve connector (10)	Harness connector (11)	Push together.

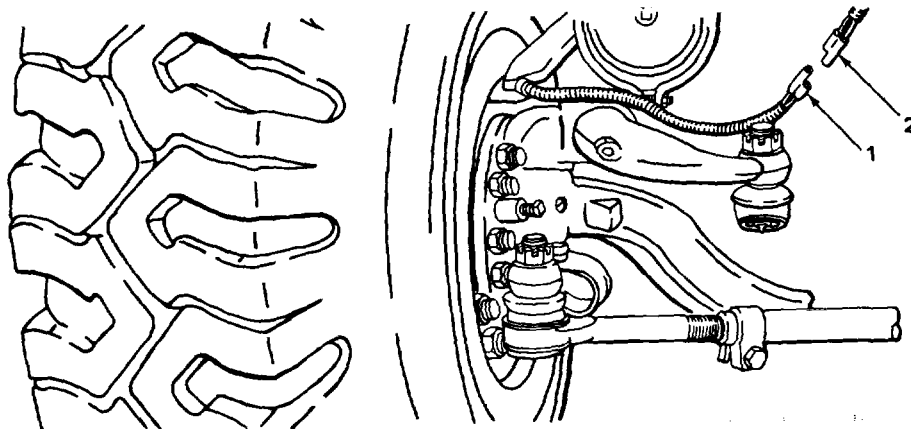


TA238245

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

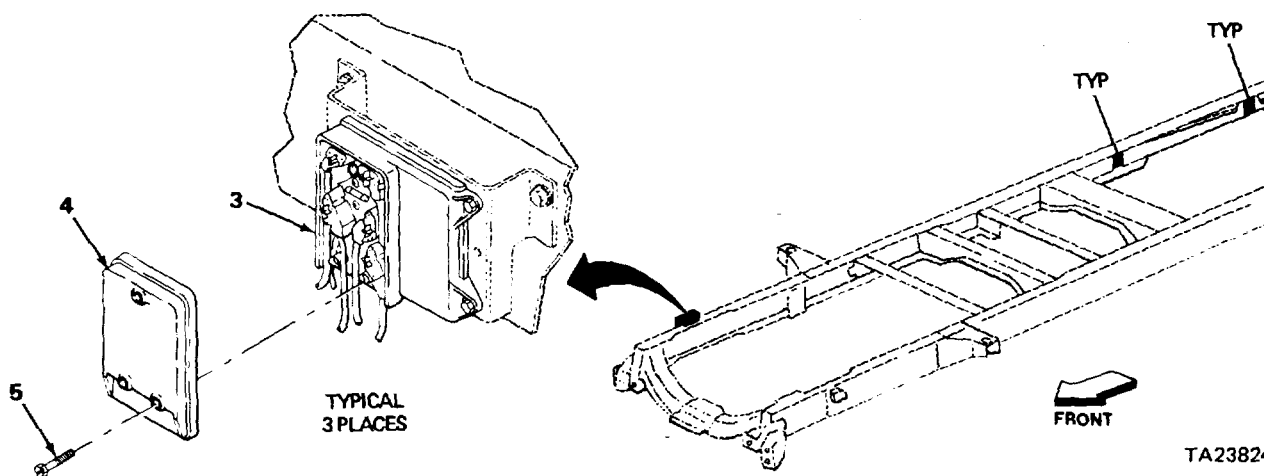
30.	Left front wheel sensor lead connector (1)	Harness connector (2)	Push together.



NOTE

The covers for all three modules are installed the same way. Repeat steps 31 thru 32 for all modules.

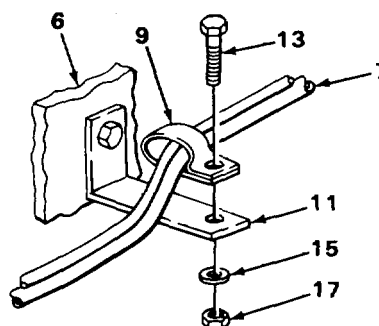
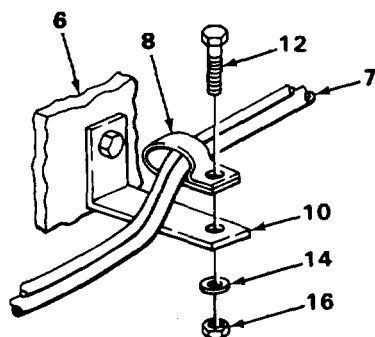
31.	Front control module (3)	Cover (4)	Put in position.
32.	Cover (4)	Three screws (5)	Screw in, and tighten using 3/8-inch socket and speeder handle with 1/4-inch drive



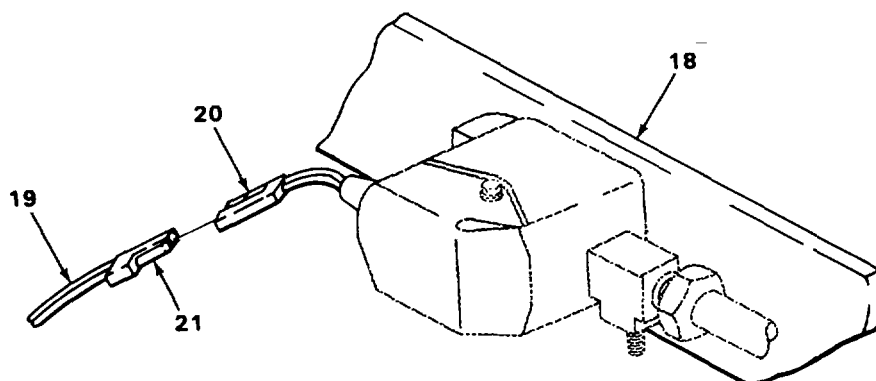
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ANTILOCK WIRING HARNESS - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED				
33.	Vehicle right frame (6)	Wiring harness (7)	Route harness (7) along frame (6).	
34.	Clamps (8) and (9)	Wiring harness (7)	Spread clamp and put over harness (7) using 3/8-inch flat-tip screwdriver.	
35.	Brackets (10) and (11)	Clamps (8) and (9)	Put in position on brackets (10) and (11).	
36.	Clamps (8) and (9)	Screws (12) and (13), washers (14) and (15), and nuts (16) and (17)	Screw on, and tighten using two 7/16-inch open-end wrenches.	

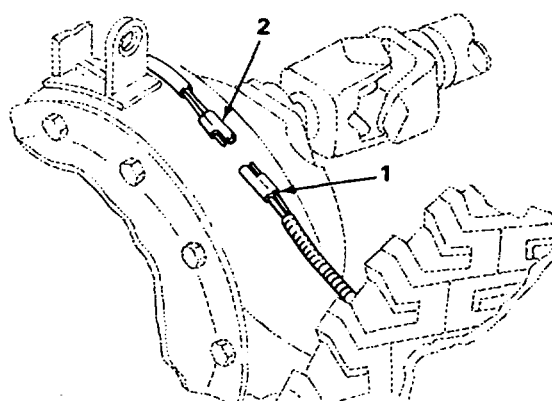
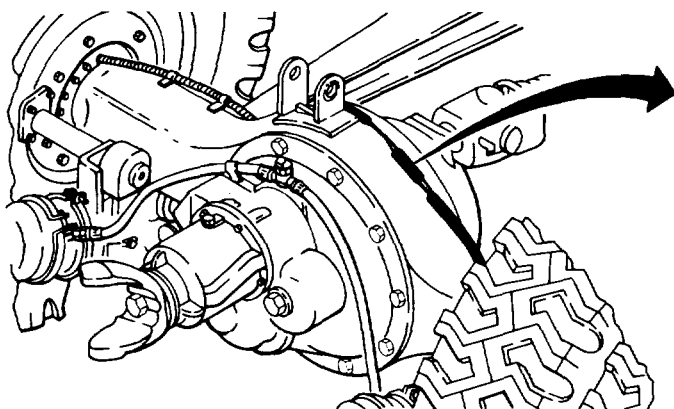


37.	Vehicle left frame (18)	Harness (19) leads to frame.	Route rear control valve and left rear	
38.	Rear air control valve connector (20)	Harness connector (21)	Push together.	

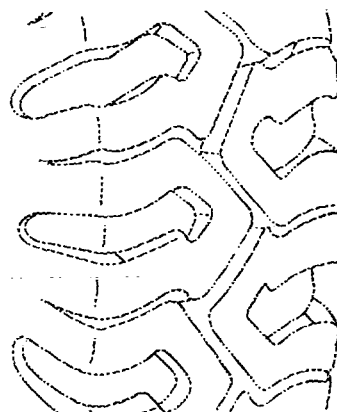
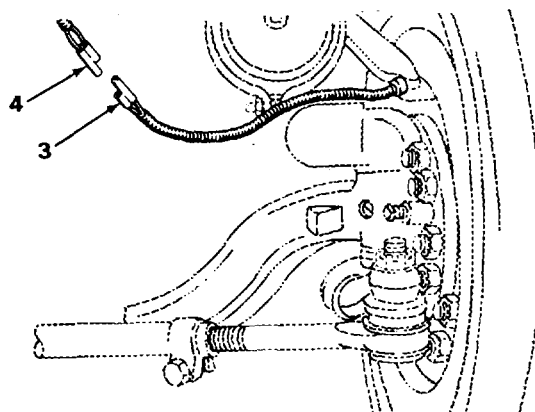


	LOCATION	ITEM	ACTION	REMARKS

39.	Left rear wheel sensor lead connector(1)	Harness connector (2)	Push together.	



40.	Right rear wheel sensor lead connector (3)	Harness connector (4)	Push together.	



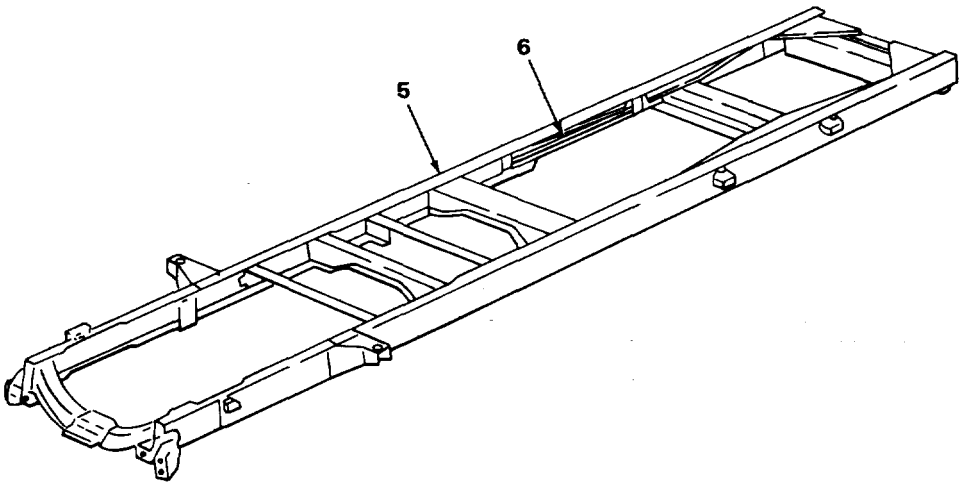
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ANTILOCK WIRING HARNESS - CONTINUED

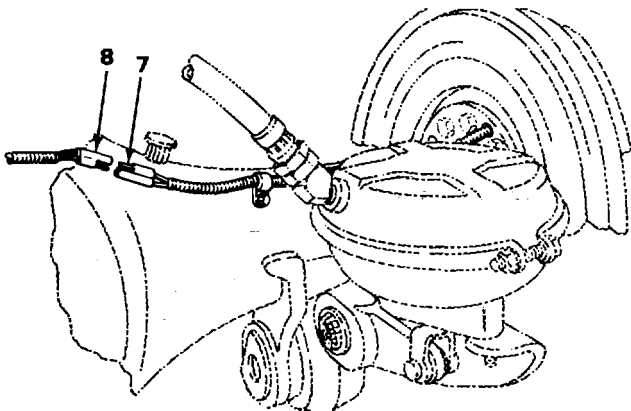
LOCATION		ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

41.	Vehicle right frame (5)	Wiring harness (6)	Route harness along frame to rear-rear module.	



42.	Right rear-rear wheel sensor (7)	Harness connector (8)	Push together.	



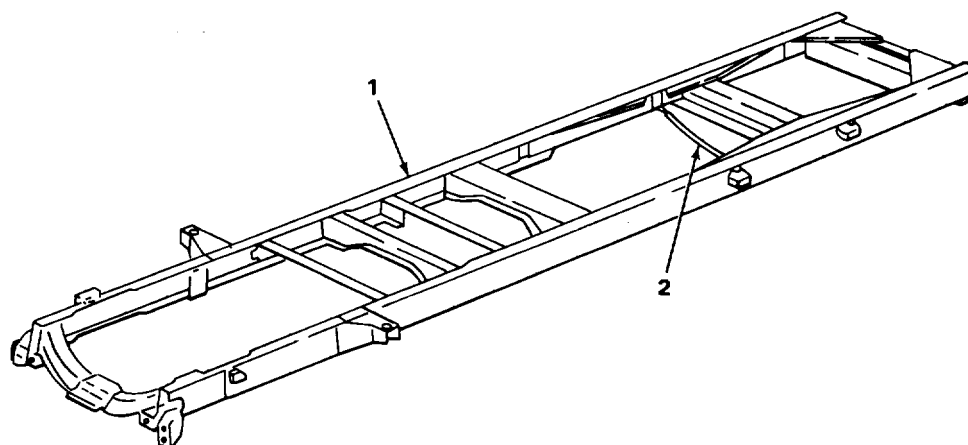
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ANTILOCK WIRING HARNESS - CONTINUED

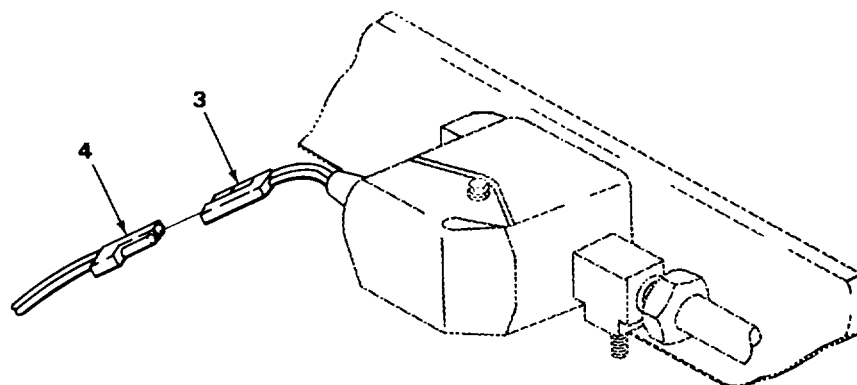
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

43.	Vehicle left frame (1)	Wiring harness (2)	Route rear-rear air control valve and wheel sensor leads to left frame of vehicle



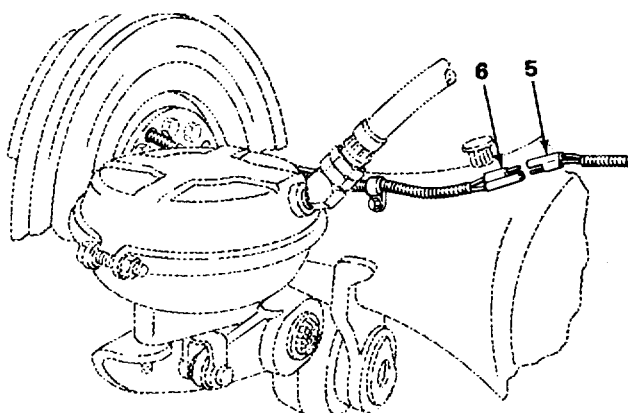
44.	Rear-rear air control valve connector (3)	Harness connector (4)	Push together.



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ANTILOCK WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
45. Left rear-rear wheel sensor lead connector (5)	Harness connector (6)	Push together.	

**NOTE**

FOLLOW-ON MAINTENANCE:

1. Connect battery cables (TM 9-2320-269-20-1).
2. Check operation of antilock warning light (TM 9-2320-269-10).
3. Check operation of antilock system (TM 9-2320-269-10).
4. Install driver's side floormat retainer (TM 9-2320-269-20-2).

TASK ENDS HERE

ANTILOCK CONTROL MODULES

This task covers:

- a. Removal (page 2-498)
- b. Inspection/Replacement (page 2-499)
- c. Installation (page 2-500)

INITIAL SETUP

Tools

Handle, ratchet, 3/8-inch drive
 Handle, speeder, 1/4-inch drive
 Pliers, round-nose, long
 Screwdriver, flat-tip, 114-inch
 Socket, 1/4-inch drive, 318-inch
 Socket, 3/8-inch drive, 112-inch
 Wrench, open-end, 5/16-inch
 Wrench, open-end, 1/2-inch

Materials/Parts

Lockwashers, control module (three required)

Personnel Required

One

Equipment Condition

Battery cables disconnected
 (TM 9-2320-269-20-1).

LOCATION		ITEM	ACTION	REMARKS
REMOVAL				
NOTE There are three module controls, each mounted on vehicle right frame, near each axle. The front module is mounted on the outside of the frame. The two rear modules are mounted on the inside of the frame. Removal procedure for all modules is the same.				
1.	Module control (1)	Three screws (2)		Using 3/8-inch socket and speeder handle with 1/4-inch drive, unscrew until cover is free.
2		Cover (3) and three screws (2)		Take off.
3		Connectors (4)		Using long round-nose pliers on raised part of connector, pull out.
4.	Ground wire terminal (5)	Nut (6)		Using 5/16-inch open-end wrench, unscrew and take off.

ANTILOCK CONTROL MODULES - CONTINUED

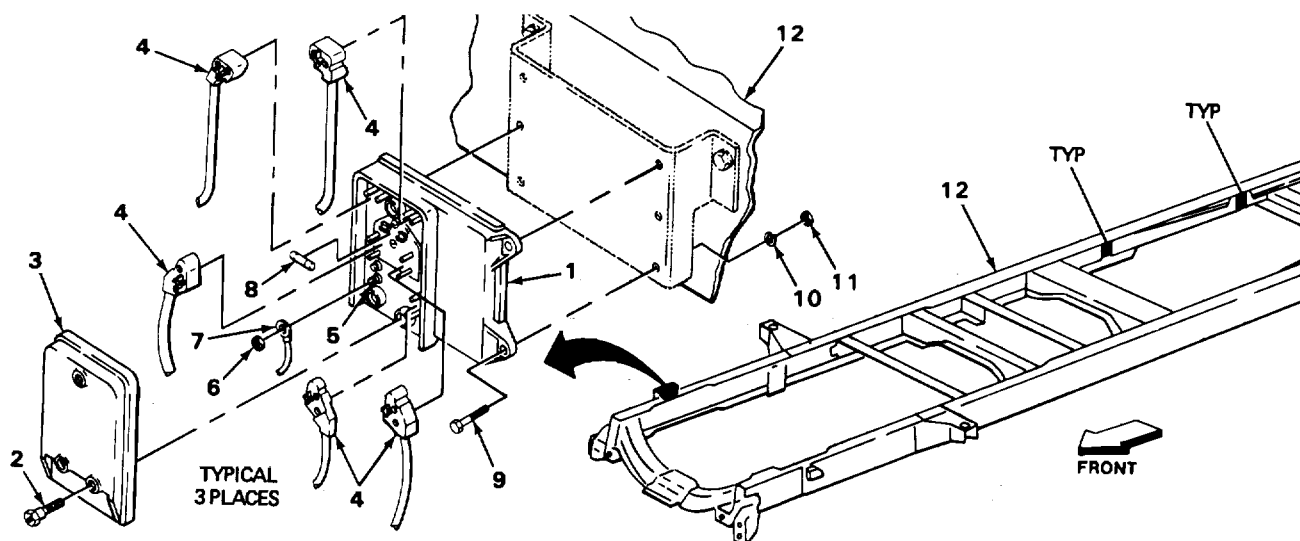
	LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED				
5.	Module control (1)	Ground wire clip (7)	Take off.	
6	Fuse (8)			If defective, using 1/4-inch flat-tip screwdriver, pry up and take out.
7		Three screws (9), lockwashers (10), and nuts (11)		a. Using 1/2-inch socket, ratchet handle with 3/8-inch drive, and 1/2-inch open-end wrench, unscrew and take off. b. Get rid of lockwashers (10).
8.	Frame (12)	Module control (1)	Take off.	

INSPECTION/REPLACEMENT

NOTE

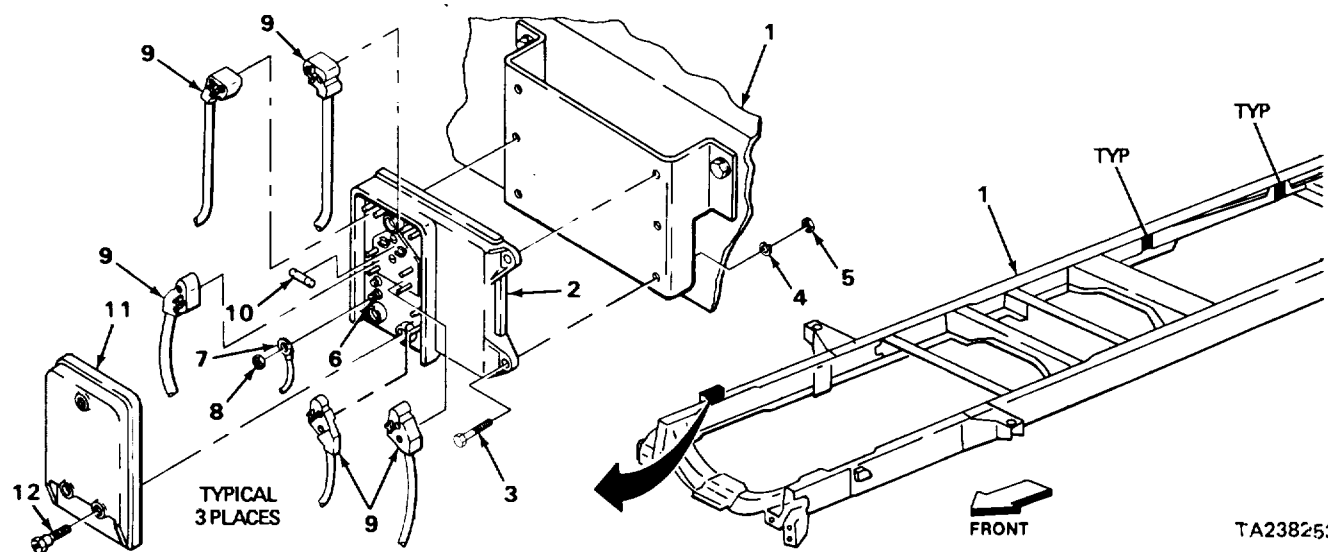
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

The modules are solid state and completely sealed, and if damaged or defective, they must be replaced.



ANTILOCK CONTROL MODULES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
	NOTE Installation procedure is same for all three modules.		
9.	Frame (1)	Module control (2)	a. Put in position. b. Aline with holes in frame.
10.	Module control (2)	Three screws (3) new lockwashers (4), and nuts (5)	Screw on, and tighten using 1/2-inch socket, ratchet handle with 3/8-inch drive, and 1/2-inch open-end wrench.
11.	Module ground terminal (6)	Ground wire clip (7)	Put on.
12.	Ground wire clip (7)	Nut (8)	Screw on, and tighten using 5/16-inch open-end wrench.
13.	Module control (2)	Connectors (9)	a. Put in position. b. Press into place using long round- nose pliers on raised section.
14	New fuse (10)		Press into place.
15	Cover (11) and three screws (12)		Put in position.
16	Three screws (12)		Screw in, and tighten using 3/8-inch socket and speeder handle with 1/4-inch



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ANTI LOCK CONTROL MODULES - CONTINUED

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE:

- 1. Connect battery cables (TM 9-2320-269-20-1).
- 2. Check operation of antilock system at each wheel (TM 9-2320-269-10).

TASK ENDS HERE

24-VOLT CONVERTER SYSTEM WIRING HARNESS

This task covers:	
a. Removal (page 2-502)	c. Inspection/Replacement (page 2-506)
b. Cleaning (page 2-506)	d. Installation (page 2-506)

INITIAL SETUP

Tools

- Handle, ratchet, 3/8-inch drive
- Screwdriver, cross-tip, number two
- Screwdriver, flat-tip, 3/8-inch
- Socket, 3/8-inch drive, 9/16-inch
- Wrench, open-end, 3/8-inch
- Wrench, open-end, 7/16-inch

Personnel Required

One

Equipment Condition

Battery cables disconnected
(TM 9-2320-269-20-1).

Materials/Parts

- Lockwashers, receptacle cover
(four required)
- Rags, wiping (item 42, appendix B)
- Solvent, drycleaning (item 49,
appendix B)
- Tag, marking (item 50, appendix B)

24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

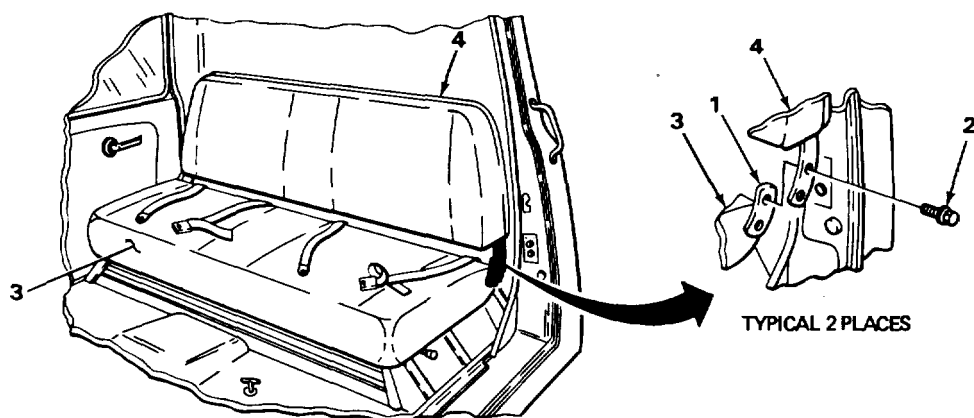
LOCATION	ITEM	ACTION	REMARKS

REMOVAL

NOTE

When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

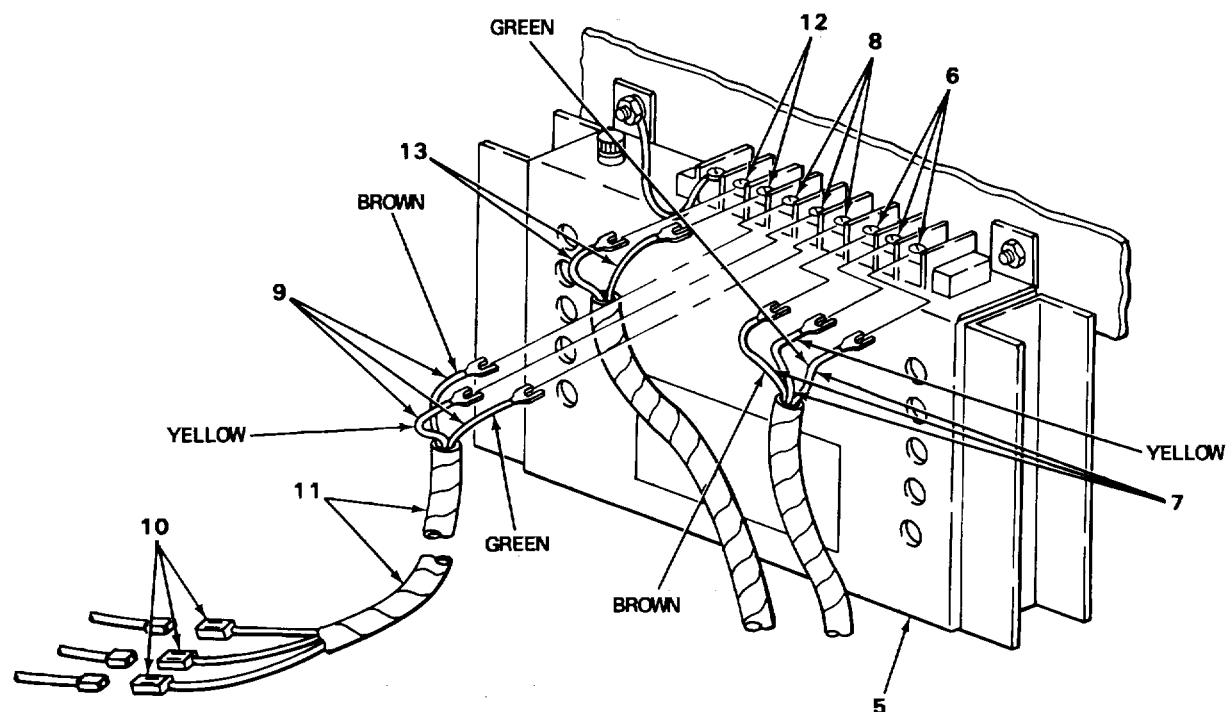
1.	Seat frame (1)	Four screws (2)	Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
2.	Seat bottom (3)	Seat back (4)	Lift off.



3	24-volt converter (5)	Three screws (6) unscrew part way.	Using 1/4-inch flat-tip screwdriver,
4		Three harness wires (7)	Take off.
5		Three screws (8)	Using 1/4-inch flat-tip screwdriver, unscrew part way.
6		Three harness wires (9)	Take off. TA238254

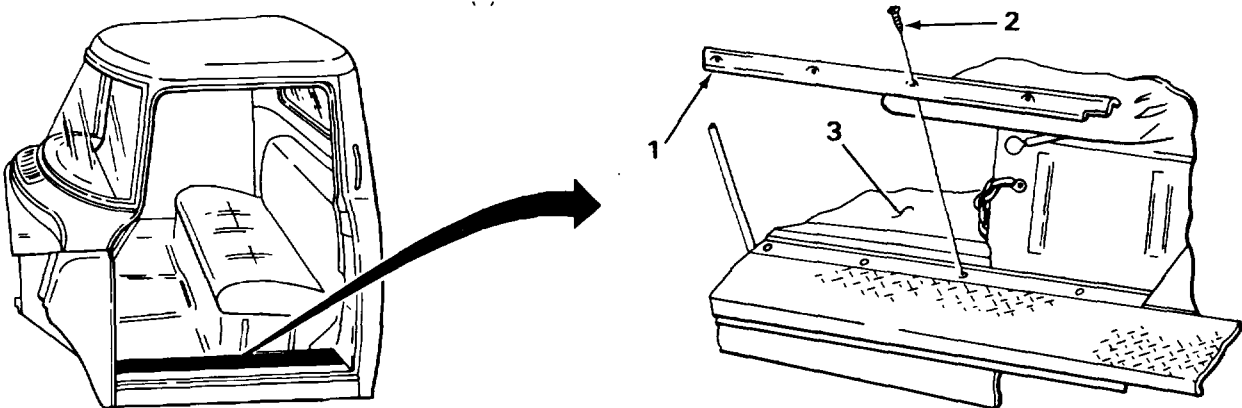
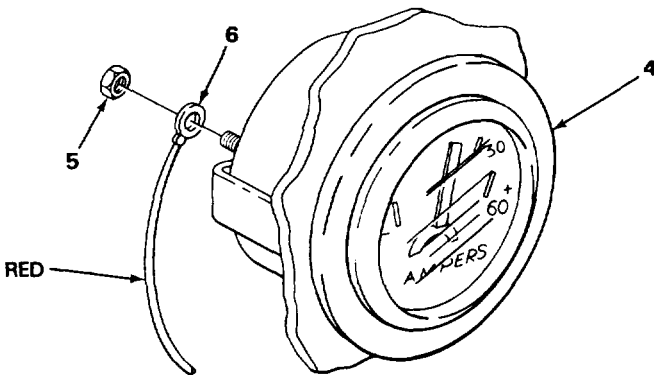
24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
7	Three connectors (10)	a. Pull apart. b. Take out harness (11).	
8	Two screws (12)	Using 1/4-inch flat-tip screwdriver, unscrew part way.	
9	Two wires (13)	Take off.	

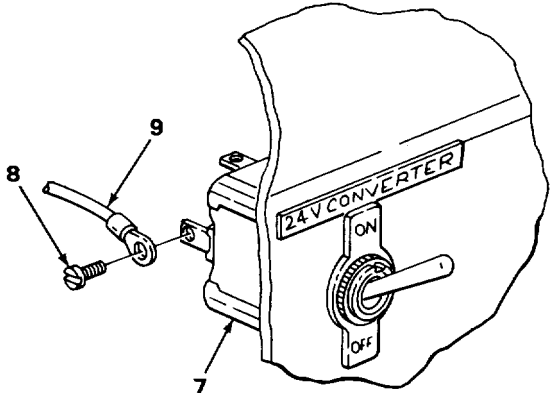


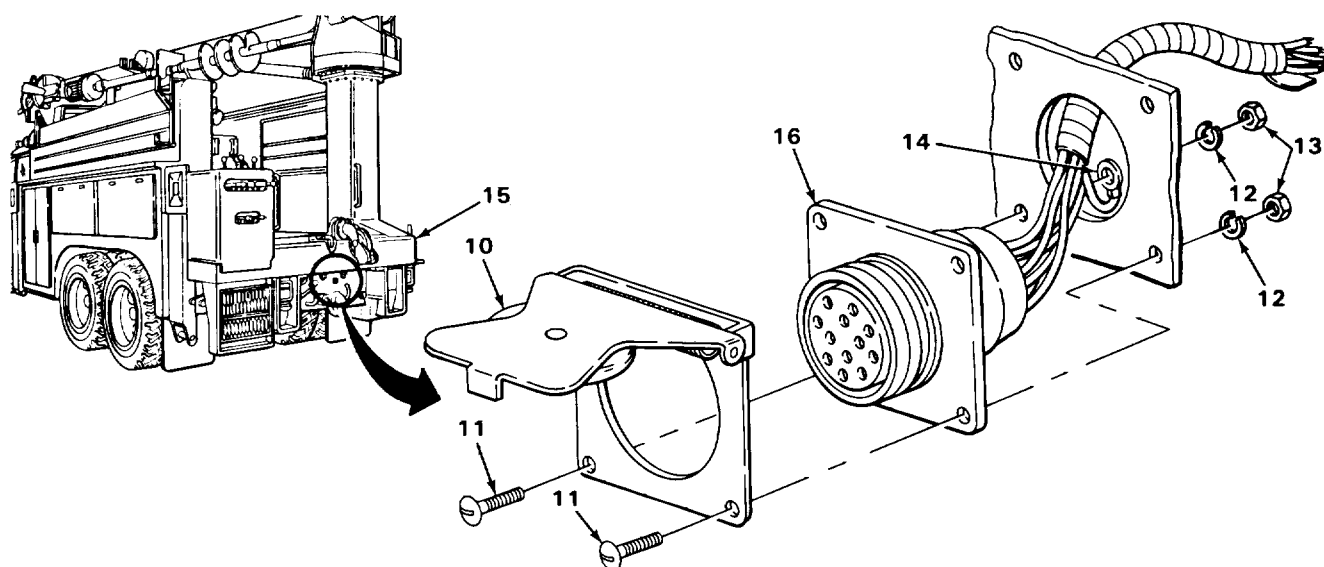
TA238255

24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED				
10.	Floormat retainer (1)	Five screws (2)	Using number two cross-tip screw-driver, unscrew and take out.	
11.	Cab floor(3)	Floormat retainer (1)	Take off.	
				
12.	Ammeter (4)	Nut (5)	Using 3/8-inch open-end wrench, unscrew and take off.	
13.	24-volt system	Take off. wire lead (6)		
				
14.	24-volt converter switch (7)	Screw (8)	Using 1/4-inch flat-tip screwdriver, unscrew and loosen.	

24VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
15	24-volt system wire lead (9)	a. Take off. b. Take harness out.	
			
16.	24-volt receptacle cover (10)	a. Using 3/8-inch flat-tip screwdriver and 7/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (12).	
17.	Vehicle (15)	At cab, pull harness through grommet in floor, work along left frame towards rear, and pull harness out.	



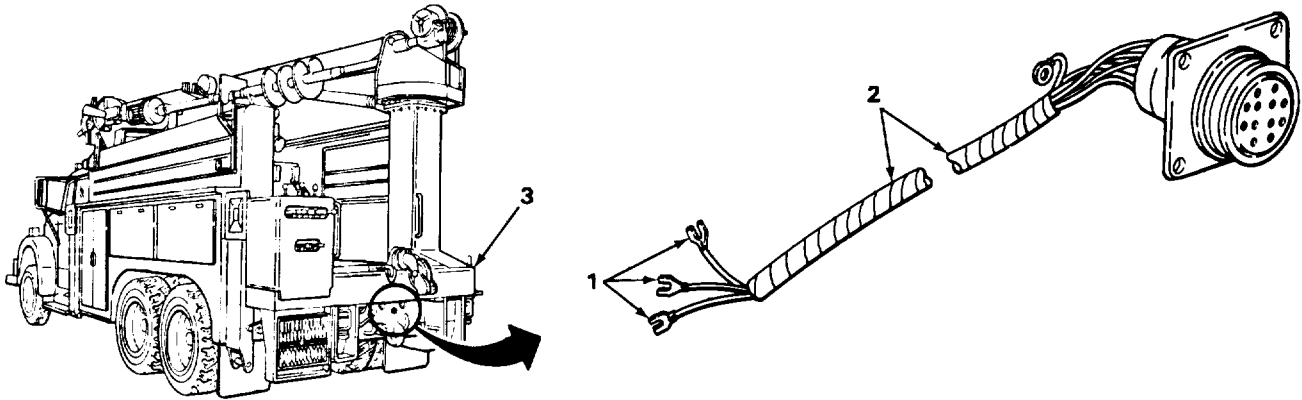
24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). WARNING Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
18	Terminals (1)	Clean with clean rag dampened with dry-cleaning solvent.	
19	24-volt wiring harness (2)	Wipe clean with damp rag, and using clean, dry rag, wipe dry.	
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.			
20	24-volt wiring harness (2)	a. Look for cut, burned, and worn insulation. b. Look for broken wires, and replace as necessary. c. Look for broken and corroded receptacle and terminals.	
INSTALLATION			
21.	Vehicle (3)	24-volt harness (2)	Route harness through receptacle hole to left frame and forward to cab.

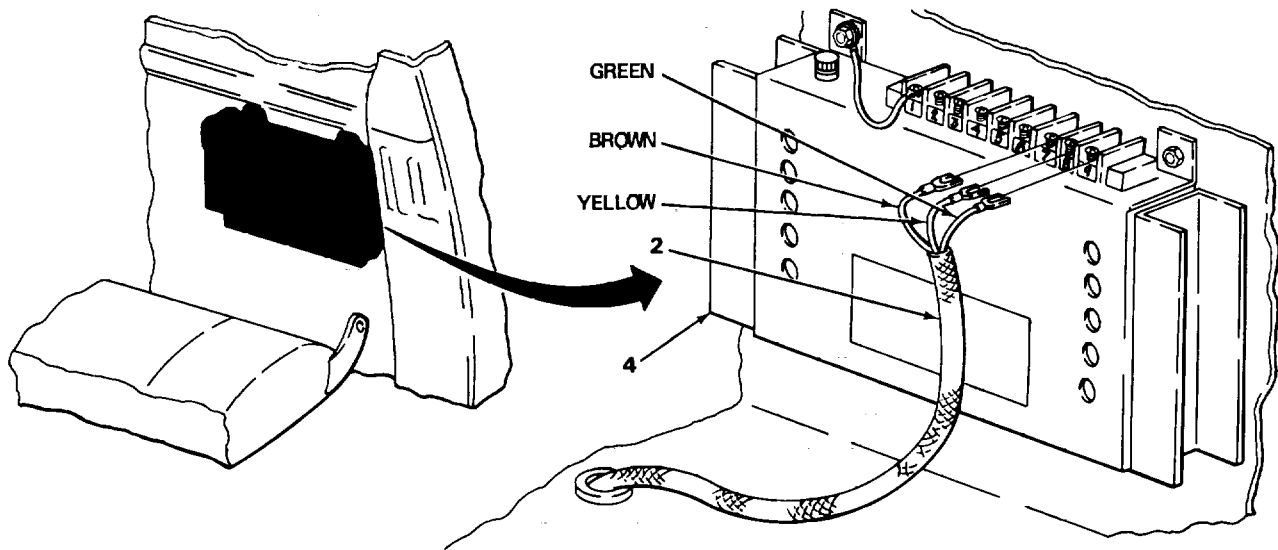
24VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



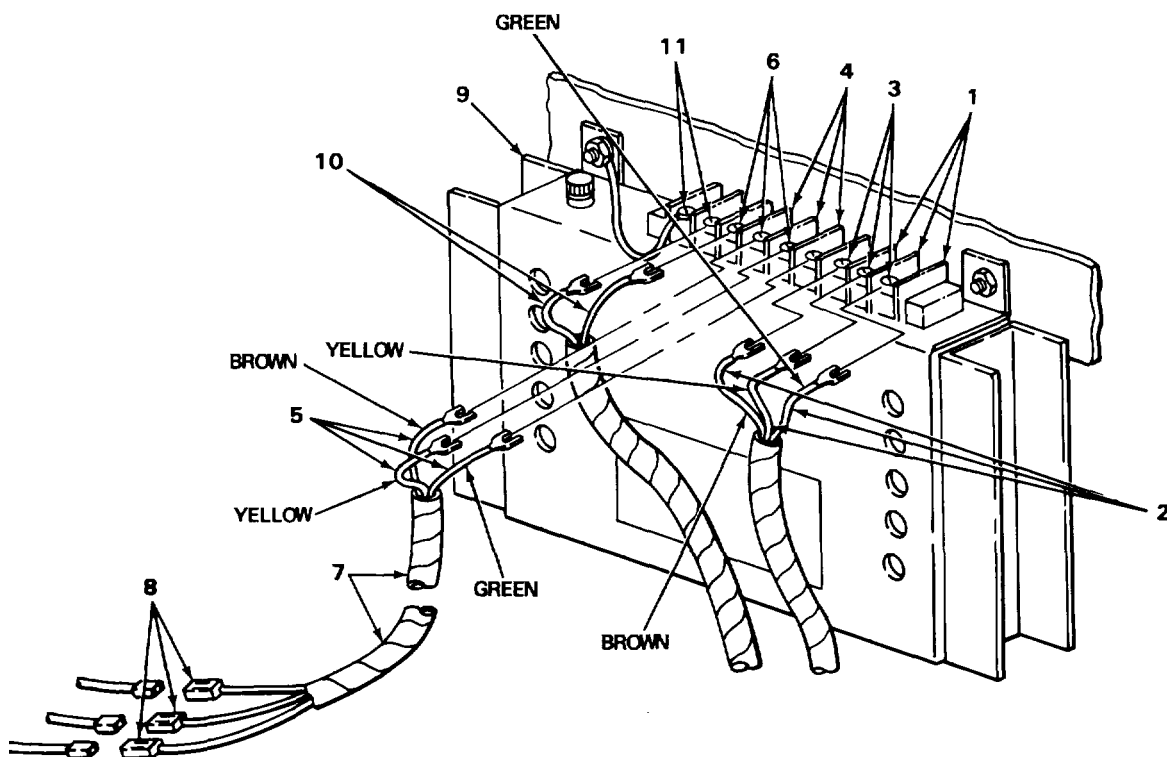
22.	24-volt converter (4)	24-volt harness (2)	Push harness up through grommet in cab floor and move to converter.



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24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
23	Terminals (1)	Three wires (2)	Put in position as tagged.
24	Three wires (2)	Three screws (3)	Screw in, and tighten using 1/4-inch flat-tip screwdriver.
25.	Terminals (4)	Three wires (5)	Put is position as tagged.
26.	Three wires (5)	Three screws (6)	Screw in, and tighten using 1/4-inch flat-tip screwdriver.
27.	Harness (7)	Three connectors (8)	a. Put in position as tagged. b. Push together.
28.	Converter (9)	Two wires (10)	Put in position.
29		Two screws (11)	Screw in, and tighten using 114-inch flat-tip screwdriver.



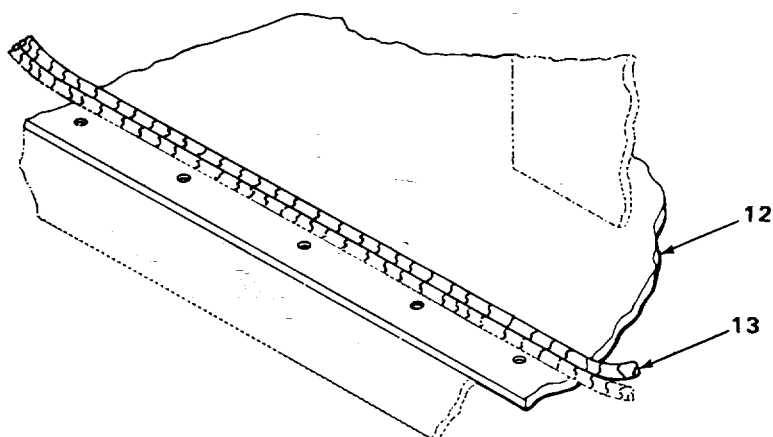
TA238259

24VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

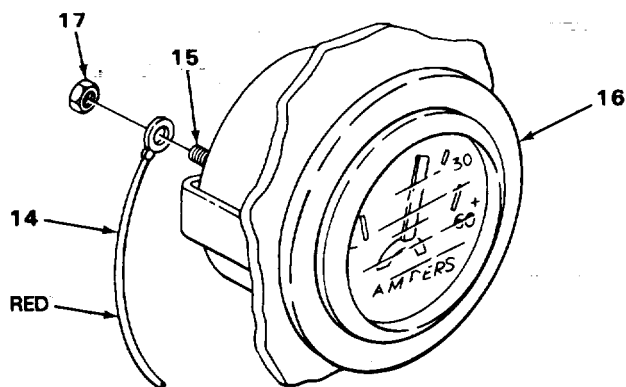
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

30.	Cab (12)	Two wire harnesses (13)	Guide harness along left door step and under instrument panel.

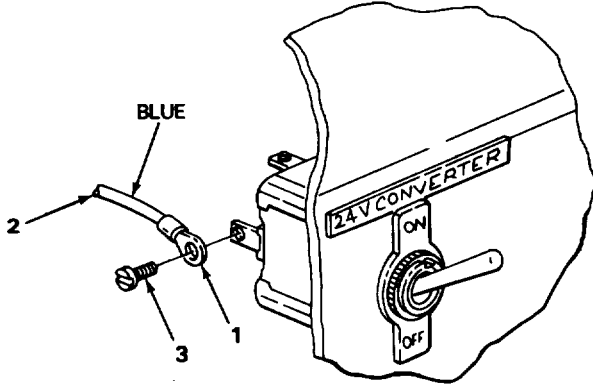
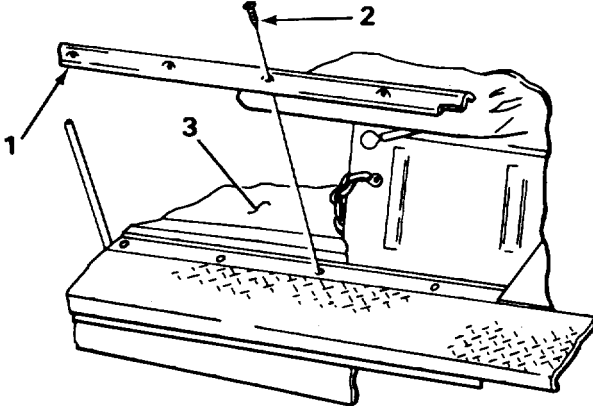


31.	Wire (14)	Ammeter terminal (15)	Put in position.
32	Ammeter (16)	Nut (17)	Screw in, and tighten using 3/8-inch open-end wrench.



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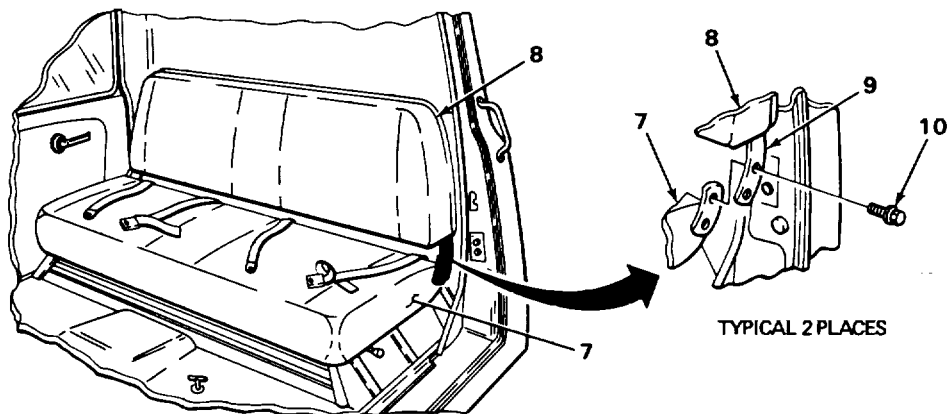
24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
33.	Terminal (1)	Wire (2)	Put in position.
34.	Wire (2)	Screw (3)	Screw In, and tighten using 1/4-inch screwdriver.
			
35.	Cab floor (4)	Floormat Retainer(5)	put in position over harness.
36.	Floormat retainer (5)	Five screws (6)	Screw in, and tighten using number two cross-tip screwdriver.
			
37.	Seat bottom (7)	Seat back (8)	Put in position.

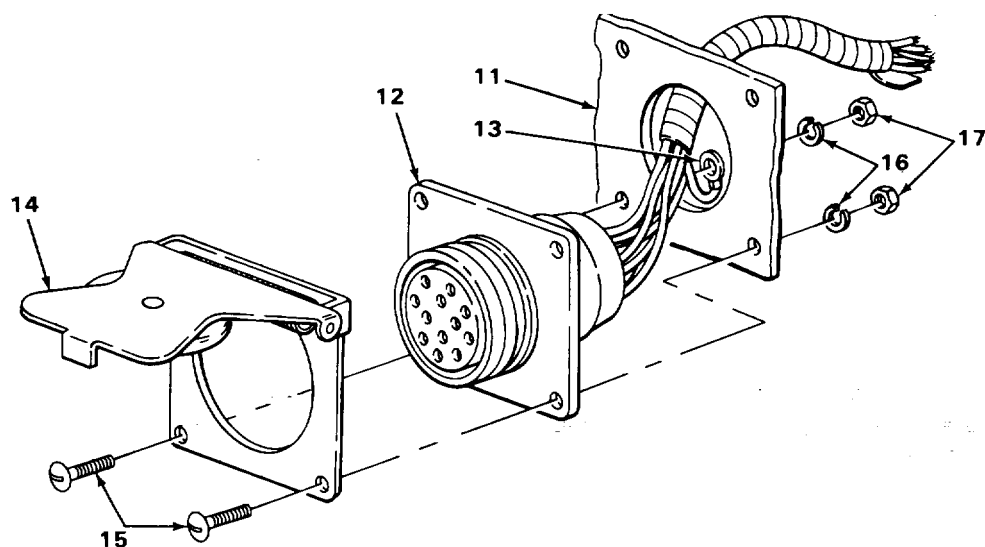
TA238261

24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
38.	Seat frame (9)	Four screws (10)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 3/8-inch drive.



39.	Vehicle (11)	24-volt receptacle (12), ground lead (13) and cover (14)	Put in position.
40.	Cover (14)	Four screws (15), new lockwashers (16), and nuts (17)	Screw in, and tighten using 3/8-inch flat-tip screwdriver and 7/16-inch open-end wrench.



TA238262

24-VOLT CONVERTER SYSTEM WIRING HARNESS - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Connect battery cables (TM 9-2320-269-20-1).
2. Check operation of 24-volt converter system (TM 9-2320-269-10).

TASK ENDS HERE**TAILLIGHT AND MARKER LIGHT WIRING HARNESS**

This task covers:

a. Removal (page 2-512)	c. Inspection/Replacement (page 2-516)
b. Cleaning (page 2-515)	d. Installation (page 2-516)

INITIAL SETUP**Tools**

Pliers, diagonal cutting
Screwdriver, cross-tip, number one
Wrench, 7/16-inch, open-end

Personnel Required

One

Equipment Condition**Materials/Parts**

Lockwashers, bracket and taillight
(three required)
Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)
Tag, marking (item 50, appendix B)

Battery cables disconnected
(TM 9-2320-269-20-1).
Seat back removed (TM 9-2320-269-20-2).

LOCATION**ITEM****ACTION****REMARKS****REMOVAL****NOTE**

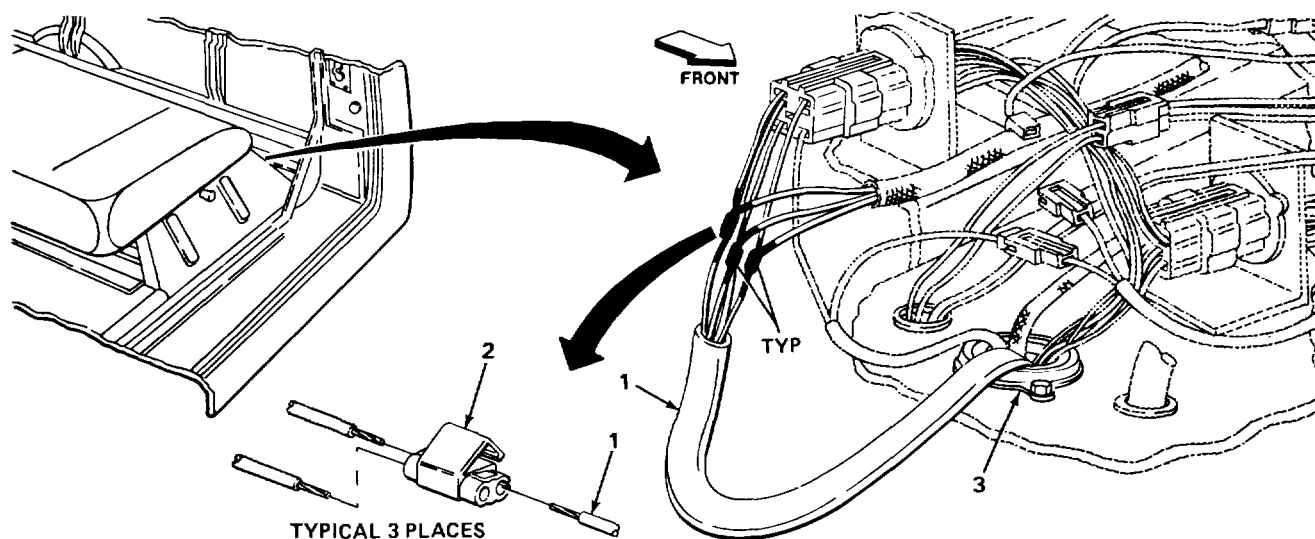
When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

TAILLIGHT AND MARKER LIGHT WIRING HARNESS - CONTINUED

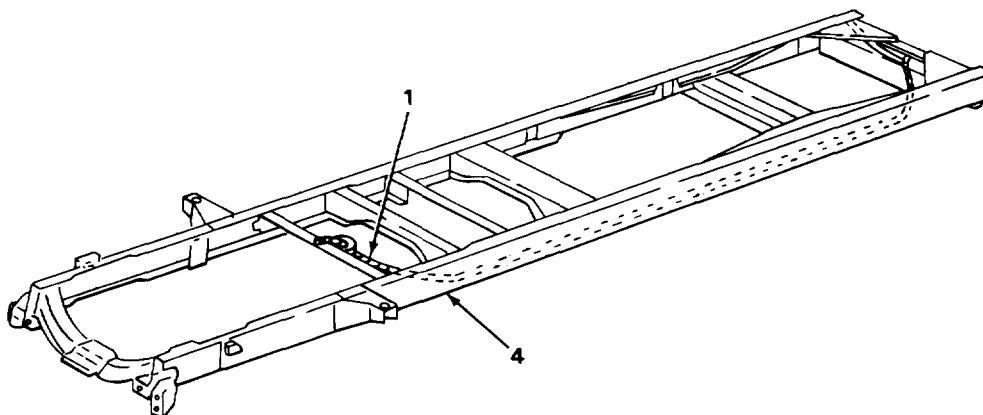
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

1.	Harness (1)	Four connectors (2)	Pull apart.
2.	Grommet (3)	Harness (1)	Push through.



3.	Frame (4)	Harness (1)	Working toward rear, pull out.



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TAILLIGHT AND MARKER LIGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

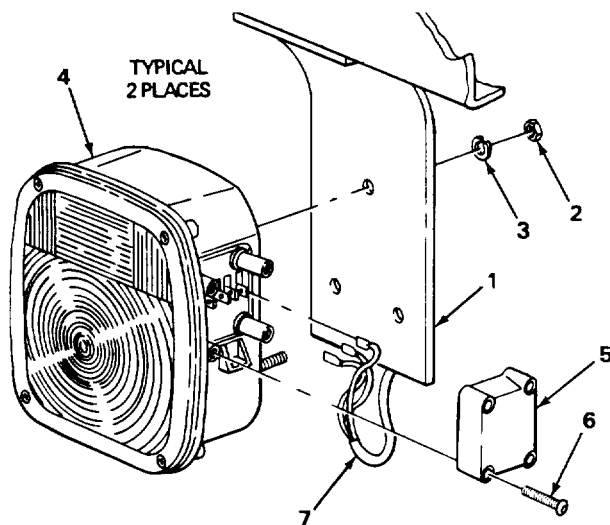
REMOVAL - CONTINUED

NOTE

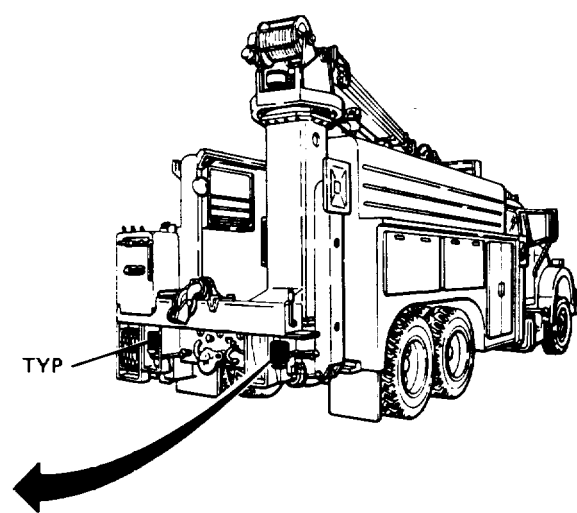
Removal procedure for both left and right taillights is the same.

Repeat steps 4 thru 8 for both taillights.

4.	Bracket (1)	Three nuts (2) and lockwashers (3)	a. Using 7/16-inch open-end wrench, unscrew and take off. b. Get rid of lockwashers (3).
5.	Taillight (4)	Take off.	
6.	Cover (5)	Four screws (6)	Using a number one cross-tip screw-driver, unscrew and loosen.
7.	Taillight (4)	Cover (5)	Take off.
8.	Three connectors (7)	Pull off.	



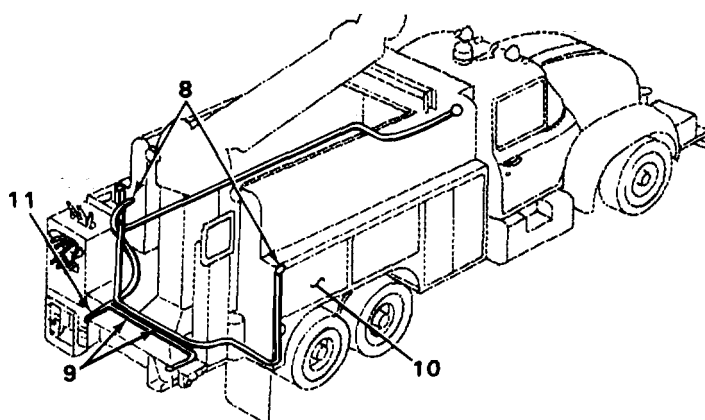
9.	Marker lights (8)	Marker light wires (9)



Using diagonal cutting pliers, cut. Cut wires at a convenient location, leaving enough wire to allow splicing of new wires.

TAILLIGHT AND MARKER LIGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
10.	Vehicle body (10)	Taillight and marker _ light harness (11)	a. Pull out and away from. b. Get rid of.



CLEANING

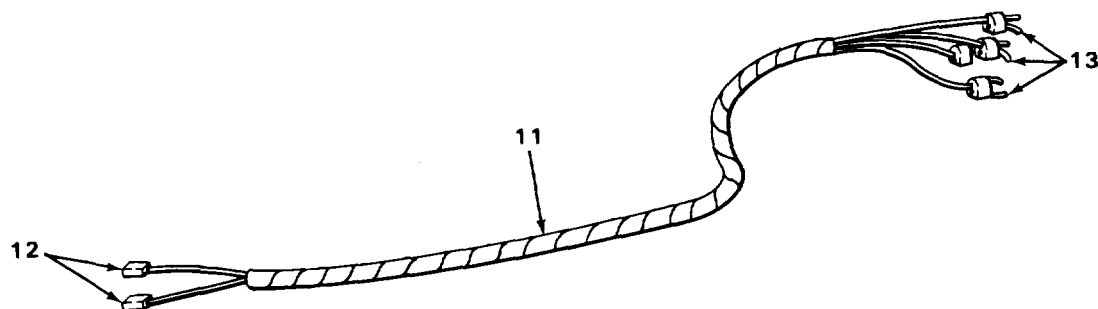
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

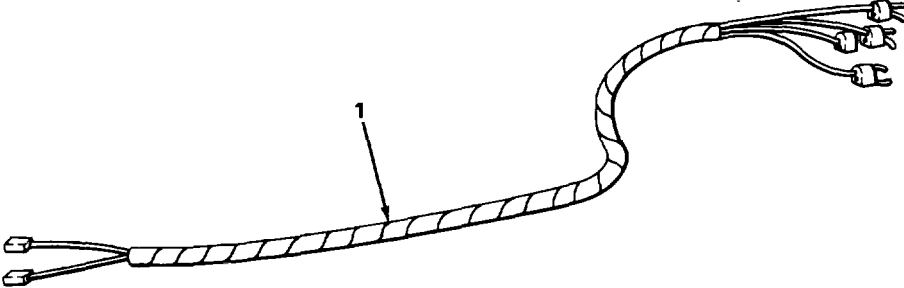
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

11.	Terminals (12) and connectors (13)	Clean with clean rag dampened with dry- cleaning solvent.
12.	Taillight and marker light harness (11)	Wipe clean with damp rag, and using a clean, dry rag, wipe dry.



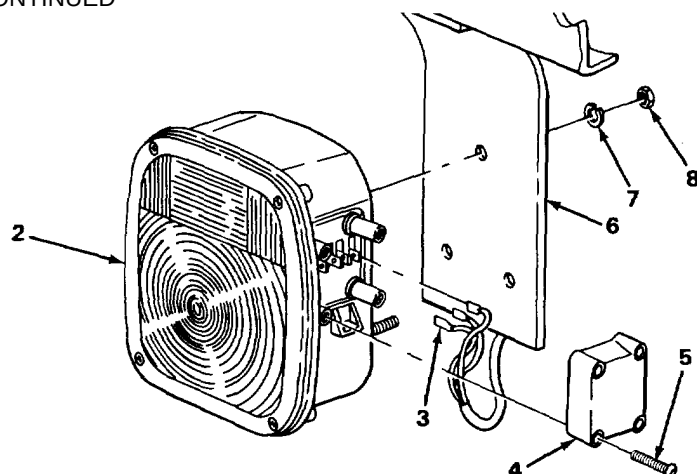
TA238265

TAILLIGHT AND MARKER LIGHT WIRING HARNESS - CONTINUED

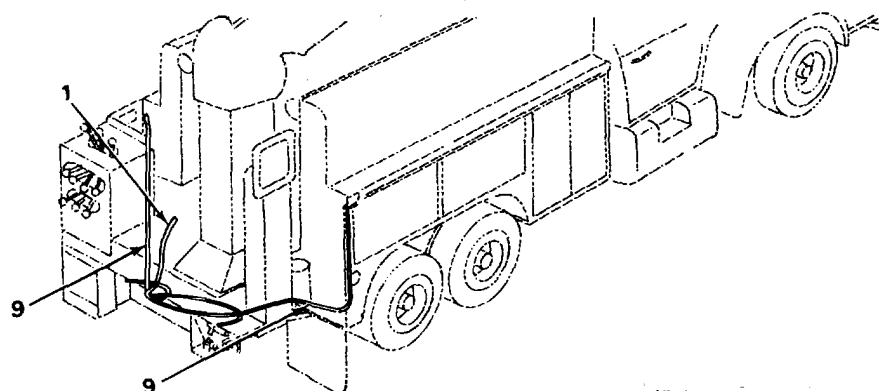
LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged or defective parts, as needed.			
13	Taillight and marker light harness (1)	a. Look for cut, burned, and worn insulation. b. Look for broken wires, and replace as necessary. c. Look for broken and corroded receptacle and terminals.	
INSTALLATION			
14.	Taillight (2)	Three connectors (3)	Push on.
15	Cover (4)	Put in position.	
16.	Cover (4)	Four screws (5)	Screw in, and tighten using number one cross-tip screwdriver.
17	Bracket (6)	Taillight (2)	Put in position.
18	Taillight (2)	Three new lock-washers (7) and nuts (8)	a. Screw on, and tighten using 7/16-inch open-end wrench. b. Repeat steps 14 thru 18 for other taillight.

LOCATION	ITEM	ACTION	REMARKS

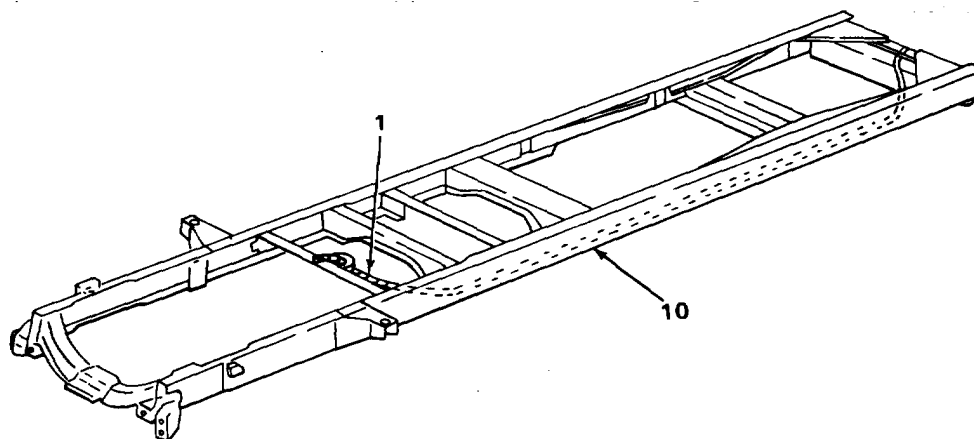
INSTALLATION - CONTINUED



19	New harness (1)	Two marker light	a. Using diagonal cutting pliers, cut to desired length. b. Splice to connect to harness (8).



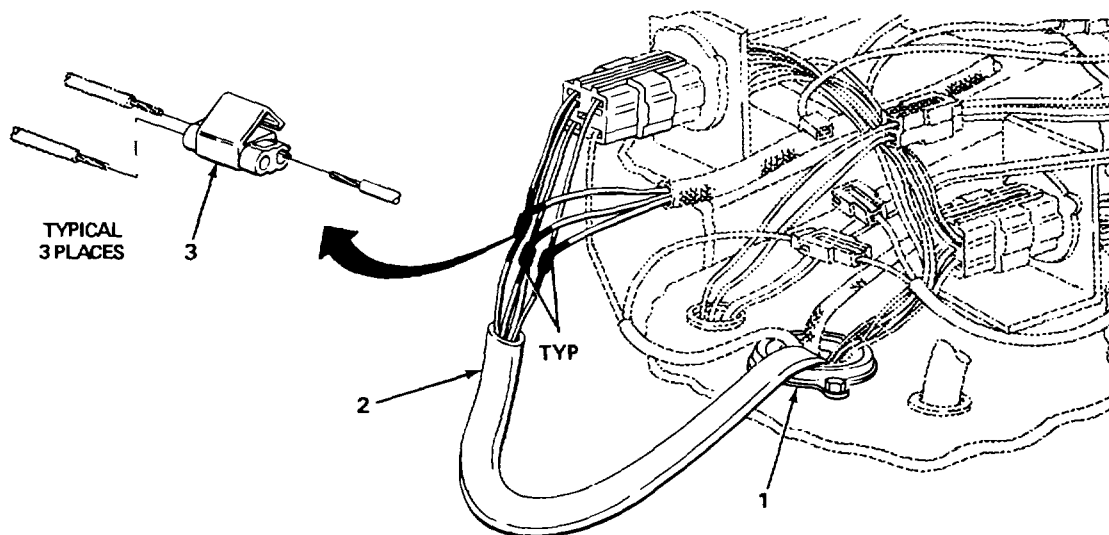
20.	Frame (10)	New harness (1)	Guide along frame (10) towards cab.



TA238267
2-517

TAILLIGHT AND MARKER LIGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
21.	Grommet (1)	New harness (2)	Push through into cab.
22.	New harness (2)	Four connectors (3)	Push together.

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Connect battery cables (TM 9-2320-269-20-1).
2. Check operation of taillights, stoplights, turn signals, and marker lights (TM 9-2320-269-10).
3. Install seat back (TM 9-2320-269-20-2).

TASK ENDS HERE

12-VOLT TRAILER HARNESS

This task covers:

a. Removal (page 2-519)	c. Inspection/Replacement (page 2-522)
b. Cleaning (page 2-522)	d. Installation (page 2-523)
-

INITIAL SETUP**Tools**

Pliers, diagonal cutting
 Screwdriver, flat-tip, 1/4-inch
 Screwdriver, flat-tip, 3/8-inch
 Wrench, open-end, 7/16-inch

Materials/Parts

Lockwasher, ground lead wire
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)
 Tag, marking (item 50, appendix B)

Personnel Required

One

Equipment Condition

Battery cables disconnected
 (TM 9-2320-269-20-1).
 Bottom seat removed
 (TM 9-2320-269-20-2).

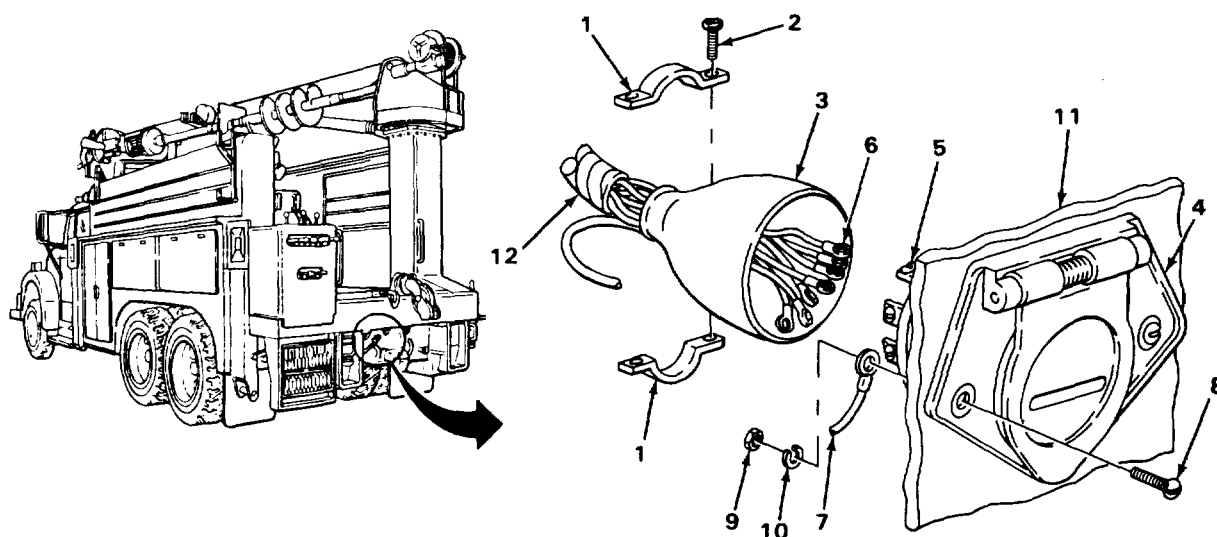
LOCATION	ITEM	ACTION	REMARKS

REMOVAL**NOTE**

When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

12-VOLT TRAILER HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
1.	Clamp (1)	Two screws (2)	Using 1/4-inch flat-tip screwdriver, unscrew and take out.
2.	Cover (3)	Clamp (1)	Take off.
3.	Receptacle (4)	Cover (3)	Slide back.
4.		Seven screws (5)	Using 1/4-inch flat-tip screwdriver, unscrew part way.
5.	Seven wires (6)	Take off.	
6.	Ground lead wire (7)	Screw (8), nut (9), and lockwasher (10)	a. Using 3/8-inch flat-tip screwdriver and 7/16-inch open-end wrench, unscrew and take off. b. Get rid of lockwasher (10).
7.	Frame (11)	Ground lead wire (7)	Take off.
8.	Harness (12)	Cover (3)	Slide off.

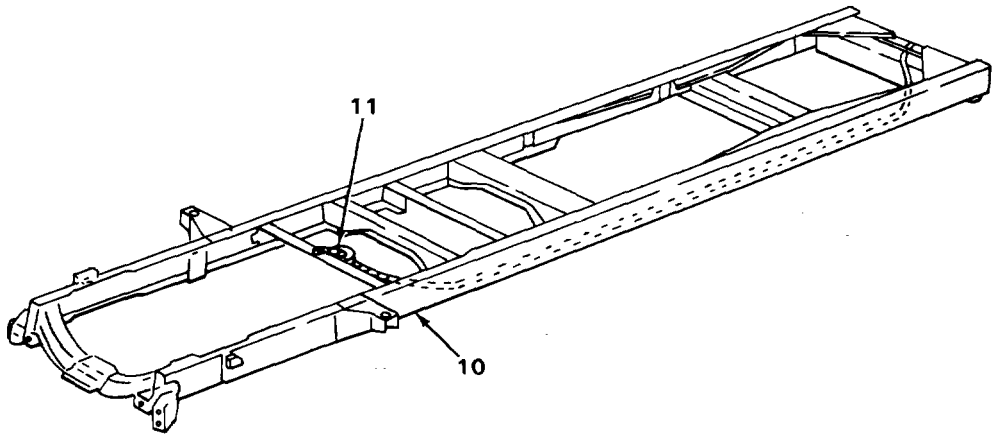


12-VOLT TRAILER HARNESS - CONTINUED

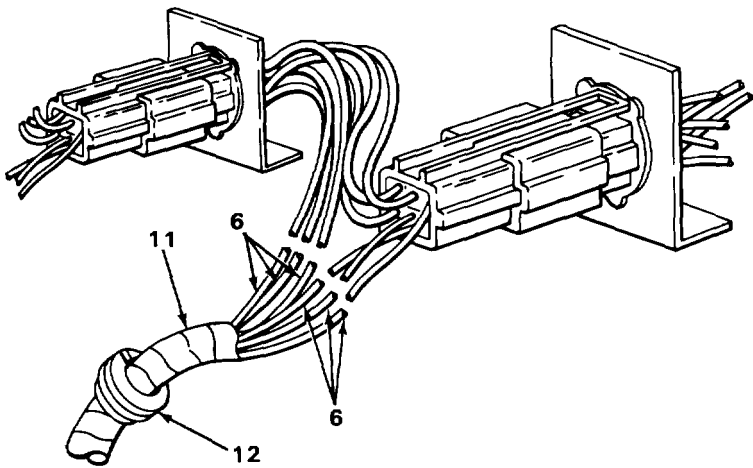
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

9. Frame (10)	Harness (11)	Working towards cab, pull out.	



10. Harness (11)	Six wires (6)	Using diagonal cutting pliers, cut. Leave enough wire to resplice to harness.	
11. Grommet (12)	Harness (11)	Pull out.	



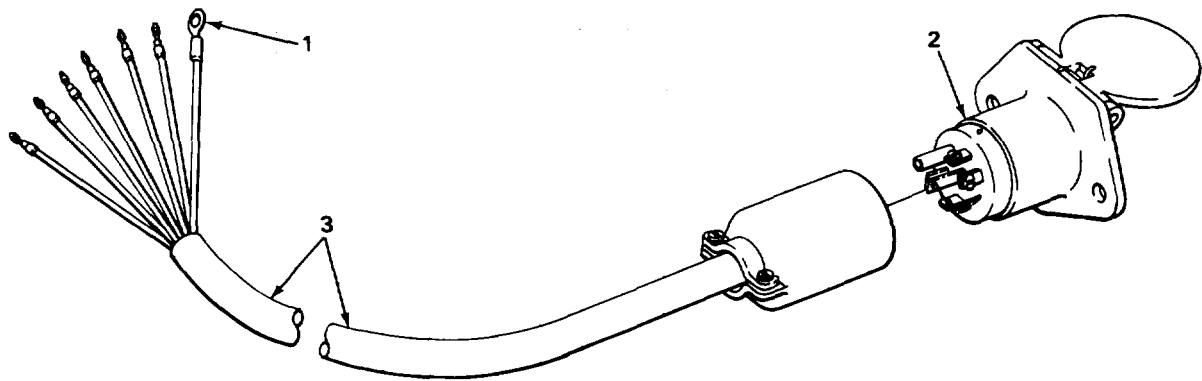
LOCATION	ITEM	ACTION	REMARKS
CLEANING			
NOTE			
For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).			
WARNING			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause injury or death.			
12.	Terminals (1) and receptacle (2)		Clean with clean rag dampened with drycleaning solvent.
13.	Harness (3)		Wipe clean with damp rag and dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

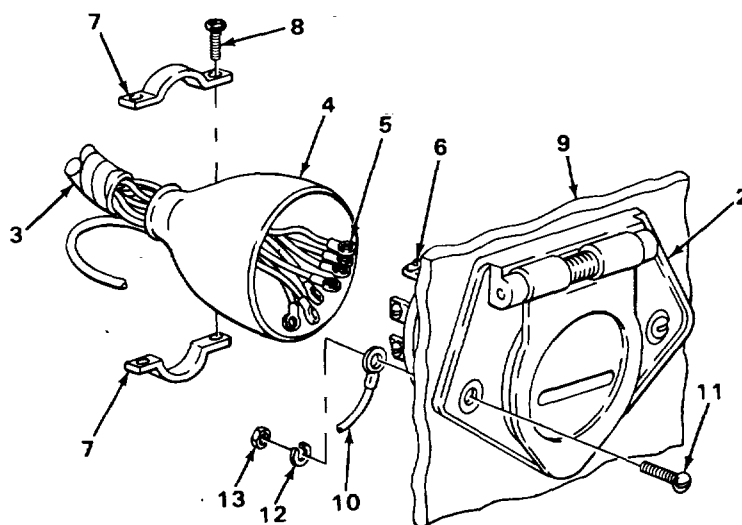
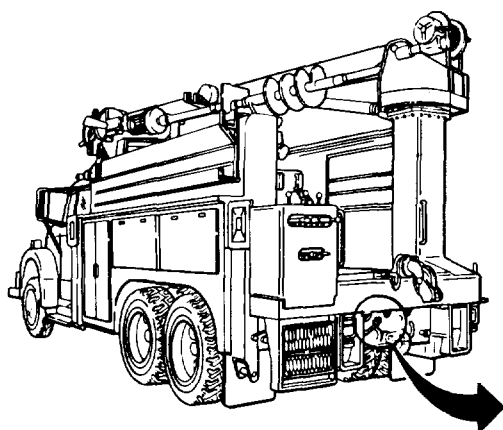
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts, as needed.

14.	Harness (3)	a. Look for cut, burned, and worn insulation. b. Look for broken wires. c. Look for broken and corroded receptacle (2) and terminals (1).



12-VOLT TRAILER HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
15. New harness (3)	Cover (4)		Put on and slide back, out of way.
16. Receptacle (2)	Seven wires (5)		Put in position.
17. Seven wires (5)	Seven screws (6)		Tighten using 1/4-inch flat-tip screwdriver.
18. New harness (3)	Cover (4)		Slide into position.
19. Cover (4)	Clamp (7)		Put in position.
20. Clamp (7)	Two screws (8)		Screw in, and tighten using 1/4-inch flat-tip screwdriver.
21. Frame (9)	Ground lead		Put in position.
22.	Screw (11), new lockwasher (12), and nut (13)		wire (10) Screw on, and tighten using 3/8-inch flat-tip screwdriver and 7/16-inch open-end wrench.

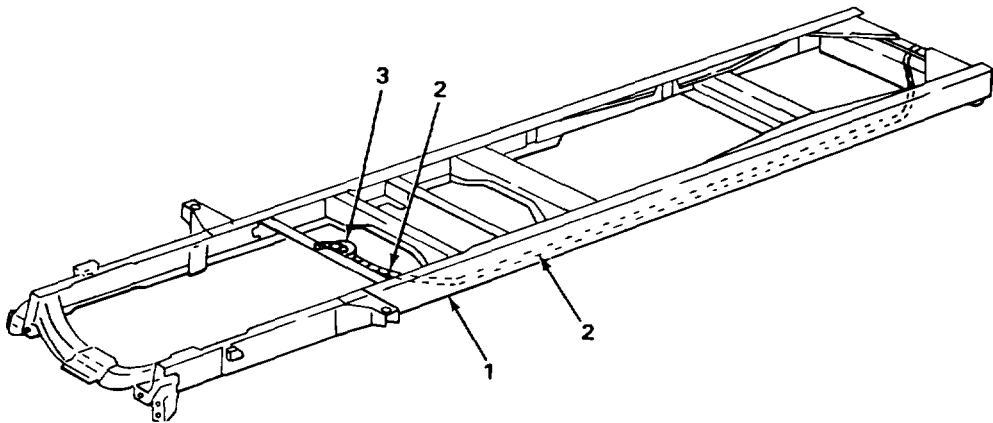


12-VOLT TRAILER HARNESS - CONTINUED

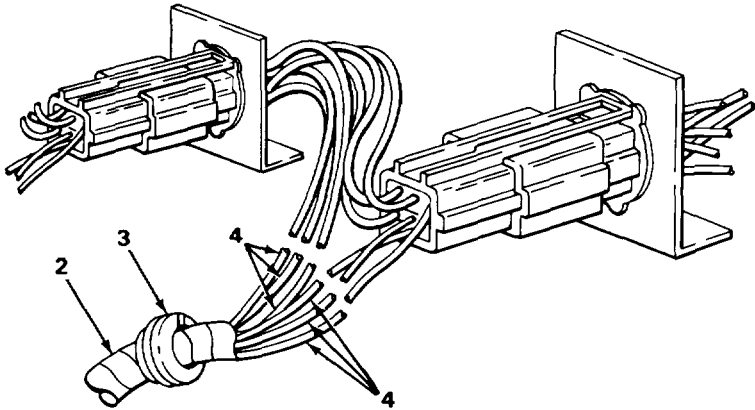
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

23. Frame (1)
- New harness (2)
- Route harness (2) along left frame to-wards grommet (3) in cab floor.



24. Grommet (3)
- New harness (2)
- Pull through grommet (3) into cab.
25. New harness (2)
- Six wires (4)
- Splice into existing harness, as tagged



NOTE

- FOLLOW-ON MAINTENANCE:
1. Connect battery cables (TM 9-2320-269-20-1).
 2. Check operation of 12-volt trailer harness (TM 9-2320-269-10).
 3. Install bottom seat (TM 9-2320-269-20-2).

TASK ENDS HERE

MAIN WIRING HARNESS

This task covers:

a. Removal (page 2-525)	c. Inspection/Replacement (page 2-541)
b. Cleaning (page 2-539)	d. Installation (page 2-540)

INITIAL SETUP**Tools**

Pliers, diagonal cutting
 Pliers, slip-joint, straight-nose
 Screwdriver, cross-tip, number two
 Screwdriver, flat-tip, 114-inch
 Wrench, open-end, 318-inch

Personnel Required

One

Equipment Condition

Battery cables disconnected
 (TM 9-2320-269-20-1).

Materials/Parts

Lockwasher, trailer lighting
 warning light
 Rags, cleaning (item 42, appendix B)
 Solvent, drycleaning (item 49,
 appendix B)
 Tag, marking (item 50, appendix B)

Air tanks drained
 (TM 9-2320-269-20-1).
 Right and left side hoods open
 (TM 9-2320-269-20-1).

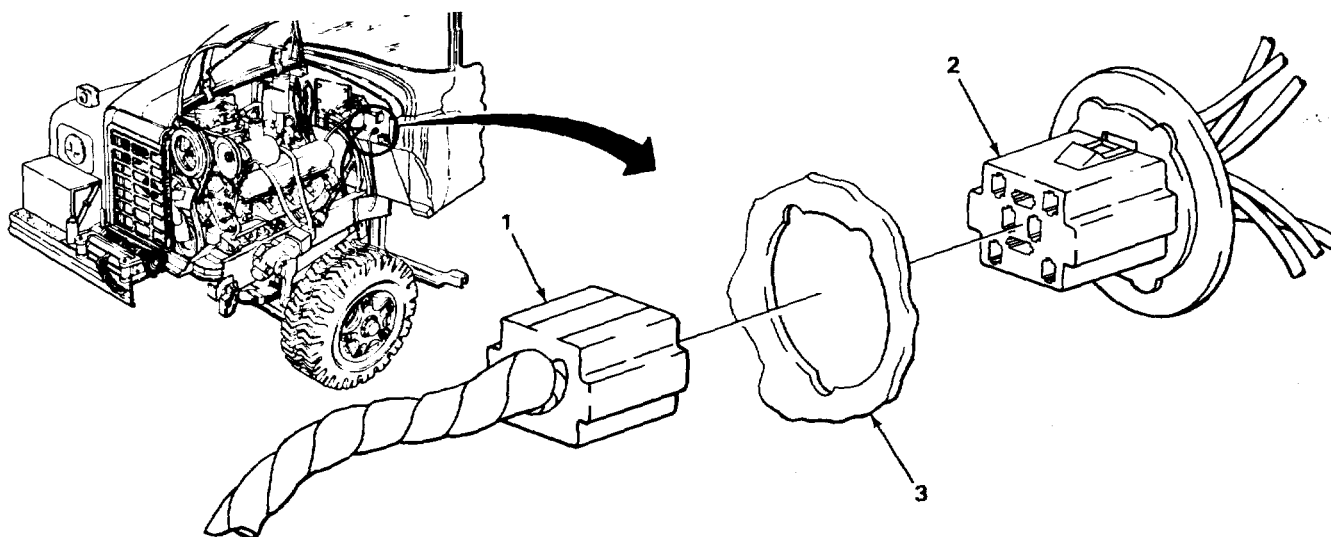
		ACTION	
LOCATION	ITEM		REMARKS

REMOVAL**NOTE**

When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

MAIN WIRING HARNESS - CONTINUED

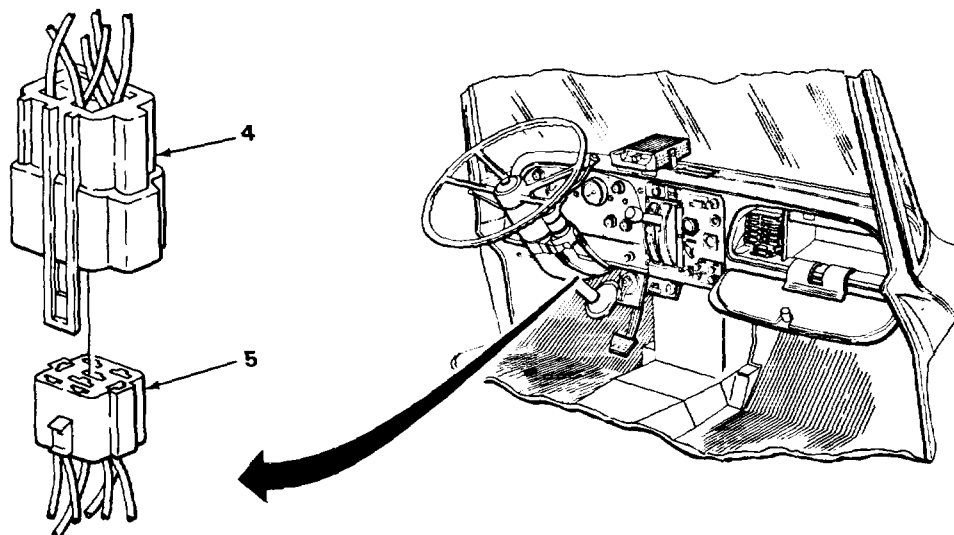
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
1. Front harness connector (1) 2. Firewall (3)	Main harness connector (2) Main harness connector (2)	Pull apart.	a. Using straight-nose slip-joint pliers, turn to align projections with slots in firewall (3). b. Take out.



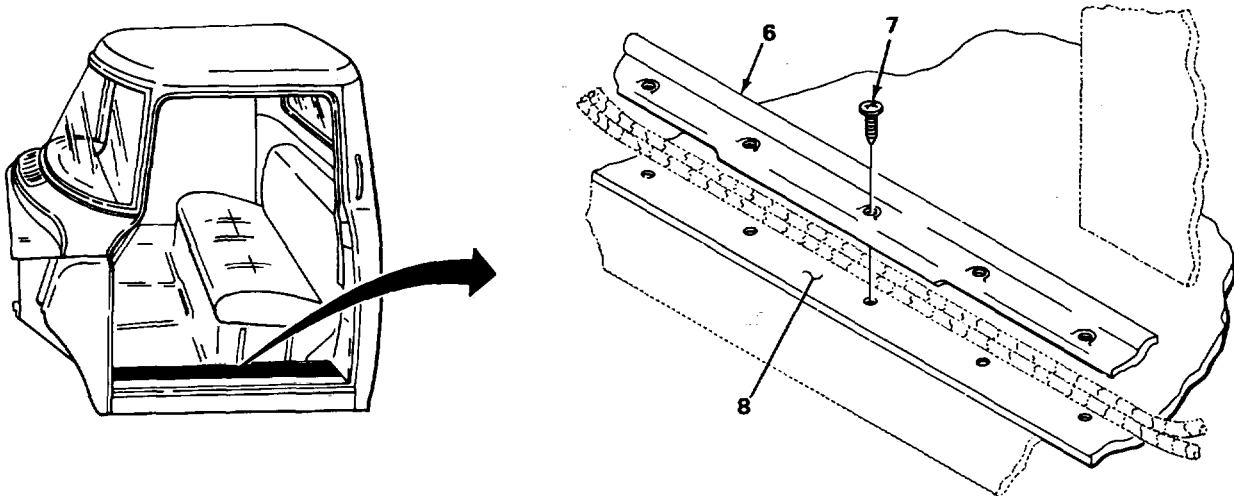
3. Harness connector (4)

Dimmer switch connector (5)

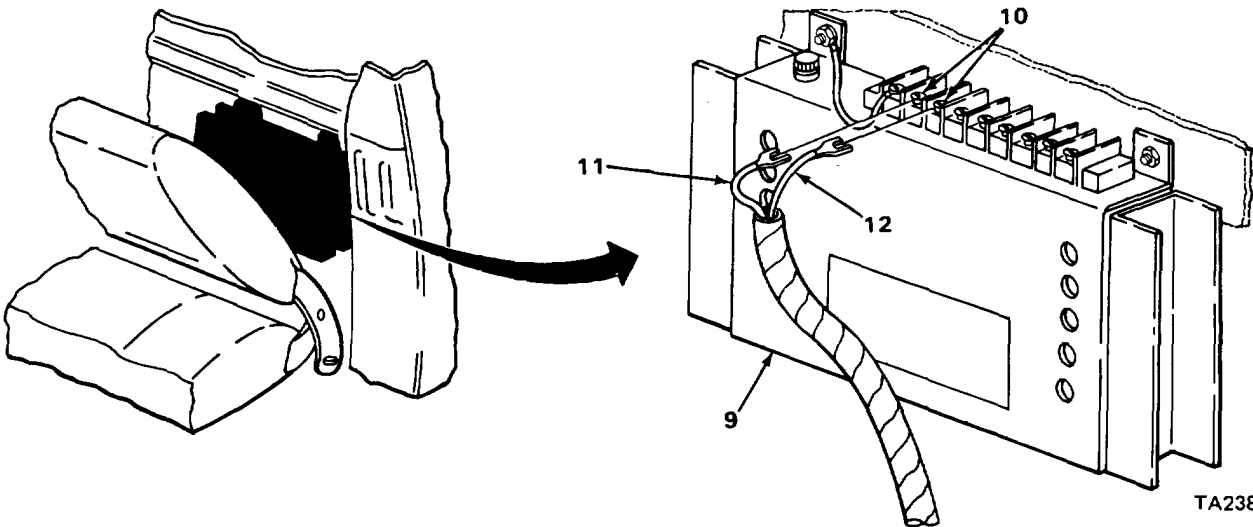
Pull apart.



LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
4. Floormat retainer (6)	Five screws (7)		Using number two cross-tip screwdriver, unscrew and take out.
5. Cab floor (8)	Floormat retainer (6)		Take off.



6. 24-volt converter (9)	Two screws (10)	Using 1/4-inch flat-tip screwdriver, unscrew and loosen.
7.	Battery wire (11) and ignition wire (12)	Take off.

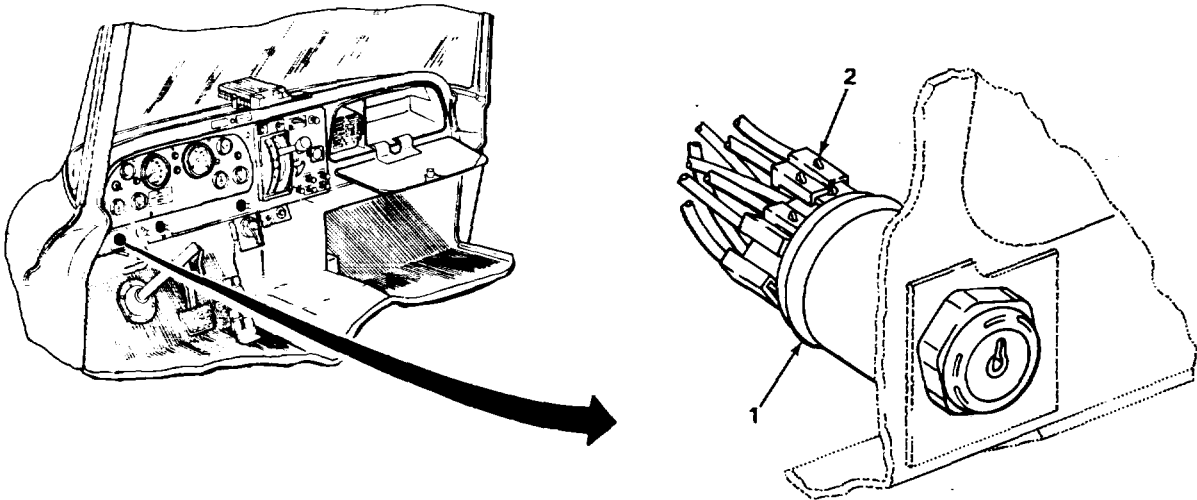


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LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

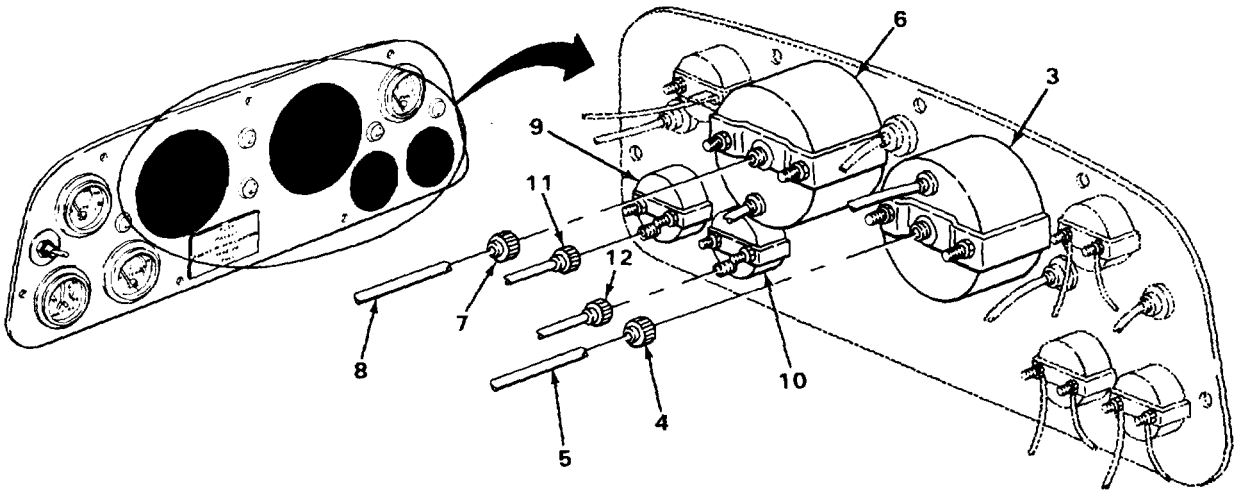
8. Key switch (1)	Lead wires (2)	Pull off.



9. Tachometer (3)	Nut (4)	Using straight-nose slip-joint pliers, unscrew and take off from under instrument panel. Pull out.
10.	Cable (5)	unscrew and take off from under instrument panel. Pull out.
11. Speedometer (6)	Nut (7) Using straight-nose slip-joint pliers,	unscrew and take off from under instrument panel. Pull out.
12.	Cable (8)	Using straight-nose slip-joint pliers, unscrew and take off from under instrument panel.
13. Two air gages (9) and (10)	Two nuts (11) and (12)	

LOCATION	ITEM	ACTION	REMARKS

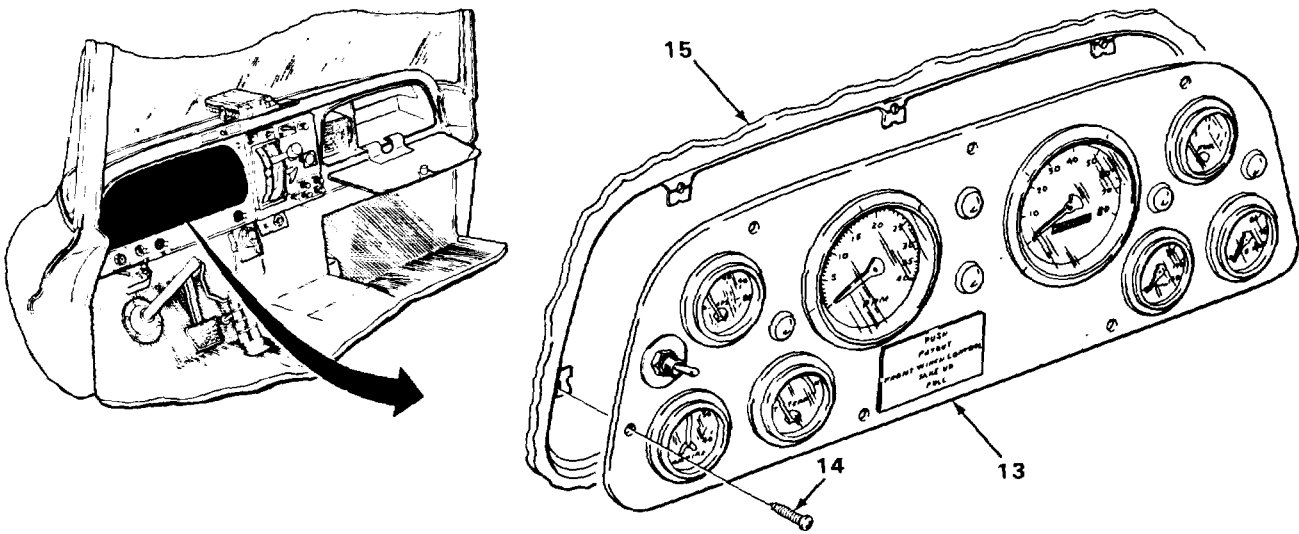
REMOVAL - CONTINUED



- 14. Instrument cluster panel (13)
- 15. Instrument panel (15)

Six screws (14)
Instrument cluster panel (13)

Using number two cross-tip screwdriver, unscrew and take out. Pull forward.



MAIN WIRING HARNESS - CONTINUED

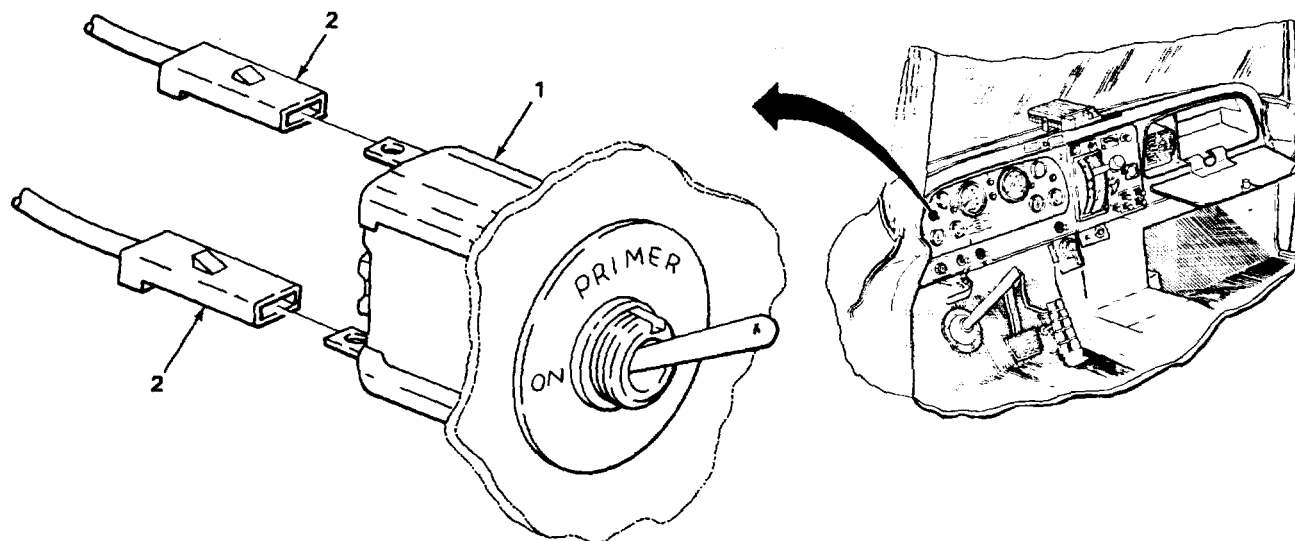
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

16 Primer switch (1)

Two connectors (2)

Pull off.



17. Ampere gage (3)

Two nuts (4) and
lead wires (5)18. Oil pressure
gage (6)Two nuts (7) and
lead wires (8)19. Water temperature
gage (9)Two nuts (10) and
lead wires (11)20. Left turn indicator
light (12)

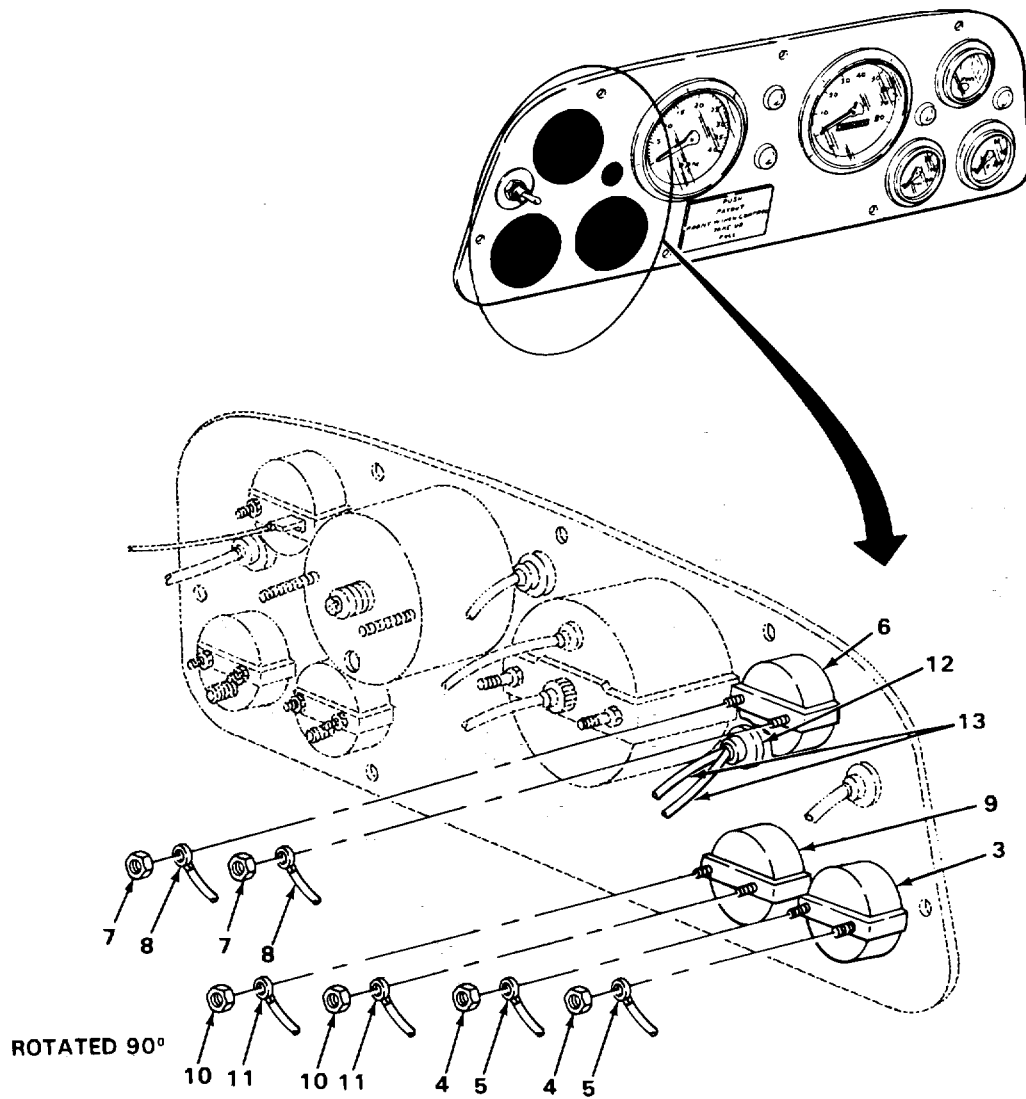
Two lead wires (13)

Using 3/8-inch open-end wrench,
unscrew and take off.Using 3/8-inch open-end wrench,
unscrew and take off.Using 3/8-inch open-end wrench,
unscrew and take off.

Using diagonal cutting pliers, cut.

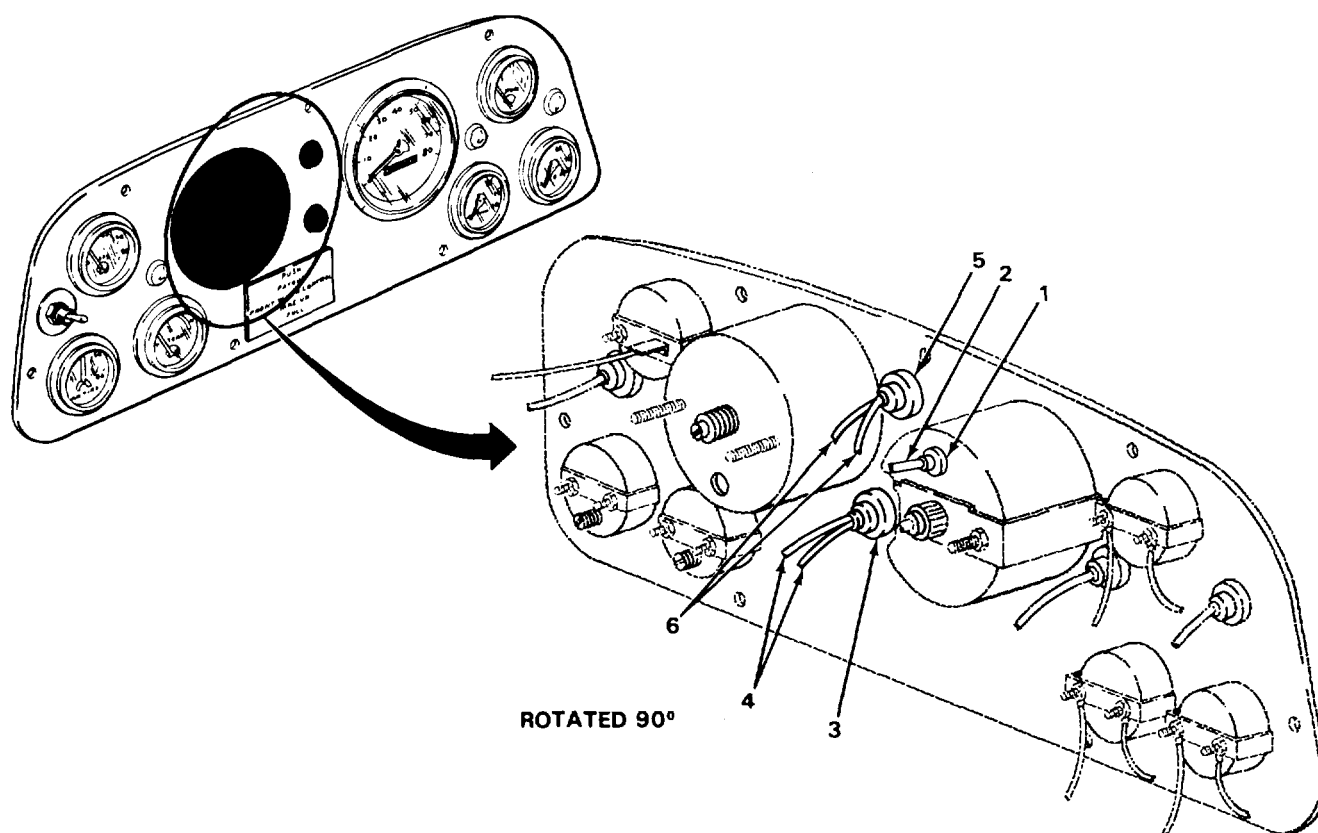
**Leave enough wire to splice to
harness.**

MAIN WIRING HARNESS - CONTINUED
REMOVAL - CONTINUED



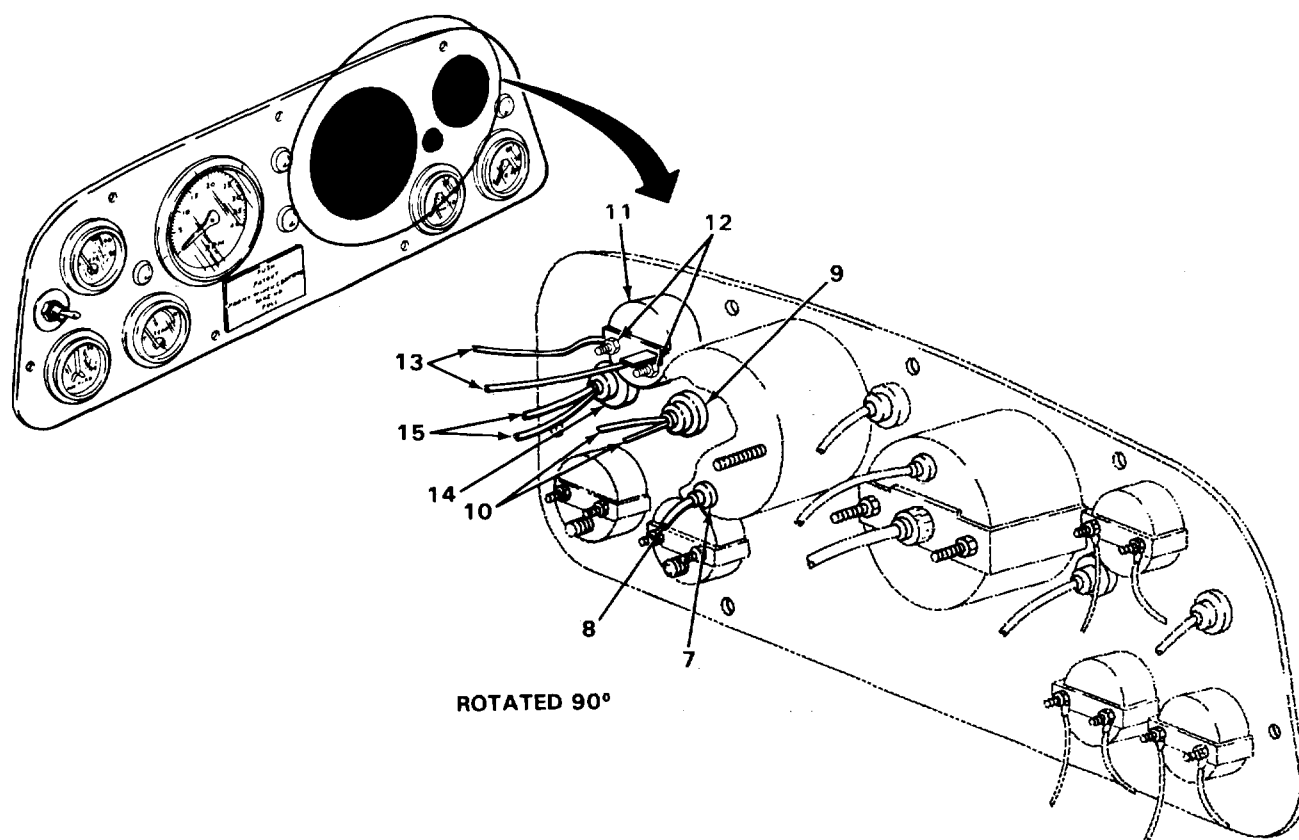
MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
21. Tachometer light (1)	Lead wire (2)	Using diagonal cutting pliers, cut.	Leave enough wire to splice to harness.
22. Antilock warning light (3)	Two lead wires (4)	Using diagonal cutting pliers, cut.	Leave enough wire to splice to harness.
23. Power divider warning light (5)	Two lead wires (6)	Using diagonal cutting pliers, cut.	Leave enough wire to splice to harness.



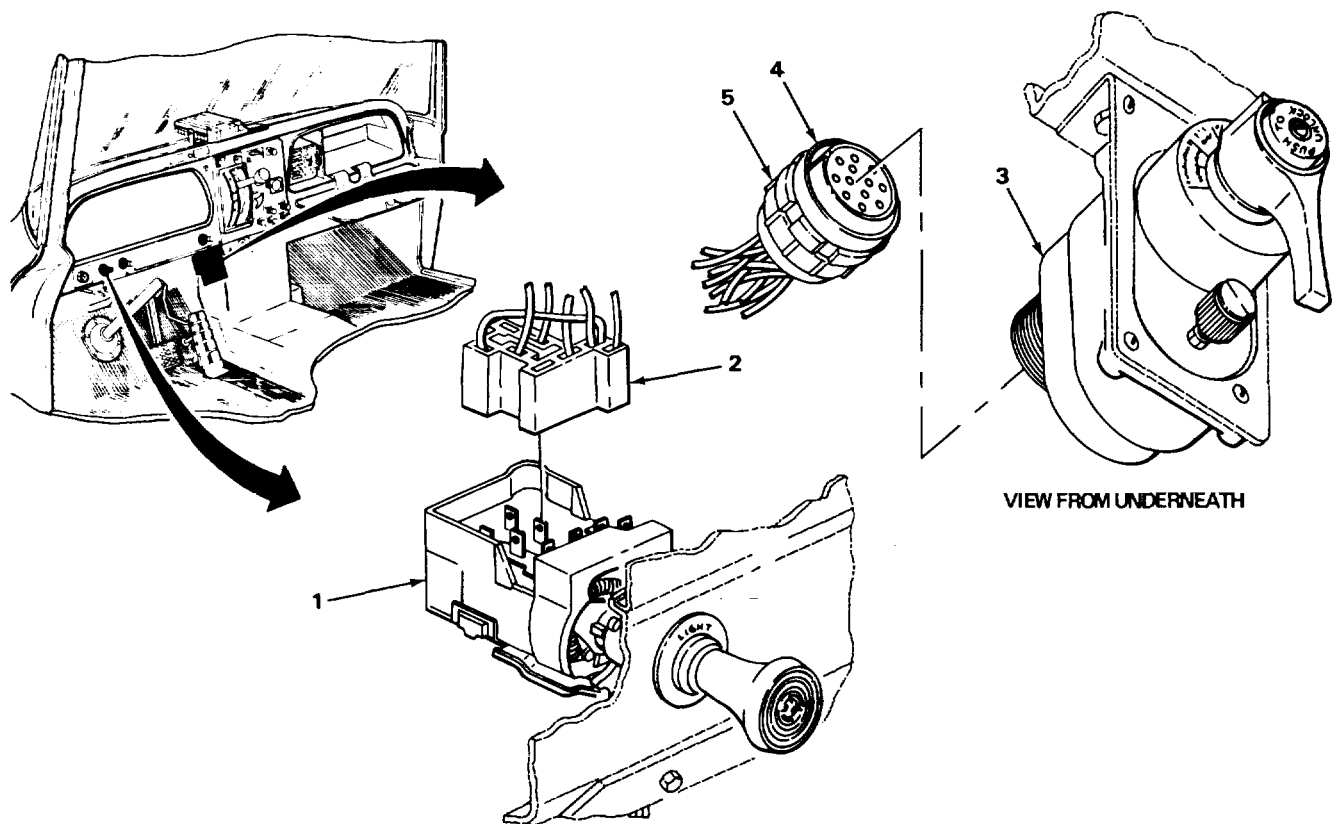
MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
24. Speedometer light (7)	Lead wire (8)	Using diagonal cutting pliers, cut.	Leave enough wire to splice to harness.
25. Right turn indicator light (9)	Two lead wires (10)	Using diagonal cutter pliers, cut.	Leave enough wire to splice to harness.
26. Fuel gage (11)	Two nuts (12)	Using 3/8-inch open-end wrench, unscrew and take off.	
27.	Two lead wires (13)	Take off.	
28. Air pressure warning light (14)	Two lead wires (15)	Using diagonal cutting pliers, cut.	Leave enough wire to splice to harness.



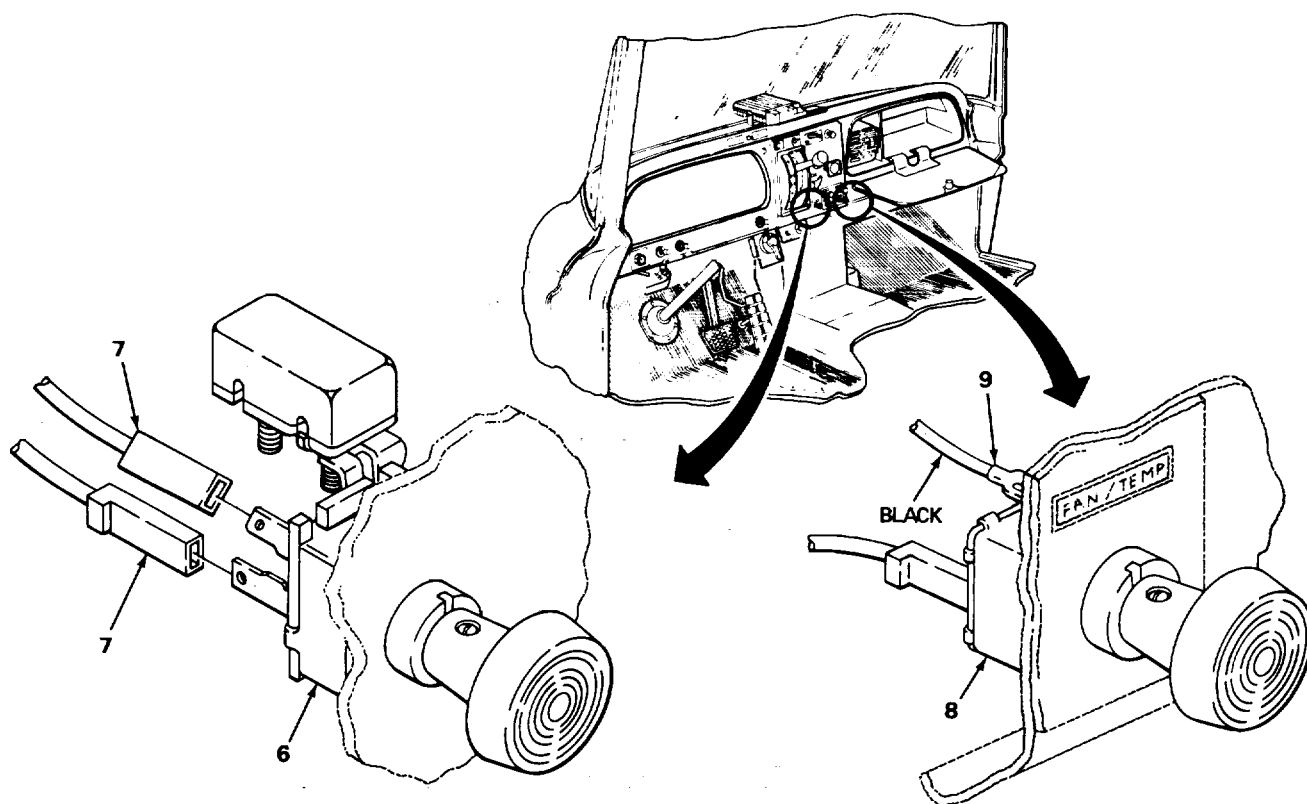
ROTATED 90°

LOCATION		ITEM	ACTION	REMARKS
REMOVAL- CONTINUED				
29.	Headlight switch (1)	Connector (2)		Pull apart.
30.	Marker light switch (3)	Nut (4)		Using straight-nose slip-joint pliers, unscrew.
31.		Connector (5)		Pull off.

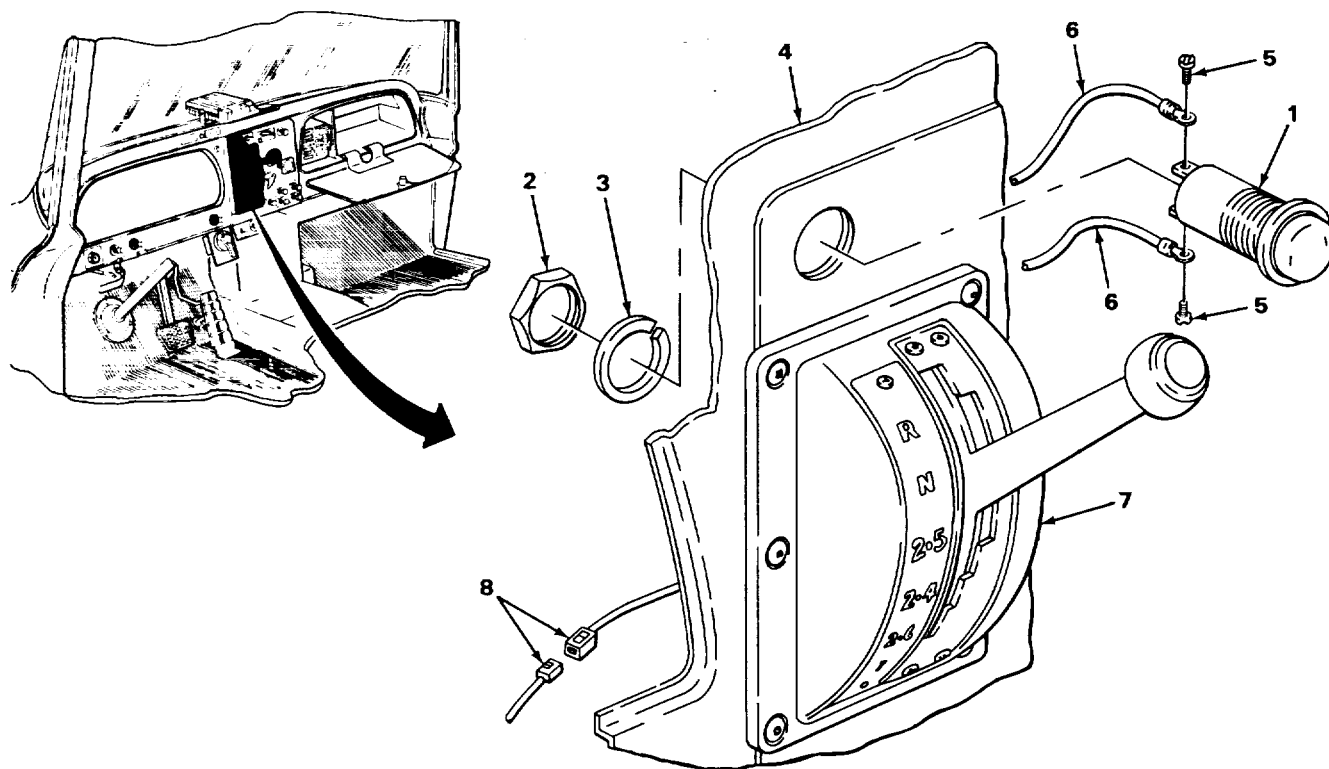


MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
32. Windshield wiper/ wash switch (6)	Two connectors (7)	Pull off.	
33. Heater fan switch (8)	Connector (9)	Pull off.	



LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
34. Trailer lighting warning light (1)	Nut (2) and lockwasher (3)	a. Using straight-nose slip-joint pliers, unscrew and take off. b. Get rid of lockwasher (3). Pull out.	
35. Instrument panel (4)	Trailer lighting warning light (1)		
36. Trailer lighting warning light (1)	Two screws (5)		
37.	Two lead wires (6)		
38. Shifter assembly (7)	Connector (8)		
			Using 1/4-inch flat-tip screwdriver, take out. Take off. Pull apart.

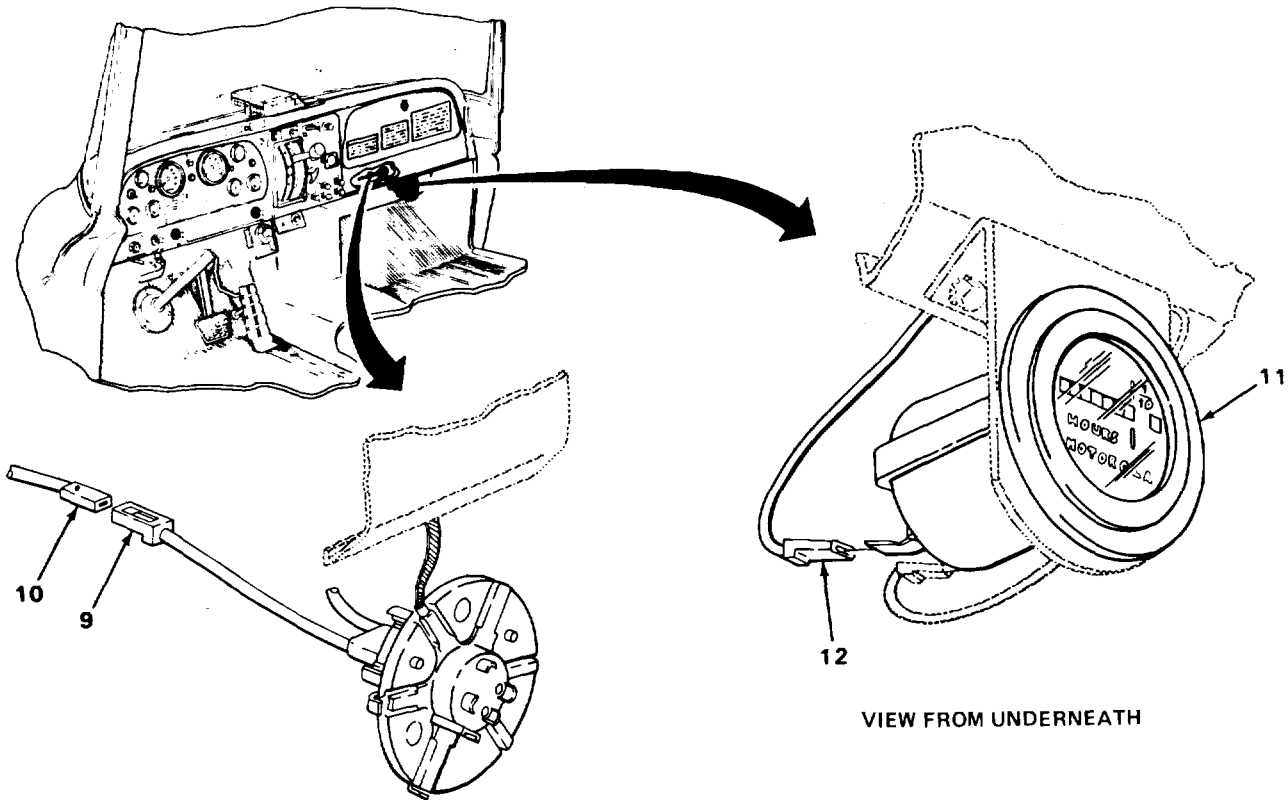


MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

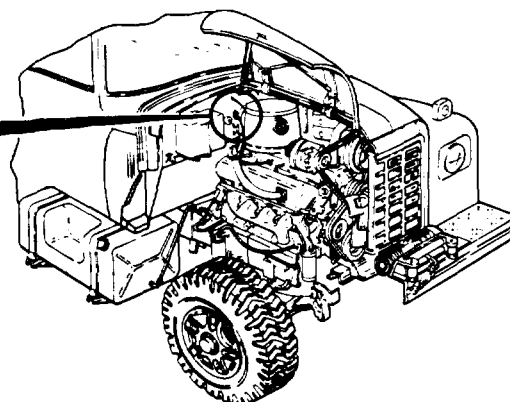
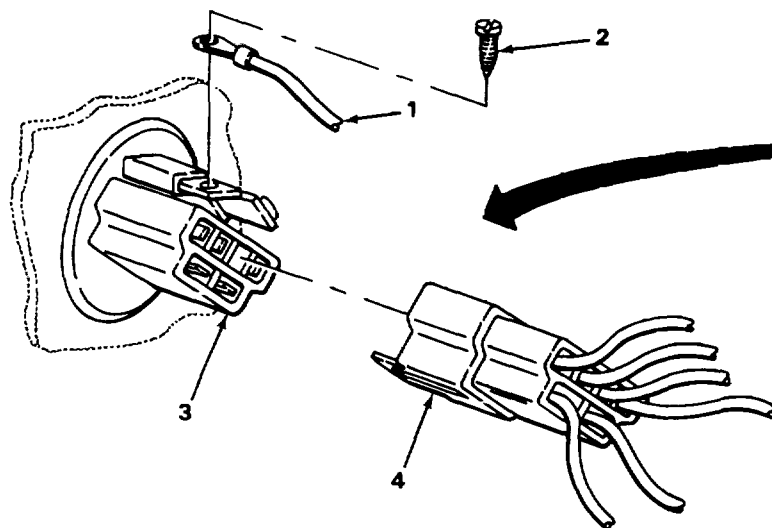
REMOVAL - CONTINUED

39. Optical lamp connector (9)	Main harness connector (10)	Pull apart.
40. Hourmeter(11)	Connector (12)	Pull apart.



MAIN WIRING HARNESS - CONTINUED

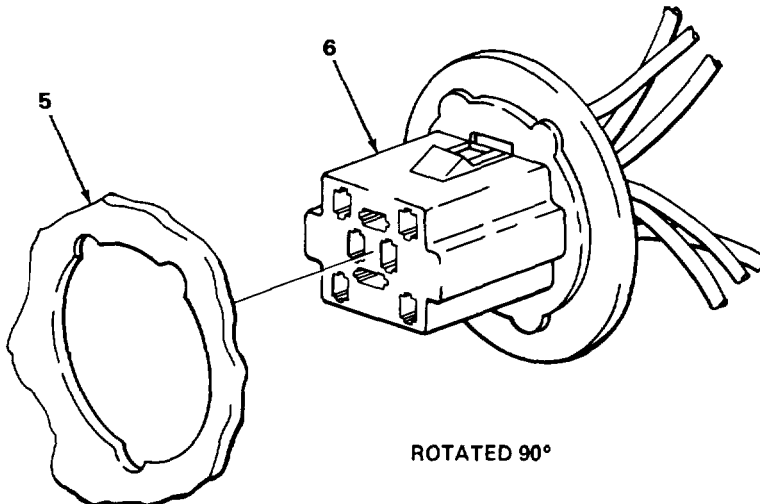
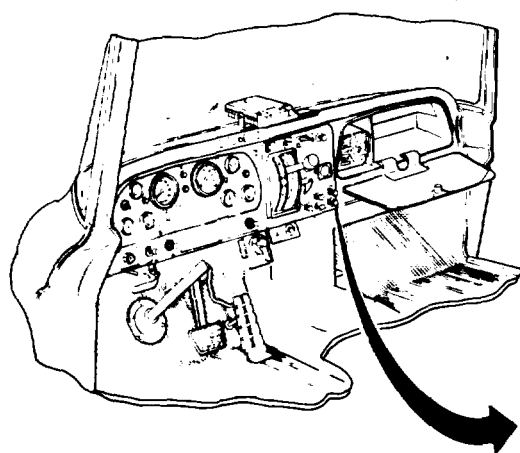
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
41. Ground wire lead (1)	Screw (2)	Using 1/4-inch flat-tip screwdriver, unscrew and take off. Pull off.	
42. Main harness connector (3)	Engine harness connector (4)		



43. Firewall (5)

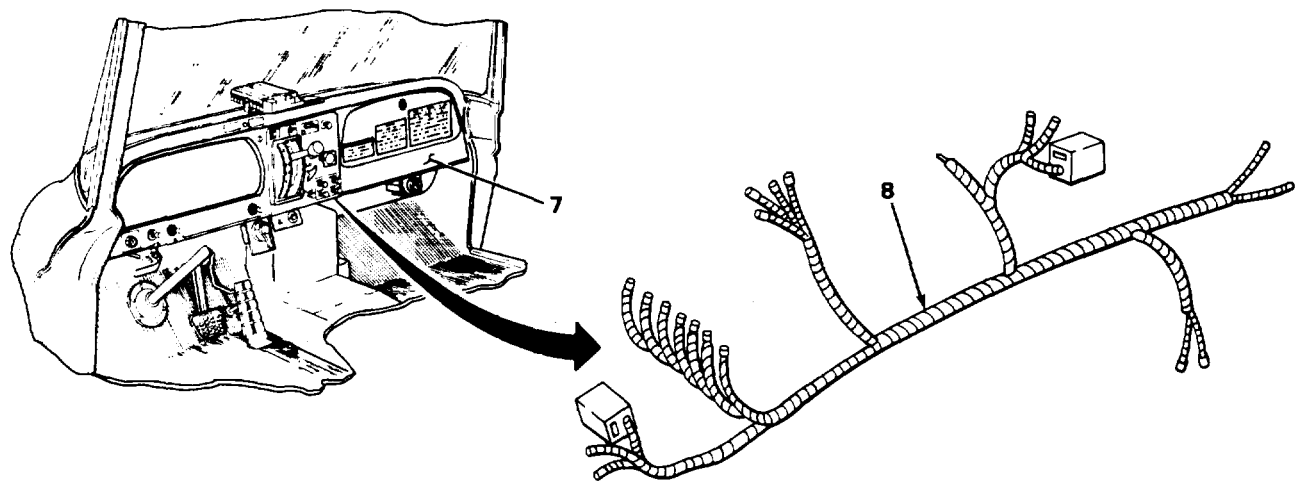
Main harness connector (6)

Using straight-nose slip-joint pliers turn connector to align projections with slots and pull out.



MAIN WIRING HARNESS - CONTINUED

		ACTION
LOCATION	ITEM	REMARKS
REMOVAL - CONTINUED		
44. Instrument panel (7)	Main wiring harness (8)	Pull out.



CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

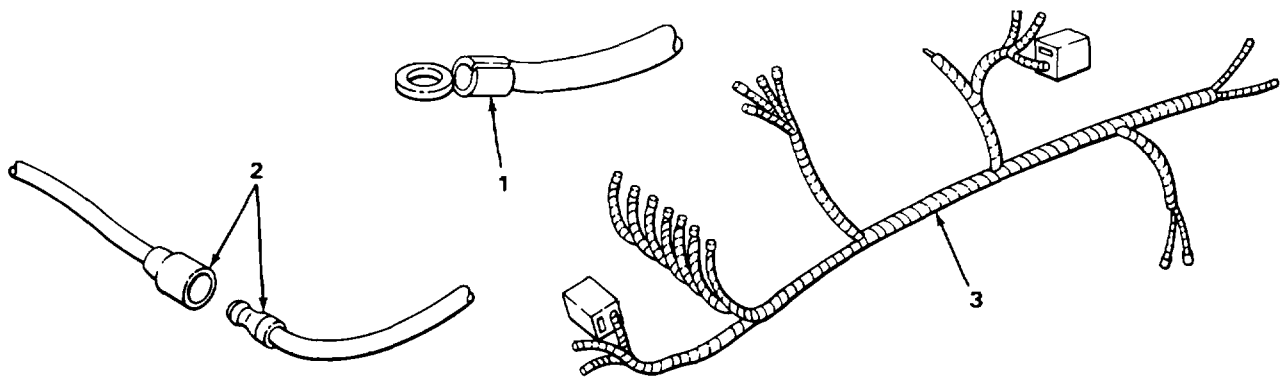
MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
WARNING			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
45.	Terminals (1)		Clean with clean rag dampened with dry-cleaning solvent.
46.	Connectors (2)		Wipe clean with clean, dry rag.
47.	Main wiring harness (3)		Wipe clean with damp rag, and using clean, dry rag wipe dry.

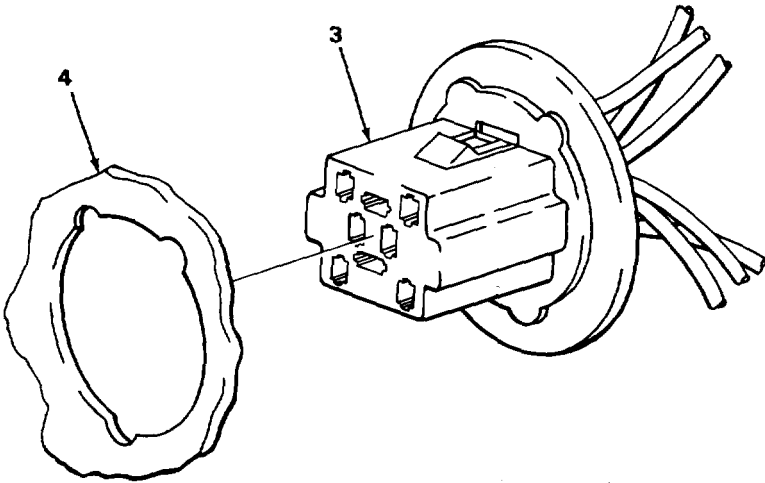
INSPECTION/REPLACEMENT

NOTE
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).
Replace damaged or defective parts, as needed.

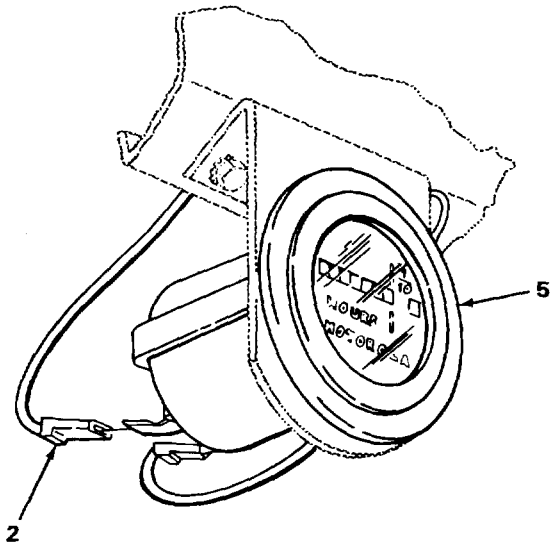
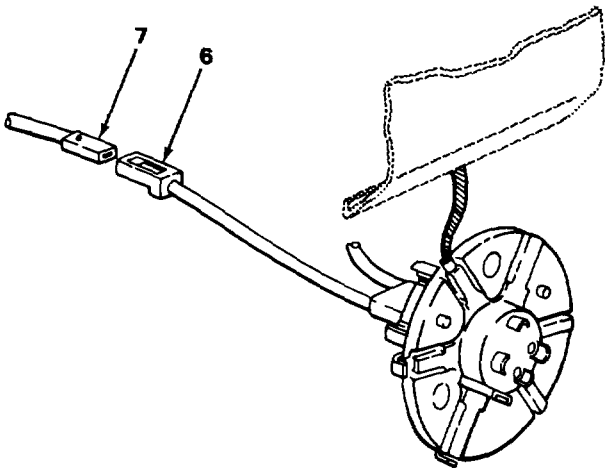
48.	Main wiring harness (3)	a. Look for cut, burned and worn insulation. b. Look for broken wires. Replace as necessary.
49	Connectors (2)	Look for missing, broken, and corroded parts.



		ACTION
LOCATION	ITEM	REMARKS
INSTALLATION		
50. Firewall (4)	Main harness connector (3)	a. Using straight-nose slip-joint pliers, turn to aline projections with slots, and push in. b. Turn to lock in place.

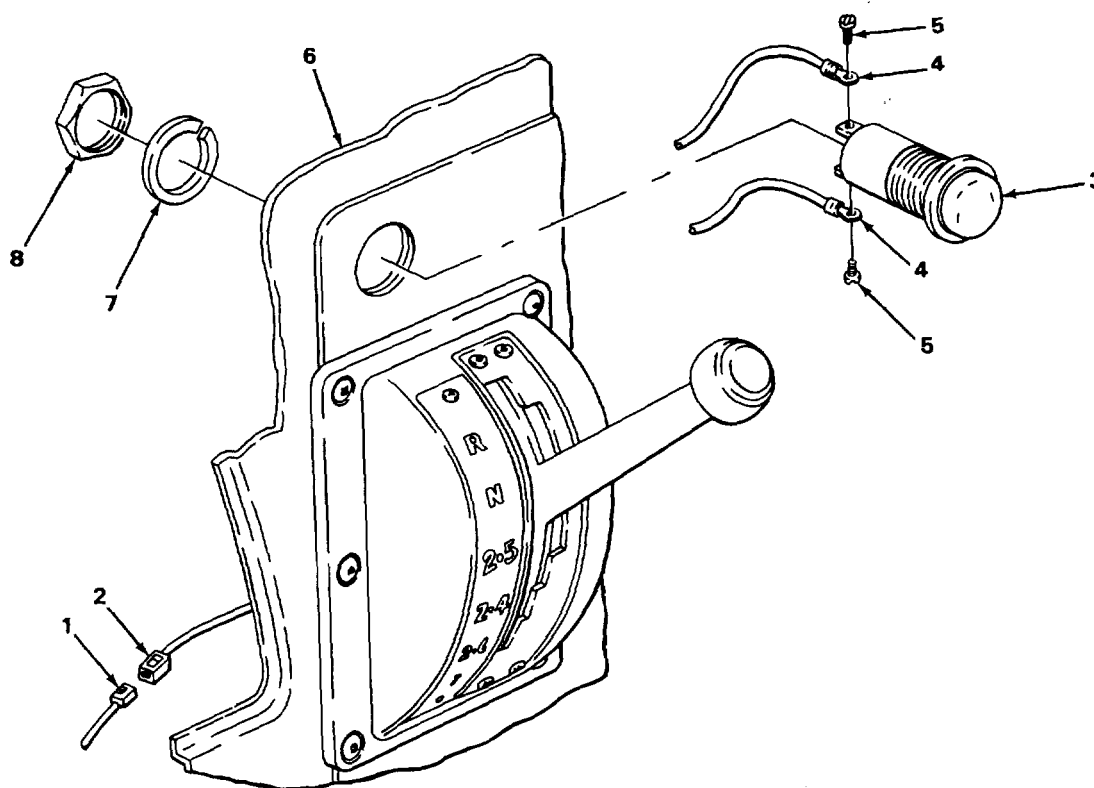


51. Hourmeter (5)	Connector (2)	Push on
52. Optical lamp	main harness connector (7)	push together.
Connector (6)		



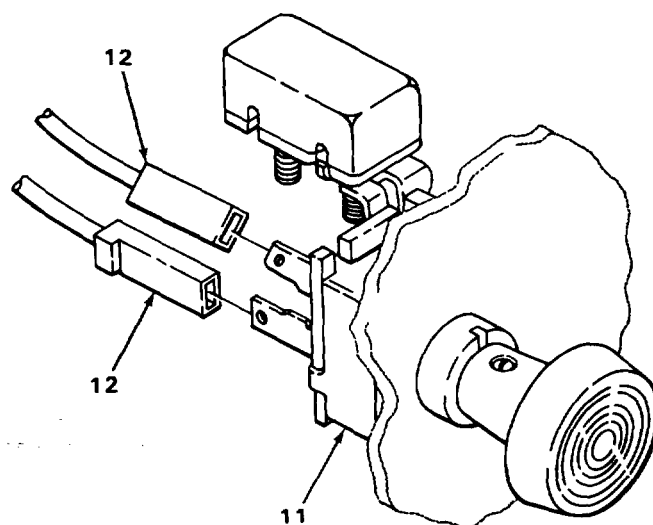
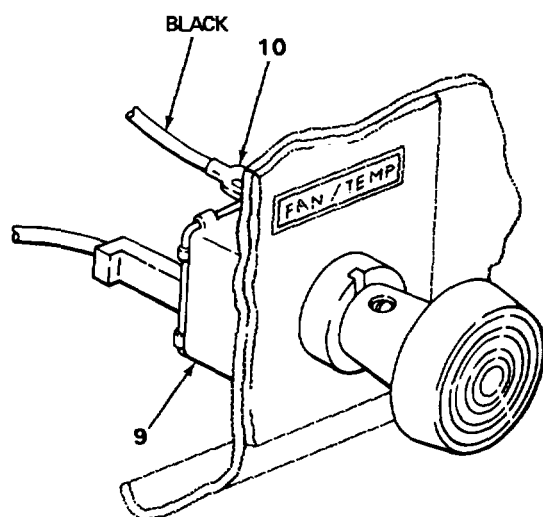
MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
53. Main harness connector (1)	Shifter lamp lead connector (2)	Push together.	
54. Trailer lighting warning light (3)	Two lead wires (4)	Put in position.	
55.	Two screws (5)	Screw in, and tighten using 1/4-inch flat-tip screwdriver.	
56. Instrument panel (6)	Trailer lighting warning light (3)	Put in position.	
57. Trailer lighting warning light (3)	New lockwasher (7) and nut (8)	Screw on, and tighten using straight-nose slip-joint pliers.	



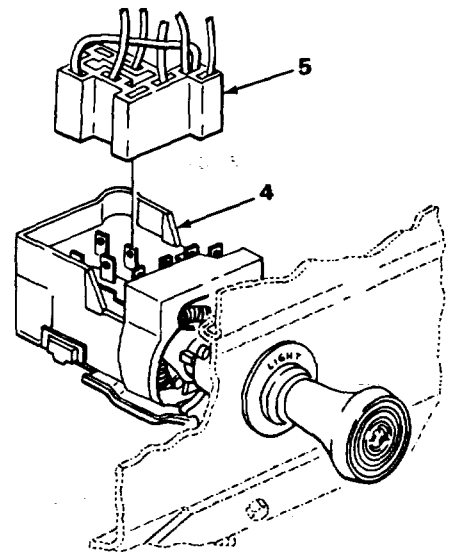
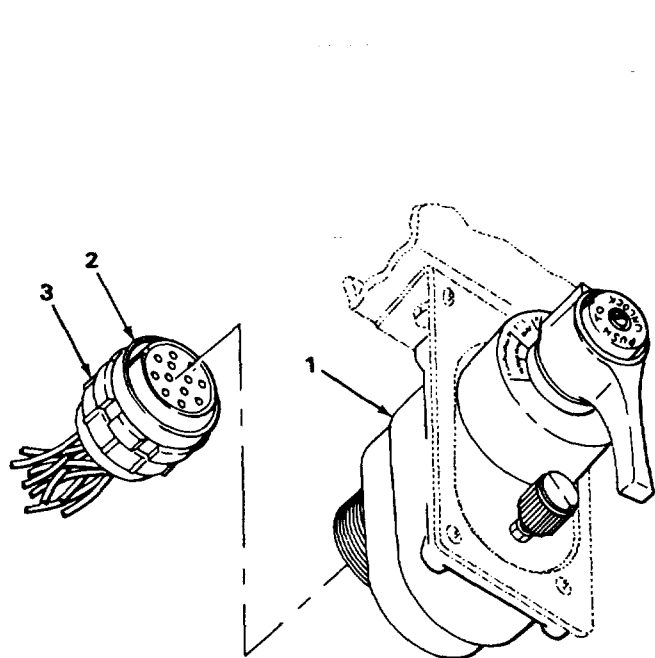
MAIN WIRING HARNESS - CONTINUED

		ACTION	
LOCATION	ITEM		REMARKS
INSTALLATION - CONTINUED			
58. Heater fan switch (9)	Connector (10)		Push on.
59. Windshield wiper/wash switch (11)	Two connectors (12)		Push on.



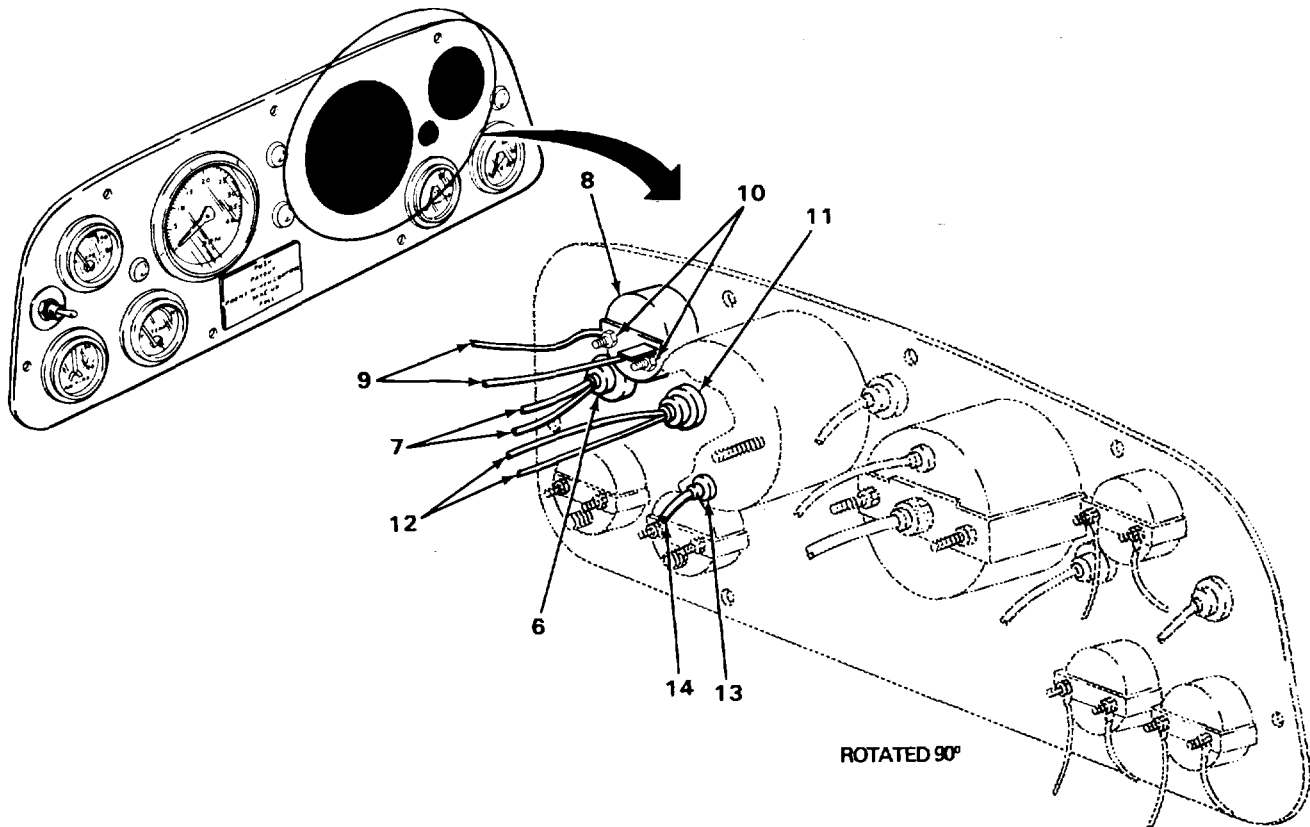
MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
60. Marker light switch (1)	Connector (2)		Push on.
61.	Nut (3)		Screw on, and tighten using straight-nose slip-joint pliers.
62. Headlight switch (4)	Connector (5)		Push on.



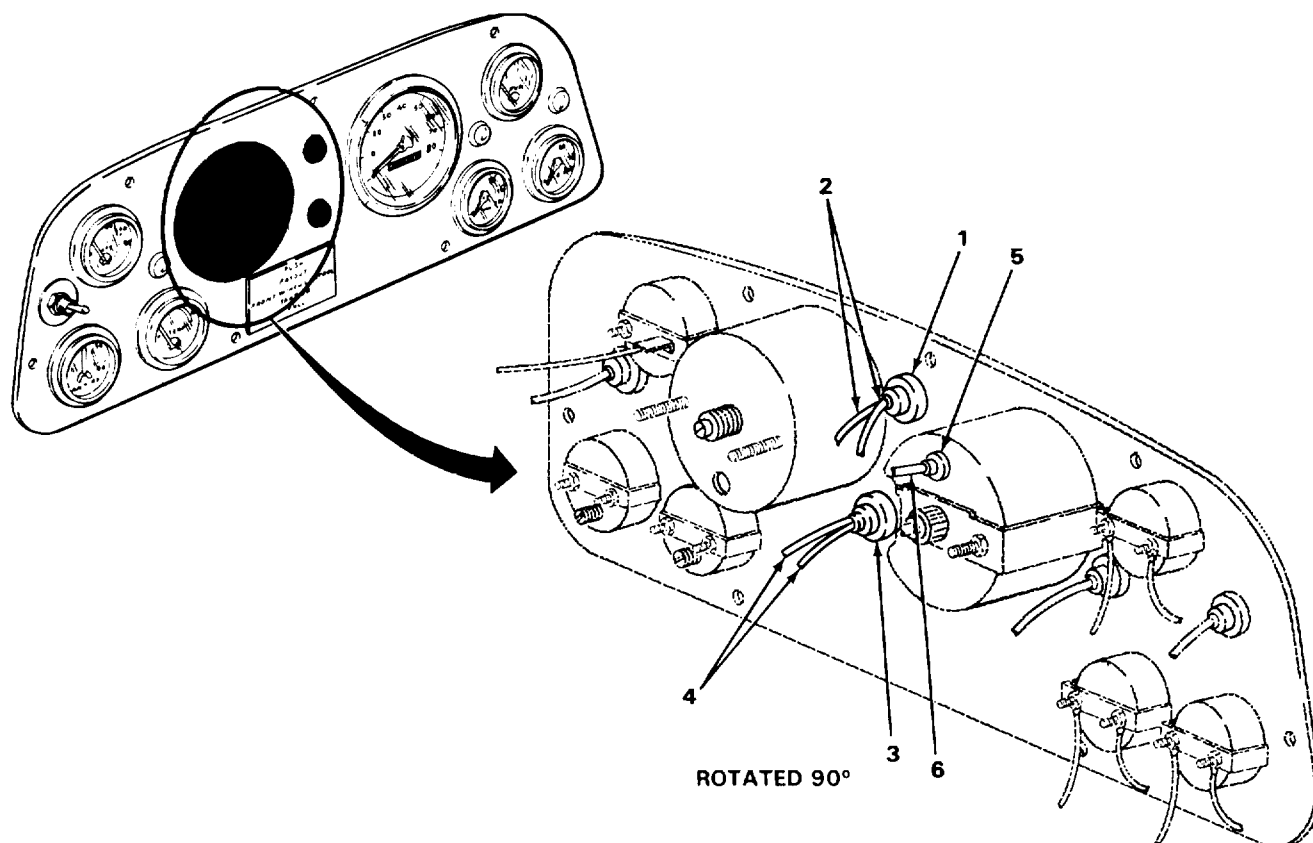
MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
63. Air pressure warning light (6)	Two lead wires (7)	Splice to harness (TM 9-2320-269-20-1).	
64. Fuel gage (8)	Two lead wires (9)		
65.	Two nuts (10)	Screw on, and tighten using 3/16-inch open-end wrench.	
66. Right turn indicator light (11)	Lead wire (12)		
67. Speedometer light (13)	Lead wire (14)	Splice into harness (TM 9-2320-269-20-1).	



MAIN WIRING HARNESS - CONTINUED

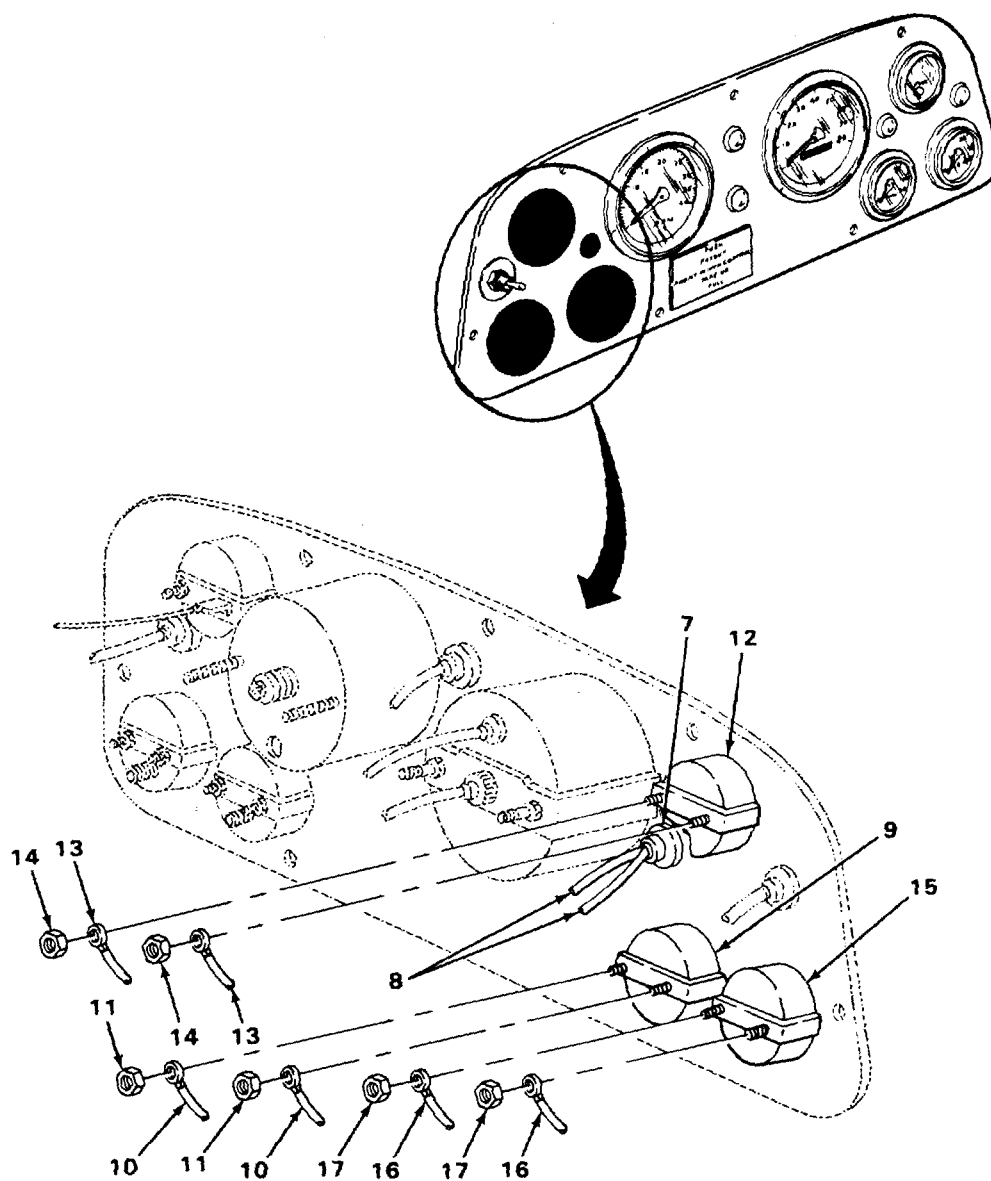
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
68. Power divider warning light (1)	Lead wire (2)	Splice into harness (TM 9-2320-269-20-1).	
69. Antilock warning light (3)	Lead wire (4)	Splice into harness (TM 9-2320-269-20-1).	
70. Tachometer light (5)	Lead wire (6) (TM 9-2320-269-20-1).	Splice into harness	



71. Left turn indicator light (7)	Lead wire (8) (TM 9-2320-269-20-1).	Splice into harness	
72. Water temperature gage (9)	Two lead wires (10)	Put in position.	
73.	Two nuts (11)	Screw on, and tighten using 3/8-inch open-end wrench.	

MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
74. Oil pressure gage (12)	Two lead wires (13)	Put in position.	
75.	Two nuts (14)	Screw on, and tighten using 3/8-inch open-end wrench.	
76. Ampere gage (15)	Two lead wires (16)	Put in position.	
77.	Two nuts (17)	Screw on, and tighten using 3/8-inch	



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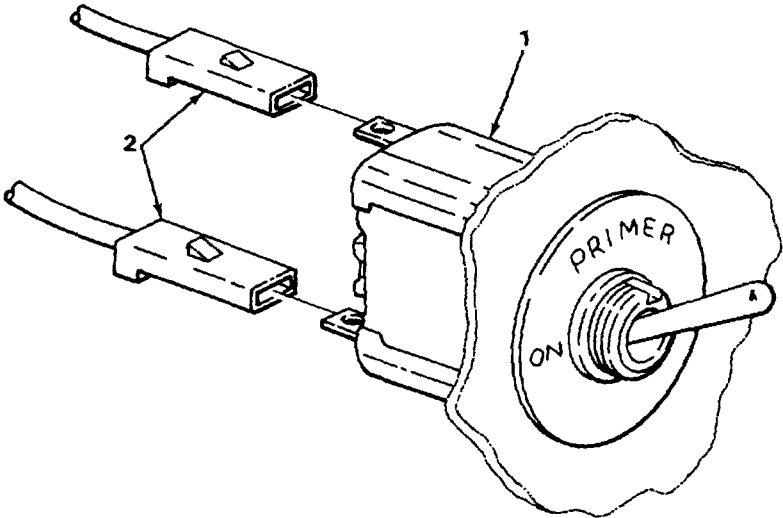
TA238295

MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

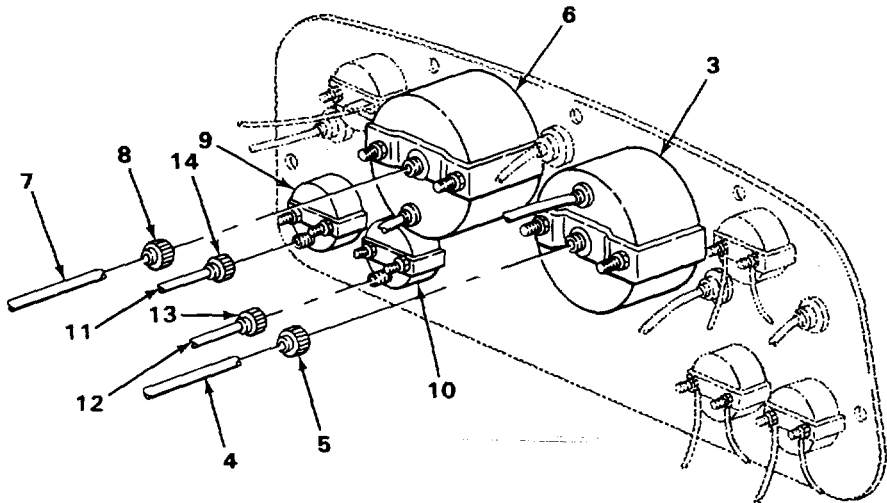
78. Primer switch (1)	Two connectors (2)	Push on.



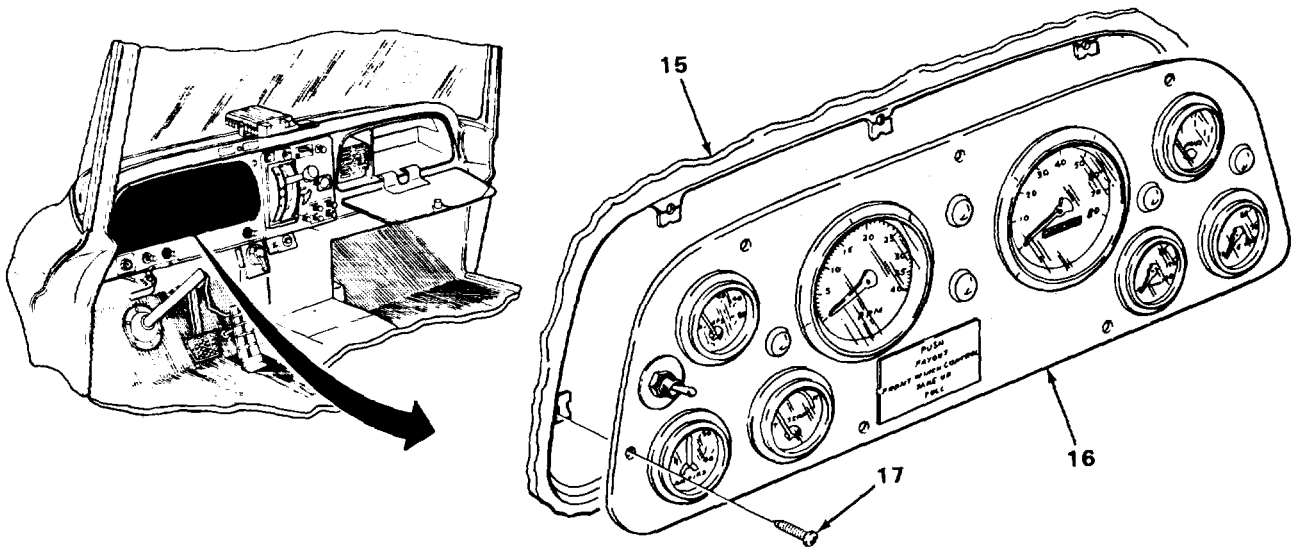
79. Tachometer (3)	Cable (4)	Put in position.
80.	Nut (5)	Screw on, and tighten using straight-nose slip-joint pliers.
81. Speedometer (6)	Cable (7)	Put in position.
82.	Nut (8)	Screw on, and tighten using straight-nose slip-joint pliers.
83. Two air gages (9) and (10)	Two air lines (11) and (12)	Put in position.
84.	Two nuts (13) and (14)	Screw on, and tighten using straight-nose slip-joint pliers.

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



85. Instrument panel (15)	Instrument cluster panel (16)	Put in position.
86. Instrument cluster panel (16)	Six screws (17)	Screw in, and tighten using number two cross-tip screwdriver.



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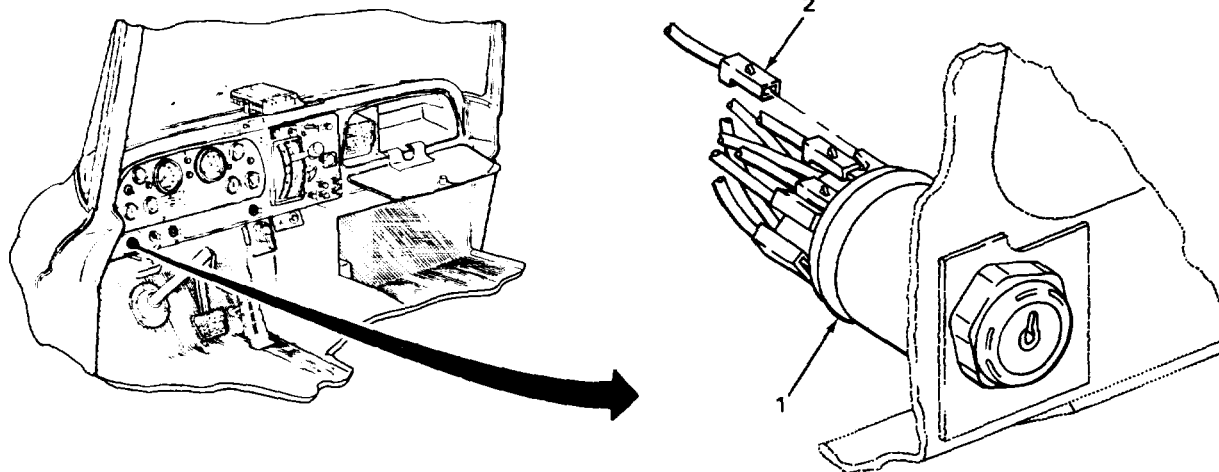
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

87. Key switch (1)

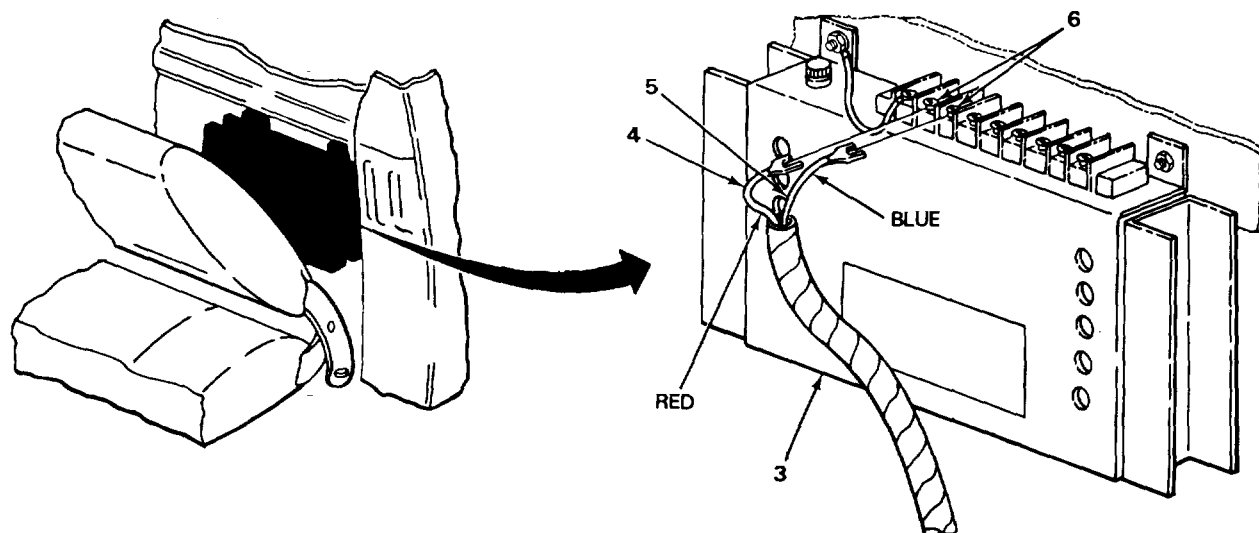
Connectors (2)

- a. Check tags for proper location.
b. Push on.

88. 24-volt
converter (3)Battery wire (4) and
ignition wire (5)
Two screws (6)

Put in position.

89.

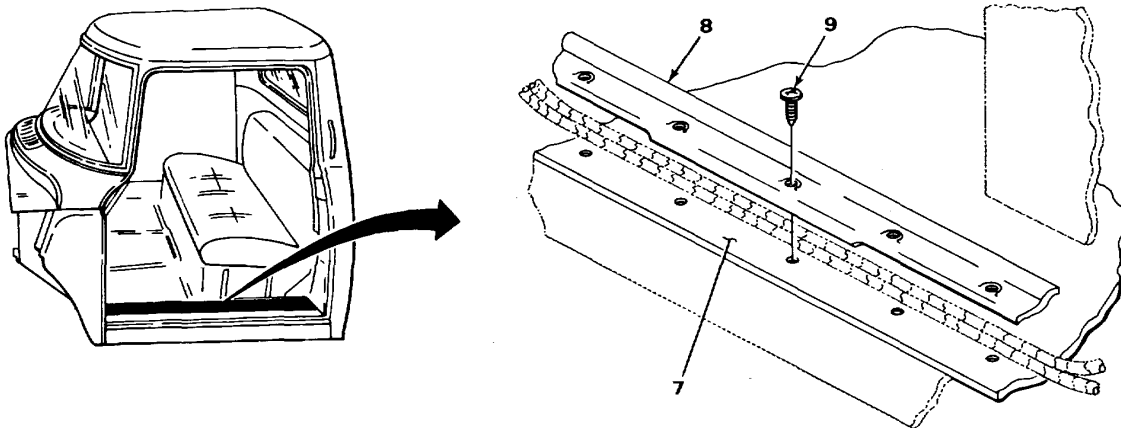
Screw in, and tighten using 1/4-inch
flat-tip screwdriver.

MAIN WIRING HARNESS - CONTINUED

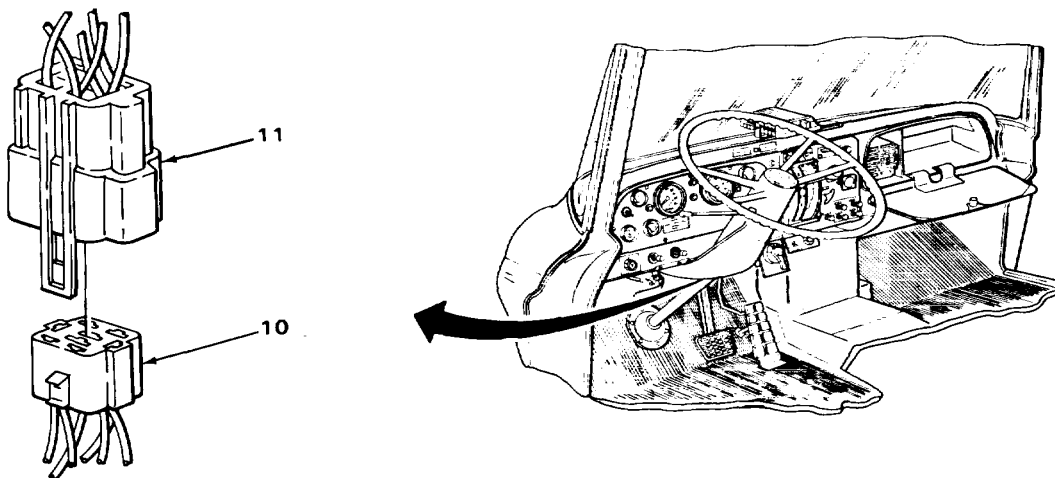
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

90. Cab floor (7)	Floormat retainer (8)	Put in position.
91. Floormat retainer (8)	Five screws (9)	Screw in, and tighten using number two cross-tip screwdriver.



92. Dimmer switch connector (10)	Main harness connector (11)	Push together.



LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

93. Firewall (1)

Main harness connector (2)

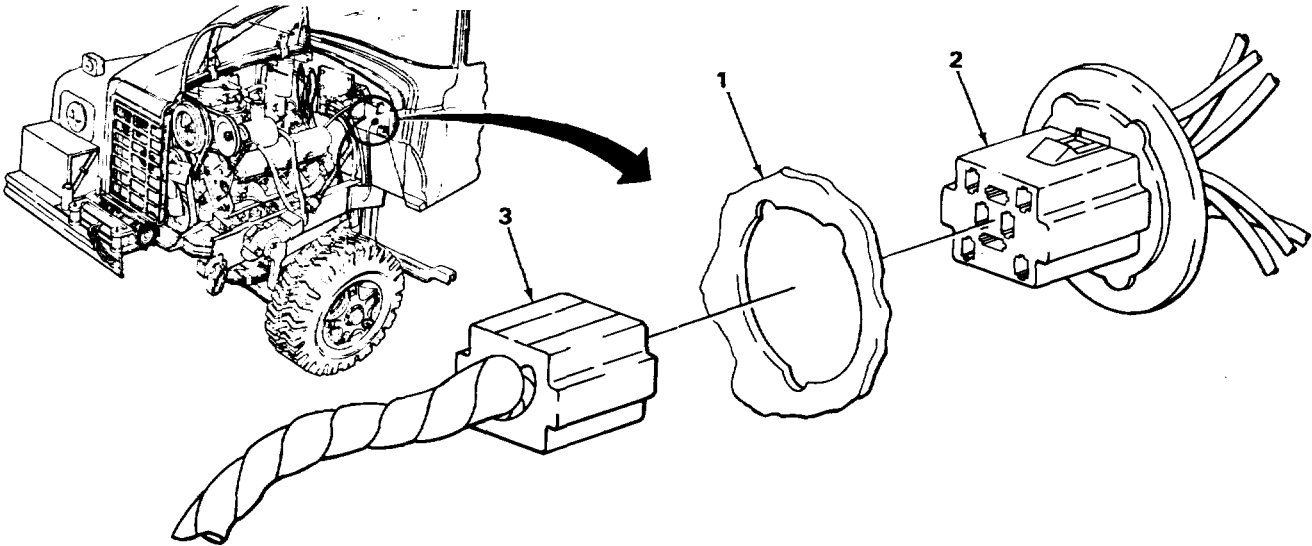
a. Aline projections with slots in firewall (1).

b. Using straight-nose slip-joint pliers, push in and turn to lock in place.

94. Main harness

Front harness

Push together.

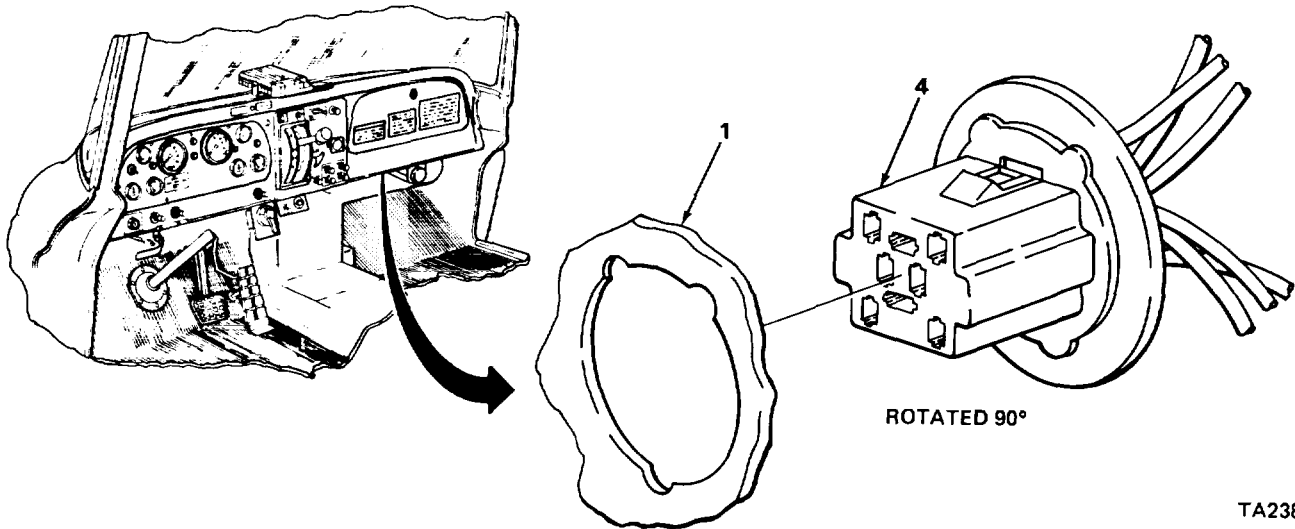


95. Firewall (1)

Main harness connector (4)

a. Aline connector with slots.

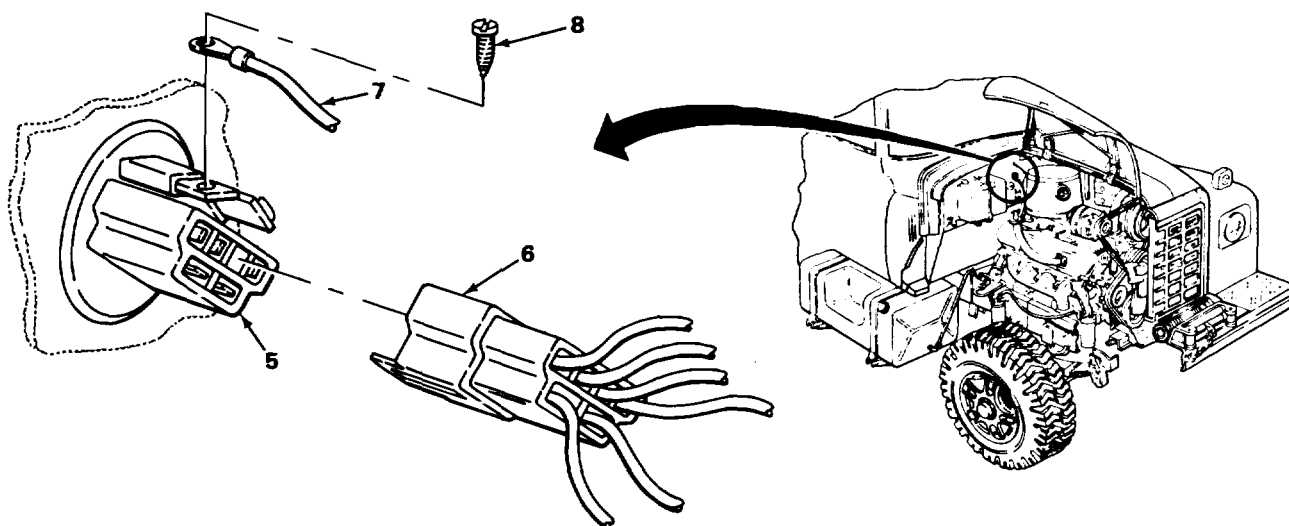
b. Using straight-nose slip-joint pliers, push in and turn to engage.



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MAIN WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
96.	Main harness connector (5)	Engine harness connector (6)	Push on.
97.	Engine harness connector (6)	Ground lead (7)	Put in position.
98.	Screw (8)		Screw in, and tighten using 1/4-inch flat-tip screwdriver.

**NOTE**

FOLLOW-ON MAINTENANCE:

1. Connect battery cables (TM 9-2320-269-20-1).
2. Check all instrument panel and instrument cluster lights, switches, and gages for proper operation (TM 9-2320-269-20-1).
3. Close valve on air tanks (TM 9-2320-269-20-1).
4. Close right and left side hoods (TM 9-2320-269-20-1).

TASK ENDS HERE

SUBMERGED FUEL PUMP WIRING HARNESS

This task covers:

a. Removal (page 2-554) b. Cleaning (page 2-557) d. Installation (page 2-558)	c. Inspection/Replacement (page 2-557)
-

INITIAL SETUP

Tools

Pliers, diagonal cutting
Screwdriver, flat-tip, 1/4-inch
Wrench, open-end, 3/8-inch

Personnel Required

One

Equipment Condition

Materials/Parts

Lockwasher, fuel sender terminal
Lockwasher, pump lead wire and terminal
Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)
Tag, marking (item 50, appendix B)

Battery cables disconnected (TM 9-2320-269-20-1).
Vehicle seat removed (TM 9-2320-269-20-2).

LOCATION	ITEM	ACTION	REMARKS

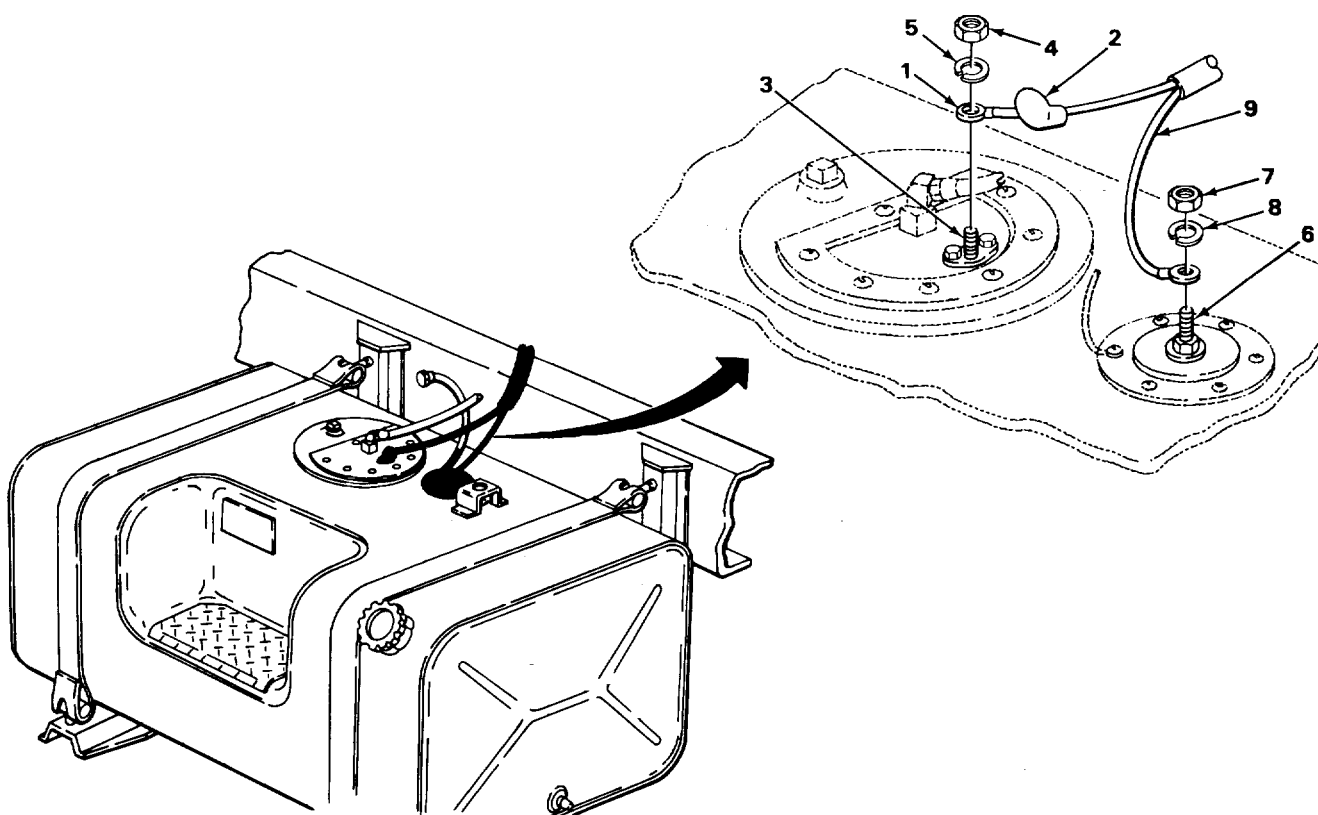
REMOVAL

NOTE

When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

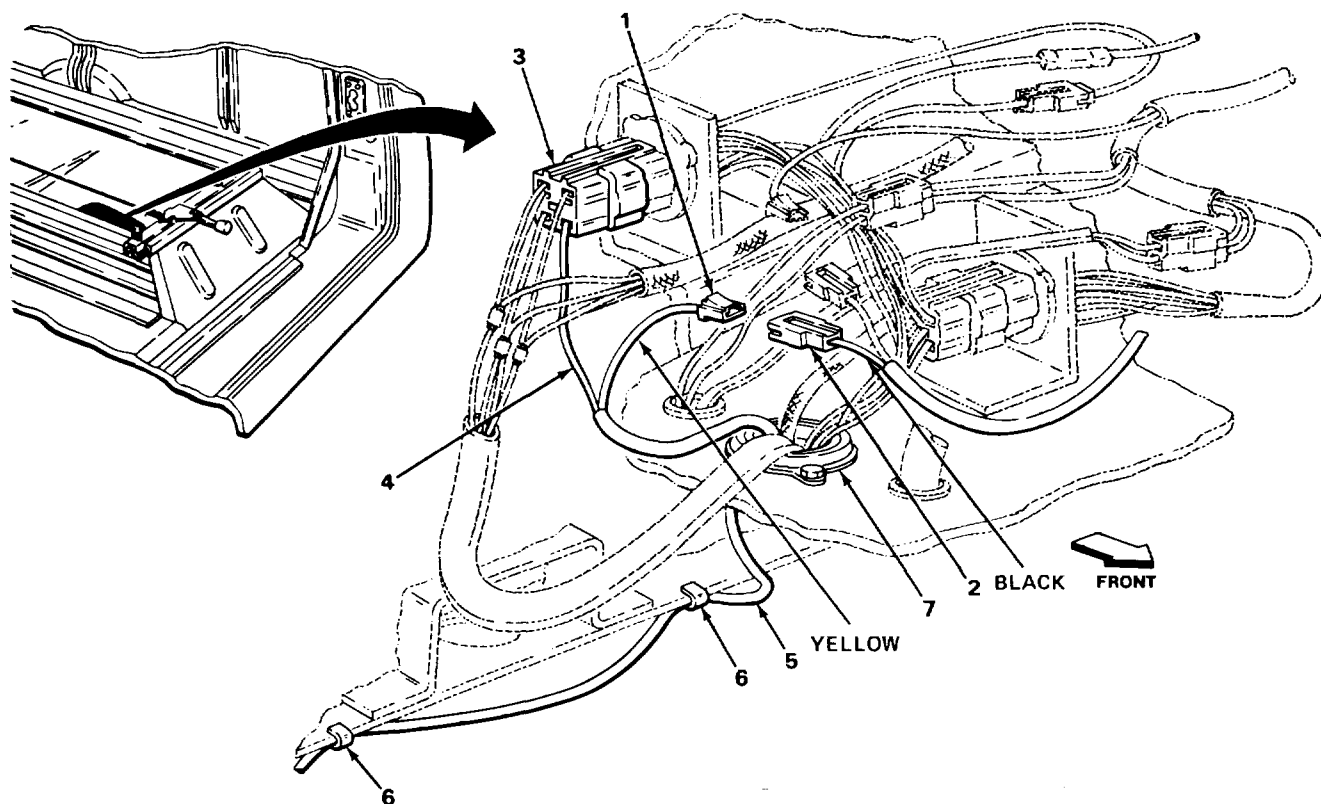
SUBMERGED FUEL PUMP WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
1.	Pump lead wire (1)	Cover (2)	Push back out of way.
2.	Terminal (3)	Nut (4) and lockwasher (5)	a. Using 3/8-inch open-end wrench, unscrew and take off. b. Get rid of lockwasher (5).
3.		Pump lead wire (1)	Take off.
4.	Fuel sender terminal (6)	Nut (7) and lockwasher (8)	a. Using 3/8-inch open-end wrench, unscrew and take off. b. Get rid of lockwasher (8).
5.		Lead wire (9)	Take off.



SUBMERGED FUEL PUMP WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6. Lead wire connector (1)	Connector (2)	a. Using 1/4-inch flat-tip screwdriver, pry up on retainer. b. Pull apart.	
7. Bulk connector (3)	Lead wire (4)	Using diagonal cutting pliers, cut. Leave enough wire at plug to splice to new harness.	
8. Harness (5)	Two wire clips (6)	Using 1/4-inch flat-tip screwdriver, pry off.	
9. Grommet (7)	Harness (5)	Pull out.	



SUBMERGED FUEL PUMP WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause injury or death.

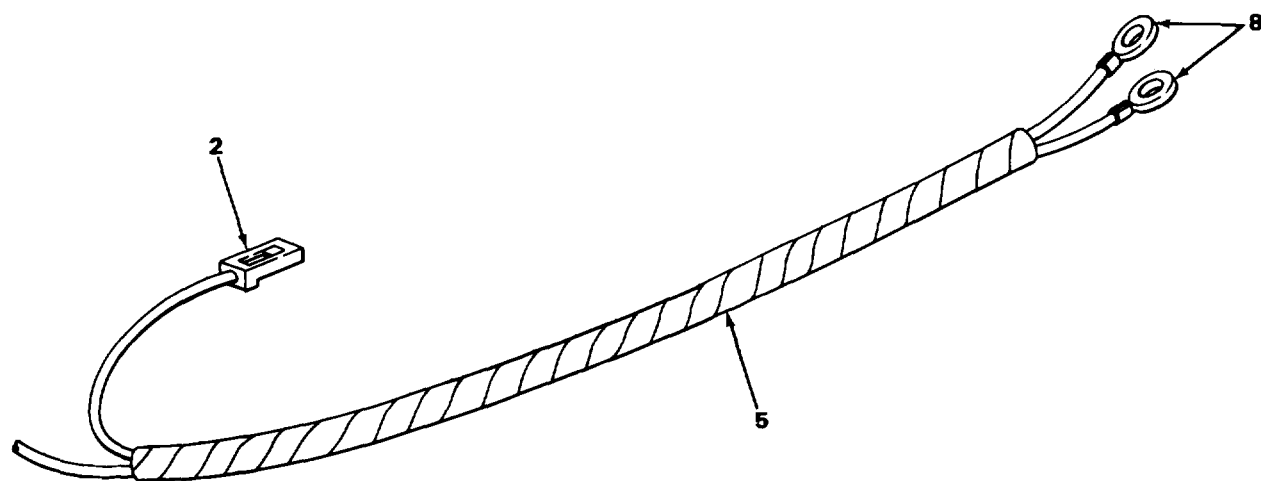
10.	Terminals (8) and connector (2)	Clean with clean rag dampened with drycleaning solvent.
11.	Harness (5)	a. Wipe clean with damp rag. b. Using clean, dry rags, wipe dry.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

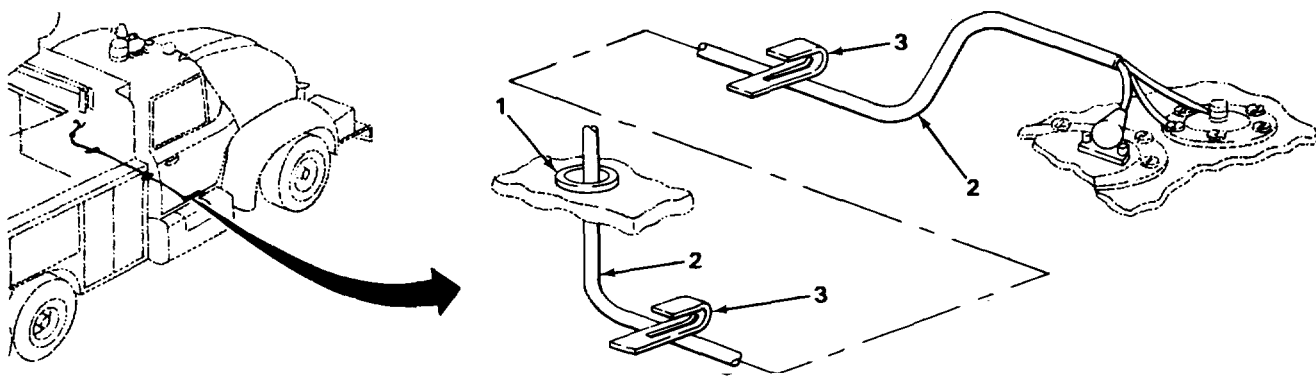
12.	Harness (5)	a. Look for cut, burned and worn insulation. b. Look for broken wires. c. Look for broken and corroded connector (2) and terminals (8).



2-557

TA238304

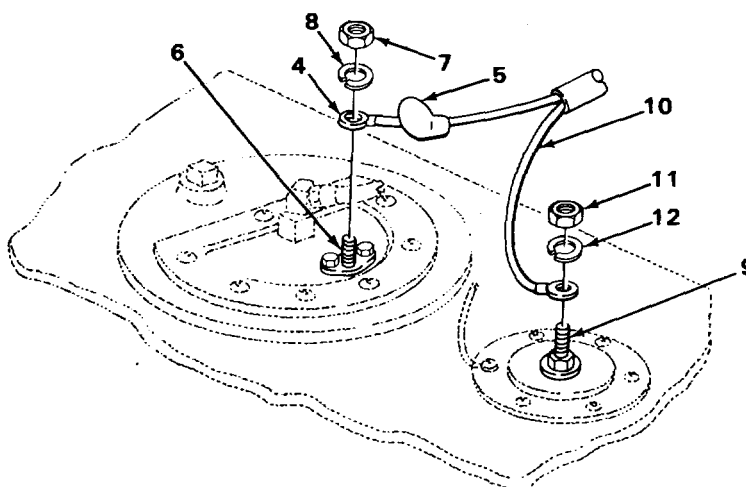
SUBMERGED FUEL PUMP WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
13. Grommet (1)	New harness (2)	a. Tie a piece of string to end of harness with terminals. b. Pull string and harness (3) through grommet and under cab to top of fuel tank.	
14. Harness (2)	Two wire clips (3)	Using 1/4-inch flat-tip screwdriver, pry on and fasten clips to brackets under cab.	
			
15. Pump lead wire (4)	Cover (5)	Put on, and push back out of way.	
16. Terminal (6)	Pump lead wire (4)	Put in position.	
17.	Nut (7) and new lockwasher (8)	Screw on, and tighten using 3/8-inch open-end wrench.	
18.	Cover (5)	Put in position.	
19. Terminal (9)	Fuel sender lead wire (10)	Put in position.	
20.	Nut (11) and new lockwasher (12)	Screw on, and tighten using 3/8-inch open-end wrench.	

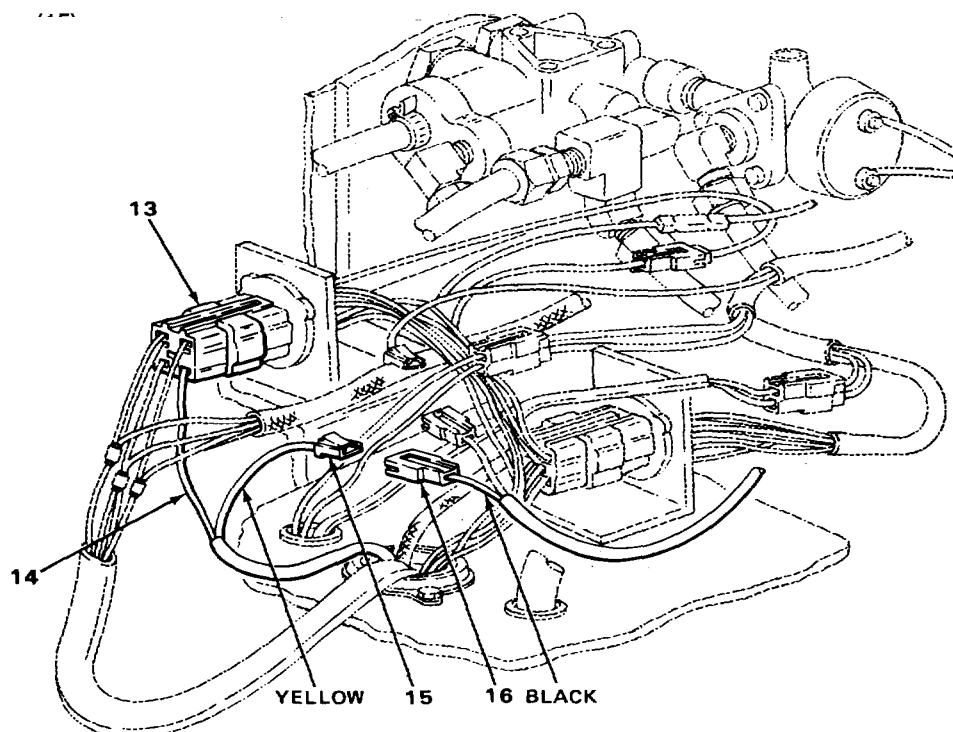
SUBMERGED FUEL PUMP WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



21. Bulk connector (13)	Lead wire (14)	Splice into harness TM 9-2320-269-20-1.
22. Lead wire Connector (15)	Connector	Push together.



SUBMERGED FUEL PUMP WIRING HARNESS - CONTINUED**INSTALLATION - CONTINUED - -****NOTE****FOLLOW-ON MAINTENANCE:**

1. Connect battery cables (TM 9-2320-269-20-1).
2. Install vehicle seat (TM 9-2320-269-20-2).
3. Check operation of fuel meter (TM 9-2320-269-10).

TASK ENDS HERE**CAB MOUNTED LIGHTS WIRING HARNESSES**

This task covers:

a. Removal (page 2-560)	c. Inspection/Replacement (page 2-564)
b. Cleaning (page 2-564)	d. Installation (page 2-565)

INITIAL SETUP**Tools**

Screwdriver, flat-tip, 1/4-inch
Connector, double crimp
Pliers, diagonal cutting

Personnel Required

One

Equipment Condition**Materials/Parts**

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)
Tag, marking (item 50, appendix B)

Battery cables disconnected
(TM 9-2320-269-20-1).

Cab headlining panels removed
(TM 9-2320-269-20-1).
Domelight removed
(TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS

REMOVAL**NOTE**

When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

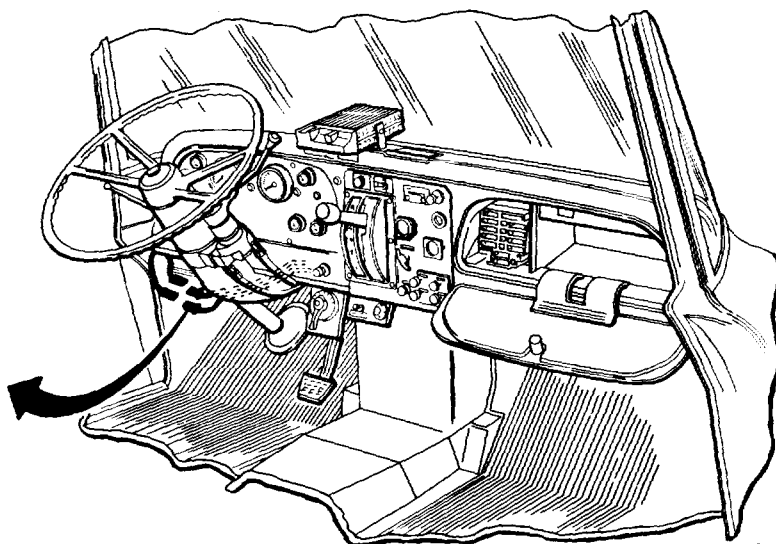
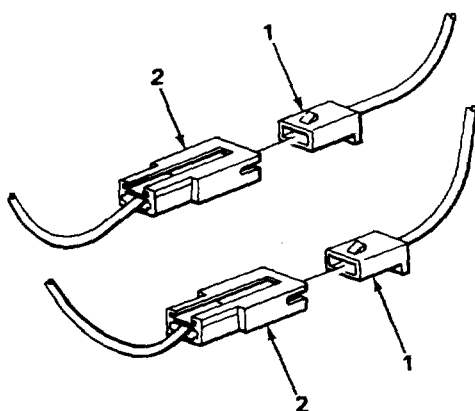
2-560

CAB MOUNTED LIGHTS WIRING HARNESSSES - CONTINUED

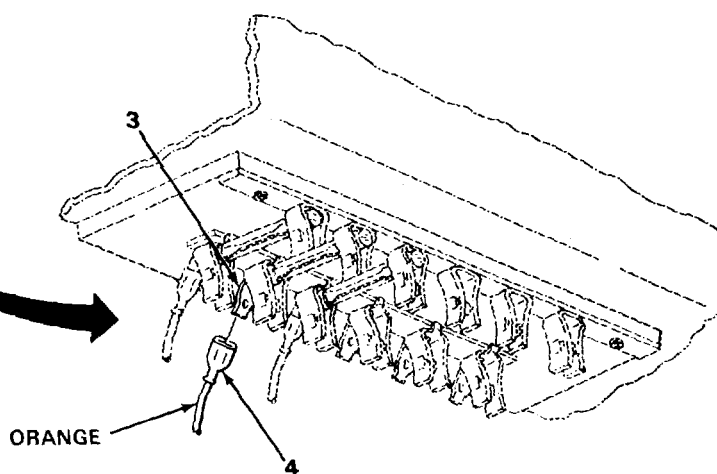
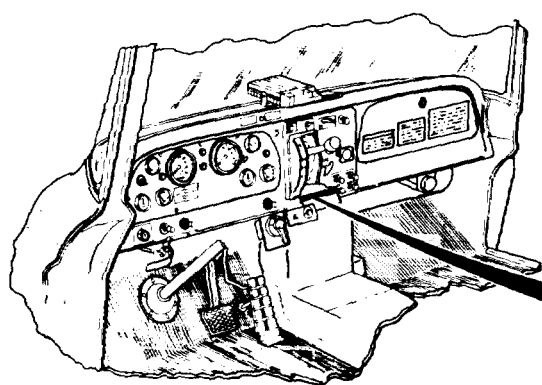
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

1.	Harness connectors (1)	Domelight wire connectors (2)	Using 11/4-inch flat-tip screwdriver, pry apart.



2.	Fuse block terminal (3)	Harness wire terminal (4)	Pull off.

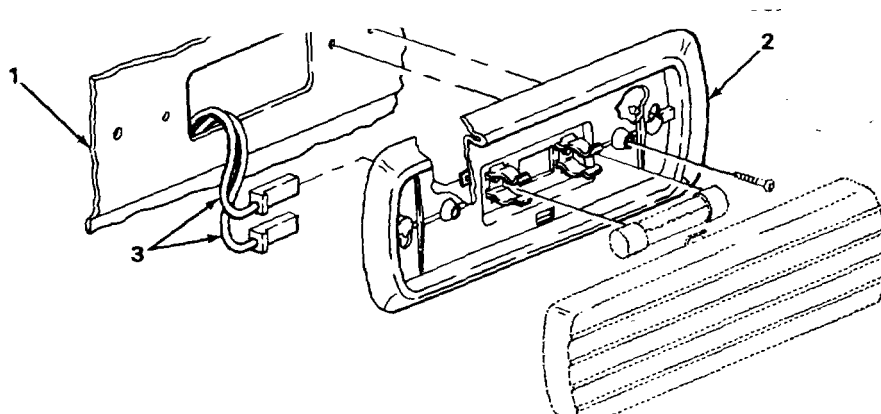


CAB MOUNTED LIGHTS WIRING HARNESSES - CONTINUED

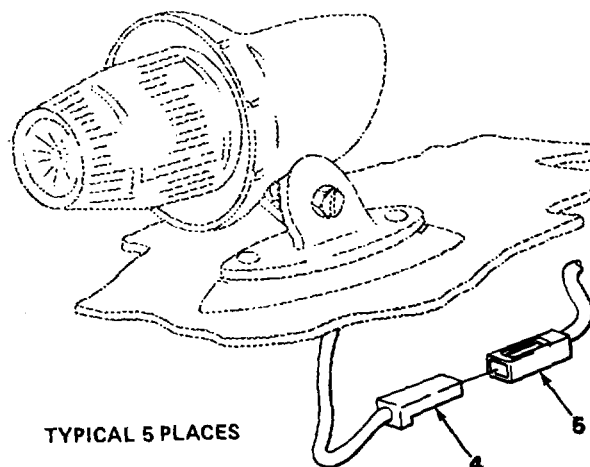
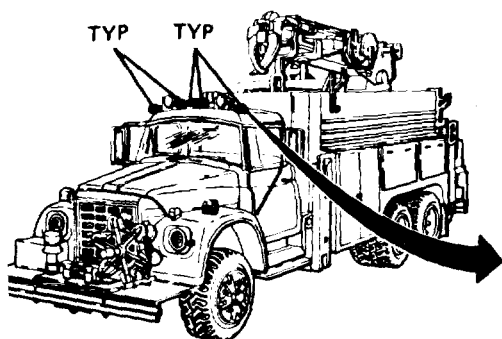
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

3.	Vehicle cab (1)	Domelight (2)	Remove (TM 9-2320-269-20-1).
4.	Domelight (2)	Two wire leads (3)	Using diagonal cutting pliers, cut. Leave enough wire to splice into new harness.



5.	Five running light connectors (4)	Five harness connectors (5)	Pull apart.

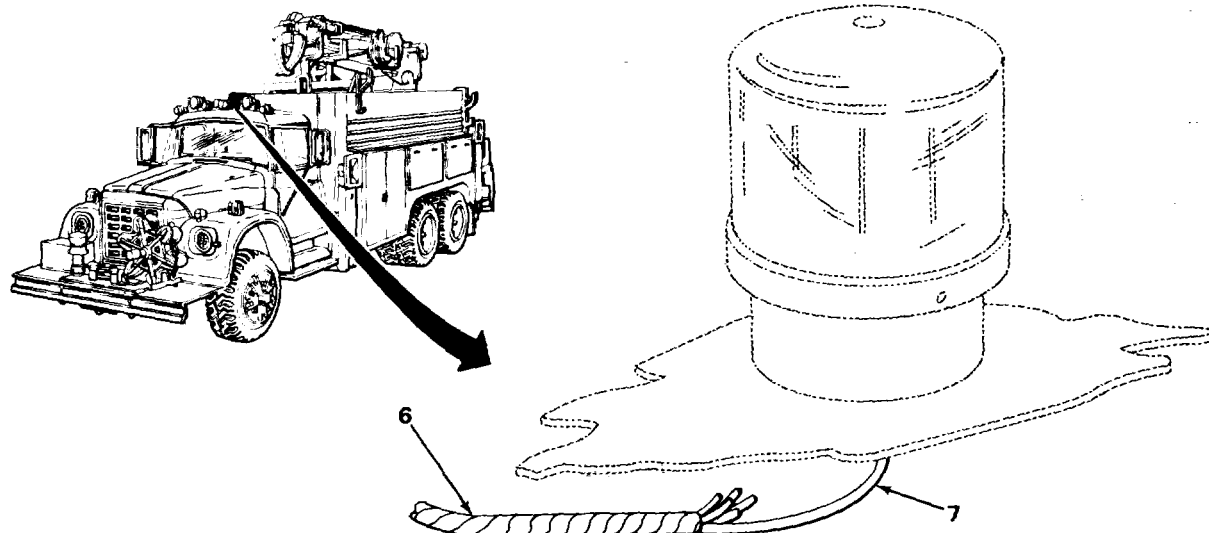


CAB MOUNTED LIGHTS WIRING HARNESSES - CONTINUED

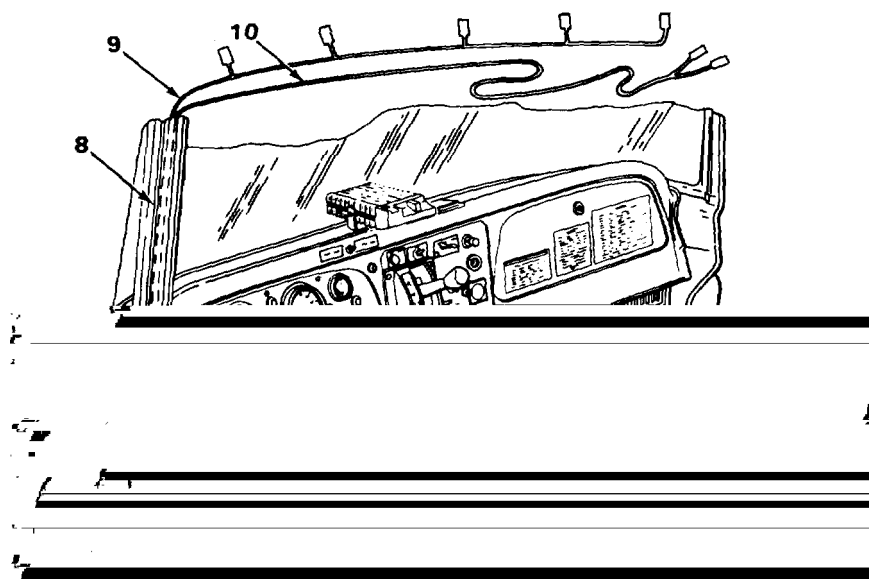
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

6. Harness (6)	Rotating warning light lead wire (7)	Using diagonal cutting pliers, cut. Leave enough wire for splicing.



7. Door post (8)	Harness (9) and domelight wire (10)	Tie piece of wire to harness (9) and dome-light wire (10), and pull up and out.



CAB MOUNTED LIGHTS WIRING HARNESSSES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

8.	Connector (1) cleaning solvent.	Clean with clean rag dampened with dry
9.	Harnesses (2)	Wipe clean with damp rag.

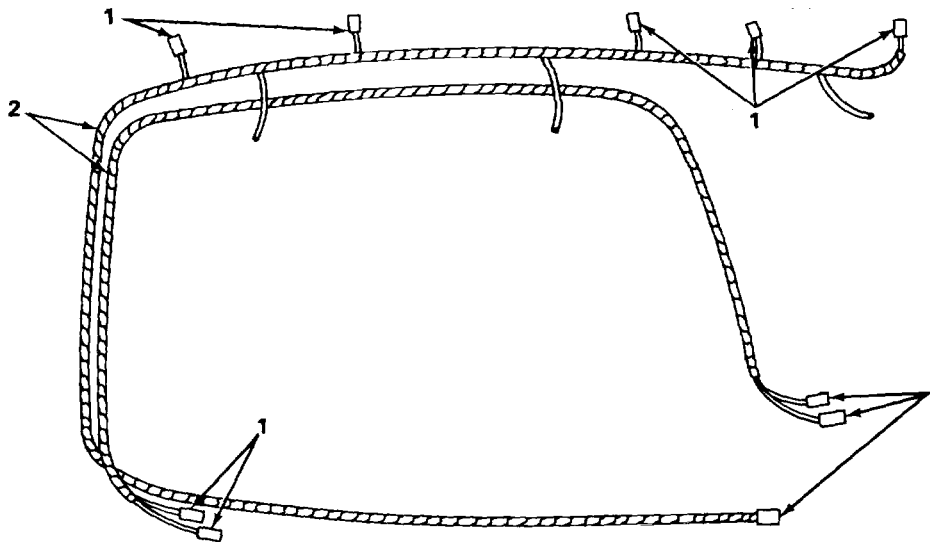
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts, as needed.

10.	Harnesses (2)	a. Look for cut, burned, and worn insulation. b. Look for broken wires. c. Look for broken and corroded connectors (1).



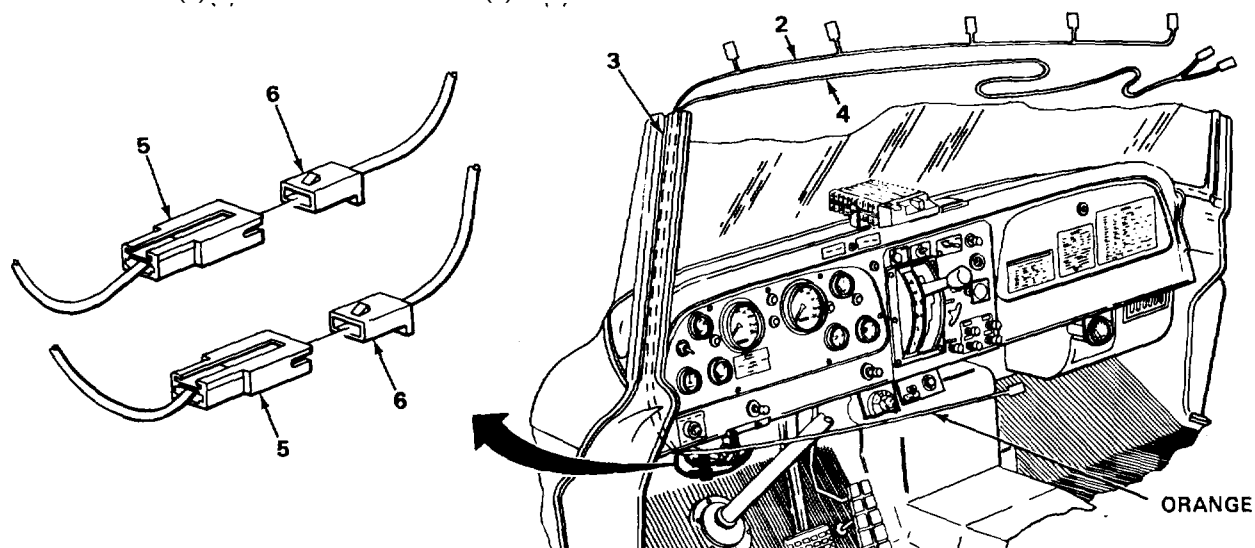
CAB MOUNTED LIGHTS WIRING HARNESSES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

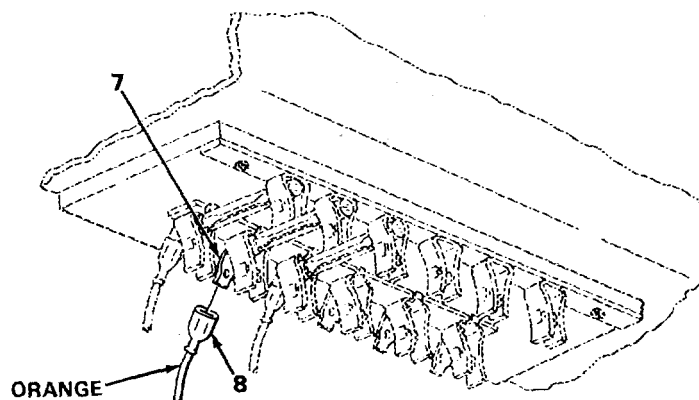
INSTALLATION

11. Door post (3) Harness (2) and dome-light wire (4) Tie piece of wire to harness (2) and dome-light wire (4), and pull down center of door post (3).

12. Dome-light wire Connectors (5) Harness wire connectors (5) Push together.



13. Fuse block terminal (7) Harness wire terminal (8) Push on.



CAB MOUNTED LIGHTS WIRING HARNESSES - CONTINUED

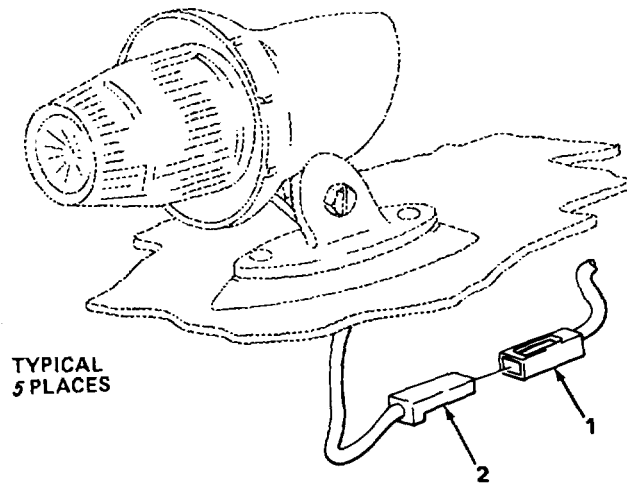
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

14. Harness connector (1)

- Five running light connectors (2)

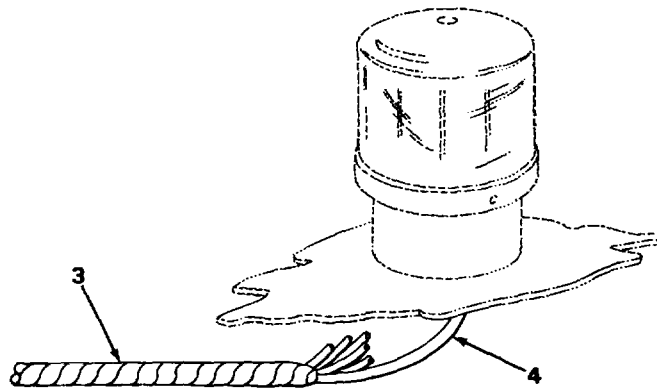
Push together.



15. Harness (3)

- Rotating warning light lead wire (4)

Using double crimp connector, put together.



NOTE

FOLLOW-ON MAINTENANCE:

1. Install domelight (TM 9-2320-269-20-1).
2. Install cab headlining panels (TM 9-2320-269-20-2).
3. Connect battery cables (TM 9-2320-269-20-1).
4. Check operation of all cab mounted lights (TM 9-2320-269-10).

TASK ENDS HERE

STOPLIGHT SWITCH WIRING HARNESS

This task covers:

a. Removal (page 2-567)	c. Inspection/Replacement (page 2-570)
b. Cleaning (page 2-569)	d. Installation (page 2-570)
-

INITIAL SETUP**Tools**

Screwdriver, flat-tip, 1/4-inch
Wrench, open-end, 3/8-inch

Personnel Required

One

Equipment Condition**Materials/Parts**

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)
Tag, marking (item 50, appendix B)

Battery cables disconnected
(TM 9-2320-269-20-1).
Bottom seat removed
(TM 9-2320-269-20-2).

LOCATION	ITEM	ACTION	REMARKS

REMOVAL**NOTE**

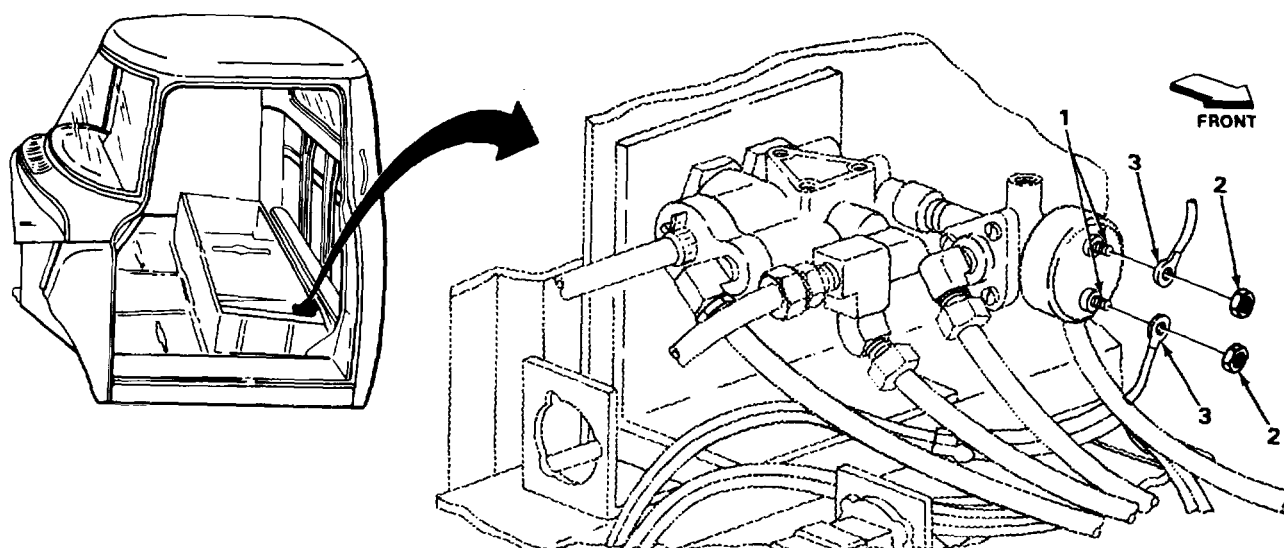
When taking electrical connectors apart, make sure wires on both sides of connectors are marked with tags. This will help in locating the right wires and connectors during installation.

STOPLIGHT SWITCH WIRING HARNESS - CONTINUED

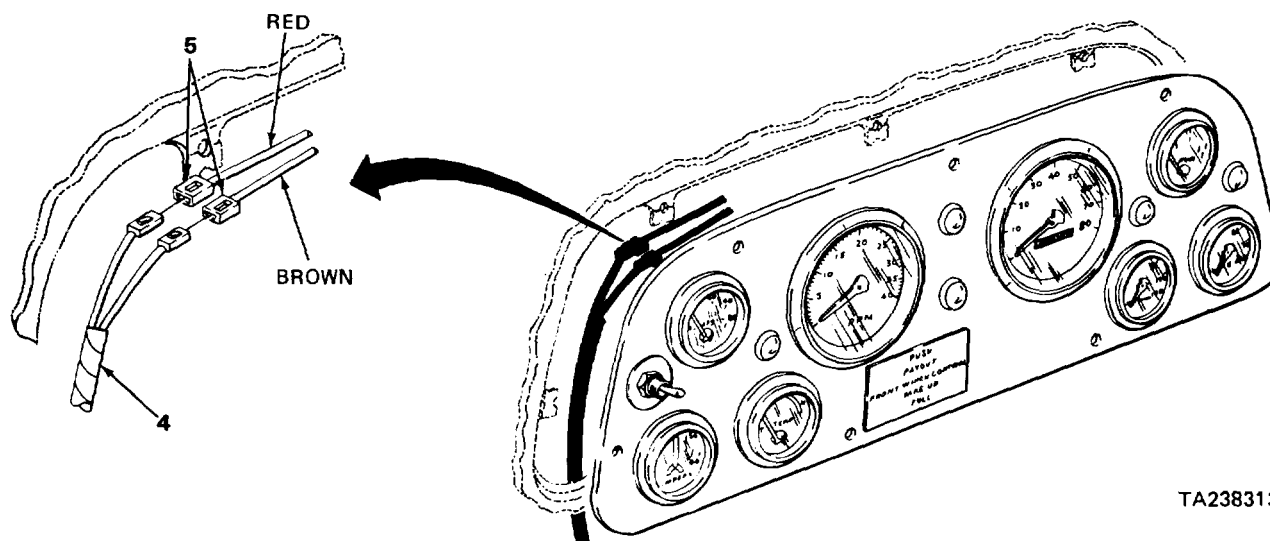
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

1.	Stoplight switch terminals (1)	Two nuts (2)	Using 3/8-inch open-end wrench, unscrew and take off.
2.		Two lead wires (3)	Take off. Tag for identification.



3.	Cab floor	Floormat retainer	Take off (TM 9-2320-269-20-2).
4.	Harness (4)	Two connectors (5)	a. Using 1/4-inch flat-tip screwdriver, pry up on retainer. b. Pull apart.



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STOPLIGHT SWITCH WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

5.	Vehicle cab (6)	Harness (4)	Take out.

CLEANING

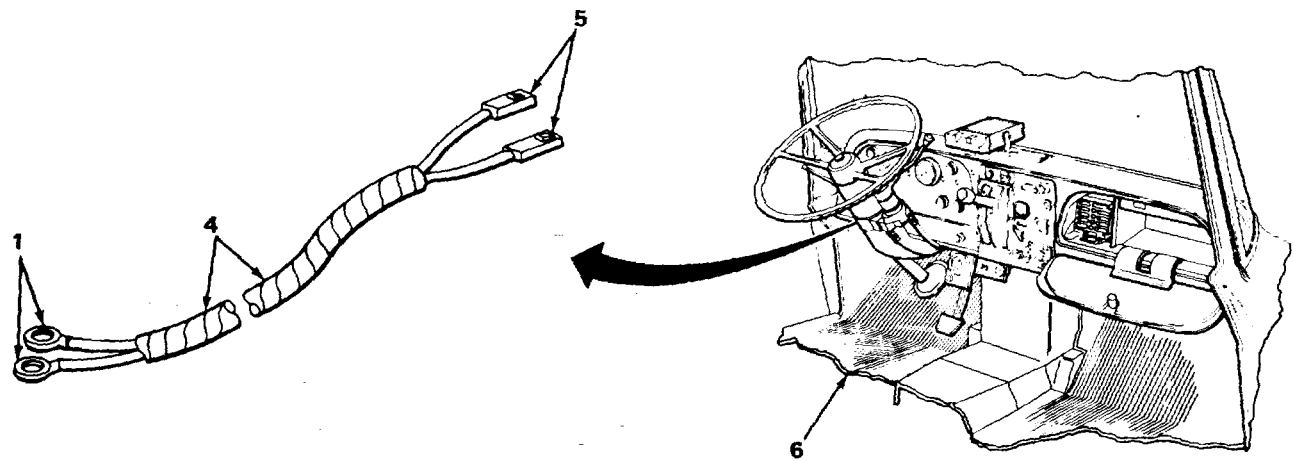
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

6.	Terminals (1)	Clean with clean rag dampened with drycleaning solvent.
7.	Connectors (5)	Wipe clean with clean, dry rag.
8.	Harness (4)	Wipe clean with damp rag, and using clean, dry rag, wipe dry.



STOPLIGHT SWITCH WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

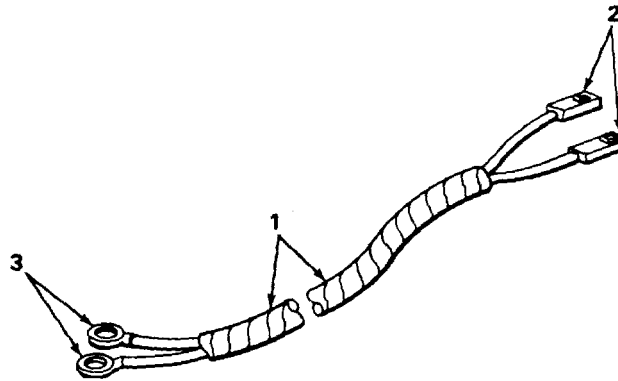
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

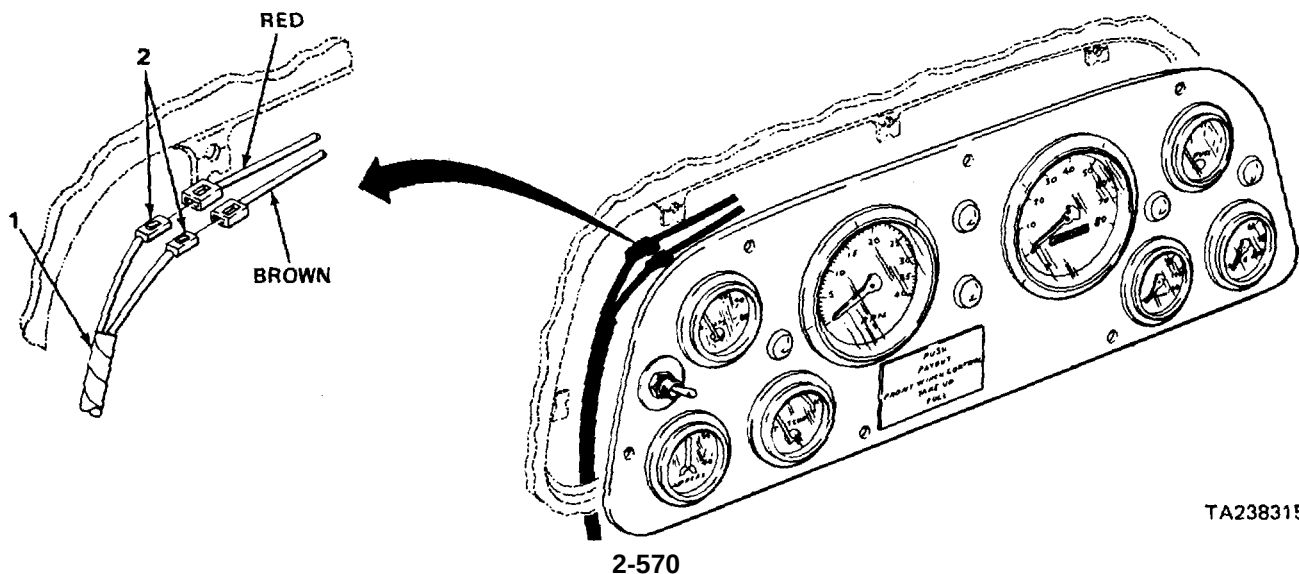
Replace damaged or defective parts as needed.

9.	Harness (1)	a. Look for cut, burned, and worn insulation. b. Look for broken wires.
10.	Connectors (2) and terminals (3)	Look for missing, broken, and corroded parts.



INSTALLATION

11.	Harness (1)	Two connectors (2)	Push together as tagged.



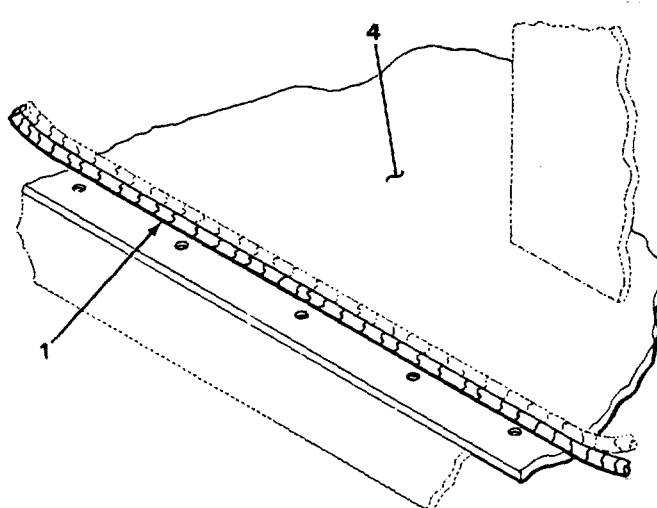
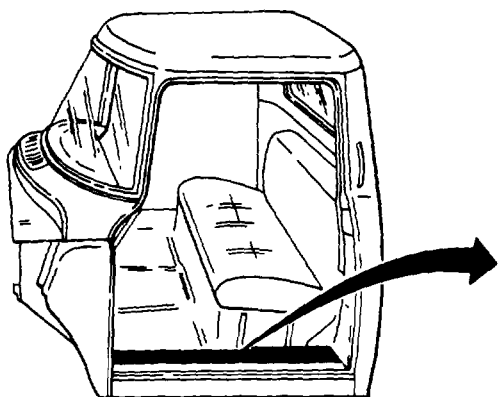
TA238315

STOPLIGHT SWITCH WIRING HARNESS - CONTINUED

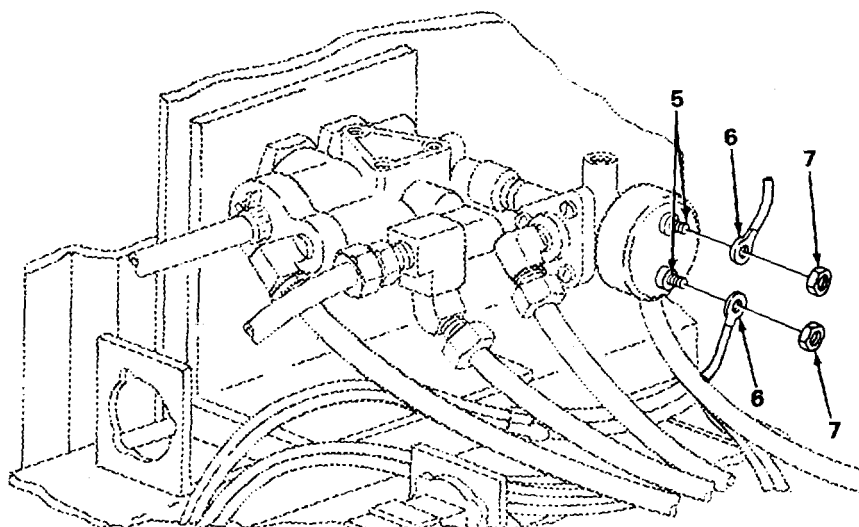
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

12. Cab floor (4)	Harness (1)	Route harness (1) along left edge of cab floor and then to stoplight switch.
13.	Floormat retainer	Install (TM 9-2320-269-20-2).



14. Stoplight switch terminals (5)	Two harness leads (6)	Put on as tagged.
15.	Two nuts (7)	Using 3/8-inch open-end wrench, screw on and tighten.



STOPLIGHT SWITCH WIRING HARNESS - CONTINUED**INSTALLATION - CONTINUED****NOTE****FOLLOW-ON MAINTENANCE:**

1. Connect battery cables (TM 9-2320-269-20-1).
2. Install bottom seat (TM 9-2320-269-20).
3. Check operation of vehicle stoplights (TM 9-2320-269-10).

TASK ENDS HERE**CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS**

This task covers:

a. Removal (page 2-573)	c. Inspection/Replacement (page 2-582)
b. Cleaning (page 2-582)	d. Installation (page 2-583)

INITIAL SETUP**Tools**

Gun, soldering
 Handle, ratchet, 3/8-inch drive
 Knife, pocket
 Pliers, diagonal cutting
 Screwdriver, flat-tip, 3/16-inch
 Socket, 3/8-inch drive, 7/16-inch
 Wrench, box-end, 3/8-inch
 Wrench, box-end, 1/2-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch

Materials/Parts

Flux, rosin (item 18, appendix B)
 Gasket, outrigger warning switch cover
 Gasket, outrigger, warning lockout switch cover
 Lockwasher, fuse block and light brown wire
 Lockwasher, throttle solenoid
 Lockwasher, relay box bottom solenoid, left terminal
 Lockwasher, relay box bottom solenoid, right terminal
 Lockwasher, relay box bottom solenoid, right front terminal

Materials/Parts - Continued

Lockwasher, relay box center solenoid, left front terminal
 Lockwasher, relay box center solenoid, right terminal
 Lockwasher, relay box top solenoid, left terminal
 Lockwasher, relay box top solenoid, right terminal
 Rags, wiping (item 42, appendix B)
 Solder (item 46, appendix B)
 Tag, marking (item 50, appendix B)
 Tie, plastic (as needed)

Personnel Required

Two

Equipment Condition

Outriggers down (TM 9-2320-269-10).
 Left side engine compartment hood open (TM 9-2320-260-10).
 Engine cover removed (TM 9-2320-269-20-1).
 Battery cables disconnected (TM 9-2320-269-20-1).

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

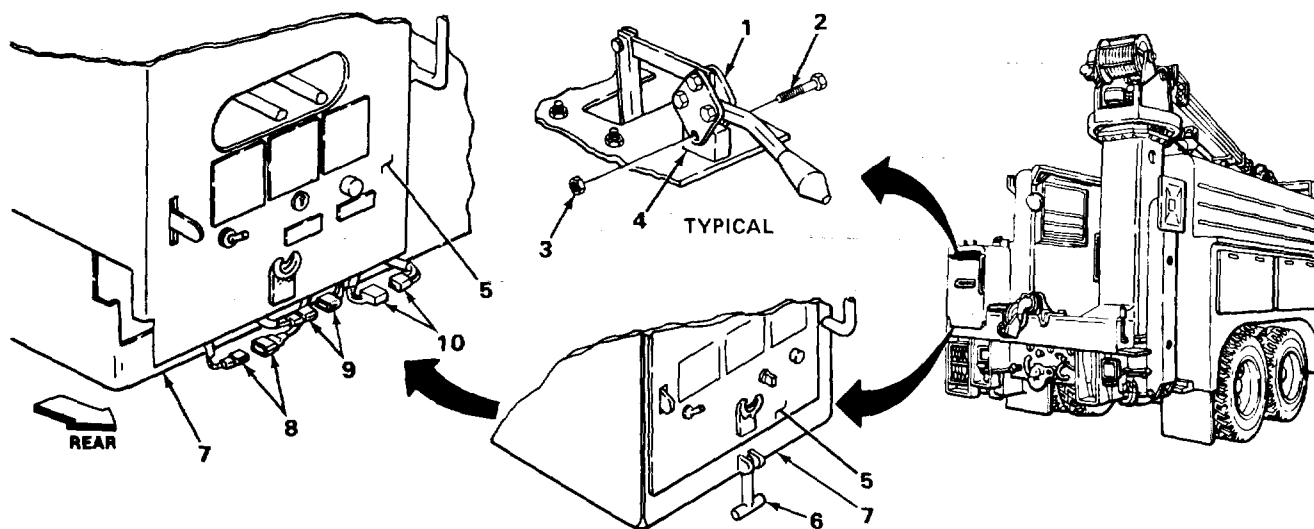
LOCATION	ITEM	ACTION	REMARKS

REMOVAL

NOTE

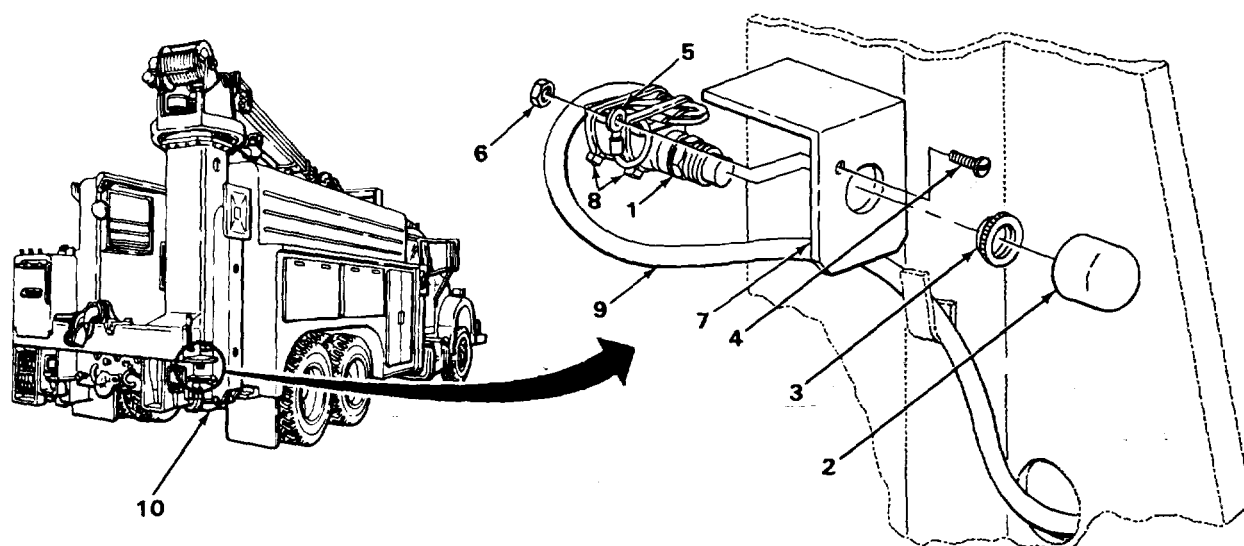
All lever links are disconnected the same way. Repeat steps 1 and 2 for all six levers.

1. Two links (1)	Screw (2) and nut (3)	Using 7/16-inch socket, ratchet handle with 318-inch drive, and 7/16-inch open-end wrench, unscrew and take out.
2. Bracket (4)	Two links (1)	Move away from.
3. Cover (5)	Handle (6)	Unlatch.
4. Console assembly (7)	Cover (5)	With help from assistants, lift up and out, but not off.
5. Cover(5)	Light switch connectors (8), stop start switch connectors (9), and emergency power switch connectors (10)	a. Pull apart. b. Tag wires. c. With help from assistant, route down into console (7) and pull out from under truck.



CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6.	Right rear emergency power switch (1)	Cap (2)	Using 3/16-inch flat-tip screwdriver, pry off.
7.		Nut (3)	Unscrew, and take off.
8.		Screw (4), ground wire (5), and nut (6)	Using 3/16-inch flat-tip screwdriver, and 3/8-inch box-end open-end wrench, unscrew and take off.
9.	Bracket (7)	Right rear emergency power switch (1)	Take out.
10.	Right rear emergency power switch (1)	Two tie wraps (8)	a. Using diagonal cutting pliers, cut. b. Get rid of.
11.		Wire (9)	a. Using diagonal cutting pliers, cut b. Tag both ends.
12.	Outrigger support (10)	Wire (9)	Pull through and out from under truck.

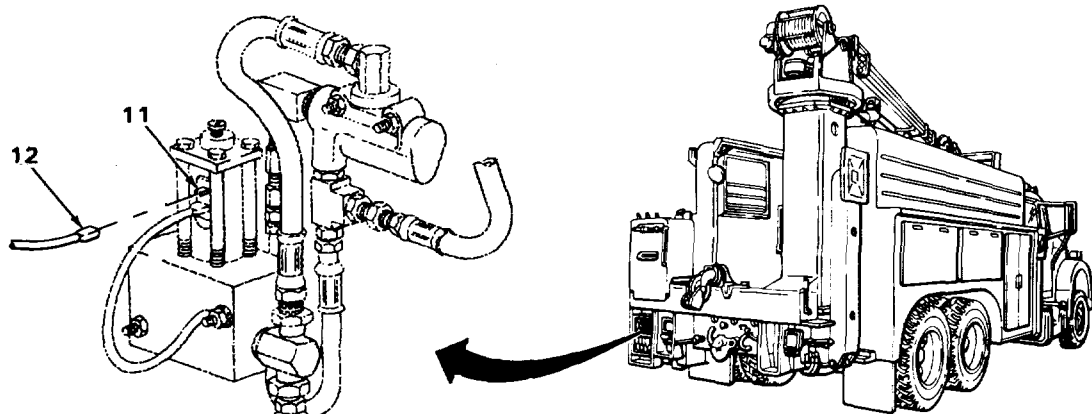


CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

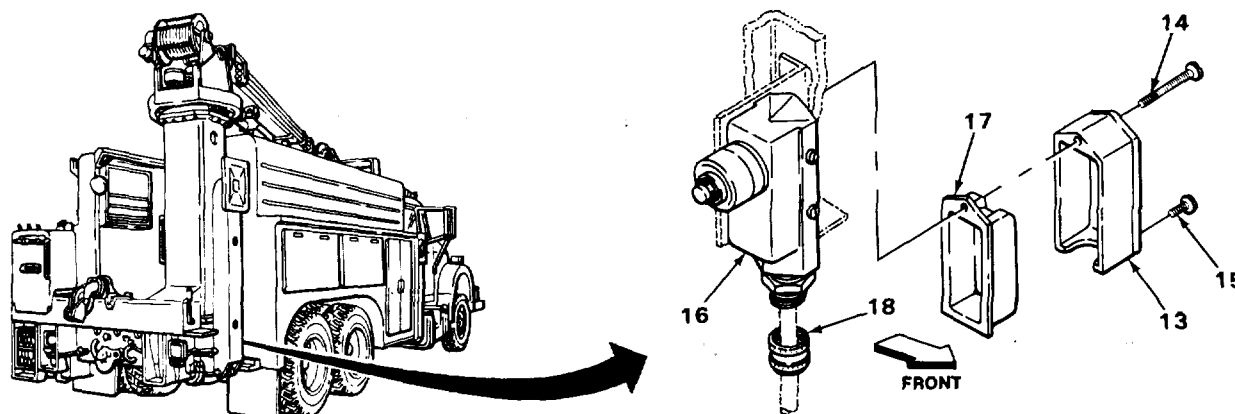
13. Positive terminal (11)	Positive wire (12)	a. Pull off. b. Tag. c. Route down underneath truck.



NOTE

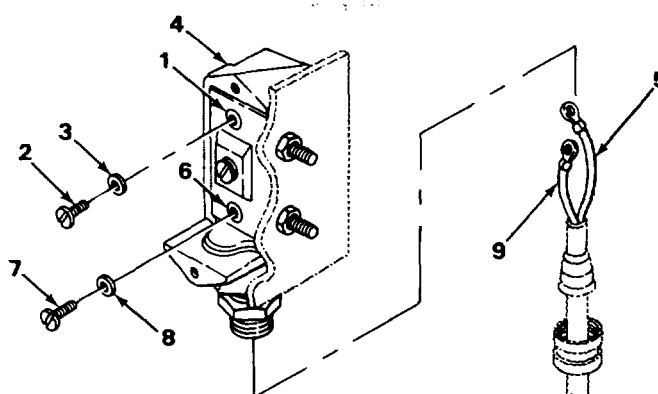
Steps 14 thru 20 cover right rear outrigger warning switch. Repeat steps for all outrigger warning switches.

14. Cover (13)	Two screws (14) and (15)	Using 3/16-inch flat-tip screwdriver, unscrew and take out.
15. Outrigger warning switch (16)	Cover (13) and gasket (17)	a. Take off. b. Get rid of gasket (17).
16.	Cap (18)	Unscrew, and pull free.



CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
17. Terminal (1)	Screw (2) and washer (3)	Using 3/16-inch flat-tip screwdriver, unscrew and take off.	
18. Outrigger warning switch (4)	Wire (5)	Pull through, and tag for installation.	
19. Terminal (6)	Screw (7) and washer (8)	Using 3/16-inch flat-tip screwdriver, unscrew and take out.	
20. Outrigger warning switch (4)	Wire (9)	- Pull through, and tag for installation. - Route wires (5) and (9) down through guide rings under truck. - Using diagonal cutting pliers, cut tie wraps as you find them, as you route wires. - Using pocket knife, cut electrical tape as you find it, as you route wires. - Get rid of wraps and/or tape.	



NOTE

Steps 21 thru 28 cover right rear outrigger lockout switch. Repeat steps for all outrigger lockout switches.

21. Cover (10)	Two screws (11) and (12)	Using 3/16-inch flat-tip screwdriver, unscrew and take out.
22. Outrigger lockout switch (13)	Cover (10) and gasket (14)	- Take off. - Get rid of gasket (14).

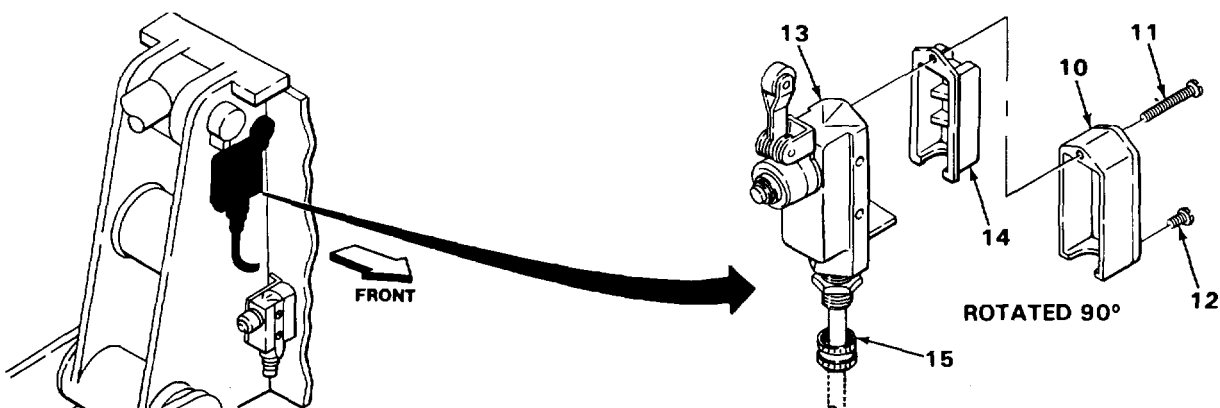
CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

23. Cap (15)

Unscrew, and pull free.



24. Terminal (16) Screw (17) and washer (18)

Using 3/16-inch flat-tip screwdriver, unscrew and take out.

25. Terminal (19) Screw (20) and washer (21)

Using 3/16-inch flat-tip screwdriver, unscrew and take out.

26. Outrigger lockout switch (13) Wire (22)

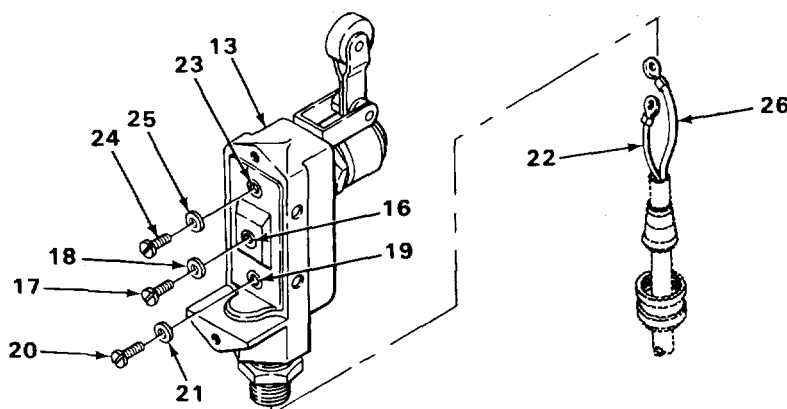
Pull through, and tag for installation.

27. Terminal (23) Screw (24) and washer (25)

Using 3/16-inch flat-tip screwdriver, unscrew and take out.

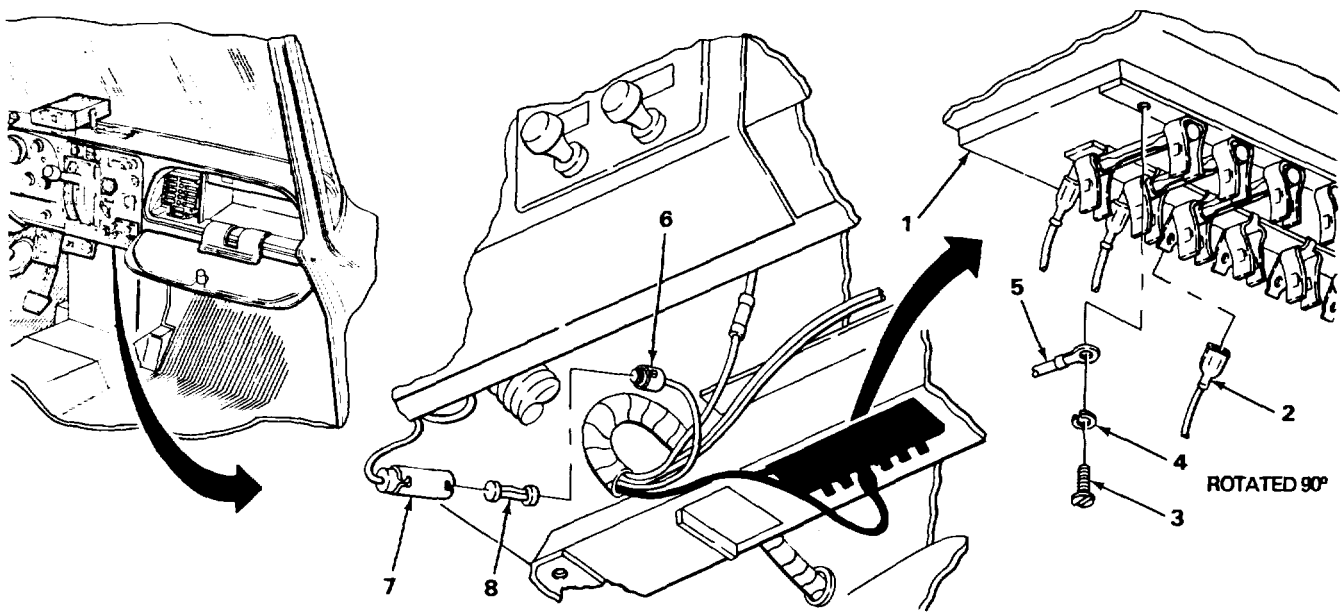
28. Outrigger lockout switch (13) Wire (26)

a. Pull through, and tag for installation.
b. Route under frame, toward engine compartment.



CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
29. Fuse block (1)	Blue wire (2)	a. Unplug. b. Tag.	
30.	Screw (3), lock-washer (4), and and light brown wire (5)	a. Using 3/16-inch flat-tip screwdriver, unscrew and take off. b. Get rid of lockwasher. c. Tag wire (5).	
31. Dark brown wire (6)	Fuse holder (7)	Push together, turn one-quarter turn counterclockwise, and take apart.	
32. Fuse holder (7)	Fuse (8)	Take out.	

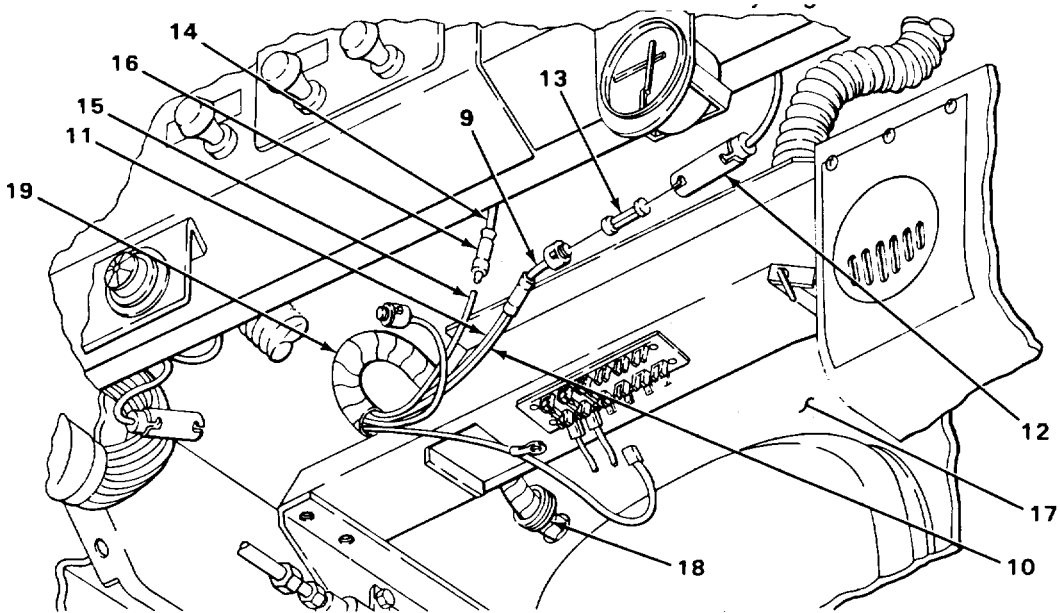


33. Brown wire (9), two red wires (10) and (11)	Fuse holder (12)	a. Push together, turn one-quarter turn counterclockwise, and take apart. b. Tag wires (9), (10), and (11).	
34. Fuse holder (12)	Fuse (13)	Take out. TA238322	
35. Cream wire (14)	Cream wire (15)	a. Using diagonal cutting pliers, cut cream wire (15) near connector (16). b. Tag wires (14) and (15).	

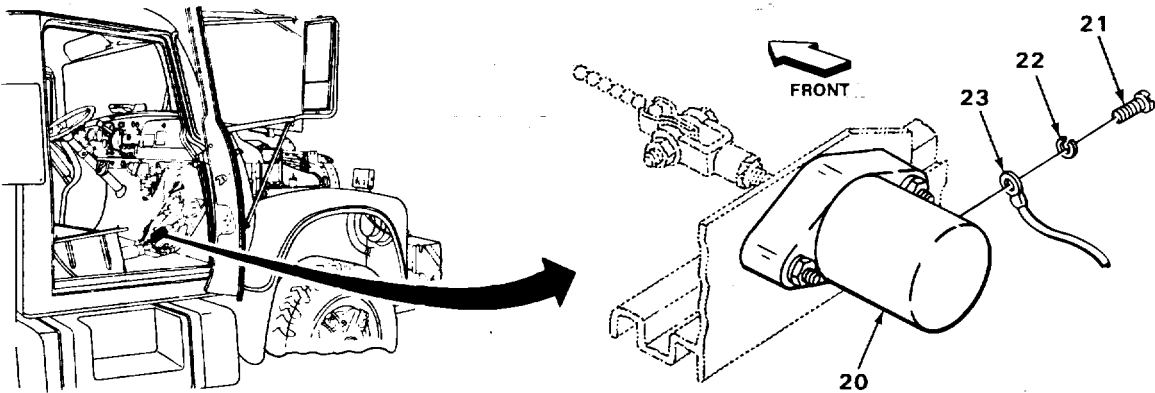
TA238322

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
36. Firewall (17)	Grommet (18)	Using 3/16-inch flat-tip screwdriver, pry out.	
37.	Wiring harness (19)	Have assistant pull out from engine side while you guide wires.	



38. Solenoid (20)	Screw (21), lock-washer (22), and wire (23)	a. Using 3/16-inch flat-tip screwdriver, unscrew and take off. b. Get rid of lockwasher (22).



CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

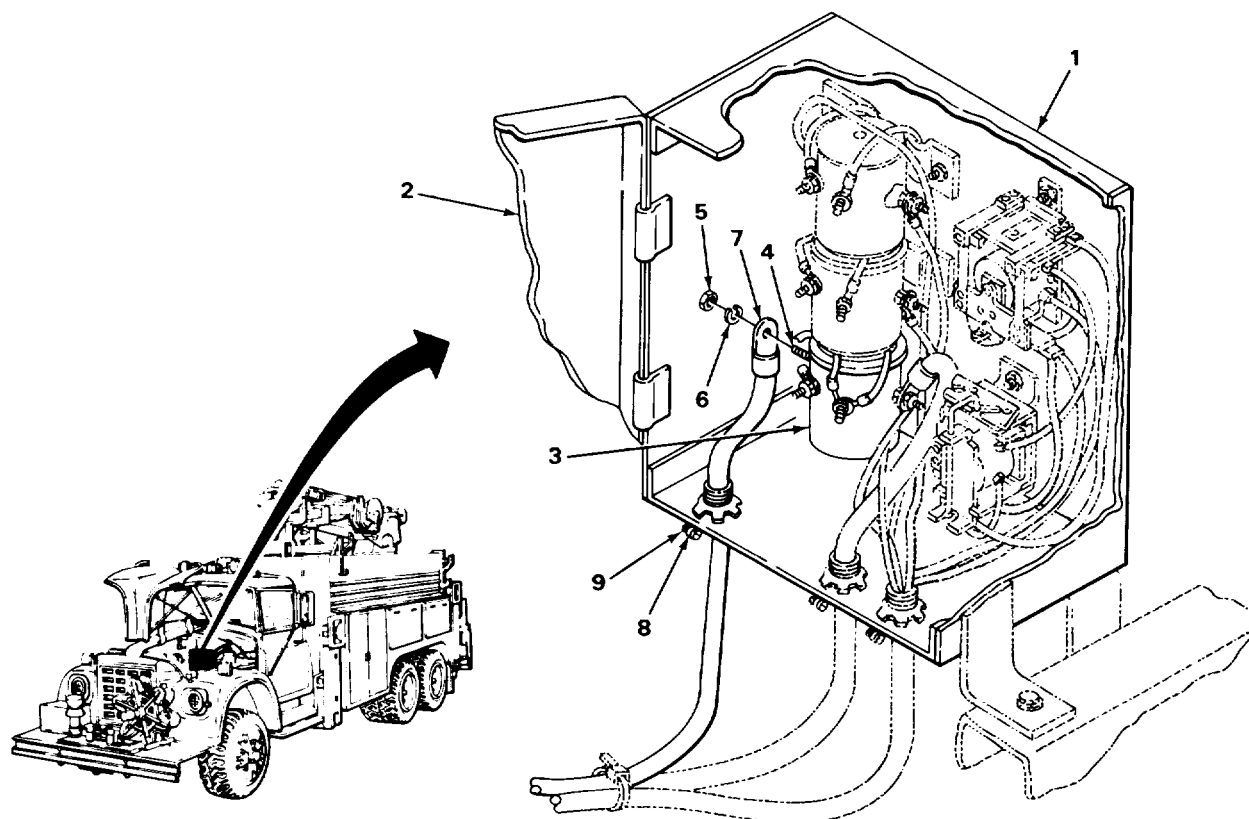
REMOVAL - CONTINUED

NOTE

Tag all wires to make installation easier.

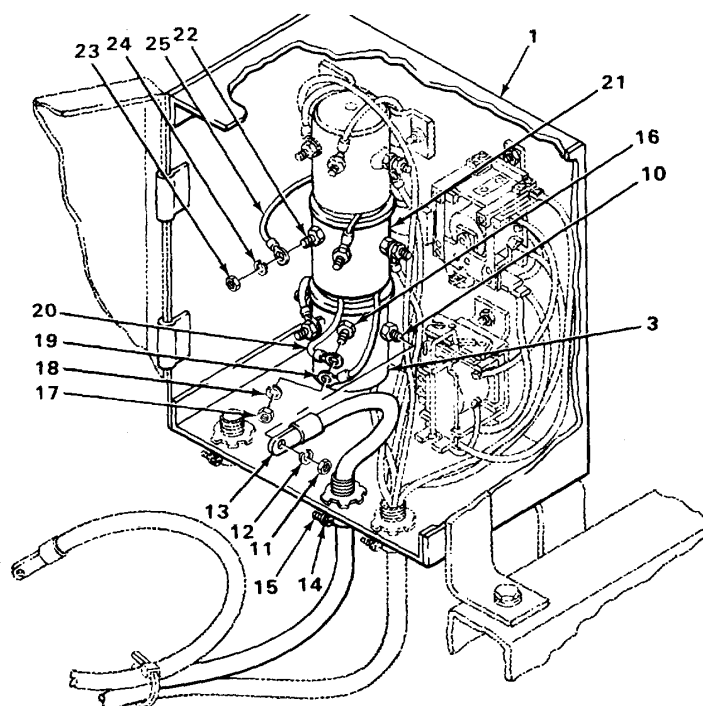
For relay box wire disconnect, right and left is based on your view of the inside of the box.

39. Relay box (1)	Door (2)	Open.
40. Bottom solenoid (3) and left terminal (4)	Nut (5), lockwasher (6), and red battery wire (7)	a. Using 11/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (6).
41. Clamp (8)	Two screws (9)	Using 3/16-inch flat-tip screwdriver, unscrew part way.
42. Relay box (1)	Red battery wire (7)	Pull out.



CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
43	Bottom solenoid (3) and right terminal (10)	Nut (11), lockwasher (12), and red auxiliary pump	a. Using 11/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (12). wire (13)
44	Clamp (14)	Two screws (15) unscrew part way.	Using 3/16-inch flat-tip screwdriver,
45	Relay box (1) wire (13)	Red auxiliary pump	Pull out.
46	Bottom solenoid (3) and right front terminal (16)	Nut (17), lockwasher (18), and two white wires (19) and (20)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (18).
47.	Center solenoid (21) and left front terminal (22)	Nut (23), lockwasher (24), and dark brown wire (25)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (24).



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CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
48 Center solenoid (1) and right terminal (2)	Nut (3), lockwasher (4), and black solenoid wire (5)	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (4).	
49. Top solenoid (6) and left terminal (7)	Nut (8), lockwasher (9), and red wire (10)	a. Using 11/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (9).	
50 Top solenoid (6) and right terminal (11)	Nut (12), lockwasher (13), and red throttle wire (14)	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (13).	
51 Top relay (15) and bottom front terminal (16)	Two brown wires (17) and (18)	Using soldering gun, unsolder.	
52 Bottom rear terminal (19)	Yellow wire (20)	Using soldering gun, unsolder.	
53 Clamp (21)	Two screws (22) unscrew part way.	Using 3/16-inch flat-tip screwdriver,	
54 Relay box (23)	Cable (24)	Pull out.	

CLEANING

55 Wiring harness (25) Wipe clean with clean, damp rags.

INSPECTION/REPLACEMENT**NOTE**

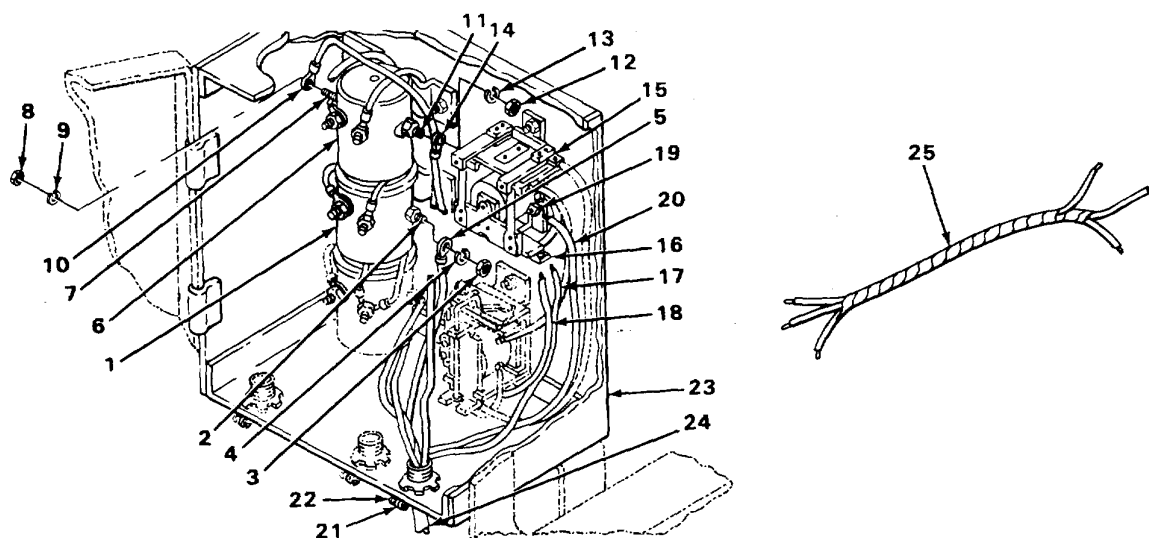
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

56 Wiring harness (25)	a Look for broken terminals. b. c.	Look for cracked and burned wires. Look for frayed and deteriorated insulation.

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

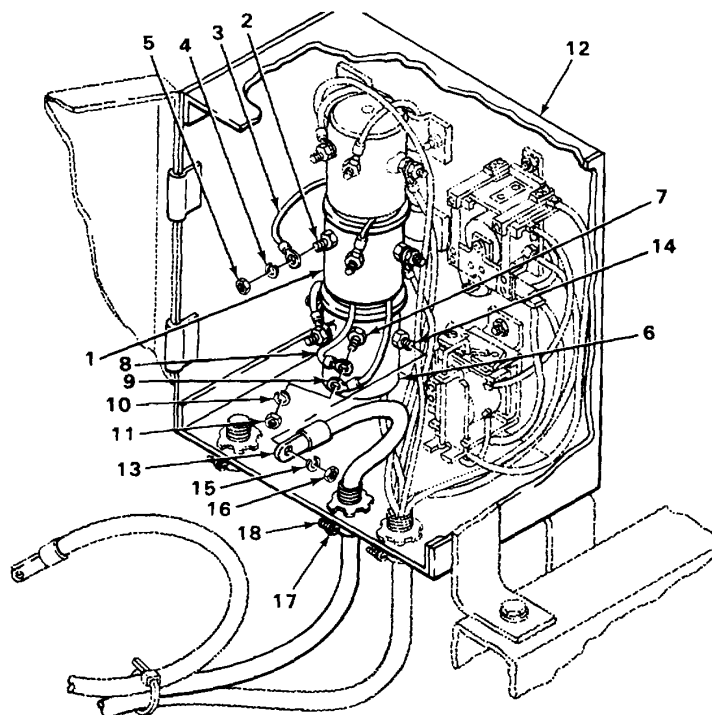
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
57	Relay box (23) wiring harness (25)	Cable (24) and	Put in position.
58	Top relay (15) and bottom rear terminal (19)	Yellow wire (20)	Solder in place using soldering gun and solder.
59	Bottom front terminal (16)	Two brown wires (17) and (18)	Solder in place using soldering gun and solder.
60	Top solenoid (6) and right terminal (11) and nut (12)	Red throttle control wire (14), new lockwasher (13), and nut (12)	Screw on, and tighten using 1/2-inch box-end wrench.
61	Top solenoid (6) and left terminal (7)	Red wire (10), new lockwasher (9), and nut (8)	Screw on, and tighten using 1/2-inch box-end wrench.
62	Center solenoid (1) and right terminal (2)	Black solenoid wire (5), new washer (4), and nut (3)	Screw on, and tighten using 1/2-inch box-end wrench.
63	Clamp (21)	Two screws (22) screwdriver.	Tighten using 3/16-inch flat-tip



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CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

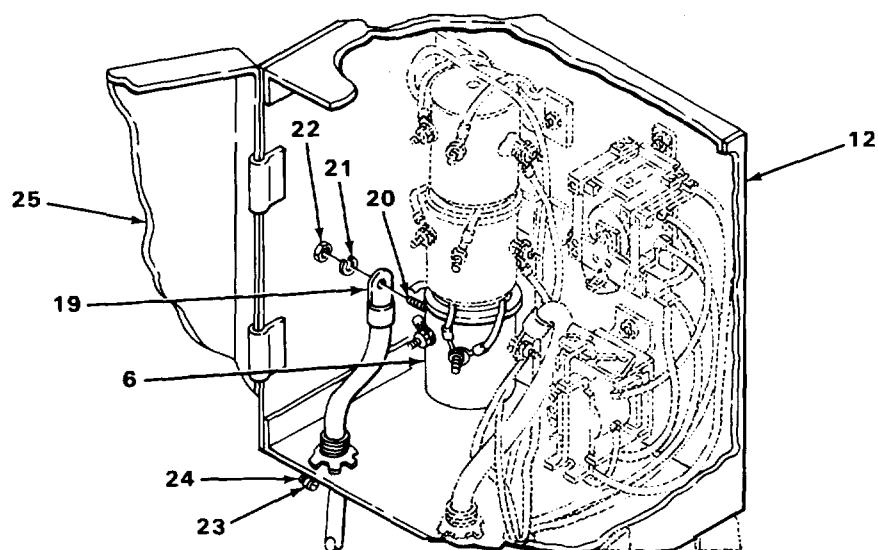
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
64	Center solenoid (1) and left front terminal (2) nut (5)	Dark brown wire (3), new lock-washer (4), and	Screw on, and tighten using 3/8-inch box-end wrench.
65	Bottom solenoid (6) and right front terminal (7) and nut (11)	Two white wires (8) and (9), new lockwasher (10),	Screw on, and tighten using 3/8-inch box-end wrench.
66	Relay box (12) pump wire (13)	Red auxiliary	Put through.
67	Bottom solenoid (6) and right front terminal (14) and nut (16)	Red auxiliary pump wire (13), new lockwasher (15),	Screw on, and tighten using 1/2-inch box-end wrench.
68	Clamp (17)	Two screws (18) screwdriver.	Tighten using 3/16-inch flat-tip



TA238327

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
69	Relay box (12) wire (19)	Red battery	Put through.
70.	Bottom solenoid (6) and left front terminal (20) nut (22)	Red battery wire (19), new lock- washer (21), and	Screw on, and tighten using 1/2-inch box-end wrench.
71	Clamp (23)	Two screws (24) screwdriver.	Tighten using 3/16-inch flat-tip
72	Relay box (12)	Door (25)	Close.

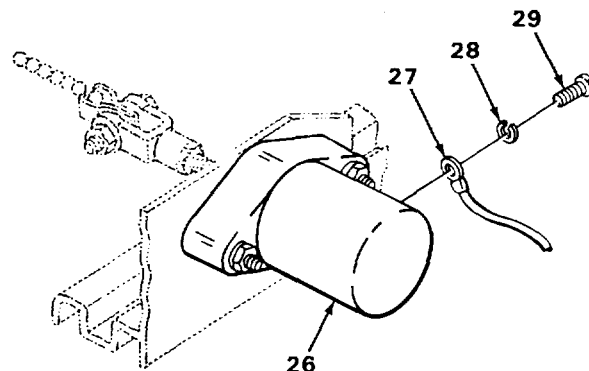
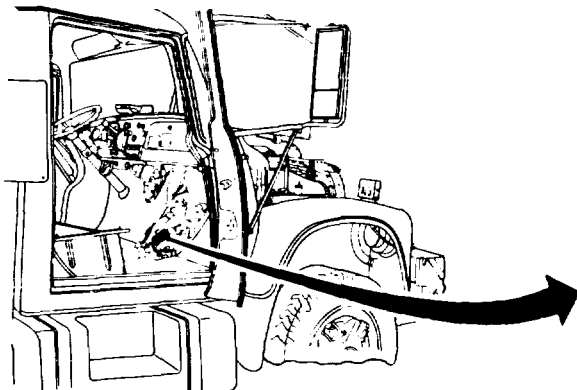


73	Solenoid (26) lockwasher (28), and screw (29)	Wire (27), new a. Take off tag. b. Screw in, and tighten using 3/16-inch flat-tip screwdriver.

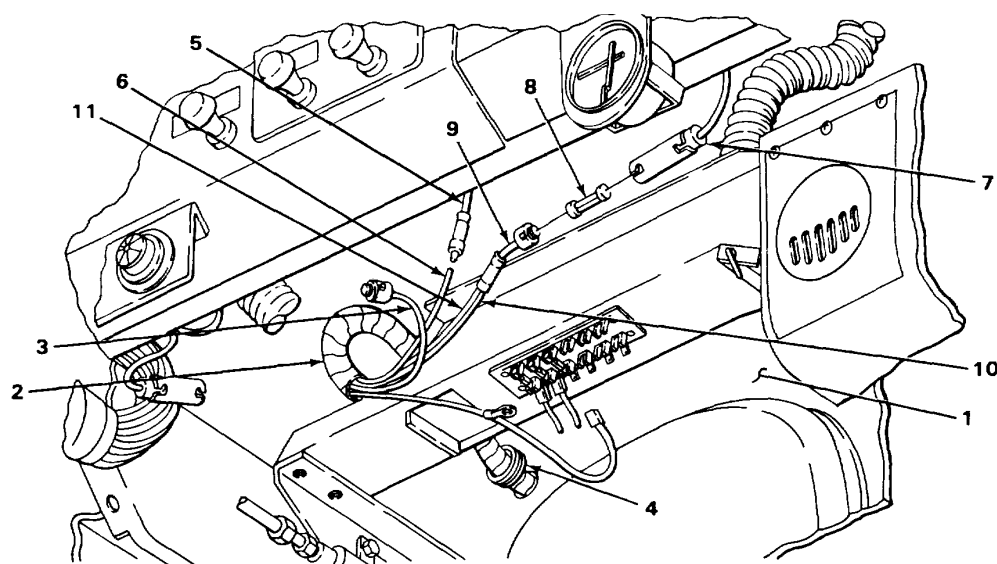
TA238328

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

74	Firewall (1) and wire (3)	Wiring harness (2)	With help from assistant, feed through.
75	Grommet (4)	Put in.	
76	Cream wire (5)	Cream wire (6)	Connect (TM 9-2320-269-20-1).
77	Fuse holder (7)	Fuse (8)	Put in.
78	Brown wire (9) and two red wires (10) and (11)	Fuse holder (7)	a. Take off tags. b. Push together and turn one-quarter turn clockwise.



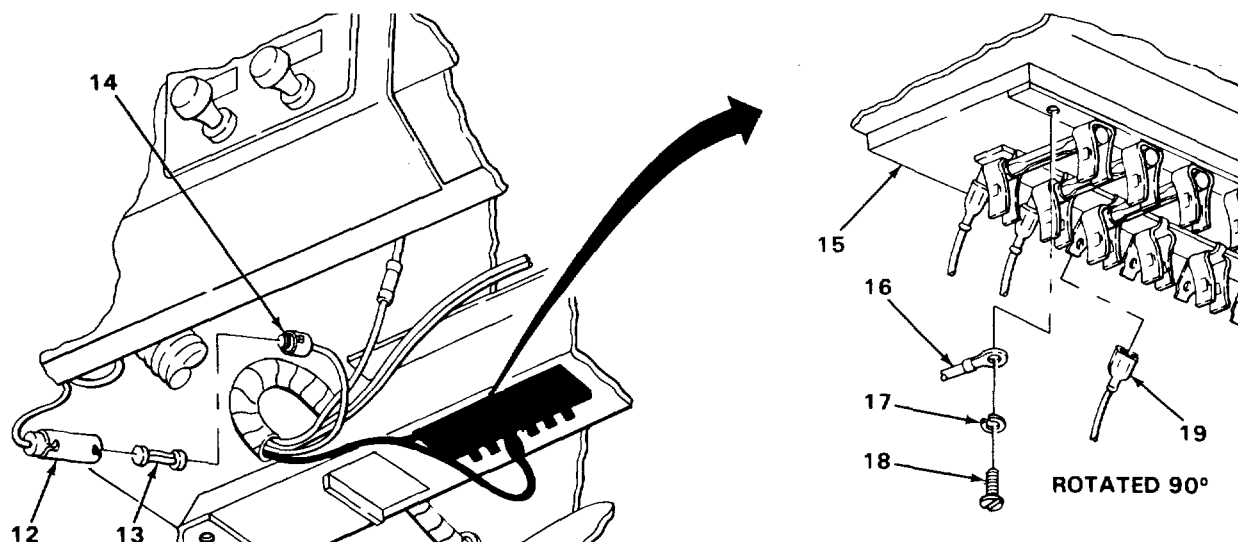
TA238329

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

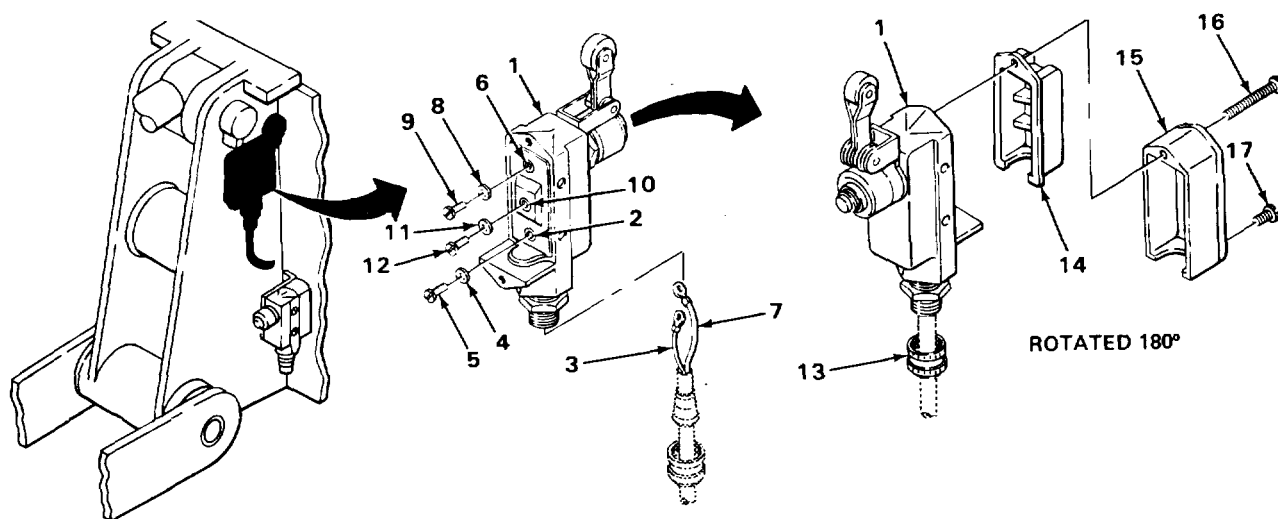
79	Fuse holder(12)	Fuse (13)	Put in.
80	Dark brown wire (14)	Fuse holder (12)	Push together and turn.
81	Fuse block (15) (16), new lock-washers (17) and screw (18)	Light brown wire b. Screw in, and tighten using 3/16-inch flat-tip screwdriver.	a. Take off tag.
82	Blue wire (19)	Plug in.	



TA238330

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

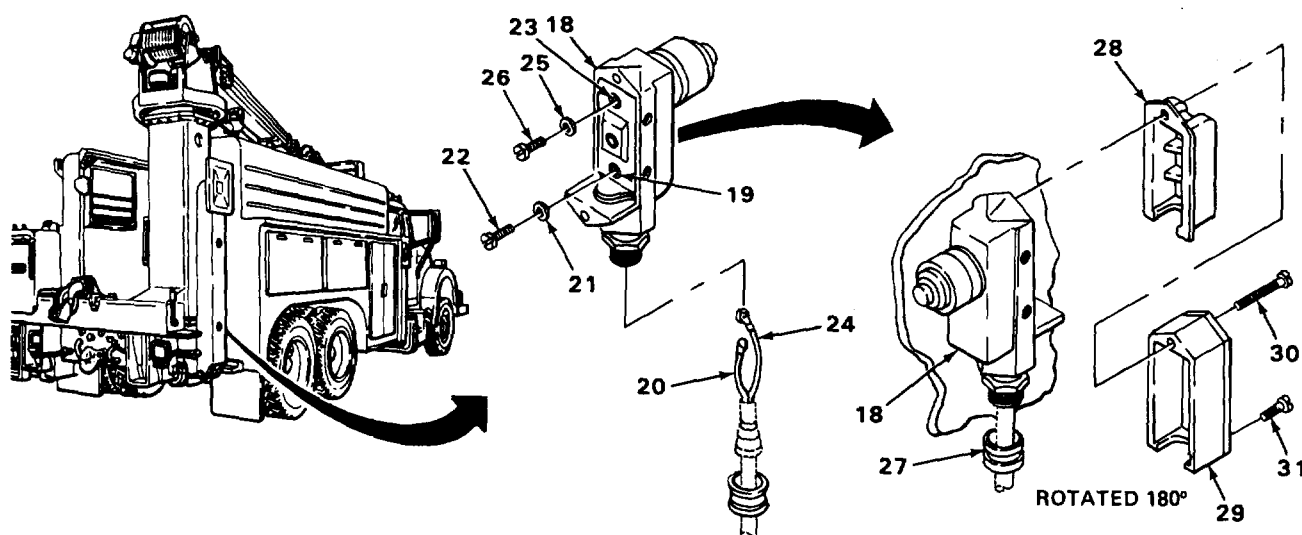
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
83	Outrigger lockout switch (1) and terminal (2)	Wire (3), washer (4) and screw (5) c. d.	a. Route harness under engine compartment and cab toward back of vehicle. b. Take off tag. Pull through to switch (1). Screw in, and tighten using 3/16-inch flat-tip screwdriver.
84.	Terminal (6) (8), and screw (9)	Wire (7), washer flat-tip screwdriver.	Screw in, and tighten using 3/16-inch
85	Terminal (10) screw (12)	Washer (11) and flat-tip screwdriver.	Screw in, and tighten using 3/16-inch
86	Outrigger lockout switch (1)	Cap (13)	Screw on, and tighten.
87	New gasket (14) and cover (15)	Put in place.	
88	Cover (15) (17)	Two screws (16) and b.	a. Screw in, and tighten using 3/16-inch flat-tip screwdriver. Repeat steps 83 thru 88 for all lock-out switches.



TA238331

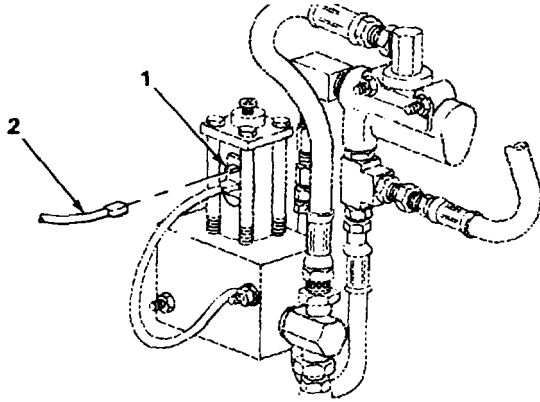
CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
89	Outrigger warning switch (18) and terminal (19)	Wire (20), washer (21), and screw (22)	a. Route wire through guide rings up to switch (18). b. Screw in, and tighten using 3/16-inch flat-tip screwdriver.
90	Terminal (23) (25), and screw (26)	Wire (24), washer tip screwdriver.	Screw in, and tighten using 3/16-inch flat-
91	Outrigger warning switch (18)	Cap (27)	Screw on and tighten.
92	New gasket (28) and cover (29)	Put in place.	
93	Cover (29) (31)	Two screws (30) and b. c.	a. Screw in, and tighten using 3/16-inch flat-tip screwdriver. Secure harness with tie wraps where necessary. Repeat steps 89 thru 93 for all out-rigger warning switches.



TA238332

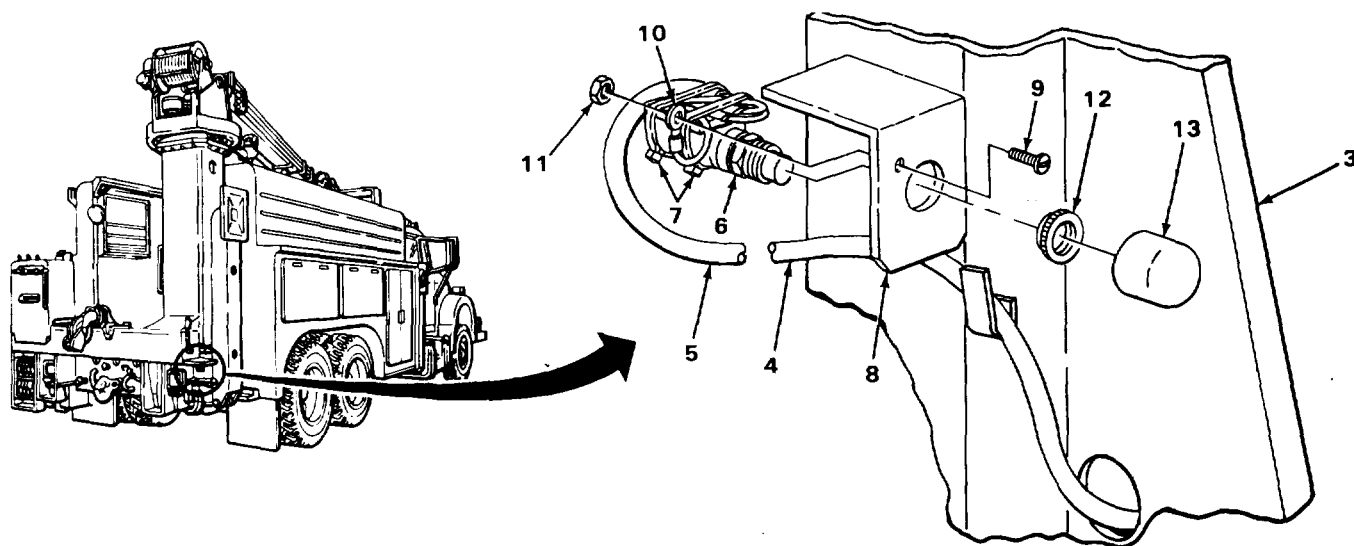
CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
94. Positive terminal (1)	Positive wire (2)	Route into position and push on.	
			
95. Outrigger support (3)	Wire (4)	a. Route through and up. b. Take off tag.	
96. Wire (4)	Wire (5)	Connect (TM 9-2320-269-20-1).	
97. Right rear emergency power switch (6)	Two new tie wraps (7)	Put on.	
98. Bracket (8) emergency power switch (6)	Right rear emer-	Put in position	
99. Right rear emergency power switch (6)	Screw (9), ground wire (10), and nut (11)	Screw in, and tighten using 3/16-inch flat-tip screwdriver and 3/8-inch open-end wrench.	
100. Nut (12)	Screw on, and tighten.		
101. Cap (13)	Push on.		

TA238333

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

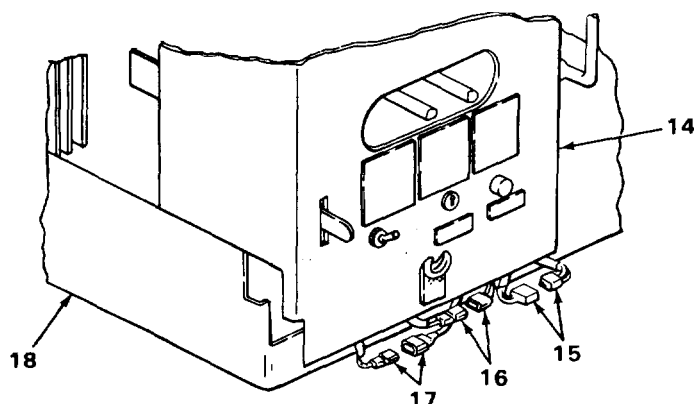
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

102 Cover (14)
switch connectors
(15), stop start
switch connectors
(16), and light
switch connectors (17)

Emergency power
underneath console assembly (18).
b. Take off tags.
c. Push together.

a. With help from assistant, route up
underneath console assembly (18).



TA238334

CONSOLE TACHOMETER AND OUTRIGGER HYDRAULIC SOLENOID WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

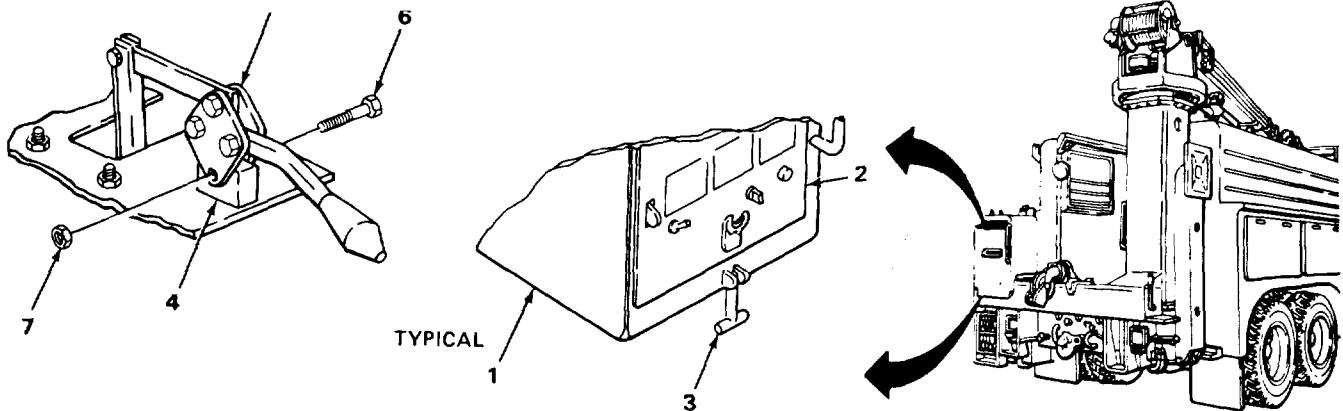
INSTALLATION - CONTINUED

103. Console assembly (1)	Cover (2) and latch (3)	a. With help from assistant, put in place. b. Fasten latch (3).

NOTE

All lever links are connected the same way. Repeat steps 104 and 105 for all six levers.

104. Bracket (4)	Two links (5)	Put in place.
105. Two links (5) nut (7)	Screw (6) and socket, ratchet handle with 3/8-inch drive, and 7/16-inch open-end wrench.	Screw in, and tighten using 7/16-inch

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Connect battery cables (TM 9-2320-269-20-1).
2. Install engine cover (TM 9-2320-269-20-2).
3. Close left side engine compartment hood (TM 9-2320-269-10).
4. Raise outriggers (TM 9-2320-269-10).
5. Check operation of outriggers and console tachometer (TM 9-2320-269-10).

TASK ENDS HERE

TA238335

BODY LIGHTS WIRING HARNESS

This task covers:

a. Removal (page 2-594)	c. Inspection/Replacement (page 2-597)
b. Cleaning (page 2-597)	d. Installation (page 2-598)
-

INITIAL SETUP**Tools**

Gun, solder
Knife, pocket
Pliers, diagonal cutting
Screwdriver, cross-tip, number one
Screwdriver, flat-tip, 3/6-inch

Personnel Required

Two

Equipment Condition

Battery cables disconnected
(TM 9-2320-269-20-1).

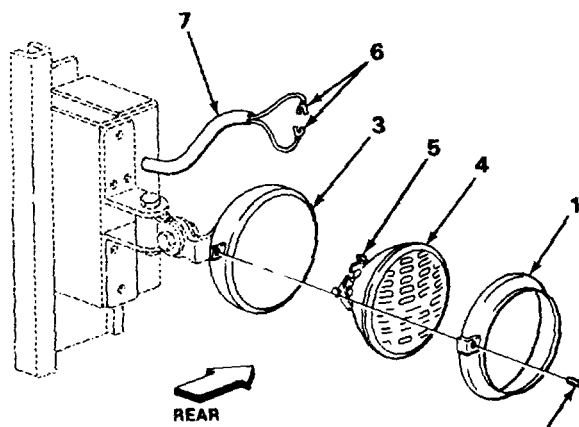
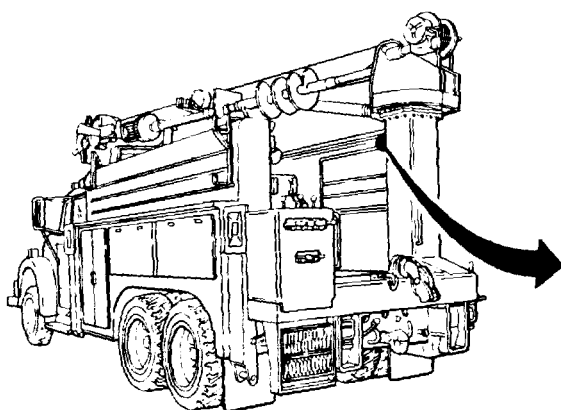
Materials/Parts

Flux, rosin (item 18, appendix B)
Gasket, lens
Gasket, marker light
Rags, wiping (item 42, appendix B)
Solder (item 46, appendix B)
Tape, electrical, vinyl (item 52, appendix B)

2-593

BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Retaining ring (1)	Screw (2) unscrew and take out.	Using 3/16-inch flat-tip screwdriver,
2.	Housing (3) and lamp (4)	Retaining ring (1)	Unhook, and pull forward.
3.	Lamp (4) and terminals (6)	Two screws (5) loosen screws (5) and take off terminals (6). b.	a. Using 3/16-inch flat-tip screwdriver, Set lamp (4) aside.
4.	Housing (3)	Wire (7)	Pull out.



5.	Retaining ring (8)	Screw (9) unscrew and take out.	Using number one cross-tip screwdriver,
6.	Housing (10)	Retaining ring (8)	Unhook, and pull forward.
7.	Lamp (11) two terminals (13)	Two screws (12) and loosen screws (12) and take off b.	a. Using 3/16-inch flat-tip screwdriver, terminals (13). Set lamp (11) aside.
8.	Housing (10)	Wire (14)	Pull out.

TA238336

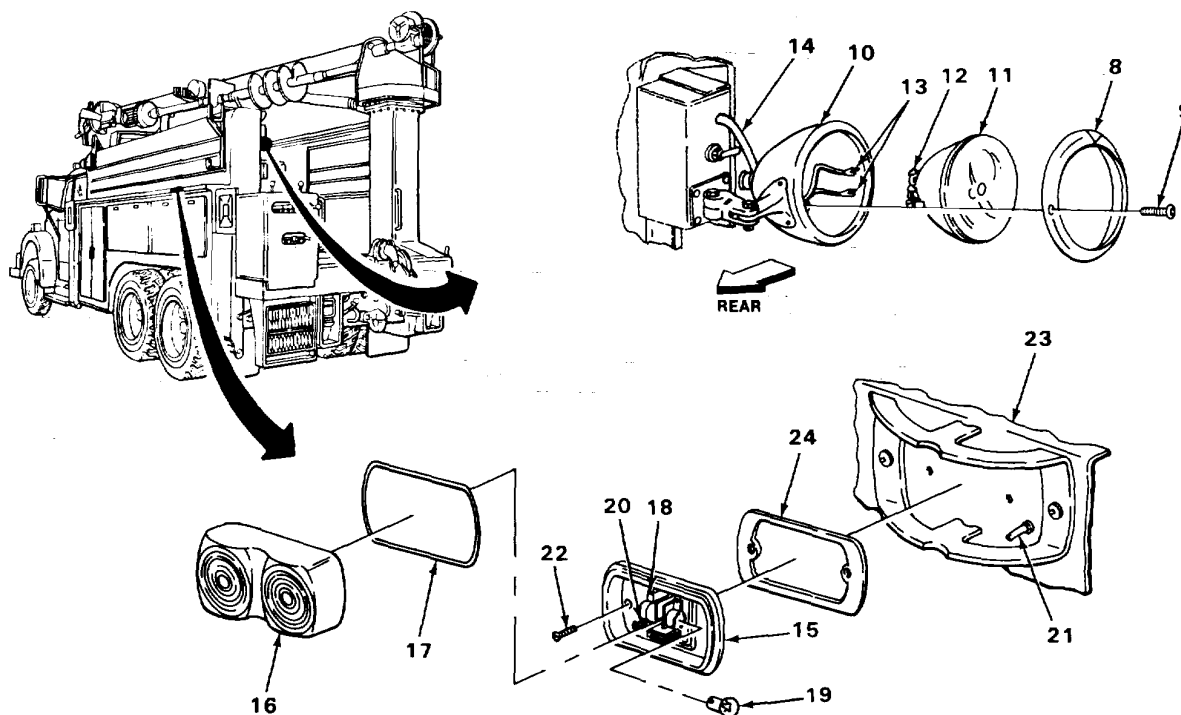
BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED**NOTE**

Right side marker light is shown. Repeat steps 9 thru 14 for left side light.

9	Marker light (15)	Lens (16) pry out.	Using 3/16-inch flat-tip screwdriver,
10	Lens gasket (17)	Take off, and get rid of.	
11	Marker light bulb clips (18)	Two bulbs (19)	Push in, turn counterclockwise and take out.
12	Lead wire contact (20)	Lead wire (21)	Using soldering gun, heat solder until wire (21) is free.
13	Marker light (15)	Two screws (22) unscrew and take out.	Using 3/16-inch flat-tip screwdriver,
14	Stowage box (23) and gasket (24)	Marker light (15) b. Get rid of gasket (24).	a. Take off.



TA238337

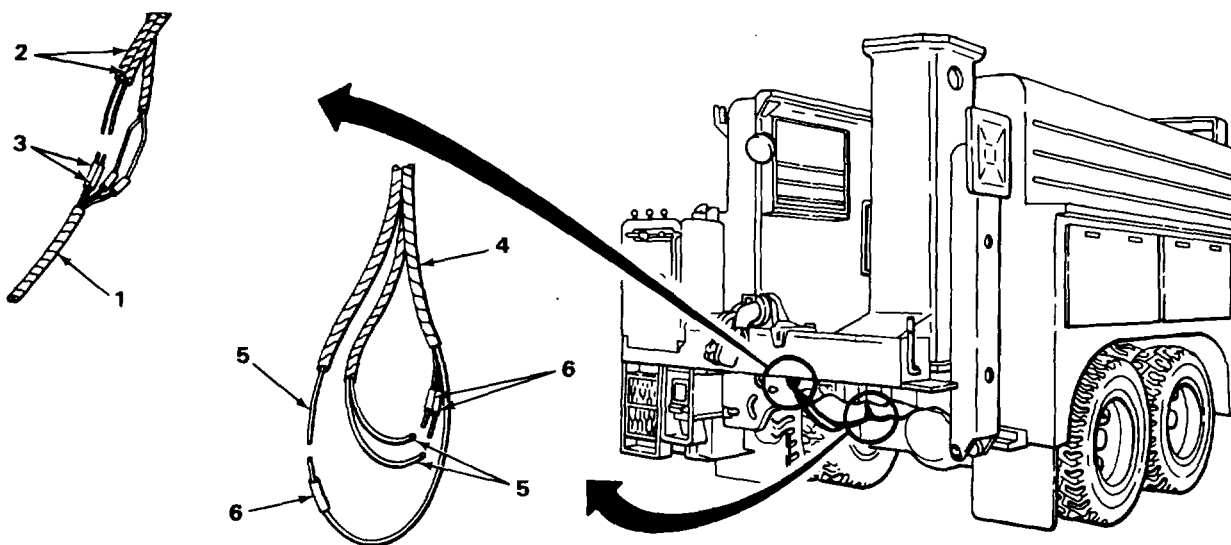
BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED**NOTE**

Tag wires before cutting to make installation easier.

15. Light wiring harness (1)	Two marker light wires (2) b.	a. Using pocket knife, cut electrical tape and get rid of. Using diagonal cutting pliers, cut wires (2) near connectors (3).
16. Main rear harness (4)	Three floodlight wires (5) b.	a. Using pocket knife, cut electrical tape and get rid of. Using diagonal cutting pliers, cut wires (5) near connectors (6).



TA238338

BODY LGHT WIRING HARNESS - CONTINUED

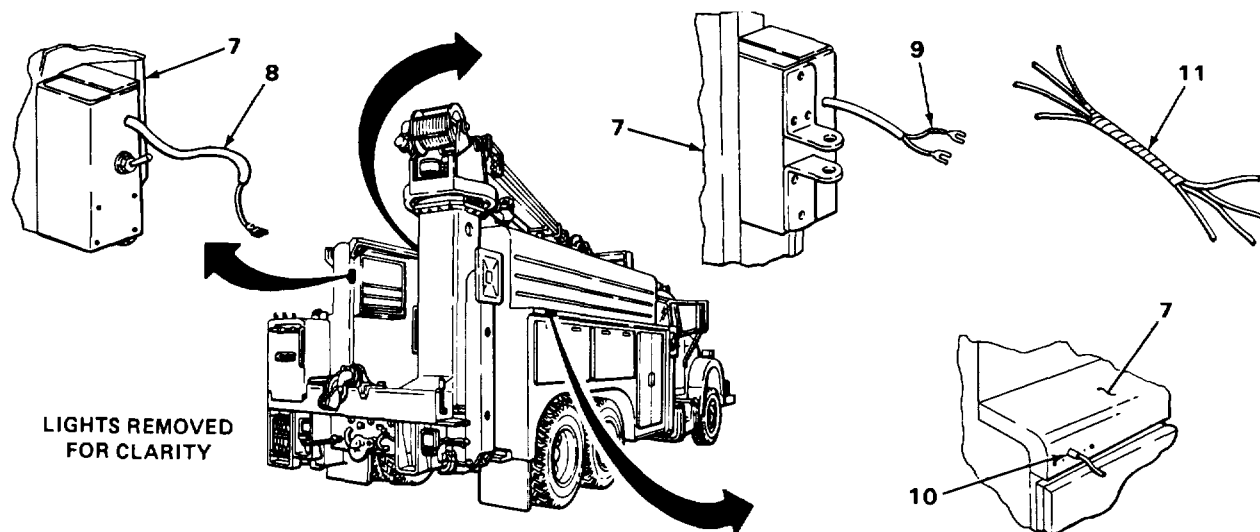
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
17 Body (7) (8) and (9)	Two spotlight wires	Pull out.	
18 Two side marker light wires (10)	Pull out.		
19 Wiring harness (11)	Take out.		
CLEANING			
20 Wiring harness (11)	Wipe clean with clean, damp rags.		
INSPECTION/REPLACEMENT			

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

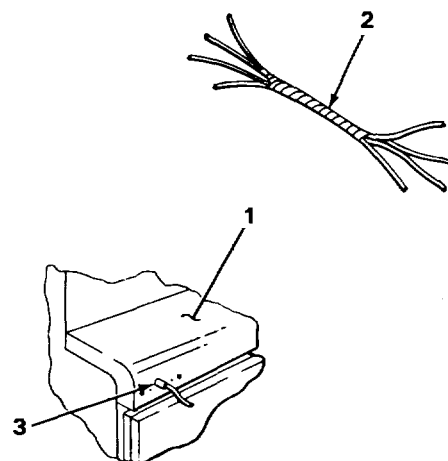
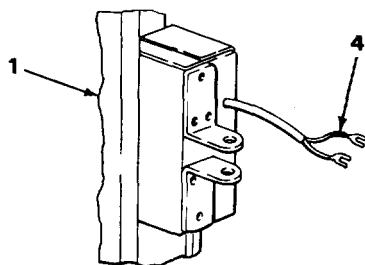
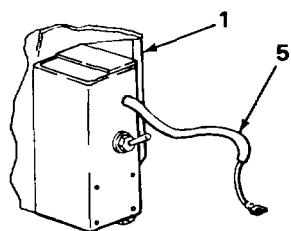
- 21 Wiring harness (11)
- Look for cut, broken, and damaged wires.
 - Look for ripped, torn, and frayed insulation



TA238339

BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION		
22 Body (1)	Wiring harness (2) position.	With help from assistant, put in
23 Two side marker light wires (3)	Push through.	
24 Two spotlight wires (4) and (5)	Push through.	



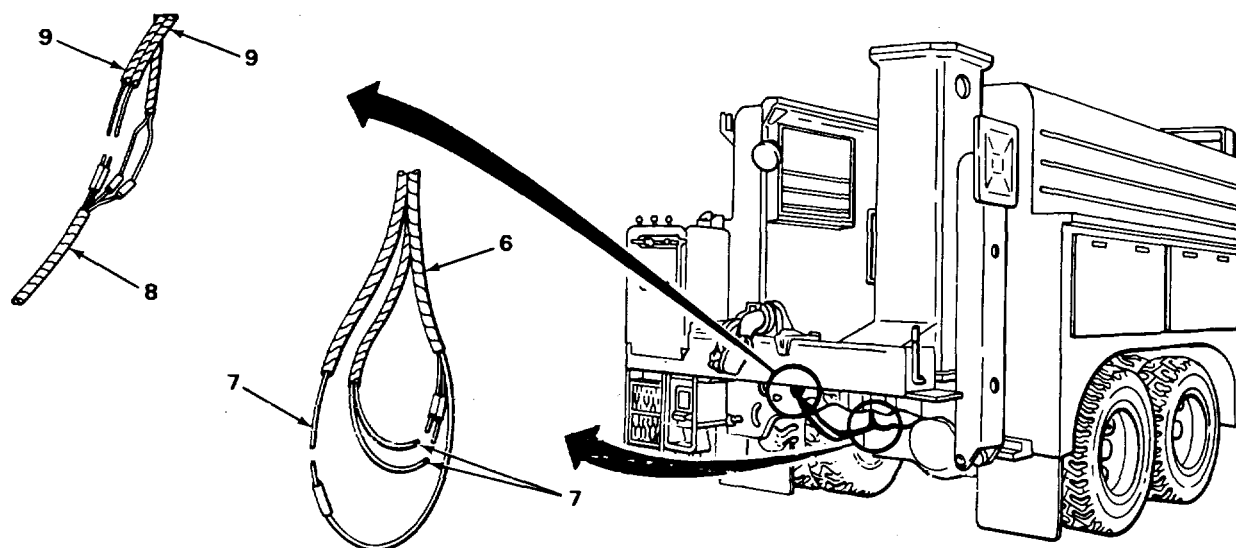
25 Main rear harness (6)	Three floodlight wires (7)	a. Crimp together (TM 9-2320-269-20-1). b. Wrap connections with electrical tape.
26 Light wiring harness (8)	Two marker light wires (9)	a. Crimp together (TM 9-2320-269-20-1). b. Wrap connections with electrical tape.

TA238340

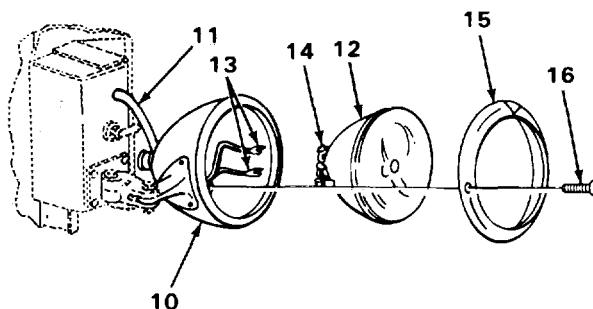
BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED



27. Housing (10)	Wire (11)	Put through.
28. Lamp (12) and housing (10)	Two terminals (13) and screws (14)	a. Put lamp (12) in position. b. Put on terminals (13), and tighten screws (14) using 3/16-inch flat-tip screwdriver.
29. Housing (10)	Retaining ring (15)	Hook, and push on.
30. Retaining ring (15)	Screw (16) cross-tip screwdriver.	Screw in, and tighten using number one



TA238341

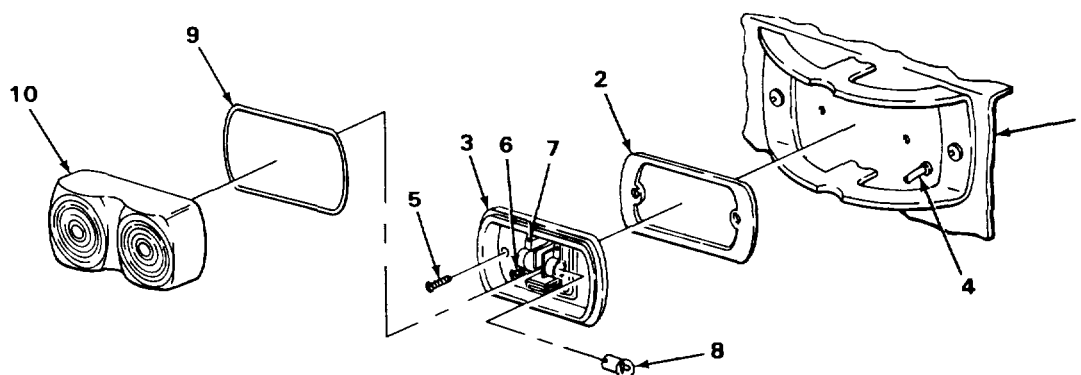
BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED**NOTE**

Right side marker light installation is shown. repeat steps 31 thru 35 for left side light.

31	Stowage box (1) marker light (3)	New gasket (2) and and light. b.	a Put wire (4) through gasket (2) Put light (3) in position.
32	Marker light (3)	Two screws (5) flat-tip screwdriver.	Screw in, and tighten using 3/16-inch
33	Lead wire contact (6)	Lead wire (4)	Solder into place using soldering gun and solder.
34	Marker light bulb clips (7)	Two bulbs (8)	Push in, and turn.
35	Marker light (3) lens (10)	New gasket (9) and	Put in place.



36	Housing (11)	Wire (12)	Put through.
37	Lamp (13) and terminals (15)	Two screws (14) b. Put on terminals (15), and	a Put lamp (13) in position. using 3/16-inch flat-tip screwdriver, tighten screws (14).
38	Housing (11)	Retaining ring (16)	Hook, and push on

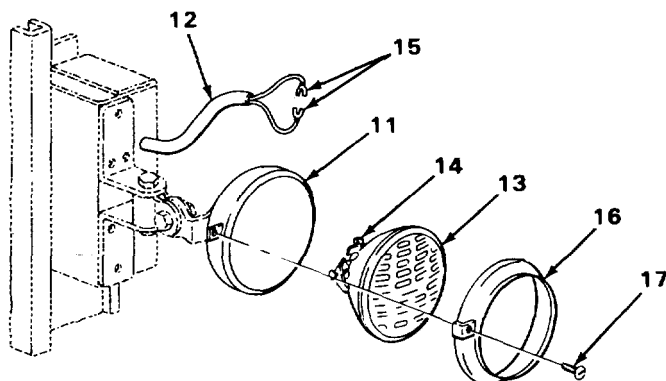
TA238342

BODY LGHT WIRING HARNESS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

39. Retaining ring (16)	Screw (17) tip screwdriver.	Screw in, and tighten using 3/16-inch flat-



NOTE

FOLLOW-ON MAINTENANCE: Connect battery cables (TM 9-2320-269-20-1).

TASK ENDS HERE

TA238343

RELAY BOX

This task covers:

a. Removal (page 2-603)	d. Inspection/Replacement (page 2-616)
b. Disassembly (page 2-608)	e. Assembly (page 2-620)
c. Cleaning (page 2-615)	f. Installation (page 2-627)

INITIAL SETUP

Tools

Battery, 12-volt
 Brush, parts cleaning
 Chisel, cold, hand, 1/2-inch
 File, hand, 6-inch
 Gun, soldering
 Hammer, ball-peen, machinist's, 2-oz
 Handle, ratchet, 3/8-inch drive
 Multimeter
 Screwdriver, flat-tip, 3/16-inch,
 Screwdriver, flat-tip, 3/8-inch
 Socket, 3/8-inch drive, 7/16-inch
 Test leads
 Wrench, box-end, 3/8-inch
 Wrench, box-end, 7/16-inch
 Wrench, box-end, 1/2-inch
 Wrench, open-end, 5/16-inch

Materials/Parts

Lockwasher, relay box bottom bracket-to-relay box (two required)
 Lockwasher, relay box bottom bracket-to-relay splash panel
 Lockwasher, relay box side bracket-to-relay box

Materials/Parts - Continued

Lockwasher, relay box bottom bracket-to-relay box
 Lockwasher, solenoid and relay-to-relay box (ten required)
 Lockwasher, solenoid, right and left front terminals (six required)
 Lockwasher, right and left terminals (six required)
 Nut, self-locking, firewall brace
 Rags, wiping (item 42, appendix B)
 Solder (item 46, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

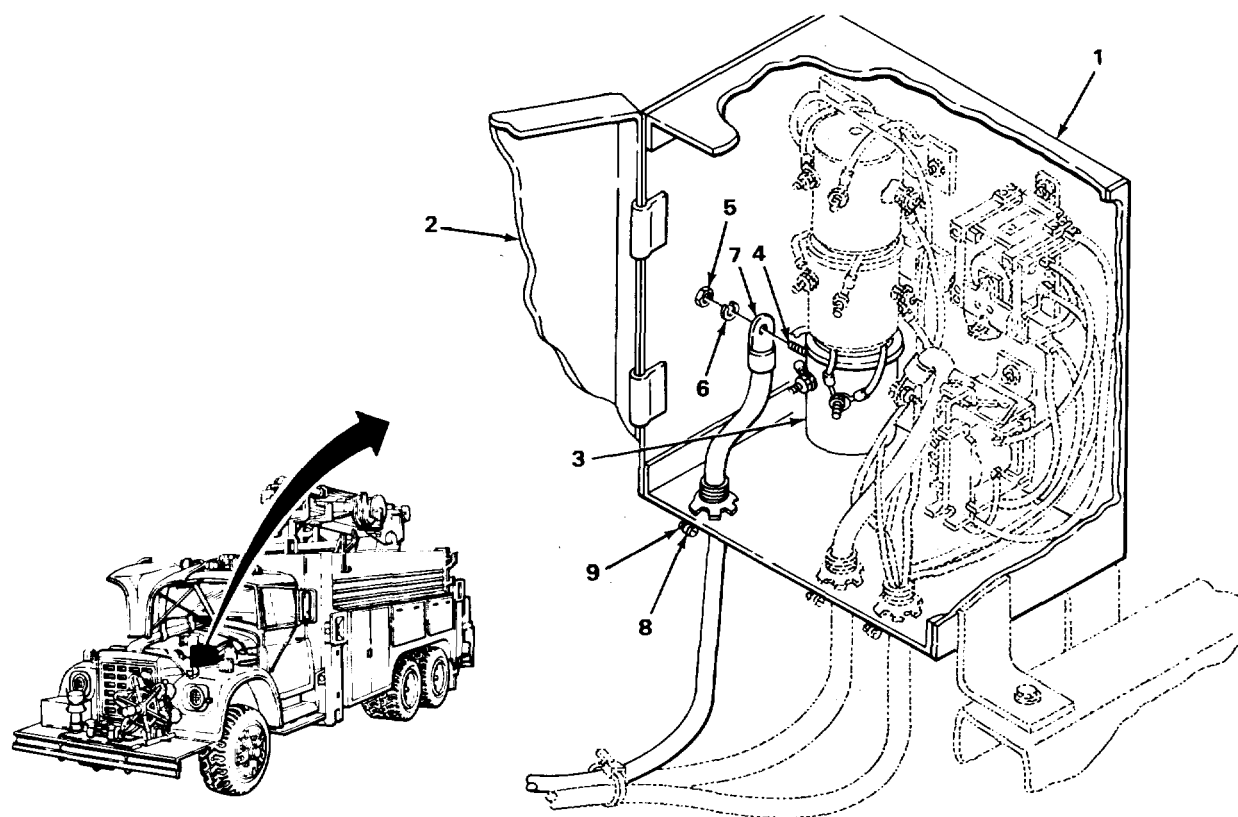
One

Equipment Condition

Left side hood open
 (TM 9-2320-269-20-2).
 Battery ground cable disconnected
 (TM 9-2320-269-20-1).

RELAY BOX - CONTINUED

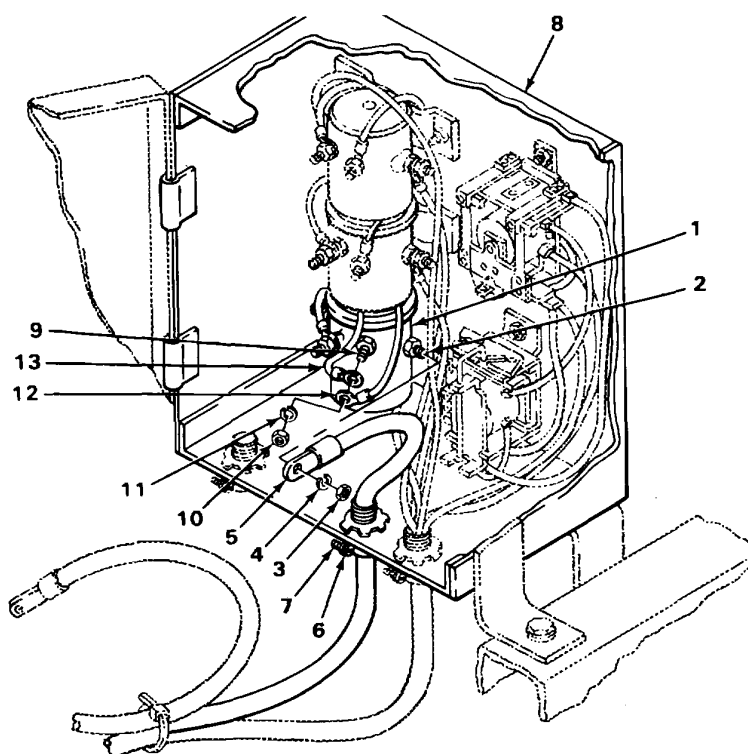
LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
NOTE			
Tag wires according to General Maintenance Instructions (page 2-46).			
For this task, right and left is based on your view of the inside of the box.			
1. Relay box (1)	Door (2)	Open.	
2. Bottom solenoid (3) and left terminal (4)	Nut (5), lockwasher (6), and red battery wire (7)	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (6).	
3. Red battery wire and clamp (8)	Two screws (9)	Using 3/16-inch flat-tip screwdriver, unscrew but do not take out.	
4. Relay Box (1) wire (7)	Red battery	Pull out.	



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RELAY BOX - CONTINUED

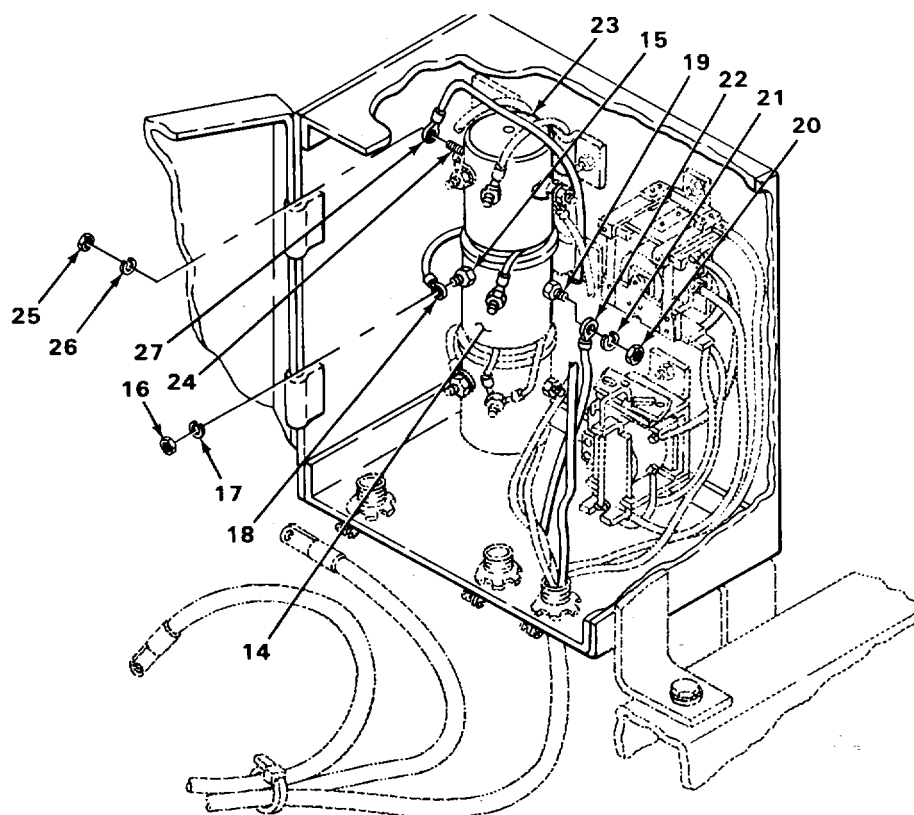
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
5. Bottom solenoid (1) and right terminal (2) wire (5)	Nut (3), lockwasher (4), and red auxiliary pump	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (4).	
6. Red auxiliary pump wire (5) and clamp (6)	Two screws (7)	Using 3/16-inch flat-tip screwdriver, unscrew but do not take out.	
7. Relay box (8) wire (5)	Red auxiliary pump	Pull out.	
8. Bottom solenoid (1) and right front terminal (9)	Nut (10), lockwasher (11), and white wires (12) and (13)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (11).	



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RELAY BOX - CONTINUED

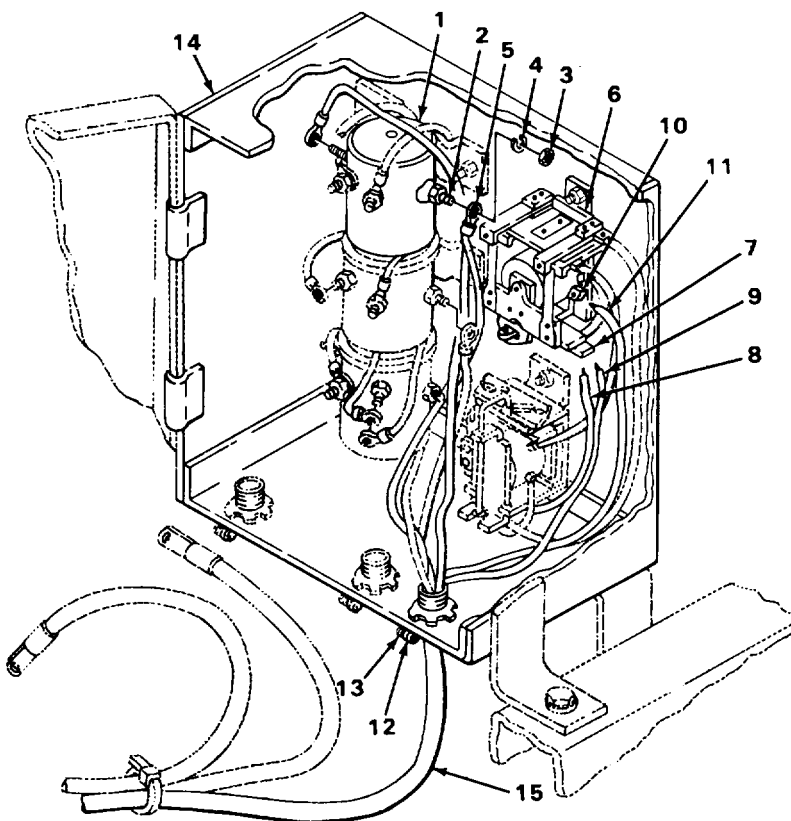
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
9. Center solenoid (14) and left front terminal (15)	Nut (16), lockwasher (17), and dark brown wire (18)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (17).	
10. Center solenoid (14) and right terminal (19)	Nut (20), lockwasher (21), and black solenoid wire (22)	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (21).	
11. Top solenoid (23) and left terminal (24)	Nut (25), lockwasher (26), and red wire (27)	a. Using 11/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (26).	



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RELAY BOX - CONTINUED

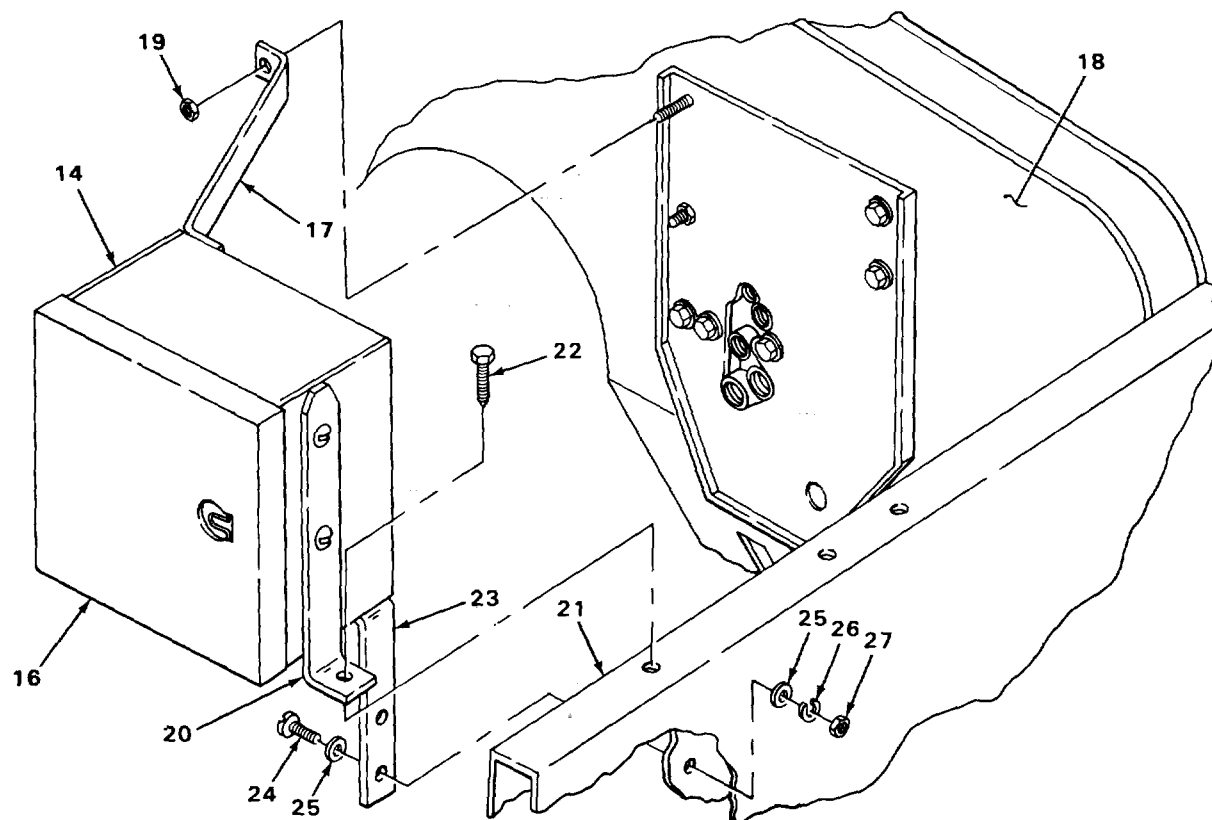
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
12	Top solenoid (1) and right terminal (2)	Nut (3), lockwasher (4), and red throttle wire (5)	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (4).
13	Top relay (6) and bottom front terminal (7)	Two brown wires (8) and (9)	Using soldering gun, unsolder(page 2-50).
14	Top relay (6) and bottom rear terminal (10)	Yellow wire (11)	Using soldering gun, unsolder(page 2-50).
15	Clamp (12)	Two screws (13) unscrew but do not take out.	Using 3/16-inch flat-tip screwdriver,
16	Relay Box (14)	Cable (15)	Pull out.



TA238347

RELAY BOX - CONTINUED

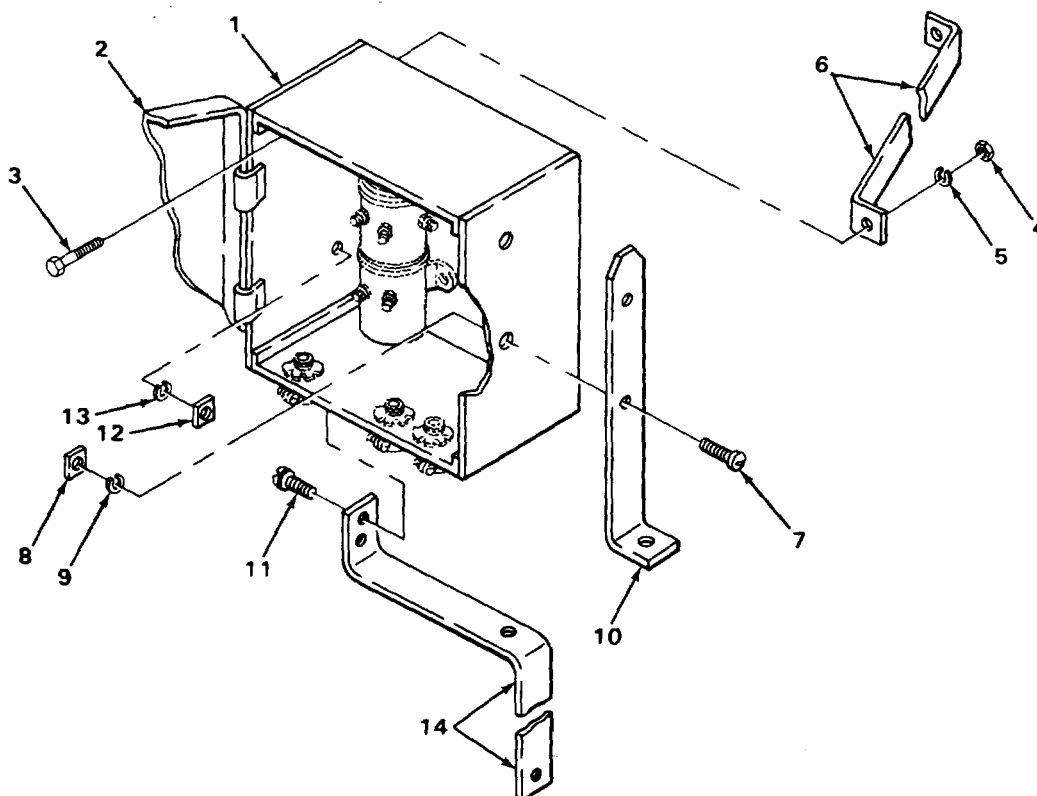
LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
17	Relay box (14)	Door (16)	Close.
18	Relay box top bracket (17) to firewall (18)	Self-locking nut (19)	a. Using 7/16-inch socket and handle with 3/8-inch drive, unscrew and take off. b. Get rid of nut (19).
19	Relay box left bracket (20) to splash panel (21)	Self-tapping screw (22)	Using 3/16-inch socket and handle with 3/8-inch drive, unscrew and take off.
20	Relay box bottom bracket (23) to splash panel (21) nut (27)	Screw (24), two washers (25), lock-washer (26) and b. Get rid of lockwashers (26).	a. Using 3/8-inch flat-tip screwdriver, 7/16-inch socket, and handle with 3/8-inch drive, unscrew and take out.
21	Splash panel (21) and firewall (18)	Relay box (14)	Take out.



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RELAY BOX - CONTINUED

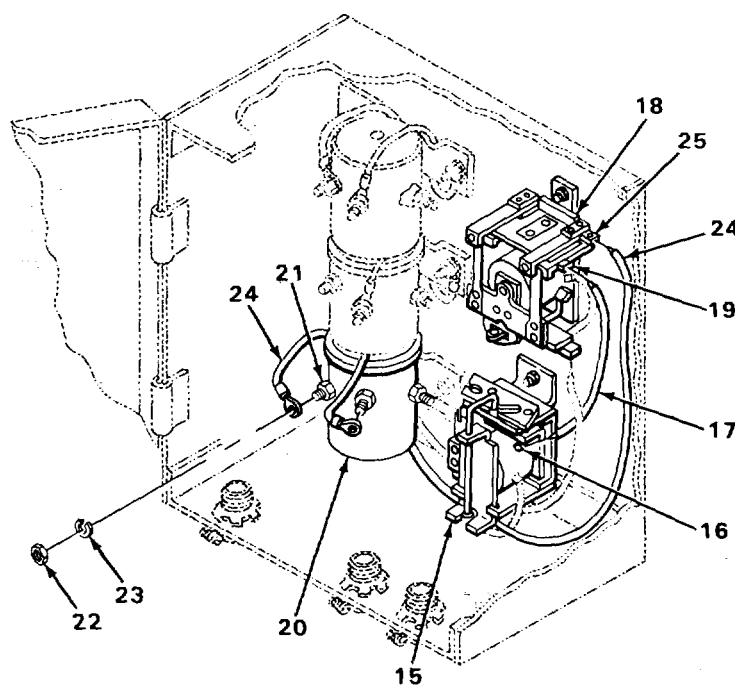
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
22	Relay box (1)	Door (2)	Open.
23	Screw (3), nut (4), lockwasher (5), and top bracket (6)	a. Using 7/16-inch box-end wrench, 7/16-inch socket, 3-inch extension, and handle with 3/8-inch drive, unscrew and take off. b.	Get rid of lockwasher (5).
24	Two screws (7), nuts (8), lockwashers (9), and side bracket (10)	a. Using 3/8-inch flat-tip screwdriver and 7/16-inch open-end wrench, unscrew and take off. b. Get rid of lockwashers (9).	
25	Three screws (11), nuts (12), lockwashers (13), and bottom bracket (14)	a. Using 3/8-inch flat-tip screwdriver and 7/16-inch open-end wrench, unscrew and take off. b. Get rid of lockwashers (13).	



TA238349

RELAY BOX - CONTINUED

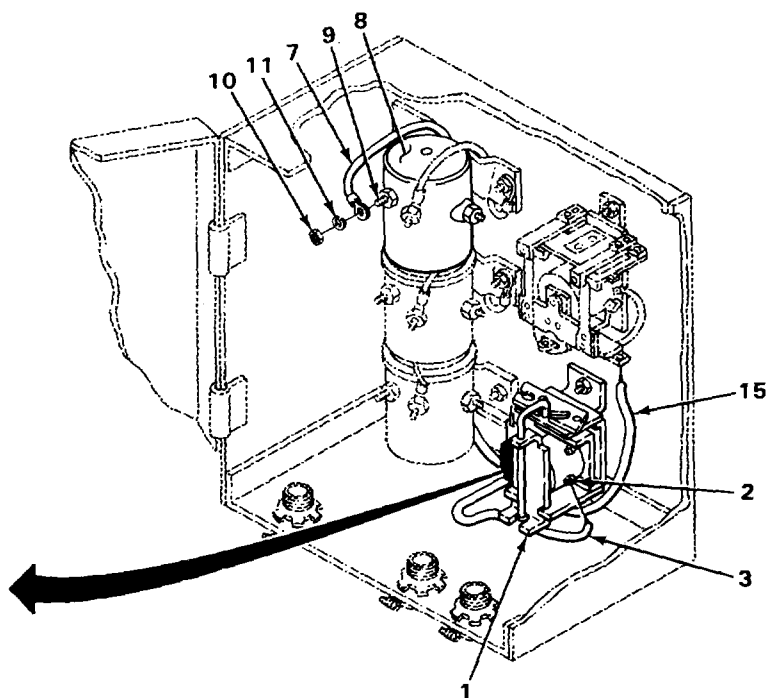
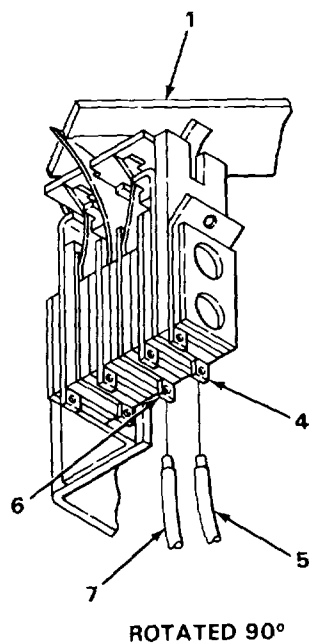
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
26 Bottom relay (15) and top right terminal (16)	White wire (17)	Using soldering gun, unsolder (page 2-50).	
27 Top relay (18) and right front terminal (19)	White wire (17)	Using soldering gun, unsolder and take out (page 2-50).	
28 Bottom solenoid (20) and right front terminal (21)	Nut (22), lockwasher (23), and orange wire (24)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (23).	
29 Top relay (18) and right rear terminal (25)	Orange wire (24)	Using soldering gun, unsolder and take out (page 2-50).	



TA238350

RELAY BOX - CONTINUED

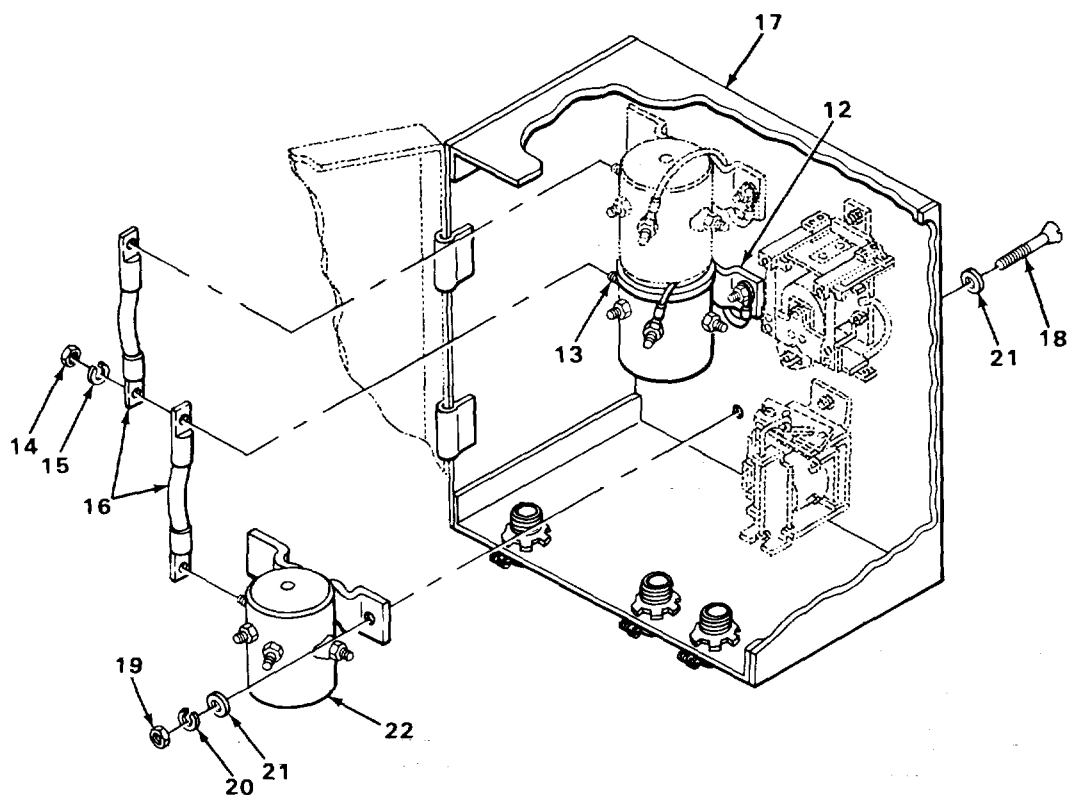
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY- CONTINUED			
30 Bottom relay (1) and bottom right terminal (2)	White ground wire (3)	Using soldering gun, unsolder and take out (page 2-50).	
31 Bottom relay terminal (4)	Brown wire (5)	Using soldering gun, unsolder and take out (page 2-50).	
32 Bottom relay terminal (6)	Blue wire (7)	Using soldering gun, unsolder and take out (page 2-50).	
33. Top solenoid (8) and left front terminal (9)	Nut (10), lockwasher (11), and blue wire (7)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (11).	



TA238351

RELAY BOX - CONTINUED

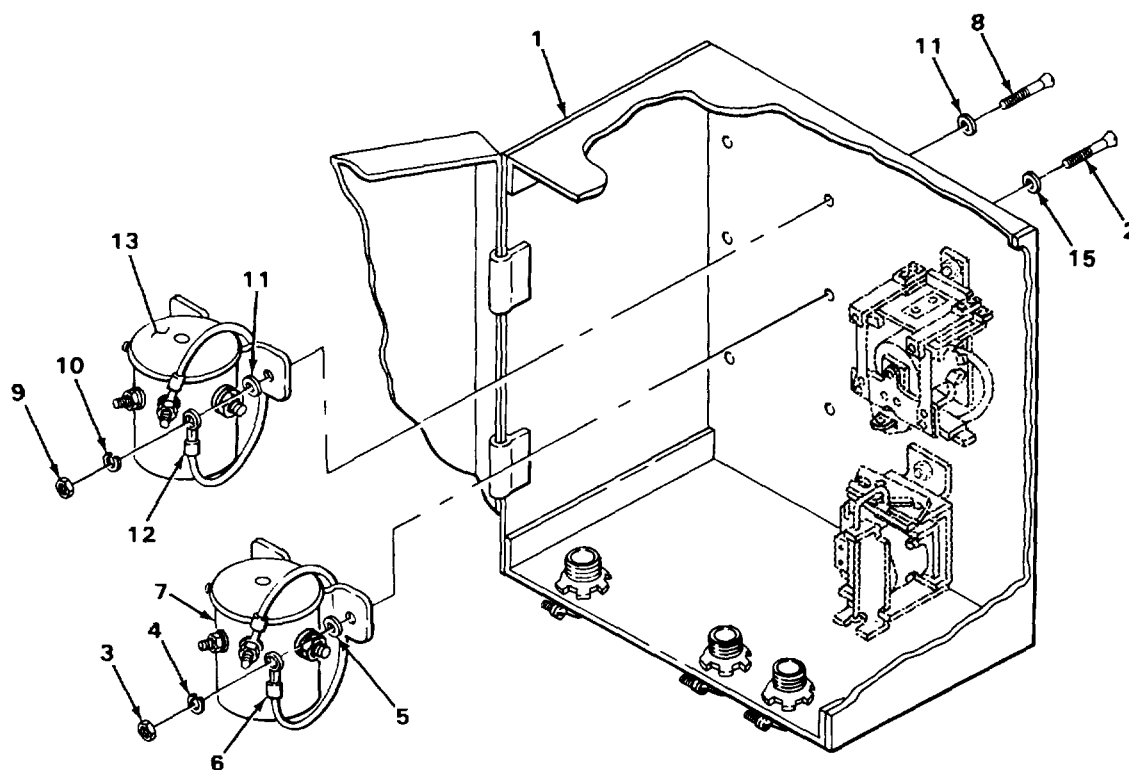
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
34. Center solenoid (12) and left terminal (13)	Nut (14), lockwasher (15) and two jumper wires (16)	a. Using 1/2-inch box-end wrench, unscrew and take off. b. Get rid of lockwasher (15).	
35. Relay box (17) nuts (19), lockwashers (20), four washers (21), and bottom solenoid (22)	Two screws (18), and 5/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (20).	a. Using 3/16-inch flat-tip screwdriver b. Get rid of lockwashers (20).	



TA238352

RELAY BOX - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
36	Relay box (1) nuts (3), lock- washers (4), four washers (5), white ground wire (6), and center solenoid (7)	Two screws (2), and 5/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (4).	a. Using 3/16-inch flat-tip screwdriver
37	Two screws (8), nuts (9), lock- washers (10), four washers (11), white ground wire (12), and top solenoid (13)	a. Using 3/16-inch flat-tip screwdriver and 5/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (10).	



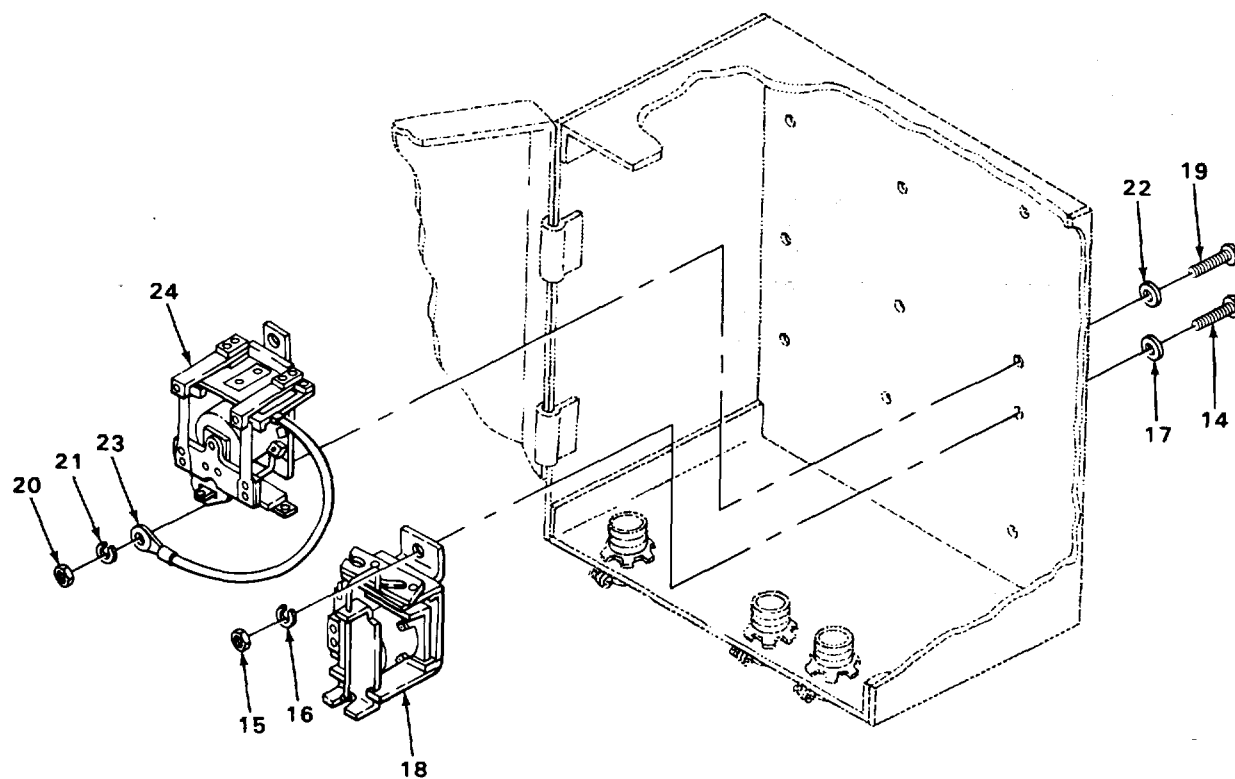
TA238353

RELAY BOX - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

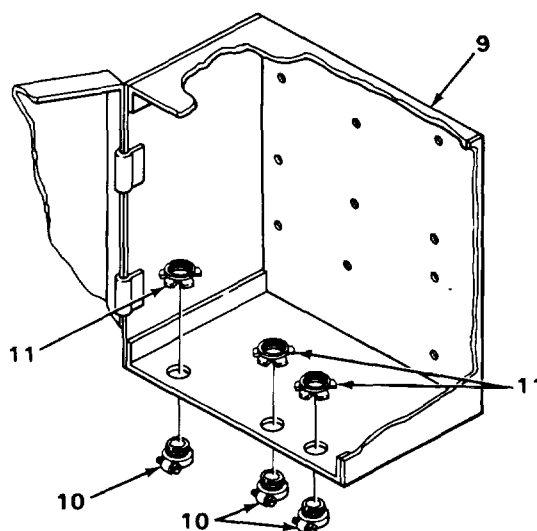
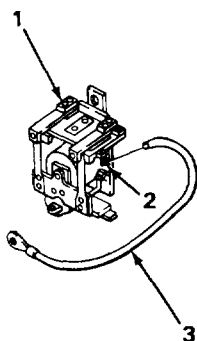
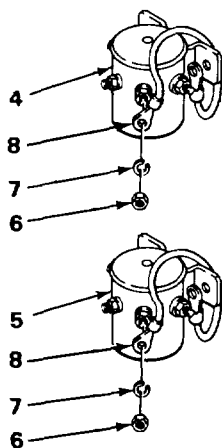
38	Two screws (14), nuts (15), lockwashers (16), washers (17), and bottom relay (18)	a. Using 3/16-inch flat-tip screwdriver and 5/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (16).
39	Two screws (19), nuts (20), lockwashers (21), washers (22), white ground wire (23), and ton relay (24)	a. Using 3/16-inch flat-tip screwdriver and 5/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (21).



TA238354

RELAY BOX - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
40	Top relay (1) and center right terminal (2)	White ground wire (3)	Using soldering gun, unsolder and take off.
41	Top solenoid (4) and center solenoid (5) wires (8)	Two nuts (6), lockwashers (7), and white ground wire (8)	a. Using 3/8-inch box-end wrench, unscrew and take off. b. Get rid of lockwashers (7).
42	Relay box (9) (10) and nuts (11)	Three wire clamps ball-peen hammer, drive nuts (11) b.	a. Using 1/2-inch cold hand chisel and counterclockwise to loosen. Unscrew and take out.

**CLEANING****WARNING**

Solvent burns easily. Solvent fumes are explosive. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

CAUTION

Do not immerse solenoids or relays in drycleaning solvent. Solvent will dissolve the insulation on coils.

TA238355

TA238355

RELAY BOX - CONTINUED

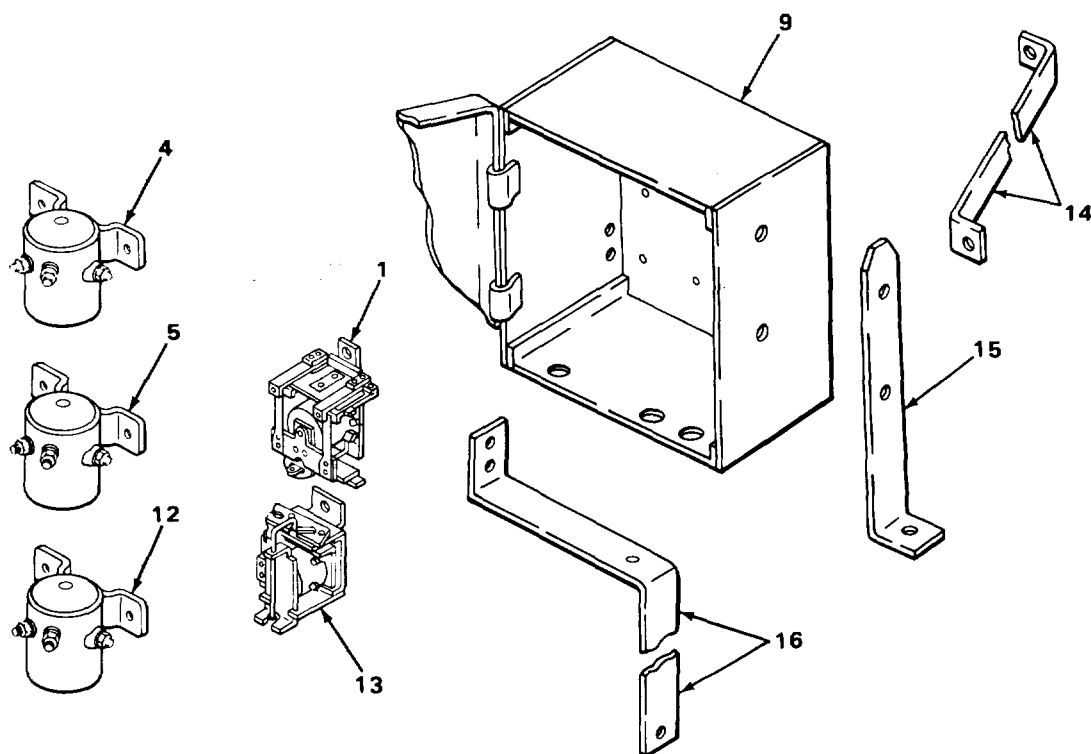
LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

43	Attaching hardware	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.	
44	Three solenoids (4), (5) and (12)	a. Wipe clean using clean rags dampened with drycleaning solvent. b. Using hand wire brush and file, clean terminals.	
45	Two relays (1) and (13)	Wipe clean using clean rags dampened with drycleaning solvent.	
46	Relay box (9), and three brackets (14), (15), and (16)	a. Wipe clean with clean, damp rags. b. Wipe dry with clean, dry rags.	



TA238356

RELAY BOX - CONTINUED

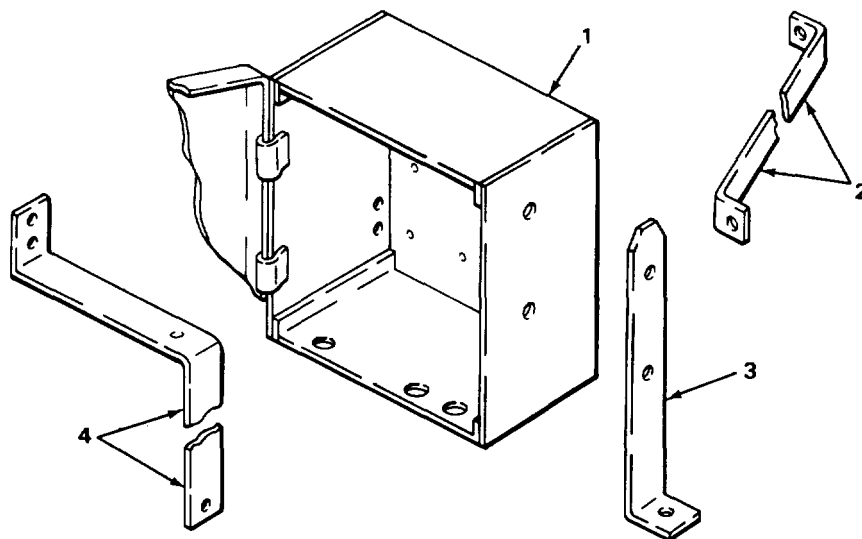
LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace defective parts as needed.

47	Relay box (1)	Look for dents, cracks, bent or broken hinges, and rust damage.
48	Three brackets (2), (3), and (4)	Look for bends, cracks, and breaks.
49	All threaded parts	Look for stripped or damaged threads.
50	All wire terminals	Look for corrosion.

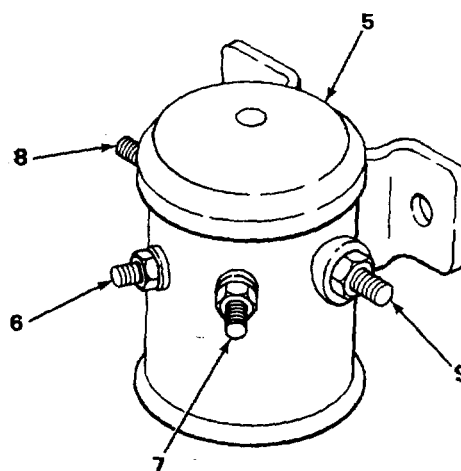


TA238357

RELAY BOX - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
51	Three solenoids (5)	a	Look for stripped or damaged terminals.
		b.	Set multimeter to RX 1 scale.
		c.	Touch probes to two front terminals(6) and (7). Multimeter should show continuity.
		d.	Touch probes to two side terminals (8) and (9). Multimeter should not show continuity.
		e.	Touch black probe to core and touch red probe to each terminal one at a time. Multimeter should not show continuity.
		f.	Using battery and two test leads, connect two front terminals (6) and (7) to battery. There should be a clicking noise when terminals are connected.
		g.	Touch multimeter probes to two side terminals (8) and (9). There should be continuity.
		h.	Disconnect test leads from solenoid and battery.

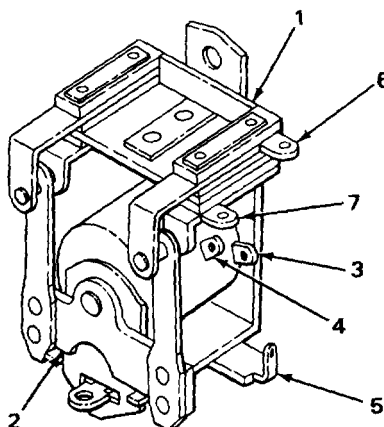
TYPICAL 3 PLACES



TA238358

RELAY BOX - CONTINUED

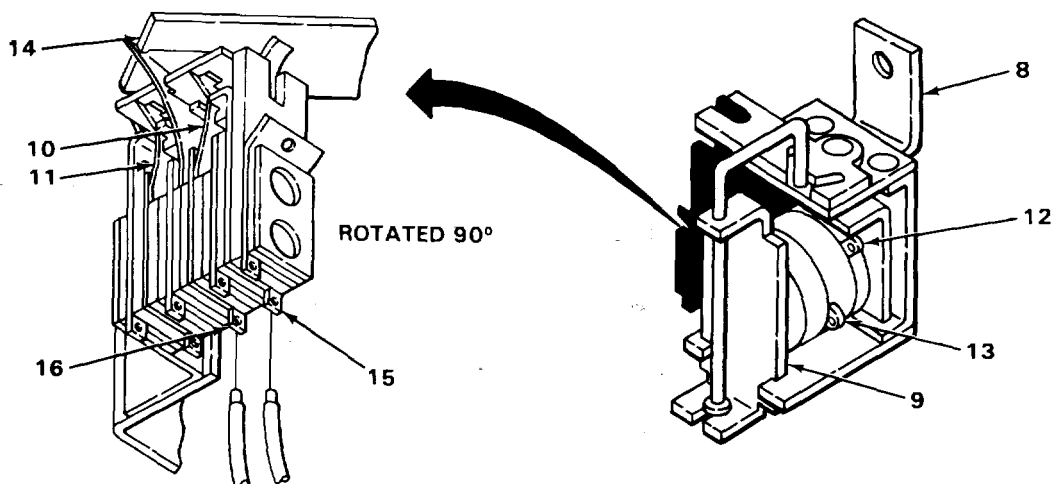
LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT- CONTINUED			
52	Upper relay (1)	a	Look for burned or pitted points.
		b.	Look for burned, missing, or damaged coil wrapping.
		c.	Check action of armature springs by pressing in the middle of armature (2). Armature (2) should spring back when released.
		d.	Using multimeter set on RX 1 scale, touch one probe to each coil terminal (3) and (4). Multimeter should show continuity.
		e.	Using multimeter set on RX 1 scale, touch red probe to bottom right terminal (5) and black probe to top rear terminal (6). Multimeter should show continuity.
		f.	Still holding probes in place from 52e, push down on armature (2). Multimeter should show infinite resistance.
		g.	With armature (2) still held down, touch black probe to top front terminal (7). Multimeter should show continuity.
		h.	Release armature with probes still held as in 52f. Multimeter should show infinite resistance.



TA238359

RELAY BOX - CONTINUED

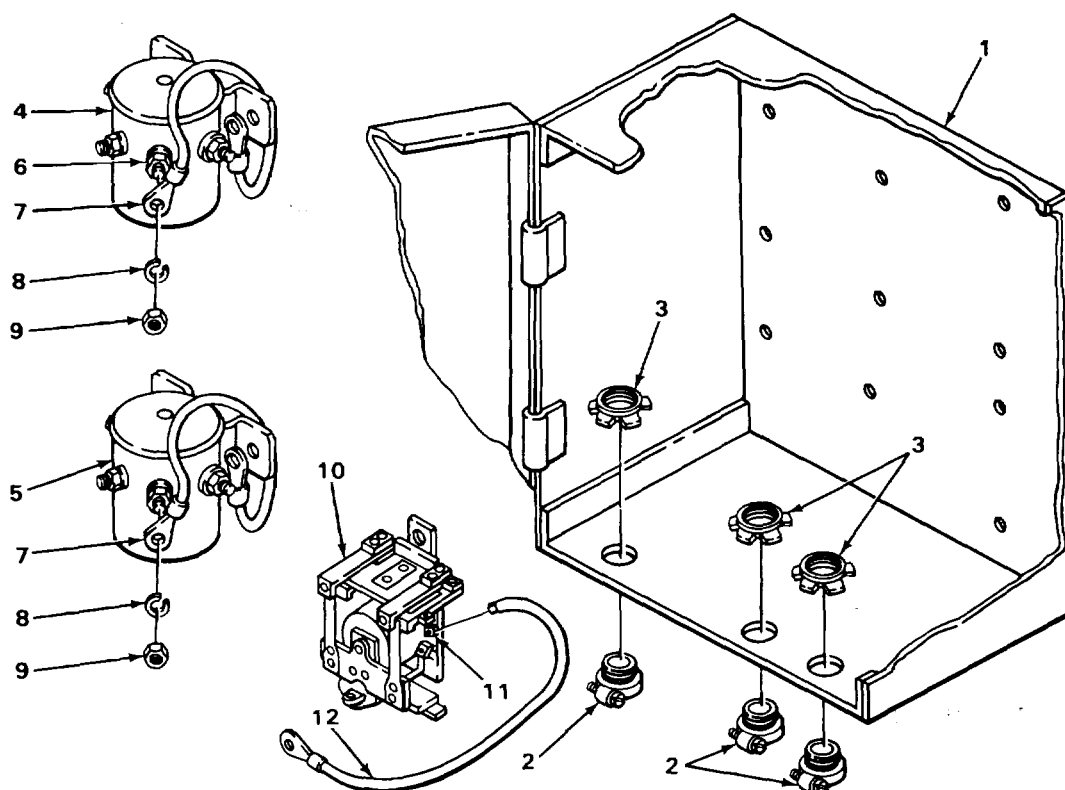
LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT- CONTINUED			
53	Lower relay (8)	a. Look for burned or pitted contact points.	Look for burned, missing, or damaged coil wrapping. Press down on armature (9) several times to check switching action. Switch tabs and should lock back, lock back, next time armature is pressed, switch tabs and should lock forward.
		b.	
		c.	
		d.	Using multimeter set on RX 1 scale, touch one probe to each coil terminal (10) and (11). Multimeter should show continuity.
		e.	With upper switch spring (12) in back position, use multimeter set on RX 1 scale to check continuity between terminal (13) and terminal (14). Multimeter should show continuity.
		f.	Push down on armature (9) to lock front position. Using multimeter set in RX 1 position, check for continuity between terminal (15) and left center terminal (16). Multimeter should show Infinite resistance.



TA238360

RELAY BOX - CONTINUED

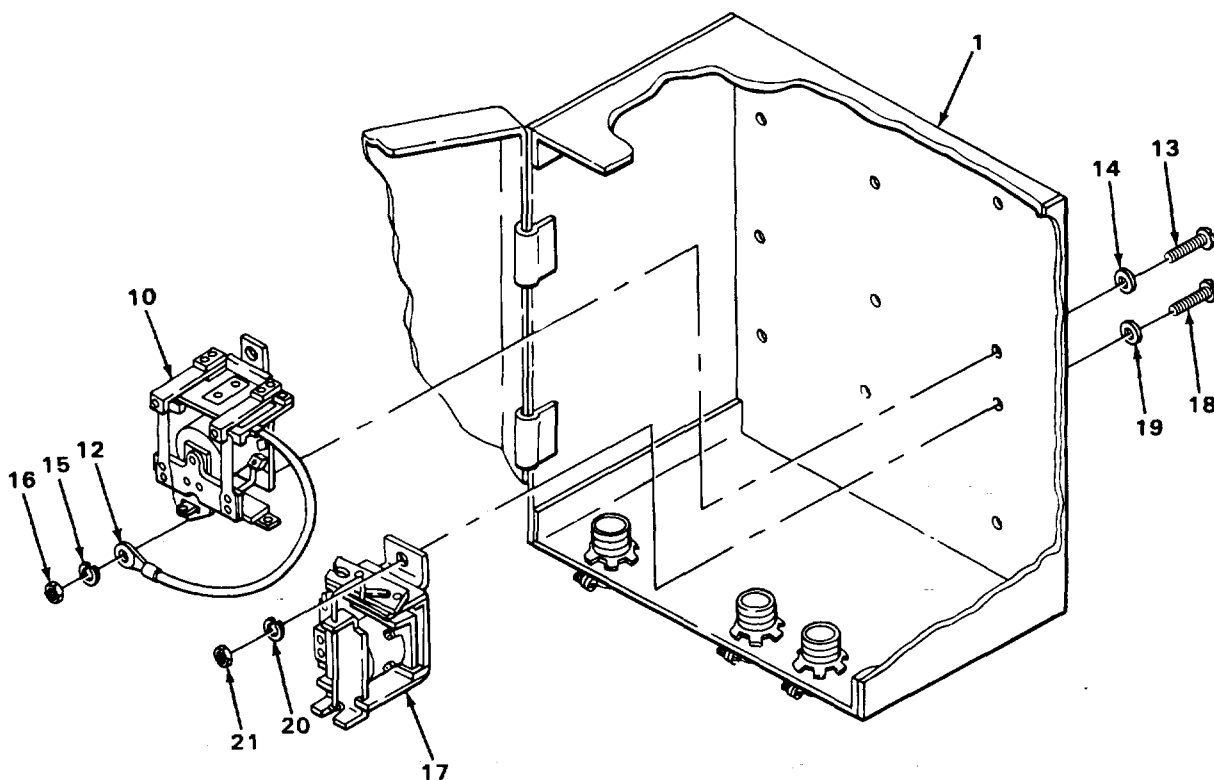
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
54. Relay box (1) clamps (2)	Three wire	Put in.	
55 Three wire clamps (2)	Three nuts (3)	a. Screw on. b. Tighten using 1/2-inch chisel and two ounce ball-peen hammer to drive clock- wise.	
56 Top solenoid (4) and center solenoid: (5) right front terminal (6)	Two white ground wires (7), new lockwashers (8), and nuts (9)	a. Screw on, and tighten using 3/8-inch box wrench. b. Route into place behind solenoid (4) or (5) so wire terminal is at mounting hole.	
57 Top relay (10) and center right	White ground wire (12)	Using soldering gun and rosin core solder, solder on.	



TA238361

RELAY BOX - CONTINUED

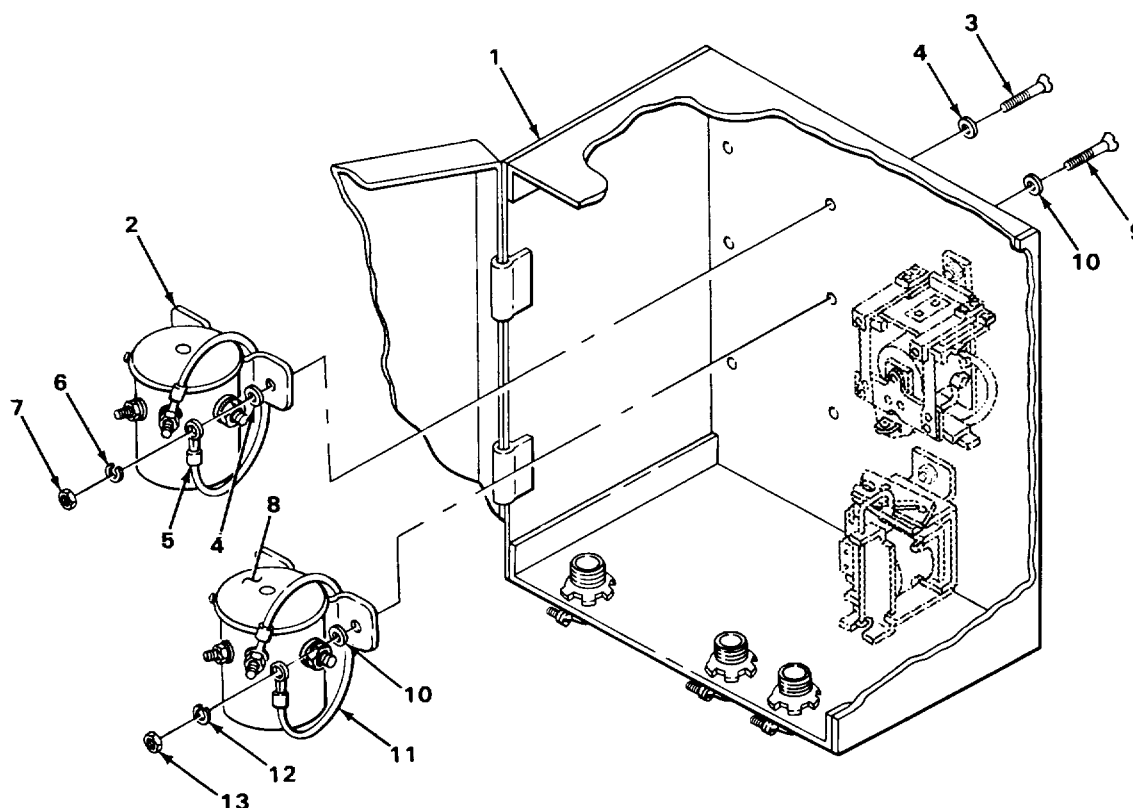
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
58. Relay box (1)	Top relay (10)	Put in place and hold.	
59. Top relay (10) and relay box (1) ground wire (12), new lockwashers (15) and nuts (16)	Two screws (13) and washers (14), white open-end wrench.	Screw in, and tighten using 3/16-inch flat-tip screwdriver and 5/16-inch	
60. Relay box (1)	Bottom relay (17)	Put in place and hold.	
61. Bottom relay (17) and relay box (1) lockwashers (20), and nuts (21)	Two screws (18), washers (19), new open-end wrench.	Screw in, and tighten using 3/16-inch flat-tip screwdriver and 5/16-inch	



TA238362

RELAY BOX - CONTINUED

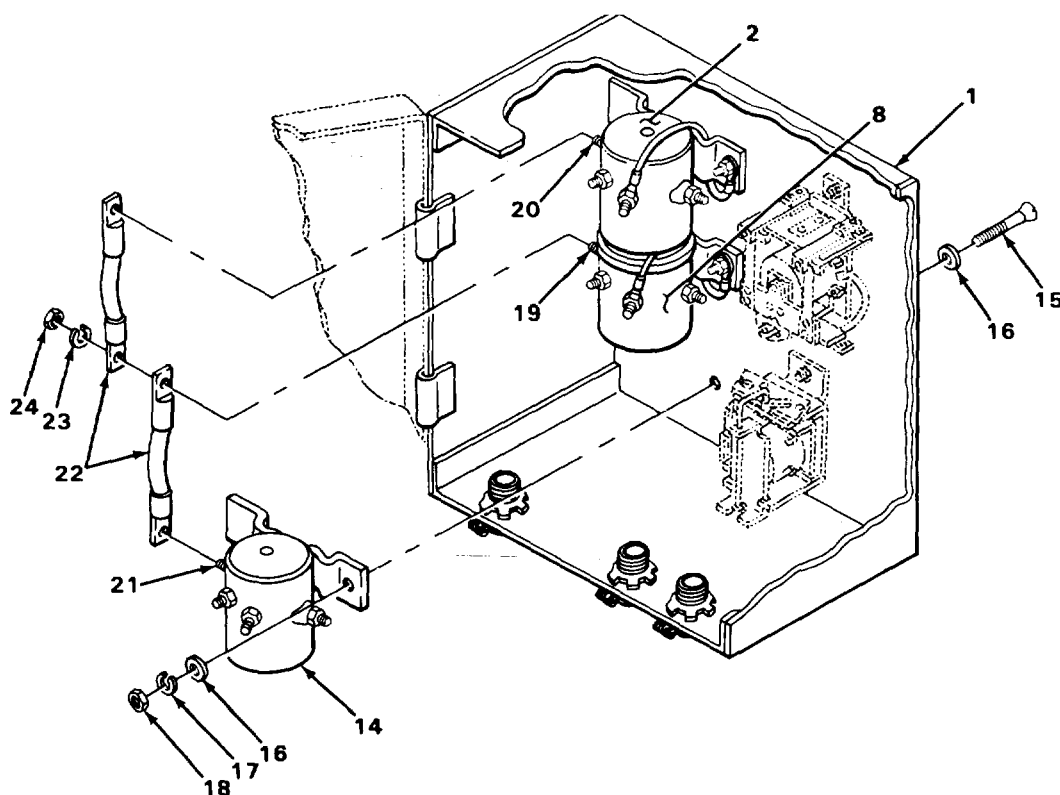
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
62.	Relay box (1)	Top solenoid (2)	Put in place and hold.
63.	Top solenoid (2) and relay box (1) white ground wire (5), two new lock-washers (6), and nuts (7)	Two screws (3), four washers (4), open-end wrench.	Screw in, and tighten using 3/16-inch flat-tip screwdriver and 5/16-inch
64.	Relay box (1)	Center solenoid (8)	Put in place and hold.
65.	Center solenoid (8) and relay box (1) white ground wire (11), two new lock-washers (12) and nuts (13)	Two screws (9), four washers (10), open-end wrench.	Screw in, and tighten using 3/16-inch flat-tip screwdriver and 5/16-inch



TA238363

RELAY BOX - CONTINUED

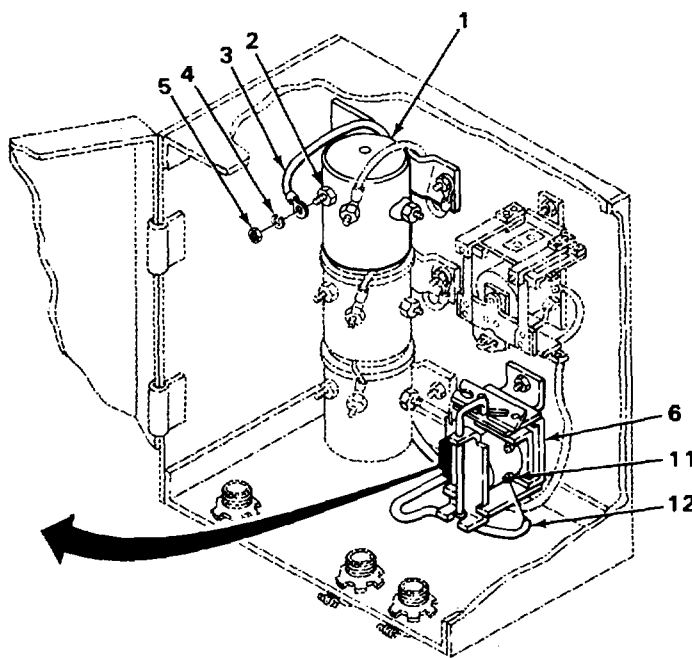
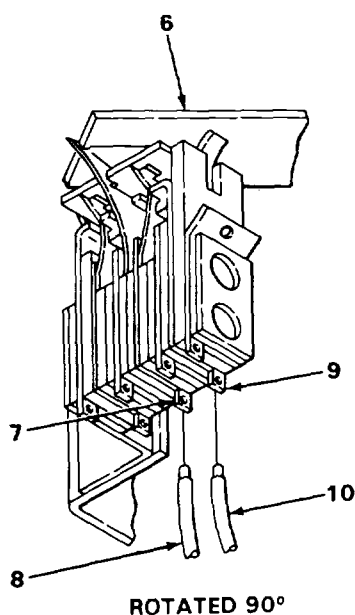
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
66. Relay box (1)	Bottom solenoid (14)	Put in place and hold.	
67. Bottom solenoid (14) and relay box (1) two new lockwashers (17) and nuts (18)	Two screws (15), four washers (16), open-end wrench.	Screw in, and tighten using 3/16-inch flat-tip screwdriver and and 5116-inch	
68. Top (2), center (8) bottom (14), solenoid and three left terminals (19), (20), and (21)	Two jumper wires (22)	Put on.	
69. Center solenoid (8) left terminal (19)	New lockwashers (23) and nut (24)	Screw on, and tighten using 112-inch box wrench.	



TA238364

RELAY BOX - CONTINUED

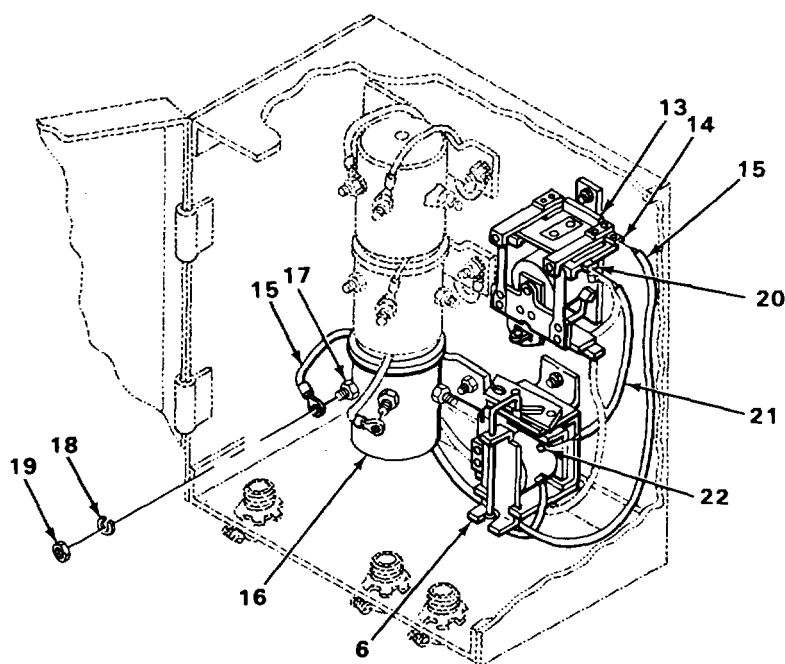
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
70 Top solenoid (1) left front terminal (2)	Blue wire (3), new lockwasher (4), and nut (5)	a. Route wire (3) into place behind solenoids. b. Screw on, and tighten using 3/8-inch box wrench.	
71 Bottom relay (6) terminal (7)	Blue wire (8)	Using soldering gun and resin core solder, solder on.	
72 Bottom relay (6) terminal (9)	Brown wire (10) b.	a. Using soldering gun and resin core sol- der, solder on. b. Route into place.	
73 Bottom relay (6) bottom right terminal (11)	White wire (12)	a. Route into place. b. Using soldering gun and resin core sol- der, solder on.	



TA238365

RELAY BOX - CONTINUED

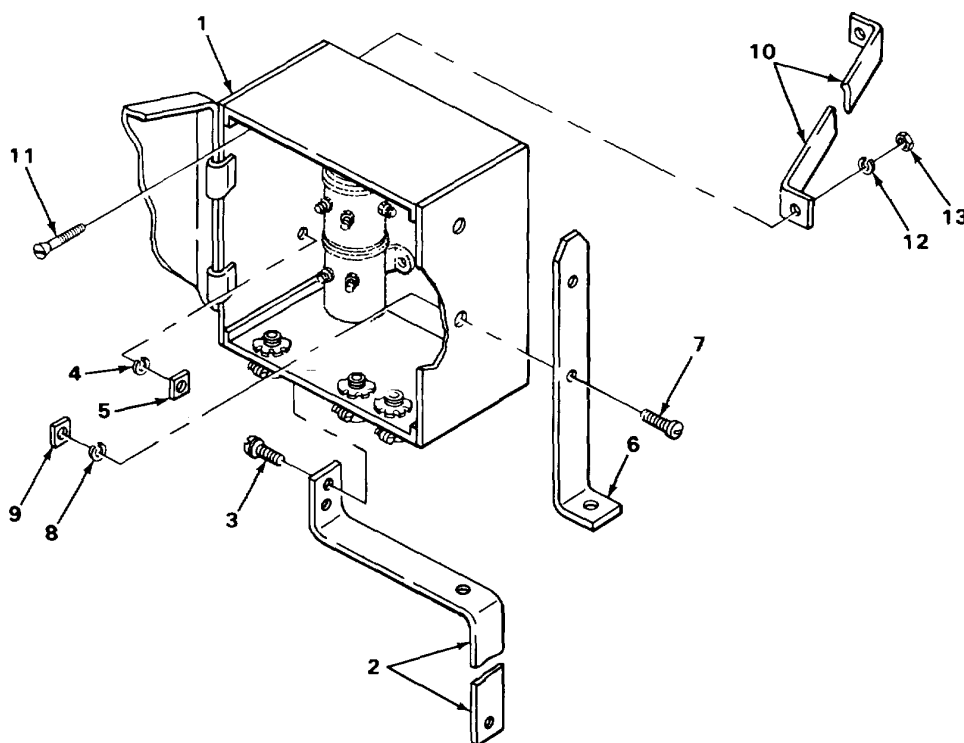
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
74 Top relay (13) right rear terminal (14)	Orange wire (15)	a. Route into place behind bottom solenoid (16). b. Using soldering gun and rosin core solder, solder on.	
75 Bottom solenoid (16) left front terminal (17)	Orange wire (15), new lockwasher (18), and nut (19)	Screw on, and tighten using 3/8-inch box wrench.	
76 Top relay (13) right front terminal (20)	White wire (21)	Using soldering gun and rosin core solder, solder on.	
77 Bottom relay (6) top right terminal (22)	White wire (21)	Using soldering gun and rosin core solder, solder on.	



TA238366

RELAY BOX - CONTINUED

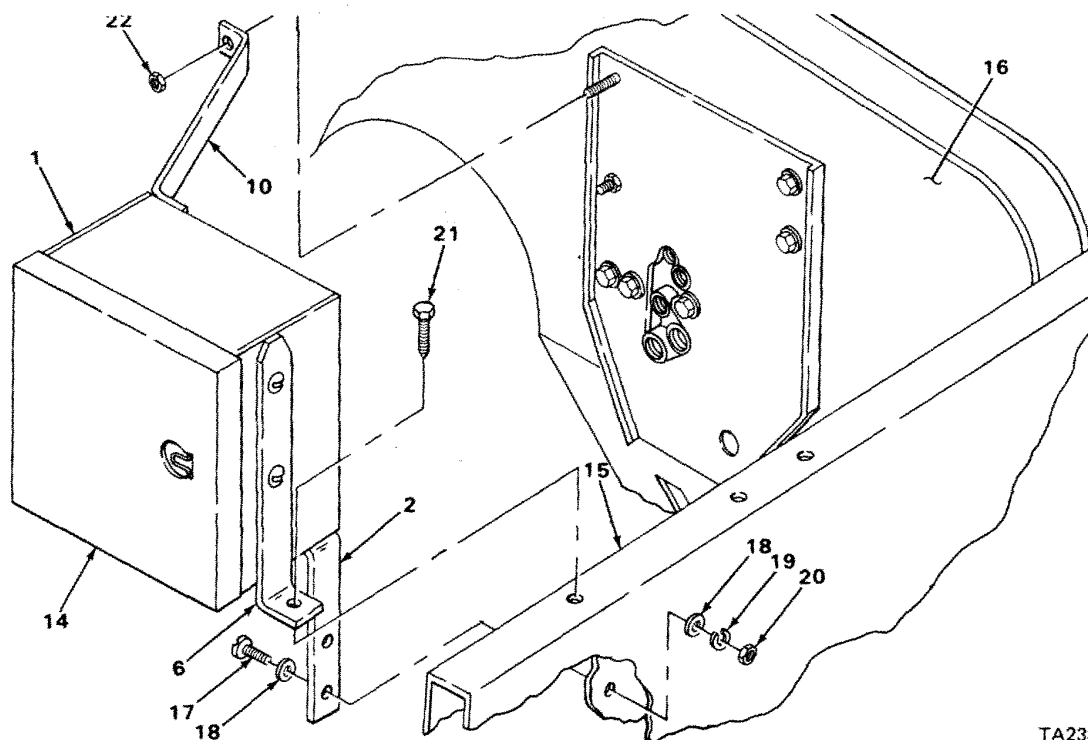
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
78. Relay box (1)	Bottom bracket (2)	Put in place and hold.	
79. Bottom bracket (2) new lockwashers (4), and nuts (5)	Three screws (3), flat-tip screwdriver and 7/16-inch open-end wrench.	Screw in, and tighten using 3/8-inch	
80. Relay box (1)	Side bracket (6)	Put in plate and hold.	
81. Side bracket (6) new lockwashers (8), and nuts (9)	Two screws (7), flat-tip screwdriver and 7/16-inch open-end wrench.	Screw in, and tighten using 3/8-inch	
82. Relay box (1)	Top bracket (10)	Put in place and hold.	
83. Top bracket (10) lockwasher (12) and nut (13)	Screw (11), new flat-tip screwdriver and 7/16-inch open-end wrench.	Screw in, and tighten using 3/8-inch	



TA238367

RELAY BOX - CONTINUED

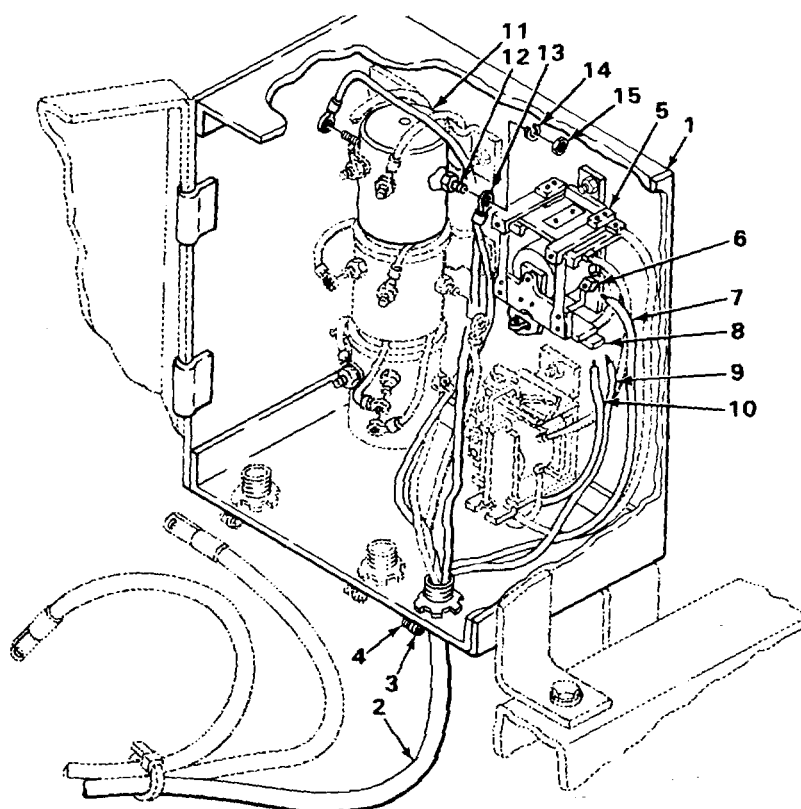
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
84 Relay box (1)	Door (14)	Close.	
85 Splash panel (15) and firewall (16)	Relay box (1)	Put in place.	
86 Bottom bracket (2) to splash panel (15) lockwasher (19), and nut (20)	Screw (17), two washers (18), new and ratchet handle with 3/8-inch drive.	Screw in, and tighten using 3/8-inch flat-tip screwdriver and 7/16-inch socket	
87 Side bracket (6) to splash panel (15)	Self-taping screw (21) drive.	Screw in, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch	
88 Top bracket (10) to firewall (16)	New self-locking nut (22) drive.	Screw on, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch	
89 Relay box (1)	Door (14)	Open.	



TA2383E

RELAY BOX - CONTINUED

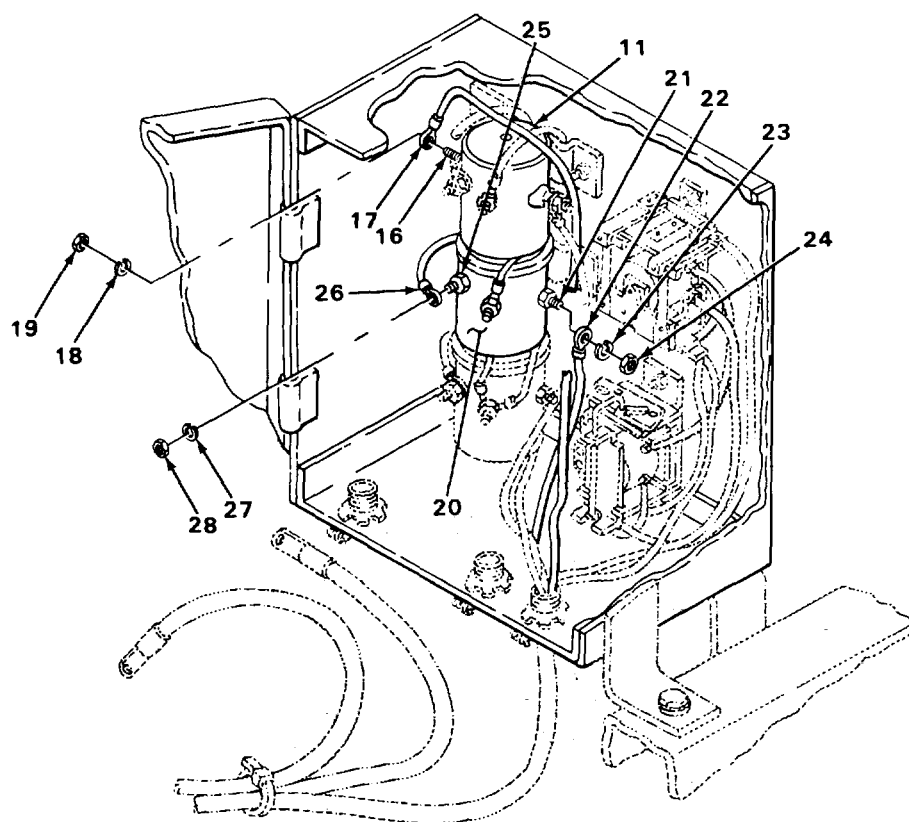
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
90 Relay box (1)	Cable (2)	Push up into place.	
91 Clamp (3)	Two screws (4) screwdriver.	Tighten using 3/16-inch flat-tip	
92 Top relay (5) and bottom rear terminal (6)	Yellow wire (7) rosin core rosin.	Solder on using soldering gun and	
93 Top relay (5) and bottom front terminal (8)	Two brown wires (9) and (10)	Solder on using gun and rosin core solder, solder on.	
94 Top solenoid (11) and right terminal (12) and nut (15)	Red throttle control wire (13), new lockwasher (14), and nut (15)	Screw on, and tighten using 1/2-inch box-end wrench.	



TA238369

RELAY BOX - CONTINUED

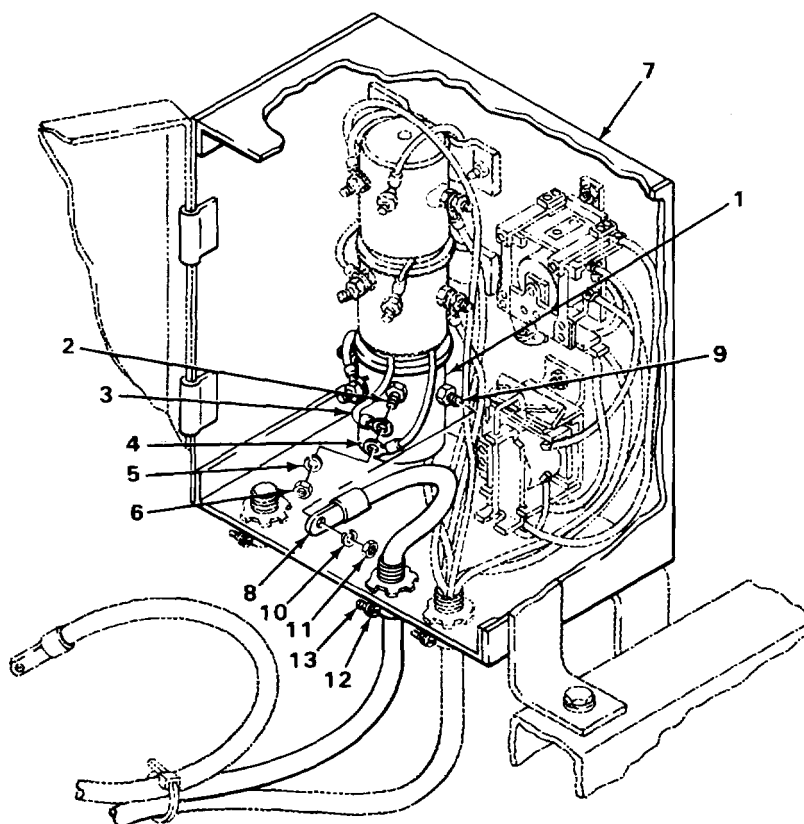
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
95. Top solenoid (11) and left terminal (16)	Red wire (17), new lockwasher (18) and nut (19)	Screw on, and tighten using 1/2-inch box-end wrench.	
96. Center solenoid (20) and right terminal (21)	Black solenoid wire (22), new lockwasher (23), and nut (24)	Screw on, and tighten using 1/2-inch box-end wrench.	
97. Center solenoid (20) and left front terminal (25) and nut (9A8)	Dark brown wire (26), new lock- washer (27),	Screw on, and tighten using 3/8-inch box-end wrench.	



TGA238370

RELAY BOX - CONTINUED

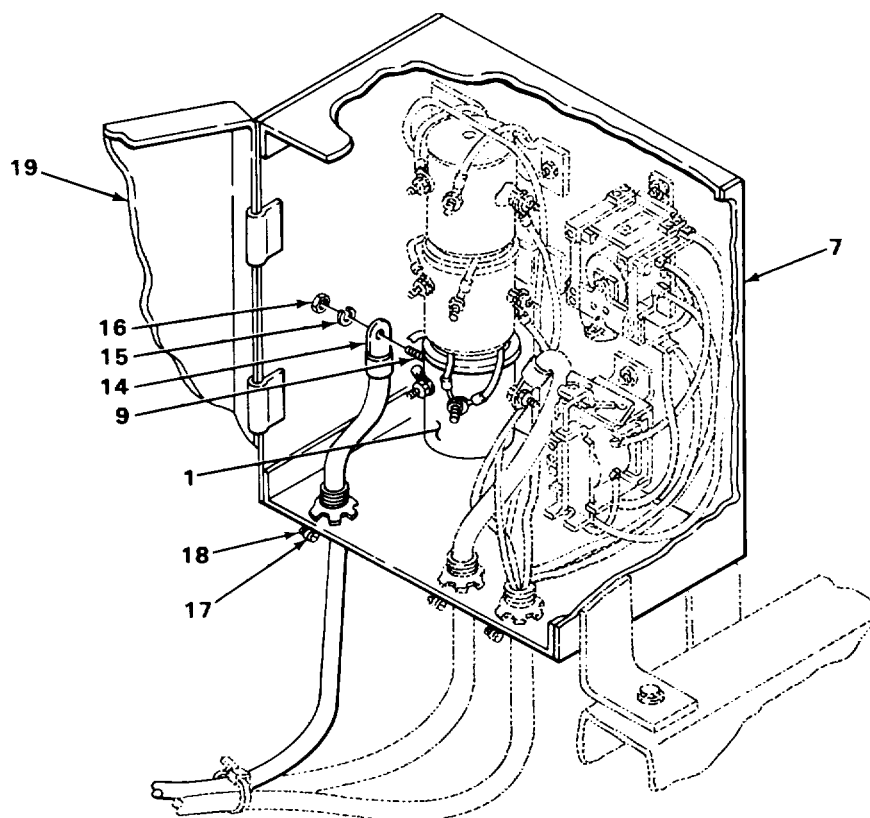
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
98 Bottom solenoid (1) and right front terminal (2) and nut (6)	White wires (3) and (4), new lock- washer (5),	Screw on, and tighten using 3/8-inch box-end wrench.	
99 Relay box (7) pump wire (8)	Red auxiliary	Push up into place.	
100 Bottom solenoid (1) and right terminal (9) and nut (11)	Red auxiliary pump wire (8), new lockwasher (10),	Screw on, and tighten using 1/2-inch box-end wrench.	
101 Clamp (12)	Two screws (13) screwdriver.	Tighten using 3/16-inch flat-tip	



TA238371

RELAY BOX - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
102 Relay box (7) wire (14)	Red battery	Push up into place.	
103 Bottom solenoid (1) and right terminal (9) nut (16)	Red battery wire (14), new lock- washer (15), and	Screw on, and tighten using 1/2-inch box-end wrench.	
104 Clamp (17)	Two screws (18) screwdriver.	Tighten using 3/16-inch flat-tip	
105 Relay box (7)	Door (19)	Close.	



TA238372

RELAY BOX - CONTINUED.

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE:

1. Connect battery ground cables (TM 9-2320-269-20-1).
2. Close left side of hood (TM 9-2320-269-20-2).

TASK ENDS HERE

Section VIII. TRANSMISSION

	Page		Page
First Range Clutch.....	2-768	Transmission Modulator Valve	
Forward Clutch and Turbine		Assembly	2-803
Shaft.....	2-737	Transmission Oil Pan and Level	
Fourth Range Clutch	2-748	Gage Tube.....	2-705
Gear Unit and Main Shaft.....	2-760	Transmission Oil Pump and Front	
Low Range Clutch and Planetary		Support	2-728
Adapter	2-779	Transmission Rear Mount, Cross-	
Low Shift Valve Assembly	2-709	member, and Support Bracket	2-813
Rear Cover and Output Shaft.....	2-771	Transmission Selector Lever and	
Third Range Clutch, Center Sup-		Shift Linkage.....	2-789
port, and Second Range Clutch.....	2-754	Transmission Shift Speed	
Torque Converter	2-692	Adjustment.....	2-808
Transmission Assembly	2-633	Transmission Subassemblies	2-650
Transmission Control			
Valve Assembly	2-713		
Transmission Governor Assembly	2-810		
Transmission Housing.....	2-783		

TRANSMISSION ASSEMBLY

This task covers:

- a. Removal (page 2-634)
 - b. Installation (page 2-642)
-

INITIAL SETUP

Tools

Barring tool, crankshaft
 Driftpin, brass, 3/4-inch
 Hammer, ball-peen, machinist's, 1-lb
 Handle, ratchet, 1/2-inch drive
 Jack, transmission
 Pan, drain
 Pliers, diagonal cutting
 Screwdriver, cross-tip, number two
 Screwdriver, flat-tip, 11/16-inch
 Screwdriver, flat-tip, 3/8-inch
 Socket, 1/2-inch drive, 7/16-inch
 Socket, 1/2-inch drive, 1/2-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 15/16-inch
 Socket, deep well, 1/2-inch drive,
 9/16-inch
 Stand, transmission overhaul
 Strap, restraining, torque converter
 Studs, guide (four required)
 Wrench, crowfoot attachment, 1/2-inch
 drive, 11/8-inch
 Wrench, open-end, 3/8-inch
 Wrench, open-end, 7/16-inch
 (two required)
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 1-inch (two required)
 Wrench, open-end, 1 1/16-inch
 Wrench, open-end, 1 1/8-inch
 Wrench, torque, 1/2-inch drive
 0 - 175 ft-lb capacity

Materials/Parts

Cord (item 10, appendix B)
 Gasket, flywheel housing
 Lockwasher, cable clamp and bracket
 Lockwasher, rear mount
 (two required)
 Lockwasher, shift cable clamp
 (two required)
 Lockwire
 Plugs, dust
 Tag, marking (item 50, appendix B)

Personnel Required

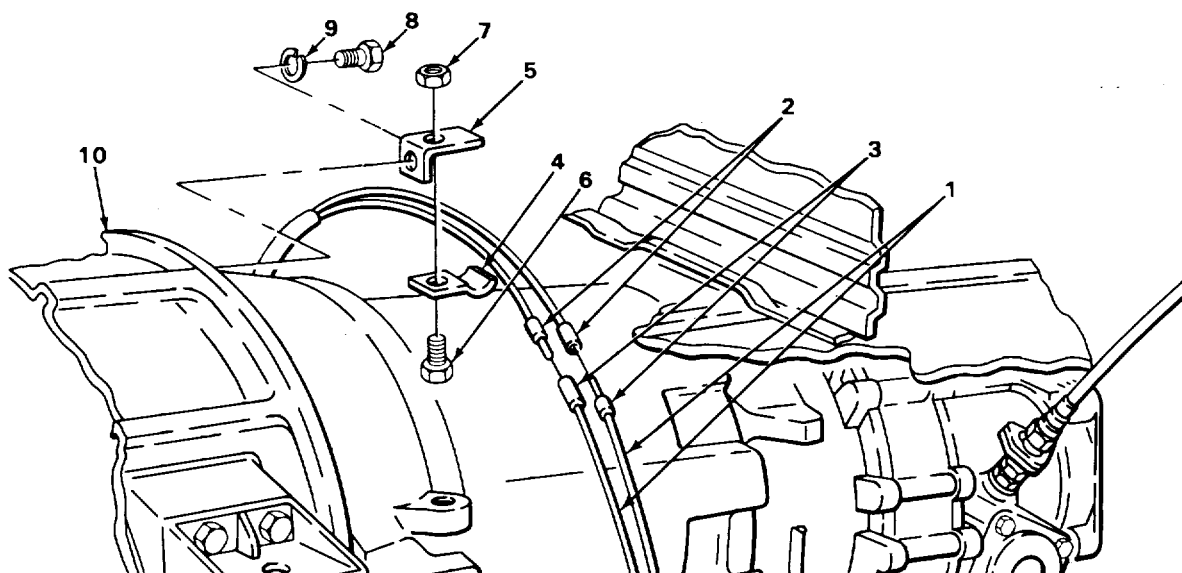
Two

Equipment Condition

Transmission drained (TM 9-2320-269-20-1).
 Transmission engine covers removed
 (TM 9-2320-269-20-2).
 Transmission-to-center bearing flange
 removed (TM 9-2320-269-20-1).
 Radiator removed (TM 9-2320-269-20-1).
 Power takeoff assembly removed
 (TM 9-2320-269-20-1).

TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. Neutral start switch wires (1)	Four connectors (2) and (3) c.	a. Tag wires. b. Unplug. c. Using cord, tie to transmission.	
2. Cable clamp (4) and bracket (5)	Screw (6) and nut (7)	Using two 7/16-inch open-end wrenches, unscrew and take out.	
3. Bracket (5) and wires (1)	Cable clamp (4)	Move away from transmission.	
4. Screw (8) and lockwasher (9)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, take out. b.	Get rid of lockwasher (9).	
5. Transmission (10)	Bracket (5)	Take off.	

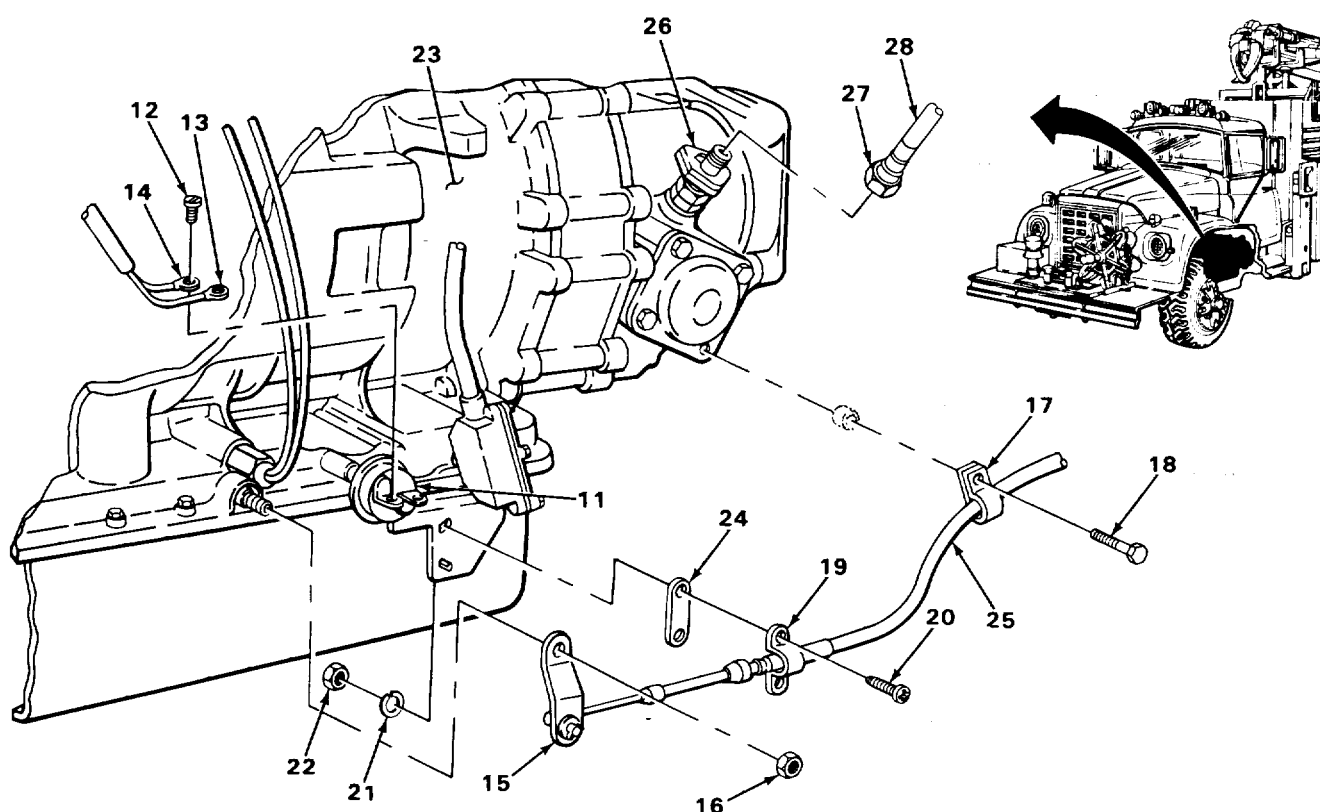


6. Oil temperature sending unit (11)	Two screws (12) and wires (13) and (14) b.	a. Using 11/4-inch flat-tip screwdriver, unscrew and take out Tag wires (13) and (14).	
7. Shift lever (15)	Nut (16)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off.	

TA238373

TRANSMISSION ASSEMBLY - CONTINUED

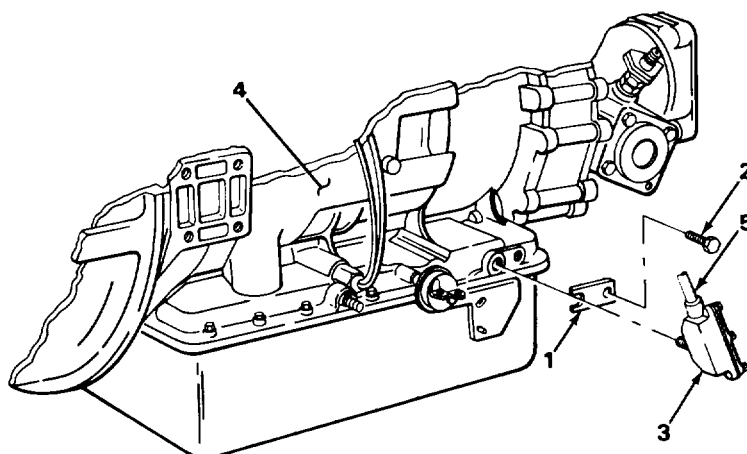
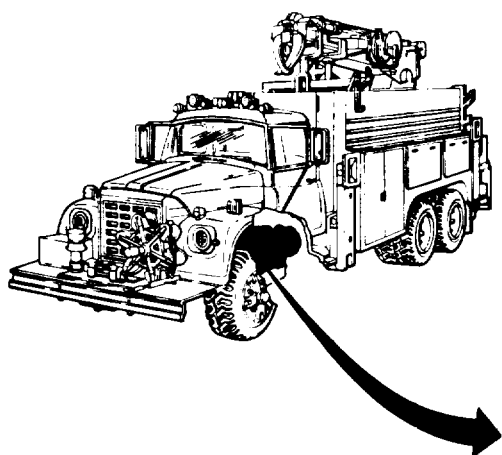
LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
8.	Cable clamp (17)	Screw (18)	a. Using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Put screw (18) back in.
9.	Cable clamp (19), lockwashers (21), and nuts (22)	Two screws (20), and 3/8-inch open-end wrench.	a. Using number two cross-tip screwdriver and 3/8-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (21).
10.	Transmission (23) cable clamp bar (24), and cable (25)	Cable clamp (19), b. Using cord, tie cable out of way.	a. Move away from.
11.	Speedometer cable adapter	Nut (27) and cable (28)	Using two 1-inch open-end wrenches, unscrew and pull cable (28) free



TA238374

TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
12	Modulator retainer (1)	Screw (2)	Using 1/2-inch socket and ratchet handle with 112-inch drive, unscrew and take out.
13	Modulator valve (3) retainer (1)	Modulator	Take off.
14.	Transmission assembly (4)	Modulator valve (3) and cable (5)	a. Take off. b. Using cord, tie out of way.



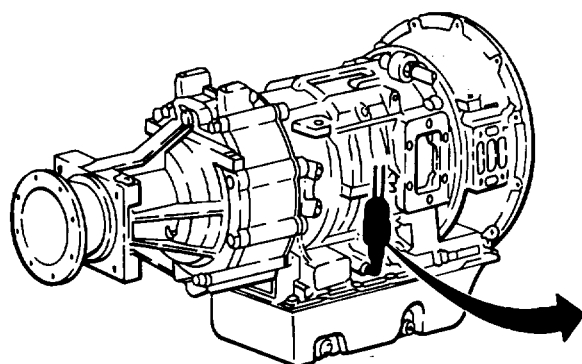
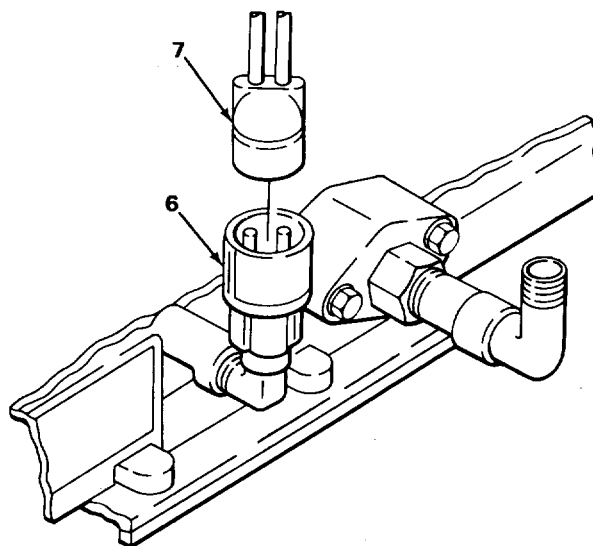
15. Transmission oil pressure sending unit (6)	Plug (7)	a. Pull out. b. Using cord, tie wires out of way.

TA238375

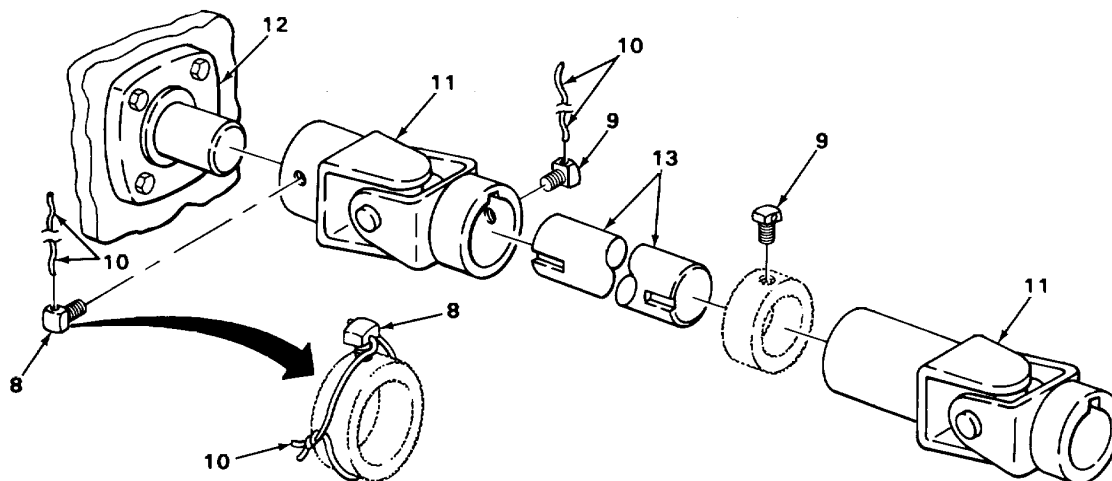
TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

TRANSMISSION REMOVED
FOR CLARITY

16 One setscrew (8) and two setscrews (9)	Three lockwires (10) b.	a. Using diagonal cutting pliers, cut wires. Take off, and get rid of.
17 Two U-joints (11) two setscrews (9)	Setscrew (8) and wrenches, loosen.	Using 9/16-inch and 3/8-inch open-end
18 Power takeoff bearing cap assembly (12) and shaft (13)	U-joint (11)	Using 1-lb ball-peen hammer and 3/4-inch brass driftpin, tap rearward and take off.



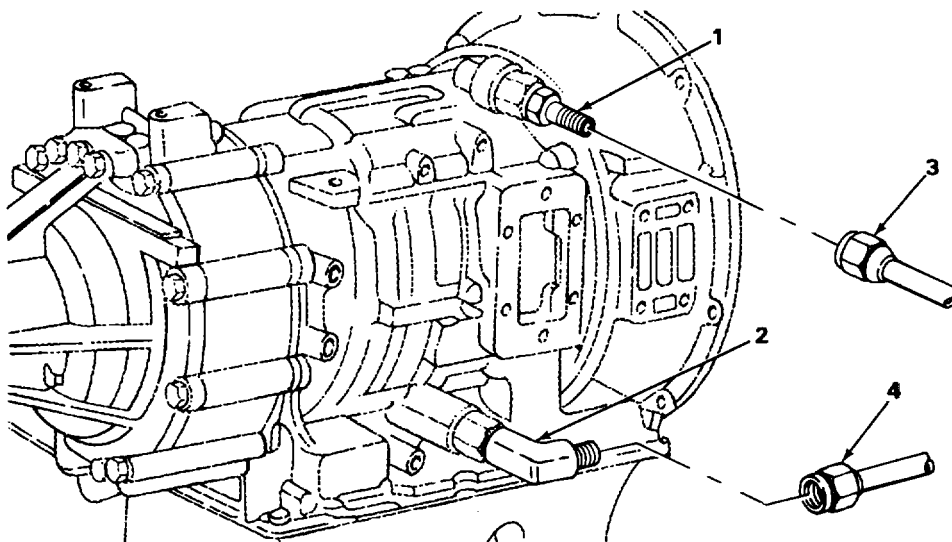
TA238376

TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

19.	Adapter (1) and elbow (2)	Two oil cooler lines (3) and (4)	a. Position drain pan to catch draining oil. b. Using 1 1/16-inch open-end wrench, unscrew and take off. c. Using dust plugs, plug end of lines (3) and (4), and fittings (1) and (2). d. Get rid of oil (page 2-46).



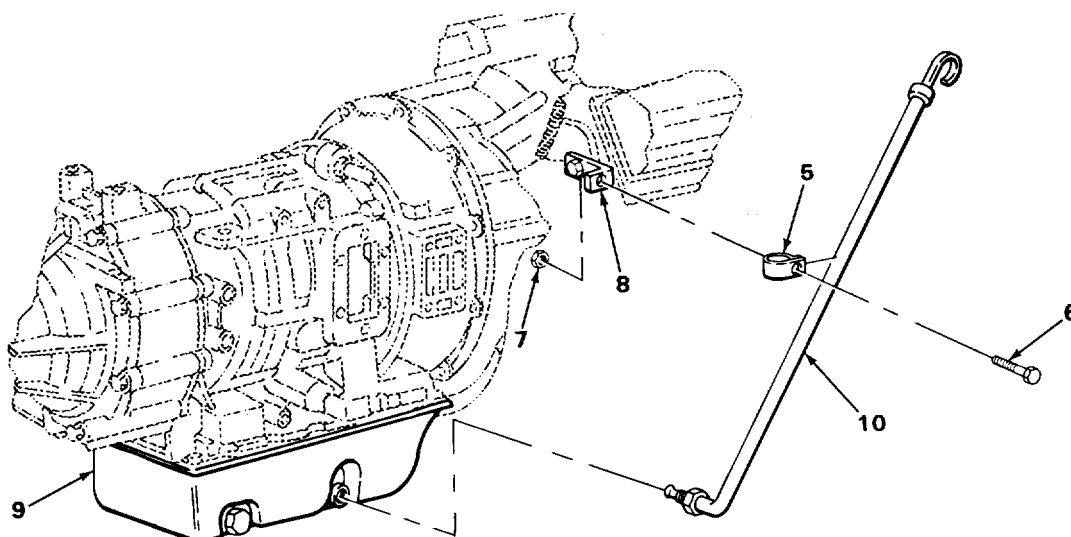
20.	Clamp (5) nut (7)	Screw (6) and with 1/2-inch drive, and 9/16-inch open- end wrench, unscrew and take off.	Using 9/16-inch socket, ratchet handle
21.	Bracket (8)	Clamp (5)	Move away from.
22.	Oil pan (9) tube (10)	Oil level gage unscrew and take off.	Using 1 1/8-inch open-end wrench,

TA238377

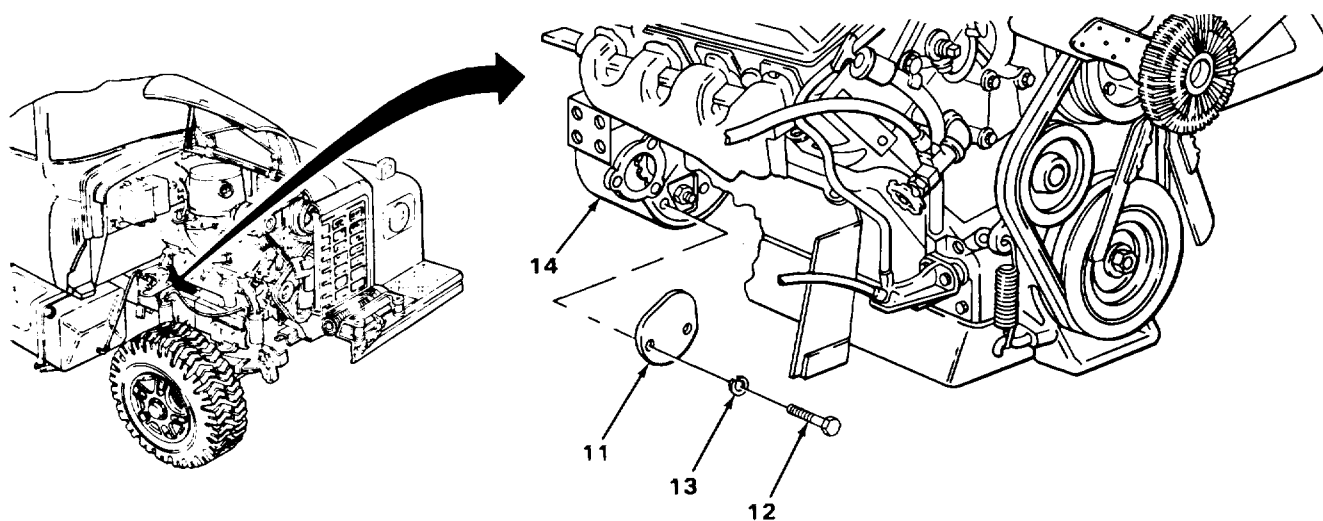
TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED



23	Handhole cover (11) lockwasher (13)	Screw (12) and handle with 112-inch drive, unscrew and take out.	Using 7/16-inch socket and ratchet
24	Flywheel housing (14)	Handhole cover (11)	Take off.



TA238378

TRANSMISSION ASSEMBLY - CONTINUED

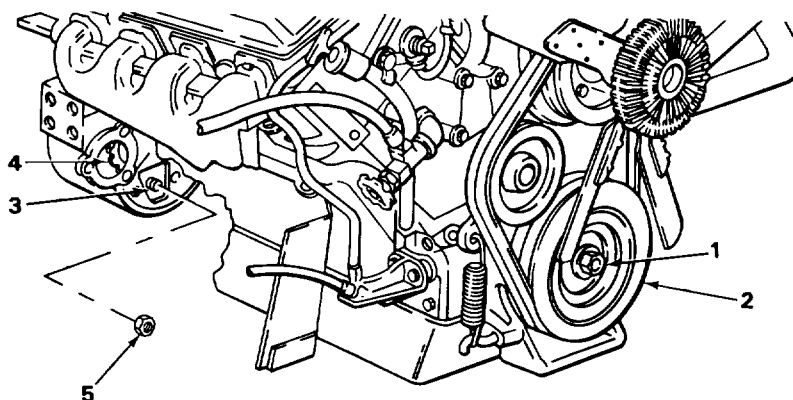
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

WARNING

Make sure ignition key is in the OFF position, and engine stop control is in the STOP position. In the following steps, the crankshaft will be rotated by hand. If the engine starts, serious injury or death could result.

25	Crankshaft (1) pulley (2)	Crankshaft crankshaft so that converter stud nuts (3) can be reached through the access hole in flywheel cover.	Using barring tool, have assistant turn
26	Flywheel (4)	Six nuts (5) ratchet handle with 112-inch drive, unscrew and take out.	Using 9/16-inch deep well socket and



27	Transmission rear mount bracket (6)	Two screws (7) and lockwashers (8) b. c.	a. Place transmission jack under trans- mission. Using 15/16-inch socket and ratchet handle with 112-inch drive, unscrew and take out. Get rid of lockwashers (8).

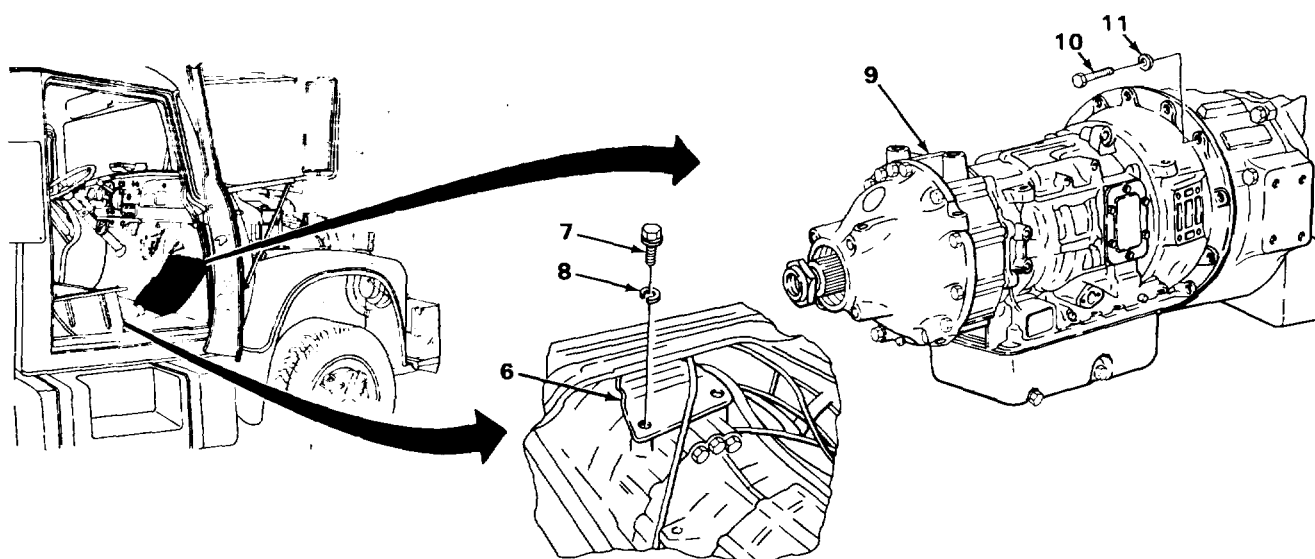
TA238379

TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

28.	Transmission (9)	Four screws (10) and washers (11)	a. Using 9/16-inch socket and ratchet handle with 11/2-inch drive, unscrew at 9, 11, 1, and 3 o'clock positions only, and take out. b. Using 3/8-inch flat-tip screwdriver, screw in and tighten four guide studs.

**WARNING**

When the transmission is disconnected from the engine, the torque converter can slide forward out of the transmission and fall, causing injury.

CAUTION

Maintain transmission alignment to engine flywheel housing during removal to prevent damage to the converter.

TRANSMISSION ASSEMBLY - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
REMOVAL - CONTINUED			
29.	Transmission assembly (1)	Eight screws (2) and washers (3)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
30.	Flywheel housing (4)	Transmission (1) and gasket (5)	a. Support the weight of the transmission assembly (1) with transmission jack. b. Using transmission jack, move transmission (1) back to separate from housing (4). Keep transmission level until clear of guide studs. c. When clear of guide studs, tilt rear of transmission (1) slightly downward, so that torque converter will not fall out. d. Lower transmission (1) and take out from under vehicle. e. Install torque converter restraining strap. f. Install assembly in overhaul stand. g. Get rid of gasket (5).

INSTALLATION

WARNING

When the transmission is installed, the torque converter can slide forward out of the transmission and fall. This can cause injury to you.

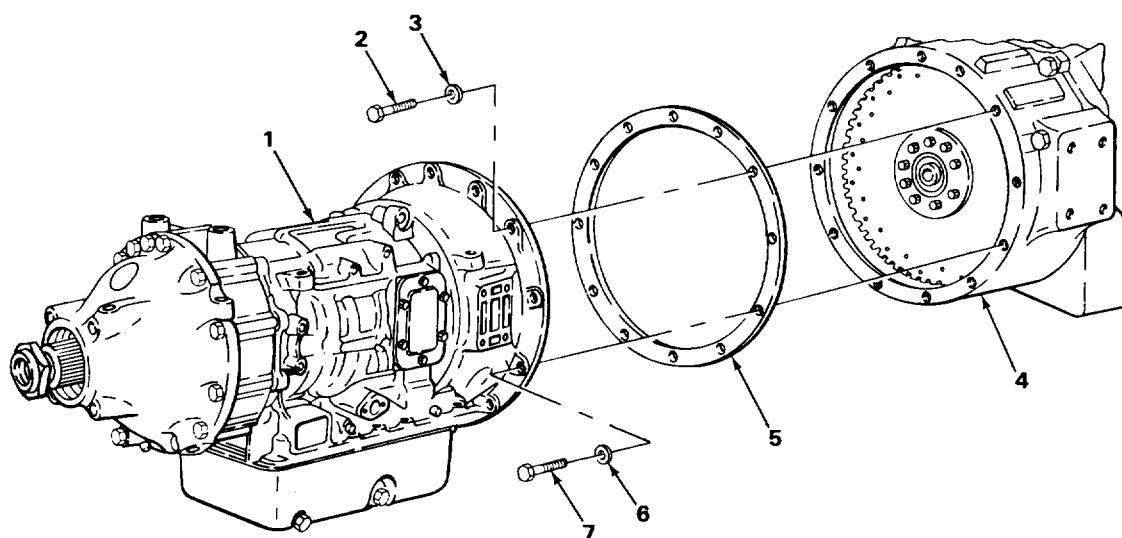
CAUTION

Maintain transmission alignment to engine flywheel housing during installation to prevent damage to the converter.

31.	Flywheel housing (4)	New gasket (5) and transmission assembly (1)	a. Remove dust plugs. b. Remove assembly from overhaul stand. c. Position the transmission on a transmission jack. d. Take off converter restraining strap. e. Position transmission under vehicle using transmission jack.

TRANSMISSION ASSEMBLY - CONTINUED

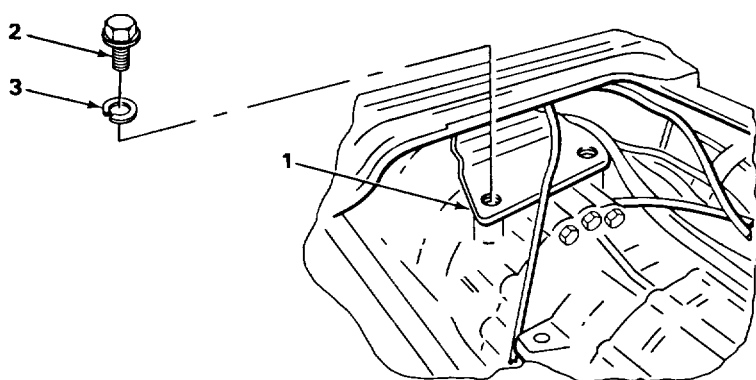
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
31.	Continued	f. Tilt the rear of the transmission slightly downward so the converter will not fall out. g. Raise and level the transmission. h. Align the holes in the transmission housing with the guide studs, and the torque converter drive studs with holes in the flywheel. i. Move into position.	
32.	Transmission assembly (1)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.	
33.	Four washers (6) and screws (7)	a. Unscrew, and take out four guide studs using 3/8-inch flat-tip screwdriver. b. Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive,	
34.	Twelve screws (2) and (7)	Using 9/16-inch socket and torque wrench with 1/2-inch drive, tighten all screws to 26-32 ft-lb (35-43 N m) of torque.	



TA238381

TRANSMISSION ASSEMBLY - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED				
35.	Transmission rear mount bracket (1)	Two screws (2) and new lockwashers (3)	a. Position transmission to bracket (1). b. Screw in until snug using 15/16-inch socket and ratchet handle with 1/2-inch drive. c. Using 15/16-inch socket and torque wrench with 1/2-inch drive, tighten to 75 - 85 ft-lb (102 - 115 N m) of torque.	

**WARNING**

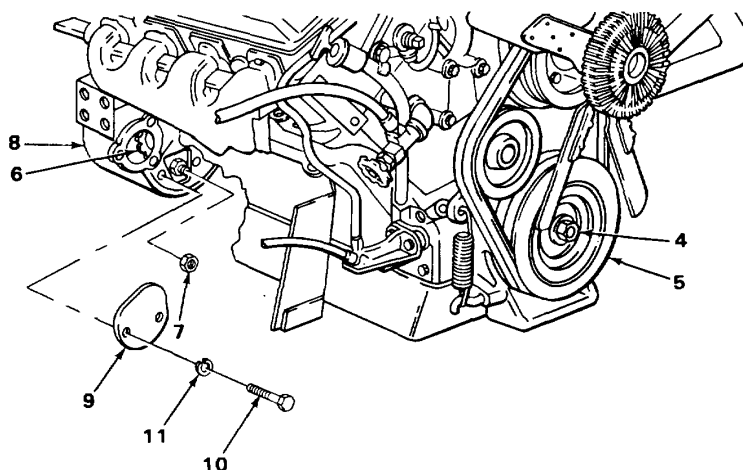
Make sure the ignition key is in the OFF position and the engine stop control is in the STOP position. In the following step, the engine will be rotated by hand. If the engine starts, serious injury or death could result.

36.	Crankshaft (4)	Crankshaft pulley (5)	Have assistant, using barring tool, turn pulley (5) to rotate flywheel (6) so that torque converter studs can be reached through handhole in the flywheel housing.	
37.	Flywheel (6)	Six nuts (7)	a. Screw on until snug using 9/16-inch deep well socket and ratchet handle with 1/2-inch drive. b. Using 9/16-inch deep well socket and torque wrench with 1/2-inch drive, tighten to 33 - 40 ft-lb (45 - 54 N m) of torque.	
38.	Flywheel housing (8)	Handhole cover (9)	Place in position.	
39.	Handhole cover (9)	Screw (10) and new lockwasher (11)	Screw in, and tighten using 7/16-inch socket and ratchet handle with 1/2-inch drive.	

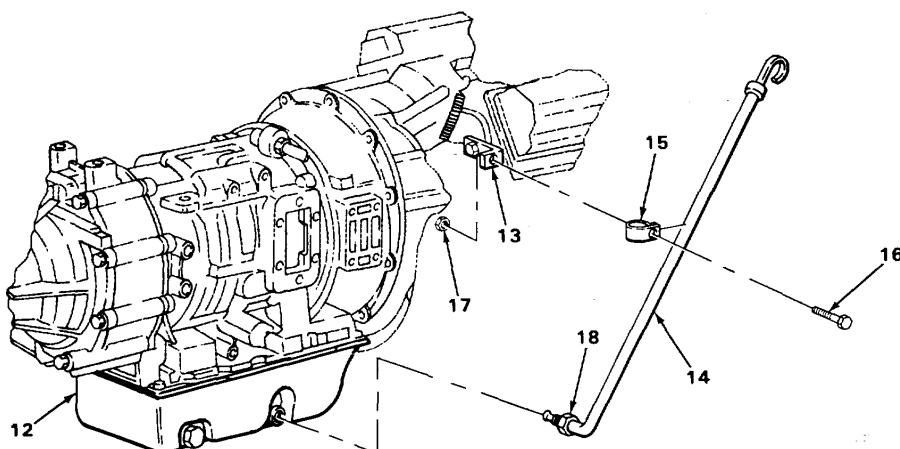
TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

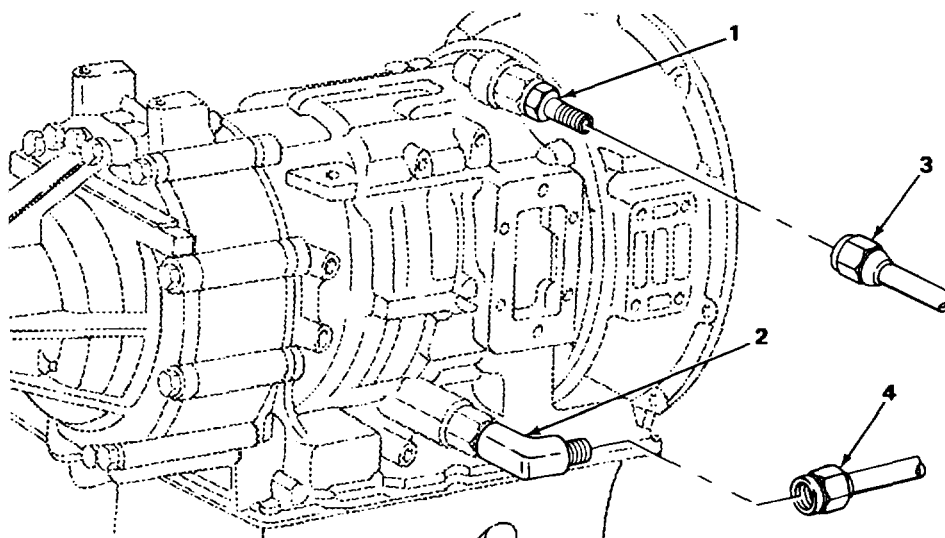


40.	Oil pan (12) and bracket (13)	Oil level gage tube (14) and clamp (15)	Put in position.
41.	Clamp (15) and bracket (13)	Screw (16) and nut (17)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive, and 9/16-inch open-end wrench.
42.	Oil pan (12)	Oil level gage tube flare nut (18)	Screw in, and tighten to - 25 ft-lb (14 - 34 N m) of torque using 1 1/8-inch open-end crowfoot wrench and torque wrench with 1/2-inch drive.

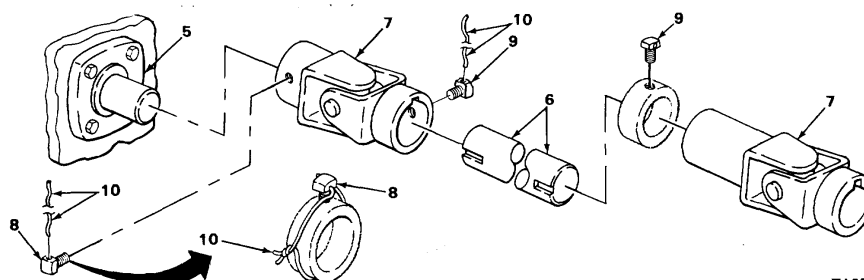


TRANSMISSION ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED		
43. Two adapters (1) and elbow (2)	Two oil cooler lines (3) and (4)	a. Take off dust plugs. b. Screw on, and tighten using 1 1/6-inch open-end wrench.



44. Power takeoff bearing cap assembly (5) and shaft (6)	U-joint (7)	a. Put in position. b. Tap forward to mate with assembly (5) using 1-lb ball-peen hammer and 3/4-inch brass driftpin.
45. Two U-joints (7)	One setscrew (8) and two setscrews (9)	Screw in, and tighten using 9/16-inch and 3/8-inch open-end wrenches.
46. One setscrew (8) and two setscrews (9)	Three lock-wires (10)	Put on (page 2-46).



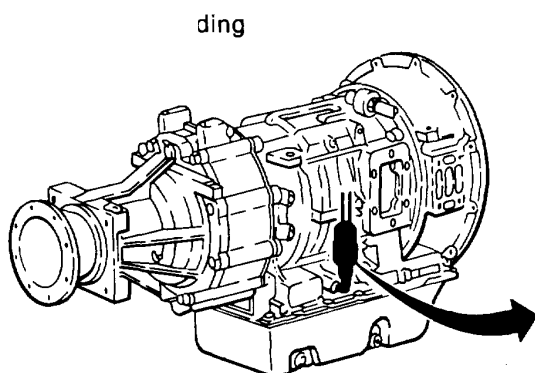
TA238384

TRANSMISSION ASSEMBLY - CONTINUED

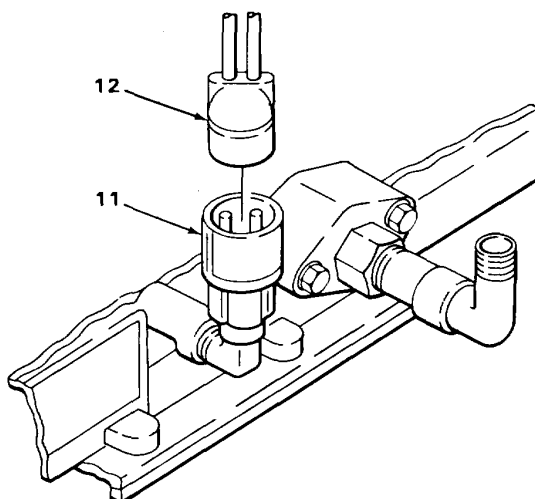
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

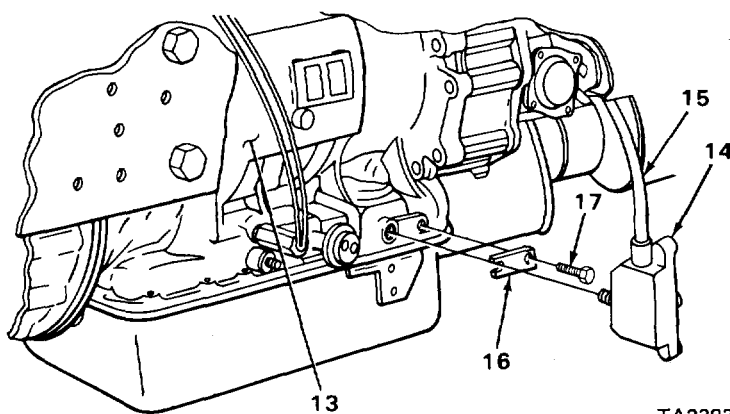
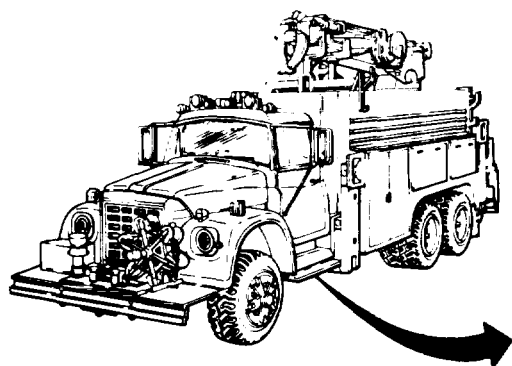
47. Transmission oil Pressure sending unit (11) Plug(12) Plug in.



TRANSMISSION REMOVED
FOR CLARITY



48. Transmission assembly (13) Modulator valve (14) and cable (15) Push into bore.
49. Modulator valve (14) and transmission assembly (13) Modulator retainer (16) Put into position.
50. Modulator retainer (16) Screw (17) Screw in, and tighten using 11/2-inch socket and ratchet handle with 1/2-inch drive.



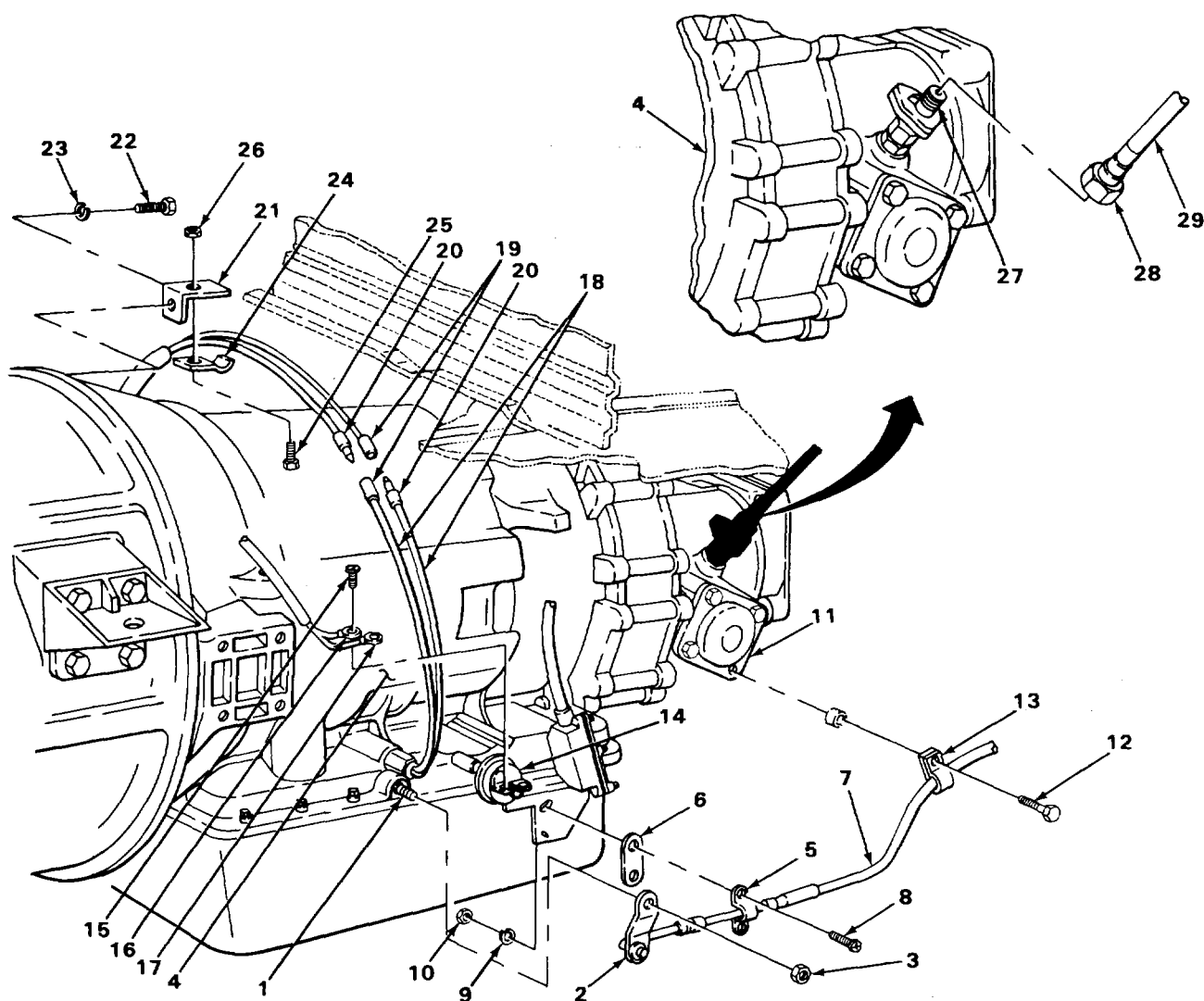
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TRANSMISSION ASSEMBLY - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
INSTALLATION - CONTINUED			
51.	Shift shaft (1)	Shift lever (2)	Put on.
52.	Shift lever (2)	Nut (3)	Screw on, and tighten using 9/16-inch socket and ratchet handle with 11/2-inch drive.
53.	Transmission (4)	Cable clamp (5), bar (6), and cable (7)	Place in position.
54.	Cable clamp (5)	Two screws (8), new lockwashers (9), and nuts (10)	Screw in, and tighten using number two cross-tip screwdriver and 3/8-inch open-end wrench.
55.	Governor cover (11)	Screw (12)	Using 1/2-inch socket and ratchet handle with 1/2-inch drive, take out.
56.		Cable clamp (13)	Put in position.
57.		Screw (12)	a. Screw in until snug using 1/2-inch socket and ratchet handle with 1/2-inch drive. b. Tighten to 15-20 ft-lb (20-27 N m) of torque using 1/2-inch socket and torque wrench with 1/2-inch drive.
58.	Oil temperature sending unit (14)	Two screws (15) and wires (16) and (17)	a. Position wires (16) and (17) as tagged. b. Screw in, and tighten using 11/4-inch flat-tip screwdriver.
59.	Neutral start switch wires (18)	Four connectors (19) and (20)	Connect wires as tagged.
60.	Transmission (4)	Bracket (21)	Put in position.
61.	Bracket (21)	Screw (22) and new lockwasher (23)	Screw in, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive.
62.		Cable clamp (24), screw (25), and nut (26)	a. Place wires (18) between bracket (21) and cable clamp (12). b. Screw on, and tighten using two 7/16-inch open-end wrenches.
63.	Speedometer cable adapter (27)	Nut (28) and cable (29)	Screw on, and tighten using two 1-inch open-end wrenches.

TRANSMISSION ASSEMBLY - CONTINUED

INSTALLATION - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE:

1. Install power takeoff assembly (TM 9-2320-269-20-1).
2. Install radiator (TM 9-2320-269-20-1).
3. Install transmission-to-center bearing flange (TM 9-2320-269-20-1).
4. Install transmission and engine covers (TM 9-2320-269-20-2).
5. Service transmission (LO 9-2320-269-12).

TASK ENDS HERE

TRANSMISSION SUBASSEMBLIES

NOTE

This task is complete teardown of transmission assembly into transmission subassemblies. In many cases, a particular subassembly can only be removed if other subassemblies are removed first. Therefore, the "This Task covers:" listing, lists the subassemblies in the order that they must be removed and installed. After a subassembly is removed, disassembly may or may not be necessary. If a disassembly is necessary, go to the section index (page 2-632) and find the subassembly you need to repair, replace, or clean.

After a complete removal of transmission subassemblies and before installation, several clearance checks must be made. Do these checks in the order listed in "This task covers:"

This task covers:

a. Torque Converter Removal (page 2-652)	s. Snapping Clearance Check (page 2-666)
b. Oil Pan Removal (page 2-652)	t. Second Range Clutch Clearance Check (page 2-668)
c. Oil Filter Removal (page 2-652)	u. Low Range Clutch Clearance Check (page 2-669)
d. Oil Tubes Removal (page 2-653)	v. Adapter Housing Installation (page 2-672)
e. Low Shift Valve Assembly Removal (page 2-654)	w. Low Range Clutch Installation (page 2-672)
f. Control Valve Assembly Removal (page 2-654)	x. Output Shaft Installation (page 2-674)
g. Oil Pump and Front Support Removal (page 2-656)	y. Rear Cover Assembly Installation (page 2-674)
h. Forward Range Clutch Removal (page 2-657)	z. Governor Assembly Installation (page 2-675)
i. Fourth Range Clutch Removal (page 2-657)	aa. First Range Clutch Installation (page 2-676)
j. Third Range Clutch Removal (page 2-658)	ab. Gear Unit Installation (page 2-678)
k. Center Support Removal (page 2-658)	ac. Second Range Clutch Installation (page 2-679)
l. Gear Unit Removal (page 2-660)	ad. Center Support Installation (page 2-680)
m. Second Range Clutch Removal (page 2-660)	ae. Fourth Range Clutch Installation (page 2-680)
n. First Range Clutch Removal (page 2-661)	af. Third Range Clutch Installation (page 2-681)
o. Governor Assembly Removal (page 2-662)	ag. Forward Range Clutch Installation (page 2-682)
p. Rear Cover and Output Shaft Removal (page 2-663)	ah. Oil Pump and Front Support Installation (page 2-684)
q. Low Range Clutch Removal (page 2-664)	al. Control Valve Assembly Installation (page 2-686)
r. Adapter Housing Removal (page 2-666)	aj. Low Shift Valve Assembly Installation (page 2-688)
	ak. Oil Tubes Installation (page 2-688)
	al. Oil Filter Installation (page 2-689)
	am. Oil Pan Installation (page 2-690)
	an. Torque Converter Installation (page 2-691)
-

TRANSMISSION SUBASSEMBLIES - CONTINUE**INITIAL SETUP****Tools**

Bar, pry, 12-inch
 Compressor, reciprocating air,
 power driven
 Crane, floor, portable, 2,000-lb
 Extension, 112-inch drive, 6-inch
 Face, inserted hammer, medium-plastic
 Fixture, selective snapping
 Gage, first clutch
 Gage, second clutch
 Gage, snapping
 Goggles, protective
 Gun, air blow
 Gun, heat
 Handle, ratchet, 1/2-inch drive
 Holder, inserted hammer-face
 Hose, air compressor
 Lifter, center support
 Lifter, converter assembly
 Lifter, front support
 Lifter, gear unit
 Lifter, output shaft
 Micrometer, depth
 Retrieving tool, magnetic
 Screwdriver, flat-tip, 1/4-inch
 Screwdriver, flat-tip, 3/8-inch
 Screws, guide, 1/4-20 x 2 1/2-inch
 (seven required)
 Screws, guide, 3/8-16 x 6-inch
 (two required)
 Screws, guide, 5/16-18 x 3-inch
 (two required)
 Socket, 1/2-inch drive, 7/16-inch
 Socket, 1/2-inch drive, 1/2-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 1/2-inch
 Socket, 1/2-inch drive, 3/4-inch
 Socket, 1/2-inch drive, 7/8-inch
 Socket, 112-inch drive, 9/16-inch
 Socket, deep well, 1/2-inch drive,
 1/2-inch
 Wrench, torque, 112-inch drive
 0 to 175 ft-lb capacity

Materials Parts

Gasket, adapter housing
 Gasket, governor cover
 Gasket, oil pump and front support assembly
 Gasket, transmission housing
 Gasket, rear cover
 Gasket, transmission oil pan
 Gasket, transmission adapter housing
 Grease, oil soluble (item 21, appendix B)
 Lockwasher, center support screw
 Oil, transmission (item 35, appendix B)
 Packing, performed, oil filter
 Rubber band
 Tag, marking (item 50, appendix B)
 Washer, oil pump (12 required)

Personnel Required

Two

Equipment Condition

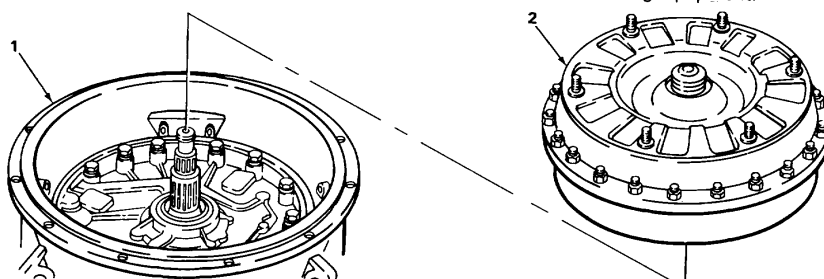
Transmission assembly removed
 (page 2-633).

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

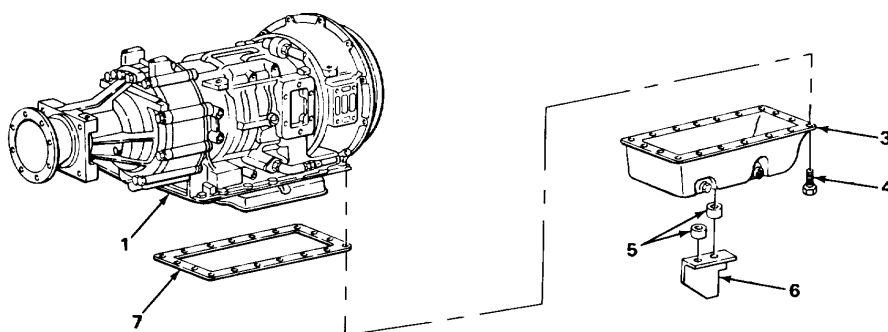
TORQUE CONVERTER REMOVAL

1.	Transmission (1)	Torque converter (2)	a. Remove restraining strap. b. Using portable floor crane, take out. c. Take off lifting equipment.



OIL PAN REMOVAL

2.	Oil pan (3)	21 screws (4)	Using 1/2-inch socket, ratchet handle with 1/2-inch drive, and 6-inch extension, unscrew and take out.
3.	Transmission (1)	Oil pan (3), two spacers (5), bracket (6) and gasket (7)	a. Take off. b. Get rid of gasket (7).



OIL FILTER REMOVAL

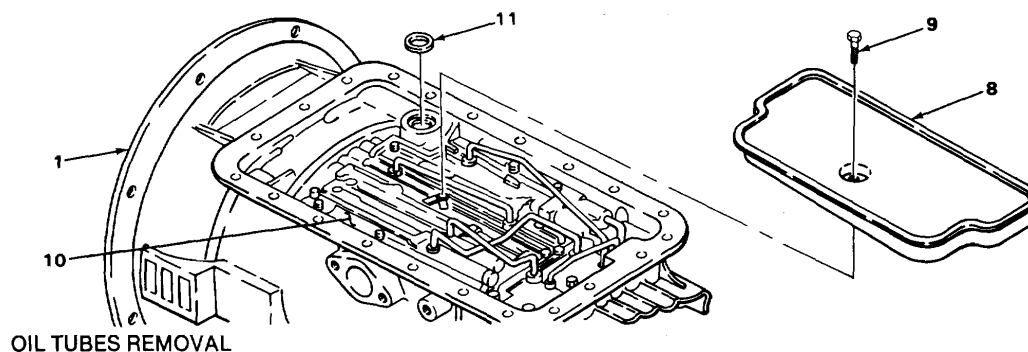
4.	Oil filter (8)	Screw (9)	Using 1/2-inch deep well socket, and ratchet handle with 1/2-inch drive, unscrew and take out.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

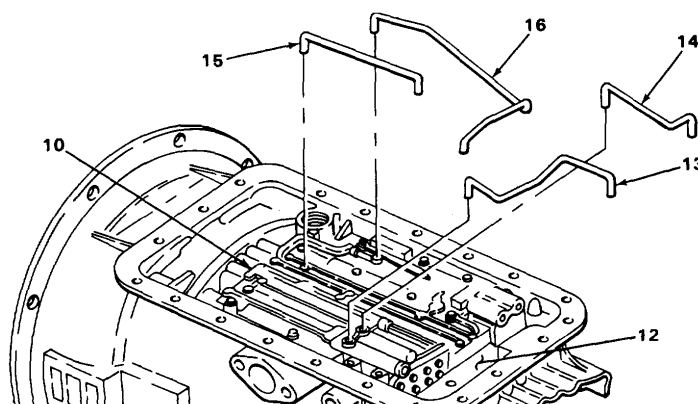
OIL FILTER REMOVAL - CONTINUED

5.	Transmission (1) and control valve (10)	Oil filter (8) and packing (11)	a. Take out. b. Get rid of packing (11).

**CAUTION**

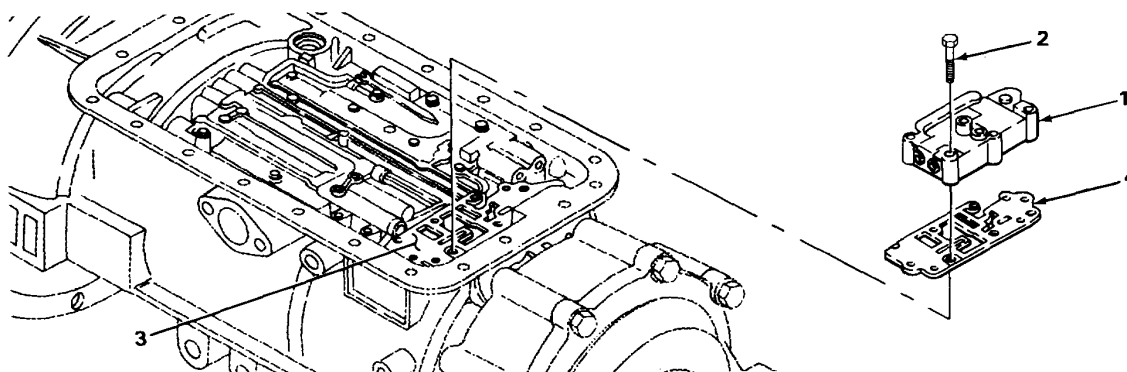
The external oil tubes on the control valve assembly can be easily kinked or bent. Use extra care when removing them.

6.	Control valve (10) and low shift valve assembly (12)	Trimmer tube (13), low clutch feed tube (14), main knockdown tube (15), and drive tube (16)	Using 3/8-inch flat-tip screwdriver, carefully pry up and take out.



TRANSMISSION SUBASSEMBLIES - CONTINUED

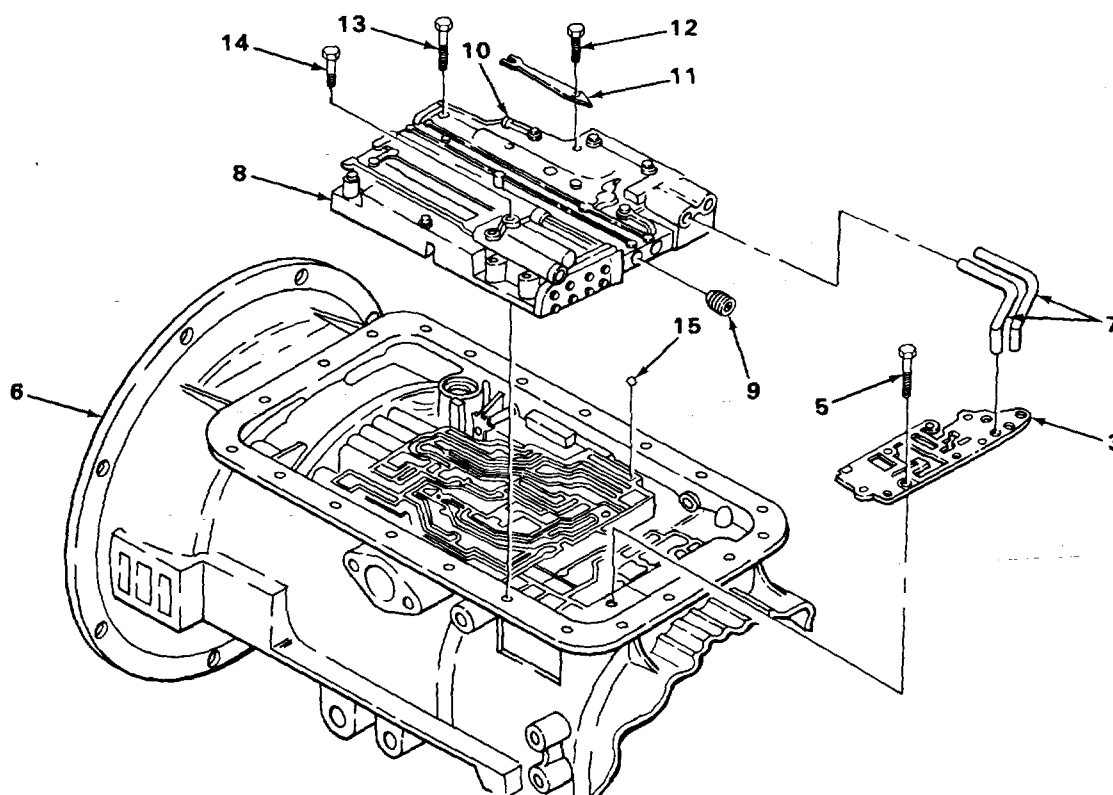
	LOCATION	ITEM	ACTION	REMARKS
LOW SHIFT VALVE ASSEMBLY REMOVAL				
7.	Low shift valve (1)	Seven screws (2)	Using 7/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. Take off.	
8.	Transfer plate (3)	Low shift valve assembly (1) and separator plate (4)		



CONTROL VALVE ASSEMBLY REMOVAL

9.	Transfer plate (3)	Two screws (5)	Using 7/16-inch socket, 6-inch extension, and ratchet handle with 1/2-inch drive, unscrew and take out.	
10.	Transmission (6)	Transfer plate (3) and two oil tubes (7)	Take out.	
11.	Control valve assembly (8)	Governor screen (9) take out.	Using 1/4-inch flat-tip screwdriver,	
12.		Range selector valve (10)	Using rubber band, put one end over pad on control valve assembly (8) and other end around the range selector valve (10) to hold it in place.	
13.	Detent spring and roller assembly (11)	Screw (12)	Using 7/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
14.	Control valve assembly (8)	Detent spring and roller assembly (11)	Take off.	

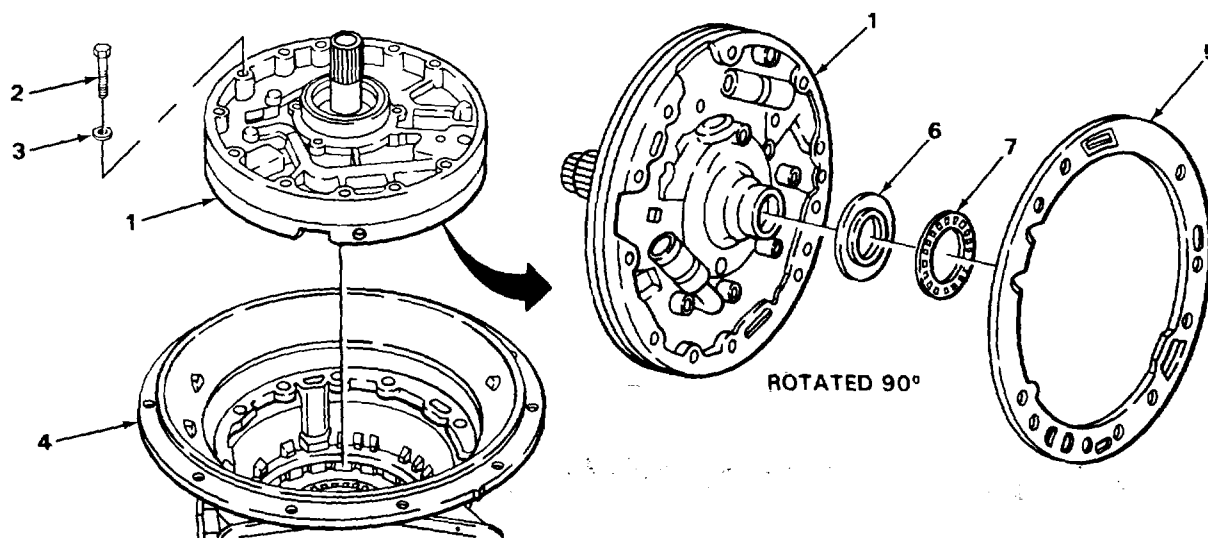
LOCATION	ITEM	ACTION	REMARKS
CONTROL VALVE ASSEMBLY REMOVAL - CONTINUED			
15.	Two screws (13)	Using 7/16-inch socket and ratchet handle with 1/2-inch drive, unscrew part way.	
16.	16 screws (14)	Using 7/16-inch socket and ratchet handle with 11/2-inch drive, unscrew and take out.	
17.	Two screws (13)	Holding the control valve assembly (8) firmly, unscrew and take out.	
NOTE			
Do not lose the governor-check ball when taking out control valve assembly.			
18.	Transmission (6)	Control valve assembly (8)	Using downward and outward movement to clear actuator pin in transmission (6), take out.
19.	Governor check ball (15)		Using retrieving tool, take out.



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TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
OIL PUMP AND FRONT SUPPORT REMOVAL				
20.	Front pump and support assembly (1)	Twelve screws (2) and washers (3)	a. Using 9116-inch socket, 6-inch extension, and ratchet handle with 112-inch drive, unscrew and take out. b. Get rid of washers (3).	
21.	Transmission housing (4)	Front pump and support assembly (1)	a. Attach front support lifter. b. Attach portable floor crane to front pump and support lifter, and carefully lift assembly (1) out of housing (4), and set it on clean workbench. If support assembly binds, warm housing with heat gun. If front pump and support assembly moves part way and then binds, use plastic-face hammer and tap it back down and lift again. c. Take off lifting equipment.	
22		Gasket (5)	a. Take off. b. Get rid of.	
23.	Front pump and support assembly (1-)	Race (6) and bearing (7)	a. Take off. b. Tao for installation	



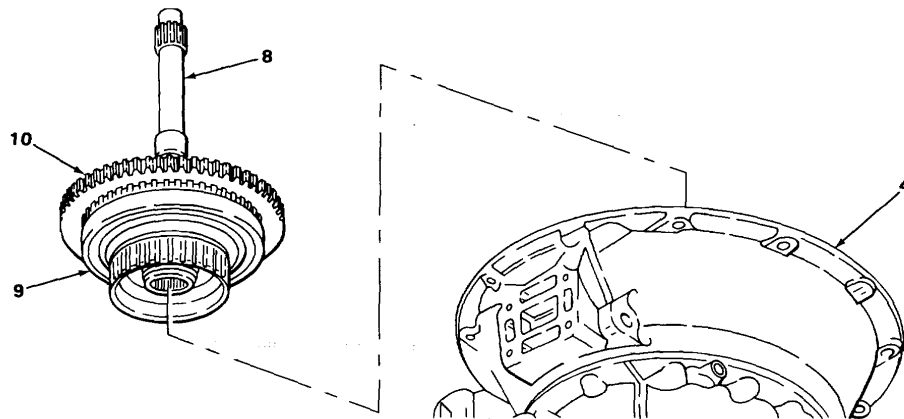
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TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

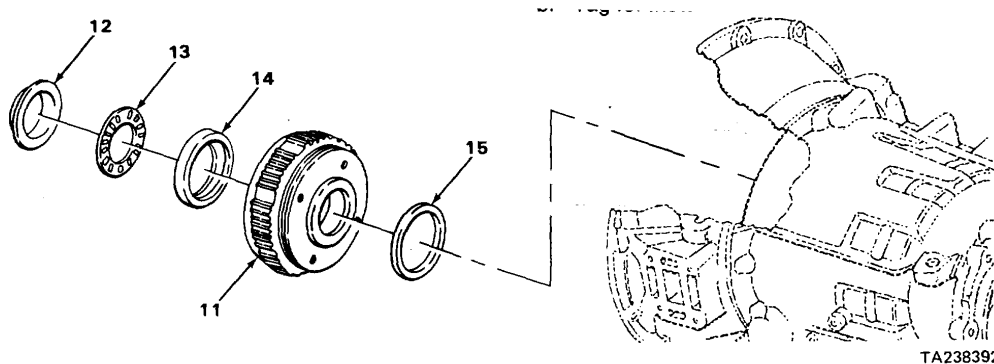
FORWARD RANGE CLUTCH REMOVAL

24.	Transmission housing (4)	Turbine shaft (8), forward clutch (9), and power take off gear (10)	Lift out as a unit, and set on clean workbench.



FOURTH RANGE CLUTCH REMOVAL

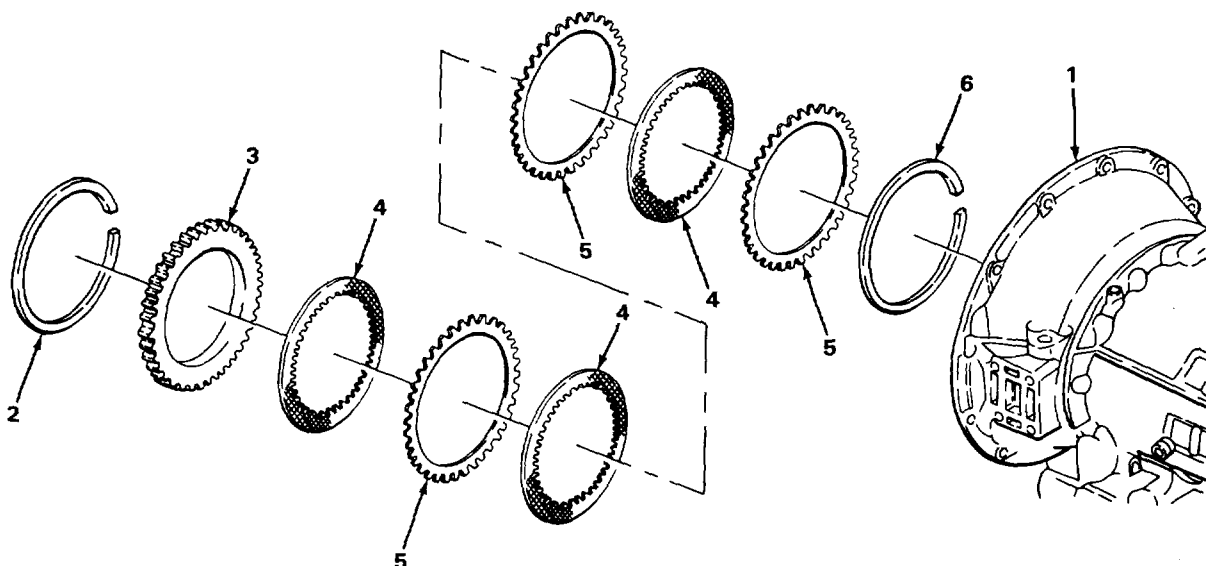
25.		Fourth clutch hub (11)	a. Grasp from inside, lift out. b. Set on clean workbench.
26.	Fourth clutch hub (11)	Race (12), bearing assembly (13), and race (14)	a. Take off. b. Tag for installation.
27.		Race (15)	a. Take off. b. Tag for installation.



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TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
THIRD RANGE CLUTCH REMOVAL			
<u>CAUTION</u>			
Keep third clutch backing plate and six clutch plates together. Mixing third clutch plates with any other clutch plates will damage the transmission.			
28.	Transmission housing (1)	Internal clutch plate snapping (2)	Using 3/8-inch flat-tip screwdriver and 12-inch pry bar, take out.
29.	Backing plate (3), three internal splined clutch plates (4), and three external tanged clutch plates (5)		Take out.
30.	Internal snapping (6)		Using 3/8-inch flat-tip screwdriver and 12-inch pry bar, take out.

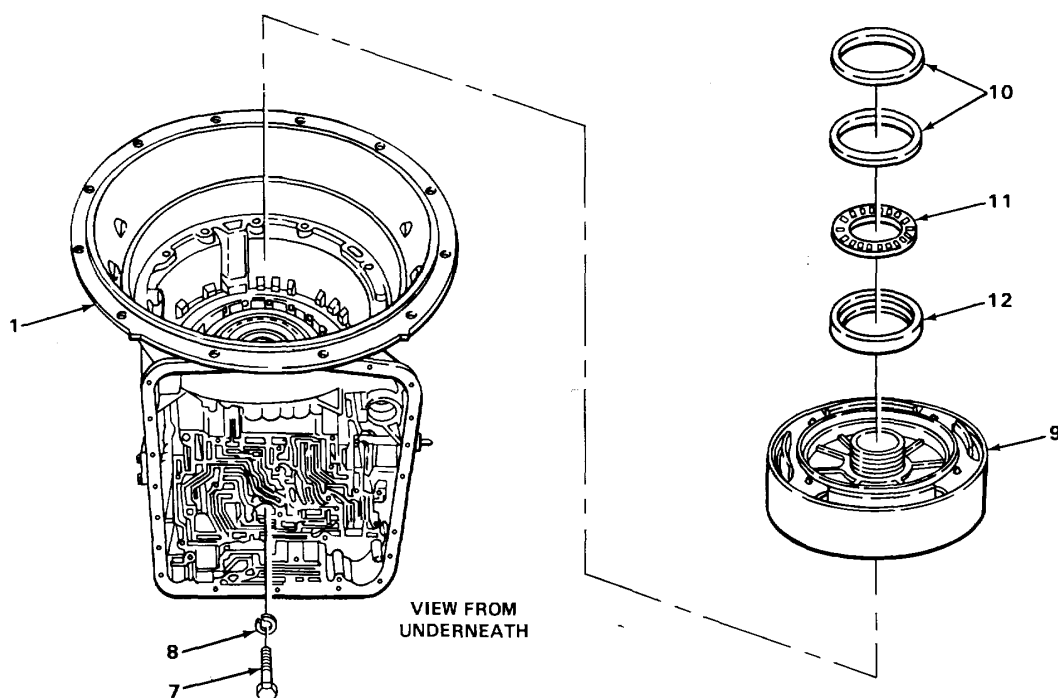


CENTER SUPPORT REMOVAL

31.	Transmission housing (1)	Screw (7) and lockwasher (8)	a. Using 9/16-inch socket and ratchet handle with 11/2-inch drive, unscrew and take out. b. Get rid of lockwasher (8).

TRANSMISSION SUBASSEMBLIES - CONTINUED

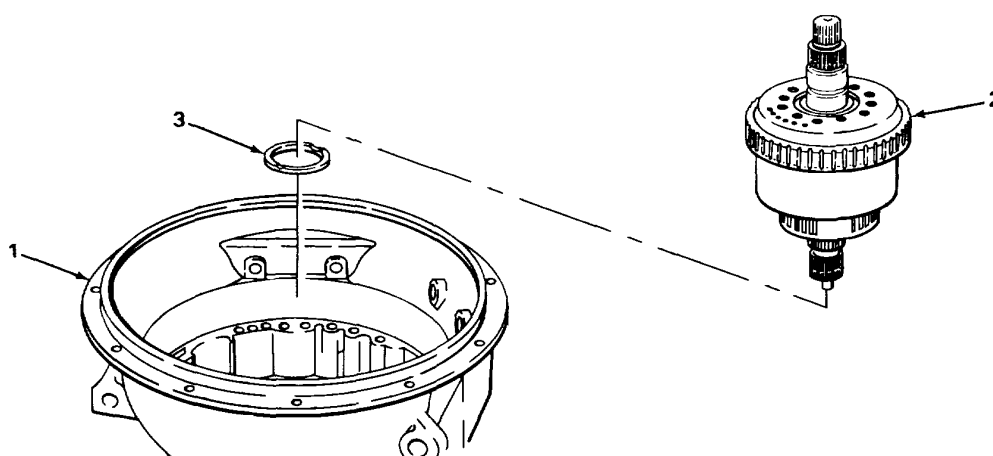
LOCATION	ITEM	ACTION	REMARKS
CENTER SUPPORT REMOVAL - CONTINUED			
32.	Center support (9)	a. Attach a center support lifter. b. Attach portable floor crane to center support lifter, carefully lift out, and set on a clean workbench. If the center support binds, warm the housing with or heat gun. If the center support moves part way and then binds, using plastic- face hammer, tap it back down and lift again. c. Take off lifting equipment.	
33.	Center support (9)	a. Take off. b. Tag parts.	Two clutch support step joint
34.	Roller bearing (11) and race (12)	a. Take off. b. Tag parts.	



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TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
GEAR UNIT REMOVAL			
35.	Transmission housing (1)	Gear unit (2)	a. Attach a gear unit lifter. b. Attach portable floor crane to gear lifter, lift out, and set on a clean workbench. c. Take off lifting equipment.
36.		Sun gear thrust washer (3)	Take out.



SECOND RANGE CLUTCH REMOVAL

37.		Snapping (4)	Using a 3/8-inch flat-tip screwdriver and 12-inch pry bar, take out.

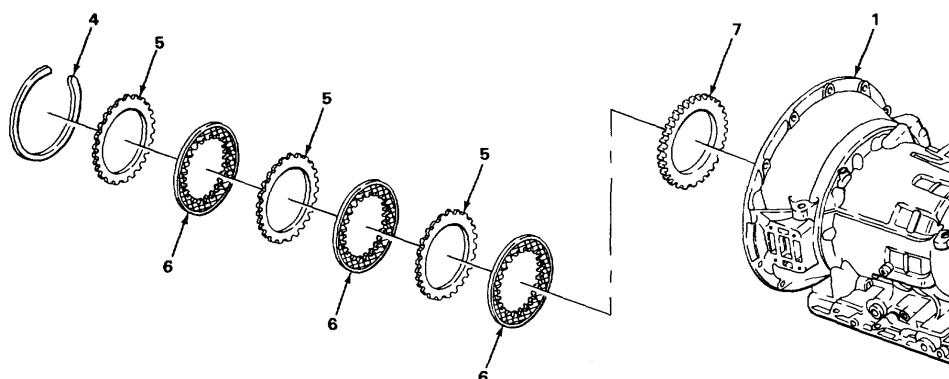
CAUTION

Keep all second clutch parts together. Mixing clutch parts with other clutch parts will cause transmission damage.

38.		Three external tanged clutch plates (5), three internal splined clutch plates (6), and backing plate (7)	Take out.

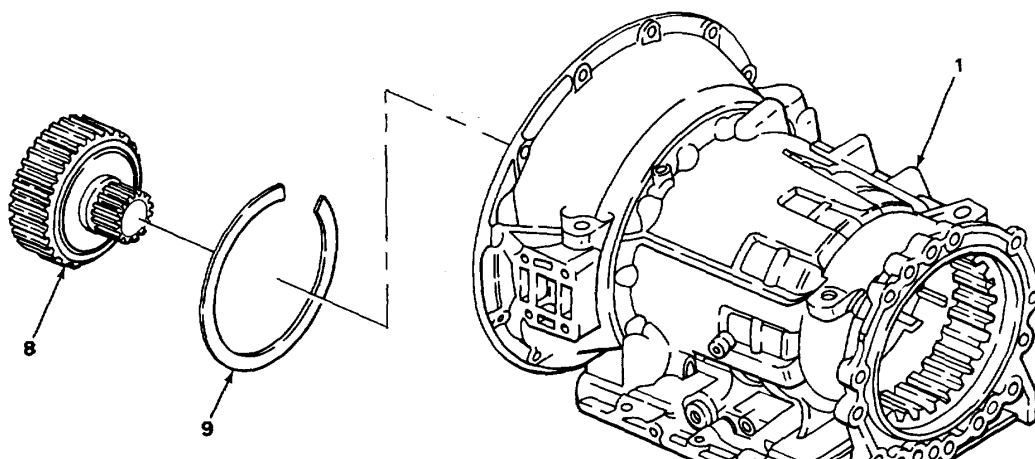
TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
SECOND RANGE CLUTCH REMOVAL - CONTINUED			



FIRST RANGE CLUTCH REMOVAL

39.	Planetary ring gear and hub assembly (8)	Take out.
40.	Snapping (9)	Using 3/8-inch flat-tip screwdriver and 12-inch pry bar, take out.



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TRANSMISSION SUBASSEMBLIES - CONTINUED

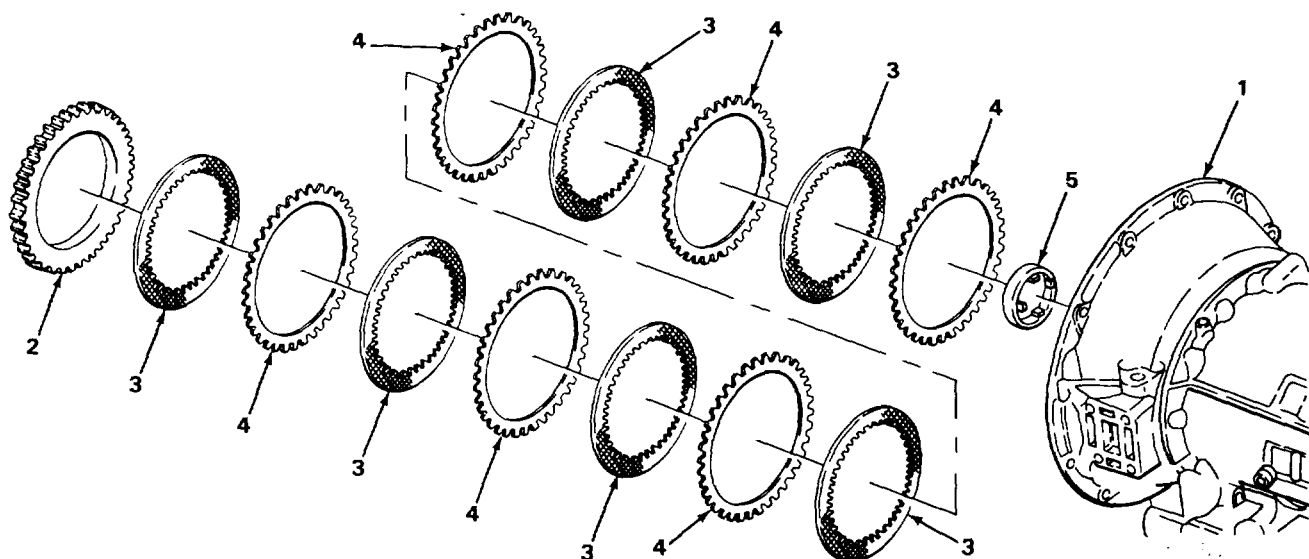
LOCATION	ITEM	ACTION	REMARKS

FIRST RANGE CLUTCH REMOVAL - CONTINUED

CAUTION

Keep all first range parts together. Mixing clutch parts with other clutch parts will cause transmission damage.

41.	Transmission housing (1)	Backing plate (2), six internal splined clutch plates (3), and six external tanged clutch plates (4)	Take out.



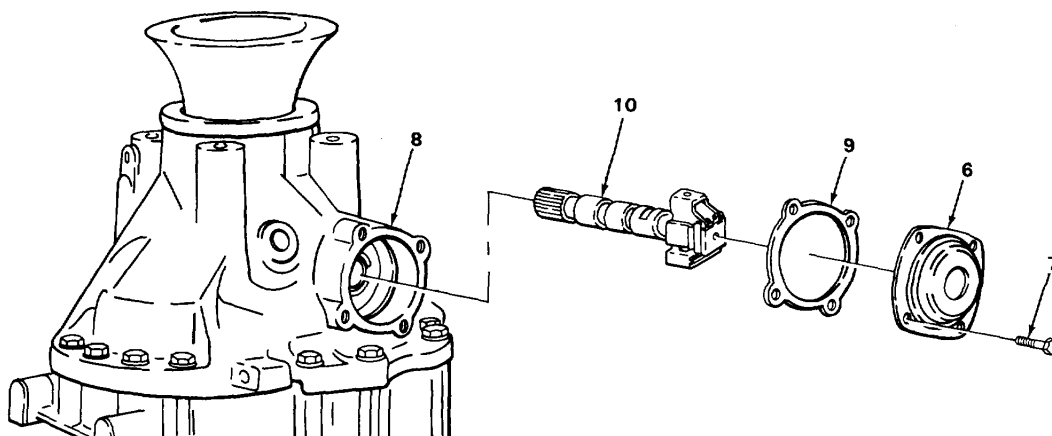
GOVERNOR ASSEMBLY REMOVAL

43.	Governor cover (6)	Four screws (7)	With the transmission positioned with output shaft end up, and using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
44.	Rear cover (8) and gasket (9)	Governor cover (6) b. Get rid of gasket (9).	a. Take off.
45.		Governor assembly (10)	Take out.

TRANSMISSION SUBASSEMBLIES - CONTINUED

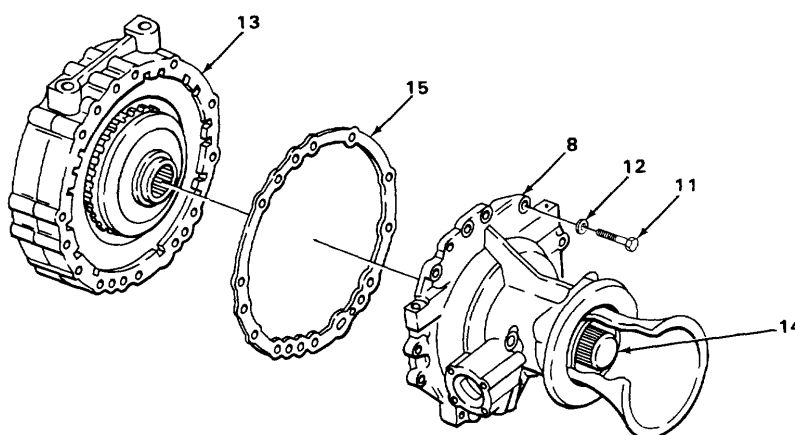
LOCATION	ITEM	ACTION	REMARKS

GOVERNOR ASSEMBLY REMOVAL - CONTINUED



REAR COVER AND OUTPUT SHAFT REMOVAL

46.		Fourteen screws (11) and washers (12)	Using 3/4-inch socket and ratchet handle with 112-inch drive, unscrew and take out.
47.	Adapter housing (13)	Output shaft (14), rear cover (8), and gasket (15)	a. Attach lifter to output shaft (14). b. Attach portable floor crane to output shaft lifter, lift out, and set on clean workbench. c. Get rid of gasket (15). d. Take off lifting equipment.

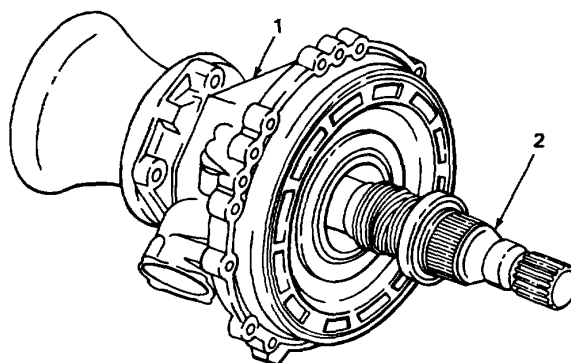


TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REAR COVER AND OUTPUT SHAFT REMOVAL - CONTINUED

48.	Rear cover assembly (1)	Output shaft (2)	Take out.



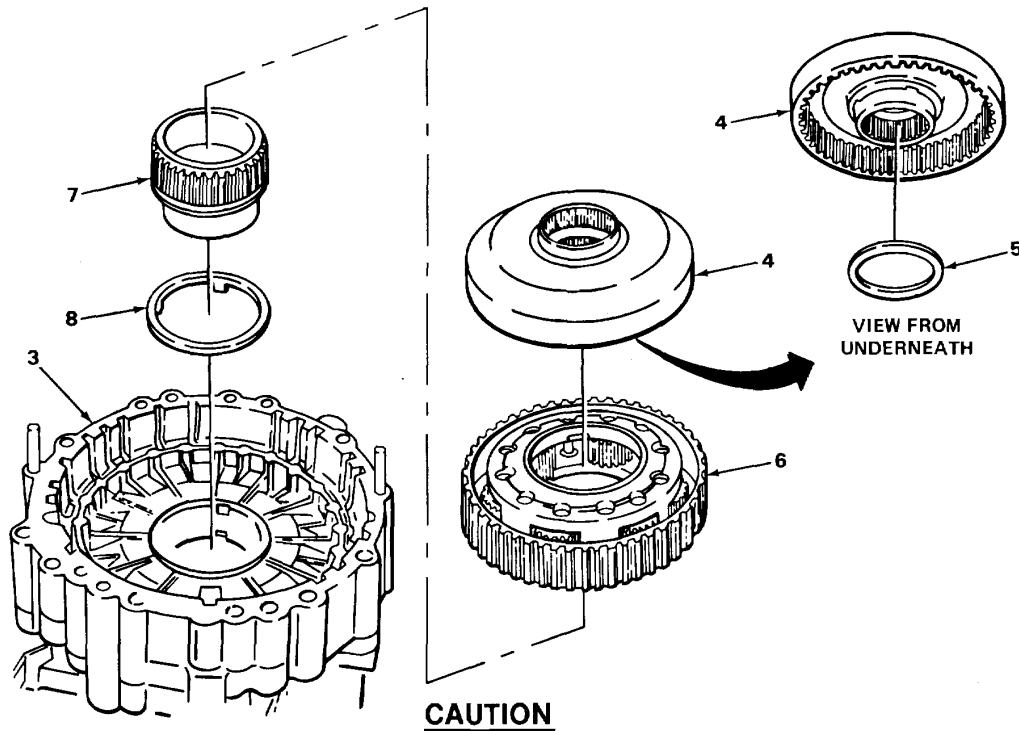
LOW RANGE CLUTCH REMOVAL

49.	Adapter housing (3)	Low clutch ring gear (4)	Take out.
50.	Low clutch ring gear (4)	Thrust washer (5)	Take out.
51.	Adapter housing (3)	Low clutch planetary carrier assembly (6)	Take out.
52.		Low sun gear (7)	Take out.
53.		Thrust washer (8)	Take out.

TRANSMISSION SUBASSEMBLIES - CONTINUED

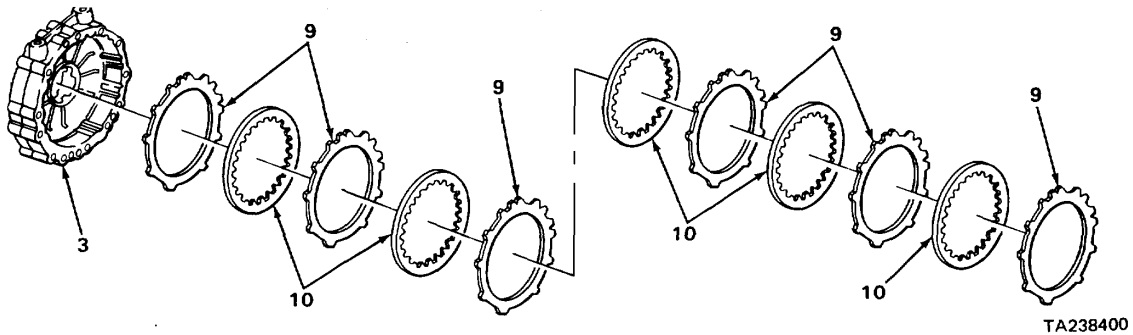
LOCATION	ITEM	ACTION	REMARKS

LOW RANGE CLUTCH REMOVAL – CONTINUED



Keep low clutch plates together. Mixing low clutch plates with any other clutch plates will cause transmission damage.

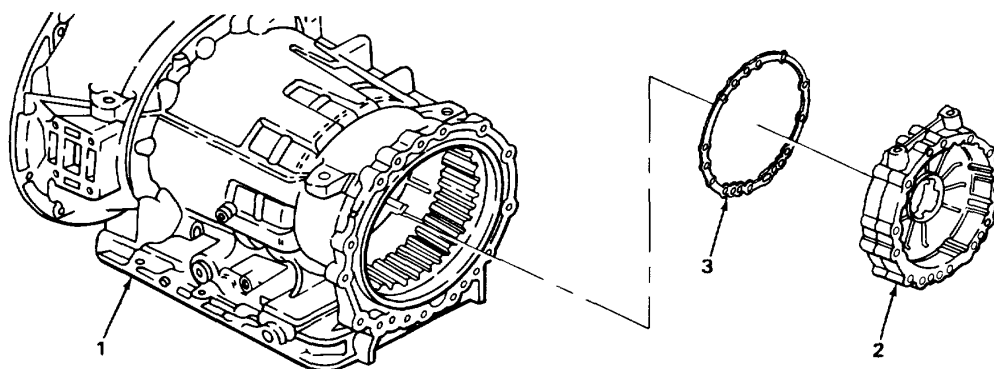
54. Adapter housing (3) Six external tanged clutch plates (9) and five internal splined clutch plates (10) Take out.



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TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ADAPTER HOUSING REMOVAL			
55.	Transmission housing (1)	Adapter housing (2) and gasket (3)	a. Lift off. It may be necessary to tap housing with plastic-face hammer to loosen. b. Get rid of gasket (3).



SNAPRING CLEARANCE CHECK

CAUTION

Make sure all transmission subassemblies have been thoroughly cleaned, in their respective maintenance procedures. Even small amounts of dust or dirt on parts will cause transmission damage.

NOTE

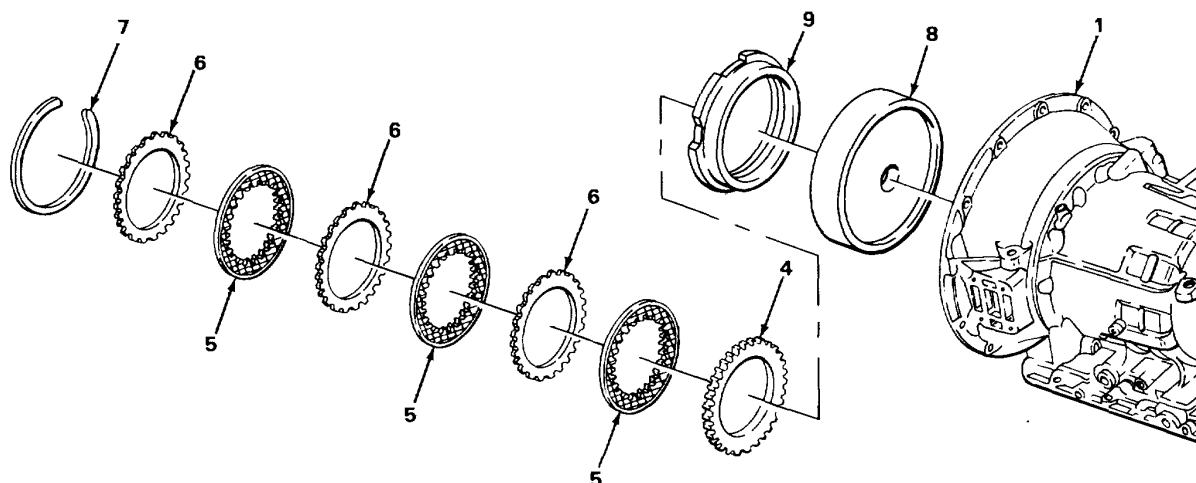
Soak all internal splined clutch plates in transmission oil for at least 2 minutes before assembling.

The second clutch backing plate is available in two thicknesses: 0.476 0.486 inch (12.09 12.34 mm) and 0.450 0.460-inch (11.43 11.68 mm). Choose one of these plates for a trial measurement, as described in the following steps. If measurement is not within tolerance, the other size backing plate may have to be used.

56.	Second clutch backing plate (4)	With the transmission positioned with converter end up, put into place.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
SNAPRING CLEARANCE CHECK - CONTINUED			
CAUTION Do not mix second clutch plates with any other clutch plates or transmission damage will occur.			
57.	Three internal splined second clutch plates (5) and three external tanged clutch plates (6)	Starting with an internal splined plate (5) and following with an external tanged clutch plate (6) put the six clutch plates in place.	
58.	Snapring (7) into groove.	Using 3/8-inch flat-tip screwdriver, put	
59.	Center support (8)	Third clutch piston (9)	Take out.
60.	Transmission housing (1)	Center support (8)	a. Attach a center support lifter. b. Attach portable floor crane to center support lifter. c. Aline the tapped hole in center support with anchor screw hole in transmission housing (1). d. Carefully lower into place. e. Take off lifting equipment.



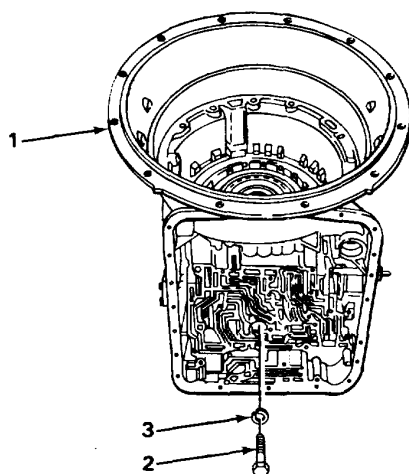
TA238402

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

SNAPRING CLEARANCE CHECK - CONTINUED

61.	Transmission housing (1)	Screw (2) and lockwasher (3)	Screw on finger tight.



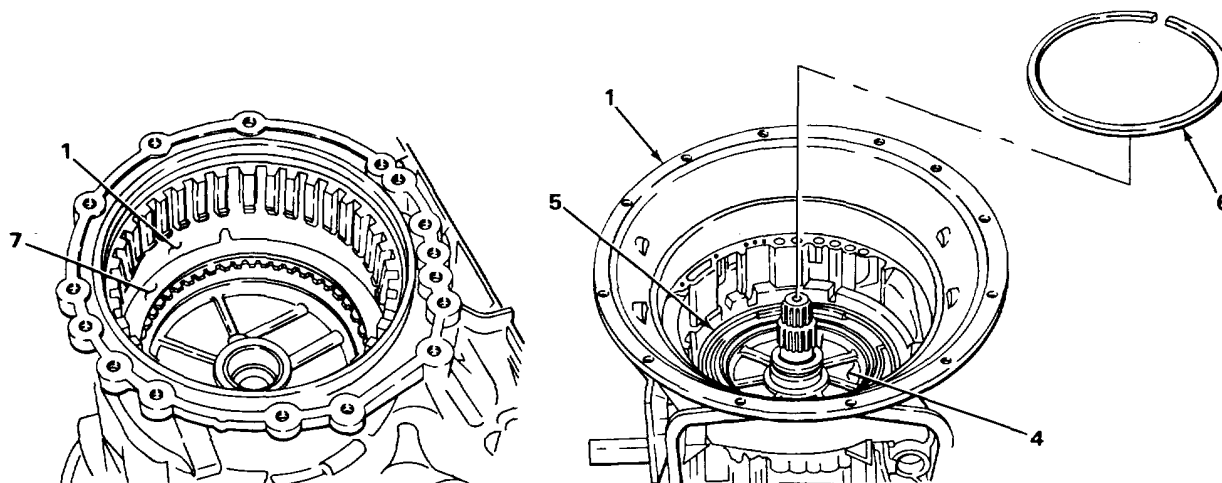
62.	Center support (4)	a. Screw in fixture center screw until snug. b. Torque fixture center screw to 5 ft-lb (6.8 N m). c. Using snapring gage, measure distance from top edge of support (4) to top of snapring groove (5). d. Choose correct size snapring.
63.	Internal snapring (6)	a. Using 3/8-inch flat-tip screwdriver, put in place. b. Remove snapring fixture.

SECOND RANGE CLUTCH CLEARANCE CHECK

64.	Second clutch backing plate (7)	a. Position transmission housing output shaft end up.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
SECOND RANGE CLUTCH CLEARANCE CHECK - CONTINUED			
64.	Continued	b. Insert the second clutch gage between plate (7) and the housing (1). The small end of the gage should fit between the backing plate and the housing, but the larger end of the gage should not fit. c. The clearance should be 0.045 - 0.109-inch (1.14 - 2.55 mm). d. If the clearance is not correct, measure the total thickness of the clutch pack and select new internal splined clutch plates, of different thickness, to give the right clearance. e. If necessary, repeat steps 35 and 36 to remove plate (7) and steps 86 and 89 thru 92 to replace with thicker or thinner backing plate.	

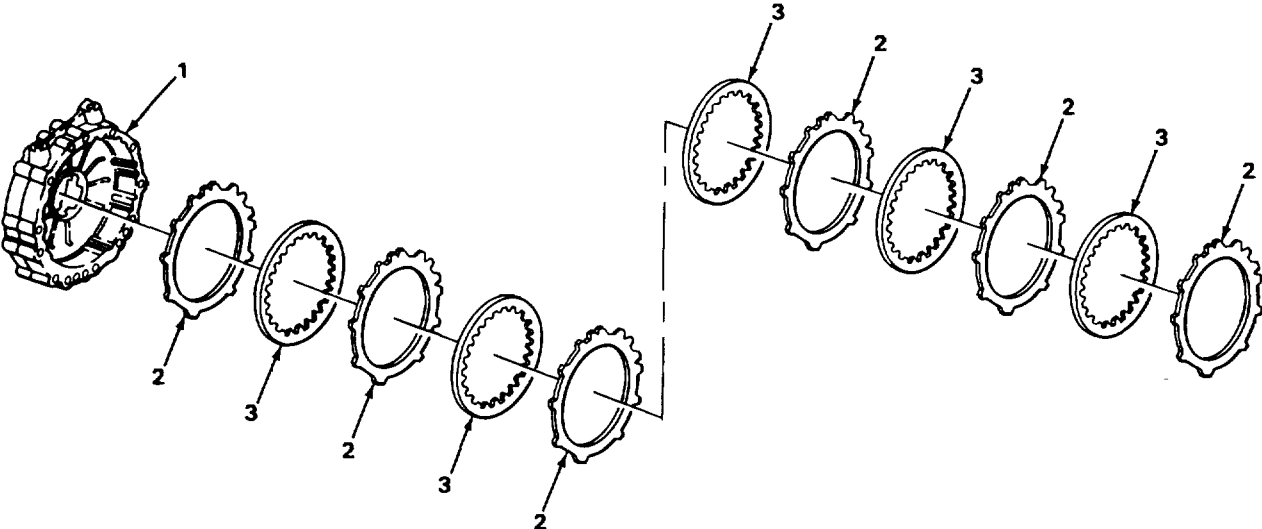


LOW RANGE CLUTCH CLEARANCE CHECK

CAUTION

Do not mix low clutch plates with any other clutch plates or transmission damage will occur.

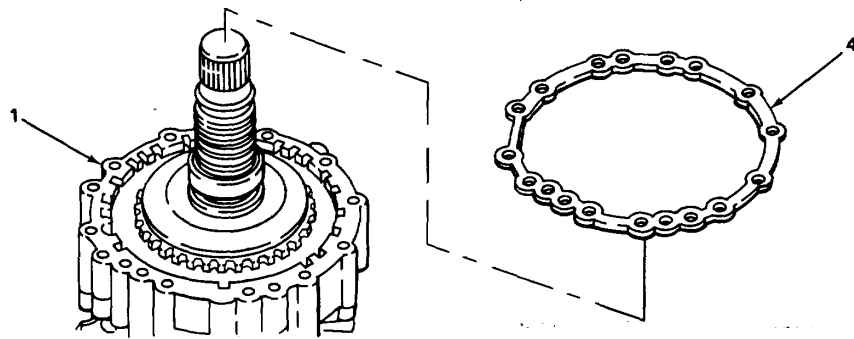
TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION REMARKS
LOW RANGE CLUTCH CLEARANCE CHECK - CONTINUED		
65.	Adapter housing (1) Six external tanged plates (2) and five internal splined plates (3)	a. Position the adapter housing (1), with first clutch piston assembled on a clean workbench with piston side facing down. b. Put an external plate (2) into place and follow with an internal plate (3) until all eleven plates are in position. c. While pressing down firmly on plates (2) and (3), use depth micrometer and measure distance from top of housing (1) to top of plates (2) and (3). d. Write down measurement.
		
66.	Adapter housing (1) New rear cover gasket (4)	Put on.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

LOW RANGE CLUTCH CLEARANCE CHECK - CONTINUED

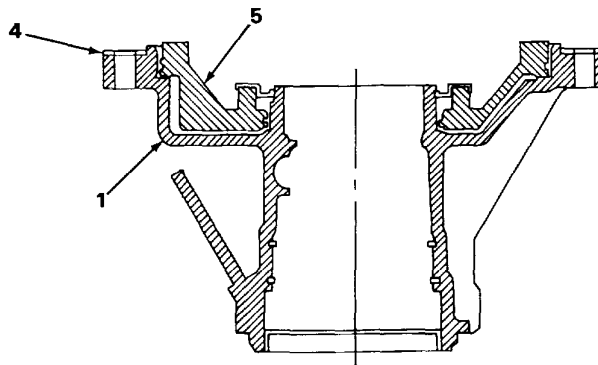


67.

Low clutch
piston (5)

- Using depth micrometer, measure distance from the top of piston (5) to the top of gasket (4).
- Write down measurement.
- Subtract this measurement from measurement taken in step 65 to get the low clutch running clearance.

The clearance should be 0.072 - 0.130-inch (1.82 - 3.30 mm), but this clearance should be brought as close to the lower dimension as possible by choosing thicker Internal spline clutch plates. This will reduce distance low clutch piston must move. The low clutch piston is available in three thicknesses.

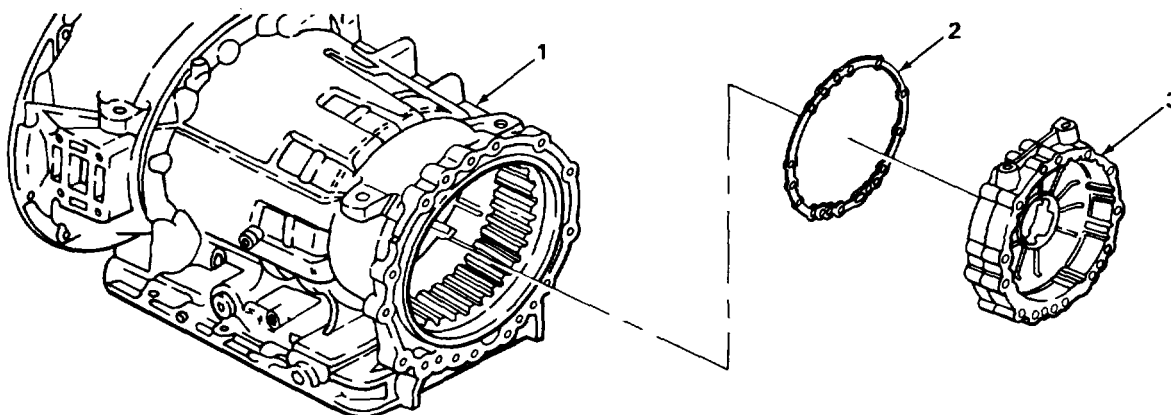


TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
LOW RANGE CLUTCH CLEARANCE CHECK - CONTINUED			
67.	Continued	d. If adapter housing or rear cover assembly is changed, it may be necessary to change the low clutch piston to a thicker or thinner part to meet the clearance. e. After clearance is met, remove the low clutch plates and tag them to identify for later assembly.	

ADAPTER HOUSING INSTALLATION

68.	Transmission housing (1)	New adapter housing gasket (2)	Put in place.
69.	Adapter housing with first clutch piston (3)		Put in place.



LOW RANGE CLUTCH INSTALLATION

70.	Adapter housing (3)	Low sun gear thrust washer (4)	Put in place.
71.	Low sun gear (5)		Put in place.

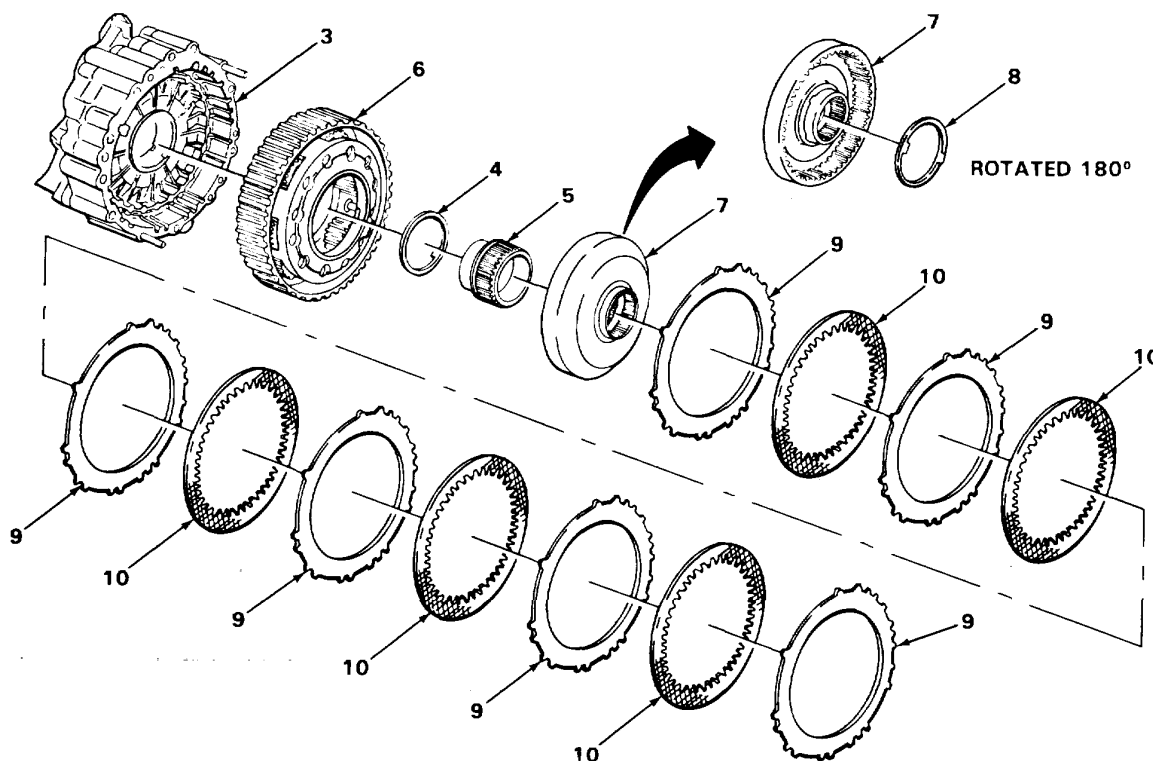
TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
LOW RANGE CLUTCH INSTALLATION - CONTINUED				
72.	Low sun gear (5)	Low clutch planetary assembly (6)	Put in place.	
73.	Low clutch ring gear (7)	Thrust washer (8)	a. Put on. b. Apply oil soluble grease to hold.	
74.	Low clutch planetary assembly (6)	Low clutch ring gear (7)	Put in place.	

CAUTION

The three sets of double tangs on each external tanged plate must be matched with double grooves in the adapter housing or damage could occur to the low clutch.

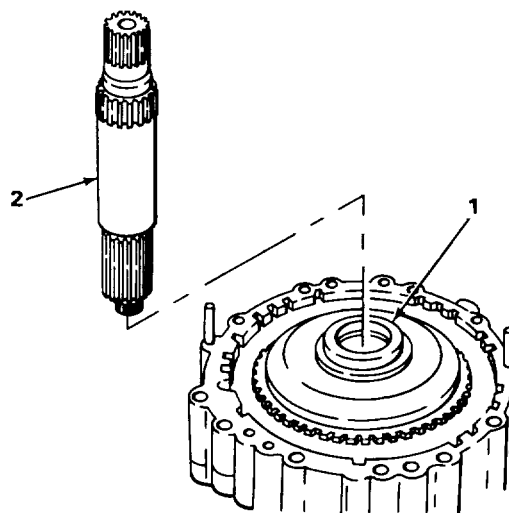
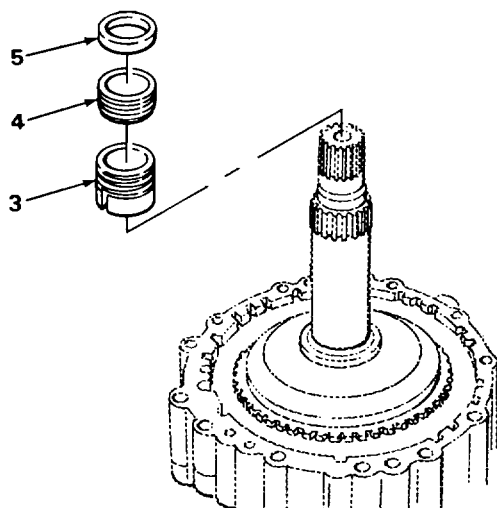
75.	Adapter housing (3)	Six external splined clutch (9) and five internal splined clutch plates (10)	Place external tanged clutch plate in position and follow with an internal splined clutch plate in position until all eleven plates are installed.



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TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
OUTPUT SHAFT INSTALLATION				
76.	Low clutch ring gear hub (1)	Output shaft (2)	Put in place.	
77.	Output shaft (2)	Governor drive gear (3)	Put on and engage spring pin.	
78.		Speedometer drive gear (4)	Put on.	
79.		Spacer (5)	Put on.	



REAR COVER ASSEMBLY INSTALLATION

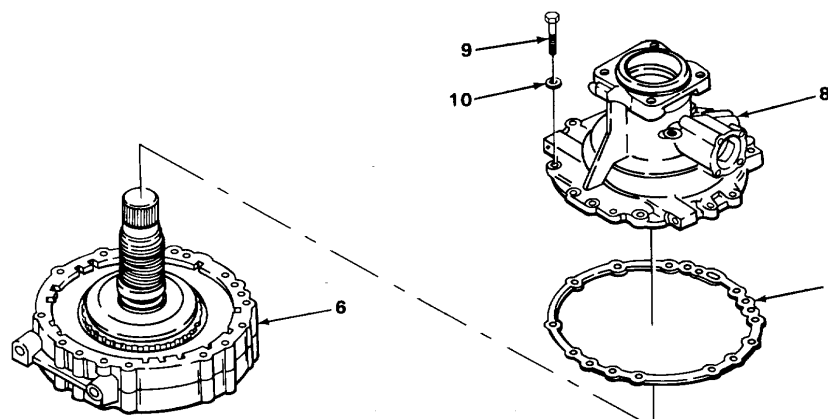
80.	Adapter housing (6)	New rear cover gasket (7)	Put in place.	
81.	Rear cover	Put in place. assembly (8)		
82.	Rear cover assembly (8)	Fourteen screws (9) and washers (10)	a. Screw in until snug, using 3/4-inch socket and ratchet handle with 1/2-inch drive. b. Using 3/4-inch socket and torque wrench with 3/8-inch drive, tighten two screws (9) 180 degrees apart to 33 ft-lb (44.7 N m) of torque.	

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

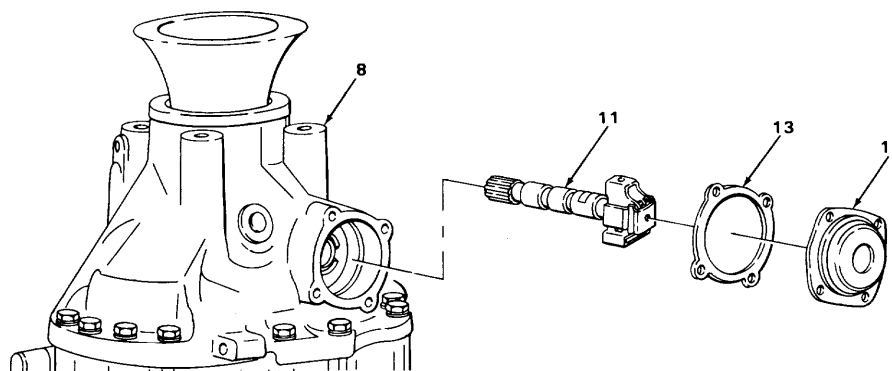
REAR COVER ASSEMBLY INSTALLATION - CONTINUED

82. Continued
- c. Tighten the remaining screws in pairs to 33 ft-lb (44.7 N m) of torque.
 d. Repeat the entire pattern above and tighten all screws to 67-80 ft-lb (90.9 - 108.5 N m) of torque.



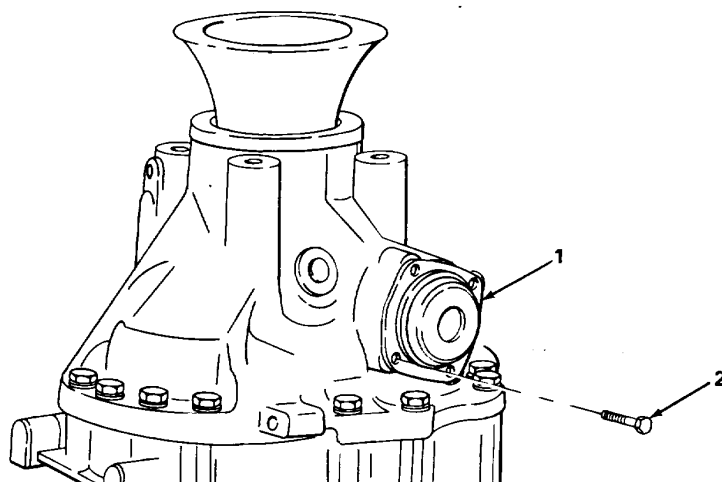
GOVERNOR ASSEMBLY INSTALLATION

83. Rear cover assembly (8) Governor assembly (11) Put into position. Governor is seated correctly when it makes about a quarter turn as it meshes with the drive gear.
- 84 Governor cover (12) and new gasket (13) Put into place.



TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
GOVERNOR ASSEMBLY INSTALLATION - CONTINUED			
85.	Governor cover (1)	Four screws (2)	a. Screw in until snug, using ½-inch socket and ratchet handle with ½-inch drive. b. Using ½-inch socket and torque wrench with ½-inch drive, tighten to 15-20 ft-lb (20.3 - 27.1 Nm) of torque.

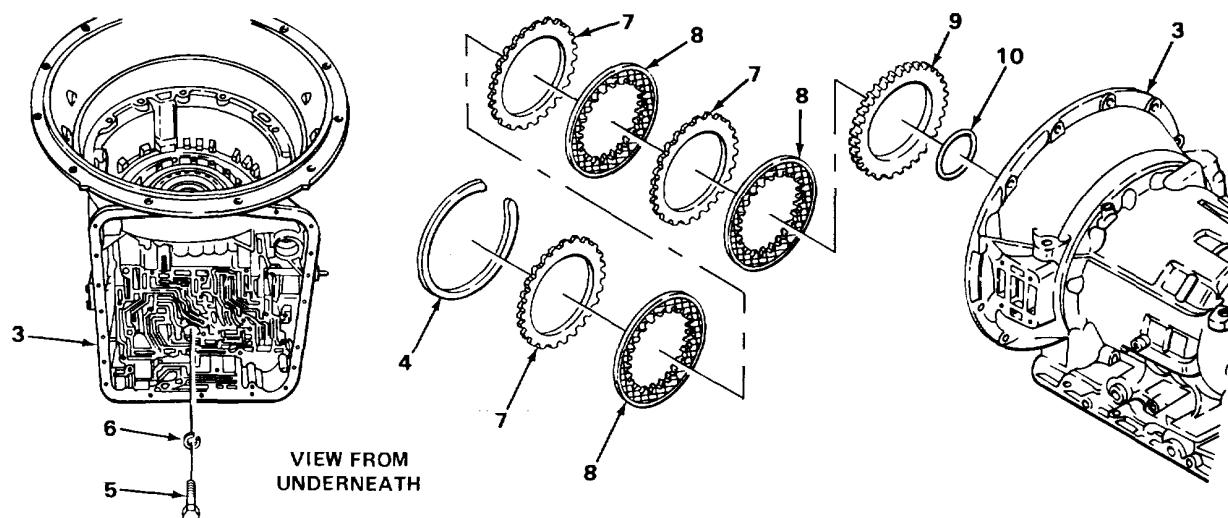


FIRST RANGE CLUTCH INSTALLATION

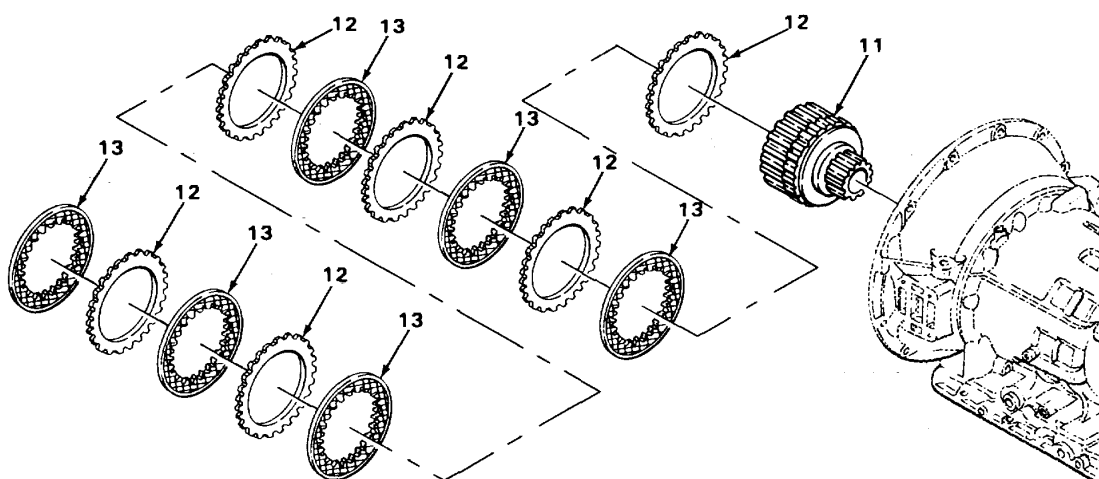
86.	Transmission housing (3)	Internal clutch plate snapping (4)	Using 3/8-inch flat-tip screwdriver and 12-inch pry bar, take out.
87.	Center support screw (5) and lockwasher (6)		a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwasher (6).
88.	Center support		Remove (page 2-650).
89.	Three external tanged clutch plates (7), three internal splined clutch plates (8), and backing plate (9)		Take out.
90.	Thrust washer (10)		Place into position.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
FIRST RANGE CLUTCH INSTALLATION - CONTINUED			

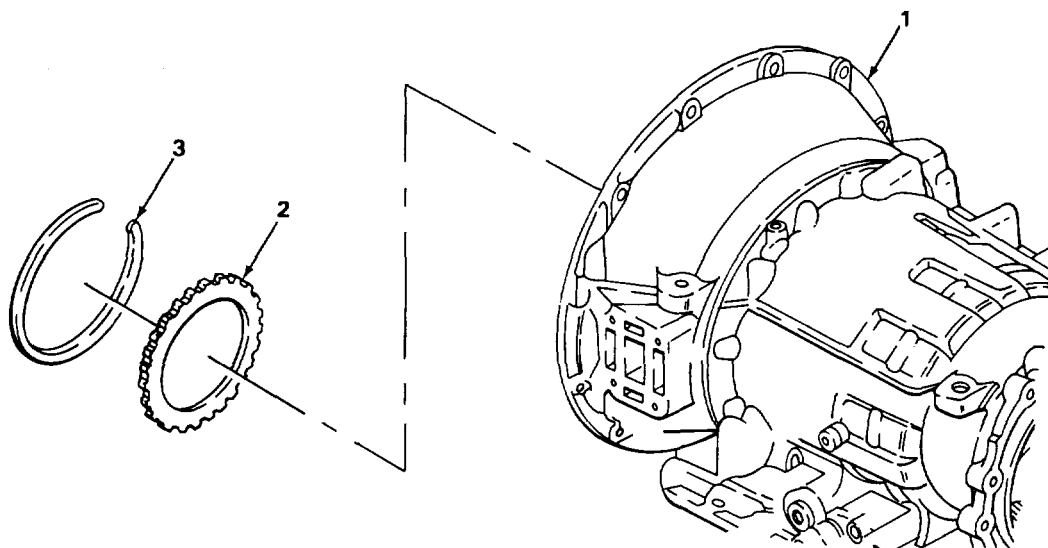


91.	First clutch hub and ring gear (11)	Put in.
92.	Six external tanged clutch plates (12) and six internal splined clutch plates (13)	Put an external tanged clutch plate (12) in place and follow with an internal splined clutch plate (13) until all twelve plates are in position.



TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
FIRST RANGE CLUTCH INSTALLATION - CONTINUED			
93.	Transmission housing (1)	First clutch backing plate (2)	Put in, flat side first.
94.	Internal snapping (3)	a. Using 3/8-inch flat-tip screwdriver, put in. b. Using first clutch gage, check clearance between snapping (3) and backing plate (2). Clearance should be between 0.063-0.136-Inch (1.60-3.45 mm). If clearance is correct, small end of gage will fit but large end will not. c. If clearance is not correct, measure the total clutch pack thickness. Replace clutch plates with thicker or thinner plates to get correct clearance. If necessary, replace backing plate with a thicker or thinner plate.	



GEAR UNIT INSTALLATION

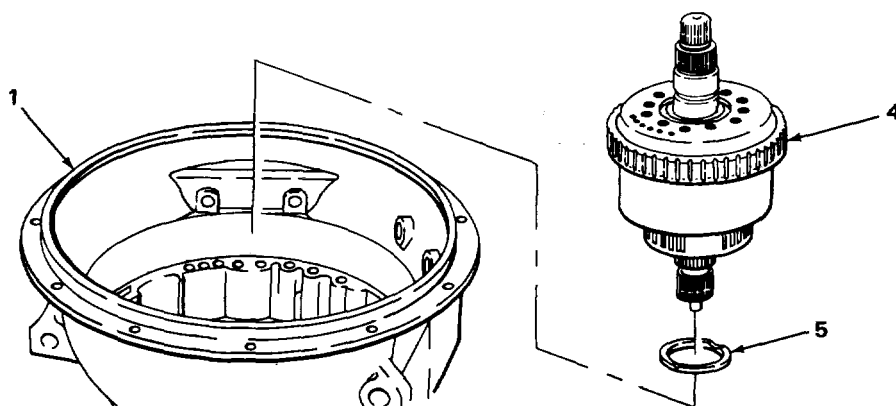
95.	Gear unit (4)	Sun gear thrust washer (5)	a. Grease with oil soluble grease. b. Put on.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

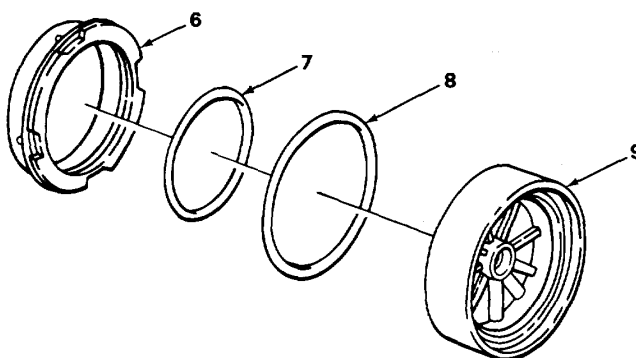
GEAR UNIT INSTALLATION - CONTINUED

96.	Transmission housing (1)	Gear unit (4)	a. Attach gear unit lifter. b. Attach portable floor crane to gear unit lifter and using crane, lower into place. c. Take off lifting equipment.



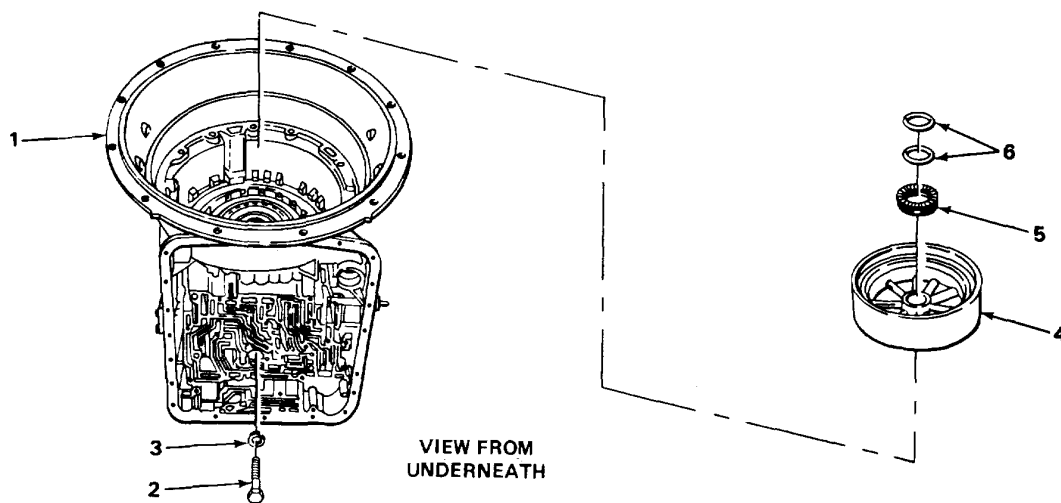
SECOND RANGE CLUTCH INSTALLATION

97.	Second clutch plates and snapping	Repeat steps 92 thru 94.	
98.	Third clutch piston and attached parts (6)	Inner clutch seal (7) and outer clutch seal (8)	a. Grease with oil soluble grease. b. Put on.
99.	Center support (9)	Third clutch piston and attached parts (6)	a. Put in with square lug on back of piston aligned with square recess in center support. b. Push to bottom of center support (9).



TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
CENTER SUPPORT INSTALLATION				
100.	Transmission housing (1)	Center support	a. Repeat steps 60 and 61. b. Place snapping gap at 12 o'clock position.	
101.	Internal snapping		a. Repeat step 63. b. Place snapping gap at 12 o'clock position.	
102.		New center support screw (2) and new lockwasher (3)	a. Screw in until snug, using 9/16-inch socket and ratchet handle with 1/2-inch drive. b. Using 9/16-inch socket and torque wrench with 1/2-inch drive, tighten to 39 - 46 ft-lb (52.9 - 62.4 N m) of torque.	
103.	Center support (4)	Needle roller bearing and race (5)	Put on, bearing side up.	
104.		Two clutch support step joint rings (6)	a. Grease with oil-soluble grease. b. Put on.	

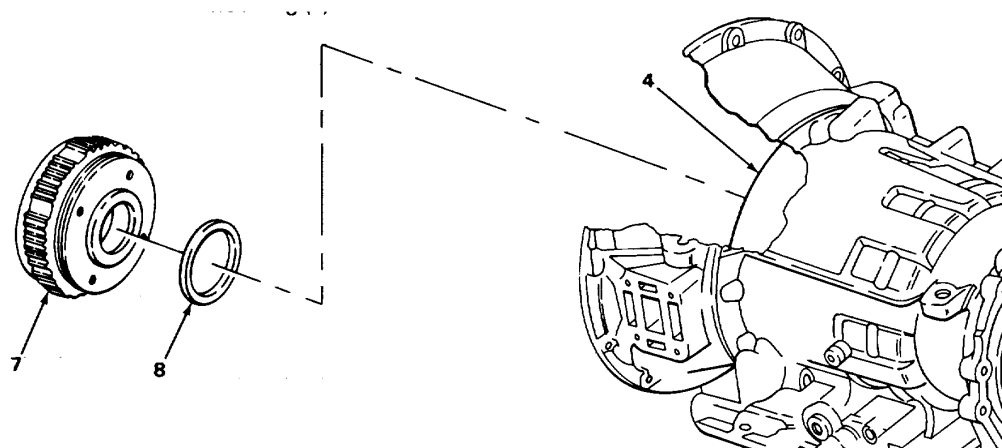


FOURTH RANGE CLUTCH INSTALLATION

105.	Fourth clutch housing (7)	Bearing race (8)	a. Put on. b. Grease with oil soluble grease.	

TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
FOURTH RANGE CLUTCH INSTALLATION - CONTINUED				
106.	Center support (4)	Fourth clutch housing (7)	Put on.	

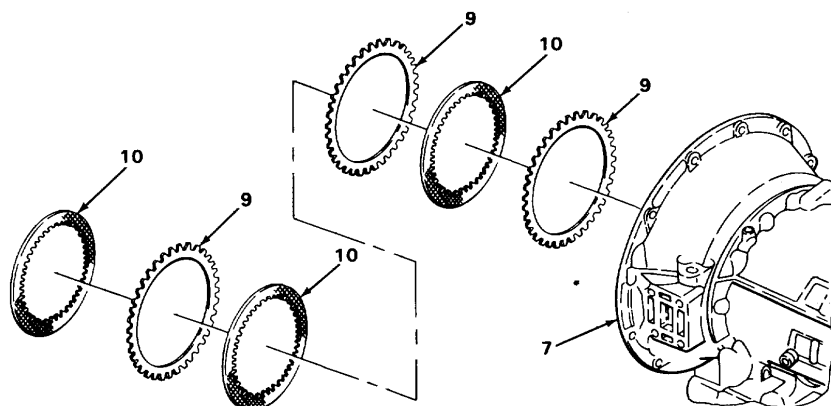


THIRD RANGE CLUTCH INSTALLATION

CAUTION

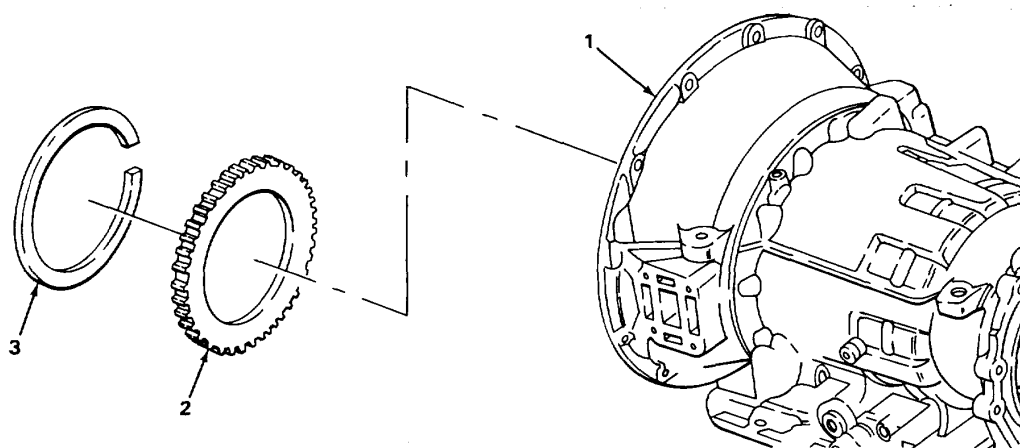
Do not mix third clutch plates with any other clutch plates or transmission damage will result.

107.	Fourth clutch housing (7)	Three external tanged clutch plates (9) and three internal splined clutch plates (10)	Put an external tanged clutch plate in place and follow with an internal splined plate until all six plates are in position.



TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
THIRD RANGE CLUTCH INSTALLATION - CONTINUED			
108.	Transmission housing (1)	Third clutch backing plate (2)	Put in.
109.	Internal snapping (3)	a. Using 3/8-inch flat-tip screwdriver, put in. b. Using a snapping gage, check clearance between snapping and backing plate. This clearance should be 0.045 - 0.109 inch (1.14 - 2.77 mm). If clearance is correct, small end of gage will fit, but large end will not. c. If clearance is not correct, measure total clutch pack thickness. d. Replace clutch plates with thicker or thinner plates to get correct clearance. e. If necessary, replace backing plate (2) with a thicker or thinner plate.	



FORWARD RANGE CLUTCH INSTALLATION

NOTE

If removed, make sure bearing race has been installed on top hub of fourth clutch housing.

110.	Fourth clutch supply port (4)	Fourth clutch plates (5)	a. Align the internal-splined plates of fourth clutch.

TRANSMISSION SUBASSEMBLIES - CONTINUED

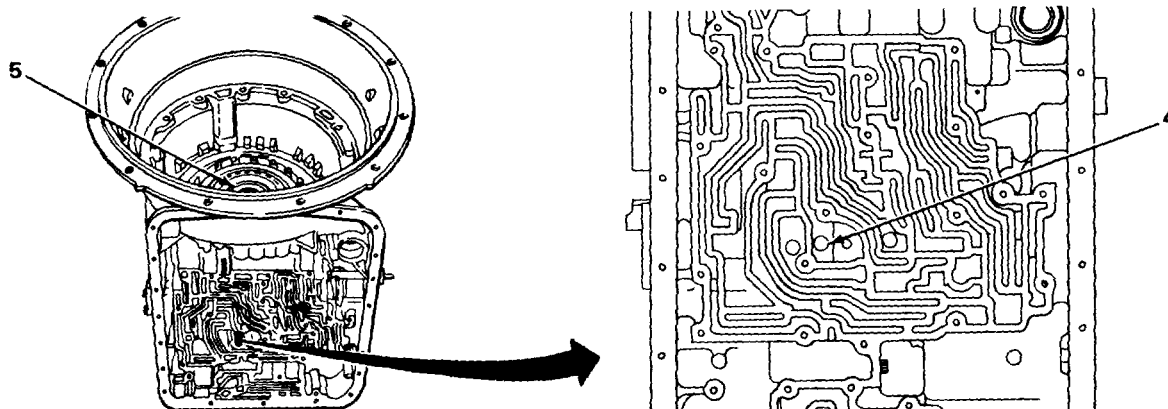
LOCATION	ITEM	ACTION	REMARKS

FORWARD RANGE CLUTCH INSTALLATION - CONTINUED

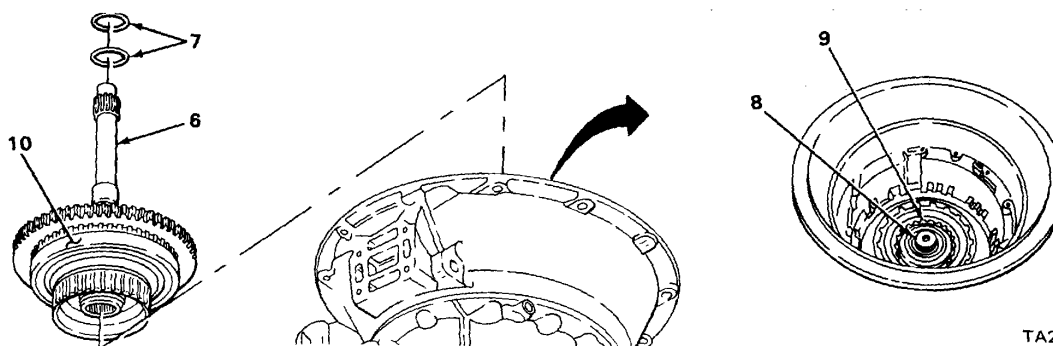
WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

110. Continued
- b. Using air compressor, direct air, 45 psi maximum (310 kPa), into the fourth clutch supply port.
This will hold the plates in place while the forward clutch is being installed.



111. Forward clutch housing shaft (6) Two new packings (7)
112. Gear unit shaft (8) and fourth clutch internal splined plates (9) Forward clutch assembly (10)
- a. Put on.
b. Apply oil soluble grease to hold in place.
- a. Lower into place.
b. Aline internal splines with splines on shaft (8), and aline fourth hub splines with plates (9).



TA2:

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

FORWARD RANGE CLUTCH INSTALLATION - CONTINUED

112. Continued

b. Continued

When correctly placed, the front of forward clutch housing will be about 1/2 inch (12 mm) below forward edge of power takeoff opening in housing.

WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

c. Using air compressor, apply short bursts of air, 45 psi maximum (310 kPa), to fourth clutch supply port.

If forward clutch does not move, it is seated correctly.

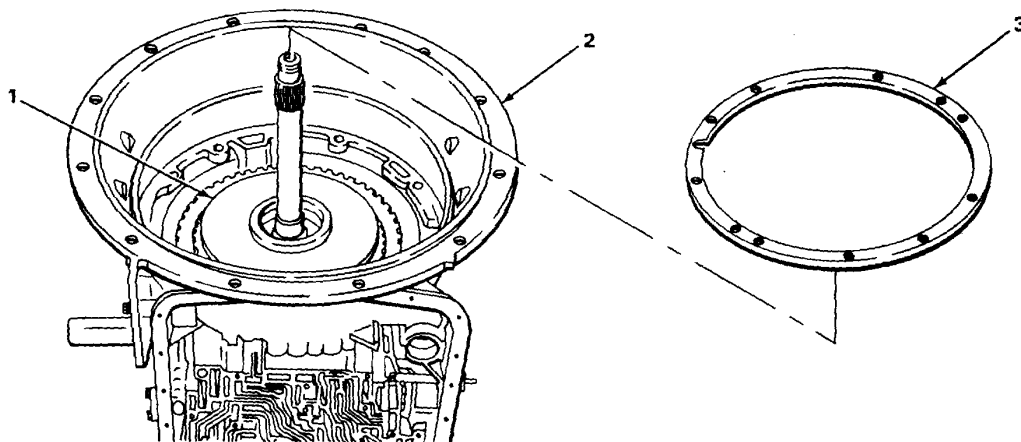
d. If clutch (1) is not seated, do steps a and b again.

OIL PUMP AND FRONT SUPPORT INSTALLATION

113. Transmission housing (2)

New front support gasket (3)

Put into place.



114. Oil pump and front support assembly (4)

New gasket (5)

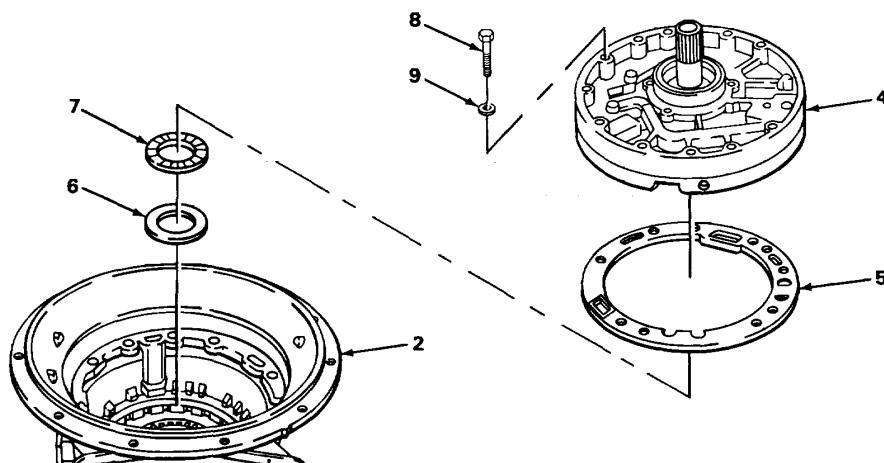
a. Put on.
b. Grease with oil soluble grease.

115. Race (6) and bearing (7)

a. Put on.
b. Apply oil soluble grease to keep in place.

TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
OIL PUMP AND FRONT SUPPORT INSTALLATION - CONTINUED				
116.	Transmission housing (2)	Oil pump and front support assembly (4)	a. Screw in two 3/8-16 x 6-inch guide screws into opposite sides of transmission housing. b. Attach front support lifter to front support assembly ground sleeve. c. Attach portable floor crane to front support lifter. d. Aline holes with guide studs and holes in gasket and transmission housing. e. Using hoist, lower into place. f. Remove lifting equipment.	
117.	Oil pump and front support assembly (4)	12 screws (8) and new washers (9)	a. Screw in. b. Screw in, until snug using 9/16-inch socket, 6-inch extension, and ratchet handle with 1/2-inch drive. c. Replace two guide studs with screws and washers, and screw in until snug. d. Using 9/16-inch socket, 6-inch extension, and torque wrench with 1/2-inch drive, tighten two screws 180 degrees apart to 15 ft-lb (20.3 N m) of torque. e. Repeat with two screws 90 degrees around circle. f. Tighten remaining screws in pairs 180 degrees apart. g. Repeat entire operation and torque all screws to 24 - 32 ft-lb (32.5 - 43.4 N m).	

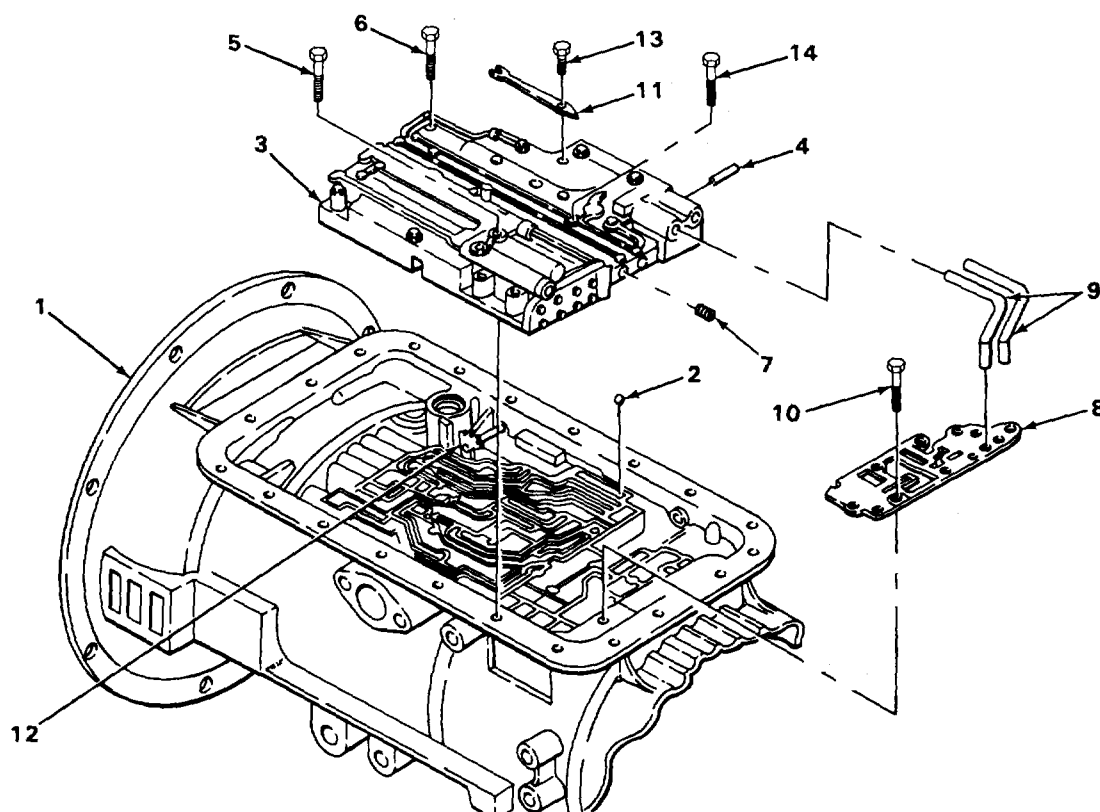


TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
CONTROL VALVE ASSEMBLY INSTALLATION				
118.	Transmission housing (1)	Governor checkball (2)		Put in place.
119		Control valve assembly (3)		Position so actuator pin (4) enters housing bore and groove in range selector valve is aligned with pin on lever.
120.	Control valve assembly (3)	17 screws (5) and one longer screw (6)		a. Put into position. b. Tighten finger tight.
121.	Governor oil screen (7)	Put in tube bore.		
122.	Transfer plate (8)	Two governor oil tubes (9)		Push into bores.
123.	Control valve assembly (3)	Two governor oil tubes (9)		Push into bores.
124.	Transmission housing (1)	Transfer plate (8)		Place into position.
125.	Transfer plate (8)	Two screws (10)		a. Place in position. b. Screw in finger tight. c. Place seven 1/4 - 20 x 2 1/2-inch guide screws in position, and screw in finger tight. d. Using 7/16-inch socket and torque handle with 1/2-inch drive, tighten to 9 - 11 ft-lb (12.2 - 14.9 N m) of torque. e. Unscrew seven guide screws and take out.
126.	Control valve assembly (3)	Detent spring and roller assembly (11)		Place into position to engage notch in detent lever (12).

TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
CONTROL VALVE ASSEMBLY INSTALLATION - CONTINUED				
127.	Detent spring and roller assembly (11)	Screw (13)	a. Place into position. b. Using 7/16-inch socket and ratchet handle with 11/2-inch drive, screw in until snug. c. Using 7/16-inch socket and torque handle with 1/2-inch drive, tighten to 8 - 12 ft-lb (10.8 - 16.3 N m) of torque.	
128.	Control valve assembly (3)	18 screws (14)	Starting from the center and working outward, using 7/16-inch socket and torque wrench with 1/2-inch drive, tighten to 8 - 12 ft-lb (10.8 - 16.3 N m) of torque.	



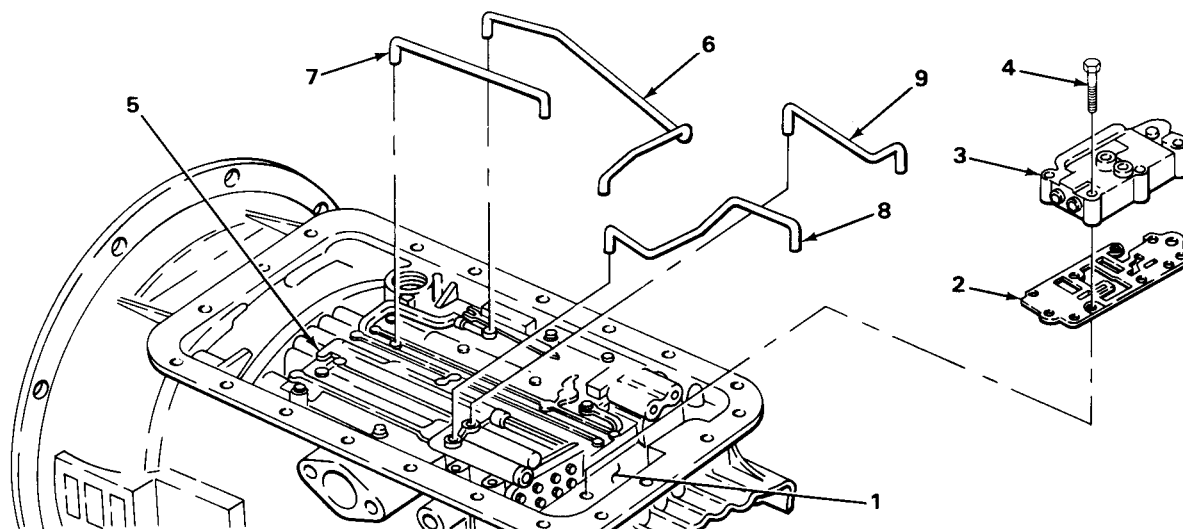
TA238421

TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
LOW SHIFT VALVE ASSEMBLY INSTALLATION			
129.	Oil transfer plate (1)	Separator plate (2) and low shift valve assembly (3)	Place into position.
130.	Low shift valve assembly (3)	Seven screws (4)	a. Place into position. b. Screw in until snug, using 7/16-inch socket and ratchet handle with 1/2-inch drive. c. Using 7/16-inch socket and torque wrench with 1/2-inch drive, tighten to 9 -11 ft-lb (12.2 - 14.9 N m) of torque.

OIL TUBES INSTALLATION

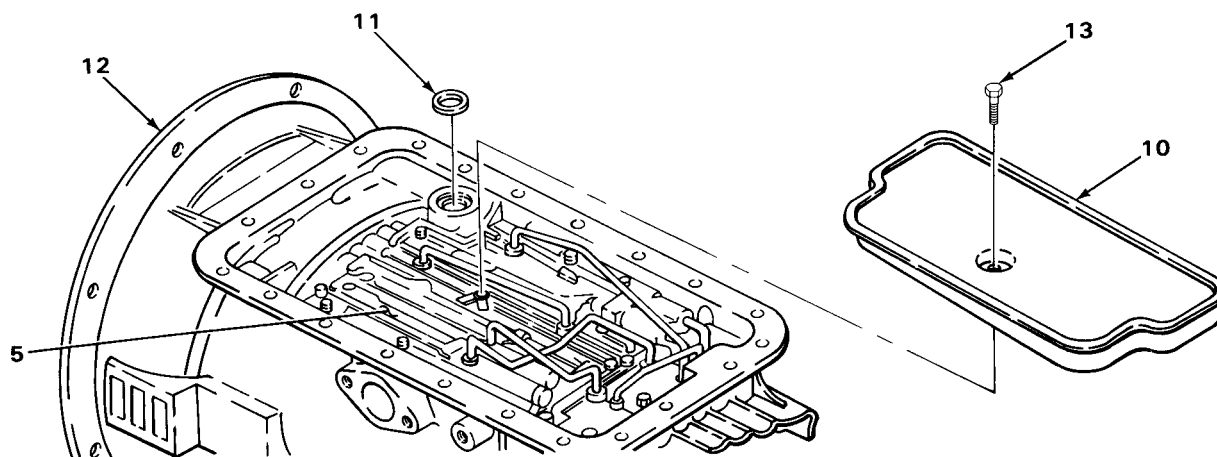
131.	Control valve assembly (5) and low shift valve assembly (3)	Drive tube (6), main knockdown tube (7), trimmer tube (8), and low clutch feed tube (9)	a. Put in position in order shown. b. Using plastic-face hammer, tap in until seated. If tubes are not fully seated, they will be in way of oil filter.



TA238422

TRANSMISSION SUBASSEMBLIES - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
OIL FILTER INSTALLATION			
132.	New oil filter (10)	New packing (11)	a. Grease packing and tube bore in housing with oil soluble grease. b. Put on.
133.	Transmission housing (12) and control valve assembly (5)	Oil filter (10)	Place into position.
134.	Oil filter(10)	Screw (13)	a. Place into position. b. Using 1/2-inch deep well socket and ratchet handle with 1/2-inch drive, screw in until snug. c. Using 1/2-inch deep well socket and torque wrench with 1/2-inch drive, tighten to 10 - 15 ft-lb 13.6 - 20.3 N m) of torque.

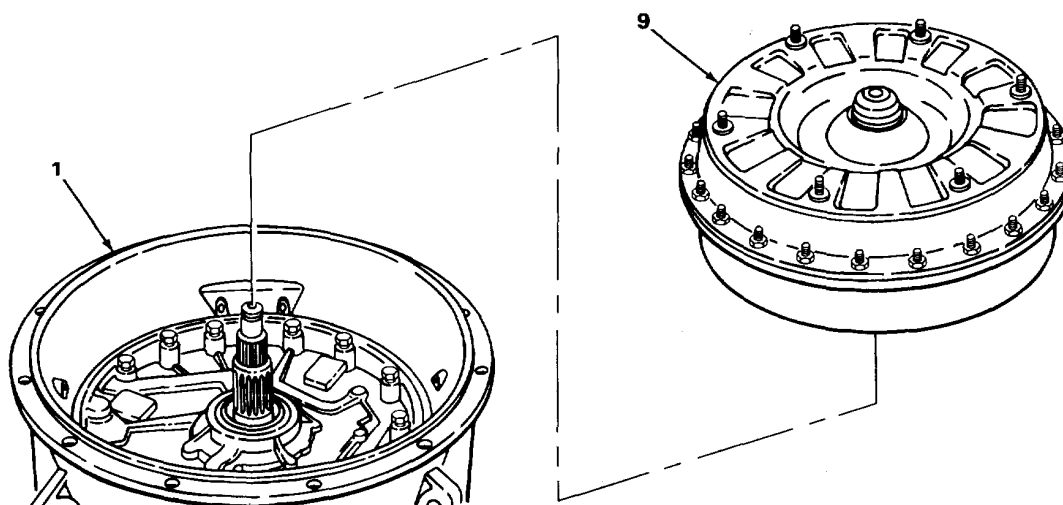


TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION		ITEM	ACTION REMARKS
OIL PAN INSTALLATION			
135.	Transmission housing (1)	New gasket (2) and oil pan (3)	a. Place into position. b. Screw in two 5/16-18 x 3-inch guide screws into top corner holes of transmission housing flange, for gasket and oil pan alignment.
136.	Oil pan (3)	17 screws (4)	a. Screw in until snug using 1/2-inch socket, ratchet handle with 1/2-inch drive, and 6-inch extension. b. Take out guide screws and replace with two screws (4). c. Using 1/2-inch socket and torque wrench with 1/2-inch drive, tighten to 10 - 13 ft-lb (13.6 - 17.6 N m) of torque. d. After gasket sets, tighten screws (4) to 15 - 18 ft-lb (20.3 - 24.4 N m) of torque.
137.		Two spacers (5) and bracket (6)	Put into position.
138.		Two screws (7) and lockwashers (8)	a. Screw in until snug using 1/2-inch socket and ratchet handle with 1/2-inch drive. b. Using 1/2-inch socket and torque wrench with 1/2-inch drive, tighten 15 - 18 ft-lb (20.3 - 24.4 N m) of torque.

TRANSMISSION SUBASSEMBLIES - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
TORQUE CONVERTER INSTALLATION			
139.	Transmission housing (1)	Torque converter (9)	a. Attach converter assembly lifter. b. Attach portable floor to crane to converter lifter and carefully lower converter onto transmission. Splines inside converter must mesh with splines on turbine shaft and ground sleeve. Also, flat areas on converter hub must align with flat areas in pump drive gear. When converter is correctly seated, distance from base of converter drive studs to top of transmission housing-mounting flange will be approximately 9 1/16-inch (14.29-mm). c. If measurement is not reached, lift, turn, and reseat converter until correct engagement is made. d. Take off lifting equipment. e. Put on restraining strap.



NOTE
FOLLOW-ON MAINTENANCE: Install transmission (page 2-633).

TASK ENDS HERE

TORQUE CONVERTER

This task covers:

a. End Play Check (page 2-692)	c. Inspection/Replacement (page 2-697)
b. Disassembly (page 2-693)	d. Assembly (page 2-698)
c. Cleaning (page 2-696)	
-

INITIAL SETUP

Tools

Caliper, micrometer, ID,
 0.5 to 2-inch range
 Chisel, cold hand, 1/2-inch
 Driftpin, brass, 3/16-inch
 Driftpin, brass, 112-inch
 Extension, 1/2-inch drive, 3-inch
 Gage, converter end play
 Hammer, ball-peen, machinist's
 Hammer, rubber
 Handle, ratchet, 1/2-inch drive
 Indicator, dial
 Installer, cover bushing
 Installer, stator, thrust bearing
 Pliers, snapping
 Press, arbor, hand-operated
 Retrieving tool, magnetic
 Ring, stator roller retainer
 Screwdriver, flat-tip, 1/8-inch
 Socket, 1/2-inch drive, 1/2-inch
 Socket, 112-inch drive, 7/16-inch
 Stone, soft
 Wrench, torque, 1/2-inch drive,
 0 - 150 ft-lb capacity

Materials/Parts

Gasket, hub
 Grease, oil soluble (item 21, appendix B)
 Lockplates (four required)
 Packing, performed, clutch backing plate
 Packing, performed, clutch piston
 Packing, performed, cover assembly
 Packing, performed, impeller assembly
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

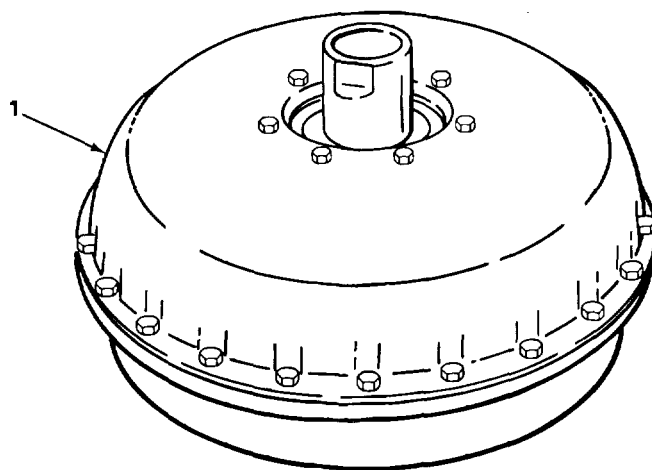
Torque converter removed
 (page 2-650).

LOCATION	ITEM	ACTION	REMARKS
END PLAY CHECK			
1.	Torque converter (1)	Using converter end-play gage and dial indicator, check end play. If end play is more than 0.025-inch (0.64 mm), use same spacer during assembly. If major part is replaced during inspection, use a new spacer.	

TORQUE CONVERTER - CONTINUED

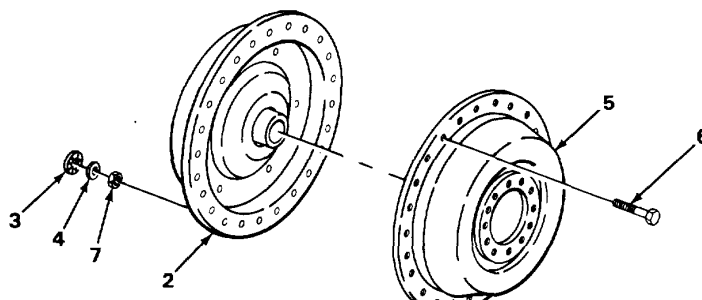
LOCATION	ITEM	ACTION	REMARKS

END PLAY CHECK - CONTINUED



DISASSEMBLY

2.	Cover assembly (2)	Six retainers (3)	Using 118-inch flat-tip screwdriver, turn and take off.
3	Six spacers (4)		Using ball-peen hammer and 1/2-inch cold hand chisel, take off.
4.	Cover assembly (2) and impeller assembly (5)	24 screws (6) and nuts (7) and take off.	a. Using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew b. Using ball-peen hammer and 3/16-inch brass drift pin, tap out screws.
5.	Impeller assembly (5)	Cover assembly (2)	Lift off.



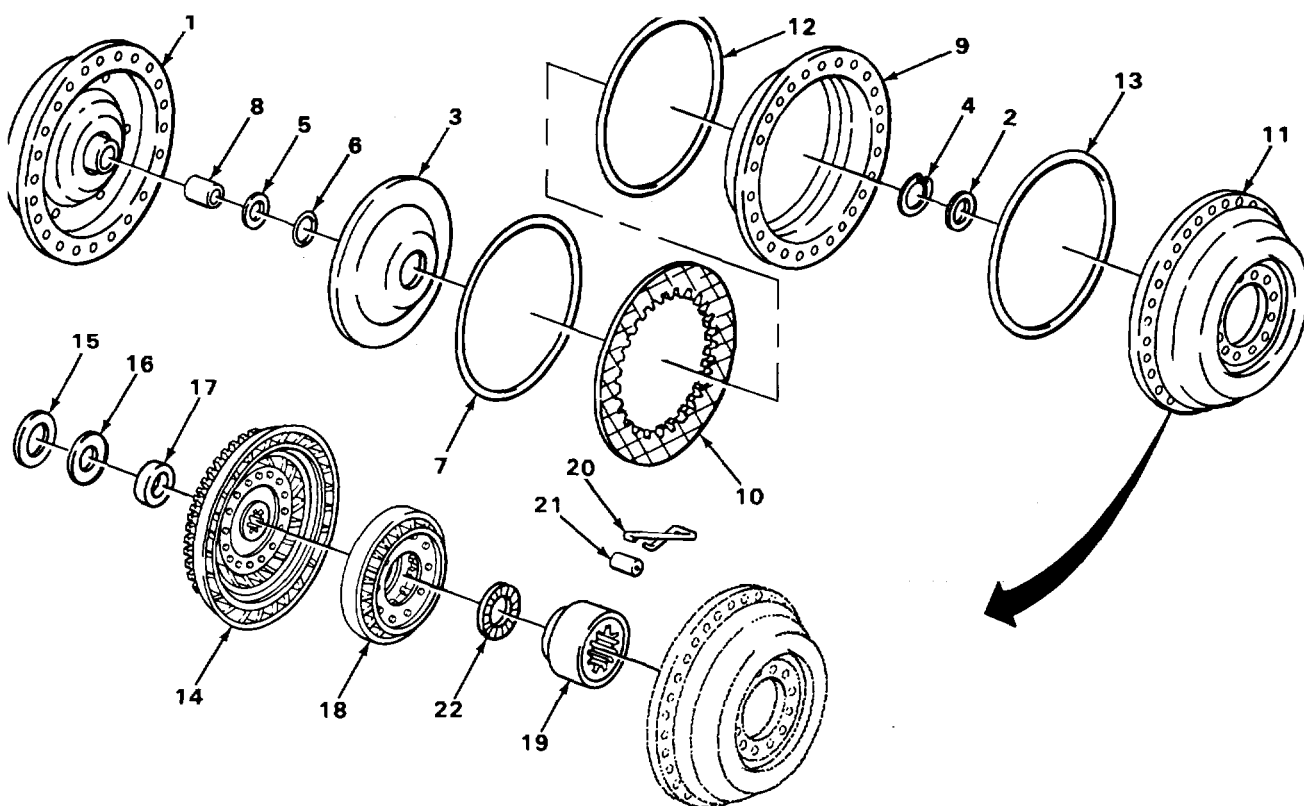
TA238426

TORQUE CONVERTER - CONTINUED

LOCATION		ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED				
6.	Cover assembly (1)	Bearing race (2)	a. Place cover (1) with clutch piston (3) facing up. b. Take off.	
7		Snpring (4) take off.	Using arbor press and snpring pliers,	
8		Clutch piston (3)	a. Turn cover (1) over on wood surface so piston (3) faces down. b. Bump cover (1) sharply on wood surface to remove piston (3).	
9		Retainer (5) and packing (6)	a. Take out. b. Get rid of packing (6).	
10.	Clutch piston (3)	Packing (7)	a. Take off. b. Get rid of.	
NOTE Do not remove bushing unless it is damaged.				
11.	Cover assembly (1)	Bushing (8)	a. Using 1/2-inch brass driftpin and ball-peen hammer, drive out. b. Get rid of.	
12.	Clutch backing plate (9)	Lockup clutch plate (10)	Lift off.	
13.	Impeller assembly (11)	Clutch backing plate (9)	Lift off.	
14.	Clutch backing plate (9)	Packing (12) b. Get rid of.	a. Take off.	
15.	Impeller assembly (11)	Packing (13) b. Get rid of.	a. Take off.	
16.	Turbine (14)	Bearing assembly (15), race (16), and spacer (17)	Using magnetic retrieving tool, take out.	
17.	Impeller assembly (11)	Turbine (14)	Lift out.	

TORQUE CONVERTER - CONTINUED

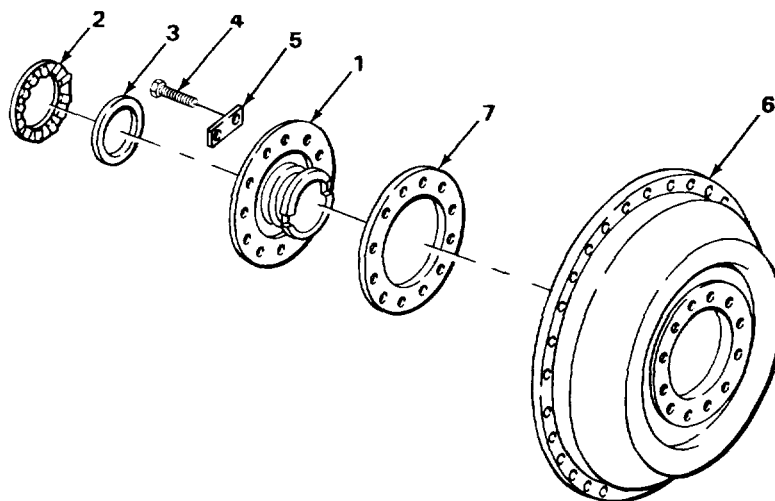
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
18.	Stator (18) with parts	Lift out.	
19.	Stator (18)	Race (19), springs (20), and rollers (21)	a. Put stator on bench with race (19) up. b. Turn race (19) clockwise and lift out. c. Take out springs (20) and rollers (21).
NOTE Do not take out bearing unless inspection shows that it must be replaced.			
20.	Bearing (22)	Using magnetic retrieving tool, take out. Be careful not to damage stator bore.	



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TORQUE CONVERTER - CONTINUED

	LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED				
21.	Hub (1)	Bearing (2) and race (3)	Take off.	
22.		Eight screws (4) and four lockplates (5)		a. Using ball-peen hammer and 1/2-inch cold hand chisel, flatten tabs. b. Using 7/16-inch socket, 3-inch extension, and ratchet handle with 1/2-inch drive, unscrew and take out. c. Get rid of lockplates (5).
23.	Impeller assembly (6)	Hub (1) and gasket (7)		a. Using rubber hammer, tap loose and take off. b. Get rid of gasket (7).



CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

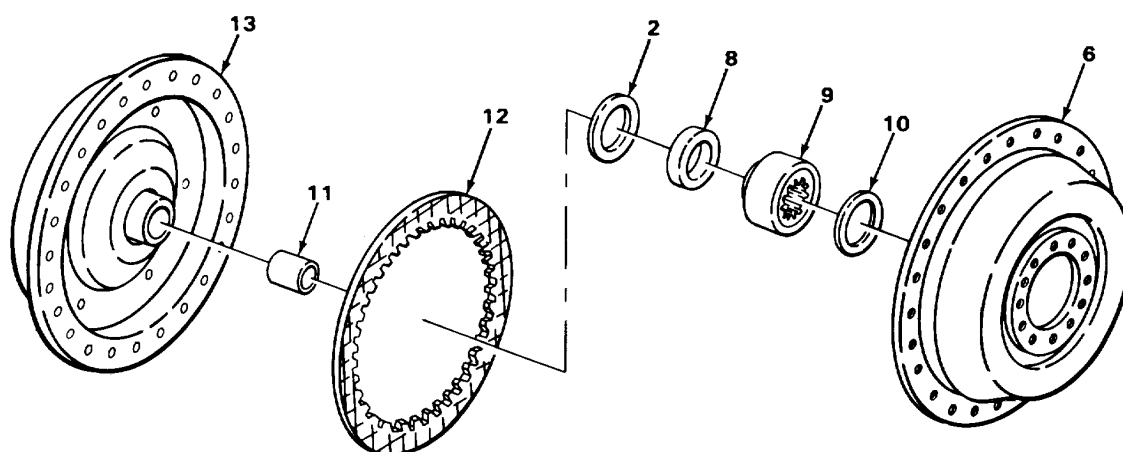
WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

24.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

TORQUE CONVERTER - CONTINUED

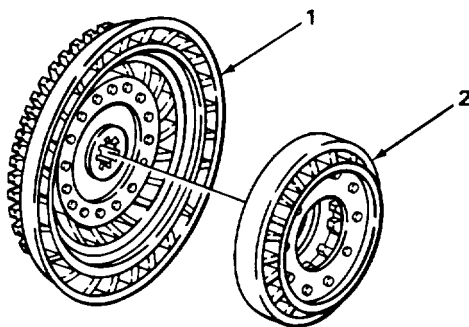
LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
25.	All bearings	Clean (TM 9-214).	
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.			
26.	All bearings	Inspect (TM 9-214).	
27.	Four bearing races (2), (8), (9), and (10)	Look for distortion, score marks, burrs, and excessive wear.	
28.	Bushing (11)	Look for excessive wear, scoring, burrs, out-of-round, and discoloration.	
29.	Lockup clutch plate (12)	- a Look for burrs and worn pitted face. Remove burrs with a soft stone. - b Look for cracks and distortion. - c Look for damaged spline teeth.	
30.	Impeller assembly (6) and cover assembly (13)	- a Look for bent, cracked, and loose vanes. - b Look for stripped threads. - c Look for mating surfaces.	



TA238429

TORQUE CONVERTER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT- CONTINUED			
31.	Turbine (1)	a. Look for bent, cracked, and loose vanes. b. Look for damaged internal spline teeth. c. Look for worn or damaged bearing surfaces.	
32.	Stator (2)	a. Look for cracked vanes. b. Look for loose external ring. c. Look for worn or damaged internal cam surfaces. d. Look for worn or damaged bearing surfaces.	



ASSEMBLY

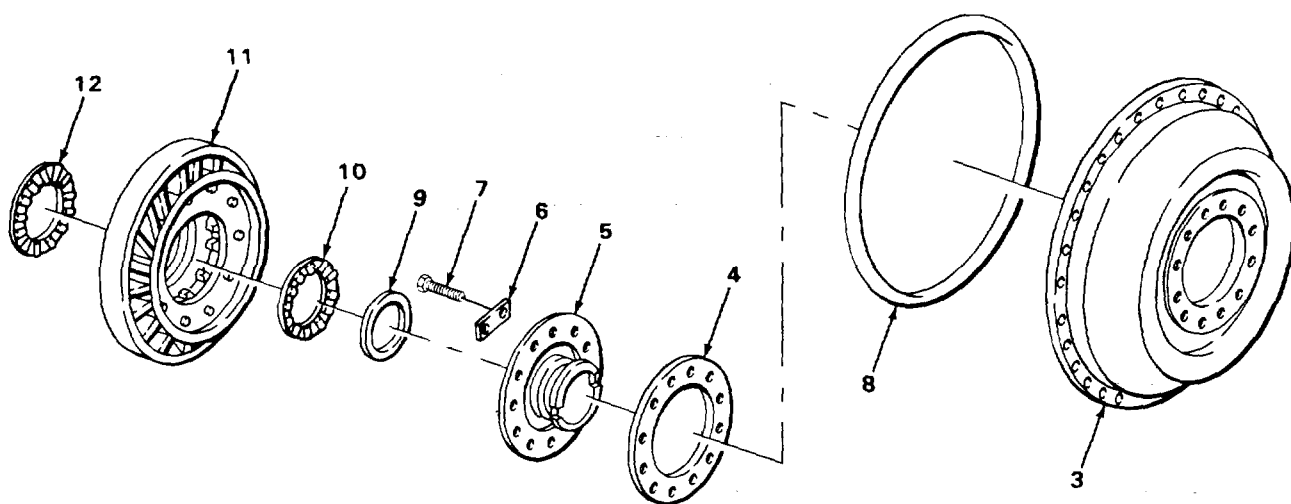
NOTE

All torque converter parts must be lubricated with clean transmission oil before assembly.

33.	Impeller assembly (3)	New gasket (4)	Place in position, lining up holes.
34.		Hub (5)	Put in position, lining up holes.

TORQUE CONVERTER - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
35. Hub (5)	Four new lock plates (6) and eight screws (7)	a. Screw in until snug using 7/16-inch socket, 3-inch extension, and ratchet handle with 1/2-inch drive. b. Using 7/16-inch socket, 3-inch extension, and torque wrench with 1/2-inch drive, tighten to 9-11 ft-lb (12-15 N m) of torque. c. Using ball-peen hammer and 1/2-inch cold hand chisel, pry up tabs.
36. Impeller assembly (3)	New packing (8)	Put on.
37. Hub (5)	Bearing race (9) and bearing (10)	a. Apply oil soluble grease. b. Put in position.
38. Stator (11)	Bearing (12)	a. If bearing (12) was removed, place new bearing into stator bore. b. Using stator thrust bearing installer tool, press the bearing into the bore until the tool bottoms in bore.



TA238431

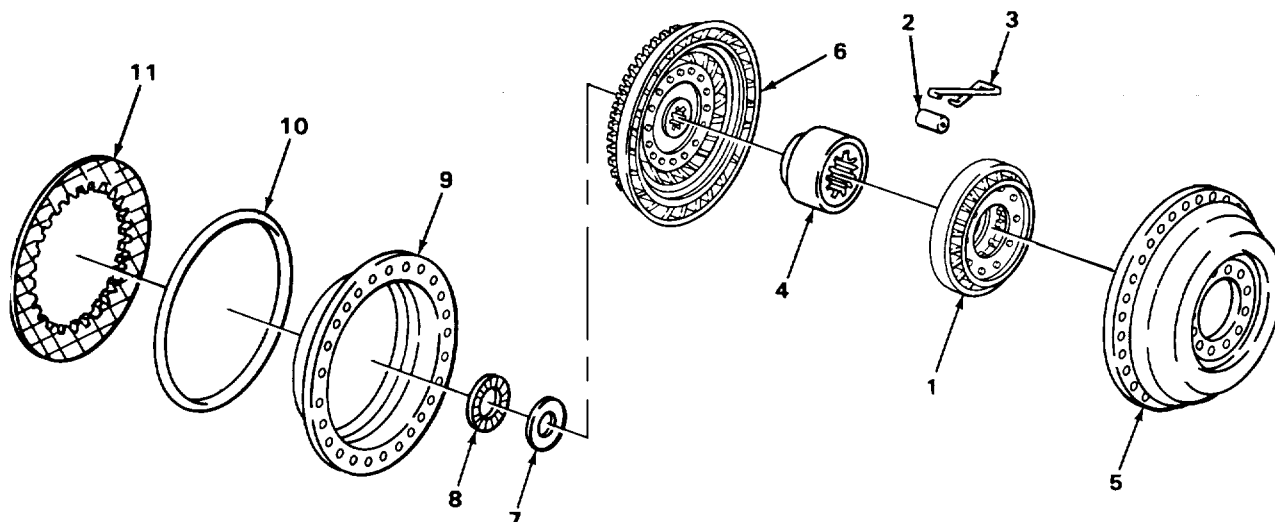
TORQUE CONVERTER - CONTINUED

	LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED			
39.	Stator (1)	Ten rollers (2) and springs (3)	a. Place stator (1) with bearing side down on bench. b. Cover bottom of stator cam pockets with oil soluble grease. c. Install stator roller retainer ring. d. Put rollers (2) and springs (3) in place. Ends of springs that touch roller must point toward center of stator.
40	Race (4)		a. Put in place, bearing side down. b. Turn clockwise while pressing down until it touches retainer tool. c. Lift up stator (1) and remove stator roller retainer ring. d. Set down stator and press down on race (4) until it is firmly seated. e. Turn race (4) firmly counterclockwise to lock it.
41.	Impeller assembly (5)	Stator (1)	With roller race down and held in position, place on hub.
42.		Turbine (6)	Put in place.
NOTE Do not install the thrust bearing spacer at this time.			
43.	Turbine (6)	Race (7)	Put in place with outer lip up.
44.	Race (7)	Bearing (8)	Grease, and put in place.
45.	Clutch backing plate (9)	New packing (10)	Put on.
46.	Impeller assembly (5)	Clutch backing plate (9)	a. Line up balance mark with mark on impeller assembly (5). b. Put in position.
47.	Clutch backing plate (9)	Lockup clutch plate (11)	Put on.

TORQUE CONVERTER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

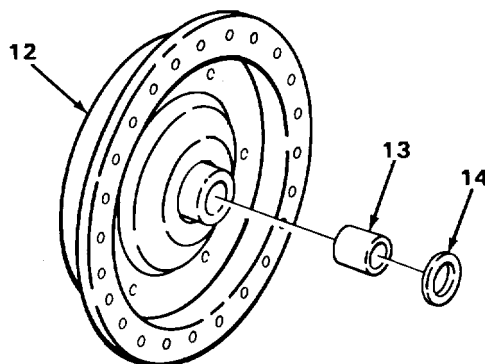
ASSEMBLY - CONTINUED



NOTE

If the cover assembly bushing has not been removed, skip step 48.

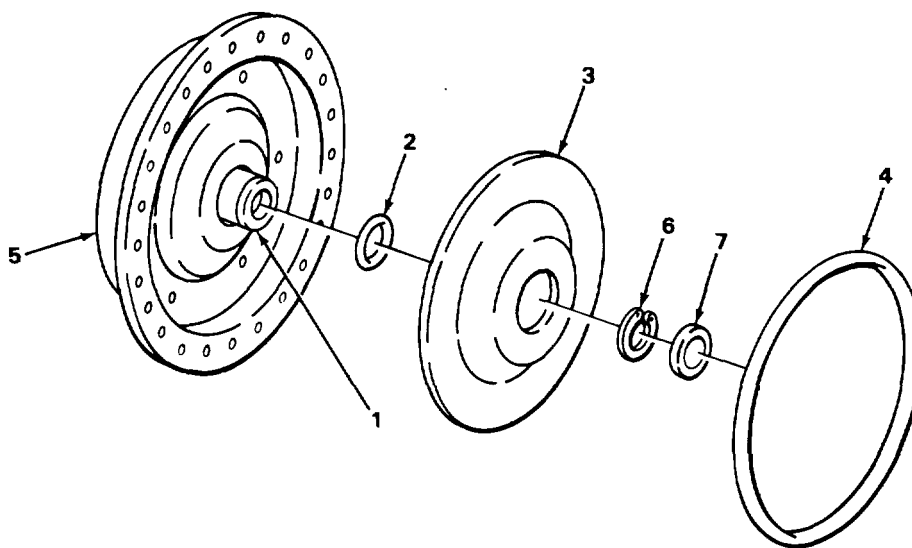
48.	Cover assembly (12)	Bushing (13)	a. Using cover bushing installer, press in. b. Using micrometer, measure inside diameter. Inside diameter must be 0.999 - 1.001-inch (2.51 - 2.57 mm).
49.		Packing retainer (14)	Position on hub with the larger diameter out.



TA238432

TORQUE CONVERTER - CONTINUED

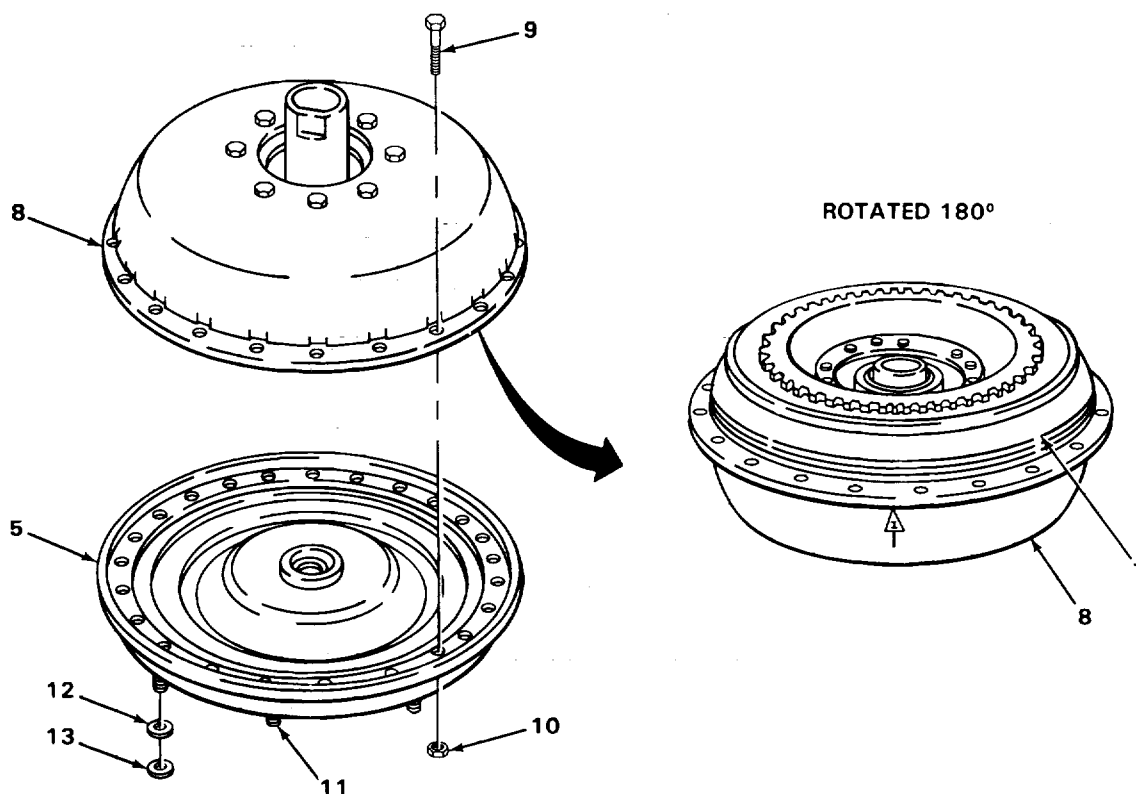
	LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED				
50.	Packing retainer (1)	New packing (2)	Put in place.	
51	Clutch piston (3)	New packing (4)	Put on.	
52	Cover assembly (5)	Clutch piston (3)	a. Aline balance marks. b. Position piston (3) so holes are over nearest guide pins in the assembly (5), and put in.	When piston is correctly positioned, the measurement from the cover mating surface to piston edge will be approximately 1.5-inches (3.81 mm).
53.		Snapring (6)	a. Using rubber hammer, tap piston (3) down. b. Using snapring pliers, put in position.	
54.	Race (7)		a. Apply oil soluble grease. b. With inner lip first, put into hub of assembly (5).	



TA238433

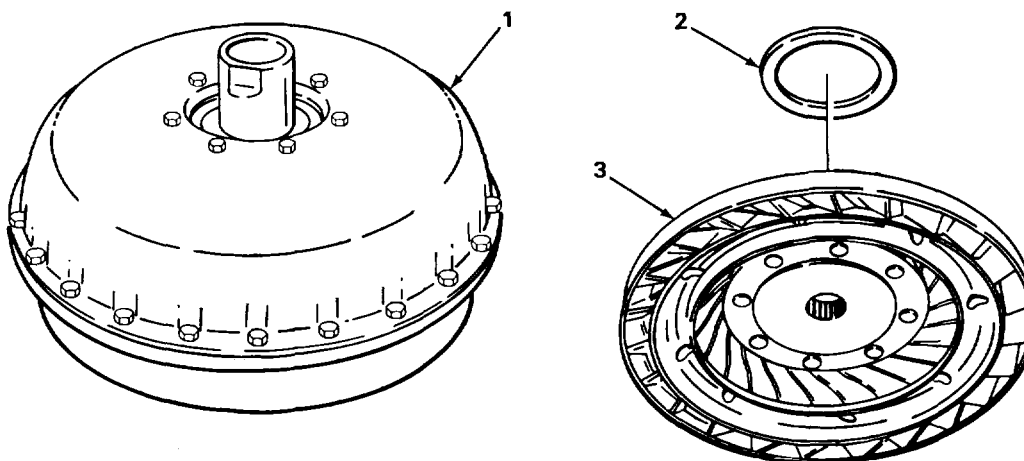
TORQUE CONVERTER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
55. Impeller assembly (8)	Cover assembly (5) with parts	a. Aline balance marks. b. Put in position.	
56. Cover assembly (5) and impeller assembly (8)	24 screws (9) and new nuts (10)	a. With flats on screws (9) next to impeller, using ball-peen hammer and 1/2-inch brass driftpin, tap in place. b. Screw on nuts (10) until snug. c. Using 112-inch socket and torque wrench with 1/2-inch drive, tighten to 19-23 ft-lb (26-31 N m) of torque.	
57. Drive studs (11)	Six spacers (12) and retainers (13)	Put on.	



TORQUE CONVERTER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
58.	Torque converter (1)		a. Repeat step 2, and record dial indicator reading. b. If necessary, disassemble the torque converter, and select proper size spacer (2) so that end play is brought to correct tolerance.
59. Turbine (3)	Thrust bearing spacer (2)		a. Position spacer in turbine hub. b. Assemble torque converter.

**NOTE**

FOLLOW-ON MAINTENANCE: Install torque converter (page 2-650).

TASK ENDS HERE

TRANSMISSION OIL PAN AND LEVEL GAGE TUBE

This task covers:

a. Removal (page 2-706)	c. Inspection/Replacement (page 2-707)
b. Cleaning (page 2-706)	d. Installation (page 2-707)
-

INITIAL SETUP**Tools**

Compressor, reciprocating air, power driven
Goggles, safety
Gun, air blow
Handle, ratchet, 1/2-inch drive
Hose, air compressor
Socket, 11/2-inch drive, 11/2-inch
Wrench, open-end, 7/16-inch (two required)
Wrench, open-end 1 1/16-inch
Wrench, torque, 1/2-inch drive, 0 to 150 ft-lb capacity

Materials/Parts

Gasket, oil pan
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Transmission drained (TM 9-2320-269-20-1).

TRANSMISSION OIL PAN AND LEVEL GAGE TUBE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
NOTE			
If transmission has been removed from the vehicle, skip step 1 thru 3.			
1. Clamp (1)	Screw (2), lock-washer (3), and nut (4)		Using two 7/16-inch open-end wrenches, unscrew and take out.
2. Bracket (5)	Clamp (1)		Move away from.
3. Oil pan (6)	Oil level gage tube (7)		Using 1 1/16-inch open-end wrench, unscrew and take off.
4. Oil level gage tube (7)	Clamp (1)		Take off.
5. Oil pan (6)	21 screws (8)		Using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
6. Transmission assembly (9)	Oil pan (6), gasket (10), bracket (11) and two spacers (12)		a. Take off. b. Get rid of gasket (10).

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

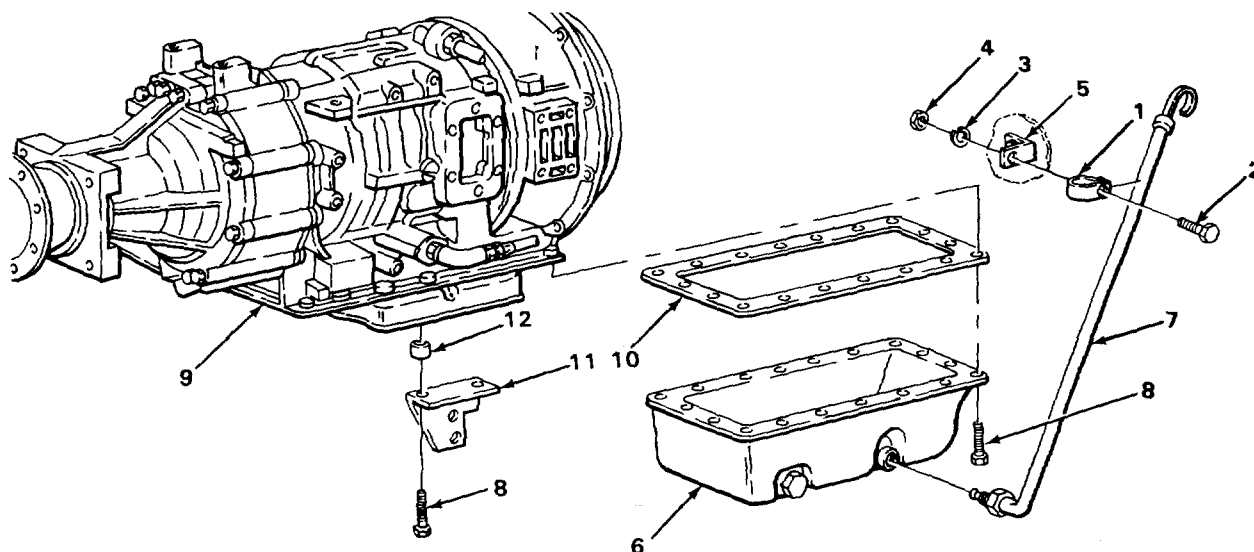
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

7.	All metal parts	a. Clean in drycleaning solvent. b. Dry with compressed air.

TRANSMISSION OIL PAN AND LEVEL GAGE TUBE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged or defective parts as needed.			
8.	Oil pan (6)	a. Look for bent or damaged flange. b. Look for stripping, gouges, or other damage to threads.	
9.	Oil level gage tube (7)	Look for bends, breaks, cracks and damaged threads.	
INSTALLATION			
10. Transmission assembly (9)	New gasket (10) and oil pan (6), two spacers (12) and bracket (11)	Place in position.	



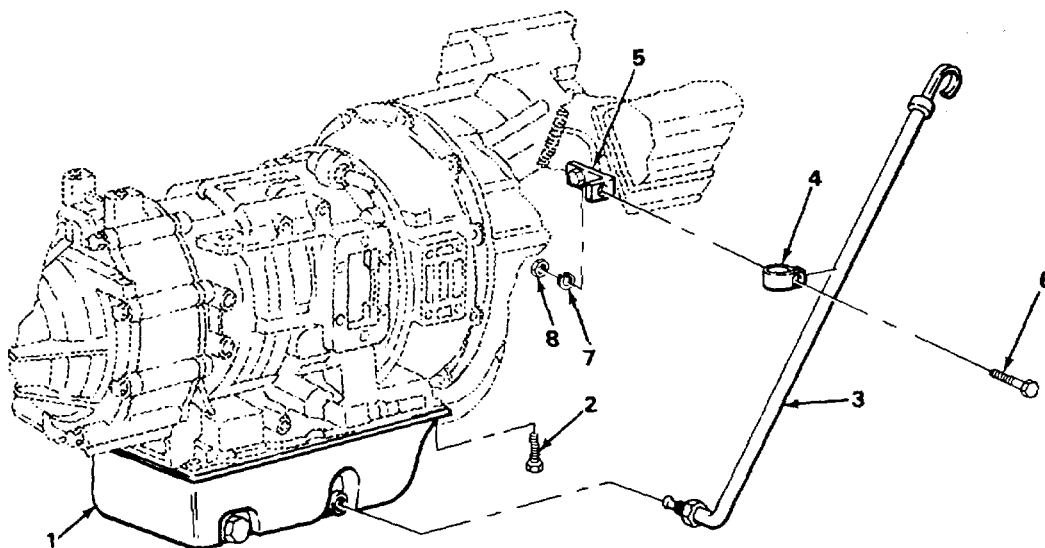
TRANSMISSION OIL PAN AND LEVEL GAGE TUBE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
11. Oil pan (1)	21 screws (2)	a. Screw in until snug using 1 1/2-inch socket and ratchet handle with 1/2-inch drive. b. Using 1/2-inch socket and torque wrench with 1/2-inch drive, tighten to 10 - 13 ft-lb (14 - 18 N m) of torque. c. After gasket sets, tighten to 15 - 18 ft-lb (20 - 24 N m) of torque.	

NOTE

Do steps 12 thru 15 only if the transmission is installed in the vehicle.

12. Oil level gage tube (3)	Clamp (4)	Put on.	
13. Oil pan (1)	Oil level gage tube (3)	Screw in, and tighten using 1 11/16-inch open-end wrench.	
14.	Bracket (5)	Clamp (4) Put in place.	
15. Clamp (4) and bracket (5)	Screw (6), new lockwasher (7), and nut (8)	Screw in, and tighten using two 7/16-inch open-end wrenches.	



TRANSMISSION OIL PAN AND LEVEL GAGE TUBE - CONTINUED
INSTALLATION - CONTINUED

NOTE

If the transmission is installed on the vehicle, perform FOLLOW-ON MAINTENANCE.

FOLLOW-ON MAINTENANCE: Lubricate transmission (LO 9-2320-269-12).

TASK ENDS HERE
LOW SHIFT VALVE ASSEMBLY

This task covers:	a. Disassembly (page 2-710)	c. Inspection/Replacement/Repair (page 2-711)
	b. Cleaning (page 2-710)	d. Assembly (page 2-712)

INITIAL SETUP

Tools

- Compressor, reciprocating air, power driven
- Goggles, safety
- Gun, air blow
- Hose, air compressor
- Pliers, round-nose, long
- Stone, soft

Materials/Parts

- Cloth, crocus (item 7, appendix B)
- Cloth, emery (item 8, appendix B)
- Solvent, drycleaning (item 49, appendix B)

Personnel Required
One

Equipment Condition

Low shift valve assembly removed (page 2-650).

LOW SHIFT VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
NOTE Before taking pin out from low shift valve, note slot in adjusting ring into which pin is seated.			
1. Low shift valve assembly (1)	Retainer pin (2)	a. Press on ring (3).	b. Using long round-nose pliers, take out.
2.	Adjusting ring (3), washer (4), valve stop (5), valve spring (6), and low shift signal valve (7)	Take out.	
3.	Retainer pin (8)	a. Press on plug (9).	b. Using long round-nose pliers, take out.
4.	Valve spring plug (9), stop pin (10), spring (11), and low shift relay valve (12)	Take out.	In some models, items (9) and (10) are one piece.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

LOW SHIFT VALVE ASSEMBLY - CONTINUED

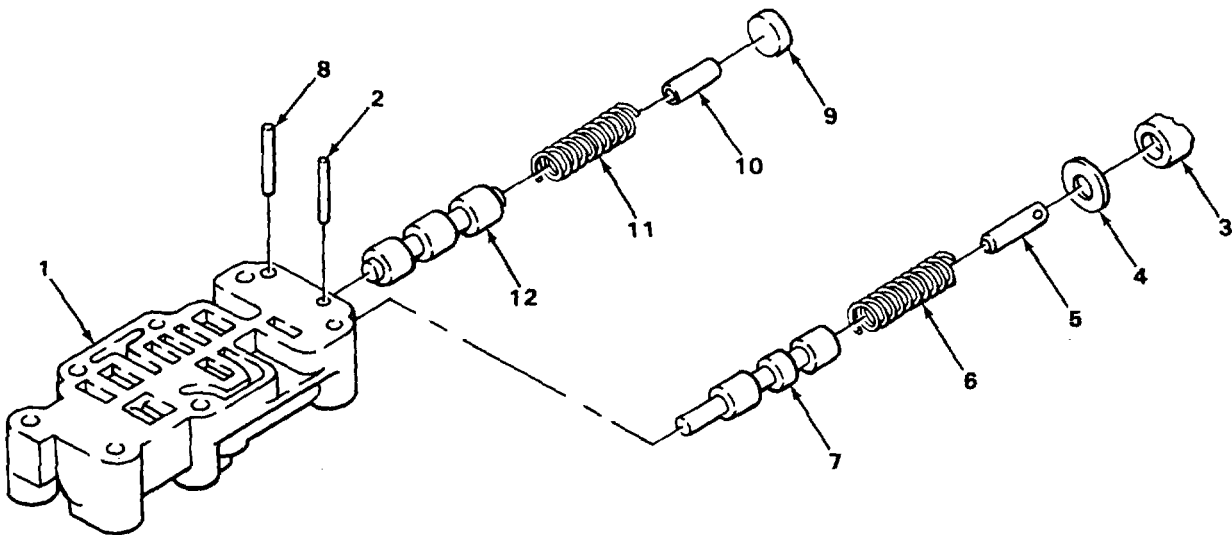
LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
5.	All metal parts	a. Clean in drycleaning solvent. b. Clean bores by flushing with dry cleaning solvent. c. Dry parts with compressed air.	

INSPECTIONIREPLACEMENTIREPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

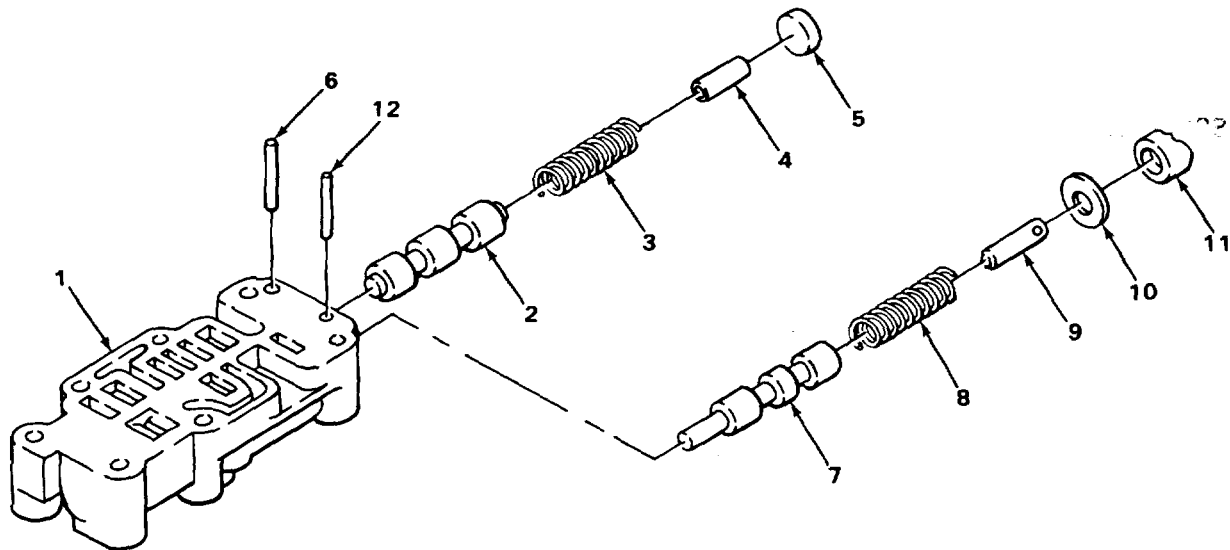
6.	Low shift valve assembly (1)	a. Look for wear, scratches, grooves, and dirt in bores. b. Remove scratches with emery cloth. c. Look for nicks, burrs, and scratches on mounting faces. d. Remove scratches with crocus cloth or soft stone. If scratches are deep, replace the assembly.	



LOW SHIFT VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
NOTE			
Before assembling parts in bores, check shape of valves and plugs to make sure they are in correct position. Be sure correct springs are being used in bore.			
Valves should move freely in their bores by their own weight. If they do not, look for burrs on valve or in bore, and carefully remove burrs with crocus cloth.			
7. Low shift valve assembly (1)	Low shift relay valve (2), spring (3), stop pin (4), and valve spring plug (5)	Put in bore.	In some models, items (4) and (5) are one piece.
8.	Retainer pin (6)	a. Press on plug (5). b. Place in position. c. Using long round-nose pliers, put in.	
9.	Low shift signal valve (7), valve spring (8), valve stop (9), washer (10), and adjusting ring (11)	a. Put in bore. b. Move the slot in ring (11) to same position as noted when removed. c. Keep hand pressure on stop (9) and ring (11).	
10.	Retainer pin (12)	a. Place in position. b. Using long round-nose pliers, put in.	

LOW SHIFT VALVE ASSEMBLY - CONTINUED **ASSEMBLY - CONTINUED**



NOTE

FOLLOW-ON MAINTENANCE: Install low shift valve assembly (page 2-650).

TASK ENDS HERE

TRANSMISSION CONTROL VALVE ASSEMBLY

This task covers:

a. Disassembly (page 2-714)	c. Inspection/Replacement/Repair (page 2-720)
b. Cleaning (page 2-720)	d. Assembly (page 2-720)

INITIAL SETUP

Tools

Compressor, reciprocating air,
 power driven
 Goggles, safety
 Gun, air blow
 Handle, ratchet, 1/2-inch drive
 Hose, air compressor
 Pliers, round-nose, long
 Retrieving tool, magnetic
 Scribe, machinist's
 Socket, 11/2-inch drive, 7/16-inch
 Stone, soft
 Wrench, torque, 1/2-inch drive,
 0 - 150 ft-lb capacity

Materials/Parts

Cloth, crocus (item 7, appendix B)
 Rubber band
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Control valve assembly removed
 (page 2-650).

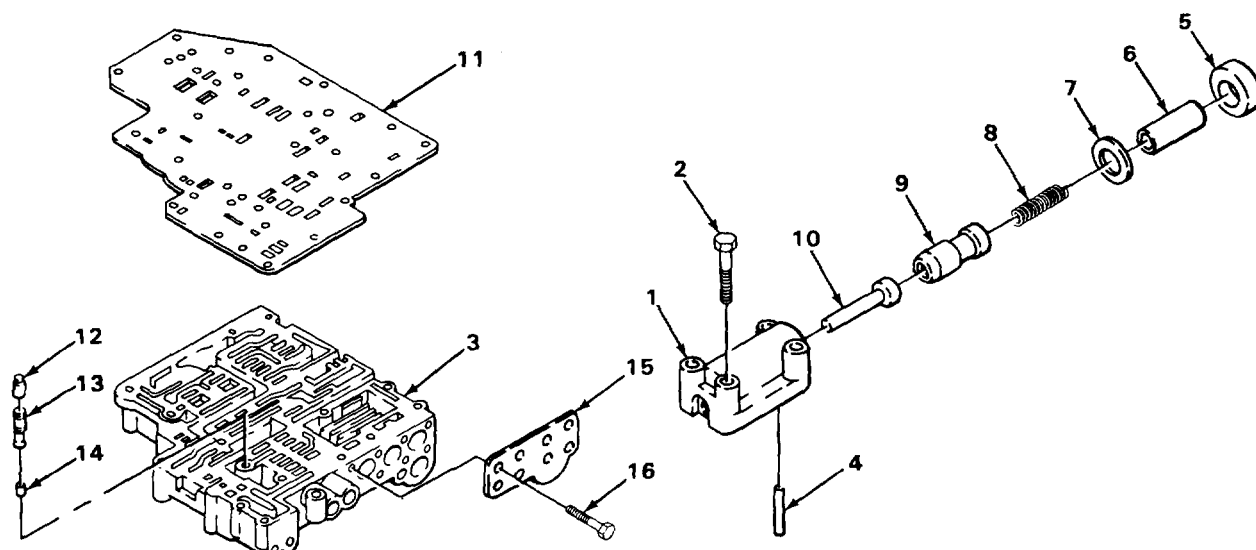
TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
WARNING			
The adjusting rings, plugs, and plates are spring loaded, and as they are removed, springs can fly out with great force and could cause serious injury to personnel. During removal use care to hold down parts while spring pressure is released.			
CAUTION			
The different valves and springs in the valve assembly are similar, can easily be mixed up, and result in transmission damage. Keep each group of parts taken from each bore separated and together in clean containers.			
1. Modulator valve body (1)	Three screws (2)		Using 7/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
2. Control valve body (3)	Modulator valve body (1)		Lift off.
3. Modulator valve body (1)	Retainer pin (4)		a. Note or mark slot in adjusting ring that pin (4) is in. b. Press on ring (5), and using long round-nose pliers, take out.
4.	Adjusting ring (5), stop (6), washer (7), spring (8), modulator valve (9), and pin (10)		Take out.
5. Control valve body (3)	Separator plate (11)		Take off.
6.	Priority valve (12), spring (13), and stop pin (14)		Take out.
7. Trimmer valve cover (15)	Eight screws (16)		Using 7/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
8. Control valve body (3)	Trimmer valve cover (15)		Take off.

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

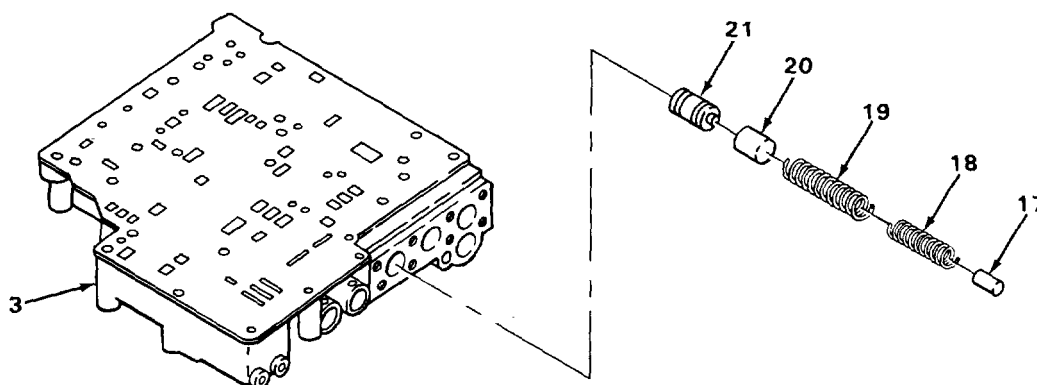
DISASSEMBLY - CONTINUED



9. Control valve
body (3)

Third clutch trimmer
valve stop (17), in-
ner spring (18), out-
er spring (19), plug (20),
and third clutch trim-
mer valve (21)

Using magnetic retrieving tool, take out.



TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
10.	Control valve body (1)		Using magnetic retrieving tool, take out.
11.	First clutch trimmer valve stop (2), inner spring (3), outer spring (4), plug (5), and first clutch trimmer valve (6)		Using magnetic retrieving tool, take out.
12.	Second clutch trimmer valve stop (7), inner spring (8), outer spring (9), plug (10), and second clutch trimmer valve (11)		Using magnetic retrieving tool, take out.
13.	Fourth clutch trimmer valve stop (12), inner spring (13), outer spring (14), plug (15), and fourth clutch trimmer valve (16)		Using magnetic retrieving tool, take out.

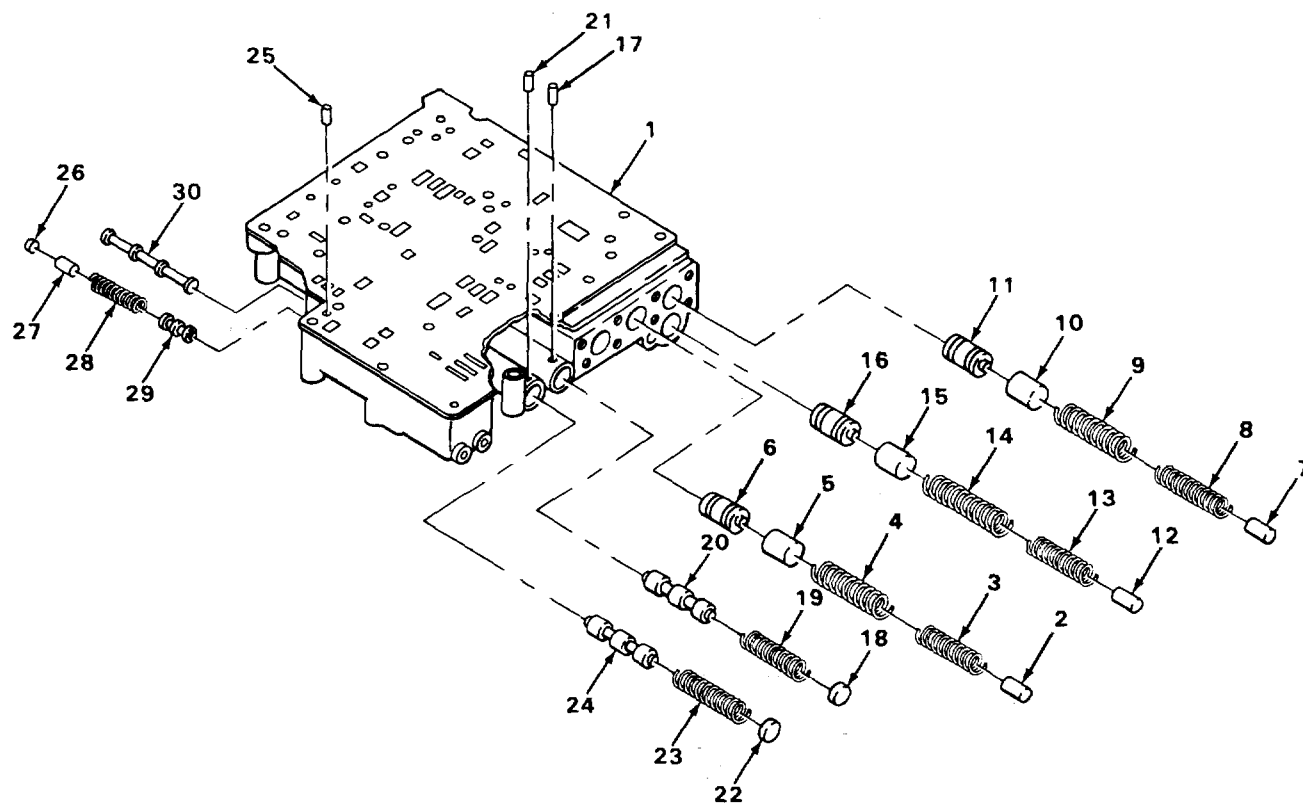
WARNING

The spacers are spring loaded, keep pressure against them while taking out retaining pins. Spacers can fly out with great force and cause injury to personnel.

13.	Retainer pin (17)	Using long round-nose pliers, take out.
14.	Stop (18), spring (19), and slave valve (20)	Using magnetic retrieving tool, take out. In some models, spacer and stop are one piece.
15.	Retainer pin (21)	Using long round-nose pliers, take out.
16.	Spacer (22), spring (23), and slave valve (24)	Using magnetic retrieving tool, take out.
17.	Retainer pin (25)	a. Press on plug (26). b. Using long round-nose pliers, take out.

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
18.	Plug (26), pin (27), spring (28), and regulator hold valve (29)	Using magnetic retrieving tool, take out.	
19.	Range selector valve (30)	a. Take off rubber band. b. Take out.	



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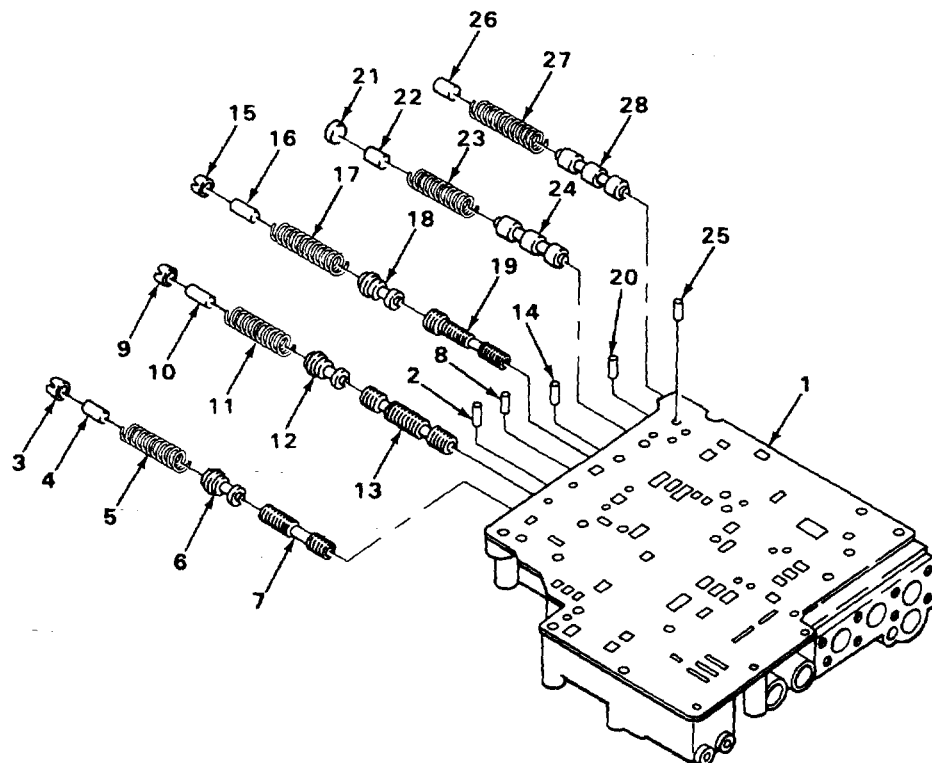
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TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
NOTE Before taking out retainer pins, using machinist's scribe, note and mark the slot in the adjusting ring in which the pins are seated. The adjusting rings are spring loaded, so they must be held in while retaining pin is removed.			
20. Control valve body (1)	Retainer pin (2)	a. Press on ring (3). b. Using long round-nose pliers, take out.	
21.	Adjuster ring (3), stop (4), spring (5), 2-3 modulator valve (6), and 2-3 shift valve (7)	Using magnetic retrieving tool, take out.	
22.	Retainer pin (8)	a. Press on, and hold ring (9). b. Using long round-nose pliers, take out.	
23.	Adjuster ring (9), valve stop (10), valve spring (11), 3-4 modulator valve (12), and 3-4 shift valve (13)	Using magnetic retrieving tool, take out.	
24.	Retainer pin (14)	a. Press on ring (15). b. Using long round-nose pliers, take out.	
25.	Adjuster ring (15), stop (16), spring (17), 4-5 modulator valve (18), and 4-5 shift valve (19)	Using magnetic retrieving tool, take out.	
26.	Retainer pin (20)	a. Press on spacer (21). b. Using long round-nose pliers, take out.	
27.	Spacer (21), stop (22), spring (23), and slave valve (24)	Using magnetic retrieving tool, take out. In some models, spacer and stop are one piece.	

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
28.	Retainer pin (25)	a. Press on stop (26). b. Using long round-nose pliers, take out.	
29.	Stop (26), spring (27), and plunger (28)	Using magnetic retrieving tool, take out.	



TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

30.	All metal parts	a. Clean in drycleaning solvent. b. Clean bores by flushing with drycleaning fluid. c. Dry parts with compressed air.

INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

31.	All machined surfaces and parts	a. Look for wear, scratches, grooves, and dirt in bores. b. Look for nicks, burrs, and scratches on mounting faces. c. Remove minor scratches with crocus cloth or soft stone. If scratches are deep, replace the assembly.

ASSEMBLY

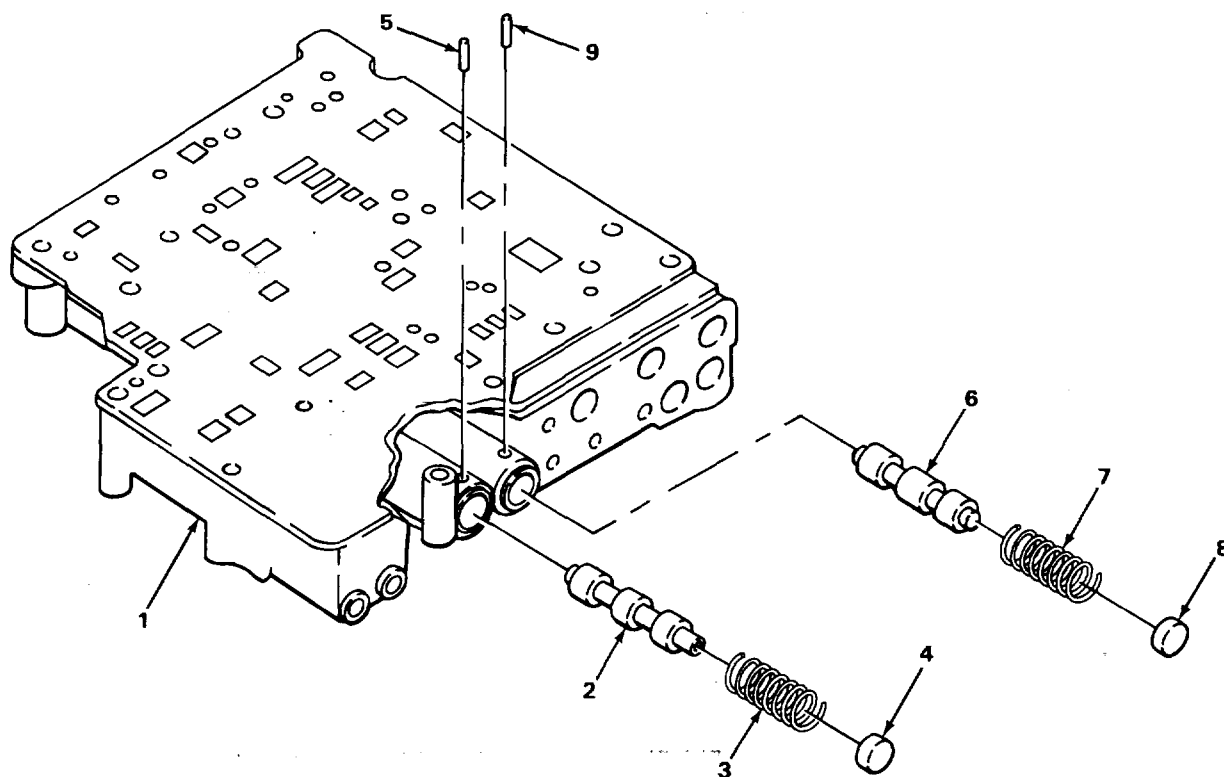
NOTE

Before assembling parts in bores, check shape of valves and plugs and make sure they are in correct position. Be sure right springs are being used in bore.

Valves should move freely in their bores of their own weight. If they do not, look for burrs on valve or in bore, and remove them with crocus cloth.

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
32. Control valve body (1)	Slave valve (2), spring (3), and spacer (4)	Put in bore.	
33.	Retainer pin (5)	a. Press on spacer (4).	
34.	Slave valve (6), spring (7), and spacer (8)	b. Using long round-nose pliers, put in. Put in bore.	
35.	Retainer pin (9)	a. Press on spacer (8).	
		b. Using long round-nose pliers, put in.	

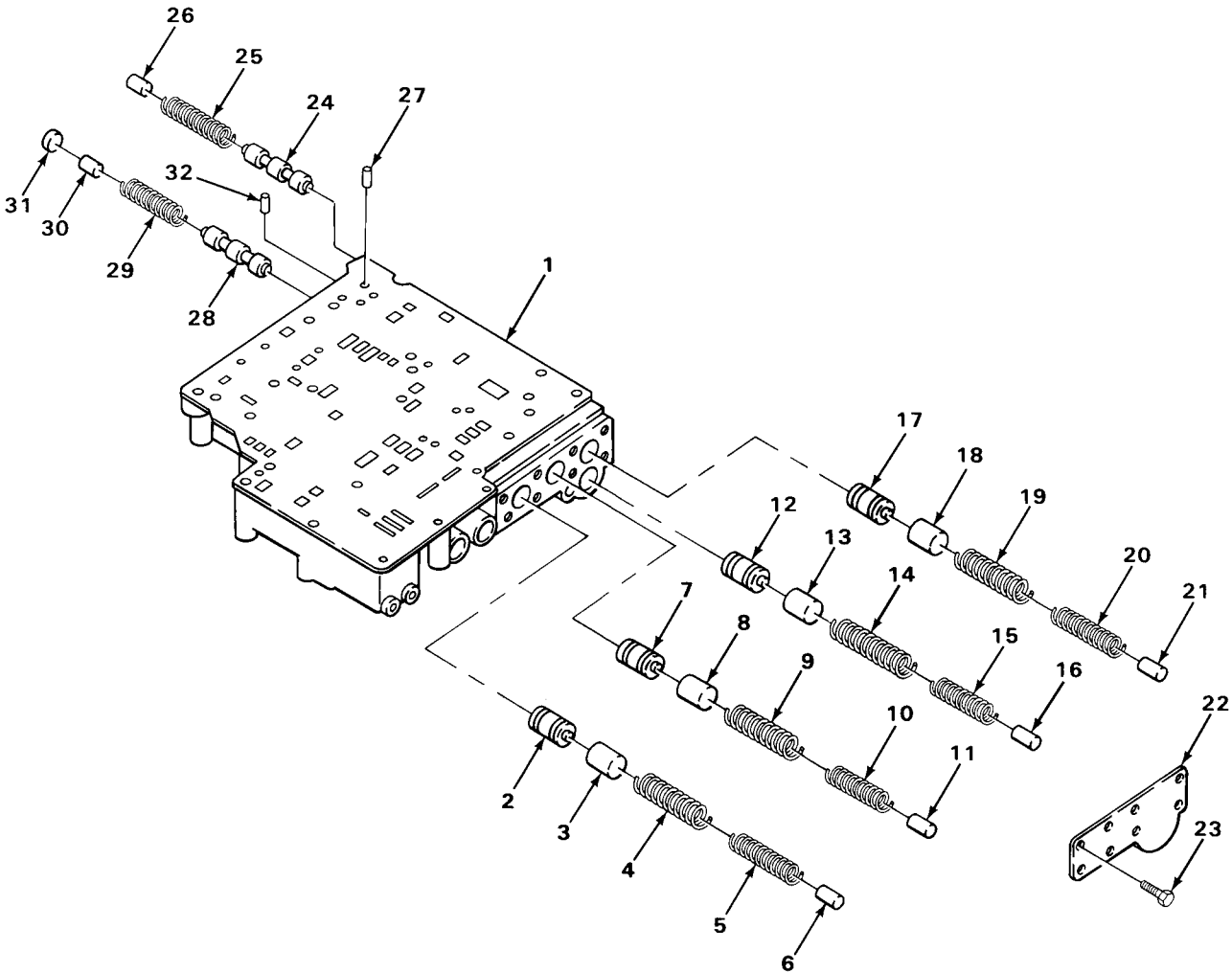


TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
36.	Control valve body (1)	Fourth clutch trimmer valve (2), plug (3), outer spring (4), inner spring (5), and stop (6)	Put in bore.
37.		Second clutch trimmer valve (7), plug (8), outer spring (9), inner spring (10), and stop (11)	Put in bore.
38.		First clutch trimmer valve (12), plug (13), outer spring (14), inner spring (15), and stop (16)	Put in bore.
39.		Third clutch trimmer valve (17), plug (18), outer spring (19), inner spring (20), and stop (21)	Put in bore.
40.		Trimmer valve cover (22)	a. Place in position. b. Press and hold in place against spring pressure.
41.	Trimmer valve cover (22)	Eight screws (23)	a. Put in position. b. Screw in until snug using 7/16-inch socket and ratchet handle with 1/2-inch drive. c. Using 7/16-inch socket and torque wrench with 1/2-inch drive, tighten to 9-11 ft-lb (12-15 N m) of torque.
42.	Control valve body (1)	Plunger (24), spring (25), and stop (26)	Put in bore.
43.		Retainer pin (27)	a. Press on stop (26). b. Place in position. c. Using long round-nose pliers, put in.

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

		ACTION
LOCATION	ITEM	REMARKS
ASSEMBLY CONTINUED		
44.	Slave valve (28), Spring (29), stop (30), and spacer (31)	Put in bore. on some models, stop and spacer are one piece.
45.	Retainer pin (32)	a. Press on spacer (31). b. using long round-nose pliers, put in.

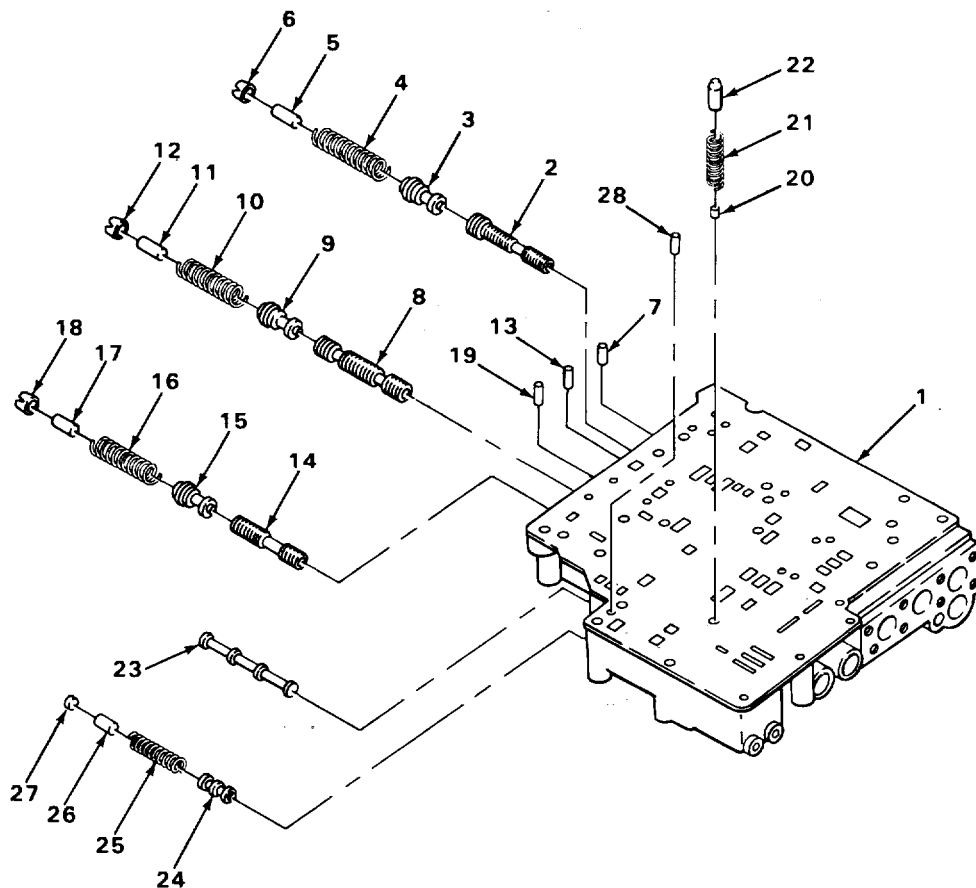


TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

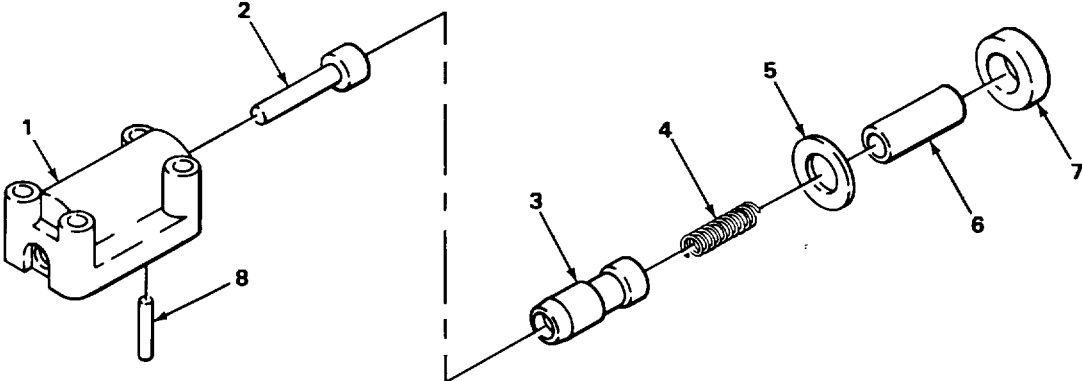
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
46.	Control valve Body (1)	4-5 shift valve (2), 4-5 modulator valve (3), spring (4), shift valve stop (5), and adjusting Ring (6)	a. Put in bore. b. Aline hole in stop (5) and slot in ring (6), that was noted when removed, with hole in body (1).
47.	Retainer pin (7)		a. Press on adjusting ring (6). b. Using long round nose pliers, put in.
48.	3-4 shift valve (8), 3-4 modulator valve (9), spring (10), shift valve stop (11), and adjusting Ring (12).		a. Put I bore. b. Aline hole in stop (11) and slot in ring (12), that was noted when removed, with hole in body (1).
49.	Retainer pin (13)		a. Press on ring (12). b. Using long round nose pliers, put in.
50.	2-3 shift valve (14), 2-3 modulator valve (15), spring (16), valve stop (17), and adjusting		a. Put in bore. b. Aline hole in stop (17) and slot in ring (18), that was noted or when removed, with hole in body.
51.	Retainer pin (19)		a. Press on ring (18). b. Using round-nose pliers, put in.
52.	Retainer pin (20), Valve spring (21), and stop pin (22)		Put in bore.
53.	Range selector Valve (23)		a. Put in bore. b. Hold in place with rubber band.

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

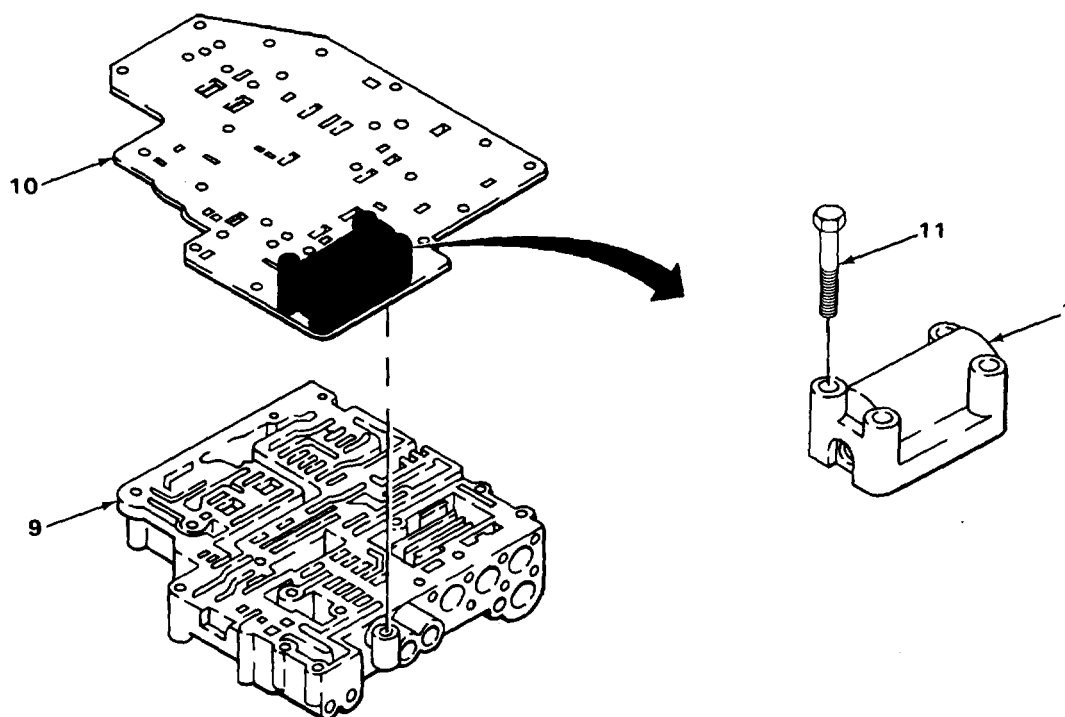
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
54.	Regulator hold valve (24), spring (25), pin (26), and plug (27)	Put in bore.	
55.	Retainer pin (28)	a. Press in plug (27). b. Using long round-nose pliers, put in.	



TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
56. Modulator valve body (1)	Pin (2), modulator valve (3), spring (4), washer (5), stop (6), and adjust-body (1).	a. Put in bore. b. Aline hole in stop (6) and slot in ring (7), that was noted when removed, with hole in	
57.	Retainer pin (8)	a. Press on ring (7). b. Using long round-nose pliers, put in.	
			
58. Control valve body (9)	Separator plate (10)	Put in position.	
59. Separator plate (10) body (1)	Modulator valve	Put in position.	
60. Modulator valve body (1)	Three screws (11)	a. Screw in until snug. b. Using 7/16-inch socket and torque wrench with 1/2-inch drive, tighten to 9 - 11 ft-lb(12 - 15 N m) of torque.	

TRANSMISSION CONTROL VALVE ASSEMBLY - CONTINUED
ASSEMBLY - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE: Install control valve assembly (page 2-650).

TASK ENDS HERE

TRANSMISSION OIL PUMP AND FRONT SUPPORT

This task covers:

a. Disassembly (page 2-729)	c. Inspection/Replacement (page 2-732)
b. Cleaning (page 2-731)	d. Assembly (page 2-733)
-

INITIAL SETUP**Tools**

Band, centering tool
 Chisel, cold hand, 114-inch
 Compressor, main regulator and
 lockup valve spring
 Compressor, reciprocating air,
 power driven
 Driftpin, brass, 1/4-inch
 File, fine hand
 Gage, thickness
 Goggles, safety
 Gun, air blow
 Hammer, ball-peen, machinist's
 Hammer, slide
 Handle, driver
 Handle, ratchet, 1/2-inch drive
 Hose, air compressor
 Installer, oil pump seal
 Installer, valve pin
 Installer, front support bearing
 Pliers, snapping
 Press, arbor, hand-operated
 Remover, valve pin
 Rule, machinist's, 12-inch
 Stone, soft
 Socket, 1/2-inch drive, 112-inch
 Socket, 1/2-inch drive, 9/16-inch
 Wire, soft
 Wrench, torque, 1/2-inch drive
 0 - 150 ft-lb capacity

Materials/Parts

Bearing assembly, needle
 Cloth, crocus (item 7, appendix B)
 Grease, oil soluble (item 21, appendix B)
 Guide, converter regulating valve
 Lubricant, high temperature seal (item 27,
 appendix B)
 Packing, preformed, oil pump and front
 support
 Seal, oil pump
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Oil pump and front support removed from
transmission (page 2-650).

TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

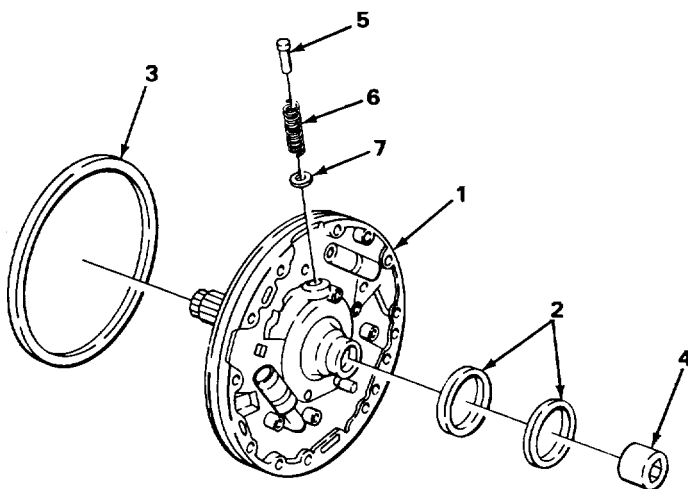
DISASSEMBLY

1.	Oil pump and front support assembly (1)	Two seal rings (2) clean workbench.	a. Position pump and front support on b. Take off.
2.	Packing (3)		a. Take off. b. Get rid of.

NOTE

Do not remove the needle bearing or the converter regulator valve guide, spring, and converter regulator valve unless part replacement is necessary.

3.	Needle bearing assembly (4)		a. Using ball-peen hammer and 1/4-inch brass driftpin, take out. b. Get rid of.
4.	Converter regulator valve guide (5), spring (6), and converter regulator valve (7)		a. Using valve pin remover tool and slide hammer, take out. b. Get rid of guide (5).



TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
WARNING The regulator valve spring is under approximately 65-lb pressure. Be careful when removing snaprings. Parts can fly off with force causing injury to personnel.			
5. Oil pump and front support assembly (1)	Two snaprings (2) and (3)	a. Attach main regulator and lockup valve using spring compressor tool. b. Using snapring pliers, take out.	
6.	Valve stop (4), spring (5), and pressure regulator valve (6)	a. Carefully loosen screws on compressor tool and take off. b. Take out.	
7.	Valve stop (7), spring (8), and lockup valve (9)	Take out.	
8. Front support (10)	Two screws (11)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
9.	12 screws (12)	Using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
10.	Oil pump (13)	Take off.	
NOTE Do not remove lockup valve plug unless it is damaged.			
11.	Lockup valve plug (14)	a. Using arbor press, take out. b. Get rid of.	
12. Oil pump (13)	Drive gear(15) and driven gear (16)	Take out.	
13.	Oil pump seal (17)	a. Using ball-peen hammer and 1/4-inch brass driftpin, take out. b. Get rid of.	

TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

NOTE

Do not remove bushing unless it is worn or damaged.

14.

Bushing (18)

Using ball-peen hammer and cold hand chisel, take out.

Do not damage bushing bore in pump housing.

CLEANING

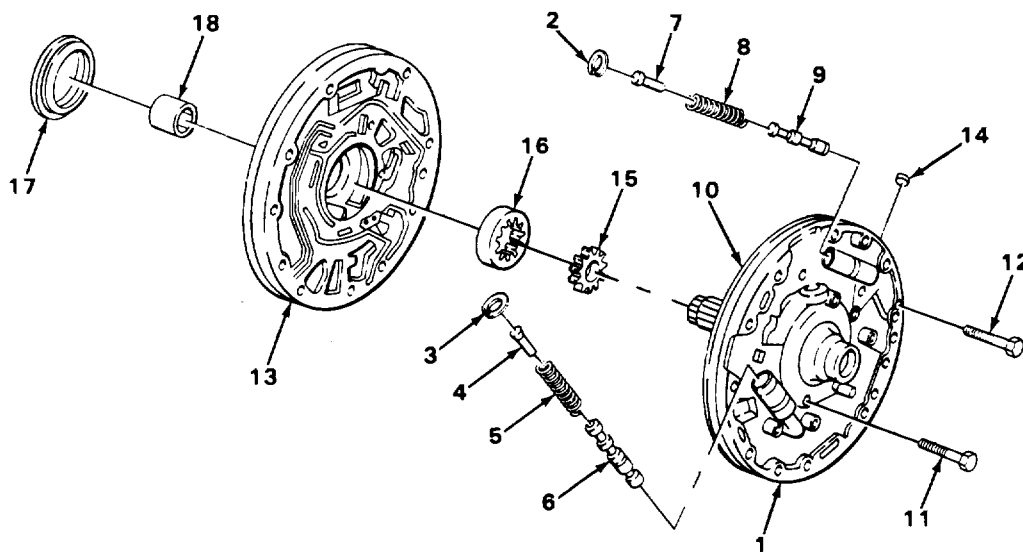
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.



2-731

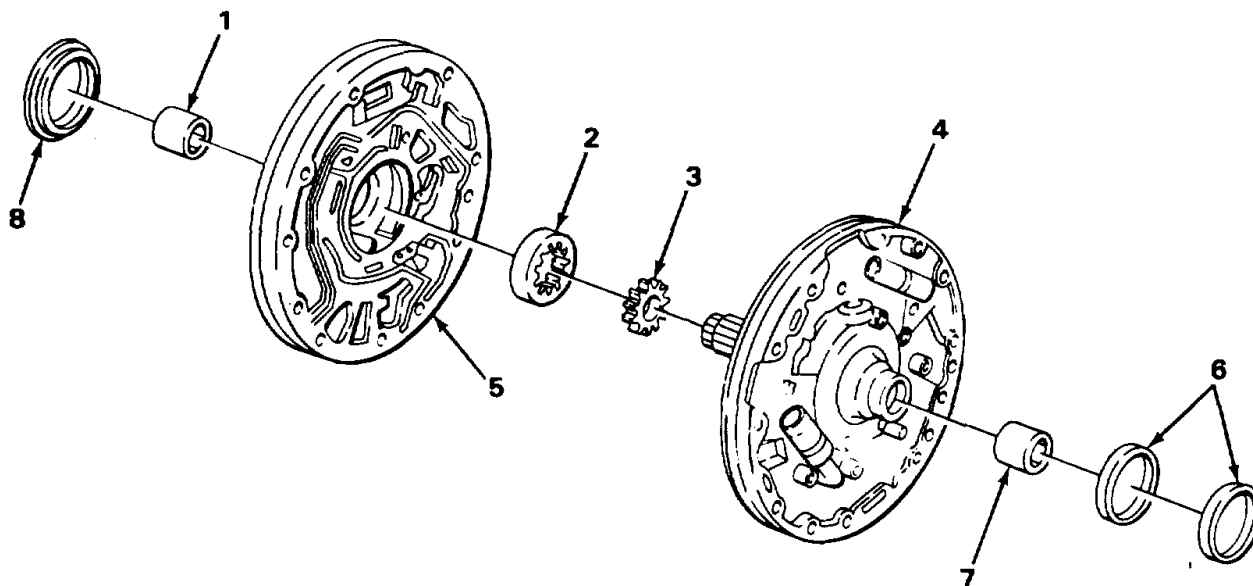
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TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
15.	All metal parts		a. Clean in drycleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with piece of soft wire and by flushing with drycleaning solvent.
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged or defective parts, as needed.			
16.	Bushing (1)		a. Look for scores, burrs, out-of-round and signs of overheating. b. Remove burrs with crocus cloth or fine hand file.
17.	Drive (2) and driven gear (3)		a. Look for nicked, burred, or broken teeth. If one gear is damaged, replace both gears. b. Put drive and driven gears in position in pump (4). c. Place machinist's rule across flat surface of pump (4). d. Place thickness gage between each gear (2) and (3) and machinist's rule. e. If clearance is more than 0.003-inch (0.08 mm), replace pump (4).
18.	Oil pump (4) and		a. Look for nicks, scratches and score front support (5) marks. b. Rub out defects with crocus cloth.
19.	Two seal rings (6)		a. Look for wear on side or outside diameter. b. Look for broken hooks.
20.	Ground sleeve (7)		a. On splines, look for stripped, twisted, chipped, or burred areas. b. Remove burrs with soft stone.

TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
NOTE If bushing was not removed, skip step 21.			
21.	Front support (5)	New bushing (1)	a. Place joint in bushing (1) between 10 and 12 o'clock position. b. Using arbor press, press in. Bushing must be flush to 0.010-Inch (0.25 mm) below edge of bore.
22.		New oil seal (8)	a. Coat outside diameter of seal with high temperature seal lubricant. b. Using arbor press, seal installer, and driver handle, press on. If seal installer is not available, install seal so spring-loaded lip is first. Using arbor press, press seal in to 0.010 to 0.020-Inch (0.25 to 0.51 mm) below edge of bore. c. Coat inside of seal with high temperature seal lubricant.

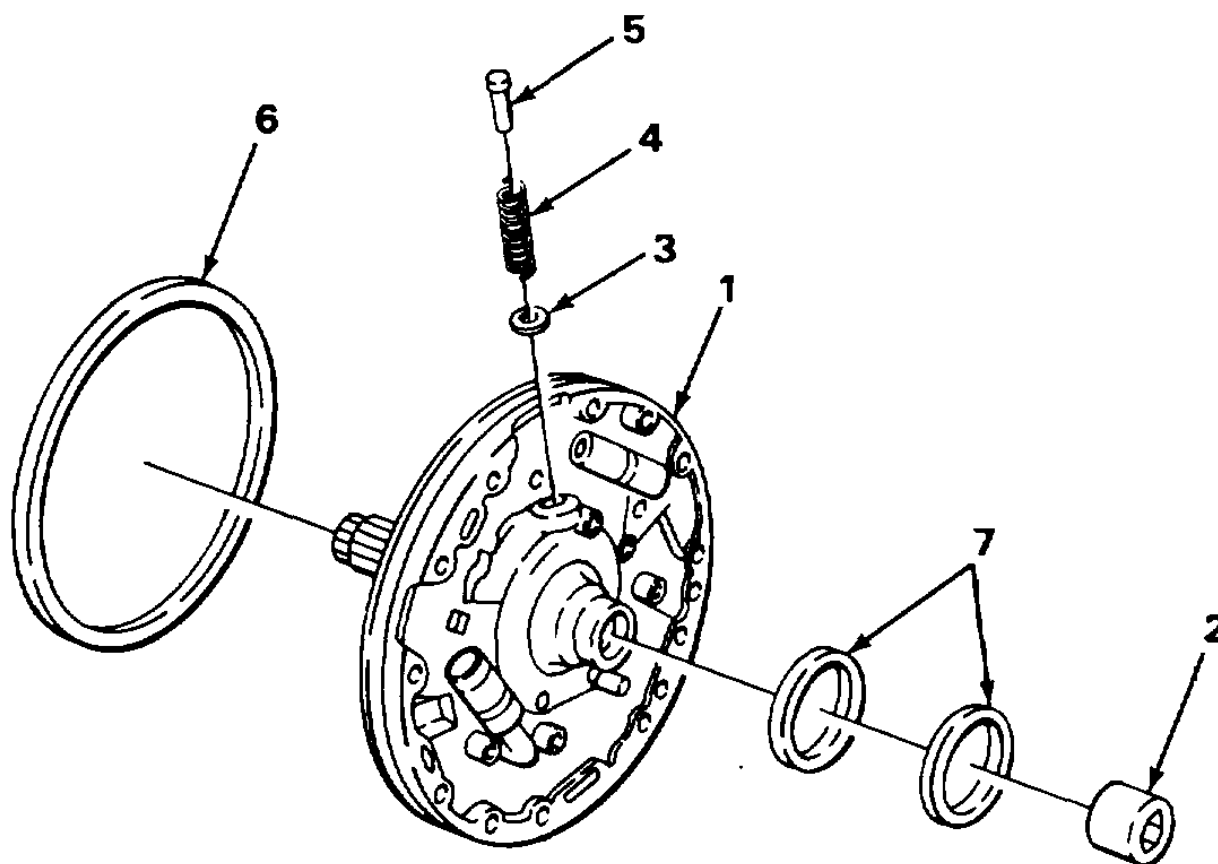


TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
23.	Oil pump (1)	Driven gear (2) and drive gear (3)	a. Position pump with flat side up. b. Place in position.
NOTE If the plug was not removed from front support, skip step 24.			
24.	Front support (4)	New lockup valve plug (5)	a. Place in position. b. Using arbor press, press in against shoulder in bore.
25.	Oil pump (1)	Put in position.	
26.	Front support (4) and oil pump (1)	12 screws (6) and two screws (7)	a. Place two screws (6) in position 1800 apart. b. Tighten one or two threads by hand. c. Place centering band tool around outside of oil pump (1) and front support (4) to align the two parts. d. Place 10 screws (12) in position. e. Using 112-inch socket and ratchet handle with 1/2-inch drive, tighten until snug. f. Place two screws (7) in position. g. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, tighten until snug. When assembled, the oil pump and front support must be aligned exactly so the line where they are joined is perfectly smooth. h. Using 1/2-inch socket and torque wrench with 1/2-inch drive, tighten 12 screws (6) to 17 - 20 ft-lb. (23 - 27 N m) of torque. i. Using 9/16-inch socket and torque wrench with 1/2-inch drive, tighten two screws (7) to 36 - 43 ft-lb. (49 - 58 N m) of torque.

TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
27. Front support (4)	Pressure regulator valve (8), spring (9), and valve stop (10)	Place in position in bore.	
28.	Lockup valve (11), spring (12), and valve stop (13)	Place in position in bore.	
29. Two valve stops (10) and (13) and front support (4)	Two snaprings (14) and (15)	- Using main regulator and lockup valve spring compressor tool, compress valve springs (9) and (12). - Using snapring pliers, put in snaprings (14) and (15). - Take off main regulator and lockup valve spring compressor tool.	



TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

NOTE

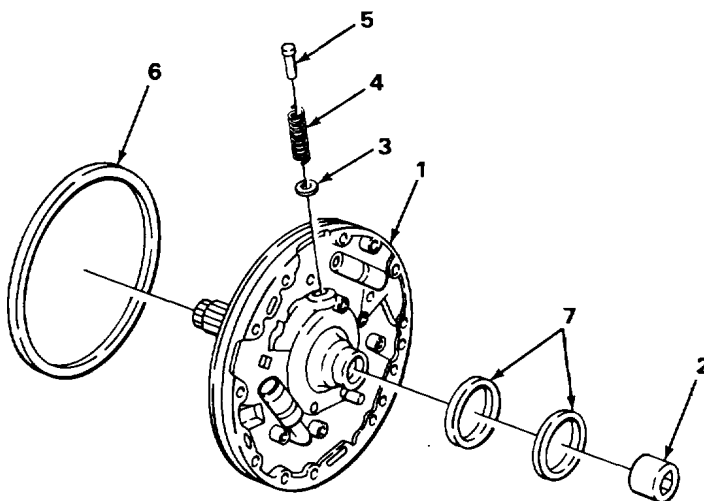
If the needle bearing assembly was not removed, skip step 30.

30.	Front support (1)	Needle bearing (2)	a. Place in position with numbered end of cage up. b. Using front support bearing installer, drive handle, and arbor press, press into bore.

NOTE

If the converter regulator valve guide, spring and converter regulator valve were not removed, skip step 31.

31.	Converter regulator valve (3), spring (4), and new converter regulator valve guide (5)c.	a. Place valve guide (5) in valve pin installer. b. Place spring (4) and converter regulator valve (3) on valve guide (5). Using valve pin installer, press in position in bore.
32.	New packing (6)	a. Lubricate with oil soluble grease. b. Put in position. Make sure packing does not twist in groove.
33.	Two seal rings (7)	Place in position.



TA238452

TRANSMISSION OIL PUMP AND FRONT SUPPORT - CONTINUED**ASSEMBLY - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install oil pump and front support (page 2-650).

TASK ENDS HERE**FORWARD CLUTCH AND TURBINE SHAFT**

This task covers:

a. Disassembly (page 2-738)	c. Inspection/Replacement/Repair (page 2-742)
b. Cleaning (page 2-741)	d. Assembly (page 2-743)

INITIAL SETUP**Tools**

Compressor, forward clutch spring
 Compressor, reciprocating air, power driven
 File, fine hand
 Gage, forward clutch
 Goggles, safety
 Gun, air blow
 Hose, air compressor
 Pliers, snapping
 Press, arbor, hand-operated
 Screwdriver, flat-tip, 3/16-inch
 Screwdriver, flat-tip, 1/4-inch
 Shim stock, steel, 0.20- x 32-inch
 Wire, soft

Materials/Parts

Cloth, crocus (item 7, appendix B)
 Grease, oil soluble (item 21, appendix B)
 Packing, preformed, piston (two required)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Forward range clutch removed from transmission (page 2-650).

2-737

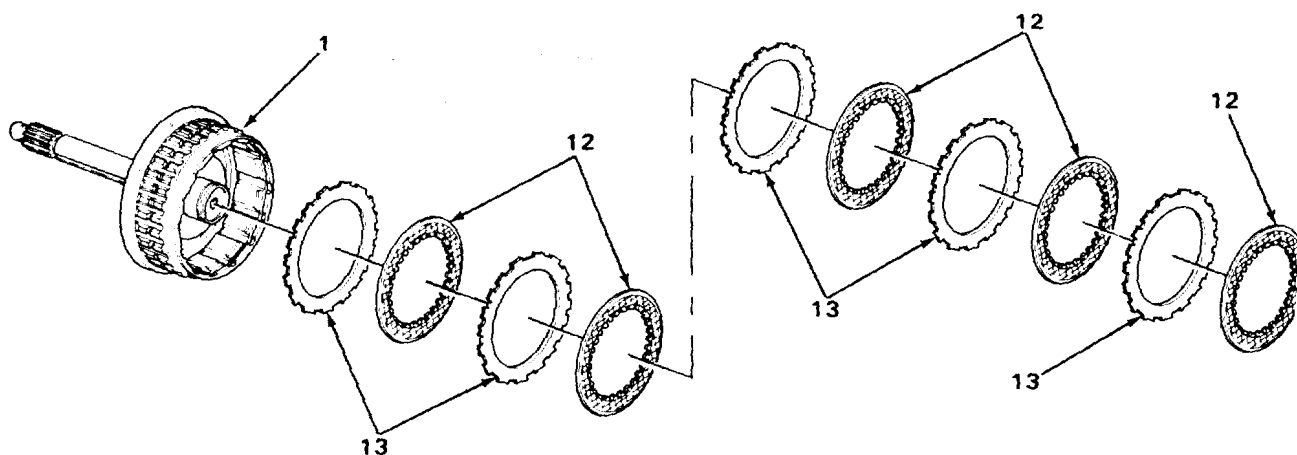
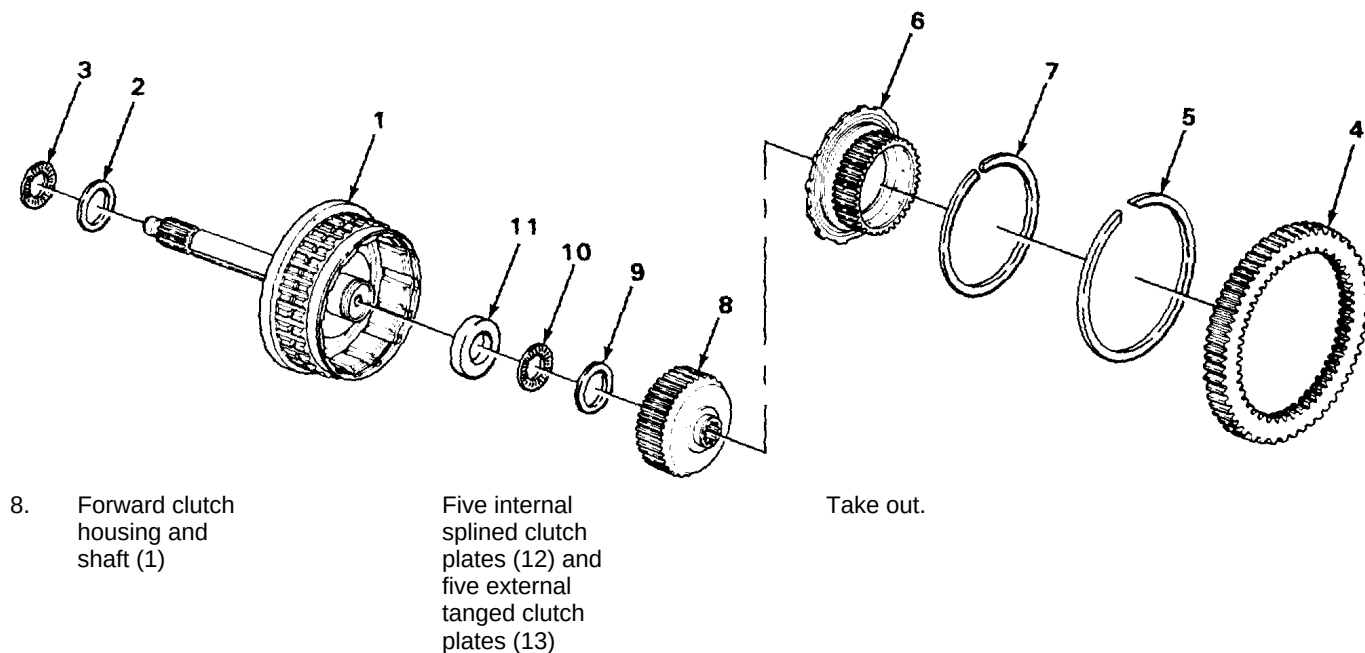
FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY		
1. Forward clutch housing and shaft (1)	Bearing race (2) and roller bearing assembly (3)	Take off.
2.	Power takeoff gear (4) and snapring (5)	a. Using 3/16-inch flat-tip screwdriver, at the cutout nearest snapring gap, press snapring (5) into its groove. b. Slip a piece of shim stock between snapring (5) and inner splines of power takeoff gear. c. Repeat above action 180° from snapring gap. d. Repeat action at every cutout, approximately every 3 inches (76 mm). e. Push gear (4) from clutch housing. If gear binds, look for area of interference and press snapring there.
3. b. Take off shim stock.	Snapring (5)	a. Using snapring pliers take off.
4. Fourth clutch driving hub (6)	Snapring (7)	Using 1/4-inch flat-tip screwdriver, take out.
5. Forward clutch hub (8)	Fourth clutch driving hub (6)	Take out.
6. Forward clutch housing and shaft (1)	Forward clutch hub (8)	Take out.
7.	Bearing race (9), roller bearing assembly (10), and bearing race (11)	Take out.

FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

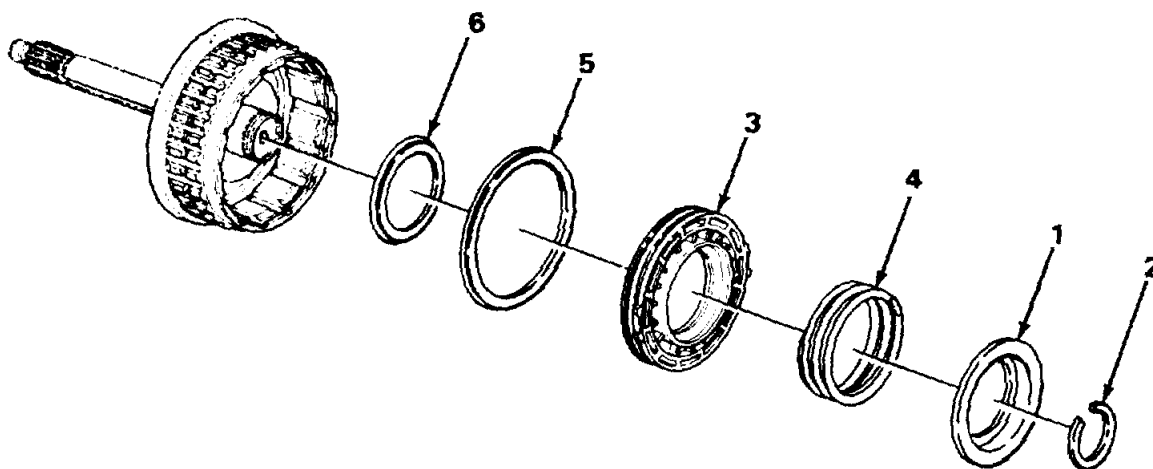
DISASSEMBLY - CONTINUED



TA238453

FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
9.	Retainer (1)	Snapping (2)	a. Place forward clutch housing, with shaft down, in an arbor press. b. Using forward clutch compressor press on retainer (1). c. Using snapping pliers, take out snapping (2).
10.	Piston (3)	Retainer (1)	Take off.
11.	Piston return	Take off. spring (4)	
12.	Packing (5)		a. Take out. b. Get rid of.
13.	Packing (6)		a. Take out. b. Get rid of.



TA238454

FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily: Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious Injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

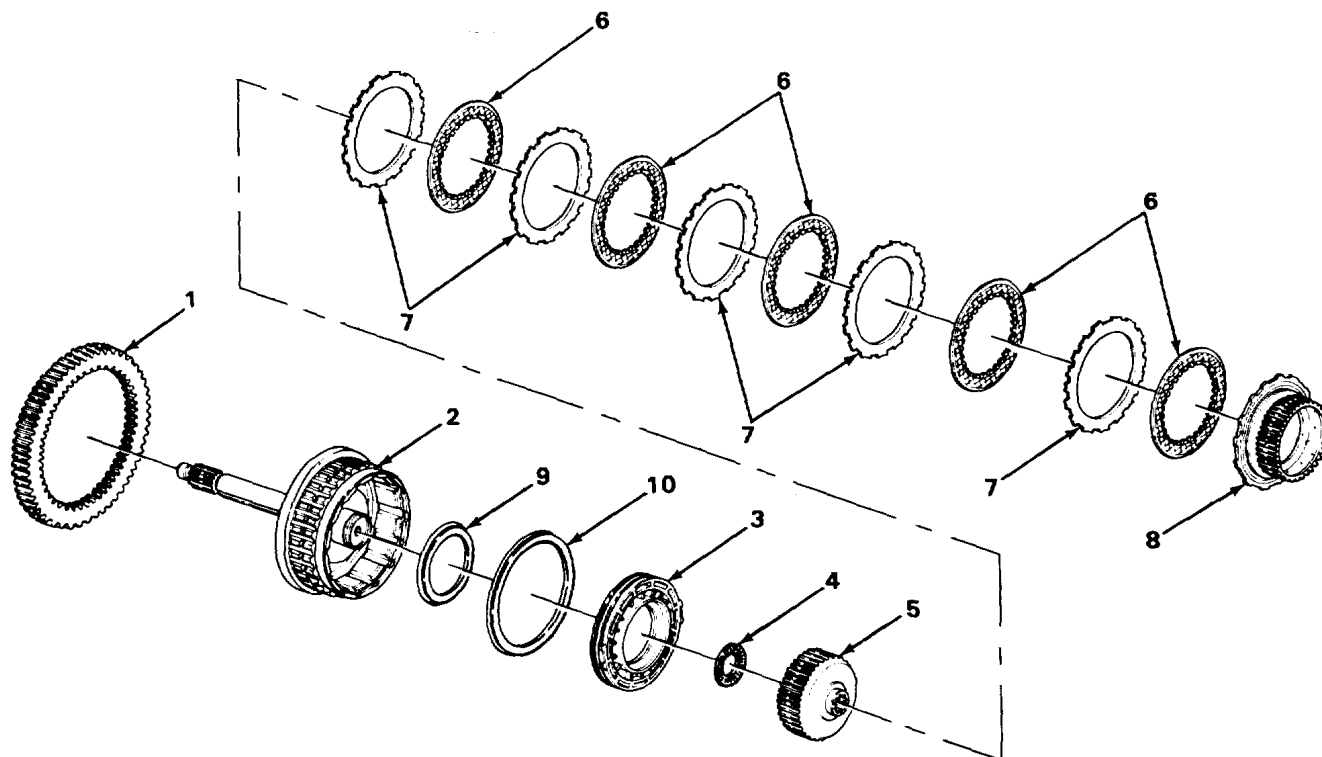
14.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with a piece of soft wire and by flushing with drycleaning solvent.
15.	All bearings	Clean (TM 9-214).

FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.			
16.	Power takeoff gear (1)	a. Look for chipped, cracked, or burred inner splines or outer drive teeth. b. Remove burrs with crocus cloth or fine hand file.	
17.	Forward clutch housing and turbine shaft (2)	a. Look for burrs on turbine shaft splines, outer gear splines, and on inner clutch plate grooves. b. Remove burrs with crocus cloth or fine hand file. c. Check that balls in clutch housing move freely in their bores.	
18.	Forward clutch piston (3)	a. Look for burrs, nicks, or scratches on inner and outer diameters. b. Remove light scratches or burrs with crocus cloth or fine hand file.	
19.	Roller bearing assembly (4)	Inspect (TM 9-214).	
20.	Forward clutch hub (5)	a. Look for burrs on inner and outer splines. b. Remove burrs with crocus cloth or fine hand file.	
21.	Internal splined clutch plates (6)	Look for worn, pitted areas on friction material.	
22.	External tapered clutch plates (7)	a. Look for burrs, heat discoloration, and wear. b. Remove burrs with crocus cloth or fine hand file.	
23.	Fourth clutch driving hub (8)	a. Look for burrs on inner and outer splines. b. Remove burrs with crocus cloth or fine hand file.	

FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
NOTE If packings are not positioned correctly, the forward clutch will not operate properly.			
24.	Forward clutch housing and turbine shaft (2)	New packing (9)	a. Position the clutch housing and shaft with the shaft facing downward. b. Lubricate packing (9) with oil soluble grease. c. Put in position. Seal lip must face out and down or toward closed end of housing.
25.	Forward clutch piston (3)	New packing (10)	a. Lubricate with oil soluble grease. b. Position in groove. Seal lip must face out and toward pressure side of piston.
26.	Forward clutch housing and turbine shaft (2)	Forward clutch piston (3)	Place in position.

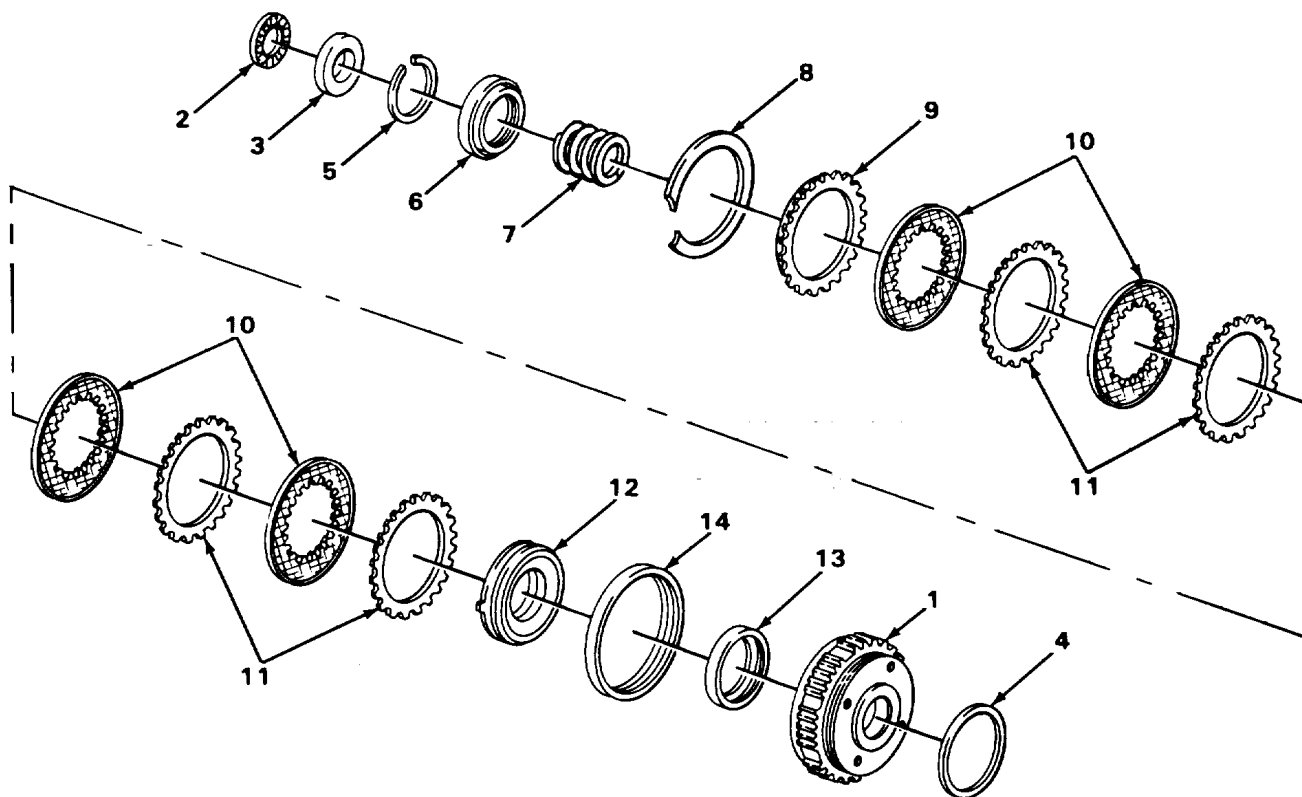


FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
NOTE Steps 27 thru 30 are performed to check forward clutch running clearance.			
27.	Forward clutch housing and turbine shaft (1)	Five external tanged clutch plates (2) and five internal splined clutch plates (3)	Put an external tanged clutch plate in position, followed with an internal splined clutch plate, until all 10 plates are in place.
28.	Fourth clutch driving hub (4)	Put in position.	
29.	Snapring (5)	Using 1/4-inch flat-tip screwdriver, put in.	
30.	Fourth clutch driving hub (4) and internal splined clutch plate (3)	Press on hub (4) firmly, and using forward clutch gage, check clearance between hub first internal splined plate.	The clearance should be 0.072 - 0.130-inch (1.83 - 3.30 mm). If the clearance is correct, smaller end of gage will fit between hub and top clutch plate and the larger end of the gage will not. If the larger end fits, the clearance is too great. To reduce clearance, replace thinnest plates with new thicker plates. If necessary, replace hub with thicker hub. If required, replace piston with new thicker piston. If the smaller end of gage will not fit, clearance is too little. To increase clearance, replace piston with a thinner piston.
31.	Snapring (5)	Using 1/4-inch flat-tip screwdriver, take out.	
32.	Fourth clutch driving hub (4)	Take out.	

FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
33.	Five internal splined clutch plates (3) and five external tanged clutch plates (2)	Take out.	
34. Piston (6)	Piston return spring (7) and retainer (8)	a. Place housing (1) on arbor press bed with shaft down. b. Place in position.	
35.	Snapring (9)	a. Using forward clutch spring compressor and arbor press, press spring retainer below snapring groove. b. Put in snapring (9) using snapring pliers. c. Take out forward clutch spring compressor.	



FORWARD CLUTCH AND TURBINE SHAFT - CONTINUED

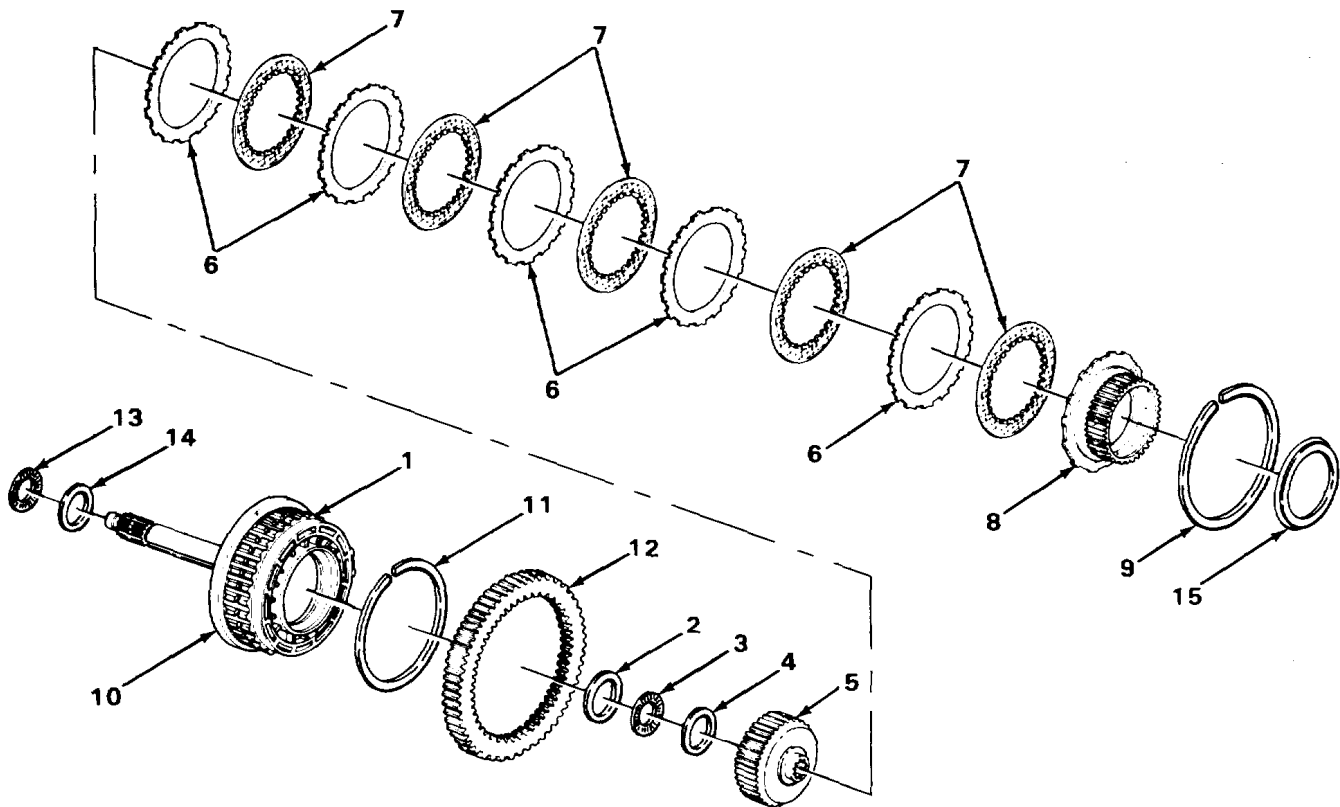
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
36.	Piston (1)	Bearing race (2), roller bearing assembly (3), b. and bearing race (4)	a. Place clutch housing and shaft on a clean workbench. Lubricate races and bearing with oil soluble grease. Use enough grease to hold races and bearing in place to prevent damage to bearing while clutch is being assembled. c. With outer lip first, place bearing race (2) in position. d. Put roller bearing assembly (3) in position. e. Put bearing race (4) in position.
37.		Forward clutch hub (5)	Place in position.
38.	Forward clutch hub (5)	Five external tanged clutch plates (6) and five internal splined clutch plates (7)	Put an external tanged plate in position followed by an internal splined plate until all 10 clutch plates are in place.
39.	Ten clutch plates (6) and (7)	Fourth clutch driving hub (8)	Place in position.
40.		Snapring (9)	Using 1/4-inch flat-tip screwdriver, put in.
41.	Forward clutch housing and turbine shaft (10)	Snapring (11)	Using snapring pliers, put on.
42.		Power takeoff gear (12)	From rear of clutch housing, with chamfered inside diameter first, and using 3/8-inch flat-tip screwdriver, slide into position over snapring while prying up on snapring.
43.		Roller bearing race (13)	a. Lubricate with oil soluble grease. b. Place in position at base of shaft (10).
44.		Roller bearing (14)	a. Lubricate with oil soluble grease. b. Place in position at base of shaft (10).

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

45.
- Race (15)
- a. Lubricate with oil soluble grease.

b. With outer lip first, place in position.



NOTE

FOLLOW-ON MAINTENANCE: Install forward range clutch (page 2-650).

TASK ENDS HERE

TA238457

FOURTH RANGE CLUTCH

This task covers:

a. Disassembly (page 2-748)	c. Inspection/Replacement/Repair (page 2-750)
b. Cleaning (page 2-750)	d. Assembly (page 2-751)

INITIAL SETUP**Tools**

Compressor, clutch spring
Compressor, reciprocating air, power driven
File, fine hand
Gage, fourth clutch
Goggles, safety
Gun, air blow
Hose, air compressor
Press, arbor, hand-operated
Screwdriver, flat-tip, 1/4-inch
Wire, soft

Materials/Parts

Cloth, crocus, (item 7, appendix B)
Cloth, emery (item 8, appendix B)
Grease, oil soluble (item 21, appendix B)
Packing, preformed, piston (two required)
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Fourth range clutch removed (page 2-650).

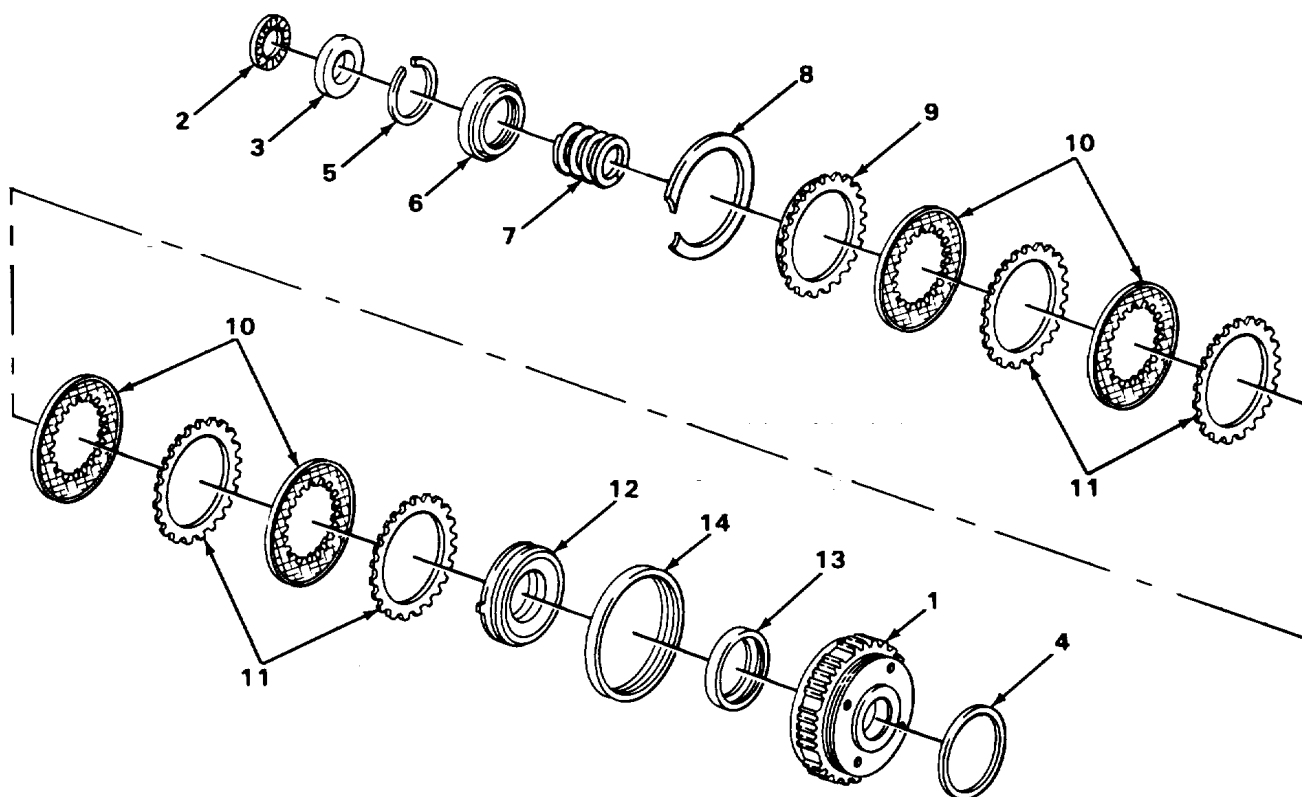
LOCATION		ITEM	ACTION	REMARKS
DISASSEMBLY				
1.	Fourth clutch housing (1)	Roller bearing (2) and race (3)	Take off.	
2.	Bearing race (4)	Take off.		
3.		Snapping (5)	a. Using clutch spring compressor and arbor press, press on retainer (6) to relieve pressure on snapping (5). b. Using 1/4-inch flat-tip screwdriver, take off snapping. c. Take off clutch spring compressor.	
4.		Clutch piston retainer (6)	Take out.	
5.		Spring (7)	Take out.	
6.		Snapping (8)	Using 1/4-inch flat-tip screwdriver, take out.	

FOURTH RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

7.		Backing plate (9)	Take out.
8.		Four internal spline clutch plates (10) and four external tanged clutch plates (11)	Take out.
9.		Piston (12)	Take out.
10.	Piston (12)	Packing (13)	a. Take off. b. Get rid of.
11.	Fourth clutch housing (1)	Packing (14)	a. Take off. b. Get rid of.



TA238458

FOURTH RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

12.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with a piece of soft wire and by flushing with drycleaning solvent.
13.	All bearings	Clean (TM 9-214).

INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

14.	All bearings	Inspect (TM 9-214).
15.	Backing plate (1) and external tanged plates (2)	a. Look for burrs, heat discoloration, and wear. b. Remove burrs with emery cloth or fine hand file.
16.	Internal splined clutch plates (3)	Look for worn, pitted areas on friction material.
17.	Piston (4)	a. Look for burrs, nicks, or scratches on inner and outer diameters. b. Remove light scratches or burrs with crocus cloth or fine hand file.

FOURTH RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT/REPAIR - CONTINUED

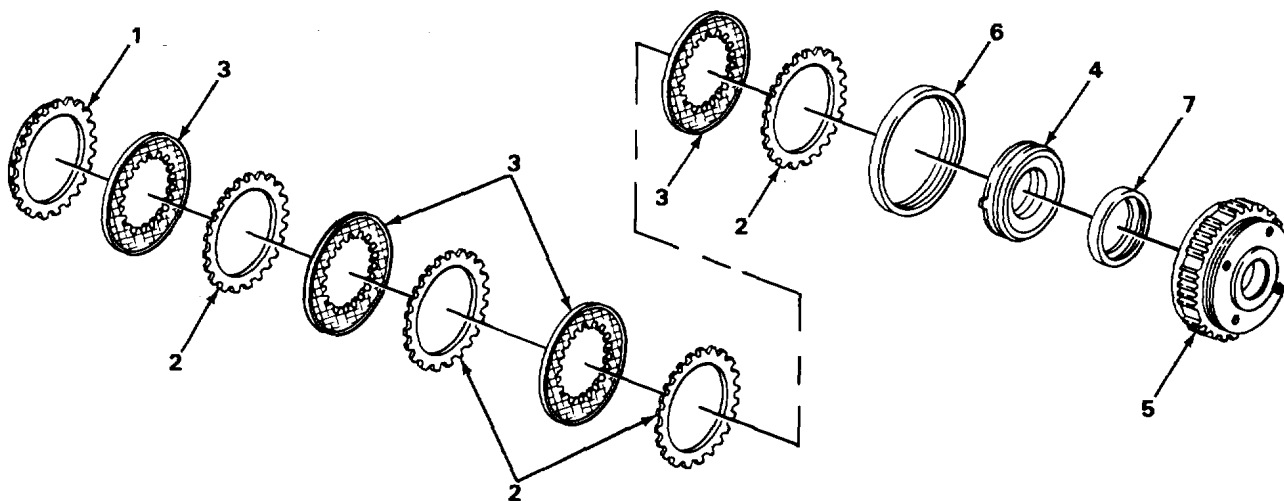
18.	Fourth clutch housing (5)	a. Look for burrs on outer splines and on inner clutch plate grooves. b. Remove burrs with emery cloth or fine hand file. c. Make sure that check balls move freely in their bores.

ASSEMBLY

NOTE

If packings are not positioned correctly, the fourth range clutch will not operate properly.

19.	Fourth clutch housing (5)	New packing (6) a. Lubricate with oil soluble grease. b. Put on hub. Seal lip must face out and down, towards closed end of housing.
20.	Piston (4)	New packing (7) a. Lubricate with oil soluble grease. b. Put on. Seal lip must face out, towards pressure side of piston.



2-751

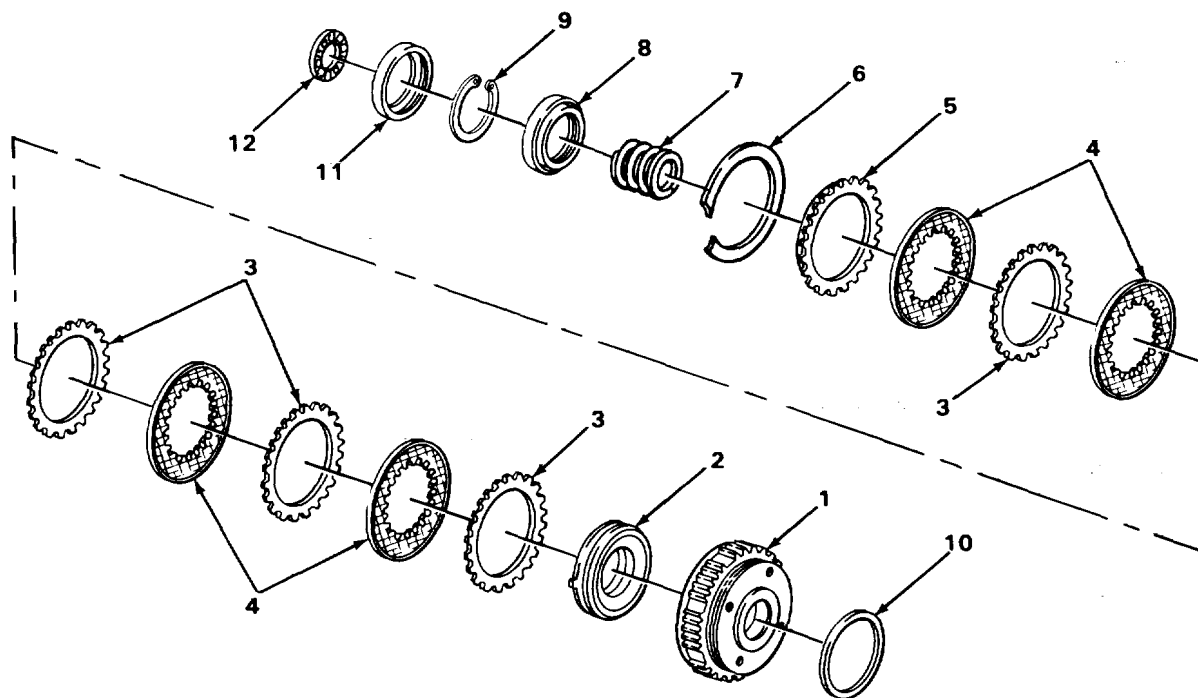
TA238459

FOURTH RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
NOTE Steps 21 thru 25 are performed to check fourth range clutch running clearance.			
21. Fourth clutch housing (1)	Piston (2)	Put in position.	
22.	Four external tanged clutch plates (3) and four internal splined clutch plates (4)	Put an external tanged clutch plate in position, and follow with an internal clutch plate, until all eight clutch plates are in place.	
23.	Backing plate (5)	Put in position with flat side down.	
24.	Snapping (6)	Using 1/4-inch flat-tip screwdriver, put in place.	
25.	Backing plate (5) and internal splined clutch plate (4)	Press on backing plate firmly and using fourth clutch gage, check clearance between backing plate and first internal splined plate.	The clearance should be 0.064-0.118 inch (1.63-3.00 mm). If the clearance is correct, smaller end of fourth clutch gage will fit between hub and top and larger end of the gage will not. If larger end of gage fits, the clearance is too great. To reduce clearance, replace thinner clutch plates with new plates. If all plates and the backing plate have been replaced and the clearance is too great, replace piston with a thicker piston. If the smaller end of the fourth clutch gage will not fit, clearance is too little. To increase clearance, replace piston with a thinner piston.
26.	Spring (7) and clutch piston retainer (8)	a. Put in position. b. Using clutch spring compressor and arbor press, press retainer below snapping groove.	

FOURTH RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
27.	Snapring (9)	a. Put in position. b. Using 1/4-inch flat-tip screwdriver, put in.	
28. Fourth clutch housing (1)	Bearing race (10)	a. Lubricate with oil soluble grease. b. With outer lip first, put in position.	
29.	Bearing race (11)	a. Lubricate with oil soluble grease. b. With outer lip first, put in position.	
30.	Roller bearing (12)	a. Lubricate with oil soluble grease. b. Put in position.	



TA238460

FOURTH RANGE CLUTCH - CONTINUED**ASSEMBLY CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install fourth range clutch (page 2-650).

TASK ENDS HERE**THIRD RANGE CLUTCH, CENTER SUPPORT, AND SECOND RANGE CLUTCH**

This task covers:

a. Disassembly (page 2-754)	c. Inspection/Replacement/Repair (page 2-756)
b. Cleaning (page 2-756)	d. Assembly (page 2-758)

INITIAL SETUP**Tools**

Compressor, reciprocating air,
power driven
File, fine hand
Goggles, safety
Gun, air blow
Hose, air compressor
Installer, lockring
Pliers, diagonal cutting
Screwdriver, flat-tip, 1/4-inch
Wire, soft, 12-inch
One

Materials/Parts - Continued

Packing, preformed, third clutch piston
(two required)
Packing, preformed, second clutch piston
(two required)
Rings, retainer, self-locking (eight required)
Solvent, drycleaning (item 49, appendix B)

Materials/Parts

Cloth, crocus (item 7, appendix B)
Grease, oil soluble (item 21,
appendix B)

Equipment Condition

Third range clutch, center support, and
second range clutch removed (page 2-650).

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY

1. Center support (1)	Third clutch piston (2) and attached parts	Using 1/4-inch flat-tip screwdriver, pry up and take out.
2. Third clutch piston (2)	Packings (3) and (4)	a. Take off. b. Get rid of.

THIRD RANGE CLUTCH, CENTER SUPPORT, AND SECOND RANGE CLUTCH - CONTINUED

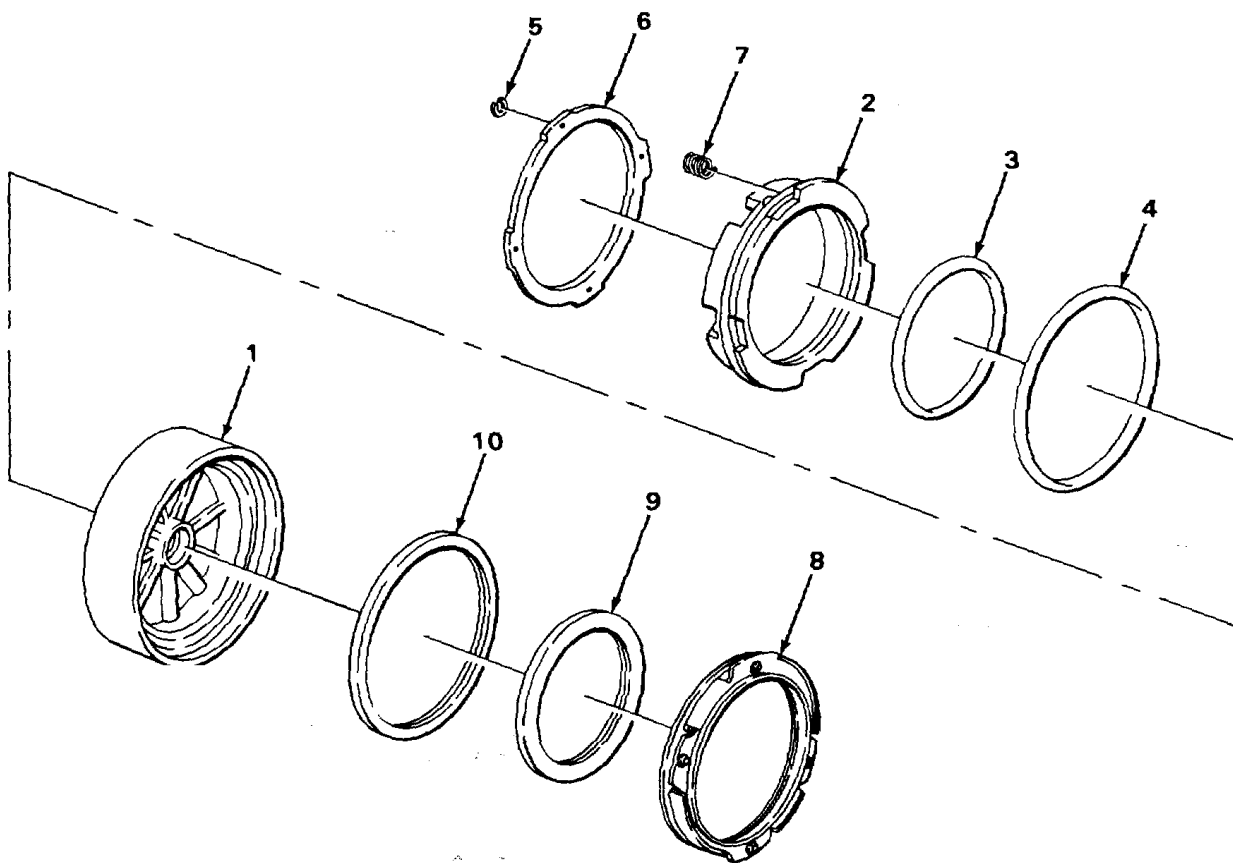
LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

NOTE

Do not disassemble third clutch piston assembly unless parts replacement is necessary.

3.	Third clutch piston (2)	Four retainer rings (5)	a. Using diagonal cutting pliers, cut and gradually take off in order. b. Get rid of.
4.		Third clutch spring retainer (6) and 20 springs (7)	Take off.
5.	Center support (1)	Second clutch piston (8) and attached parts	Take out.
6.	Second clutch piston (8)	Packing (9) and (10)	a. Take off. b. Get rid of.



THIRD RANGE CLUTCH, CENTER SUPPORT, AND SECOND RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
7.	Second clutch piston (1)	Four retainer rings (2)	a. Using diagonal cutting pliers, cut and gradually take off in order. b. Get rid of.
8.	Second clutch spring retainer (3) and 20 springs (4)		Take off.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

9.	All metal parts	a. Clean in drycleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with a piece of soft wire and by flushing with drycleaning solvent.

INSPECTION/REPLACEMENT/REPAIR

NOTE

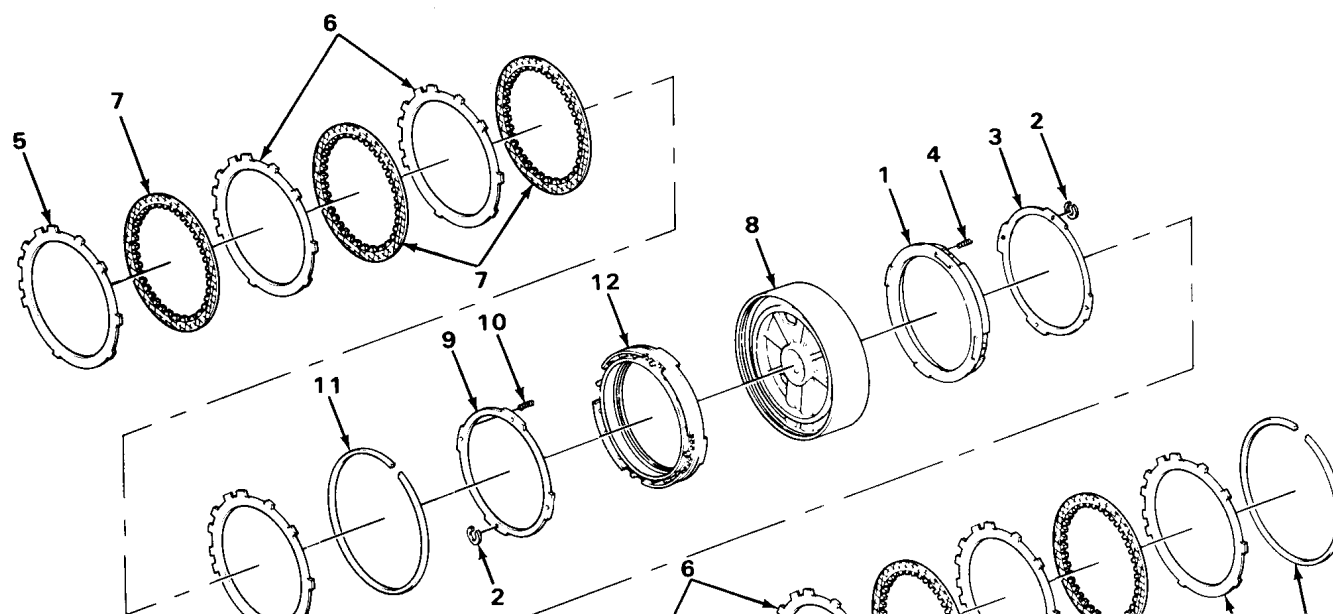
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts, as needed.

10.	Backing plates (5) and external tanged	a. Look for burrs, heat marks, and wear. b. Remove burrs with a crocus cloth or clutch plates (6) fine hand file.
11.	Internal splined clutch plates (7)	a. Look for heat marked, worn, or pitted areas.

THIRD RANGE CLUTCH, CENTER SUPPORT, AND SECOND RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
11. Continued		b.	Look for worn splines.
12.	Third clutch piston (8), retainer (9), second clutch piston (1), and retainer (3)	a. b.	Look for burrs or nicks. Remove burrs and nicks with crocus cloth.
13.	Third clutch springs (10) and second clutch springs (4)	a. b.	Look for springs that are discolored from heat. Look for springs that have taken set.
14.	Retainer rings (2) and snap-rings (11) and third clutch spring retainer (12)	a. b. c. d.	Look for burrs. Look for heavy wear. Look for cracked or broken hooks. Remove burrs with crocus cloth.

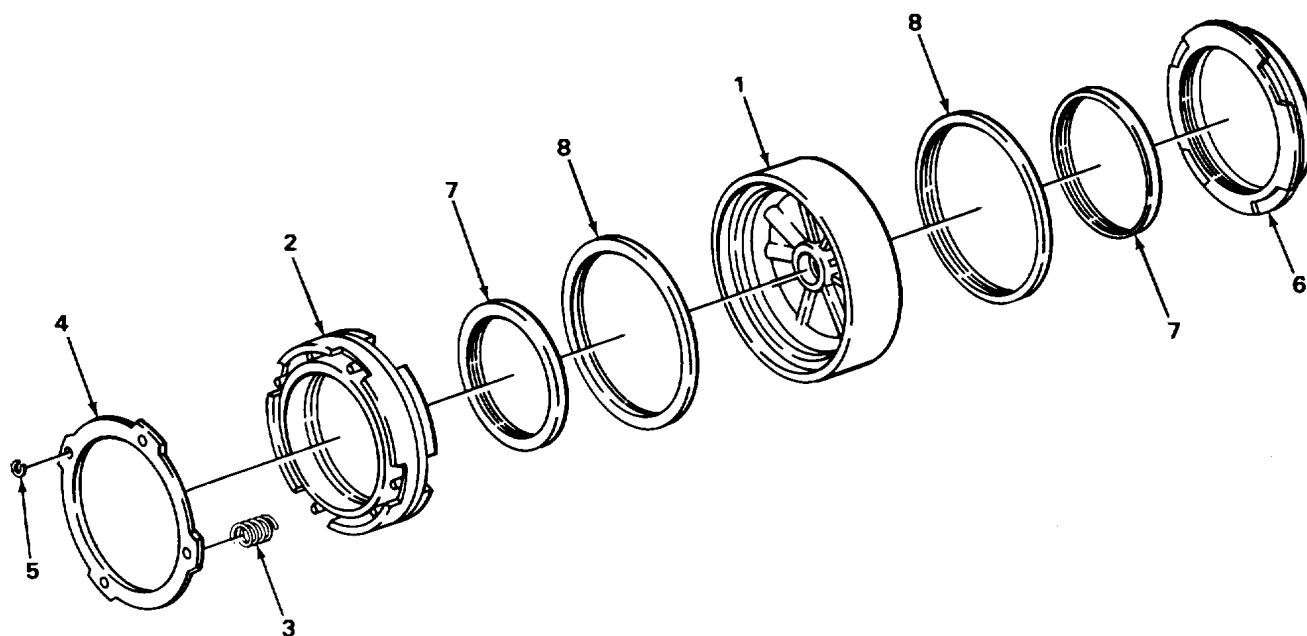


THIRD RANGE CLUTCH, CENTER SUPPORT, AND SECOND RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY		
15. Center support (1)	Third clutch piston (2)	a. Align square lug on piston bottom with square recess in center support (1). b. Press into place in front bore.
16. Third clutch piston (2)	20 springs (3)	Position in pockets.
17.	Clutch spring retainer (4)	a. Align holes in retainer (4) with pins on piston (2). b. Put on and press down. Piston must be bottomed in its bore when retaining rings are installed to give proper clutch clearance.
18.	Four new retaining rings (5)	a. Put in position. b. Using lockring installer, press onto pins.
19. Center support (1)	Third clutch piston (2)	a. Take out. b. Repeat steps 15 thru 19 to assemble second clutch piston, except use rear bore in center support (1). Line up square lug on piston bottom with square recess in center support.
20. Third clutch piston (2) and second clutch piston (6)	New inner packing (7) and new outer packing (8)	a. Lubricate with oil soluble grease. b. Put in position so lip of seals face oil pressure side of piston. If seals are not assembled correctly, the clutches will not operate properly.
21. Center support (1)	Second clutch piston with attached parts (6)	a. Place in position. b. Press into rear bore.
22.	Third clutch piston with attached parts (2)	a. Place in position. b. Press into front bore.

THIRD RANGE CLUTCH, CENTER SUPPORT, AND SECOND RANGE CLUTCH - CONTINUED

ASSEMBLY - CONTINUED

**NOTE**

FOLLOW-ON MAINTENANCE: Install second range clutch, center support, and third range clutch (page 2-650).

TASK ENDS HERE

TA238463

GEAR UNIT AND MAIN SHAFT

This task covers:

a. Disassembly (page 2-760)	c. Inspection/Replacement/Repair (page 2-764)
b. Cleaning (page 2-762)	d. Assembly (page 2-764)

INITIAL SETUP**Tools**

Bit, drill twist, 1/4-inch
Compressor, reciprocating air, power driven
Drill, electric, portable
Goggles, safety
Gun, air blow
Hammer, ball-peen, machinist's
Hose, air compressor
Installer, lubrication orifice plug
Pliers, snapping
Screwdriver, flat-tip, 3/16-inch
Screwdriver, flat-tip, 3/8-inch
Screwdriver, flat-tip, 1/4-inch
Stone, soft
Wire, soft, 12-inch

Materials/Parts

Cloth, crocus (item 7, appendix B)
Grease, oil soluble (item 21, appendix B)
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

Gear unit removed (page 2-650).

LOCATION	ITEM	ACTION	
		REMARKS	

DISASSEMBLY

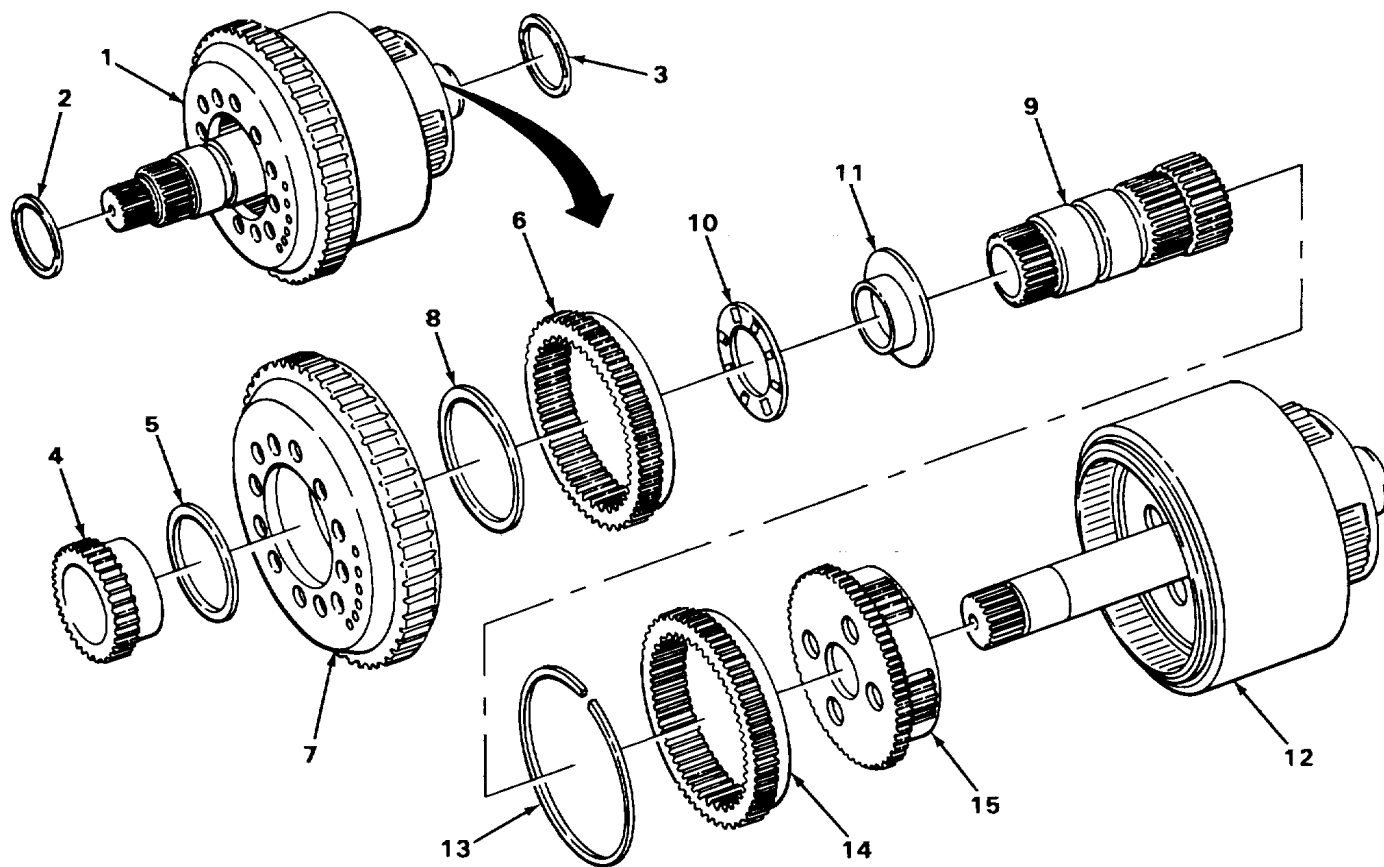
1.	Gear unit and main shaft (1)	Sun gear thrust washers (2) and (3)	Take off.
2.	Front sun gear (4)	Take out.	
3.	Front sun gear (4)	Sun gear thrust washer (5)	Take off.
4.	Front planetary ring gear (6)	Front carrier assembly (7)	Lift off.
5.	Front carrier assembly (7)	Planetary carrier thrust washer (8)	Take off.
6.	Gear unit and main shaft (1)	Center sun gear shaft (9)	Take out.

GEAR UNIT AND MAIN SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

7.	Center sun gear shaft (9)	Bearing assembly (10) and race (11)	Take off.
8.	Planetary carrier drum (12)	Snapping (13)	Using 1/4-inch flat-tip screwdriver, take out.
9.		Front planetary ring gear (14)	Take out.
10.		Center planetary	Take out. carrier assembly (15)



TA238464

GEAR UNIT AND MAIN SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
11.	Planetary carrier drum (1)	Main shaft (2) and attached parts	Take out.
12.	Main shaft (2)	Snapring (3)	Using 3/16-inch flat-tip screwdriver, take off.
13.	Center planetary ring gear (4)	Main shaft (2)	Take out.
NOTE Do not remove plug unless it is damaged.			
14.	Main shaft (2)	Lubrication orifice	a. Using electric drill and 1/4-inch plug (5)drill twist bit, drill out. b. Get rid of.
15.	Rear planetary sun gear (6)	Snapring (7)	)Using snapring pliers, take off.
16.	Center planetary ring gear (4)	Rear planetary sun gear (6)	Take out.
17.	Planetary carrier drum (1)	Snapring (8)	Using 3/8-inch flat-tip screwdriver, take out.
18.		Rear planetary carrier assembly (9)	Take out.
19.	Rear planetary carrier assembly (9)	Roller bearing (10)	Take out.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

LOCATION	ITEM	ACTION	REMARKS

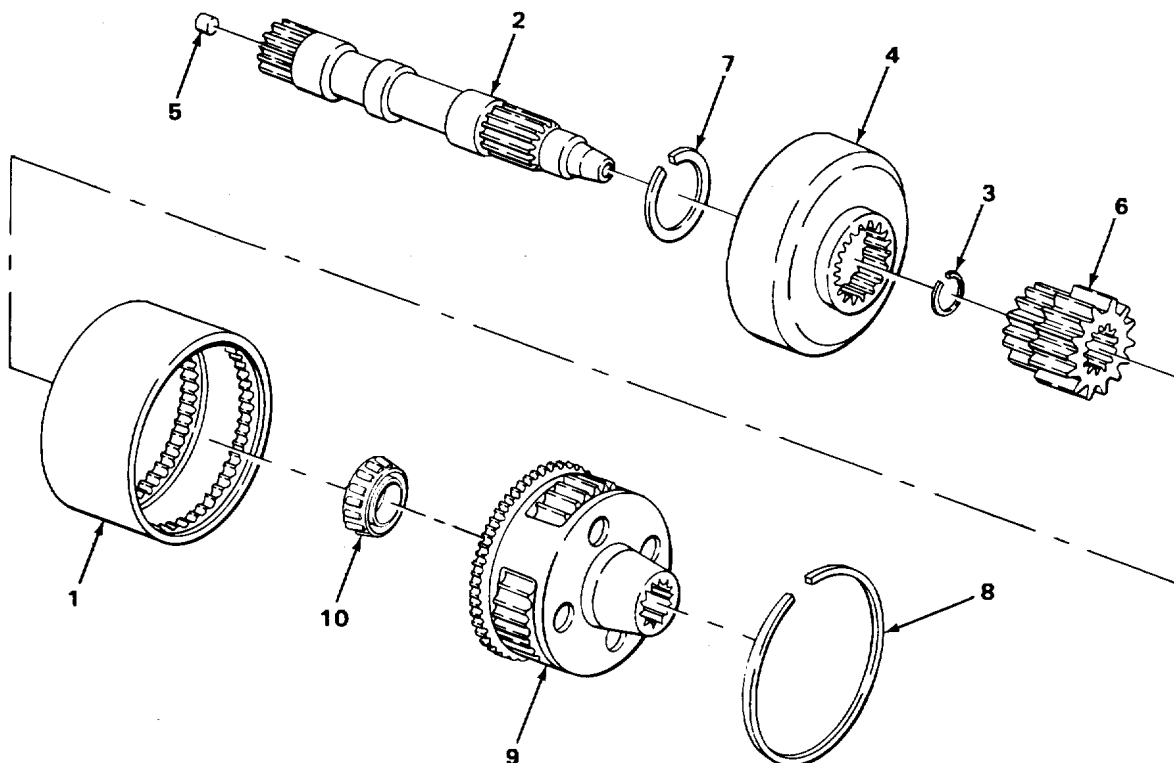
CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

20.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with a piece of soft wire and by flushing with drycleaning solvent.
21.	All bearings	Clean (TM 9-214).



2-763

TA238465

GEAR UNIT AND MAIN SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts, as needed.

22.	All gears	a. Look for scuffed areas and nicked, burred, and broken teeth. If defects cannot be removed with a soft stone, replace the gear or assembly. b. Look for wear that has changed shape of gear. If found, replace gear or assembly.
23.	All splined parts	a. Look for stripped, twisted, chipped, or burred splines. Remove burrs with a soft stone. Replace part if defects cannot be removed. b. Look for spline wear. If wear affects tightness of fit, replace part.
24.	All bearings	Inspect (TM 9-214).
25.	All bushings	a. Look for scores, burrs, out-of-round, and signs of overheating. b. Remove scores and burrs with crocus cloth. c. If defects cannot be removed, replace the assembly.

ASSEMBLY

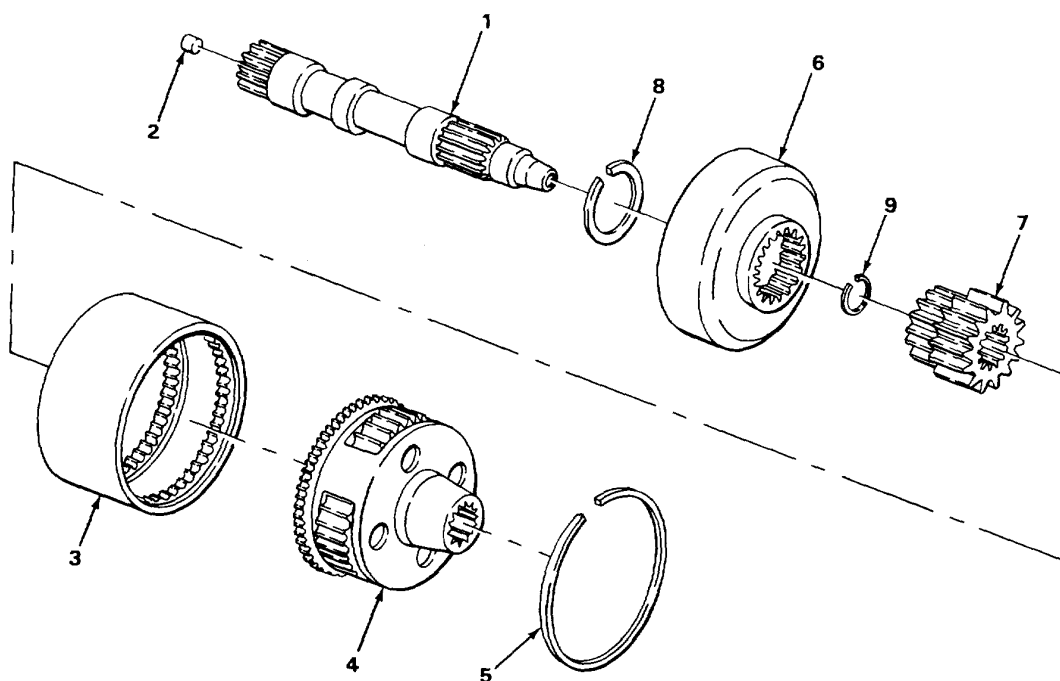
NOTE

If the lubrication orifice plug was not removed, skip step 26.

26. Main shaft (1)	New lubrication orifice plug (2)	a. Place in position with small orificed end first. b. Using orifice plug installer and ball-peen hammer, tap into place.

GEAR UNIT AND MAIN SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
27.	Planetary carrier drum (3)	Rear planetary carrier assembly (4)	With drum (3) facing with long internal splines down, place in position.
28.		Snapring (5)	Using 1/4-inch flat-tip screwdriver, put in.
29.	Center planetary ring gear (6)	Rear planetary sun gear (7)	Place in position.
30.	Rear planetary sun gear (7)	Snapring (8)	a. Put in position. b. Using snapring pliers, put on.
31.		Main shaft (1)	Put into position.
32.	Main shaft (1)	Snapring (9)	a. Put in position. b. Using 3/16-inch flat-tip screwdriver, put on.
33.	Planetary carrier drum (3)	Main shaft (1) and center planetary ring gear (6) and rear planetary sun gear (7)	Put into position. Rear sun gear must seat against bearing in carrier.



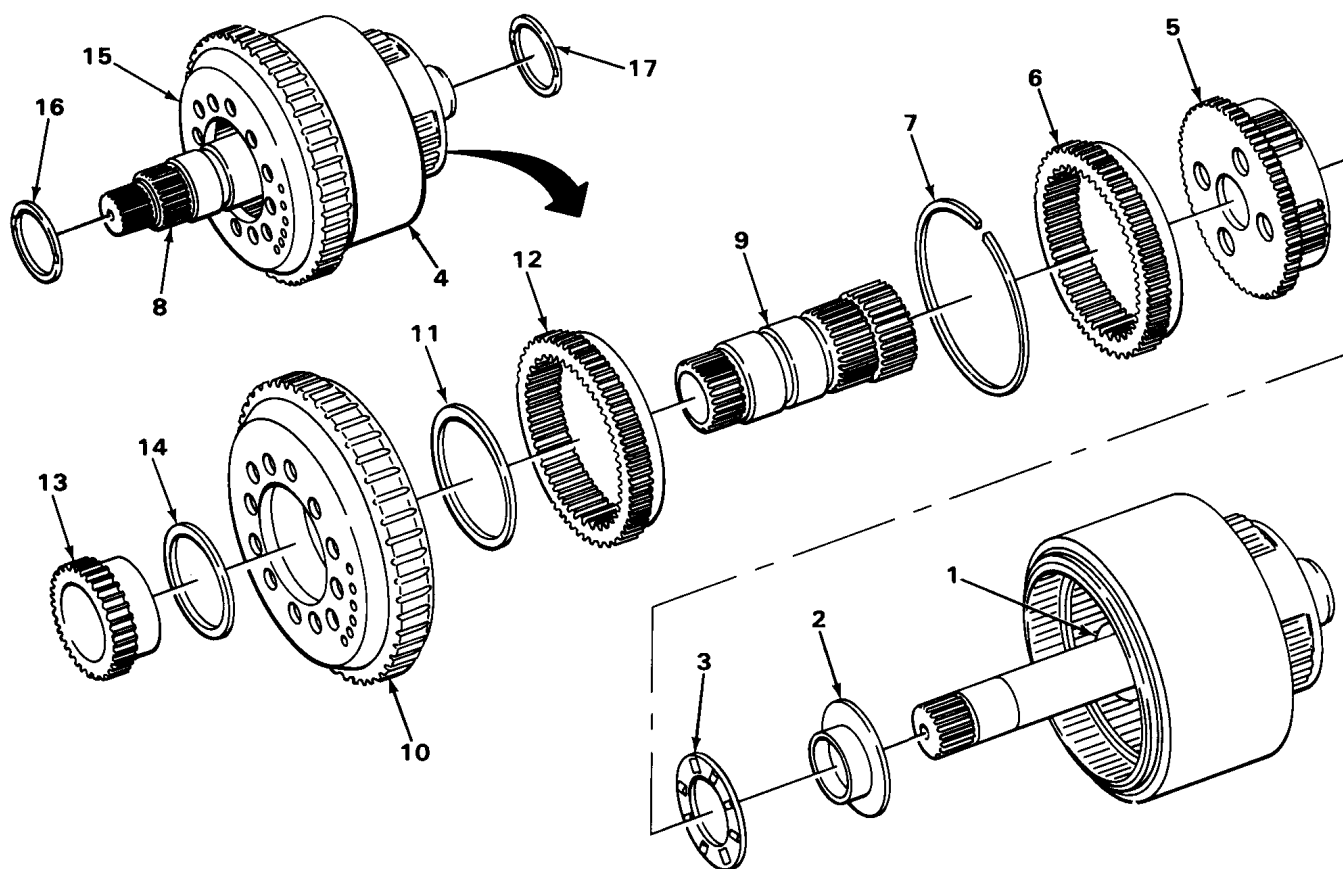
TA238466

GEAR UNIT AND MAIN SHAFT - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
34. Rear planetary sun gear (1)	Bearing race (2) and needle bearing assembly (3)	a. Lubricate with oil soluble grease. b. Put in position.
35. Center planetary ring gear (4)	Center planetary carrier assembly (5)	Put in position.
36. Center planetary carrier assembly (5)	Front planetary ring gear (6)	Put in position.
37. Front planetary ring gear (6)	Snapring (7)	a. Put in position. b. Using 114-inch flat-tip screw- driver, put in.
38. Main shaft (8)	Center sun gear shaft (9)	Put in position.
39. Front carrier assembly (10)	Planet carrier thrust washer (11)	a. Lubricate with oil soluble grease. b. Put in position.
40. Front planetary ring gear (12)	Front carrier assembly (10)	Put in position.
41. Front sun gear (13)	Sun gear thrust washer (14)	a. Lubricate with oil soluble grease. b. Put in position.
42. Center sun gear shaft (9)	Front sun gear (13)	a. Align gap in internal splines with pin on shaft. b. Put on.
43. Gear unit and main shaft (15)	Sun gear thrust washers (16) and (17)	a. Lubricate with oil soluble grease. b. Put in position.

GEAR UNIT AND MAIN SHAFT - CONTINUED

ASSEMBLY - CONTINUED



NOTE

FOLLOW-ON MAINTENANCE: Install gear unit (page 2-650).

TASK ENDS HERE

TA238467

FIRST RANGE CLUTCH

This task covers:

a. Disassembly (page 2-768)	c. Inspection/Replacement/Repair (page 2-769)
b. Cleaning (page 2-768)	d. Assembly (page 2-770)

INITIAL SETUP**Tools**

Compressor, reciprocating air,
power driven
File, fine hand
Goggles, safety
Gun, air blow
Hose, air compressor
Screwdriver, flat-tip, 1/4-inch

Personnel Required

One

Equipment Condition

First range clutch, backing plate, planetary
ring gear and hub assembly removed
(page 2-650).

Materials/Parts

Cloth, crocus (item 7, appendix B)
Solvent, drycleaning (item 49,
appendix B)

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY

1.	Planetary ring gear (1)	Snapping (2)	Using 1/4-inch flat-tip screwdriver, take out.
2.		Clutch ring gear hub (3)	Take out.

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

FIRST RANGE CLUTCH - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

3.	All metal parts	a. Clean in drycleaning solvent. b. Dry parts with compressed air.

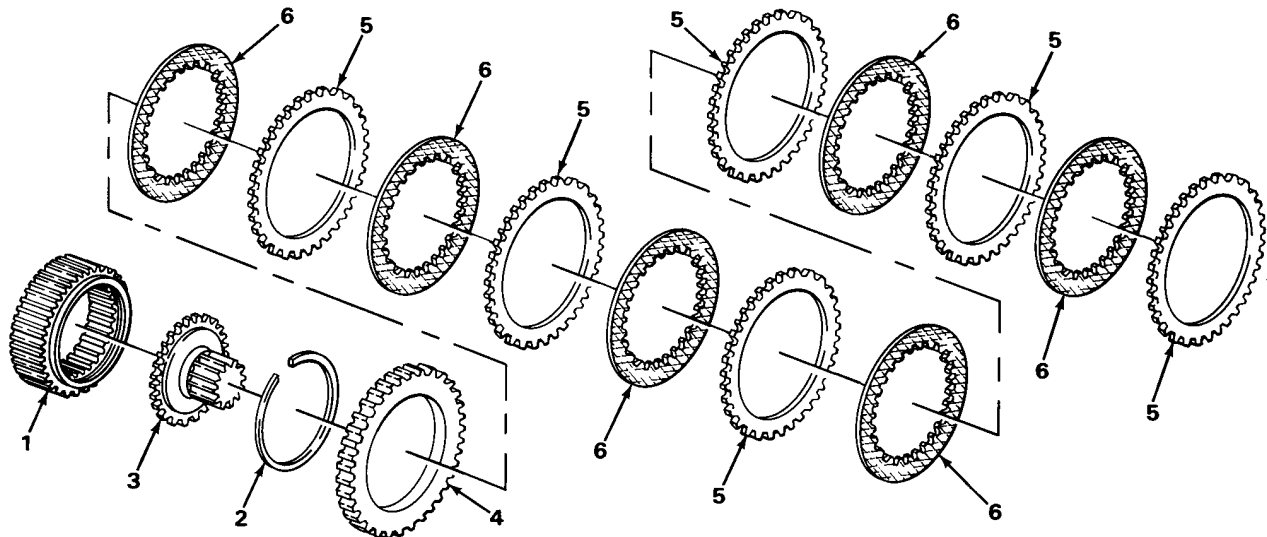
INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

4.	Backing plate (4) and external tanged clutch plates (5)	a. Look for burrs, heat discoloration, and wear. b. Remove burrs with crocus cloth or fine hand file.
5.	Internal splined clutch plates (6)	a. Look for worn, pitted areas on friction material. b. Look for worn splines.



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FIRST RANGE CLUTCH - CONTINUED

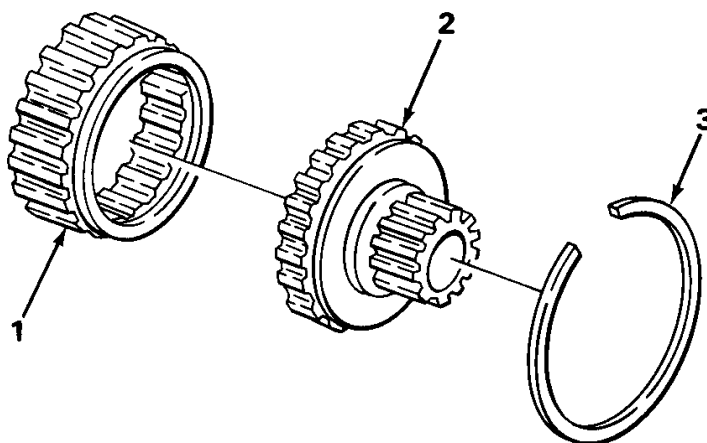
LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT/REPAIR - CONTINUED

6.	Planetary ring gear (1) and clutch ring gear hub (2) hand file.	a. Look for burrs on splines. b. Remove burrs with crocus cloth or fine

ASSEMBLY

7.	Planetary ring gear (1)	Clutch ring gear hub (2)	Put in position.
		Snapping (3)	a. Put in position. b. Using 1/4-inch flat-tip screwdriver, put in.



NOTE

FOLLOW-ON MAINTENANCE: Install first range clutch, backing plate, planetary ring gear and hub assembly (page 2-650).

TASK ENDS HERE

TA238469

REAR COVER AND OUTPUT SHAFT

This task covers:

- a. Disassembly (page 2-772)
- b. Cleaning (page 2-774)
- c. Inspection/Replacement/Repair (page 2-775)
- d. Assembly (page 2-776)

INITIAL SETUP**Tools**

Compressor, low and first clutch
 Compressor, reciprocating air, power driven
 Driftpin, brass, 3/16-inch
 Goggles, safety
 Gun, air blow
 Hammer, ball-peen, machinist's
 Handle, driver
 Handle, ratchet, 3/8-inch drive
 Hose, air compressor
 Installer, dust-shield
 Installer, orifice plug
 Installer, output shaft bearing
 Installer, output shaft oil seal
 Installer, rear bearing
 Key, socket-head screw, 5/16-inch
 Pliers, slip-joint
 Press, arbor, hand-operated
 Remover, rear bearing
 Remover, seal and dust shield
 Screwdriver, flat-tip, 3/8-inch
 Socket, 3/8-inch drive, 7/16-inch
 Socket, 3/4-inch drive, 2 1/8-inch
 Wrench, torque multiplier, 3/4-inch drive, 0 - 1, 000 ft-lb. capacity

Materials/Parts

Cloth, crocus (item 7, appendix B)
 Compound, sealant, non-hardening (item 13, appendix B)
 Grease, oil soluble (item 21, appendix B)
 Packing, preformed, low clutch piston, inner
 Packing, preformed, low clutch piston, outer
 Pin, output shaft spring
 Seal, output shaft bearing
 Solvent, drycleaning (item 49, appendix B)
 Tube, drain, rear cover assembly

Personnel Required

One

Equipment Condition

Rear cover output shaft removed (page 2-650).

2-771

REAR COVER AND OUTPUT SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
1.	Output shaft (1)	Output shaft nut (2)	Hold prop shaft adapter (3), and using 2 1/8-inch socket and torque multiplier wrench with 3/4-inch drive, take off. Nut has been tightened to over 500 ft-lb. (678 N m) of torque.
2.		Prop shaft adapter (3)	Take off.
3.	Rear cover assembly (4)	Output shaft bearing (5), governor drive gear (6), speedometer gear (7), and spacer (8)	Take out.
4.	Output shaft (1)	Spacer (8), speedometer gear (7), and governor drive gear (6)	Take off.
5.		Spring pin (9)	a. Using slip-joint pliers, pull out. b. Get rid of.

NOTE

Do not perform steps (6), (7), and (8) unless part replacement is necessary.

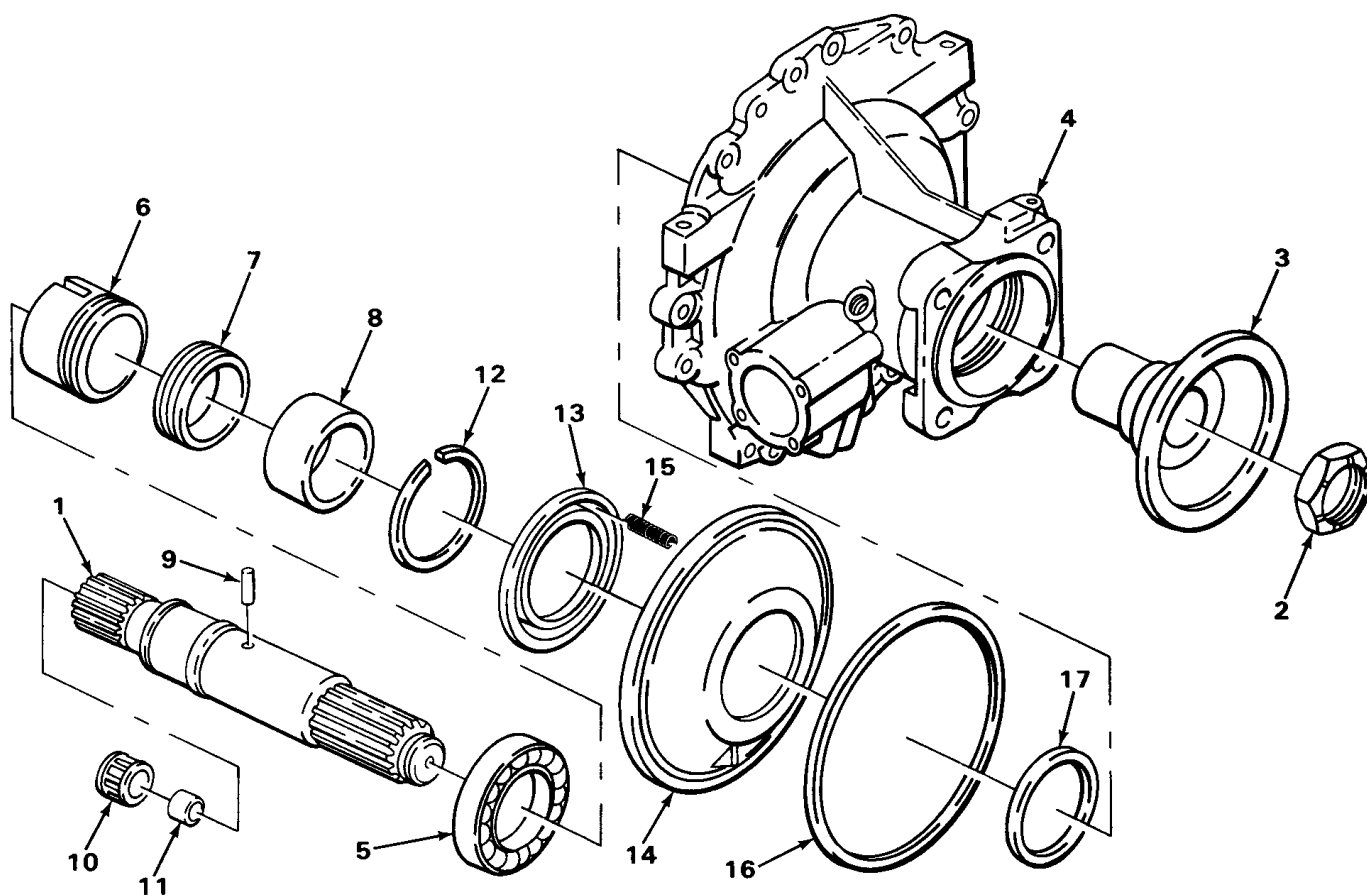
6.		Output shaft bearing (5)	Using an arbor press, press off.
7.		Roller bearing (10)	a. Using rear bearing remover, take out. b. Get rid of.
8.		Cap plug (11)	a. Using 3/8-inch flat-tip screwdriver pry out. b. Get rid of.
9.	Rear cover assembly (4)	Snapping (12)	a. Position cover (4) front side up. b. Using low and first clutch compressor tool and 3/8-inch flat-tip screwdriver, take out. c. Carefully release low and first clutch, and take out.
10.		Spring retainer (13)	Take out.

REAR COVER AND OUTPUT SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

11.	Low clutch piston (14)	26 springs (15)	Take out.
12.	Rear cover assembly (4)	Low clutch piston (14)	Take out.
13.	Low clutch piston (14)	Two packings (16) and (17)	a. Take off. b. Get rid of.



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REAR COVER AND OUTPUT SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
NOTE			
Do not perform steps 14 thru 18 unless part replacement is necessary.			
14. Rear cover assembly (1)	Output shaft bearing dust shield (2)	a. Place rear cover (1) on workbench, front side down. b. Using seal and dust shield remover, take out. c. Get rid of.	
15.	Output shaft bearing seal (3)	a. Using seal and dust shield remover, take out. b. Get rid of.	
16.	Snapring (4)	Using 3/8-inch flat-tip screwdriver, take out.	
17.	Output shaft ball bearing (5)	Take out.	
18.	Snapring (6)	Using 3/8-inch flat-tip screwdriver, take out.	
19.	Two plugs (7)	Using 7/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.	
20.	Drain tube (8)	a. Using slip-joint pliers, pull out. b. Get rid of.	
21.	Governor support pin (9)	Using 3/16-inch brass driftpin and ball-peen hammer, drive out.	
22.	Plug (10)	Using 5/16-inch socket-head screw key, unscrew and take out.	

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

REAR COVER AND OUTPUT SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

23.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Dry parts with compressed air.
24.	All bearings	Clean (TM 9-214).

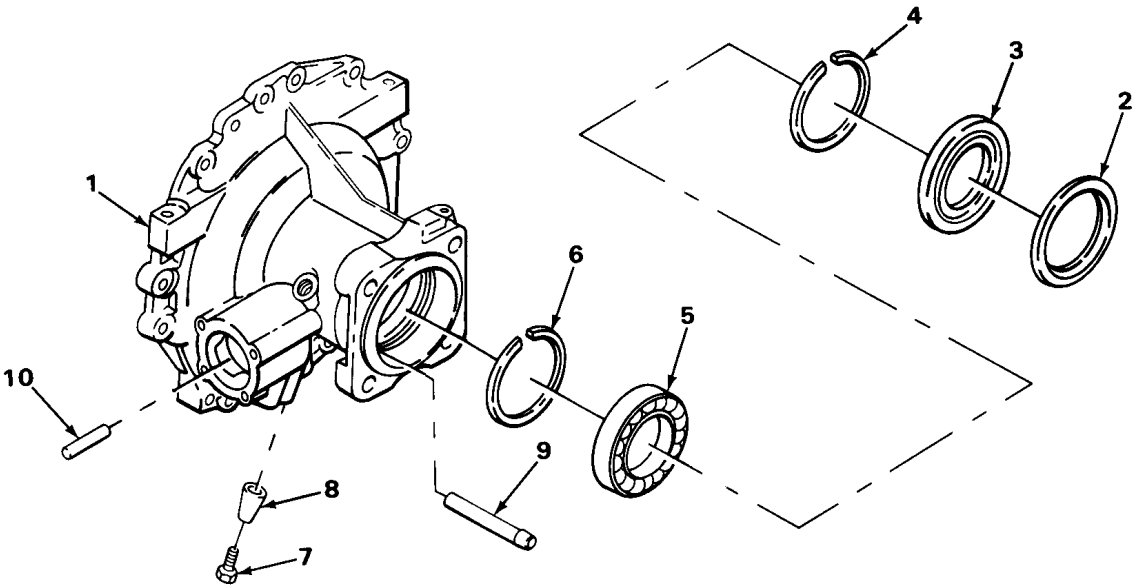
INSPECTION/REPLACEMENT/REPAIR

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

25.	All bearings	Inspect (TM 9-214).



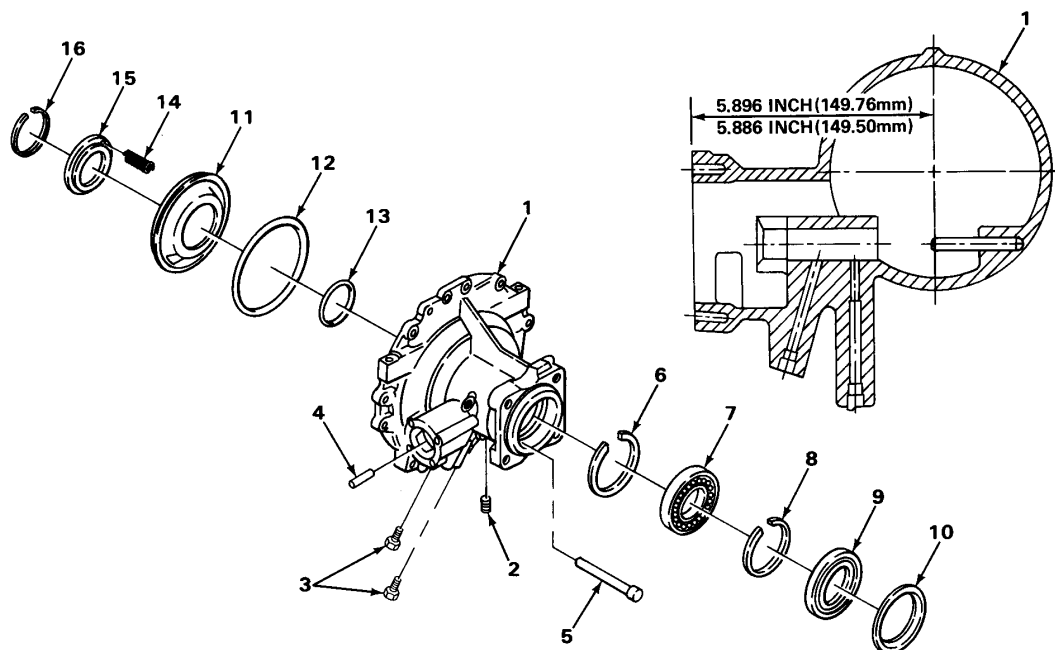
TA238471

REAR COVER AND OUTPUT SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT/REPAIR - CONTINUED			
26.	Rear cover	a. Look for nicks, burrs, and scratches on assembly (1) mounting surface. b. Remove nicks, burrs, and scratches with crocus cloth. c. If nicks and scratches are deep and could affect sealing, replace the part.	
ASSEMBLY			
27.	Rear cover assembly (1)	New plug (2)	Using 5/16-inch socket-head screw key, screw in and tighten.
28.		Two plugs (3)	Using 7/16-inch socket and ratchet handle with 3/8-inch drive, screw in.
<u>CAUTION</u>			
If the governor support pin is not positioned correctly, governor, cover driven gear can be damaged.			
29.	New governor support pin (4)	a. Put in position. b. Using 3/16-inch brass driftpin and ball-peen hammer, tap in to dimension shown.	
30.	New drain tube (5)	Tap in using ball-peen hammer.	
31.	Snapring (6)	Using 3/8-inch flat-tip screwdriver, put in.	
32.	Output shaft ball bearing (7)	Using output shaft bearing installer, seat against snapring.	
33.	Snapring (8)	Using 3/8-inch flat-tip screwdriver, put in so leveled side faces rear.	
34.	New output shaft seal (9)	a. Apply non-hardening sealant to outer rim. b. Put on output shaft oil seal installer, spring side away from installer. c. Using ball-peen hammer, drive into place. Seal should be 1.03 - 1.07 inches (2.62 - 2.72 mm) below rear face of seal bore.	

REAR COVER AND OUTPUT SHAFT - CONTINUED

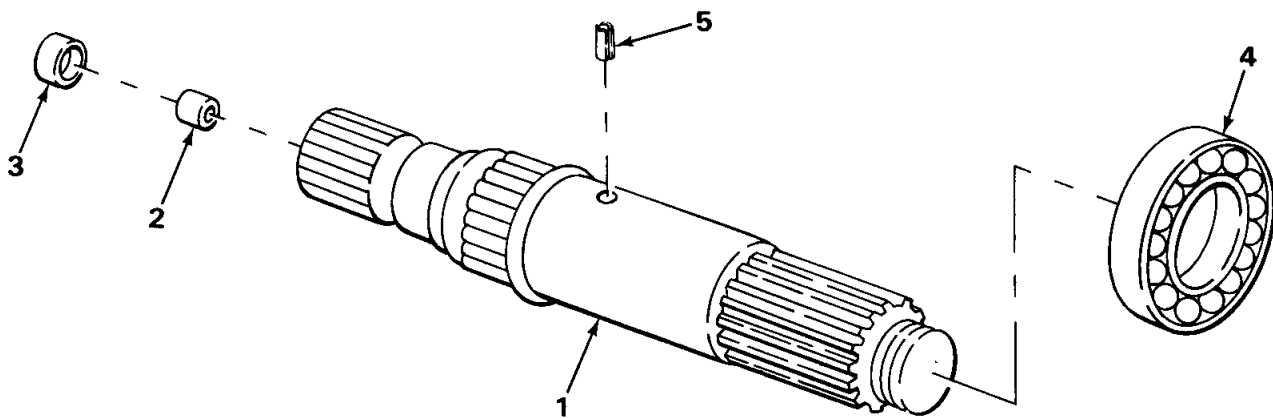
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
35.	Output shaft dust shield (10)	a. Apply non-hardening sealing compound to outer rim. b. Put in position. c. Put seal on dust shield installer, concave side first. d. Using ball-peen hammer, drive seal in until it is flush to 0.40-inch (1.02 mm) below the face of the bore.	
36.	Low clutch piston (11)	Two new packings (12) and (13)	a. Lubricate with oil soluble grease. b. With lips of packings facing rear of piston (11), put on.
37.	Rear cover assembly (1)	Low clutch piston (11)	Put in carefully. Lips of seals must not be folded.
38.	Low clutch piston (11)	26 springs (14)	Put in position.
39.		Spring retainer (15)	Using low and first clutch compressor, depress below snapping groove in rear cover assembly (1).
40.	Rear cover assembly (1)	Snapping (16) in.	Using 3/8-inch flat-tip screwdriver, put



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REAR COVER AND OUTPUT SHAFT - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
41.	Output shaft (1)	Cap plug (2)	Using orifice plug installer and ball-peen hammer, tap into place.
42.	Roller bearing (3)		a. Position numbered end of bearing towards installer. b. Using rear bearing installer, driver handle, and ball-peen hammer, tap into position. Bearing should be 0.270 - 0.290-inch (6.86 - 7.37 mm) below face of bore.
43.	Output shaft ball bearing (4)		a. Position bearing with chamfered edge of bore toward shoulder of shaft (1). b. Using output shaft bearing installer and arbor press, press against shaft (1) shoulder.
44.	New spring pin (5)		Using an arbor press, press in 0.1 - 0.170-inch (3.81 - 4.31 mm) above shaft surface.



NOTE

The output shaft, speedometer drive gear, governor drive gear, and spacer will be installed when transmission is assembled.

FOLLOW-ON MAINTENANCE: Install rear cover (page 2-650).

TASK ENDS HERE

LOW RANGE CLUTCH AND PLANETARY ADAPTER

This task covers:

- a. Disassembly (page 2-779)
- b. Cleaning (page 2-780)
- c. Inspection/Replacement/Repair (page 2-781)
- d. Assembly (page 2-782)

INITIAL SETUP**Tools**

Compressor, first and low clutch
 Compressor, reciprocating air, power driven
 File, fine hand
 Goggles, safety
 Gun, air blow
 Hose, air compressor
 Screwdriver, flat-tip, 3/8-inch
 Stone, soft
 Wire, soft, 12-inch

Materials/Parts

Cloth, crocus (item 7, appendix B)
 Grease, oil soluble (item 21, appendix B)
 Packing, preformed, piston, outer
 Packing, preformed, piston, inner
 Solvent, dry-cleaning (item 49, appendix B)

Personnel Required

One

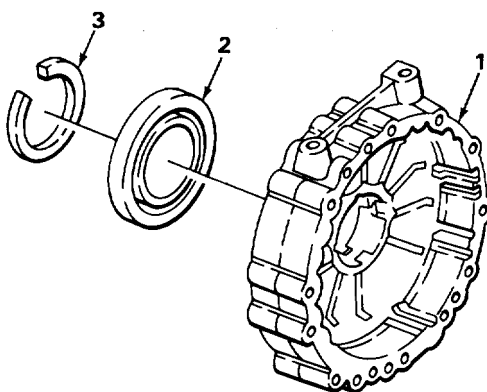
Equipment Condition

Low range clutch and planetary adapter removed (page 2-650).

LOCATION	ITEM	ACTION	REMARKS

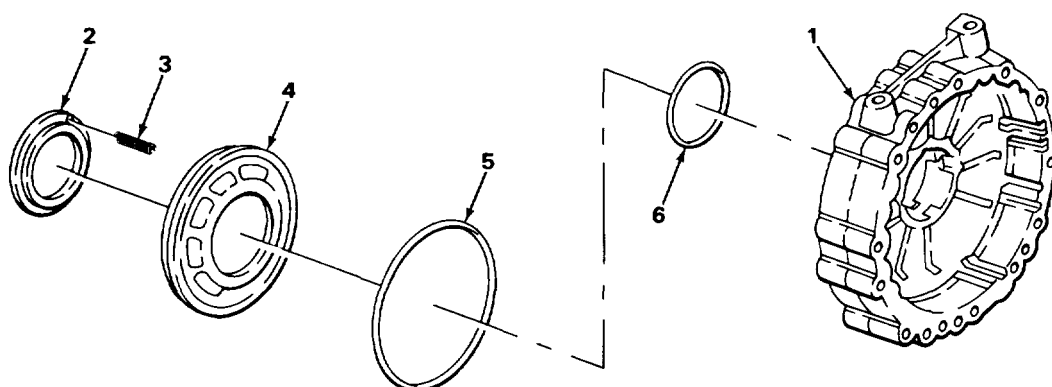
DISASSEMBLY

1. Adapter housing (1)	Retainer (2) and snapping (3)	a. Place adapter housing (1) front side up on a clean workbench. b. Using first and low clutch compressor, press on retainer (2). c. Using 3/8-inch flat-tip screwdriver, take out snapping (3).



LOW RANGE CLUTCH AND PLANETARY ADAPTER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
2. Adapter housing (1)	Retainer (2), 26 springs (3), and first clutch piston (4)	Take out.	
3. First clutch piston (4)		a. Take off. b. Get rid of.	

**CLEANING****NOTE**

For more information how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

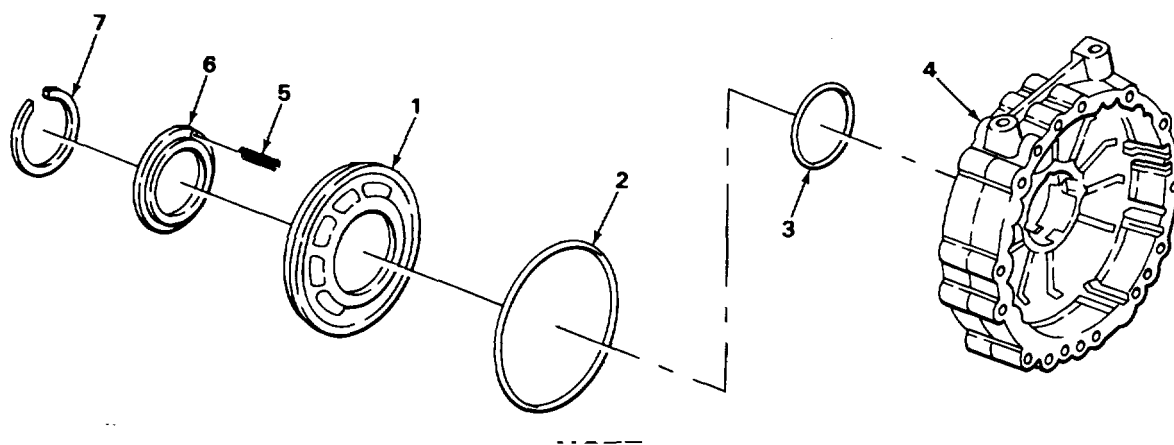
Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

LOW RANGE CLUTCH AND PLANETARY ADAPTER - CONTINUED

LOCATION	ITEM	ACTION REMARKS
CLEANING - CONTINUED		
4.	All metal parts	a. Clean in dry-cleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with a piece of soft wire and by flushing with dry-cleaning solvent.
5.	All bearings	Clean (TM 9-214).
INSPECTION/REPLACEMENT/REPAIR		
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.		
6.	All gears	a. Look for scuffed areas and nicked, burred, and broken teeth. If defects cannot be removed with a soft stone, replace the gear or assembly. b. Look for wear that has changed shape of gear. If found, replace gear or assembly.
7.	All splined parts	a. Look for stripped, twisted, chipped, or burred splines. Remove burrs with a stone. Replace part if defects cannot be removed. b. Look for spline wear. If wear affects tightness of fit, replace part.
8.	All bearings	Inspect (TM 9-214).
9.	All clutch plates	a. Look for burrs, heat marks, and wear. b. Remove burrs with crocus cloth or fine hand file. c. Look for worn splines.

LOW RANGE CLUTCH AND PLANETARY ADAPTER - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
10.	First clutch piston (1)	Two new packings (2) and (3)	a. Lubricate with oil soluble grease. b. Put on so lips face pressure side of piston (1).
11.	Adapter housing (4)	First clutch piston (1)	Align lug on piston (1) with recess in housing and put in.
12.	First clutch piston (1)	26 springs (5)	Put in position.
13.		Spring retainer (6)	a. Put in position. b. Using first and low clutch compressor tool, press on retainer.
14.	Adapter housing (4)	Snapring (7)	Using 3/8-inch flat-tip screwdriver, put in.

**NOTE**

FOLLOW-ON MAINTENANCE: Install low range clutch and planetary adapter (page 2-650).

TASK ENDS HERE

TRANSMISSION HOUSING

This task covers:

- a. Disassembly (page 2-784)
- b. Cleaning (page 2-785)

- c. Inspection/Replacement/Repair
(page 2-786)
- d. Assembly (page 2-786)

INITIAL SETUP

Tools

Chisel, cold hand, 1/2-inch
Compressor, reciprocating air,
power driven
Driftpin, brass, 1/4-inch
Driftpin, brass, 3/8-inch
Goggles, safety
Gun, air blow
Hammer, ball-peen, machinist's
Handle, ratchet, 3/8-inch drive
Handle, ratchet, 1/2-inch drive
Hose, air compressor
Key, socket-head screw, 3/16-inch
Knife, pocket
Pliers, slip-joint, angle-nose
Screwdriver, flat-tip, 11/4-inch
Socket, socket-head screw, 3/8-inch
drive, 3/16-inch
Socket, 3/8-inch drive, 1/2-inch
Wire, soft, 12-inch
Wrench, crowfoot attachment,
1/2-inch drive, 9/16-inch
Wrench, open-end, 9/16-inch
Wrench, torque, 1/2-inch drive,
0 - 150 ft-lb capacity

Materials/Parts

Cloth, crocus (item 7, appendix B)
Compound, sealing (item 14, appendix B)
Gasket, lube valve
Grease, oil soluble (item 21, appendix B)
Packing, selector shaft
Packing, valve tube
Solvent, dry-cleaning (item 49, appendix B)
Vent assembly

Personnel Required

One

Equipment Condition

All transmission subassemblies removed
(page 2-650).

TRANSMISSION HOUSING - CONTINUED

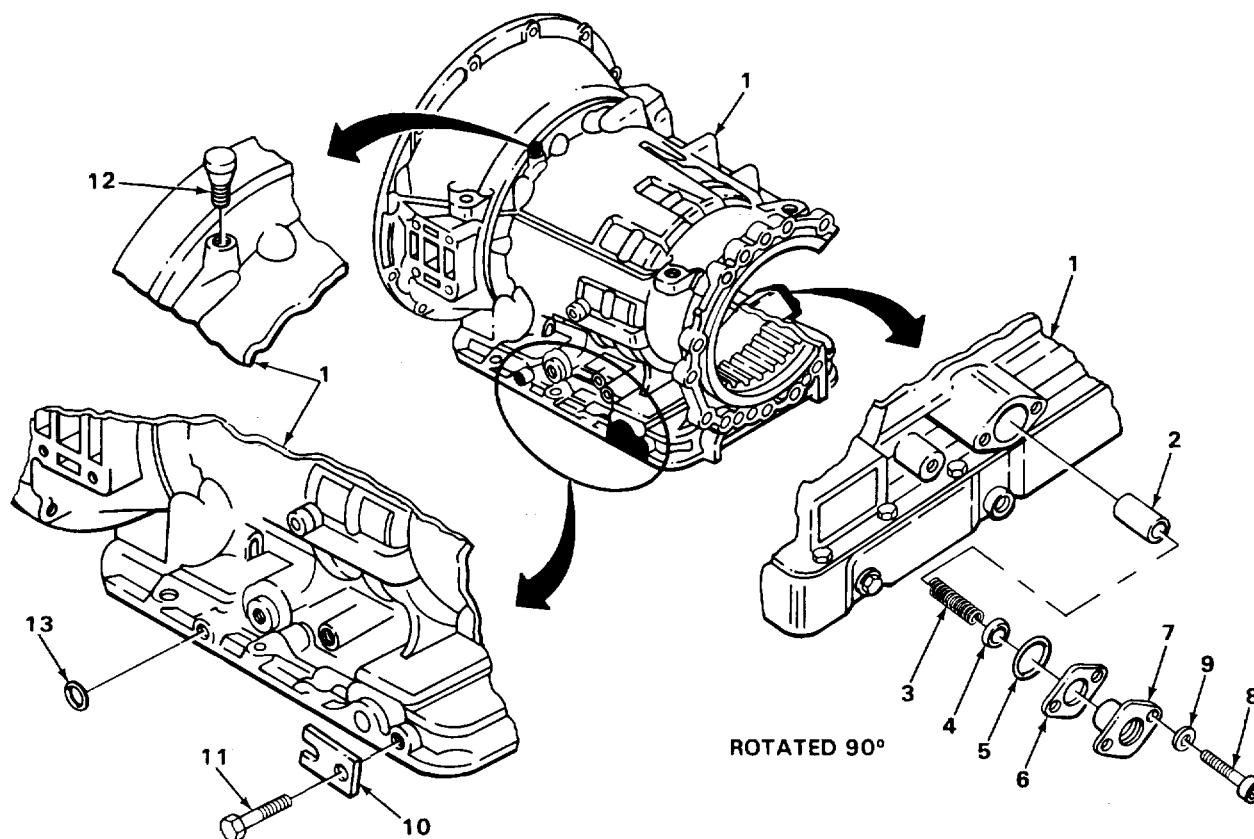
LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
NOTE Do not perform steps 1 thru 13 to disassemble the housing unless it is necessary for cleaning or part replacement.			
1.	Transmission housing (1)	Three plugs (2) with 3/8-inch drive, take out.	Using 1/2-inch socket and ratchet handle
2.		Manual selector shaft (3)	Pry out part way using 1/4-inch screw-driver.
3.	Manual selector	Nut (4)	Using 9/16-inch open-end wrench, unscrew and take off.
4.		Shaft retainer pin (5)	Using angle-nose slip-joint pliers, pull out.
5.	Detent lever (6)	Take off.	
6.	Transmission	Manual selector housing (1)	Pull out. shaft (3)
7.	Manual selector	Packing (7) shaft (3)	a. Using pocket knife, take off. b. Get rid of.
8.	Transmission housing (1)	Vent assembly (8)	a. Using ball-peen hammer and 1/2-inch cold hand chisel, tap out. b. Get rid of.
9.	Modulator retainer (9)	Screw (10)	Using 1/2-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
10.	Transmission housing (1)	Modulator retainer (9)	Take off.
11.	Adapter lube valve tube (11)	Two screws (12) and washers (13)	Using 3/16-inch socket-head screw key, unscrew and take off.

TRANSMISSION HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

12.	Adapter lube valve tube (11), gasket (14), packing (15), lube valve (16), and spring (17)	a. Take out. b. Get rid of gasket (14) and packing (15).
13.	Valve guide tube (18)	Using angle-nose slip-joint pliers, pull out.



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CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

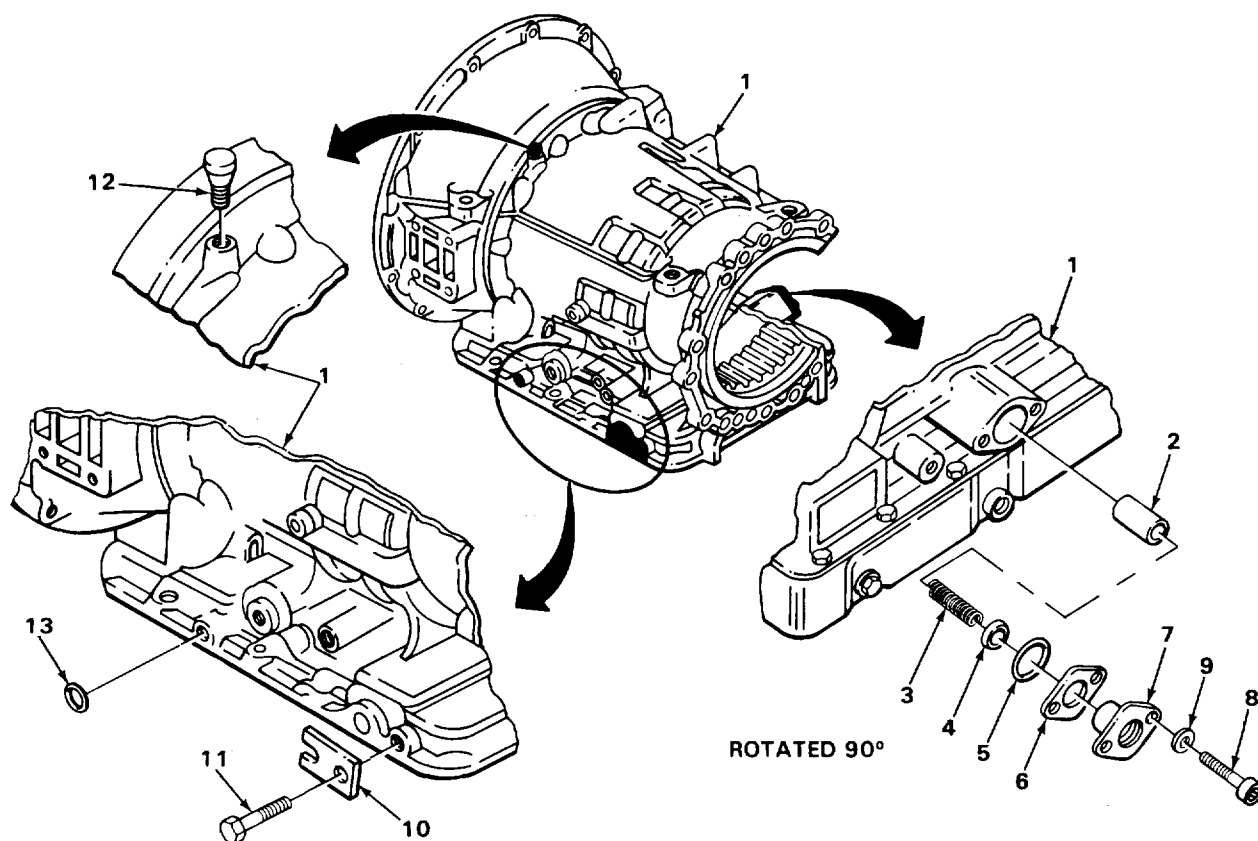
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TRANSMISSION HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING - CONTINUED			
WARNING			
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.			
14.	All metal parts	a. Clean in dry-cleaning solvent. b. Dry parts with compressed air. c. Clean oil passages with a piece of soft wire and by flushing with drycleaning solvent.	
INSPECTION/REPLACEMENT/REPAIR			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged or defective parts, as needed.			
15.	Transmission housing (1)	a. Look for cracks, breaks, and dents. If cracks and dents are large, housing should be replaced. b. Look for nicks, scratches, and burrs in bores or on mating surfaces. c. Remove defects with crocus cloth.	
ASSEMBLY			
16. Transmission housing (1)	Valve guide tube (2)	Using 3/8-inch brass driftpin and ball-peen hammer, tap in 0.56 - 0.60 inch (1.42 - 1.52 mm) below adapter mounting surface.	
17.	Spring (3), lube valve (4), new packing (5), new gasket (6), and adapter lube valve tube (7)	Put in position.	

TRANSMISSION HOUSING - CONTINUED

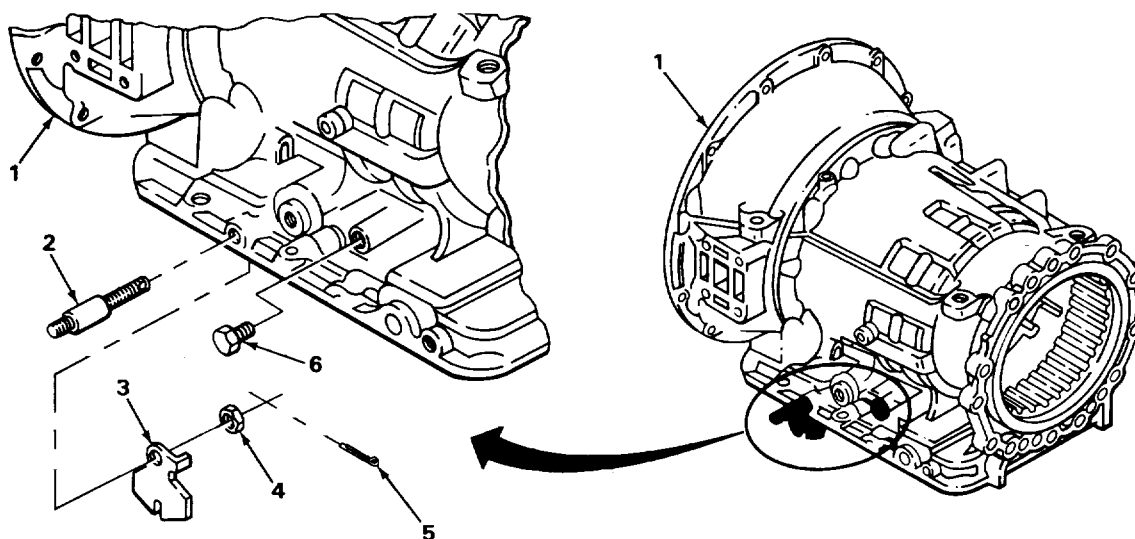
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
18.	Adapter lube valve tube (7)	Two screws (8) and two washers (9)	a. Screw in until snug, using 3/16-inch socket-head screw key. b. Tighten to 9-11 ft-lb (12-15 N m) of torque using 3/16-inch socket-head screw socket and torque wrench with 1/2-inch drive.
19.	Transmission housing (1)	Modulator retainer (10)	Put in position.
20.		Screw (11)	Screw in, and tighten using 1/2-inch socket and ratchet handle with 3/8-inch drive.
21.		New vent assembly (12)	Using ball-peen hammer, tap in.
22.		New packing (13)	a. Put sealing compound on rim of packing (13). b. With lip facing into bore, and using ball-peen hammer, tap in. c. Lubricant inner bore with oil soluble grease.



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TRANSMISSION HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
23.	Transmission housing (1)	Manual selector shaft (2)	With grooved end first, put in.
24.	Manual selector shaft (2)	Detent lever (3)	a. With pin towards the inside, align slot with flats on lever (3). b. Put on.
25.		Nut (4)	a. Hold detent lever (3), and screw in until snug using 9/16-inch open-end wrench. b. Using 9/16-inch crowfoot attachment and torque wrench with 1/2-inch drive, tighten to 15-20 ft-lb (20-27 N m) of torque.
26.		Shaft retainer pin (5)	a. Put in position. b. Using ball-peen hammer, tap in.
27.		Three plugs (6)	Screw in, and tighten using 1/2-inch socket and ratchet handle with 3/8-inch drive.

**NOTE**

FOLLOW-ON MAINTENANCE: Install all transmission subassemblies (page 2-650)

TASK ENDS HERE

TRANSMISSION SELECTOR LEVER AND SELECTOR LEVER AND LINKAGE

This task covers:

a. Removal and Disassembly (page 2-790) b. Cleaning (page 2-795)	c. Inspection/Replacement (page 2-796) d. Assembly and Installation (page 2-796) e. Shift Linkage Adjustment (page 2-801)
-

INITIAL SETUP

Tools

Compressor, reciprocating air,
power driven
Extension, 3/8-inch drive, 6-inch
Goggles, safety
Gun, air blow
Handle, ratchet, 1/2-inch drive
Hose, air compressor
Key, socket-head screw, 118-inch
Pliers, slip-joint, angle-nose
Screwdriver, cross-tip, number two
Screwdriver, flat-tip, 3/8-inch
Socket, 1/2-inch drive, 1/2-inch
Socket, 1/2-inch drive, 9/16-inch
Wrench, open-end, 3/8-inch
Wrench, open-end, 1/2-inch
Wrench, open-end, 11-mm
Wrench, pliers
Wrench, torque, 1/2-inch drive,
0 - 150 ft-lb capacity

Materials/ Parts

Lamp, indicator
Locknut, pivot
Lockwashers, bracket (two required)
Lockwashers, clamp (two required)
Lockwashers, U-bolt (two required)
Pin, cotter
Pin, cotter, swivel
Solvent, drycleaning (item 49, appendix B)
Tag, marking (item 50, appendix B)

Personnel Required

One

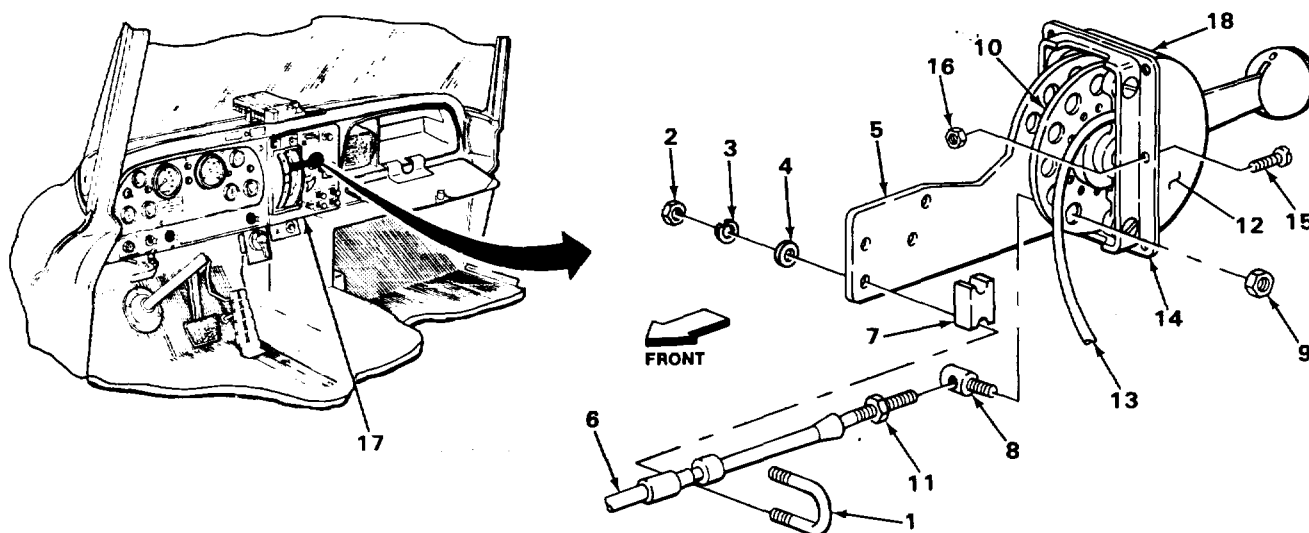
TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL AND DISASSEMBLY			
NOTE Disassemble only as required for parts replacement.			
1.	U-bolt (1)		a. Using 3/8-inch open-end wrench, unscrew and take off.
2.	Adapter plate (5)		b. Get rid of lockwashers (3). Take off.
3.	Pivot (8)		a. Move lever (10) to lowest position. b. Using 1/2-inch open-end wrench, unscrew and take off. c. Get rid of locknut (9).
4.	Lever (10)	Pivot (8)	Press on lever (10), and take out.
5.	Cable (6)	Nut (11) and pivot (8)	a. Using 11-mm open-end wrench and pliers wrench, loosen nut (11). b. Using angle-nose slip-joint pliers and pliers wrench, unscrew pivot (8) and take off.
6.	Control lever housing (12)	Indicator light wires (13)	Disconnect and tag harness wires.
7.	Control mounting flange (14)	Six screws (15) and nuts (16)	Using number two cross-tip screwdriver, unscrew and take out.
8.	Instrument panel (17)	Control lever assembly (18)	Lift out.

TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL AND DISASSEMBLY - CONTINUED



9. Control mounting flange (14)

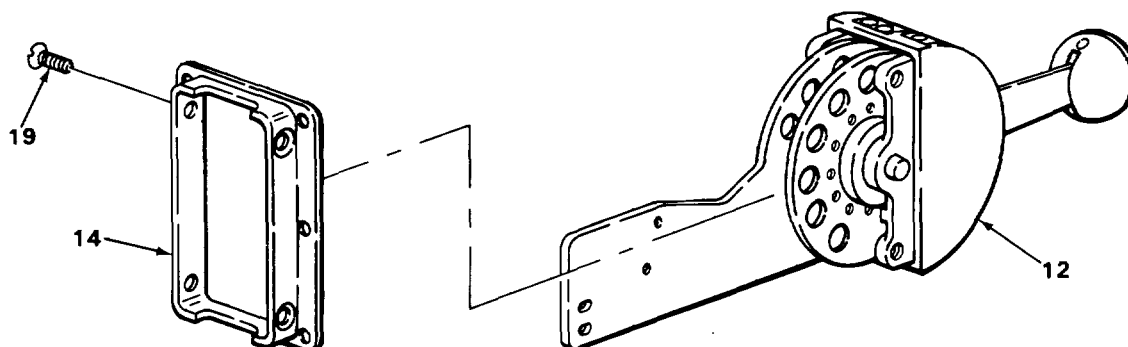
Four screws (19)

Using 3/8-inch flat-tip screwdriver, unscrew and take out.

10. Control lever housing (12)

Control mounting flange (14)

Take off.

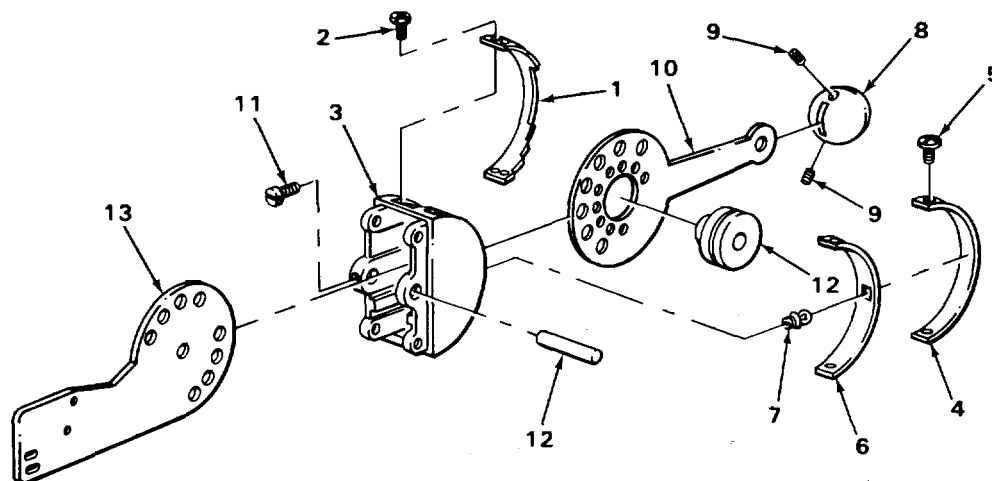


TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

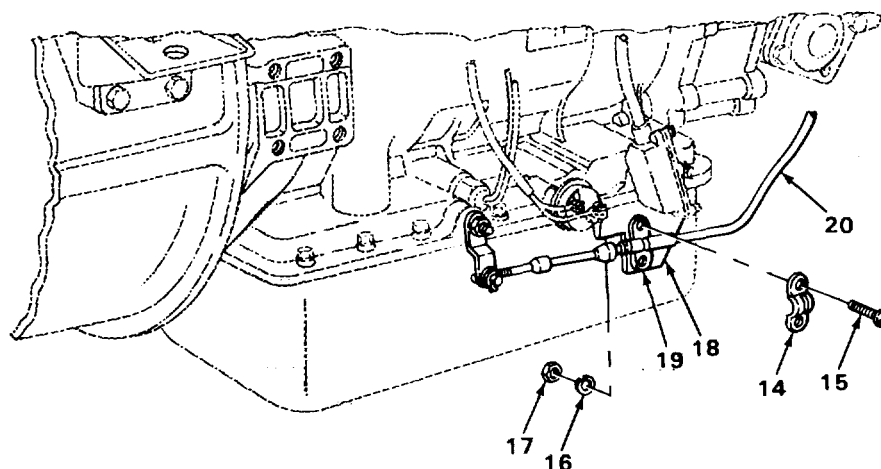
LOCATION	ITEM	ACTION	REMARKS
REMOVAL AND DISASSEMBLY - CONTINUED			
11. Speed change gate (1)	Four screws (2)		Using number two cross-tip screwdriver, unscrew and take out.
12. Control lever housing (3)	Speed change gate (1)	Take off.	
13. Position strip (4)	Two screws (5)		Using number two cross-tip screwdriver, unscrew and take out.
14. Control lever housing (3)	Position strip (4) and indicator light lens (6)	Take off.	
15.	Lamp (7)	a. Take out. b. Get rid of.	
16. Handle (8)	Two setscrews (9)		Using 1/8-inch socket-head screw key, loosen.
17. Shift lever (10)	Handle (8)	Pull off.	
18. Control lever housing (3)	Setscrew (11)		Using 1/8-inch socket-head screw key, unscrew part way.
19.	Shift lever (10) with spring assembly (12) and adapter plate (13)	Take out.	

TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

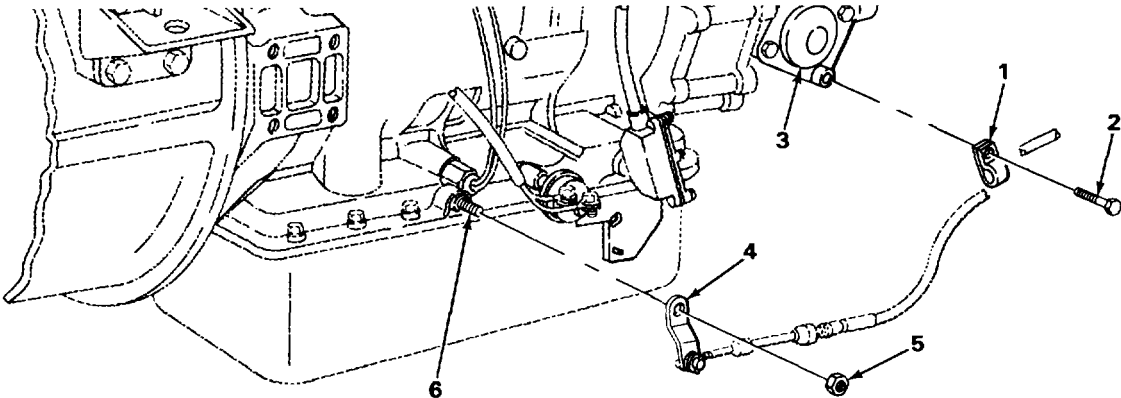
LOCATION	ITEM	ACTION	REMARKS



20.	Cable clamp (14)	Two screws (15), lockwashers (16), and nuts (17)	a. Using number two cross-tip screw-driver and 3/18-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (16).
21.	Bracket (18)	Cable clamp (14), clamp bar (19), and cable (20)	Take off.



TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL AND DISASSEMBLY - CONTINUED			
22.	Cable clamp (1)	Screw (2)	Using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
23.	Governor cover (3)	Cable clamp (1)	a. Take off. b. Put screw (2) back in finger tight.
24.	Shift lever (4)	Nut (5)	Hold lever (4) firmly and using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off.
25.	Lever shaft (6)	Shift lever (4)	Take off.
			
26.	Swivel (7)	Cotter pin (8)	a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.
27.		Shift lever (9) and three washers (10)	Take off.
28.	Control cable (11)	Nut (12)	Note the location of the nut on the cable and using 1/2-inch open-end wrench and pliers wrench, loosen.
29.		Swivel (7)	Using angle-nose slip-joint pliers, unscrew and take off.
30.		Nut (12)	Return nut to original location on the cable.

TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL AND DISASSEMBLY - CONTINUED			
31. Bracket (13)	Two screws (14)		Using 1/2-inch socket, ratchet handle with 112-inch drive, and 6-inch extension, unscrew and take out.
32. Oil pan (15)	Two spacers (16) bracket (13) and	a. Take off. b. Get rid of lockwashers (17).	

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

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TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

33.	All metal parts	a. Clean in drycleaning solvent. b. Dry with compressed air.

INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

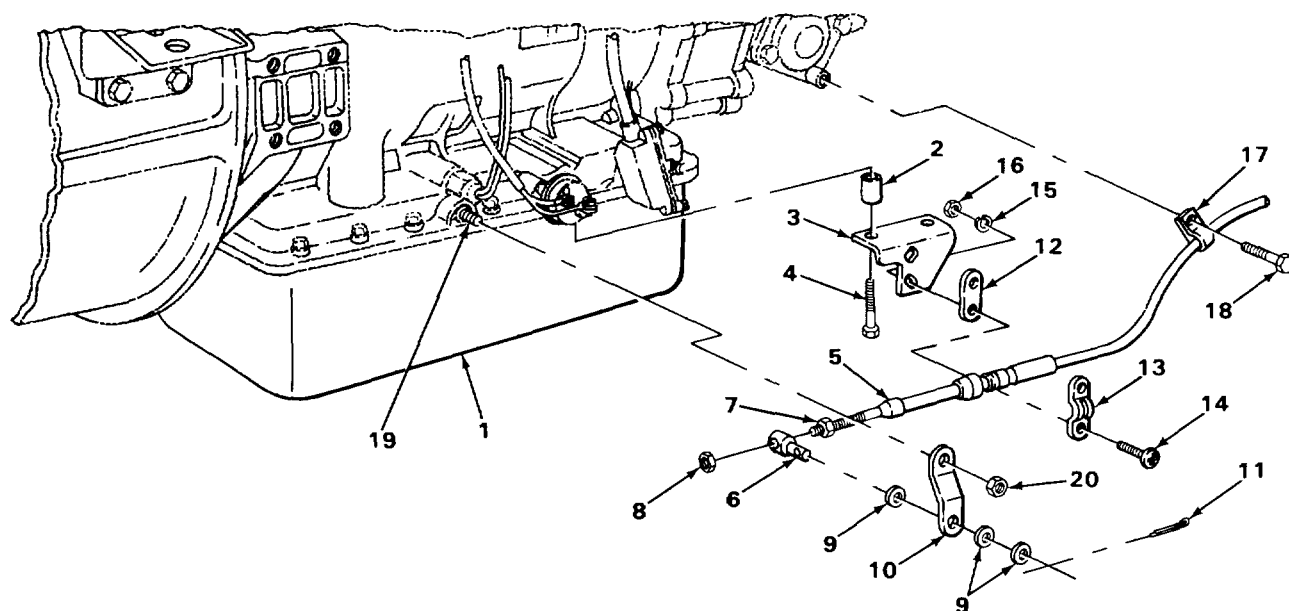
Replace damaged or defective parts, as needed.

ASSEMBLY AND INSTALLATION

34.	Oil pan (1)	Two spacers (2) and bracket (3)	Put in position.
35.	Bracket (3)	Two screws (4)	a. Tighten until snug using 1/2-inch socket, ratchet handle with 112-inch drive, and 6-inch extension. b. Tighten to 10-13 ft-lb (13.6-17.6 N m) of torque using 1/2-inch socket, 6-inch extension, and torque wrench with 1/2-inch drive.
36.	Control cable (5)	Swivel (6)	Screw on until against nut (7) using angle-nose slip-joint pliers and wrench pliers.
37.		Nut (8)	Tighten against swivel (6) using 1/2-inch open-end wrench.
38.	Swivel (6)	Three washers (9) and shift lever(10)	Put on.

TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY AND INSTALLATION - CONTINUED			
39.	New cotter pin (11)	a. Put in position. b. Using angle-nose slip-joint pliers, bend ends over.	
40. Bracket (3)	Clamp bar (12), cable (5), and cable clamp (13)	Put in position.	
41. Cable clamp (13)	Two screws (14), new lockwashers (15), and nuts (16)	a. Put in position. b. Screw in, and tighten using number two cross-tip screwdriver and 3/8-inch open-end wrench.	
42. Cable clamp (17)	Screw (18)	Unscrew and take out.	
43.	Cable clamp (17) and screw (18)	a. Put in position. b. Screw in, and tighten using 1/2-inch socket and ratchet handle with 1/2-inch drive.	
44. Lever shaft (19)	Shift lever (10)	Put in position.	
45. Shift lever (10)	Nut (20)	Screw on, and tighten using 9/16-inch socket and ratchet handle with 1/2-inch drive	



TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

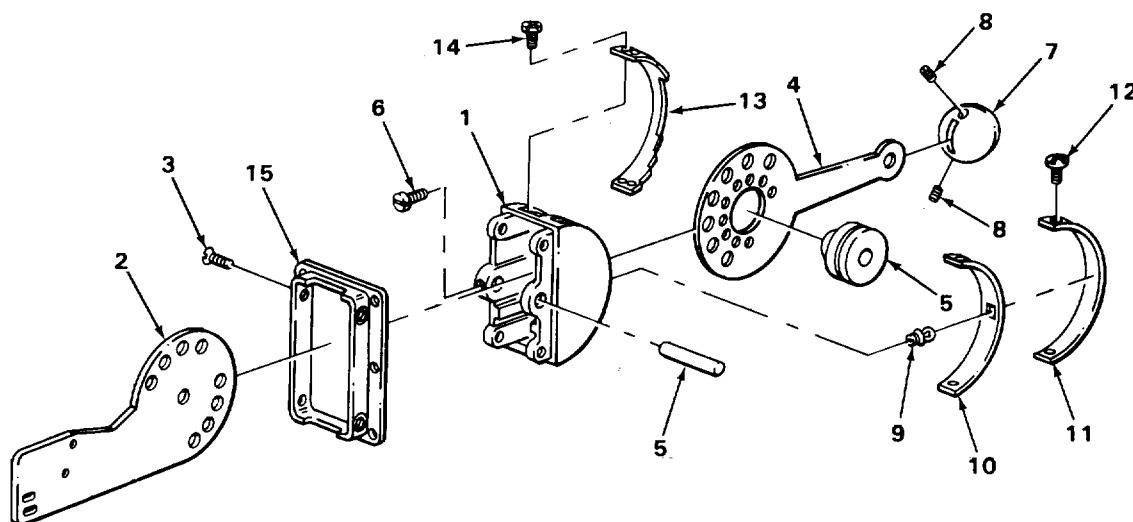
LOCATION	ITEM	ACTION REMARKS
ASSEMBLY AND INSTALLATION - CONTINUED		
46. Control lever housing (1)	Adapter plate (2)	Aline holes in plate (2) with holes in housing (1).
47.	Four screws (3)	Screw In part way using 3/8-inch flat-tip screwdriver.
48.	Shift lever (4) and spring assembly (5)	Aline with hole in housing (1) and adapter plate (2).
49.	Setscrew (6)	Screw in, and tighten using 3/8-inch flat-tip screwdriver.
50. Shift lever (4)	Handle (7)	Put on.
51. Handle (7)	Two setscrews (8)	Screw in, and tighten using 1/8-inch socket-head screw key.
52. Control lever housing (1)	New lamp (9)	Put In.
53.	Indicator light lens (10) and position strip (11)	Put in position.
54. Position strip (11)	Two screws (12)	Screw in, and tighten using number two cross-tip screwdriver.
55. Control lever housing (1)	Speed change gate (13)	Put in position.
56. Speed change gate (13)	Four screws (14)	Screw In, and tighten using 9/16-inch socket and handle with 1/2-inch drive.

TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

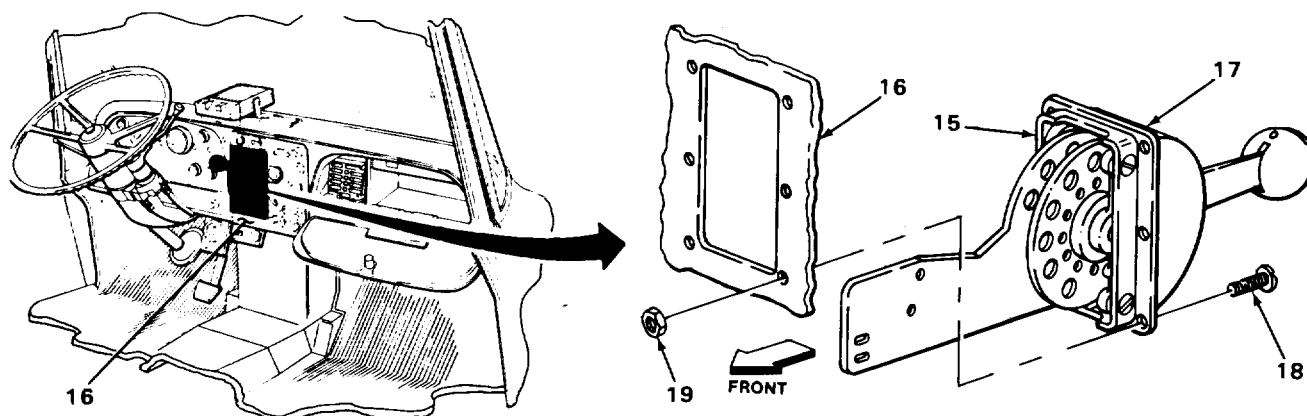
LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY AND INSTALLATION - CONTINUED

57.	Control lever housing (1)	Control mounting flange (15)	Put on.
58.	Control mounting flange (15)	Four screws (3)	Tighten using 3/8-inch flat-tip screwdriver.

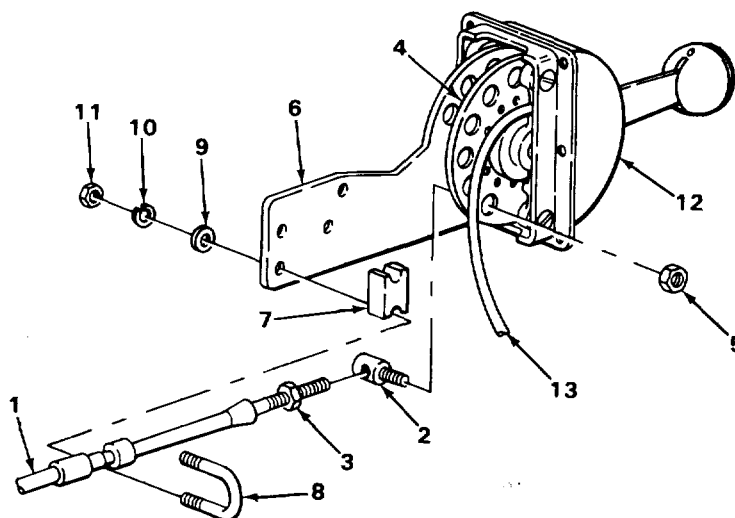


59.	Instrument panel (16)	Control lever assembly (17)	Put in position.
60.	Control mounting flange (15)	Six screws (18) and nuts (19)	Screw in, and tighten using number two cross-tip screwdriver.



TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY AND INSTALLATION - CONTINUED			
61.	Cable (1)	Pivot (2)	Screw on.
62.		Nut (3)	Tighten nut against pivot (2) using 11-mm open-end wrench and pliers wrench.
63.	Lever (4)	Pivot (2)	a. Put lever (4) in lowest position, and press sideways. b. Put pivot (2) in bottom hole.
64.	Pivot (2)	New locknut (5)	Screw on, and tighten using 1/2-inch open-end wrench.
65.	Adapter plate (6)	Spacer (7), cable (1), and u-bolt (8)	Put in position.
66.	U-Bolt (8)	Two washers (9), new lockwashers (10), and nuts (11)	a. Put on. b. Tighten nuts (11) using 3/8-inch open-end wrench.
67.	Control lever	Indicator light	Connect with tagged wires.



TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

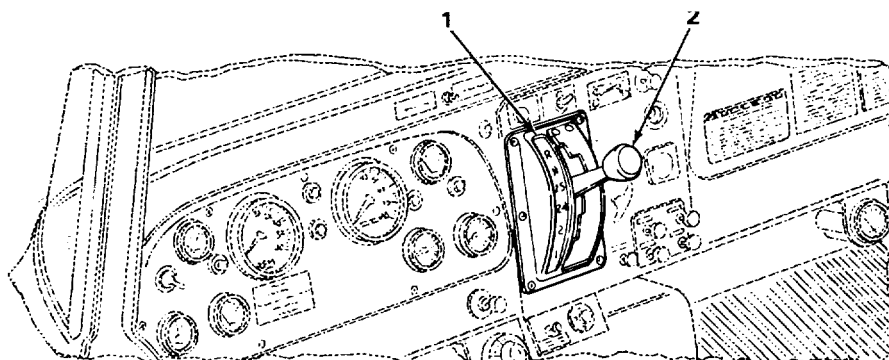
SHIFT LINKAGE ADJUSTMENT**CAUTION**

Proper adjustment of selector lever shift linkage is important to proper operation of transmission. Shift control lever positions on panel must match exactly to detent stops in transmission or damage to transmission can result.

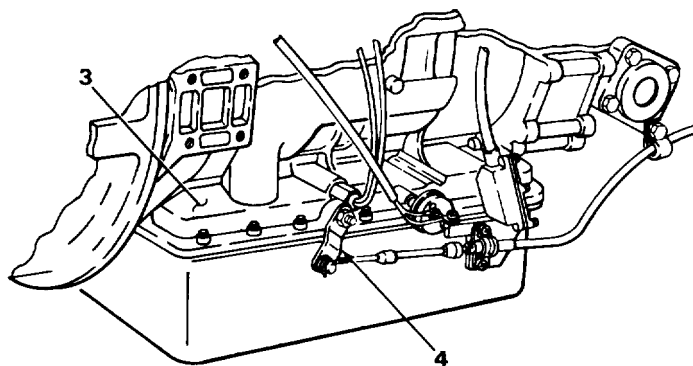
NOTE

Control lever positions must match exactly with detents in the transmission. Lever should move freely through complete range of travel.

68. Range selector assembly (1)	Range selector lever (2)	Put in 2 - 5 position against stop in gate.



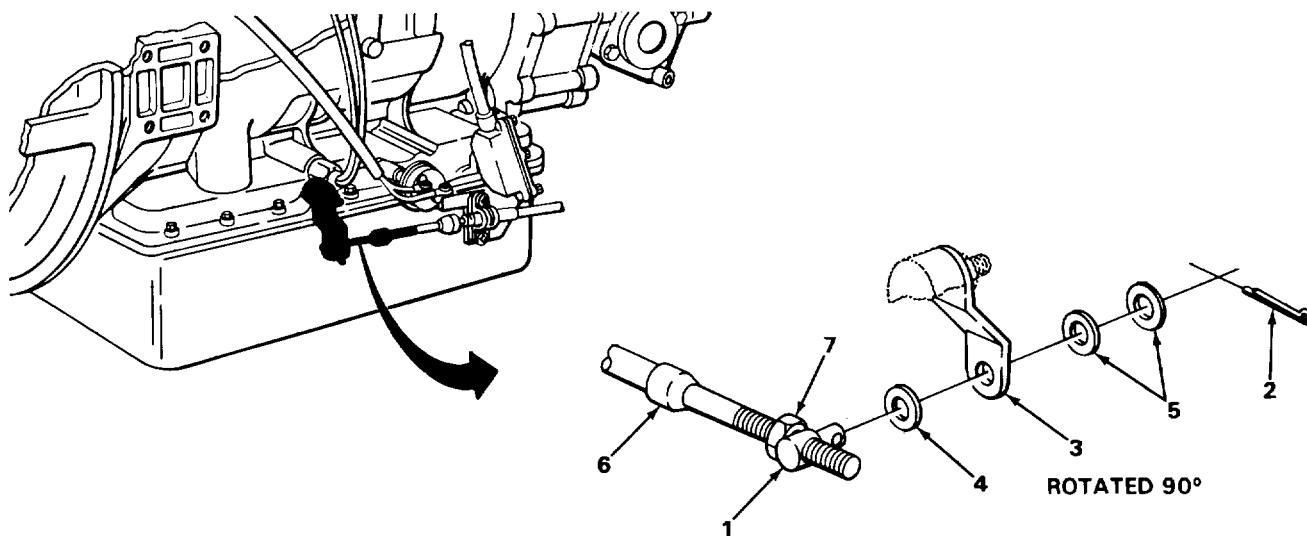
69. Transmission	Shift lever (4) assembly (3)	a. Push to extreme forward position. b. Bring back three detent positions.



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TRANSMISSION SELECTOR LEVER AND SHIFT LINKAGE - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
SHIFT LINKAGE ADJUSTMENT - CONTINUED			
70.	Swivel (1)	Cotter pin (2)	a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.
71.	Shift lever (3)	Swivel (1) and washers (4) and (5)	Take off.
72.	Cable (6)	Swivel (1)	Using angle-nose slip-joint pliers and pliers wrench, turn to aline with shift lever (3).
73.		Nut (7)	Using 112-inch open-end wrench, tighten against swivel (1).
74.	Swivel (1)	Washer (4)	Put on.
75.	Shift lever (3)	Swivel (1)	Put in.
76.	Swivel (1)	Two washers (5)	Put on.
77.		New cotter pin (2)	a. Put in.



TASK ENDS HERE

TRANSMISSION MODULATOR VALVE ASSEMBLY

- This task covers:
- a. Removal (page 2-804)

b. Cleaning (page 2-805)

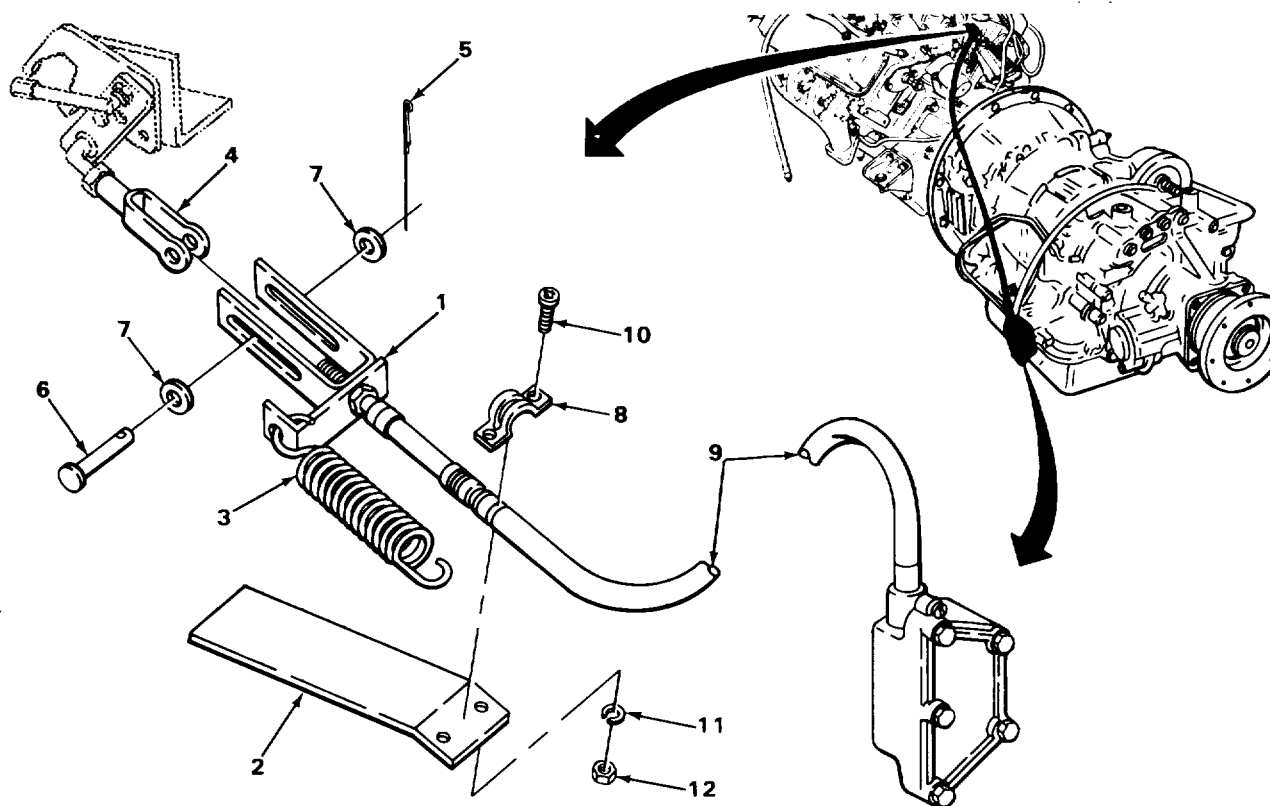
c. Inspection/Replacement (page 2-805)

d. Installation (page 2-806)

INITIAL SETUP	Personnel Required
Tools	One
Handle, ratchet, 3/8-inch drive	Equipment Condition
Pliers, slip-joint, angle-nose	Engine and transmission covers removed
Screwdriver, cross-tip, number two	(TM 9-2320-269-20-2).
Socket, 3/8-inch drive, 1/2-inch	
Wrench, open-end, 318-inch	
Materials/Parts	
Lockwashers, cable clamp (two required)	
Packing, preformed	
Pin, cotter	
Rags, wiping (item 42, appendix B)	
Solvent, drycleaning (item 49, appendix B)	

TRANSMISSION MODULATOR VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. Bracket (1) and bracket (2)	Spring (3)	Using angle-nose slip-joint pliers, take off.	
2. Clevis (4) pin (6), and two washers (7)	Cotter pin (5),	a. Using angle-nose slip-joint pliers, straighten cotter pin (5), and pull out. b. Take out pin (6) and washers (7). c. Get rid of cotter pin (5).	
3. Cable clamp (8) and cable (9) and nuts (12)	Two screws (10), lockwashers (11),	a. Using 3/8-inch open-end wrench and number two cross-tip screwdriver, unscrew and take off. b. Get rid of lockwashers (11).	



4. Modulator retainer (13)	Screw (14)	Using 11/2-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.	
5. Modulator valve (15)	Modulator retainer (13)	Take off.	

TRANSMISSION MODULATOR VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6. Transmission assembly (16)	Modulator valve (15) and cable (9)	Take off.	
7. Modulator valve(15)	Packing (17)	a. Takeoff. b. Get rid of.	

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

8.	Modulator valve (15)	a. Clean with clean rag dampened with drycleaning solvent. b. Wipe dry with clean, dry rags.

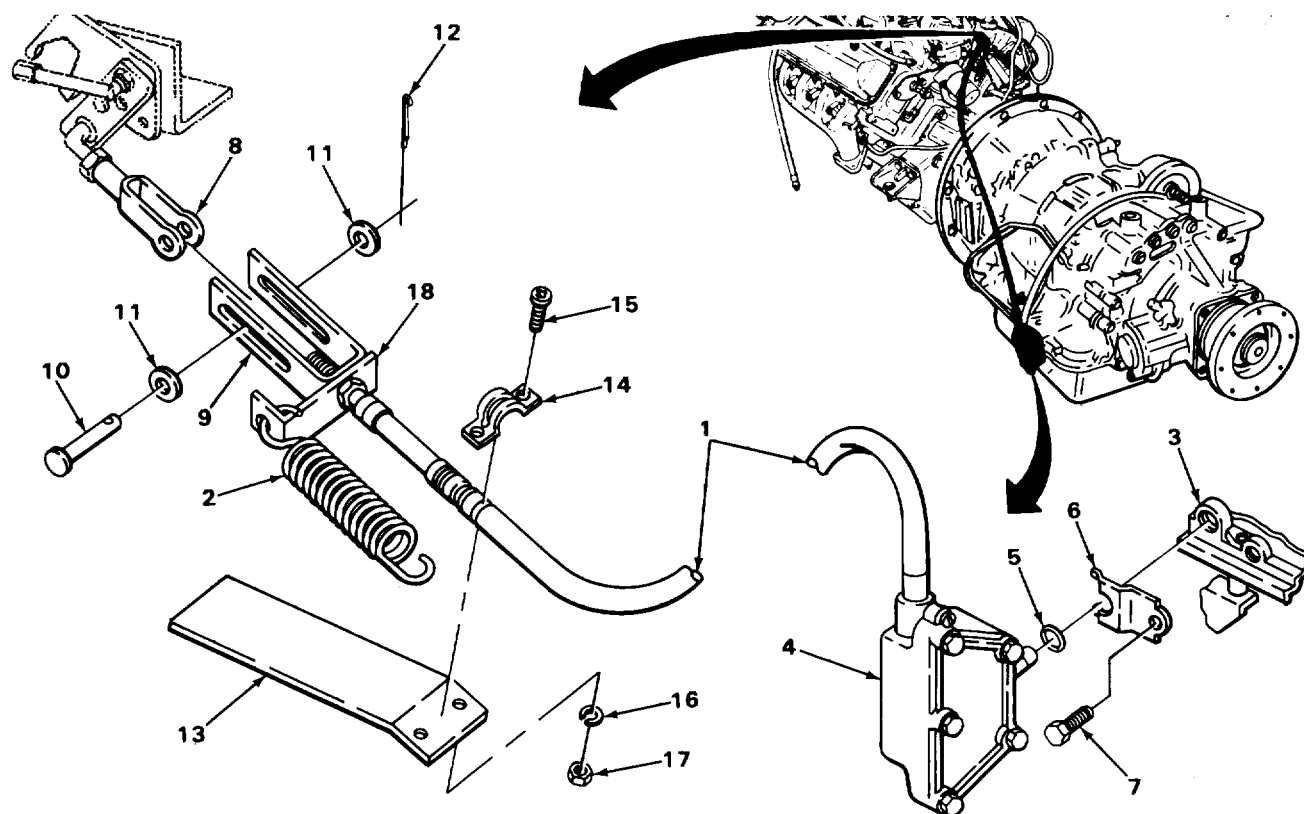
INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

2-805

TRANSMISSION MODULATOR VALVE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
9.	Cable assembly (1)	a. Look for kinks or cuts. b. Check for binding. c. If cable is damaged or binds, replace modulator valve assembly.	
10.	Spring (2)	a. Look for cracked or broken ends. b. Look for damage or loss of tension.	
INSTALLATION			
11. Transmission assembly (3)	Cable assembly (1)	Route over transmission to engine throttle linkage.	
12. Modulator valve (4)	New packing (5)	Put on.	
13. Transmission assembly (3)	Modulator valve (4)	Push into bore.	
14. Modulator valve (4)	Retainer (6)	Put into position.	
15. Retainer (6)	Screw (7)	Screw in, and tighten using 1/2-inch socket and ratchet handle with 3/8-inch drive.	
16. Clevis (8)	Cable bracket (9)	Put in, and aline hole with elongated slots.	
17. Clevis (8) and cable bracket (9)	Pin (10) and two washers (11)	Put in position.	
18. Pin (10)	New cotter pin (12)	Put in, and using angle-nose slip-joint pliers, spread and bend ends.	
19. Cable (1) and	Cable clamp (14)	Put in position. mounting plate (13)	
20. Cable clamp (14)	Two screws (15), new lockwashers (16), and nuts (17)	Screw on, and tighten using 3/8-inch open-end wrench and number two cross-tip screwdriver.	
21. Bracket (18)	Spring (2)	Put on.	

**TRANSMISSION MODULATOR VALVE ASSEMBLY - CONTINUED
INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install engine and transmission covers (TM 9-2320-269-20-2).

TASK ENDS HERE

TRANSMISSION SHIFT SPEED ADJUSTMENT

This task covers:

Adjustment (page 2-808)

INITIAL SETUP**Tools**

Pliers, round-nose, long
Test stand, transmission

Personnel Required
One

Equipment Condition

Transmission removed and mounted on test
stand (page 2-633)
Transmission oil filter removed
(page 2-650)

LOCATION	ITEM	ACTION	REMARKS

NOTE

Shift speeds are adjusted by changing positions of adjusting rings in control valve body and low shift valve body assemblies.

Turning adjusting rings clockwise increases spring force on shift valves and raises transmission shifting speed. Turning adjusting rings counterclockwise lowers shifting speed. Turning adjusting ring one notch will change transmission speed approximately 40 RPM.

ADJUSTMENT

1.	Control valve body (1)	Adjusting rings (2), (3), and (4)	Using long round-nose pliers, push in and turn to adjust.
2.	Low shift valve body (5)	Adjusting ring (6)	Using long round-nose pliers, push in and turn to adjust.

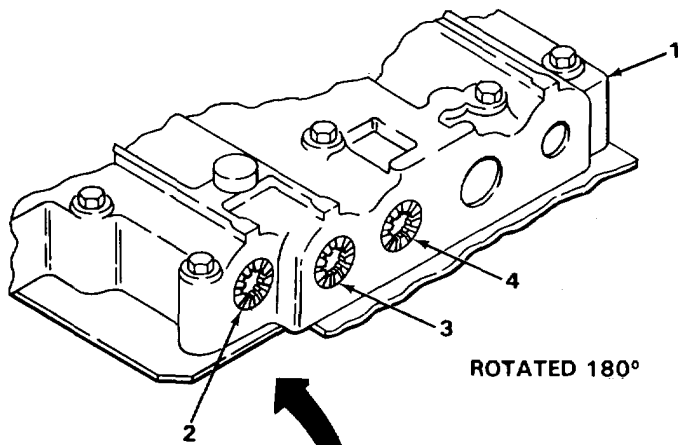
NOTE

The following chart shows output shaft RPM's at which various transmission shifts should occur.

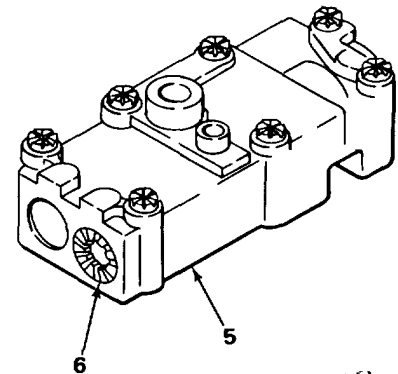
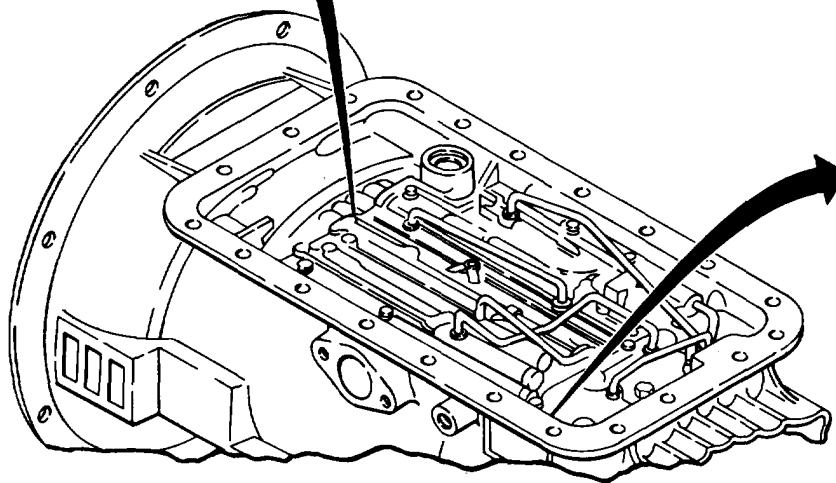
On transmission test stand, check all shift speeds and compare with those shown on charts. Make necessary adjustments to bring transmission shifts within the ranges shown on the chart on the following page.

TRANSMISSION SHIFT SPEED ADJUSTMENT - CONTINUED

ADJUSTMENT - CONTINUED



TRANSMISSION SHIFT SPEED ADJUSTMENT			
ENGINE GOVERNED SPEED (RPM)		3,000	
RANGE	THROTTLE SETTING	SHIFT	TRANSMISSION OUTPUT SPEED AT START OF SHIFT (RPM)
DRIVE (2-5)	FULL	2-3	685-740
		3-4	1,240-1,380
		4-5	2,085-2,280
DRIVE 3 (2-4)	FULL	5-4	2,450 MIN.
DRIVE 2 (2)	FULL	4-3	1,530-1,860
DRIVE 1 (1)	FULL	3-2	910-1,100
		2-1	365-510
DRIVE (2-5)	CLOSED	5-4	225-640
		4-3	445-700
		3-2	205-530



NOTE

FOLLOW-ON MAINTENANCE:

1. Install transmission oil filter (page 2-650).
2. Install transmission (page 2-633).
3. Service transmission (LO 9-2320-269-12).
4. Road check vehicle for proper transmission operation (TM 9-2320-269-10).

TASK ENDS HERE

TRANSMISSION GOVERNOR ASSEMBLY

This task covers:

a. Removal (page 2-810)	c. Inspection/Replacement (page 2-811)
b. Cleaning (page 2-810)	d. Installation (page 2-812)
-

INITIAL SETUP

Tools

Compressor, reciprocating air,
power driven
Goggles, safety
Gun, air blow
Handle, ratchet, 1/2-inch drive
Hose, air compressor
Pan, drain
Socket, 1/2-inch drive, 1/2-inch
Stone, soft
Wrench, torque, 112-inch drive,
0 - 150 ft-lb capacity

Materials/Parts

Gasket, governor cover
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. underneath.	Governor cover (1) screws (3)	Screw (2) and three	a. Place drain pan
		b. Using 1/2-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
		c. Allow fluid to drain and get rid of (page 2-46).	
2.	Rear cover assembly (4) cover (1), and gasket (7)	Clamp and cable (5), spacer (6), governor	a. Take off. b. Get rid of gasket (7).
3.	Governor assembly (8)	Take out.	

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

TRANSMISSION GOVERNOR ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

Be sure to wear safety goggles or lenses when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

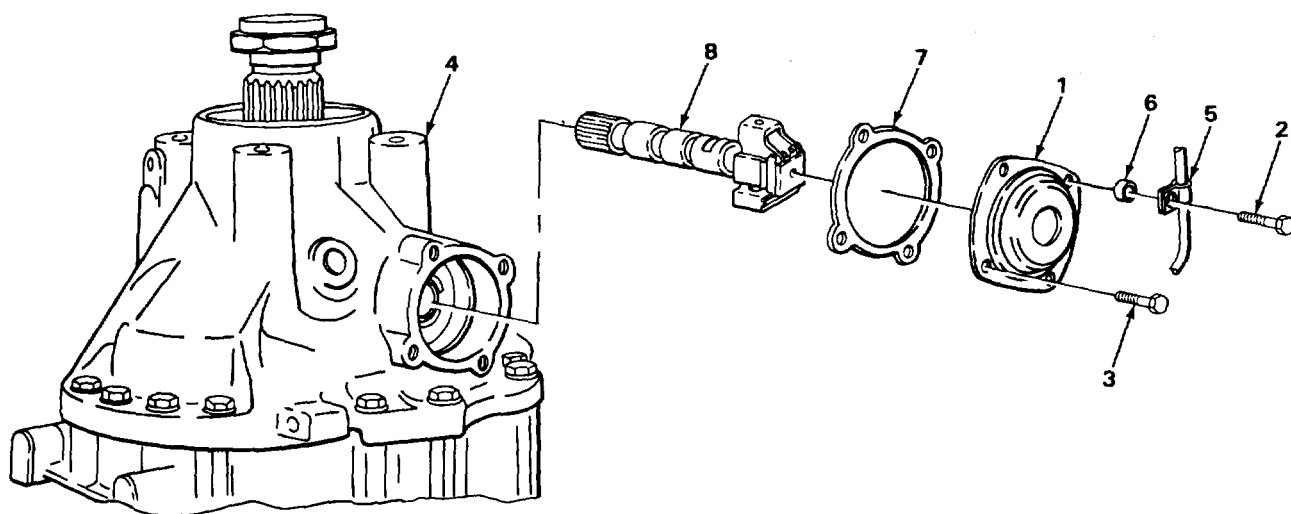
4.	Governor assembly (8) and governor cover (1)	a. Clean in drycleaning solvent. b. Dry with compressed air.

INSPECTION/REPLACEMENT

NOTE

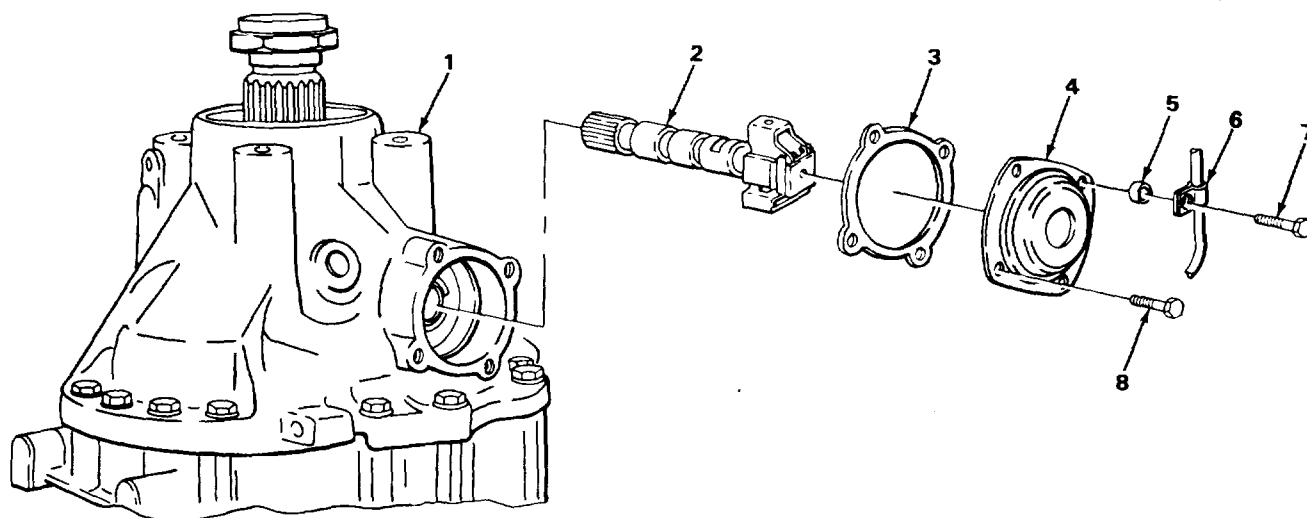
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

5.	Governor assembly (8)	a. Inspect driven gear for scuffed, nicked, burred, or broken teeth. If defect cannot be removed with soft stone, replace assembly. b. Look for bent, restricted, or damaged flyweights.



TRANSMISSION GOVERNOR ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
6. when	Rear cover assembly (1)	Governor assembly (2)	Governor Put in position. Governor is seated correctly driven gear makes about a quarter turn as it meshes with drive gear.
7.	New gasket (3), governor cover (4), spacer (5), clamp and cable (6)	Put in position.	
8. ratchet	Governor cover (4) screws (8)	Screw (7) and three a. handle with 1/2-inch drive, screw in until snug. b. Using 11/2-inch socket and torque wrench with 11/2-inch drive, tighten to 15 - 20 ft-lbs (20.3 - 27.1 N m) of torque.	



TASK ENDS HERE

TRANSMISSION REAR MOUNT, CROSSMEMBER, AND SUPPORT BRACKETS

This task covers:

- a. Removal (page 2-813)

b. Cleaning (page 2-816)
- c. Inspection/Replacement (page 2-816)

d. Installation (page 2-816)

INITIAL SETUP

Tools

Extension, 1/2-inch drive, 5-inch
Handle, ratchet, 1/2-inch drive
Press, arbor
Socket, 1/2-inch drive, 3/4-inch
Socket, 1/2-inch drive, 15/16-inch
Trestle, motor vehicle
Wrench, open-end, 3/4-inch
Wrench, open-end, 1 1/6-inch

Materials/Parts - Continued

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

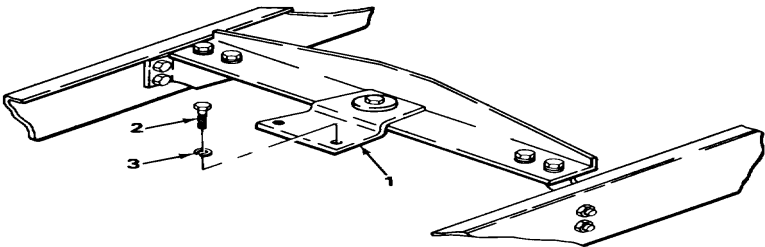
Equipment Condition

Materials/Parts

Lockwasher, rear mounting bracket
(two required)
Lockwasher, rear mounting cross-
member

Transmission and engine covers removed
(TM 9-2320-269-20-2).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL	1. Transmission rear mounting bracket (1) and ratchet	Two screws (2) and lockwashers (3)	a. Place trestle underneath
			b. Using 15116-inch socket
			handle with 1/2-inch drive, unscrew and take out. c. Get rid of lockwashers (3).



TRANSMISSION REAR MOUNT, CROSSMEMBER, AND SUPPORT BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
2. ratchet 3/4- and	Transmission rear mounting cross- member (1) nuts (5)	Four screws (2), washers (3), lock- washers (4), and take out. b. Get rid of lockwashers (4).	a. Using 3/4-inch socket and handle with 112-inch drive, and inch open-end wrench, unscrew
3. floor	Two side frame members (6) and (7) member (1), and transmission rear	Transmission rear mounting cross-	Slide forward and take out through opening.
4. extension,	Transmission left support bracket (9) and frame side member (7)	Two screws (10) and nuts (11)	Using 3/4-inch socket, 5-inch ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew and take out.
5.	Frame side member (7)	Transmission left support bracket (9)	Take off.

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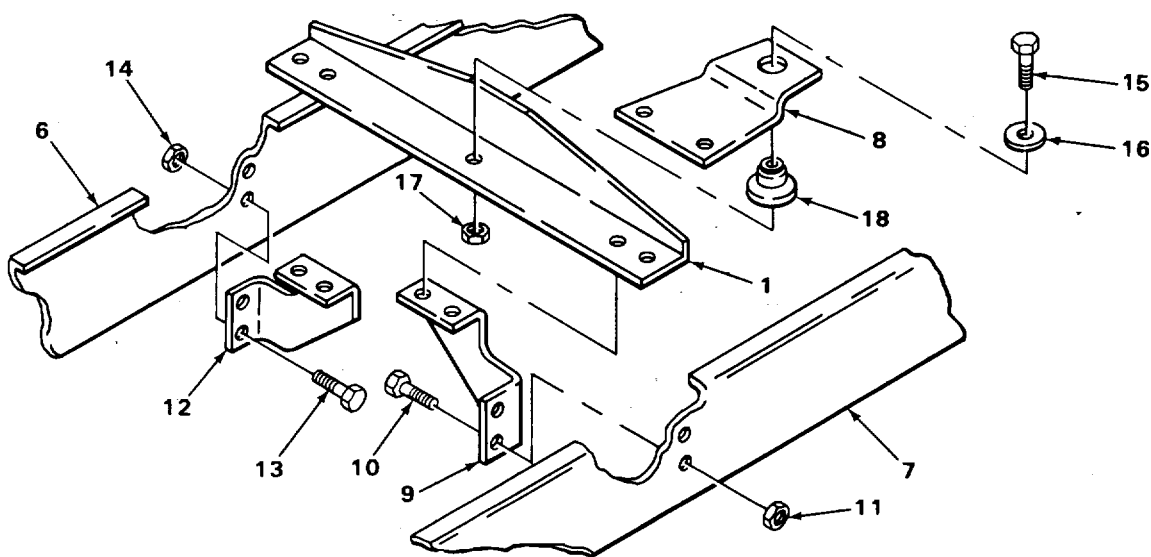
TRANSMISSION REAR MOUNT, CROSSMEMBER, AND SUPPORT BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6.	Transmission right support bracket (12) and frame side member (6)	Two screws (13)	Using 3/4-inch socket, ratchet handle and nuts (14) with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew and take out.
7.	Frame side Member (6)	Transmission right support bracket (12)	Take off.
8.	Transmission rear mounting bracket (8)	Screw (15), washer (16), and nut (17)	Using 15/16-inch socket, ratchet handle with 1/2-inch drive, and 1
1/16-	transmission rear mounting cross-member (1)		inch open-end wrench, unscrew and take off.
9.	Transmission rear mounting cross member (1)	Transmission rear mounting bracket (8)	Take off.

NOTE

Do not do step 10 unless insulator is damaged.

10. Transmission rear mounting bracket (8) Insulator (18) a. Using arbor press, press out.
b. Get rid of.



TRANSMISSION REAR MOUNT, CROSSMEMBER, AND SUPPORT BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

11.	All metal parts	a. Clean in drycleaning solvent. b. Dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts, as needed.

12.	All metal parts	Look for breaks, dents, and cracks.

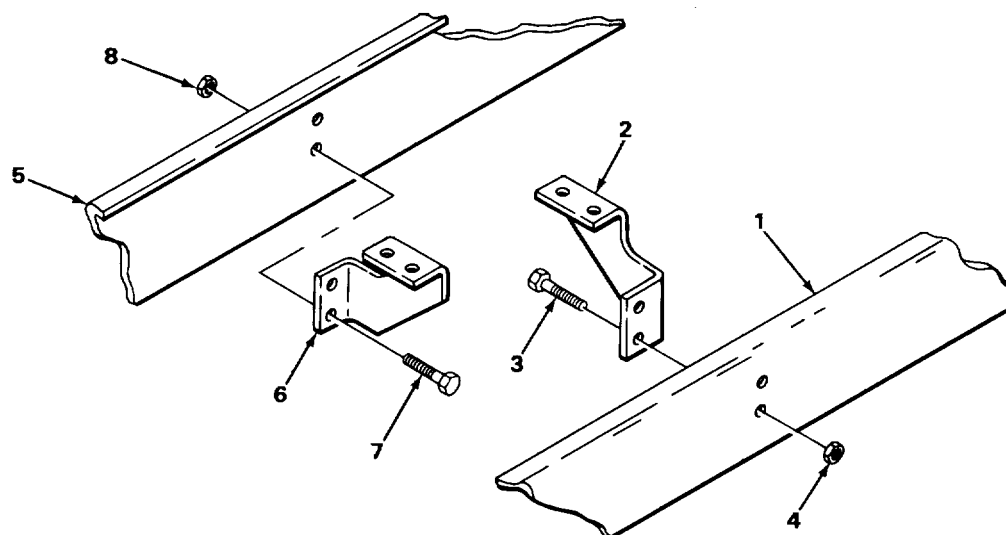
INSTALLATION

13.	Side frame member (1)	Transmission left support bracket (2) Put in position.
14.	Transmission left support bracket (2) and side frame member (1)	Two screws (3) Screw on until snug using 3/4-inch socket, 5-inch extension, ratchet handle with 112-inch drive, and 3/4-inch open-end wrench.
15.	Side frame member (5)	Transmission right support bracket (6) Put in position.
16.	Transmission right support bracket (6) and side frame member (5)	Two screws (7) Screw on until snug using 3/4-inch socket, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench.

TRANSMISSION REAR MOUNT, CROSSMEMBER, AND SUPPORT BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

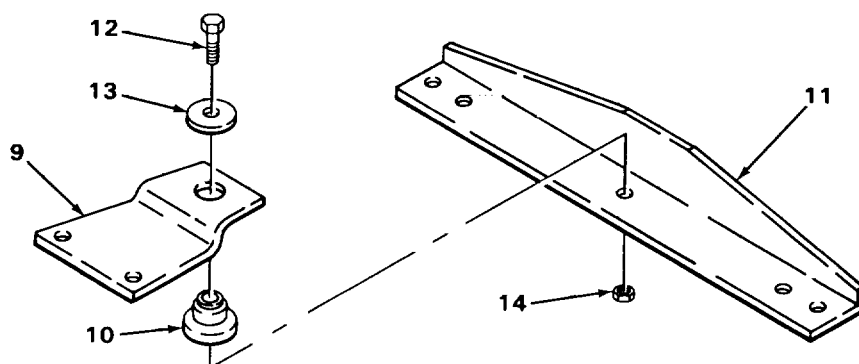
INSTALLATION - CONTINUED



NOTE

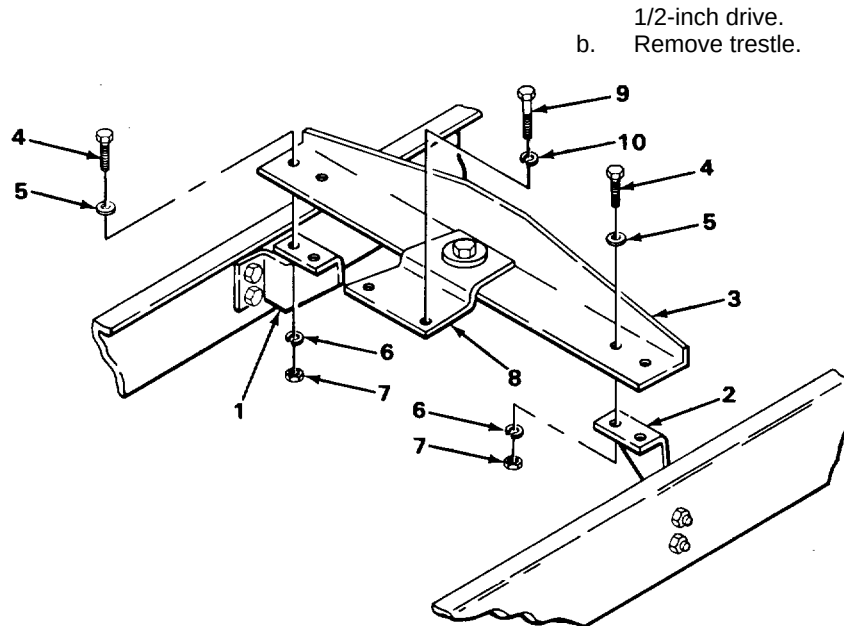
Do not do step 17 unless insulator was removed.

17.	Transmission rear mounting bracket (9)	New insulator (10)	Press in using arbor press.
18.	Transmission rear mounting cross-member (11)	Transmission rear mounting bracket (9)	Put in position.
19.	Transmission rear mounting open-bracket (9)	Screw (12), washer (13), and nut (14)	Screw on until snug using 15/16-inch socket, ratchet handle with 11/2-inch drive, and 1 11/16-inch open-end wrench.



TRANSMISSION REAR MOUNT, CROSSMEMBER, AND SUPPORT BRACKETS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
20.	Right and left support brackets (1) and (2)	Transmission rear mounting cross-member (3)	Put in position through floor opening.
21.	Transmission rear mounting cross-member (3)	Four screws (4), washers (5), new lockwashers (6), and nuts (7)	Screw in, and tighten using 3/4-inch socket, ratchet handle with 1/2-inch drive, and 31/4-inch open-end wrench.
22.	Transmission rear mounting bracket (8)	Two screws (9), and a. new lockwashers (10)	Screw in, and tighten using 1/2-inch drive. Remove trestle. Inch socket and ratchet handle with

**NOTE**

FOLLOW-ON MAINTENANCE: Install transmission and engine covers (TM 9-2320-269-20-2).

TASK ENDS HERE

Section IX. FRONT AXLE

	Page		Page
Front Axle Assembly.....	2-819	Steering Knuckles and Kingpins	2-823

FRONT AXLE ASSEMBLY

This task covers:

a. Removal (page 2-820)	c. Inspection/Replacement (page 2-821)
b. Cleaning (page 2-820)	d. Installation (page 2-822)
-

INITIAL SETUP**Tools**

Brush, stiff-bristle
 Handle, ratchet, 3/4-inch drive
 Jack, dolly-type
 Socket, deep well, 3/4-inch drive,
 1 1/8-inch
 Trestle, motor vehicle
 (two required)

Personnel Required

One

Equipment Condition

Steering knuckles and kingpins removed
 (page 2-823).

Materials/Parts

Detergent, non-sudsing (item 14,
 appendix B)
 Rags, wiping (item 42, appendix B)
 Solvent, drycleaning (item 49, appendix B)

FRONT AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

WARNING

It is very important that the vehicle is firmly supported and balanced before you begin to maintain the front axle. If the truck is not properly supported with trestles, it could fall and crush you.

REMOVAL

1. axle	Two U-bolt seats (1) and front axle (2)	Four U-bolts (3), eight washers (4), and nuts (5)	a. Position dolly-type jack under (2), and raise axle slightly. b. Position two trestles under frame, and raise to support vehicle. c. Remove jacks from axle (2). d. Using 1 1/8-inch deep well socket, and ratchet handle with 3/4-inch drive, unscrew and take off.
2.	Two front spring assemblies (6)	Two U-bolt seats (1)	Take off.
3.	Front axle (2)	Using dolly-type jack,	lower axle (2) and take out from under vehicle.
4.	Front axle (2)	Castor wedge (7)	Take off and note angle.

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

5.	Front axle (2)	a. Clean with drycleaning solvent. b. Wipe dry with clean, dry rags.

FRONT AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSPECTION/REPLACEMENT

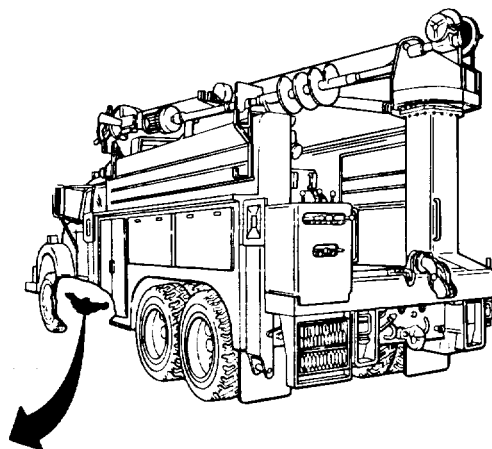
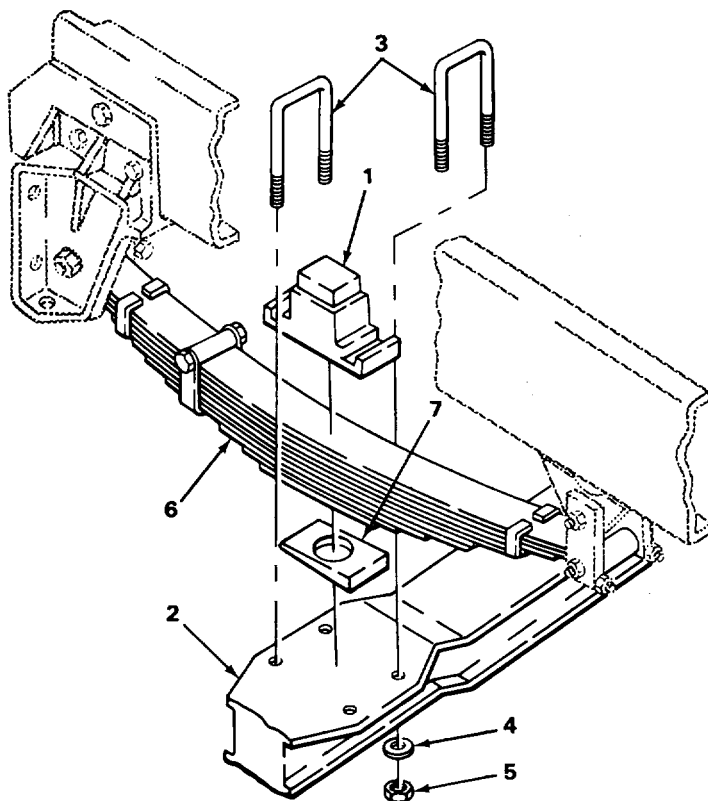
6.	Two U-bolt seats (1)	a. Clean in soapy water. b. Scrub off stubborn dirt and grime with stiff-bristle brush. c. Rinse in clean water. d. Dry with clean, dry rags.

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

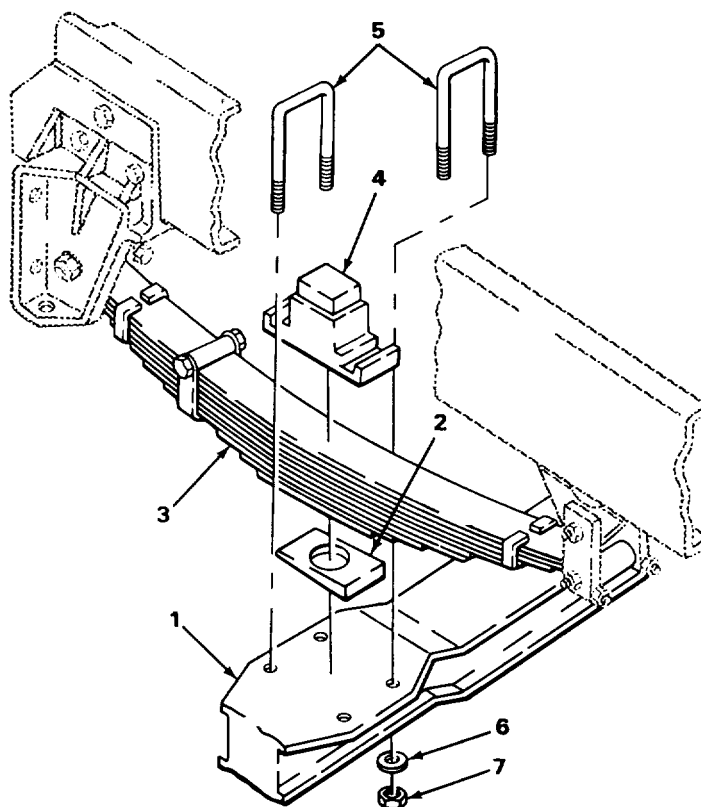
Replace defective parts as needed.

7.	Front axle (2)	a. Look for cracks, breaks, large dents, and gouges. b. Make sure kingpin bores are clean and smooth.



FRONT AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
8.	Front axle (1)	Wedge (2)	Put in place.
9.	Two front spring assemblies (3)	Front axle (1)	Using dolly-type jack, place in position.
10.	Two U-bolt seats (4)	a. Put in position. b. Using dolly-type jack, raise axle (1).	
11. 1/8- ratchet	Two U-bolt seats (4) and front axle (1)	Four U-bolts (5), eight washers (6), and nuts (7) a. Screw in, and tighten using 1 inch deep well socket and handle with 3/4-inch drive. b. Remove trestles from frame and place under axle (1). c. Remove dolly-type jack.	



FRONT AXLE ASSEMBLY - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Install steering knuckles and kingpins (page 2-823).

TASK ENDS HERE**STEERING KNUCKLES AND KINGPINS**

This task covers:

a. Removal (page 2-824) b. Disassembly (page 2-826) c. Cleaning (page 2-827)	d. Inspection/Replacement (page 2-828) e. Assembly (page 2-828) f. Installation (page 2-830)

INITIAL SETUP**Tools**

Driftpin, brass, 3/4-inch
 Driftpin, bronze, 3/4-inch,
 18-inch long
 Extension, 3/8-inch drive, 6-inch
 Gage, thickness
 Hammer, ball-peen, machinist's, 3-lb
 Handle, ratchet, 3/8-inch drive
 Handle, ratchet, 3/4-inch drive
 Jack, hydraulic, hand
 Pliers, slip-joint, angle-nose
 Press, arbor, hand-operated
 Punch, drive-pin, 3/16-inch
 Sleeve, knuckle bushing remover
 Socket, 3/8-inch drive, 1/2-inch
 Socket, 3/8-inch drive, 7/16-inch
 Socket, deep well, 3/8-inch drive,
 9/16-inch
 Socket, 3/4-inch drive, 1 7/8-inch
 Vise, machinist's
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 1/2-inch
 Wrench, torque, 3/8-inch drive
 Wrench, torque, 3/4-inch drive
 0 - 600 ft-lb capacity

Materials/Parts

Bushing, steering knuckle (as needed)
 Grease, GAA (item 20, appendix B)
 Lockwasher, bracket
 Lockwasher, knuckle cap (six required)
 Packing, knuckle (two required)
 Pin, cotter (two required)
 Rags, wiping (item 42, appendix B)
 Seal, front axle (two required)
 Shims and washers (as needed)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

One

Equipment Condition

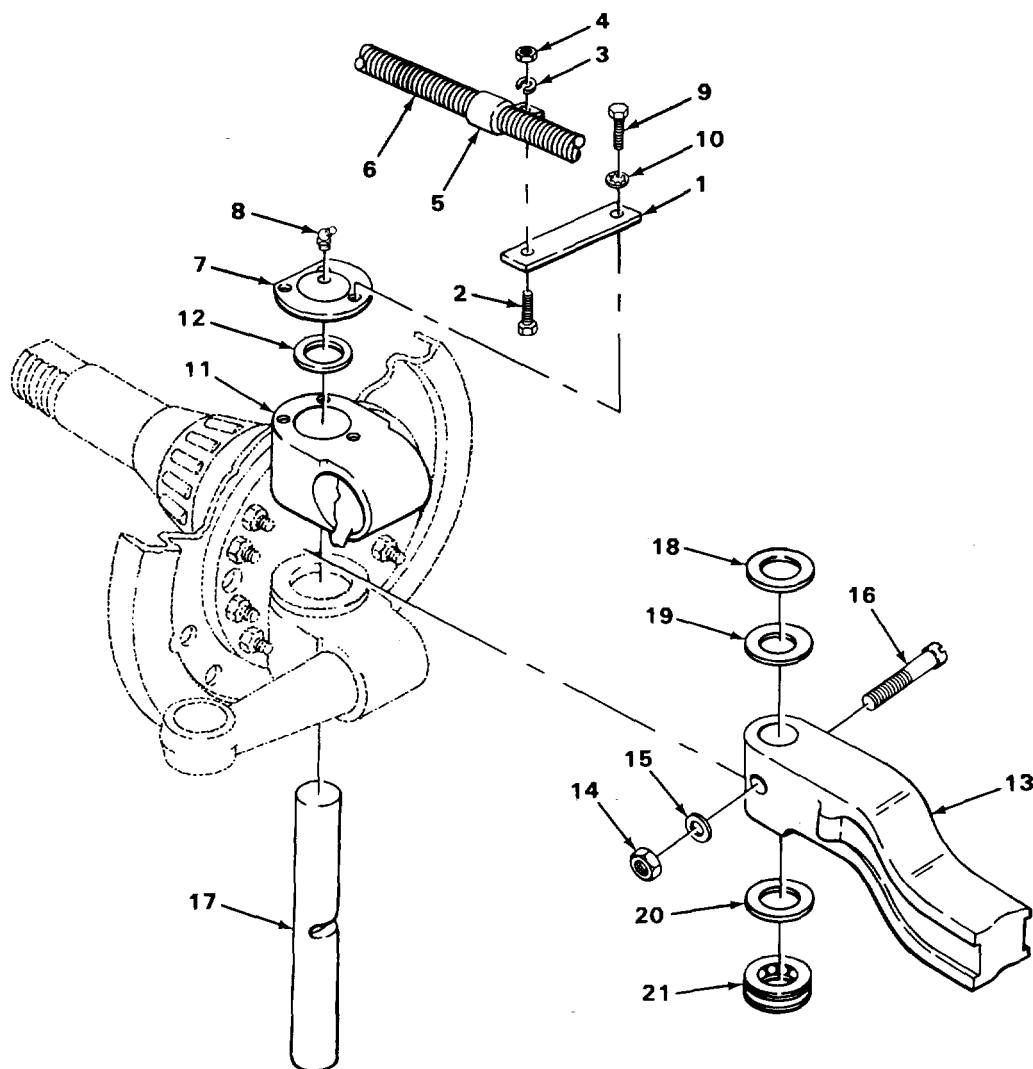
Front wheels and hubs removed
 (TM 9-2320-269-20-1).
 Tie rod removed (TM 9-2320-269-20-1).
 Brake chambers and mounting brackets
 removed (TM 9-2320-269-20-1).
 Brakes and backing plates removed
 (TM 9-2320-269-20-1).
 Slack adjusters removed
 (TM 9-2320-269-20-1).

STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION REMARKS
NOTE		
Right and left side steering knuckles are serviced the same way. Left side is shown. If only right side is being serviced, skip step 1 and begin at step 2.		
REMOVAL		
1.	Left side steering knuckle	Drag link Removal (TM 9-2320-269-20-1).
2.	Bracket (1) washer (3), and nut (4)	Screw (2), lock- a. Using 7/16-inch socket, 6-inch extension, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (3).
3.	Clip (5) and sensor wire (6)	Take off, and move out of the way.
4.	Two knuckle caps (7) fittings (8)	Two lubrication Using 7/16-inch open-end wrench, unscrew and take out.
5.	Six screws (9) and lockwashers (10)	a. Using 1/2-inch open-end wrench, 112-inch socket, and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwashers (10).
6.	Steering knuckle (11) and bracket (1)	Two knuckle caps a. Take out. (7), packings (12), b. Get rid of packings (12).
7.	Front axle (13) washer (15)	Nut (14) and Using 9/16-inch deep well socket and ratchet handle with 3/8-inch drive, unscrew and take out.
8.	Draw key (16)	Using 3/16-inch drive-pin punch and 3-lb ball-peen hammer, drive out.
9.	Steering knuckle (11)	Kingpin (17) Using bronze 3/4-inch driftpin and 3-lb ball-peen hammer, drive out.

STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
10.	Front axle (13) knuckle (11)	Steering a. Take off. b. Secure in machinist's vise.	
11.	Upper seal (18), shim pack (19), lower seal (20), and bearing (21)	a. Take off. b. Get rid of seals (18) and (20).	



STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
NOTE			
If you are servicing right side knuckle, do not do steps 12 thru 15.			
12.	Upper steering arm (1)	Cotter pin (2)	a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.
13.	Nut (3)	Using 1 7/8-inch socket and ratchet handle with 3/4-inch drive, unscrew and take off.	
14.	Steering knuckle (4) arm (1)	Upper steering	Using 3/4-inch brass driftpin and 3-lb ball-peen hammer, drive out.
15.	Upper steering arm (1)	Woodruff key (5)	Using 3/16-inch drive-pin punch and ball-peen hammer, tap out.
16.	Lower steering arm (6)	Cotter pin (7)	a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.
17.	Nut (8)	Using 1 7/8-inch socket and ratchet handle with 3/4-inch drive, unscrew and take out.	
18.	Steering knuckle (4) arm (6)	Lower steering	Using 3/4-inch brass driftpin and 3-lb ball-peen hammer, drive out.
19.	Lower steering arm (6)	Woodruff key (9)	Using 3/16-inch drive-pin punch and ball-peen hammer, tap out.
NOTE			
Do not remove bushings unless inspection shows they must be replaced. Go to step 29 for inspection guidelines.			
20.	Steering knuckle (4)	Upper bushing (10)	a. Using knuckle bushing remover and 3-lb ball-peen hammer, drive out. b. Get rid of.
21.	Lower bushing (11)	a.	Using knuckle bushing remover sleeve and 3-lb ball-peen hammer, drive out. b. Get rid of.

STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

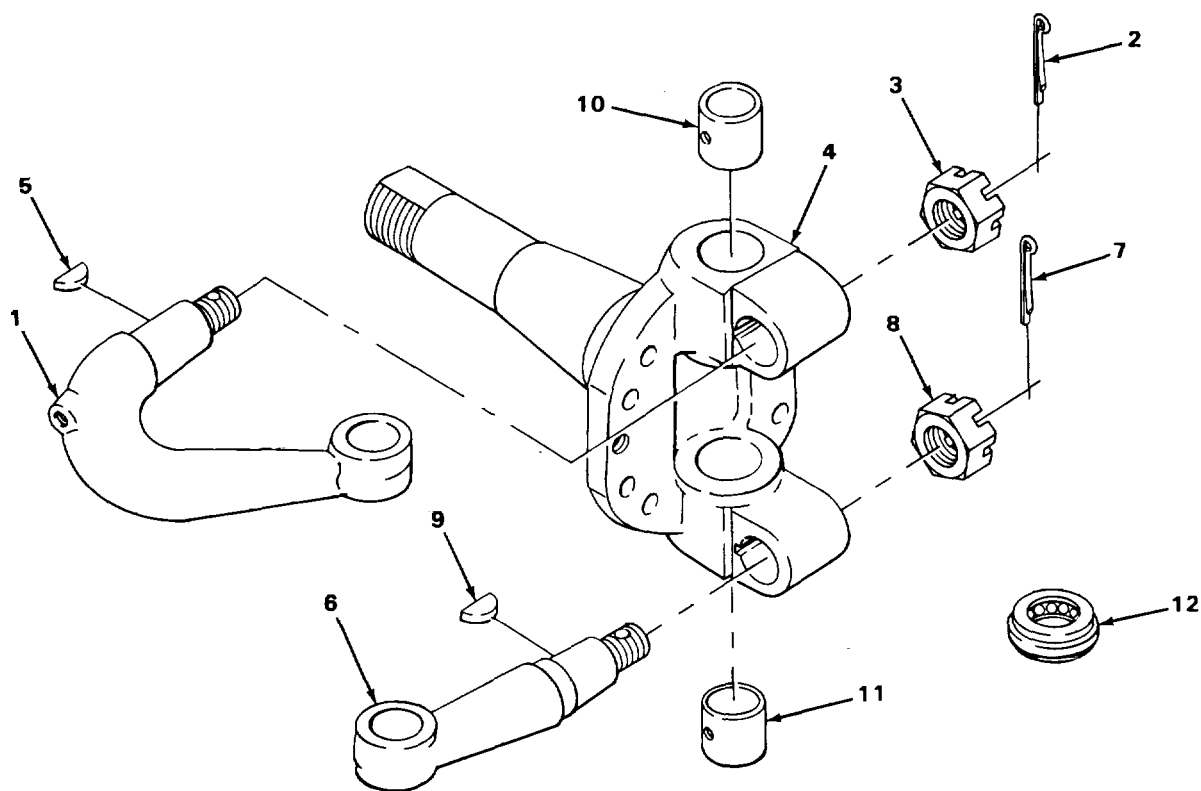
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

22.	All metal parts except bearing (12)	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.
23.	Bearing (12)	Clean (TM 9-214).



2-827

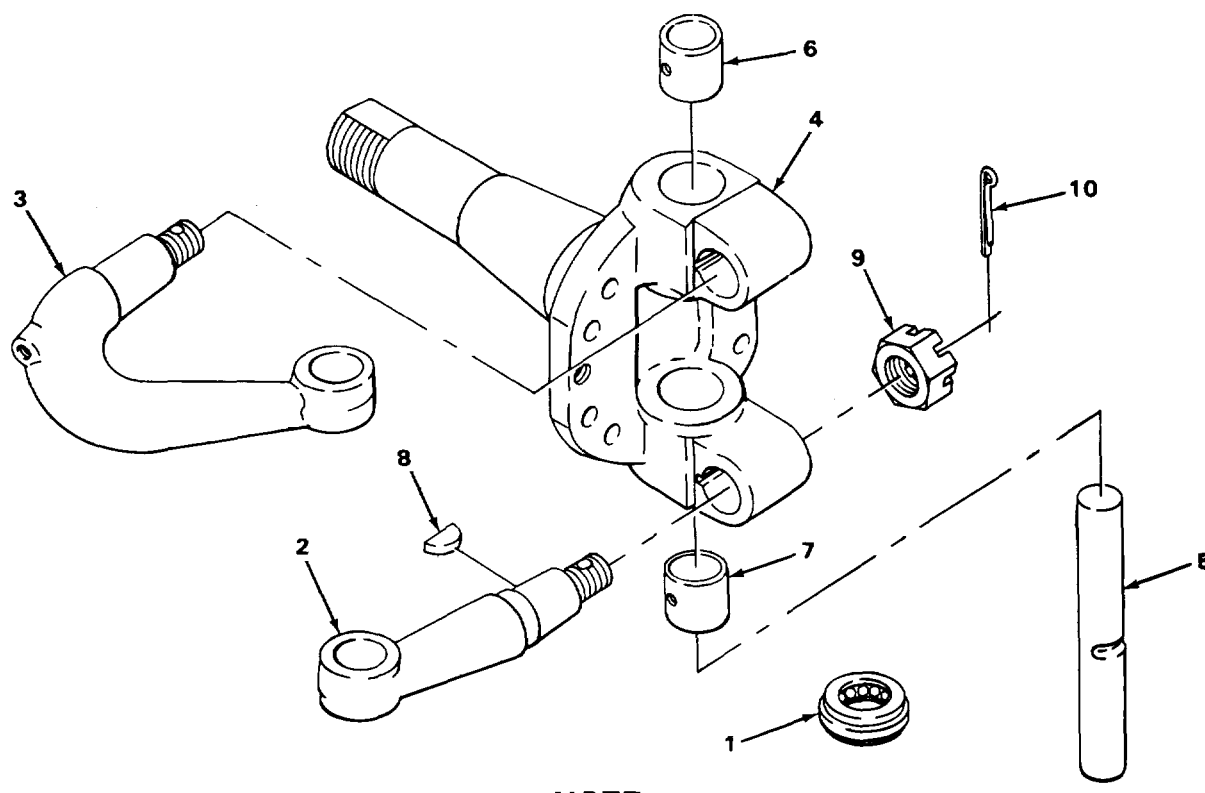
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STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT			
NOTE			
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).			
Replace damaged parts as necessary.			
24.	Bearing (1)	Inspect (TM 9-214).	
25.	Lower steering arm (2)	a. Look for cracks, breaks, and dents. b. Look for damaged threads and key slot.	
NOTE			
Do not do step 26 if you are inspecting left side knuckle assembly.			
26.	Upper steering arm (3)	a. Look for cracks, breaks, and dents. b. Look for damaged threads and key slots.	
27.	Steering knuckle (4)	a. Look for cracks, breaks, dents, and deeply scratched bushing bores. b. Look for signs of excessive wear.	
28.	Kingpin (5)	a. Look for scratches, dents, and flat spots. b. Look for signs of wear.	
29.	Upper bushing (6) and lower bushing (7)	a. Look for deep scratches and gouges. b. Check for looseness. c. Look for signs of uneven wear. d. Look for out-of-round condition.	If any defects are found, go back to step 20, and remove damaged bushings. If bushings are not damaged, continue task at step 30.
ASSEMBLY			
30.	Steering knuckle (4)	New lower bushing (7)	Press in until flush with knuckle (4) using arbor press.
31.	New upper bushing (6)		Press in until bushing is 0.20 to 0.26-inch (0.50 to 0.66 mm) below edge of bore using arbor press.

STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
32.	Lower steering arm (2)	Woodruff key (8)	Put in.
33.	Steering knuckle (4)	Lower steering a. Put knuckle (4) in machinist's vise. arm (2) b. Line up key (8) with keyway, and put in.	
34.	Lower steering arm (2)	Nut (9)	Screw in until snug, and tighten to 350-400 ft-lb (474-542 N m) of torque using 1 7/8-inch socket and torque wrench with 3/4-inch drive.
35.	New cotter pin (10)	Put in, and bend back ends over nut using angle-nose slip-joint pliers.	You may have to back off nut so holes line up.

**NOTE**

Steps 36 thru 39 are only used for left side steering knuckle. If you are assembling right side knuckle, go on to step 40.

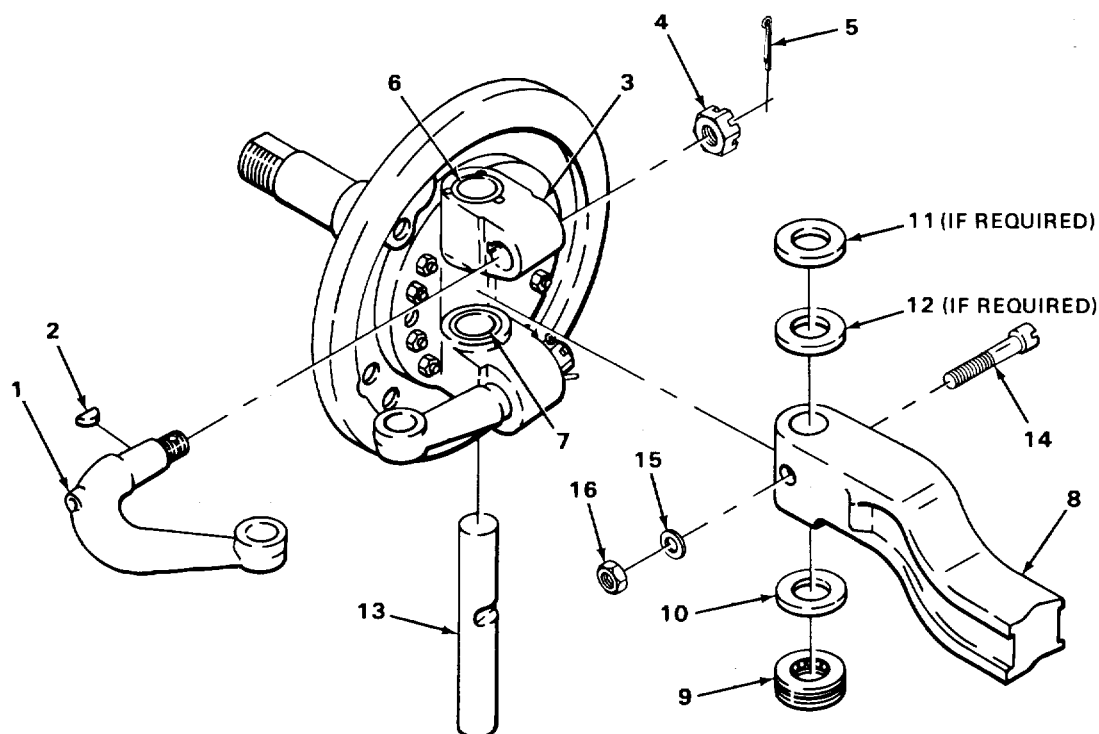
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STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
36.	Upper steering arm (1)	Woodruff key (2)	Put in.
37.	Steering knuckle (3)	Upper steering arm (1)	Line up key (2) with keyway and put in.
38.	Upper steering arm (1)	Nut (4)	Screw on until snug, and tighten to 350-400 ft-lb (474-542 N m)) of torque using 1 7/8-inch socket and torque wrench with 3/4-inch drive.
39.	New cotter pin (5)	Using angle-nose slip-join pliers, put in ends over nut (4).	You may have to back off nut so holes line up.
INSTALLATION			
40.	Steering knuckle (3)	Two bushings (6) and (7)	Apply grease (LO 9-2320-269-12).
41.	Front axle (8) knuckle (3)	Steering a.	Make sure axle (8) kingpin hole is clean and dry.
		b.	Put in position.
42.	Steering knuckle (3)	Thrust bearing (9) and two new	a. Raise knuckle (3) slightly. b. Slide in bearing (9) and seals
(10).	seals (10)		Thrust bearings that are not marked TOP, should be put in so retainer lip is down.
43.	Front axle (8) knuckle (3)	Steering a.	Place hydraulic jack underneath.
		b.	Raise knuckle (3) using jack so that all clearance is taken up between lower yoke, thrust bearing (9), and lower face of the axle (8).
		c.	Using thickness gage, measure clearance between the top of axle and lower face of the upper knuckle yoke.
			The clearance must not be more than 0.015 inch (0.03 mm). Washers and shims are available in various thicknesses to take up this clearance.

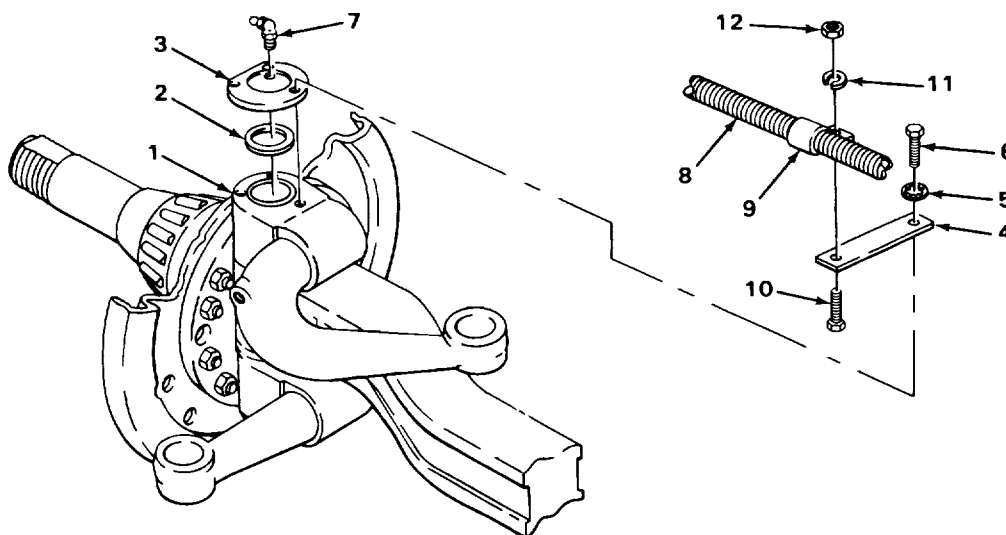
STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
44. mm)	Steering knuckle (3) required	Shims (11) and washers (12) as	Put in to maintain 0.015-inch (0.03 clearance as outlined in step 43c.
45.	Kingpin (13)	a. Apply grease. b. Line up flat with draw key hole. c. Using 3-lb ball-peen hammer and 3/4- inch bronze drift, drive in.	
46.	Draw key (14)	Drive in so flat side mates with the flat on the kingpin using 3-lb ball-peen hammer and 3/16-inch drive-pin punch.	
47. 50-55	Draw key (14) nut (16)	Washer (15) and ft-lb (68-75 N m) of torque using 9116-inch deep well socket and torque wrench with 318-inch drive.	Screw on until snug, and tighten to



STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
48.	Steering knuckle (1)	Two new packings (2)	Put on.
49.	Two knuckle caps (3) and bracket (4)	Put in place.	
50. and	Two knuckle caps (3) and bracket (4)	Six new lock-washers (5) and screws (6)	Screw in, and tighten using 1/2-inch open-end wrench, 1/2-inch socket, ratchet handle with 3/8-inch drive.
51.	Two knuckle caps (3)	Two lubrication fittings (7)	Screw in, and tighten using 7/16-inch open-end wrench.
52.	Bracket (4) with clip (9)	Sensor wire (8)	Put in place.
53.	Screw (10), new lockwasher (11), and nut (12)		Screw together, and tighten using 7/16-inch socket, 6-inch extension, and ratchet handle with 3/8-inch drive.
54.	Left side steering knuckle	Drag link	Install (TM 9-2320-269-20-1).



STEERING KNUCKLES AND KINGPINS - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE:

1.

2.

3.

4.

5.

6.
- Install slack adjusters (TM 9-2320-269-20-1).

Install backing plates and brakes (TM 9-2320-269-20-1).

Install mounting brackets and brake chambers (TM 9-2320-269-20-1).

Install tie rod (TM 9-2320-269-20-1).

Install front hubs and wheels (TM 9-2320-269-20-1).

Lubricate steering knuckle and kingpins (LO 9-2320-269-20-1).

TASK ENDS HERE

Section X. REAR AXLE

	Page		Page
Forward-Rear Axle Differential	2-847	Power Divider Lockout Assembly	2-897
Forward-Rear Axle Housing	2-844	Rear-Rear Axle Differential	2-908
Interaxle Differential	2-875	Rear-Rear Axle Housing	2-905
Intermediate Differential	2-887	Tandem Axle Assembly	2-834

TANDEM AXLE ASSEMBLY

This task covers:

- a. Removal (page 2-835)
- b. Installation (page 2-839)

INITIAL SETUP**Tools**

Bar, pry, 24-inch
 Block, wood, 8-in. x 8-in. x 8-ft
 (as required)
 Chocks, wheel
 Driftpin, brass, 3/4-inch
 Hammer, ball-peen, machinist's
 Handle, ratchet, 3/4-inch drive
 Hoist, overhead, 20-ton lifting
 capacity
 Pliers, slip-joint, angle-nose
 Socket, 3/4-inch drive, 1 5/16-inch
 Socket, 3/4-inch drive, 1 11/16-inch
 Wrench, open-end, 7/16-inch
 Wrench, open-end, 7/8-inch
 (two required)
 Wrench, open-end, 1-inch
 Wrench, open-end, 1 11/16-inch
 Wrench, torque, 3/4-inch drive,
 0 - 600 ft-lb capacity

Materials/Parts

Pin, cotter, torque rod studs
 (two required)
 Lockwasher, wheel sensor wire clips
 (six required)

Personnel Required

Two

Equipment Condition

Rear axles drained (LO 9-2320-269-12).
 Air reservoir drained (TM 9-2320-269-20-1).
 Propeller shaft disconnected at interaxle
 differential (TM 9-2320-269-20-1).

TANDEM AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

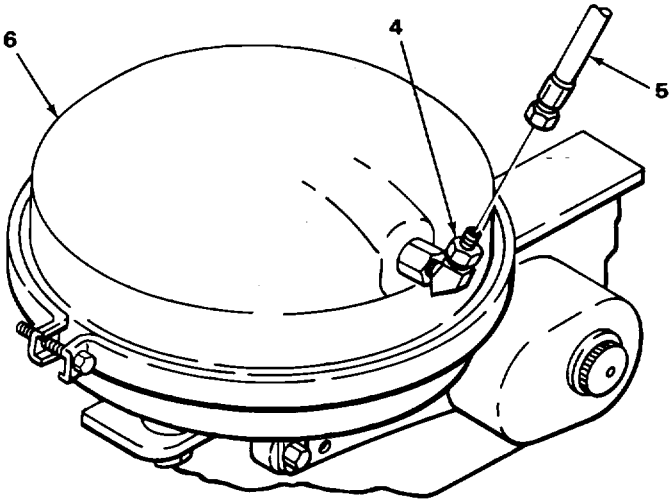
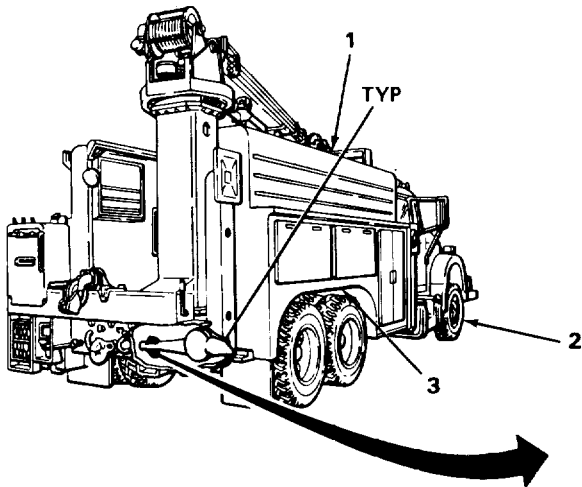
REMOVAL

1.	Vehicle (1)	Front wheels (2)	Block with chocks.

WARNING

In the following step you will be securing the rear frame overhead hoist. You must make absolutely sure that the hoist can bear the weight of the vehicle and hold it securely when vehicle is raised. If lifting hoist is not secured properly, the vehicle could fall causing serious injury or death to you or others.

2.	Rear frame (3)	Secure to 20-ton overhead hoist.	Lifting chains or cables should not have any slack. Do not lift truck at this time.
3.	Two elbows (4) assemblies (5)	Two hoseUsing 7/8-inch and 1-inch open-end wrenches, unscrew and take off.	
4.	Two rear-rear axle brake chambers (6)	Two hoseMove away from. assemblies (5)	



TYPICAL 2 PLACES

TANDEM AXLE ASSEMBLY - CONTINUED

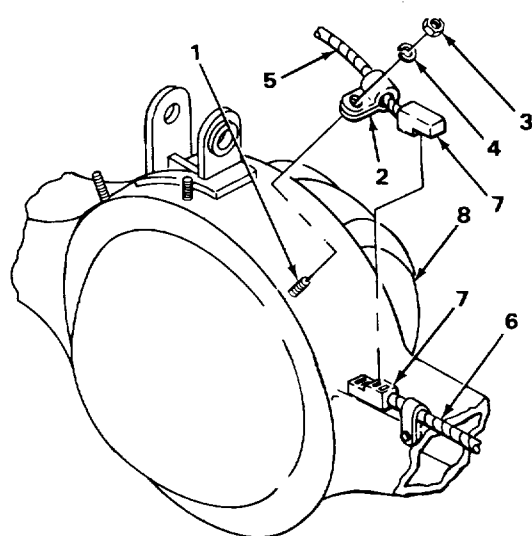
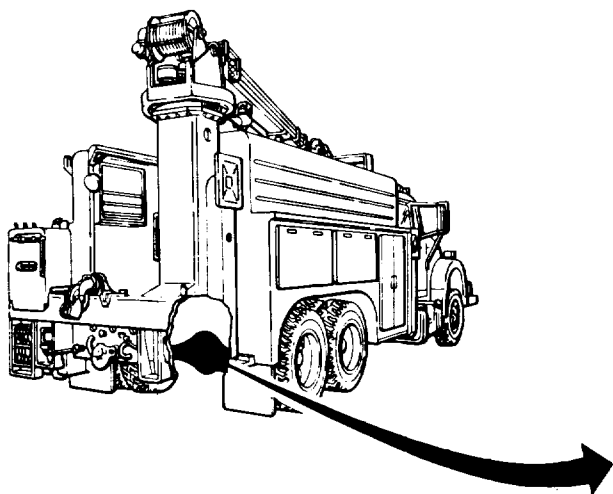
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

NOTE

Steps 5 thru 8 disconnect wheel sensor wiring from rear-rear axle housing. Do the same steps for forward-rear axle housing.

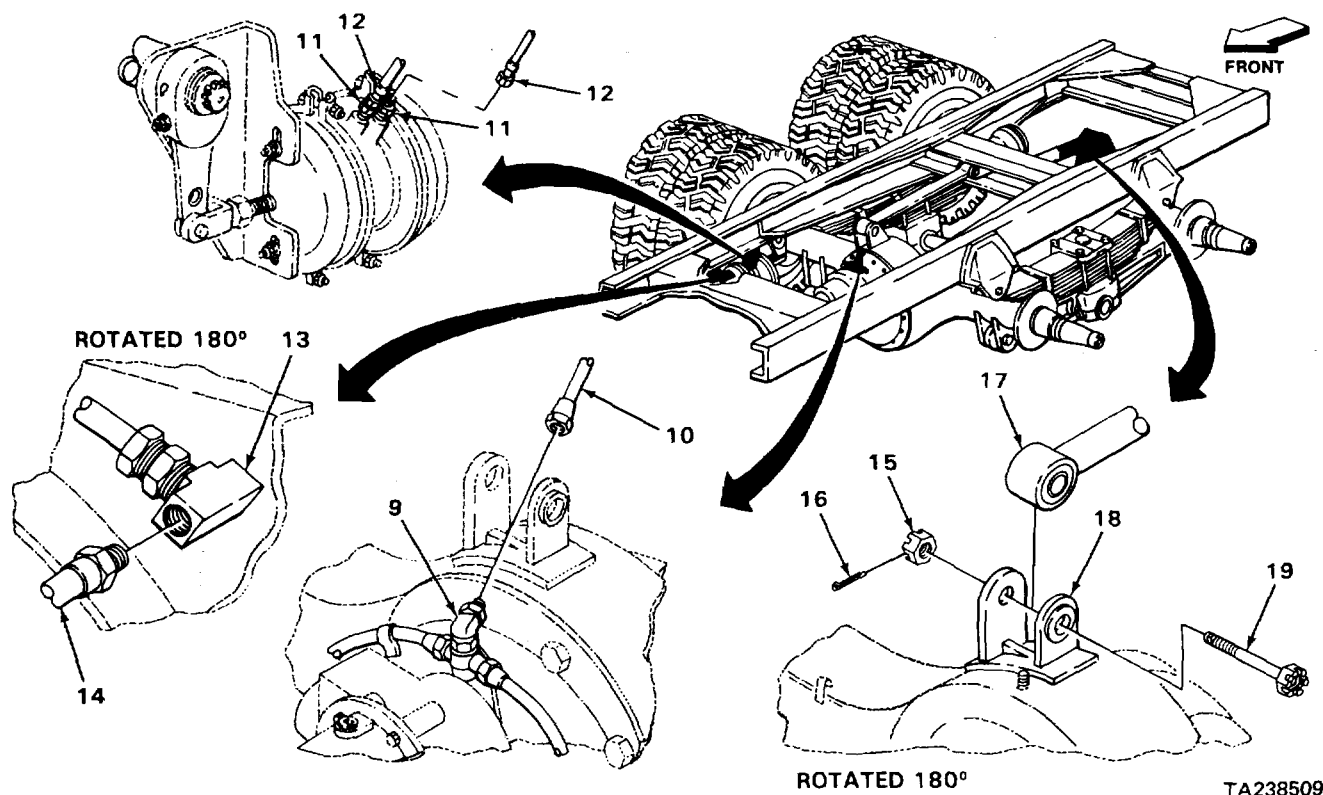
5. wrench,	Three studs (1) and clips (2)	Three nuts (3) and lockwashers (4)	a. Using 7/16-inch open-end unscrew and take off. b. Get rid of lockwashers (4).
6.	Three studs (1) with wheel sensor wires (5)	Three clips (2)	Take off.
7.	Four wheel sensor wires (5) and (6)	Four connectors (7)	Pull apart.
8.	Axle housing (8) wires (5)	Two wheel sensor	Move away from.



9. open-end	Elbow (9)	Hose assembly (10)	a. Using 7/8-inch and 1-inch wrenches, unscrew and take out. b. Move out of the way.
10. open-end	Coupling (11)	Hose assembly (12)	a. Using 7/8-inch and 1-inch wrenches, unscrew and take off. b. Move out of the way. c. Do step 10a and 10b for right side.

TANDEM AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL- CONTINUED			
11. unscrew and	Tee (13)	Hose assembly (14) Using two 7/8-inch wrenches, take out.	
NOTE			
Steps 12 thru 15 are disconnect procedures for rear-rear axle torque rod. Do the same steps for forward-rear axle torque rod.			
12.	Nut (15)	Cotter pin (16) a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.	
13.	Torque rod (17) and axle housing bracket (18)	Nut (15) Using 1 11/16-inch open-end wrench, 1 11/16-inch socket, and ratchet handle with 3/4-inch drive, unscrew and take out.	
14.	Torque rod stud (19)	Using ball-peen hammer and 3/4-inch brass driftpin, drive out.	
15. toward	Axle housing bracket	Torque rod (17) Using 24-inch pry bar, push up frame, out of the way.	



TANDEM AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

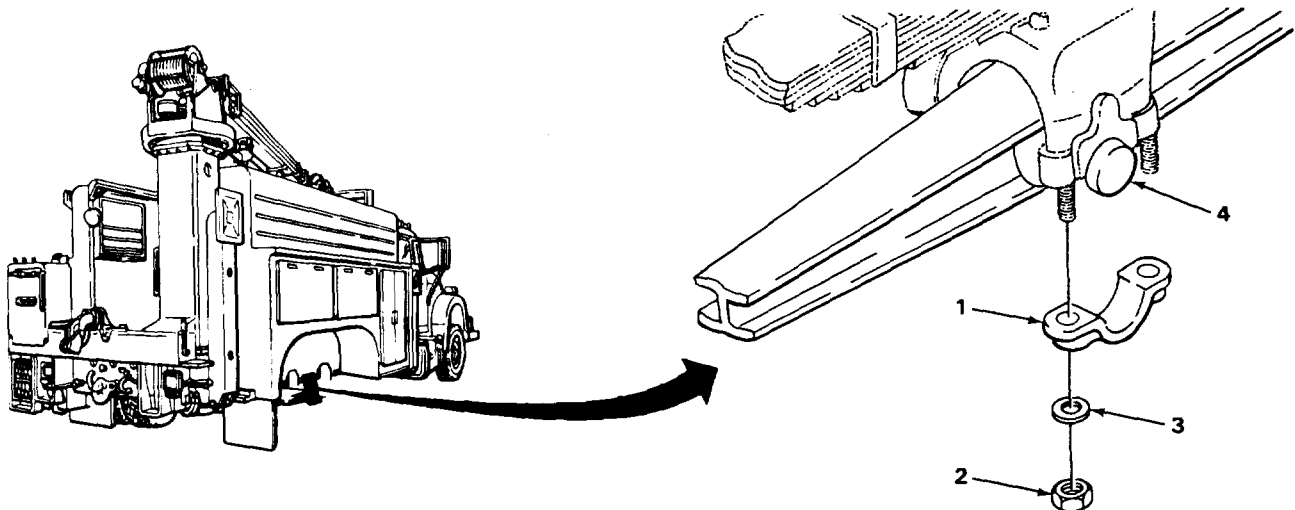
NOTE

Steps 16 and 17 are steps for left side saddle caps. Repeat for right side.

16.	Two saddle caps (1)	Four nuts (2) and washers (3) Using 1 5/16-inch socket and ratchet handle with 3/4-inch drive, unscrew and take off.
17.	Equalizer beam (4)	Two saddle caps (1) Take off.

WARNING

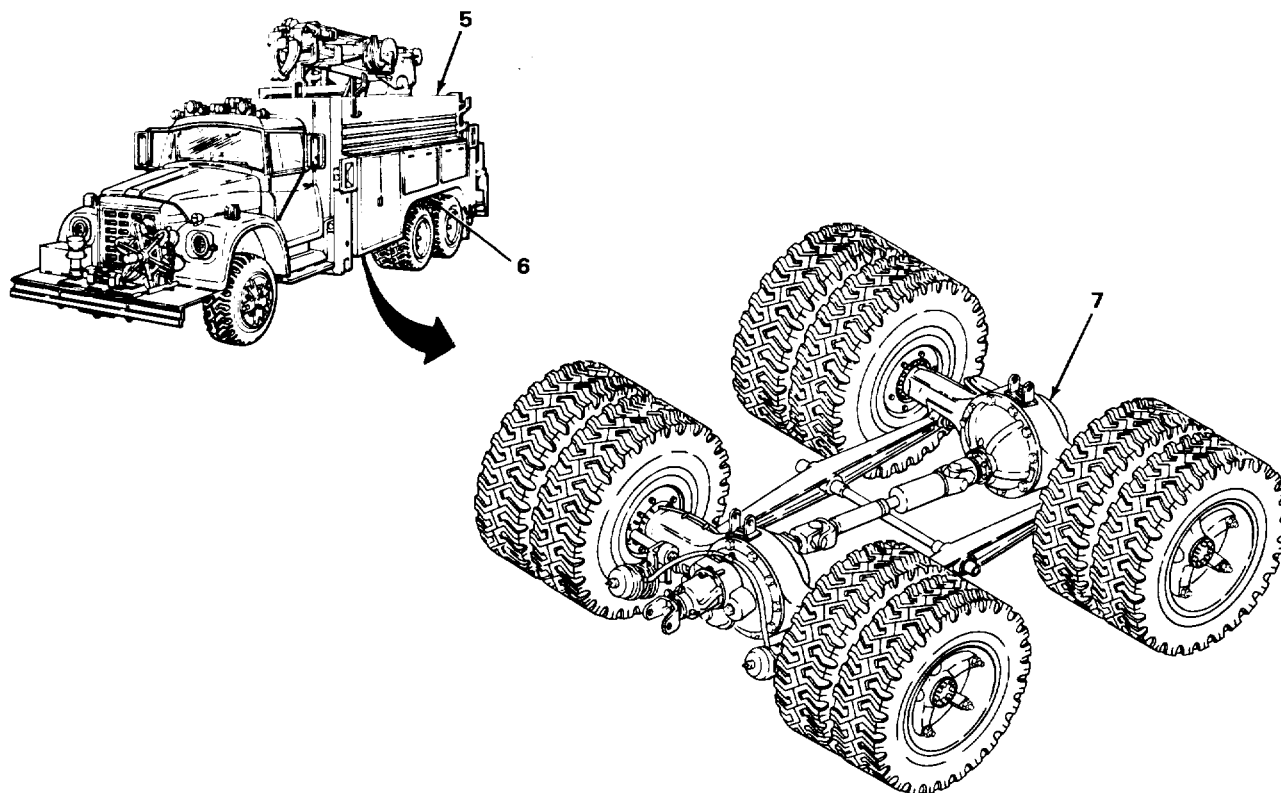
In the following steps you will be raising the vehicle. You must make absolutely sure that the hoist can bear the weight of the vehicle and hold it securely when vehicle is raised. If the hoist is not secured properly, the vehicle could fall, causing serious injury and death to you or others.



18.	Vehicle (5)	Rear frame (6) Using 20-ton overhead hoist, lift until saddle clears equalizer beam.
19.	Tandem axle assembly (7)	a. Check behind vehicle to make sure there is enough clearance for assembly (7). b. Make sure there is no equipment in the way. c. With help from assistant, roll straight out from under frame (6).

TANDEM AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
20.	Rear frame (6)	a. Put wood blocks in position under frame. b. Using 20-ton overhead hoist, lower onto blocks and make sure frame is secure. Do not take off hoist.	
INSTALLATION			
21. Vehicle (5)	Rear frame (6)	a. Using 20-ton overhead hoist, raise. b. Take wood blocks out from under frame.	
22.	Tandem axle assembly (7)	With help from assistant, roll under frame (6) into position.	
23.	Rear frame (6)	Using 20-ton overhead hoist, carefully lower and, at the same time, have	



TANDEM AXLE ASSEMBLY - CONTINUED

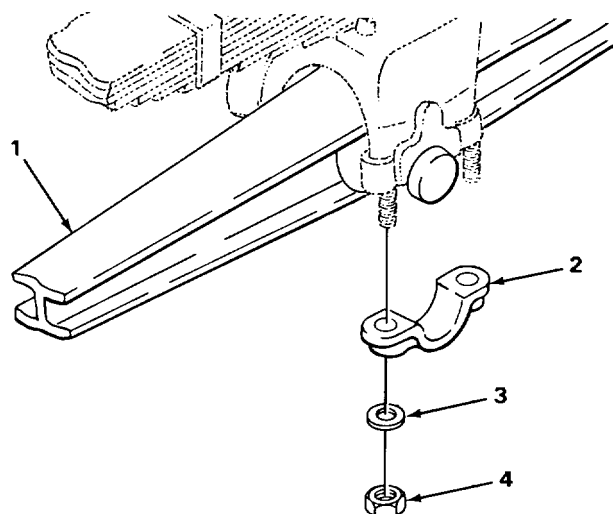
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

NOTE

Steps 24 and 25 are saddle cap installation for right side. Repeat steps for left side.

24. Equalizer beam (1)	Two saddle caps (2)	Put in place.
25. Two saddle caps (2)	Four washers (3) and nuts (4)	Using 1 5/16-inch socket and torque wrench with 3/4-inch drive, screw on and tighten to 225 - 275 ft-lb (206 - 373 N m) of torque.

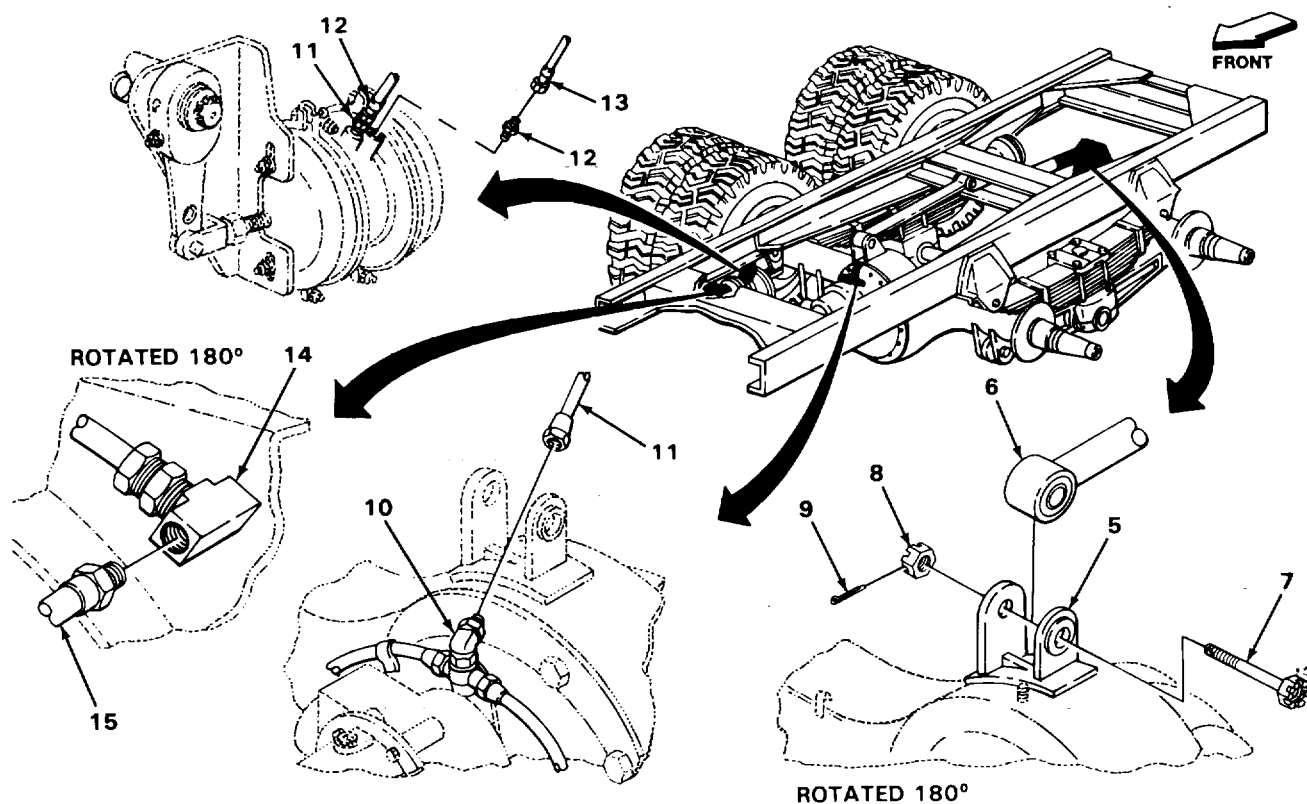
**NOTE**

Steps 26 thru 29 are rear-rear axle torque rod installation procedures. Repeat steps for forward-rear axle torque rod.

26. Axle housing bracket (5)	Torque rod (6)	Pull down, and put in position.
27. Housing bracket (5) and torque rod (6)	Torque rod stud (7)	Using ball-peen hammer, drive in.
28.	Nut (8)	a. Screw on and tighten to 225-250 ft-lb (306-339 N m) of torque using 1 11/16-inch socket torque wrench with 3/4-inch drive, and 1 11/16-inch open-end wrench.

TANDEM AXLE ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
28. Continued			b. Line up slots with hole in stud. Do not back off nut to line up holes.
29. Nut (8)	New cotter pin (9)		a. Using angle-nose slip-joint pliers, put in. b. Separate ends and bend back over nut (8).
30. Elbow (10)	Hose assembly (11)		a. Screw on, and tighten using 7/8-inch and 1-inch open-end wrenches.
31. Coupling (12)	Hose assembly (13)		b. Do the same for the right side. Screw on, and tighten using 7/8-inch and 1-inch open-end wrenches.
32. Tee (14)	Hose assembly (15)		Screw in, and tighten using two 7/8-inch open-end wrenches.



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TANDEM AXLE ASSEMBLY - CONTINUED

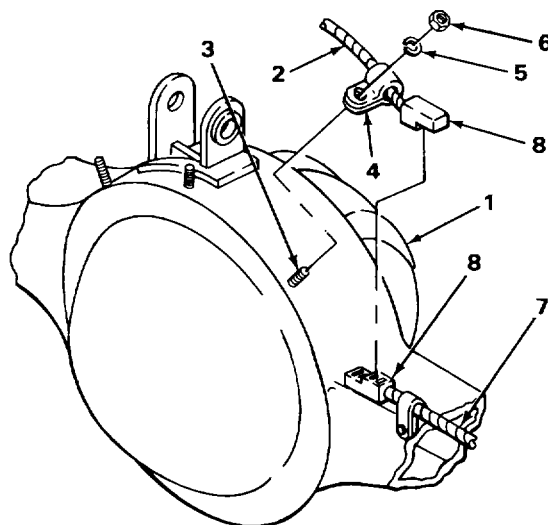
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

NOTE

Steps 33 thru 36 will connect wheel sensor wiring to rear-rear axle housing. Do the same steps for forward-rear axle housing.

33. Axle housing (1)	Two wheel sensor wires (2)	Put in position.
34. Three studs (3)	Three clips (4) with wheel sensor wires (2)	Put on.
35. Three studs (3) and clips (4)	Three new lock-washers (5) and nuts (6)	Screw on, and tighten using 7/16-inch open-end wrench.
36. Four wire sensor wires (2) and (7)	Four connectors (8)	Push together.



37. Two rear-rear airbrake chambers (9)	Two hose assemblies (10)	Put in position.
38. Two elbows (11)	Two hose assemblies (10)	Screw on, and tighten using 7/8-inch and 1-inch open-end wrenches.

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TANDEM AXLE ASSEMBLY - CONTINUED

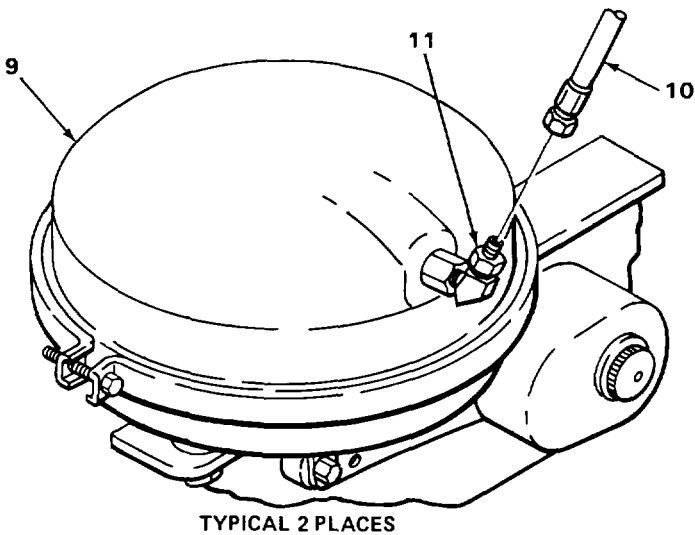
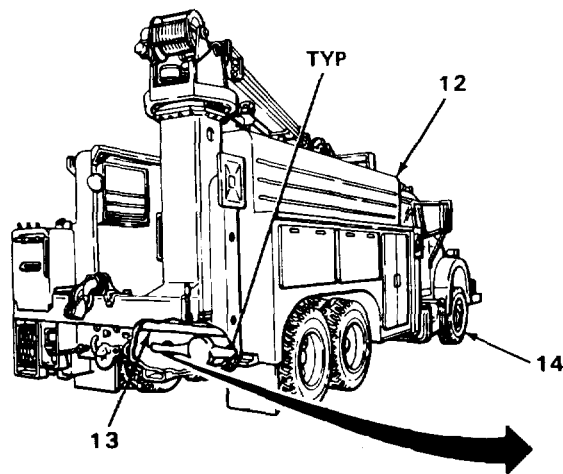
LOCATION	ITEM	ACTION	REMARKS

INSTALLATION - CONTINUED

39. Vehicle(12)
40.

Rear frame (13)
Front wheels (14)

Take off hoist.
Take out chocks.



NOTE

FOLLOW-ON MAINTENANCE:

1. Connect propeller shaft at interaxle differential (TM 9-2320-269-20-1).
2. Pressurize air reservoir (TM 9-2320-269-20-1).
3. Lubricate rear axle (LO 9-2320-269-12).

TASK ENDS HERE

FORWARD-REAR AXLE HOUSING

This task covers:

a. Disassembly (page 2-844)	c. Inspection/Replacement (page 2-845)
b. Cleaning (page 2-844)	d. Assembly (page 2-846)

INITIAL SETUP**Tools**

Handle, ratchet, 1/2-inch drive
Wrench, open-end, 11116-inch

Personnel Required

One

Equipment Condition**Materials/Parts**

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)

Tandem axle assembly removed (page 2-834).
Forward-rear axle differential removed
(page 2-847).
Equalizer beams removed (page 2-1124).
Airbrake chambers removed
(TM 9-2320-269-20-1).
Slack adjuster removed
(TM 9-2320-269-20-1).
Brakes and backing plates removed
(TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
1. Forward-rear axle housing (1)	Breather (2)		Using 11116-inch open-end wrench, unscrew and take out.
2.	Magnetic drain plug (3)		Using ratchet handle with 1/2-inch drive, unscrew and take out.
3.	Plug (4)		Using ratchet handle with 112-inch drive, unscrew and take out.

CLEANING**NOTE**

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

FORWARD-REAR AXLE HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
WARNING Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
4.	All metal parts	a. Clean with drycleaning solvent. b. Wipe clean with clean, dry rags.	

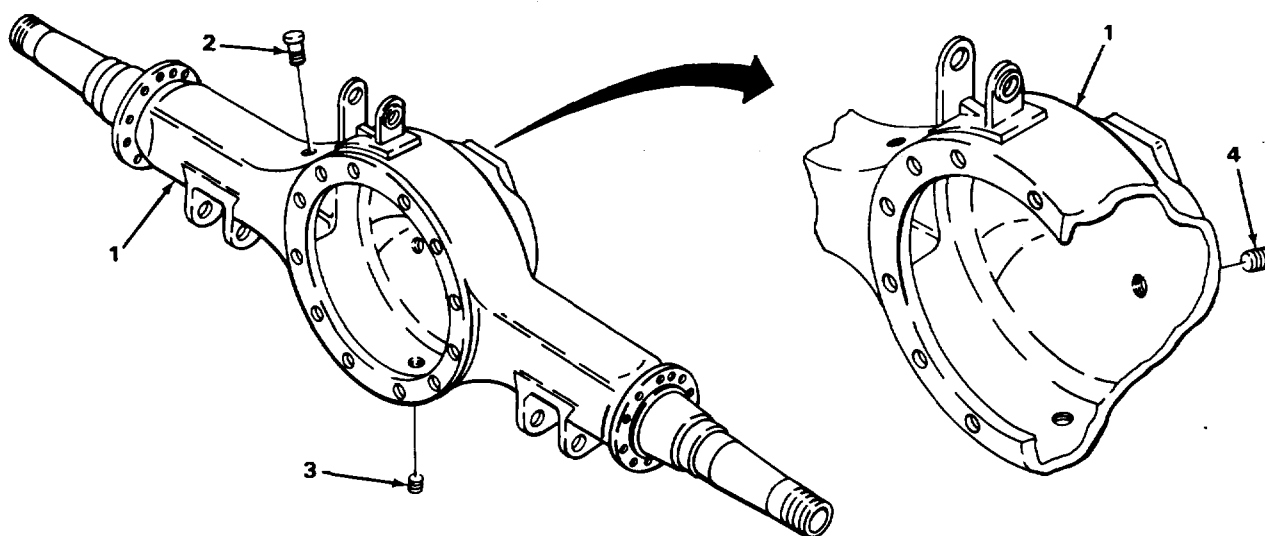
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

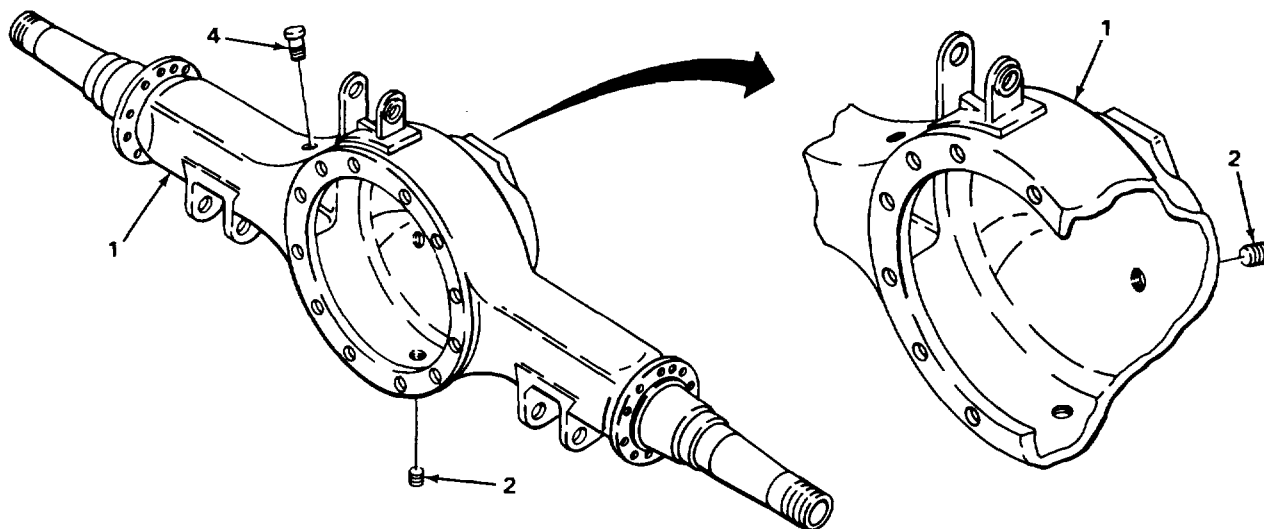
Replace damaged or defective parts as needed.

5.	Forward-rear axle housing (1)	a. Look for broken welds, cracks breaks, and dents. b. Look for damaged threads. Do not try to fix broken welds, cracks, and breaks. Replace housing.
6.	Two plugs (3) and	Look for damaged threads.



FORWARD-REAR AXLE HOUSING - CONTINUED

		ACTION	
LOCATION	ITEM	REMARKS	
ASSEMBLY			
7.	Forward-rear axle housing (1)	Plug (2)	Screw in, and tighten using ratchet handle with 1/2-inch drive.
8.		Magnetic drain plug (3)	Screw in, and tighten using ratchet handle, with 11/2-inch drive.
9.		Breather (4)	Screw in, and tighten using 11116-inch open-end wrench.



NOTE

FOLLOW-ON MAINTENANCE:

1. Install backing plates and brakes (TM 9-2320-269-20-1).
2. Install slack adjuster (TM 9-2320-269-20-1).
3. Install airbrake chambers (TM 9-2320-269-20-1).
4. Install equalizer beams (page 2-1124).
5. Install forward-rear axle differential (page 2-847).
6. Install tandem axle assembly (page 2-834).

TASK ENDS HERE

FORWARD-REAR AXLE DIFFERENTIAL

This task covers:

a. Removal (page 2-848)	d. Inspection/Replacement (page 2-857)
b. Disassembly (page 2-850)	e. Assembly (page 2-858)
c. Cleaning (page 2-856)	f. Installation (page 2-872)
-

INITIAL SETUP**Tools**

Bar, pry, 24-inch
 Block, wood (three required)
 Caliper, micrometer, OD
 Caps, vise jaw
 Driftpin, brass, 3/4-inch
 Face, inserted, hammer, medium-plastic
 Fixture, riveting
 Gage, thickness, ribbon
 Grinder, pencil, portable
 Hammer, ball-peen, machinist's, 3-lb
 Handle, ratchet, 318-inch drive
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Hoist, with lifting cables, 4000-lb capacity
 Holder, inserted hammer-face
 Indicator, dial
 Jack, dolly-type
 Jack, hydraulic hand
 Pinion setting gage set
 Pliers, slip-joint, angle-nose
 Pliers, snapping
 Press, arbor, hand-operated
 Press, hydraulic, 75-ton
 Puller, gear and bearing
 Punch, drive-pin, blunt-point, 3/8-inch
 Screws, puller, 1/2-inch NC, 3-inch (two required)
 Scribe, machinist's
 Socket, 3/8-inch drive, 7/16-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 13/16-inch
 Socket, 1/2-inch drive, 3/4-inch
 Socket, 3/4-inch drive, 15/16-inch
 Socket, 314-inch drive, 1 5/8-inch
 Socket, deep well, 3/4-inch drive, 1 13/16-inch
 Socket, deep well, impact, 3/4-inch drive, 1 13/16-inch

Tools - Continued

Stand, overhaul
 Tester, spring scale
 Vise, machinist's
 Wire or strong cord, 36-inch
 Wrench, adjustable
 Wrench, impact, air-driven, 3/4-inch drive
 Wrench, open-end, 3/4-inch
 Wrench, torque, 1/2-inch drive, 0 to 200 ft-lb capacity
 Wrench, torque, 3/4-inch drive, 0 to 800 ft-lb capacity
 Wrench, torque multiplier, 3/4-inch drive, 0 to 800 ft-lb capacity

Materials/Parts

Cloth, emery (item 8, appendix B)
 Gasket, bearing retainer
 Gasket, differential carrier (four required)
 Lockwasher, carrier to housing (12 required)
 Lockwasher, oil scoop to flanged case
 Lubricant, rear-axle (item 28, appendix B)
 Paint, oiled red lead (item 37, appendix B)
 Pin, cotter, bearing locks (two required)
 Plates, lock, bearing caps (two required)
 Rags, wiping (item 42, appendix B)
 Rivets (12 required)
 Sealant, gasket (item 44, appendix B)
 Seal, oil
 Shims, pinion cage and carrier
 Solvent, drycleaning (item 49, appendix B)
 Spacer, pinion assembly
 Tag, marking (item 50, appendix B)
 Washers, thrust, side (two required)
 Washers, thrust, pinion (four required)

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

INITIAL SETUP - CONTINUED

Personnel Required
Two

Equipment Condition
Tandem axle assembly removed (page 2-834).
Forward-rear axle shafts removed
(TM 9-2320-269-20-1).
Intermediate differential removed
(page 2-887).

LOCATION		ITEM	ACTION	REMARKS
REMOVAL				
1.	Yoke (1)	Two lock plates (2) and four screws (3)	a. Using 3-lb ball-peen hammer and 3/8-inch drive-pin punch, flatten tabs. b. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. c. Get rid of lock plates (2).	
2.		Upper bearing cap (4)	a. Place hydraulic hand jack under shaft (5), near yoke (6), and fit a wood block between shaft (5) and jack. b. Using jack, carefully raise shaft (5) until cap (4) is forced out. If necessary, use angle-nose slip-joint pliers to twist out cap (4).	
3.		Lower bearing cap (7)	Place wood block against finger (8) and, using 3-lb ball-peen hammer, strike block sharply downward to free lower cap (7). Be sure to strike evenly so that cap will not jam sideways in yoke. If necessary, use slip-joint pliers to twist out cap.	
4.		Yoke (6) and propeller shaft (5)	a. Tip universal cross (9) and slide yoke (6) out of yoke (1). b. Remove jack and, with help from assistant, lower shaft (5).	
5.	Bearing retainer (10)	Four screws (11) and lockwashers (12)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwashers (12).	

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

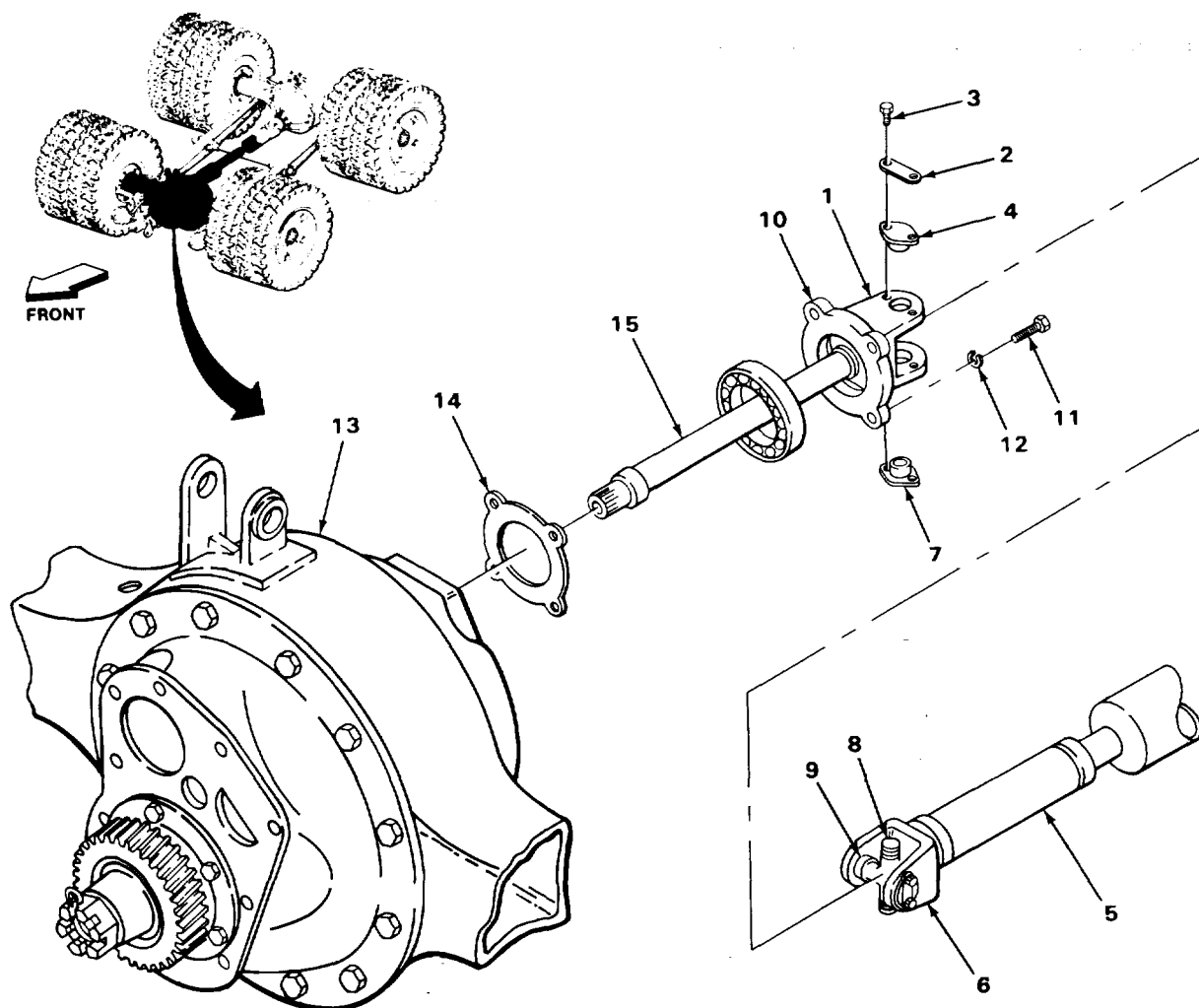
LOCATION	ITEM	ACTION	REMARKS

REMOVAL - CONTINUED

6. Forward-rear axle housing (13)

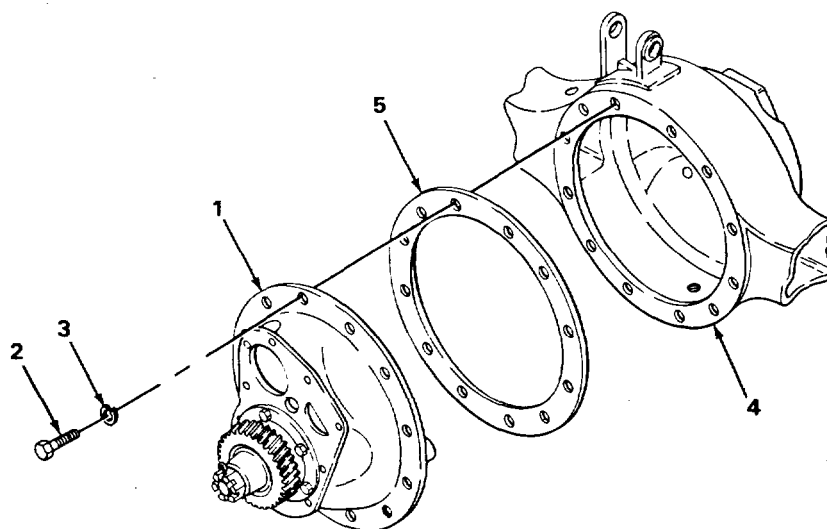
Bearing retainer (10), gasket (14), output shaft assembly (15), and yoke (1)

a. Take out.
b. Get rid of gasket (14).



FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
7. Differential carrier (1)	Twelve screws (2) and lockwashers (3)	a. Using dolly-type jack, support differential carrier (1). b. Screw two 1/2-inch puller screws into holes provided in differential carrier (1). c. Using 15/16-inch socket and ratchet handle with 3/4-inch drive, unscrew and take out. d. Get rid of lockwashers (3).	
8. Forward-rear axle housing (4) gasket (5)	Differential carrier (1) and	a. Using adjustable wrench, screw in 1/2-inch puller screws evenly until differential carrier is free of housing (4). b. Using dolly-type jack, move differential carrier (1) away from housing. c. Get rid of gasket (5). d. Mount differential carrier (1) in overhaul stand.	

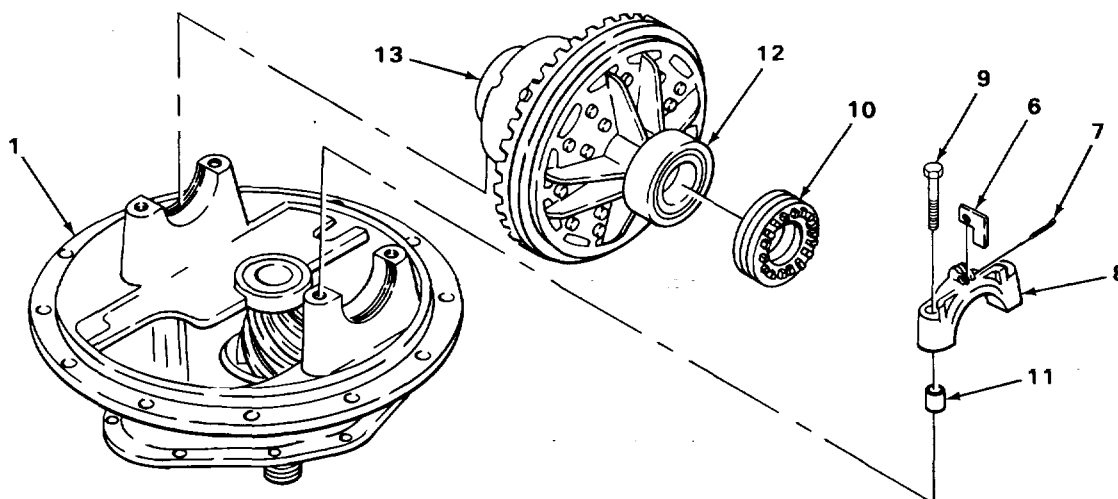


DISASSEMBLY

9. Two locks (6)	Two cotter pins (7)	a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
10. Two bearing caps (8)	Two locks (6)	Using angle-nose slip-joint pliers, pull out.	
11.	Four screws (9)	a. Using scribe, matchmark one cap (8) and carrier leg. b. Using 13/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.	
12. Two bearing adjusters (10)	Two bearing caps (8) and four dowels (11)	a. Using plastic-face hammer, tap loose and take off. b. Tag dowels (11).	
13. Two cones (12) adjusters (10)	Two bearing take off.	Using 24-inch pry bar, unscrew and	
14. Differential carrier (1)	Differential assembly (13)	a. Attach hoist and lifting cables. b. Using hoist, lift assembly (13) out of carrier (1) and place on bench. c. Tilt assembly (13) to allow ring gear to pass radial bearing.	



FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
15.	Two bearing cones (1)	Two bearing cups (2)	Take off.
16.	Flanged case (3) and bearing case (4)	Two bearing cones (1)	Using bearing puller, pull off.
17.	Bearing case (4)	Eight screws (5) and nuts (6)	a. Using scribe, matchmark both cases (3) and (4). b. Using 3/4-inch socket, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew and take off.
18.	Flanged case (3)	Bearing case (4)	Take off.
19.		Side thrust washer (7), side gear (8), and differential spider (9)	a. Take out. b. Get rid of washer (7).
20.		Side gear (10) and side thrust	a. Take out. b. Get rid of washer (11). washer (11)
21.	Oil scoop (12)	Screw (13) and lockwasher (14)	a. Using 7/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. b. Get rid of lockwasher (14).
22.	Flanged case (3)	Oil scoop (12)	Take out.

NOTE

Do not separate ring gear from flanged case unless the gear or case is damaged and must be replaced.

Do not use a chisel to cut off rivet heads.

23.	Twelve rivets (15)	a. Using pencil grinder, grind off rivet heads. b. Using 3/8-inch blunt-point drive-pin punch and 3-lb ball-peen hammer, drive out. c. Get rid of.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

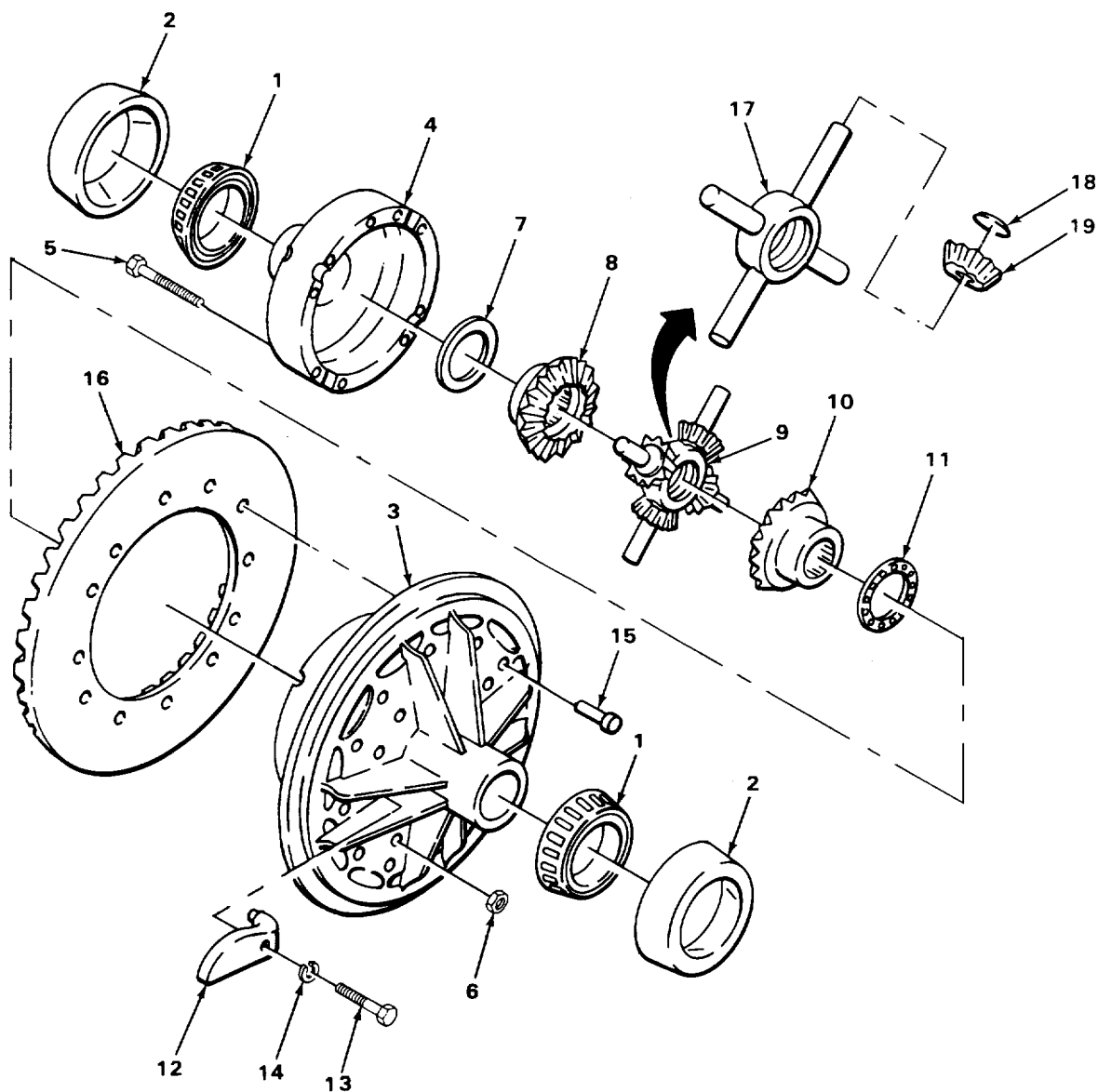
LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

24.
25. Spider(17)

Ring gear (16)
Four thrust washers
(18) and four pinion

Take off.
a. Take off.
b. Get rid of washers (18).
gears (19)



FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
26.	Pinion nut (1)	Cotter pin (2)	a. Using angle-nose slip-joint pliers, straighten pin and pull out. b. Get rid of.
27.	Bearing cage (3) and gear (4)	Pinion nut (1) and washers (5)	a. Block gears inside carrier (6) with wood block. b. Using 1 5/8-inch impact socket and impact wrench with 3/4-inch drive, unscrew and take off. c. Take out wood block.
28.	Bearing cage (3)	Gear (4)	Take off.
29.		Six screws (7)	a. Using scribe, matchmark cage (3) and carrier (6). b. Using 13/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
30.	Differential carrier (6)	Bearing cage (3) and shims (8)	a. Using 3/4-inch brass driftpin and 3-lb ball-peen hammer, strike sharply against pinion gear (9) to start cage (3) out of carrier (6). b. Take off cage (3). c. Keep shims (8) together.
31.		Pinion gear (9)	Pull out. with attached parts
32.		Bearing cage (3)	Bearing cone (10) Take off.
33.		Pinion gear (9)	Spacer (11) Take off.
34.		Pinion gear	Using gear and bearing puller, pull off. bearing (12)

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

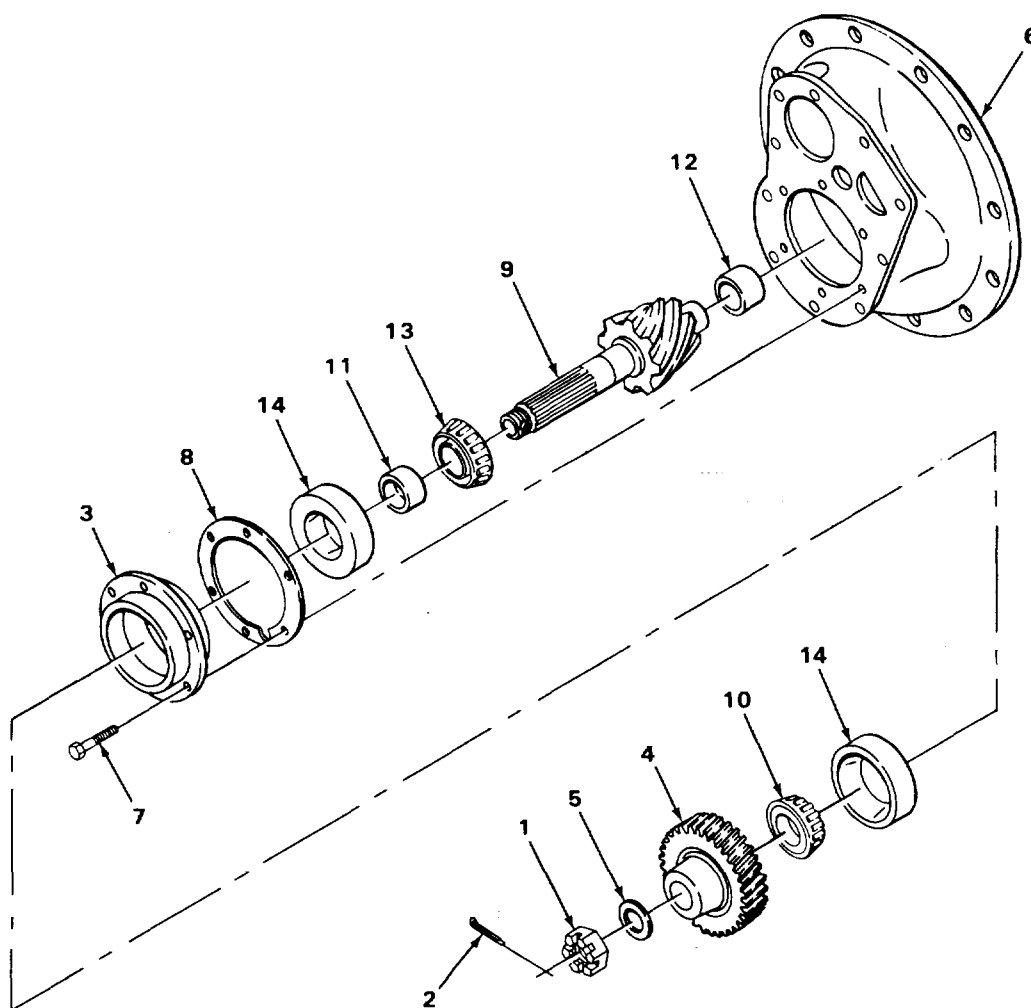
DISASSEMBLY - CONTINUED

35.	Bearing cone (13)	Using gear and bearing puller, pull off.

NOTE

Do not remove bearing cups unless they are damaged. If cups need to be replaced, replace their mating bearing cones also.

36. Bearing cage (3)	Two bearing cups (14)	Using arbor press, press out.

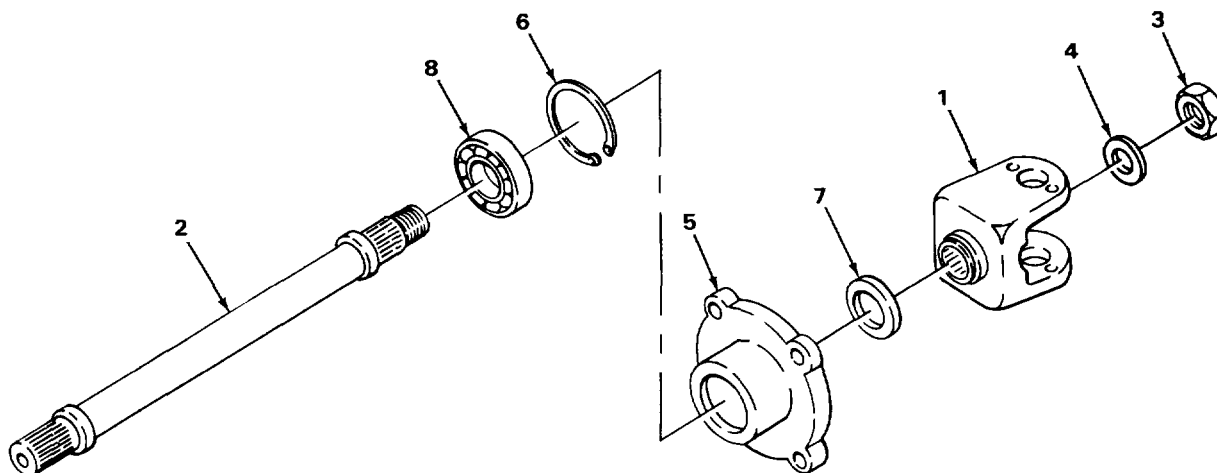


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TA238522

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
37. Yoke (1) and output shaft (2)	Nut (3) and washer (4)	a. Mount shaft (2) in machinist's vise. b. Using 1 13116-inch deep well impact socket and impact wrench with 3/4- inch drive, unscrew and take off.	
38. Output shaft (2)	Yoke (1)	a. Take off. b. Take shaft (2) out of machinist's vise.	
39. Bearing	Snapping (6)	Using snapping pliers, take out. retainer (5)	
40.	Output shaft (2)	Bearing retainer (5) Take off.	
41.	Bearing retainer (5)	Oil seal (7) a. Using arbor press, press out.	
42. Output shaft (2)	Bearing (8)	b. Get rid of. Using arbor press, press out.	



CLEANING

43.	All bearings	Clean (TM 9-214).

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

44.	All metal parts	a. Clean in drycleaning solvent. b. Dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

45.	All bearings	Inspect (TM 9-214).
46.	All bearing cups	a. Look for scratches and score marks. b. Look for discoloration that may be a sign of overheating.
47.	All gears	a. Look for worn, chipped, or broken teeth. b. Look for deep scratches and score marks. c. Look for cracks and distortion. d. Look for twisted and cracked splines. e. If any gear within a set is damaged, replace all gears in that set.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

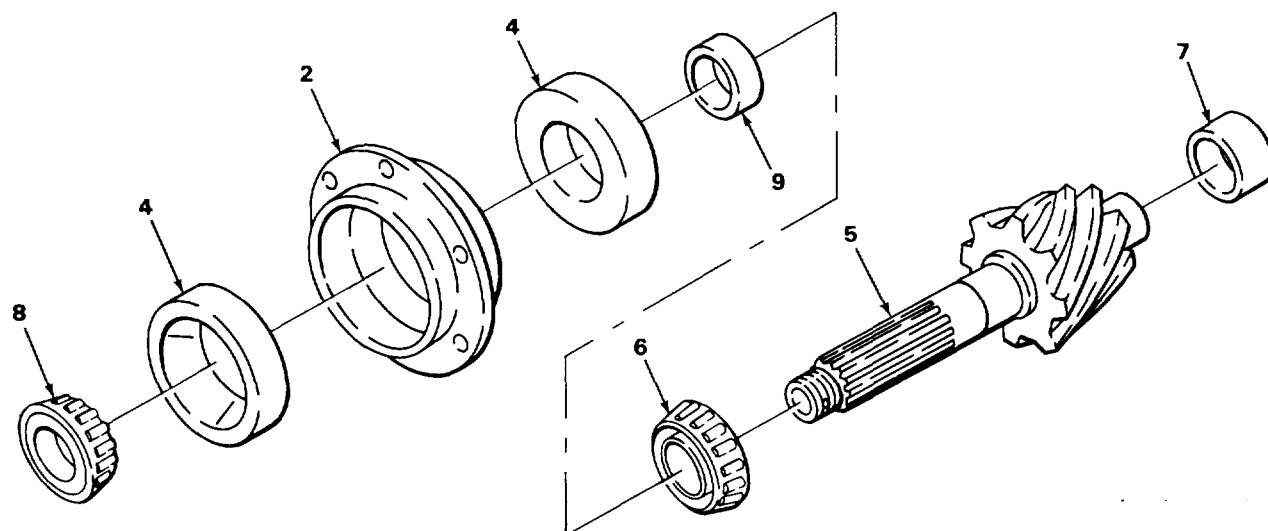
LOCATION	ITEM	ACTION	REMARKS
INSPECTION/REPLACEMENT - CONTINUED			
48.	Differential carrier (1)		a. Look for cracks, breaks, and dents. b. Look at bearing cap legs for wear.
49.	Bearing cage (2) and bearing case (3)		a. Look for scratches and score marks. b. Look for discoloration due to overheating.
ASSEMBLY			
NOTE			
Do not do step 50 unless bearing cups were removed.			
50. Bearing cage (2)	Two new bearing cups (4)		Using arbor press, press in.
51. Pinion gear (5)	Bearing cone (6)		Using arbor press, press on.
52.	Pinion gear bearing (7)		a. Press on until seated firmly against shoulder using arbor press. b. Stake face of gear (5) in six evenly spaced places using 3/8-inch blunt-point drive-pin punch and 3-lb ball-peen hammer.
53.	Bearing cage (2)		Pinion gear (5) Put in.
54.	Pinion gear (5) and spacer (9)		Bearing cone (8) Put on.

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FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED



NOTE

The adjustments made on the differential carrier assembly are performed to establish the proper gear tooth contact. Correct contact will result in a long wearing, quiet running, forward-rear axle assembly.

There are five adjustments to be made and these adjustments are performed as the carrier is assembled. The adjustments are:

1. Preloading the ring and pinion gear cone bearings
2. Establishing the pinion nominal dimensions
3. Setting gear lash
4. Preloading the differential bearings
5. Checking the gear tooth contact

Ring and pinion gear cone bearings preload is established by choosing the correct size spacer that is located between the bearings and tightening the drive pinion nut. The spacer is available in different thicknesses to obtain correct bearing preload.

Steps 55 thru 61 outline the procedure for establishing correct bearing preload.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

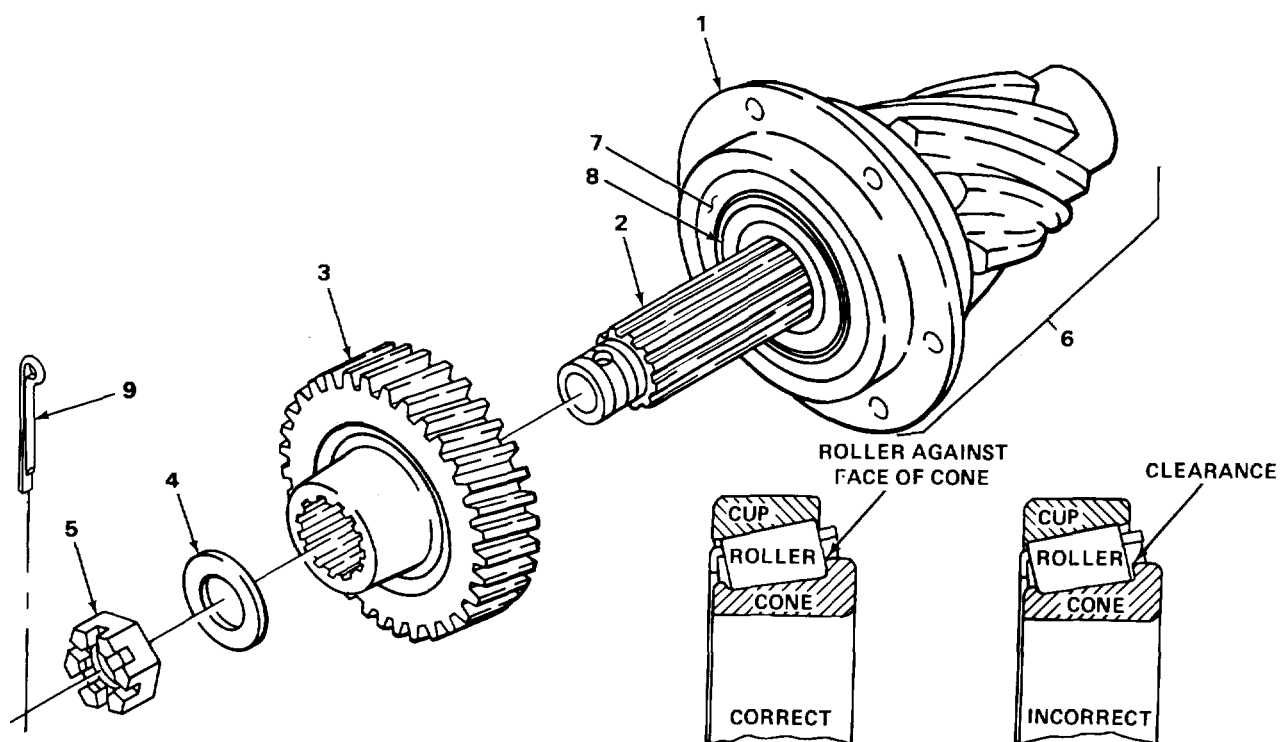
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
55. Bearing cage (1) and ring and pinion gear (2)	Pinion shaft gear (3)	a. Put on. b. Put assembly in machinist's vise with soft jaws so gear (3) is held firmly.	
56.	Washer (4) and drive pinion nut (5)	a. Rotate cage (1) and, at the same time, screw on nut (5) and tighten to 325 ft-lb (441 N m) of torque using 1 5/8-inch socket and torque wrench with 3/4-inch drive.	Be sure to turn cage while tightening nut so pinion bear- ing cones will line up and seat. Bearing rollers must be seated against face of cone.
57. Pinion assembly (6)	Bearing cage (1)	a. Measure bearing preload by wrapping a strong cord or soft wire around bearing cage (1) and attaching end to suitable spring scale. b. Pull on scale and note reading while rotating cage.	Scale reading should show 3 - 8 lb (1.35 - 3.6 kg).

NOTE

When preload does not agree with specification (3 - 8 lb, 1.35 - 3.6 kg) bearing load may be increased by installing a thicker spacer. If necessary, go back to disassembly to remove spacer. Measure thickness of old spacer with caliper micrometer and select a different spacer. Spacers are available in various thicknesses, in graduations of 0.001 inch (0.025 mm). Closer adjustment can be made by working spacer to desired thickness using an emery cloth on flat surface. Be sure to clean off emery cutting before installing spacer.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
58. Two bearing cups (7)	Two pinion bearing cones (8)		Check that rollers are in contact with cone face using thickness gage ribbon. There must be no clearance at ends of rollers.
59. Nut (5)	New cotter pin (9)		Put in, and using angle-nose slip-joint pliers, bend back ends.
60.	Pinion shaft gear (3)		a. Take out of machinist's vise. b. Take off gear (3).



FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
61.	Pinion cage (1)	Shims (2)	Put on.
62.		Six screws (3)	Put in.
63.	Differential carrier (4)	Pinion cage (1)	Line up scribe marks and put in position.
64.	Pinion cage (1)	Six screws (3)	a. Have assistant hold up cage (1). b. Start screws (3) into carrier (4). c. Screw in, and tighten to 100-120 ft-lb (135 - 163 N m) of torque using 13/16-inch socket and torque wrench with 112-inch drive.

NOTE

The following step will establish pinion nominal dimension. This dimension is the distance from the face or finished end of the installed pinion to the center line of the ring gear.

65. Differential carrier (4)	Ring and pinion gear (5)	a. Using step plate and clamp assembly from pinion setting gage set, attach it to carrier (4), locating step plate screw over center of ring and pinion gear (5). b. Install another step plate under clamp screw and tighten screw to hold plate securely in place. Step plates are necessary to project the face of pinion gear so it can be measured. c. Be sure lugs on step plate straddle the bearing staking marks on end of ring and pinion gear (5). d. Install assembled setting gage and discs (number D-2) in carrier (4) bearing bores. Make sure bearing bores are clean and free of nicks and burrs. e. Adjust micrometer so it is directly over end and at a 90-degree angle to step plate.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

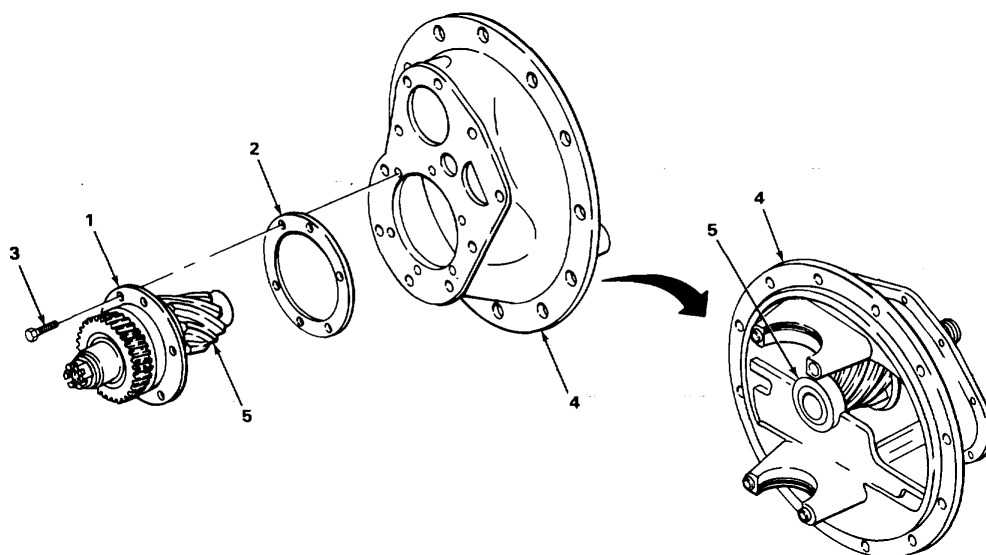
ASSEMBLY - CONTINUED

65. Continued

- f. Run micrometer thimble down to measure distance between center of ring gear and step plate.
- g. Note reading.
Nominal dimension tolerance is 3.4725 inches (88.20 mm).
- h. Look for etched markings on pinion gear (5) which show variations from zero cone setting.
- i. If marking from step h above is a minus figure, subtract it from 3.4725 inches (88.20 mm).
- j. If marking from step h above is a plus figure, add it to 3.4725 inches (88.20 mm).

NOTE

Comparison of corrected nominal dimension with the actual or measured dimensions indicates the amount of change necessary for correct pinion gear position. It may be necessary to add or remove shims between pinion cage and carrier.



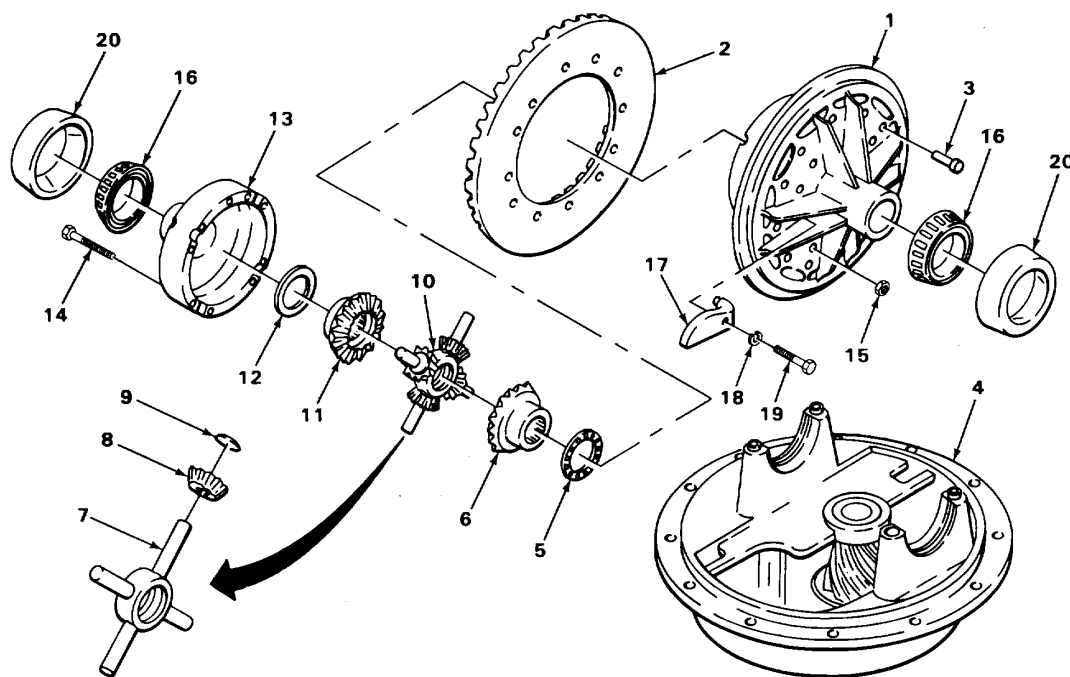
TA238527

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
65.	Continued	k.	If nominal dimension is not correct, go back to disassembly, to change shims.
		l.	If shims were changed, go back to installation of cage on carrier.
		m.	Take off pinion setting gage set.
NOTE			
If gear was not removed from flanged case, do not do steps 65 and 66.			
66.	Flanged case (1)	Ring gear (2)	Place in position.
67.		Twelve new rivets (3)	Put in using riveting fixture and hydraulic press capable of delivering 45 to 50 tons (40.8 to 45.3 metric tons).
68.		All parts	Apply rear axle lubricant to all parts, including inside walls of carrier (4).
69.	Flanged case (1)	New thrust washer (5) and side gear (6)	Place in position.
70.	Spider (7)	Four pinion gears (8) and four new thrust washers (9)	Place in position.
71.	Flanged case (1)	Spider differential (10)	Place in position.
72.	Spider differential (10)	Side gear (11) and new thrust washer (12)	Place in position.
73.	Flanged case (1)	Bearing case (13)	Line up matchmarks and put in place.
74.	Bearing case (13)	Eight screws (14) and nuts (15)	a. Screw in until snug. b. Turn gears to check for free movement. c. If gears do not turn freely, take out screws (14), nuts (15), and case (13) and reposition gears.

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

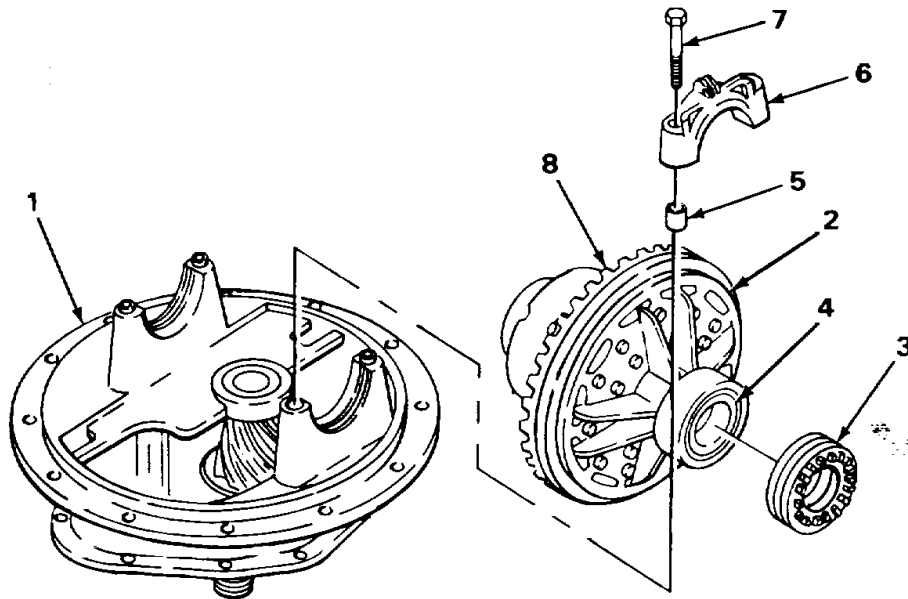
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
74.	Continued	d.	Tighten screws (14) and nuts (15) to 80 - 90 ft-lb. (109 - 12 N m) of torque using 3/4-inch socket, torque wrench with 1/2-inch drive, and 3/4-inch open-end wrench.
75.	Bearing case (13) and flanged case (1)		Press on using arbor press.
76.	Flanged cage (1)		Put in place.
77.	Oil scoop (17)		Screw in, and tighten using 7/16-inch socket and ratchet handle with 3/8-inch drive.
78.	Two bearing cones (16)	a. Put on. b. Coat with rear axle lubricant.	



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FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
79.	Differential carrier (1)	Differential assembly (2)	a. Attach hoist with lifting cables. b. Using lifting equipment, put in position. Tilt assembly to allow ring gear to pass pinion gear.
80.		Two bearing adjusters (3)	Screw in, handtight, against bearings (4).
81.		Four dowels (5)	Note location and put in place.
82.		Two bearing caps (6)	Note matchmarks and put in correct position.
83.	Two bearing caps (6)	Four screws (7)	Screw in, and tighten using 13/16-inch socket and ratchet handle with 1/2-inch drive.
84.	Differential carrier (1) and two bearing caps (6)	Two bearing adjusters (3)	Tighten each adjuster alternately using 24-inch pry bar, and, at the same time turn ring gear (8). Tighten adjusters until all end play is gone.
85.	Two bearing caps (6)	Four screws (7)	Tighten to 150-160 ft-lb. (203-217 N m) of torque using 13/16-inch socket and torque wrench with 1/2-inch drive.



TA238529

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

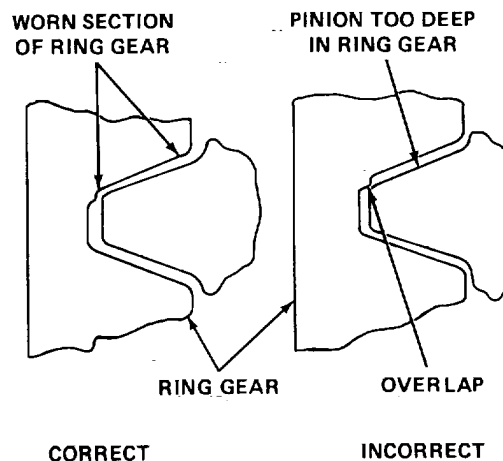
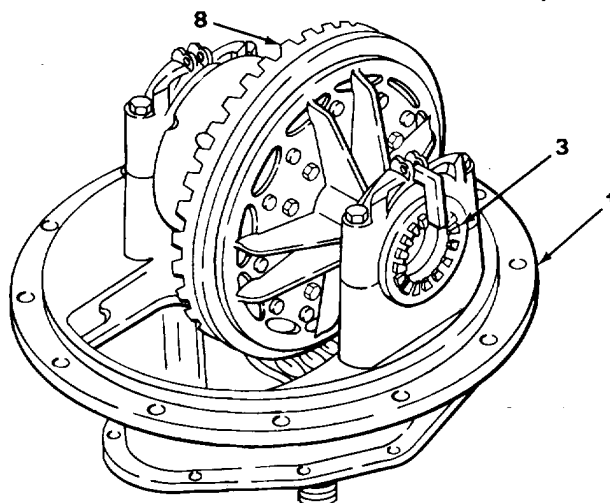
ASSEMBLY - CONTINUED

NOTE

A special effort should be made to set the backlash between pinion gear and ring gear to the same amount as was originally built into them, 0.006 0.012-inch (0.15 0.30 mm). Usually the amount of backlash is stamped or etched on the ring gear.

When original pinion gear and ring gear sets are reinstalled, the wear pattern on the gear teeth must be considered in the backlash adjustment. Gears that have been in service for a long time, form running contacts and should not be changed too much. If, in checking backlash, the amount measured is more than amount stamped on ring gear, the backlash may be reduced only the amount that will avoid overlap of the worn tooth section. An overlap at the worn section will cause gear operation to be noisy and rough.

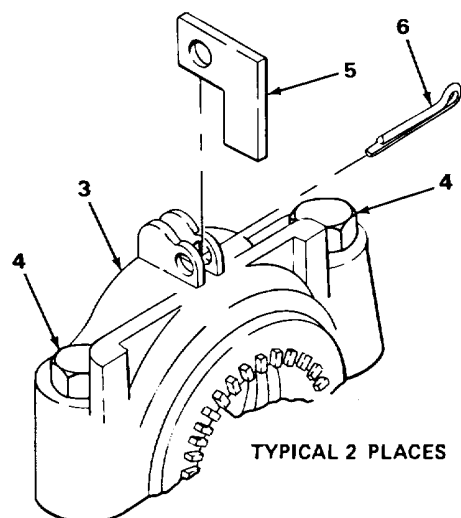
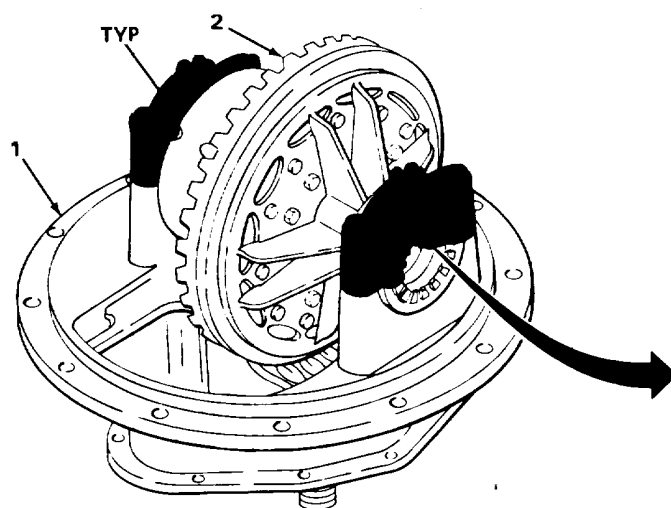
86. Differential carrier (1)	Ring gear (8) and two bearing adjusters (3)	a. Mount dial indicator on carrier. b. Measure backlash on ring gear (8) using indicator. Backlash tolerance is 0.008 inch (0.20 mm). c. To adjust backlash, use 24-inch pry bar and back off one adjuster (3) while advancing the other adjuster (3) the same amount.



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FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

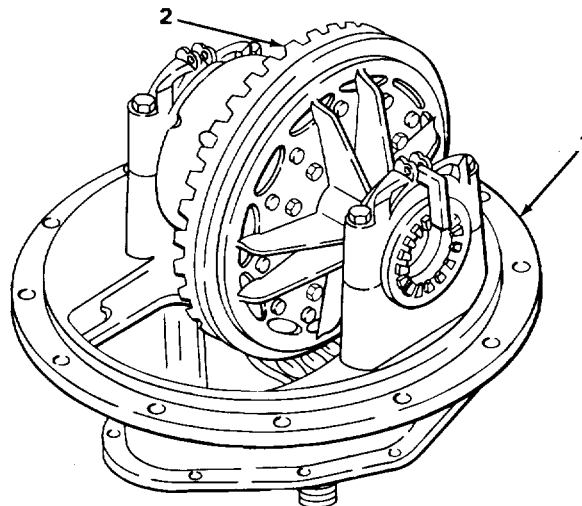
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
87.	Differential carrier (1)	Ring gear (2)	To set bearing preload, mount dial indicator at side of gear (2).
88.	Two bearing caps (3)	Four screws (4)	Unscrew only enough to note end play on indicator using 13/16-inch socket and ratchet handle with 1/2-inch drive.
89.	Differential carrier (1)	Ring gear (2)	a. While gear (2) is held at zero end play, and before loading bearings, check runout by turning ring gear (2). b. If runout is more than 0.008-inch (0.20 mm), remove differential assembly and check for cause.
90.	Two bearing caps (3)	Four screws (4)	a. Tighten to 150 - 160 ft-lb. (203 - 217 N m) or torque using 13116-inch socket and torque wrench with 112-inch drive. b. Recheck backlash, see step 81.
91.		Two adjuster locks (5)	Put in.
92.	Two adjuster locks (5)	Two new cotter pins (6)	a. Put in. b. Separate ends and bend back using angle-nose slip-joint pliers.



TA238531

FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
NOTE			
The final check of the differential assembly is checking the gear tooth contact by paint impression method. When the ring is turned, the applied print is squeezed away by the contact of the teeth, leaving bare spots, the exact size, shape, and location of the contacts.			
When making adjustment, check drive side of gear teeth. Coast side should be correct when drive side is correct. With all adjustments properly made, the result is a quiet running ring gear and pinion gear because the load is evenly distributed over all teeth.			
93. Differential carrier (1)	Ring gear (2)	a. Apply oiled red lead paint lightly to 12 gear teeth. b. Turn gear (2) one complete turn.	Sharper impressions can be made by applying some resistance to gear with a pry bar and using an open-end wrench to turn pinion gear.



FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

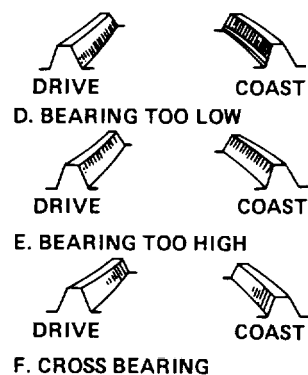
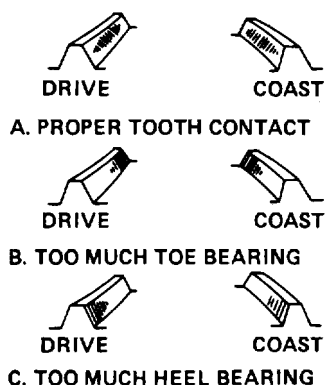
ASSEMBLY - CONTINUED

93. Continued

- c. With adjustments made correctly, tooth contact should be similar to that shown in illustration A below.

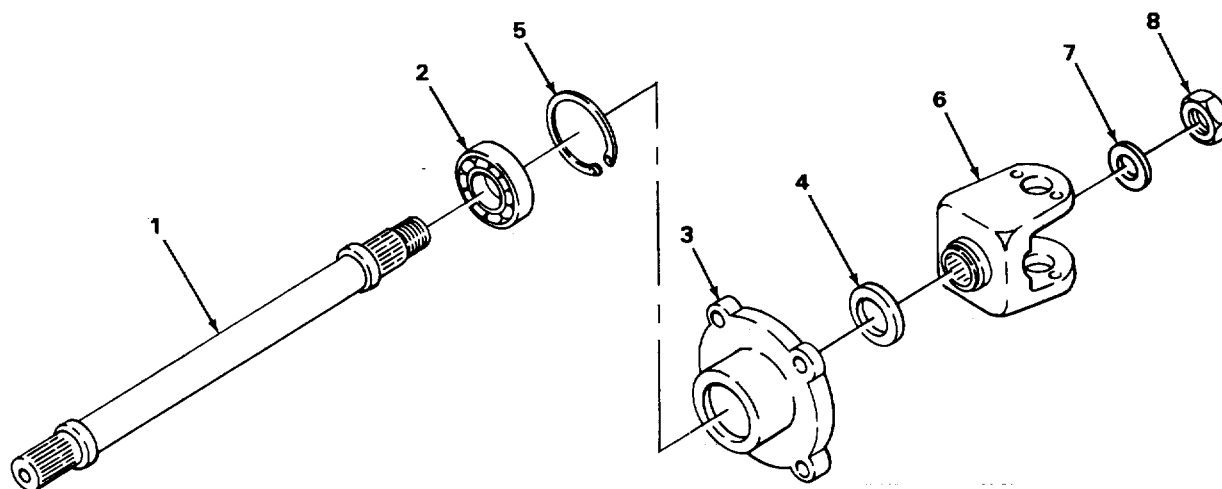
The contact area starts near the toe of the gear and extends about 62.5 percent of the tooth length. When checking paint impressions on gear teeth under heavy load, the impressions will spread longer than patterns made from bench test. This is normal. Mounted ring gear should show a bearing toward the toe (small) end of the tooth, never at heel (large) end. It is impossible to make gears and gear mounting so rigid that no deflection will occur when full torque is applied. This deflection causes the bearing to approach the heel of the tooth, and the result is a concentration of load on the top corner of the heel, and the tooth will break.

- d. If paint impressions are not correct, use examples of tooth contact impression shown below, and make necessary corrections.



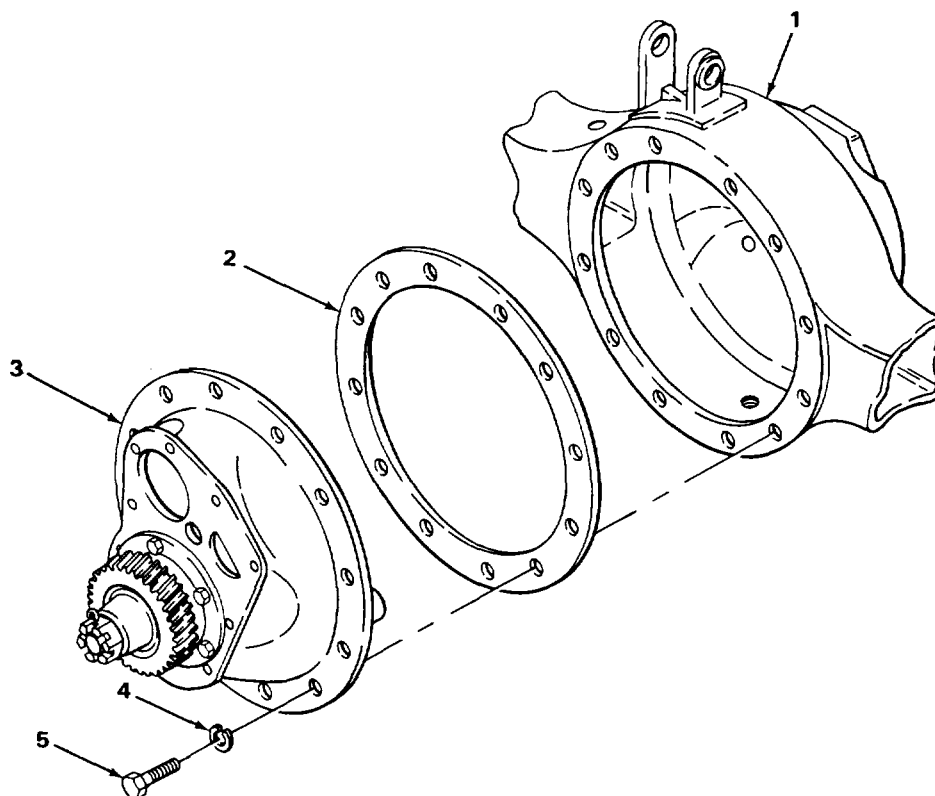
FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
94.	Output shaft (1)	Bearing (2)	Press on using arbor press.
95.	Bearing retainer (3)	New oil seal (4)	Press in using arbor press.
96.	Output shaft (1)	Bearing	Put on.
97.	Bearing retainer (3)	Snapping (5)	Put on using snapping pliers.
98.	Output shaft (1)	Yoke (6)	Put on.
99.	Yoke (6) and output shaft (1)	Washer (7) and nut (8)	a. Put shaft (1) in vise with soft jaws. b. Screw on nut (8), and tighten to 700 ft-lb (950 N m) of torque using 1 13/16-inch deep well socket, torque multiplier and torque wrenches with 3/4-inch drive.



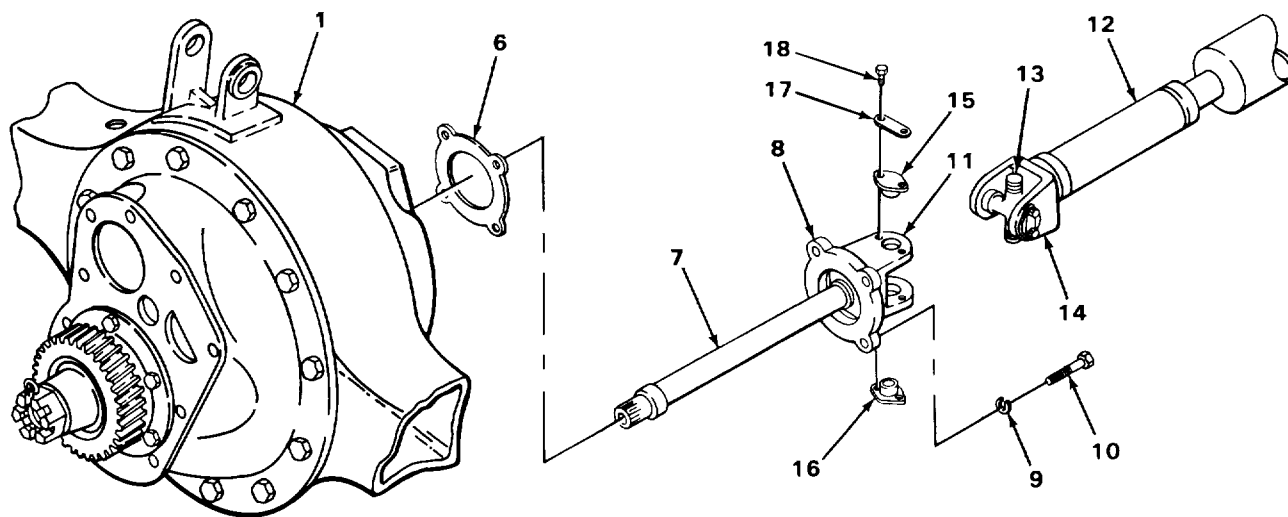
FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
100. Forward-rear axle housing (1) carrier (3)	New gasket (2) and differential	a. With aid of assistant, remove differential carrier (3) from overhaul stand and support on dolly-type jack. b. Apply 118-inch (3.1 mm) bead of gasket sealant on housing (1). c. Using dolly-type jack, line up carrier (3) and gasket (2) with housing (1), and roll into place.	A small prybar may be used to help straighten carrier.
101. Differential carrier (3) and screws (5)	Twelve new lockwashers (4)	Using 15/16-inch socket and torque wrench with 3/4-inch drive, screw in and tighten to 80 - 90 ft-lb (109 - 122 N m) of torque.	



FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
102.	Forward-rear axle housing (1)	New gasket (6) and output shaft (7) with bearing retainer (8)	Put in position.
103.	Bearing retainer (8) screws (10)	Four new lock-washers (9) and	Using 9/16-inch socket and torque wrench with 1/2-inch drive, screw in and tighten to 30 - 40 ft-lb (41 - 54 N m) of torque.
104.	Yoke (11)	Propeller shaft (12)	a. With help from assistant, put in position and support with hydraulic jack. b. Tip universal cross (13) forward and slide yoke (14) into yoke (11).
105.	Upper bearing cap (15) and lower bearing cap (16)	Using 3-lb ball-peen hammer and wood block, tap sharply into place.	
106.	Upper and lower bearing caps (15) and (16)	Two new locking plates (17) and four screws (18)	a. Put on plates (17). b. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, screw in and tighten screws. c. Using 3-lb ball-peen hammer and 3/8-inch drive-pin punch, bend up lock plate tabs. d. Remove hydraulic jack.



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FORWARD-REAR AXLE DIFFERENTIAL - CONTINUED

INSTALLATION - CONTINUED

NOTE

FOLLOW-ON MAINTENANCE:

1. Install intermediate differential (page 2-887).
2. Install forward-rear axle shafts (TM 9-2320-269-20-1).
3. Install tandem axle assembly (page 2-834).

TASK ENDS HERE

INTERAXLE DIFFERENTIAL

This task covers:

a. Removal (page 2-876)	d. Inspection/Replacement (page 2-880)
b. Disassembly (page 2-878)	e. Assembly (page 2-881)
c. Cleaning (page 2-880)	f. Installation (page 2-885)

INITIAL SETUP**Tools**

Bar, pry, 24-inch
 Block, wood (three required)
 Caliper, micrometer, OD
 Chisel, cape, hand, 1/4-inch,
 5 1/2-inch
 Face, inserted hammer, soft-plastic
 Gage, thickness
 Hammer, machinist's ball-peen, 2-lb
 Handle, ratchet, 3/8-inch drive
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Holder, inserted hammer-face
 Jack, hydraulic hand
 Knife, putty
 Pail, utility, 2-gallon
 Pliers, slip-joint, angle-nose
 Press, arbor, hand-operated
 Puller, bearing
 Punch, drive-pin, 3/8-inch
 Screwdriver, flat-tip, 11/4-inch,
 4-inch blade
 Scribe, machinist's
 Socket, 3/8-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 3/4-inch
 Socket, 3/4-inch drive, 1 13/16-inch
 Wrench, torque, 1/2-inch drive,
 0 - 200 ft-lb capacity
 Wrench, torque, multiplier, 3/4-inch
 drive, 0-1,000 ft-lb capacity

Material/Parts

Bushing, case
 Gasket, housing
 Lubricant, rear axle (item 28, appendix B)
 Pack, shim
 Plates, lock, upper and lower bearing caps
 (two required)
 Rags, wiping (item 42, appendix B)
 Seal, oil, housing
 Solvent, dry-cleaning (item 49, appendix B)
 Washer, fiber
 Washers, thrust, two pinion gears
 (four required)
 Washers, thrust, two side gears
 (three required)

Personnel Required

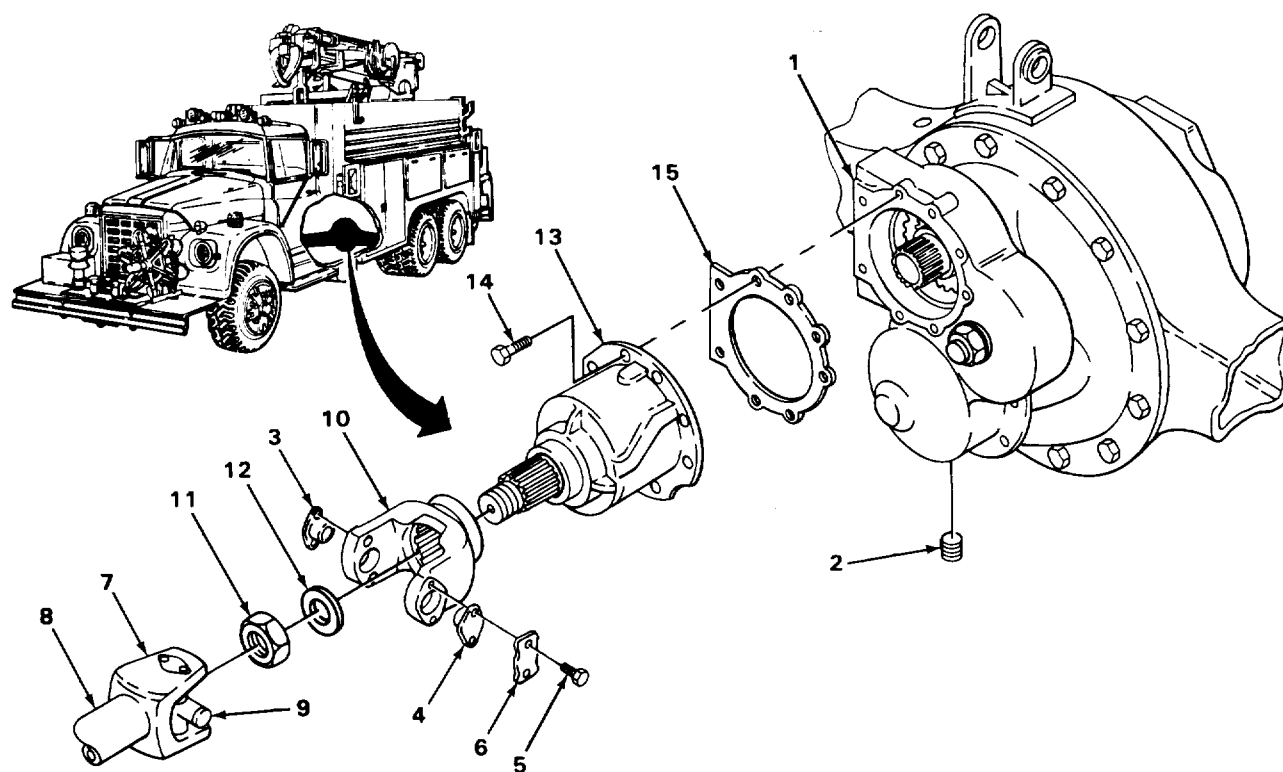
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INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Power divider intermediate case (1)	Plug (2)	- Place container underneath to catch draining oil. - Using 1/2-inch drive ratchet handle, unscrew and take out. - Allow oil to drain. - Get rid of oil (page 2-46).
2.	Upper bearing cap (3) and lower bearing cap (4)	Four screws (5) and two lockplates (6)	- Using 3/8-inch drive-pin punch and 2-lb ball-peen hammer, flatten tabs. - Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out. - Get rid of lockplates (6).
3.	Propeller shaft yoke (7)	Upper bearing cap (3)	- Place hydraulic jack under propeller shaft (8) near yoke (7), and place wood block between. - Using hydraulic jack, carefully raise shaft (8) until cap (3) is forced out of yoke (7). - Using angle-nose slip-joint pliers, gently twist out cap (3). - Remove jack.
4.		Lower bearing cap (4)	Place wood block against yoke finger (9) and with 2-lb ball-peen hammer, strike sharply to force out cap (4). Make sure you strike evenly so cap does not jam in yoke.
5.	Mating yoke (10)	Propeller shaft yoke (7)	- Tip universal cross and slide out. - Carefully set propeller shaft (8) down.

INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
6. Mating yoke (10)	Nut (11) and washer (12)	Using 1 13/16-inch socket and ratchet handle with 3/4-inch drive, unscrew and take off.	
7. Housing (13)	Mating yoke (10)	Take off.	
8.	Eight screws (14)	Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.	
9. Power divider intermediate	Housing (13) and gasket (15) case (1)	a. Using 24-inch pry bar, loosen and take off. b. Using putty knife, scrape off gasket (15) and get rid of.	

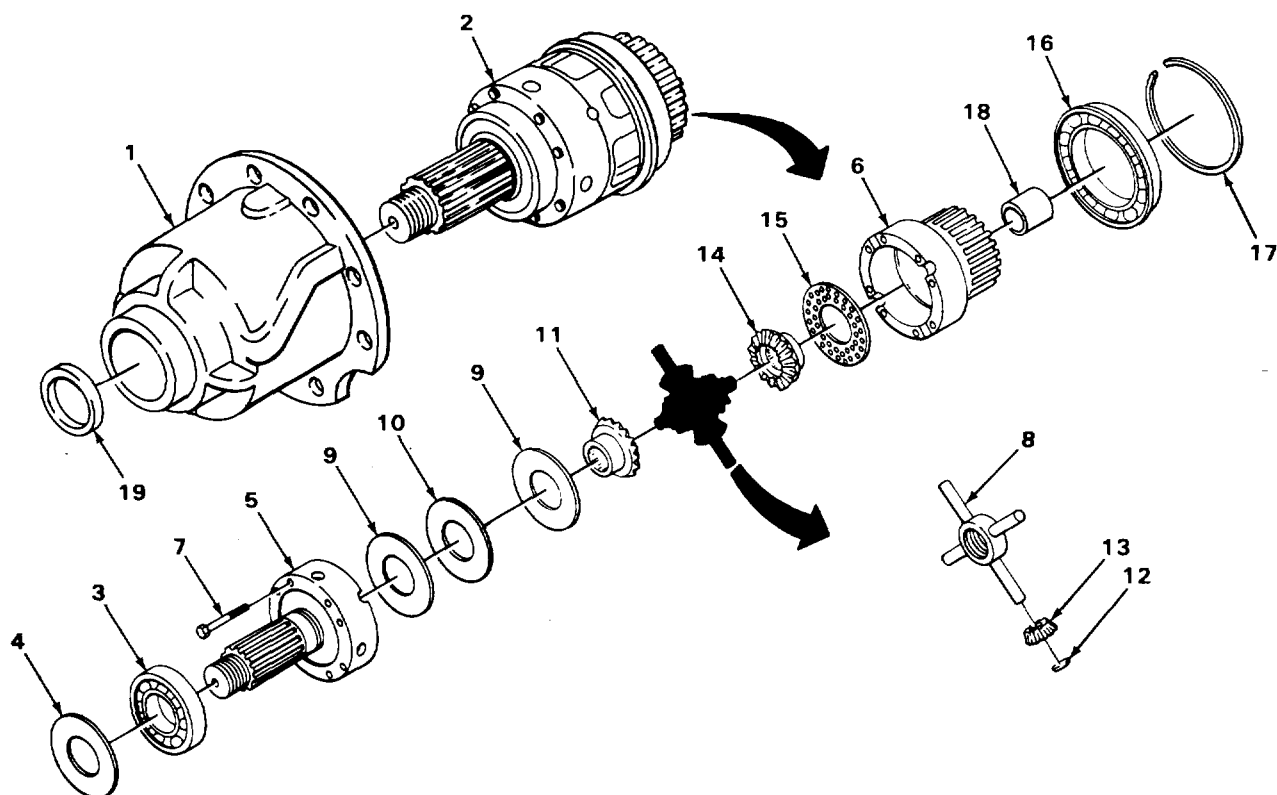


INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY		
10. Housing (1)	Interaxle differential assembly (2)	Using arbor press, press out. Use plate under support blocks to prevent assembly from falling.
11. Bearing (3)	Shims (4)	a. Take off. b. Using micrometer, measure thickness and record.
12. Spider case (5)	Bearing (3)	a. Using bearing puller, pull off. b. Using scribe, matchmark cases (5) and (6).
13.	Eight screws (7)	Using 3/4-inch socket and ratchet handle with 1/2-inch drive, unscrew and take out.
14. Case (6)	Spider case (5)	Lift off.
15. Spider(8)	Two thrust washers (9), fiber	a. Take off. b. Get rid of washers (9) and (10). washer (10), and side gear (11)
16. Spider case (5)	Spider (8)	Take off.
17. Spider(8)	Four thrust washers (12) and	a. Take off. b. Get rid of washers (12). pinion gears (13)
18. Case (6)	Side gear (14) and thrust washer (15)	a. Take out. b. Get rid of washer (15).
19.	Bearing	Using arbor press, press off. assembly (16)
20. Bearing assembly (16)	Snapring (17) take off.	Using 1/4-inch flat-tip screwdriver,

INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
21. Case (6)	Bushing (18)	a.	Collapse bushing (18) inward by inserting the point of chisel between bushing (18) seam and case (6) and carefully tapping chisel with 2-lb ball-peen hammer.
			Do not damage case.
22. Housing (1)	Oil seal (19)	b.	Get rid of bushing (18).
		a.	Using arbor press, press out.
		b.	Get rid of.



INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
CLEANING 23.	Two bearings	Clean (TM 9-214). (1) and (2)	
NOTE For more information on how to clean parts, go to General Maintenance Instructions (page 2-46). <u>WARNING</u> Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.			
24.	All metal parts	a. Clean in dry-cleaning solvent. b. Wipe dry with clean, dry rags.	
INSPECTION/REPLACEMENT			
NOTE For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46). Replace damaged or defective parts as needed.			
25.	Two bearings (1) and (2)	Inspect (TM 9-214).	
26.	Four pinion gears (3) and two side gears (4)	a. Look for chipped, nicked, and worn teeth. b. Look for discoloration.	
27.	Spider case (5)	a. Look for dents, breaks, and cracks. b. Look for twisted or cracked splines.	
28.	Case (6)	Look for dents, breaks, cracks, and score marks.	
29.	Housing (7)	Look for cracks and dents.	

INSPECTION/REPLACEMENT - CONTINUED

- Apply thin coat of rear axle lubricant.
- Press in using arbor press.

Apply rear axle lubricant to all parts.



INTERAXLE DIFFERENTIAL - CONTINUED

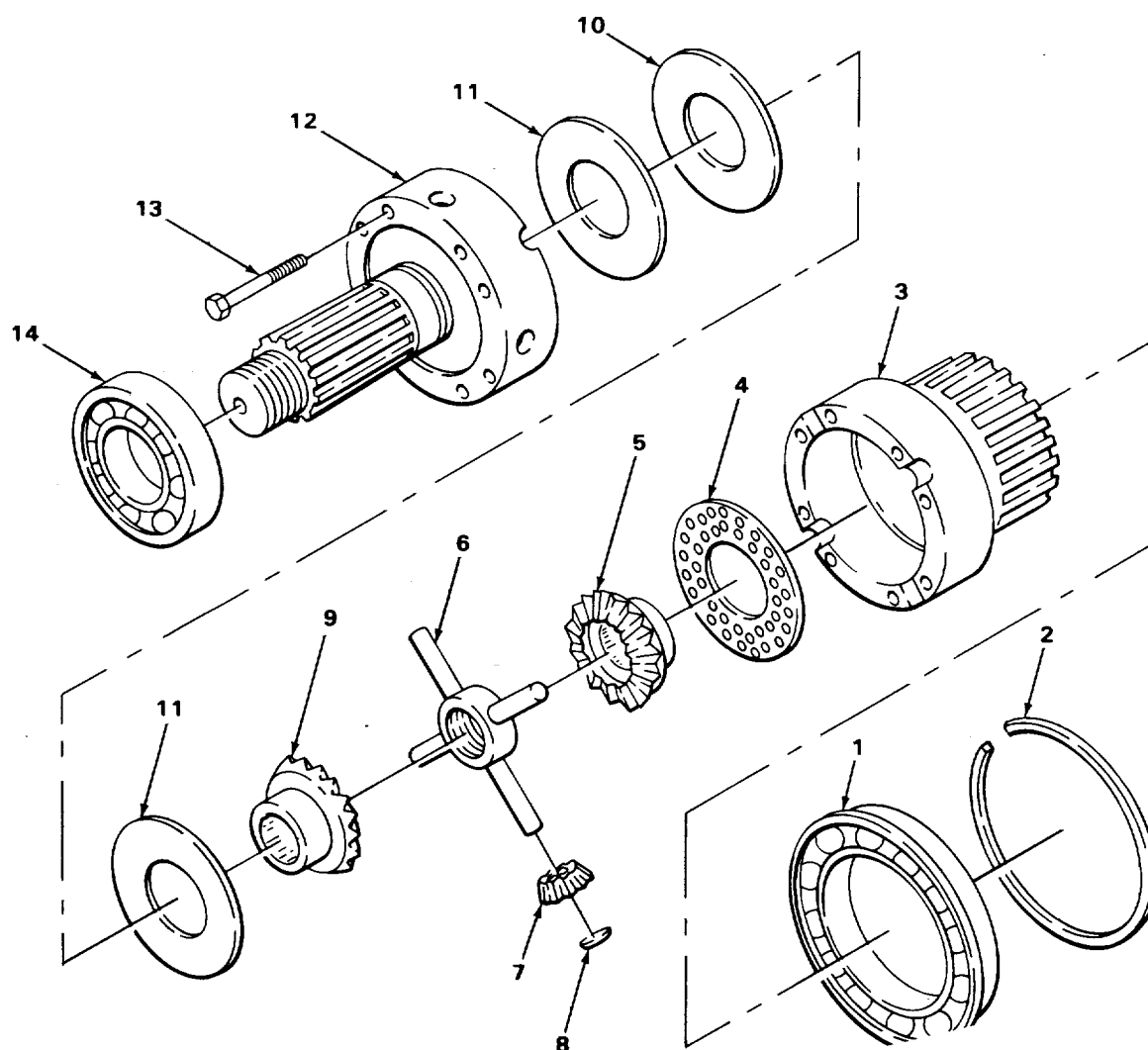
LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
32. Bearing (1)	Snapping (2)	Put on using 1/4-inch flat-tip screwdriver.
33. Case (3)	Bearing (1)	Press on using arbor press.
34.	New thrust washer (4) and rear side gear (5)	Put in place. Dimples on washer face up.
35. Spider (6)	Four pinion gears (7) and four new thrust washers (8)	Put on.
36. Case (3)	Spider (6) with gears (7) and washers (8)	Put in place.
37. Spider (6)	Front side gear (9), new fiber washer (10), and two new thrust washers (11)	Put in place. Make sure all gears mesh properly.
38. Case (3)	Spider case (12)	Line up scribe marks and put on.
39. Spider case (12)	Four screws (13)	a. Space equally and screw in. b. Tighten using 3/4-inch socket and ratchet handle with 1/2-inch drive. c. Check for free rotation of gears (5), (7), and (9). d. If gears (5), (7), and (9) turn freely, go on to step 41. e. If gears (5), (7), and (9) do not turn-freely, take out screws, take off case (12), and reseal gears. f. Do steps 39a thru 39e until gears are seated and turn freely.
40.	Four screws (13)	a. Screw in. b. Using 3/4-inch socket and torque wrench with 112-inch drive, tighten all eight screws (13) to 80 - 100 ft-lb (108 - 135 N m) of torque.

INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

41.	Bearing (14)	Press on using arbor press.	Large radius on Inner race should be next to case (12).

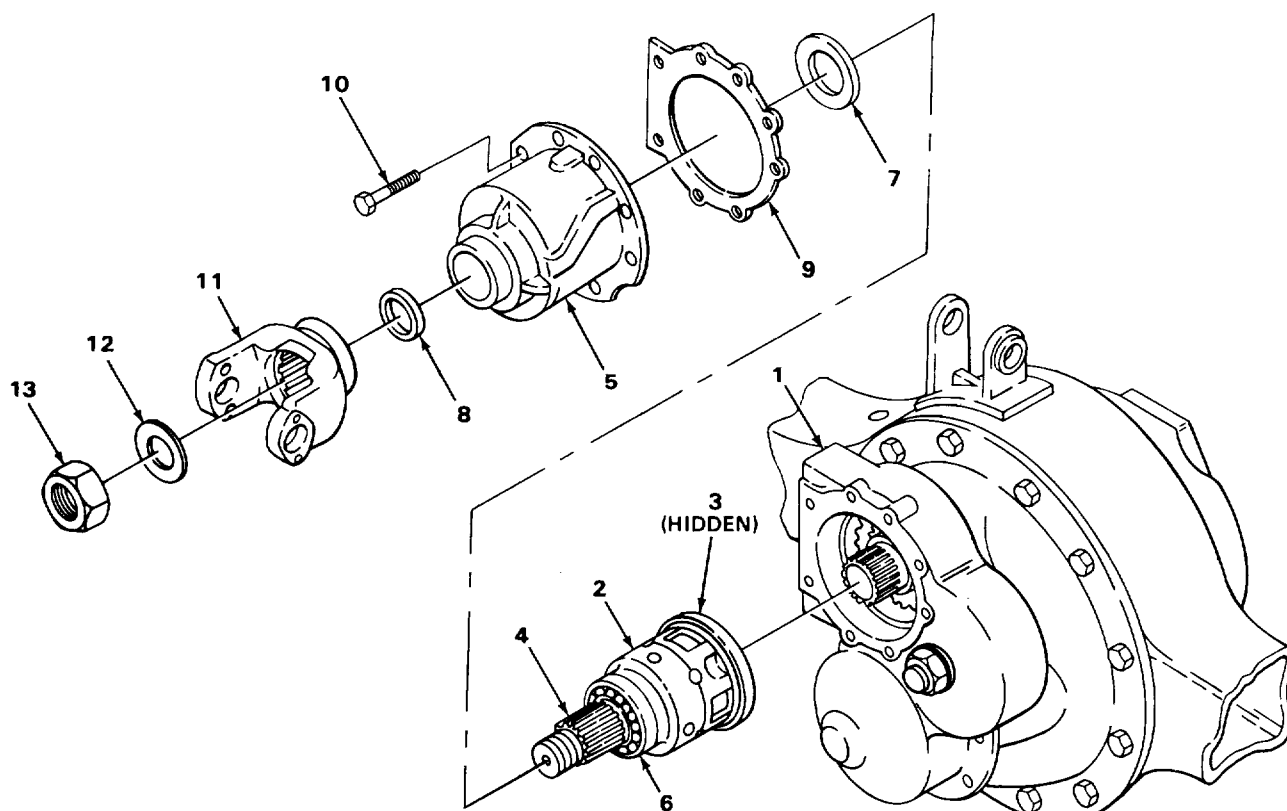


INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
42.	Power divider intermediate case (1)	Interaxle differential assembly (2)	- Put in position so that rear bearing (3) seats into bearing bore. - Using plastic-face hammer, tap on end of shaft (4) to seat.
43.	Interaxle differential assembly (2)	Housing (5)	- Put in place. - Using plastic-face hammer tap to seat. - Measure clearance between front bearing (6) and housing (5), and record using thickness gage. Total end play allowed is 0.000 to 0.005 inch (0.000 to 0.013 mm). - Take off housing (5). - To determine the thickness of shims (7) required to obtain the specified end play, subtract the allowable end play, 0.000 to 0.005-inch (0.000 to 0.13 mm) from the total end play recorded in step c above. - Select shim pack with total thickness within the range found in e above. Shims are available in thickness of 0.005 and 0.010 inch (0.13 and 0.25 mm).
44.	Housing (5)	New oil seal (8)	Press on until face of seal (8) is flush with edge of housing using arbor press.
45.		Shims (7)	Put on.
46.	Interaxle differential assembly (2)	Housing (5) and new gasket (9)	- Put on. Make sure shims (7) are centered on bearing (6). - Using plastic-face hammer, tap to seat against case (1). - Check end play clearance again, from step 43c, using thickness gage.

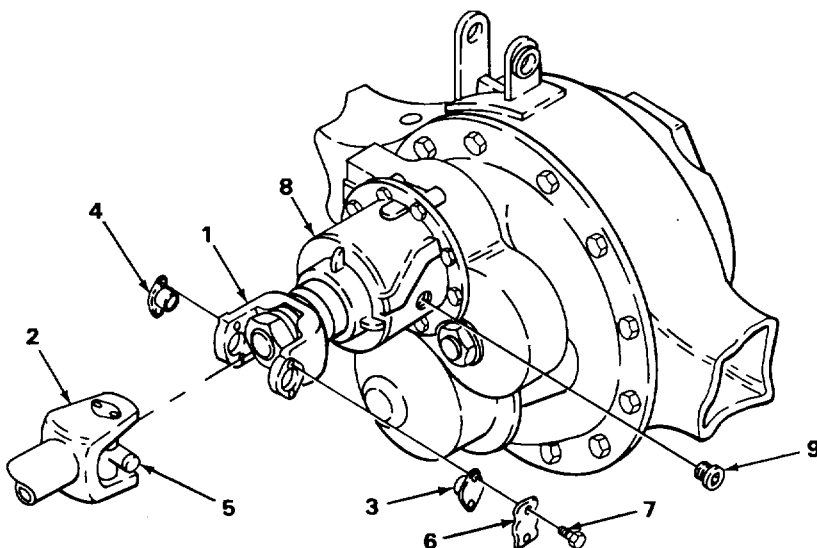
INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
47.	Housing (5) and power divider case (1)	Eight screws (10)	Using 9/16-inch socket and torque wrench with 1/2-inch drive, screw in and tighten to 75 - 85 ft-lb (101 - 115 N m) of torque.
48.	Shaft (4)	Yoke (11)	Put in place.
49.	Yoke (11)	Washer (12) and nut (13)	Using 1 13/16-inch socket and torque multiplier wrench with 3/4-inch drive, screw on and tighten to 700 ft-lb (950 N m) of torque.



INTERAXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
50.	Yoke (1) yoke (2)	Propeller shaft	Tip universal cross forward and slide shaft yoke (2) into mating yoke (1).
51.	Upper bearing cap (3) and lower bearing cap (4)		a. Put cap (3) into finger (5). b. Place wood block on cap (3). c. Using plastic-face hammer, sharply strike on block to seat cap (3). d. Do the same for lower cap (4).
52.	Upper bearing cap (3) and lower bearing cap (4)	Two new lockplates (6) and four screws (7)	a. Using 9/16-inch socket and handle with ratchet handle with 1/2-inch drive, screw on and tighten. b. Using 3/8-inch drive-pin punch and 2-lb ball-peen hammer, bend up tabs against screws.
53.	Housing (8)	Plug (9)	Using 1/2-inch drive ratchet handle, screw in and tighten.

**NOTE**

FOLLOW-ON MAINTENANCE: Lubricate interaxle differential (LO 9-2320-269-12).

TASK ENDS HERE

TA238542

INTERMEDIATE DIFFERENTIAL

This task covers:

a. Removal (page 2-888)	d. Inspection/Replacement (page 2-891)
b. Disassembly (page 2-889)	e. Assembly (page 2-892)
c. Cleaning (page 2-890)	f. Installation (page 2-895)

INITIAL SETUP**Tools**

Block, wood
 Caliper, micrometer, OD
 Hammer, ball-peen, machinist's, 3-lb
 Handle, ratchet, 112-inch drive
 Handle, ratchet, 1-inch drive
 Indicator, dial
 Pliers, snapping
 Press, arbor, hand-operated
 Puller, bearing
 Punch, drive-pin, 318-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 3/4-inch drive, 1 5/8-inch
 Socket, 1-inch drive, 3 1/8-inch
 Wrench, adjustable, 12-inch
 Wrench, crowfoot, attachment,
 1/2-inch drive, 9/16-inch
 Wrench, open-end, 9/16-inch
 Wrench, torque, 1/2-inch drive,
 0 - 175 ft-lb capacity
 Wrench, torque multiplier, 3/4-inch
 drive, 0 - 600 ft-lb capacity

Materials Parts

Gasket, intermediate differential case
 Lockwasher, hose bracket (two required)
 Lockwasher, intermediate differential case
 (five required)
 Lockwasher differential carrier
 (three required)
 Rags, wiping (item 42, appendix B)
 Sealant, gasket (item 44, appendix B)
 Solvent, dry-cleaning (item 49, appendix B)
 Spacer, idler shaft (as needed)

Personnel Required

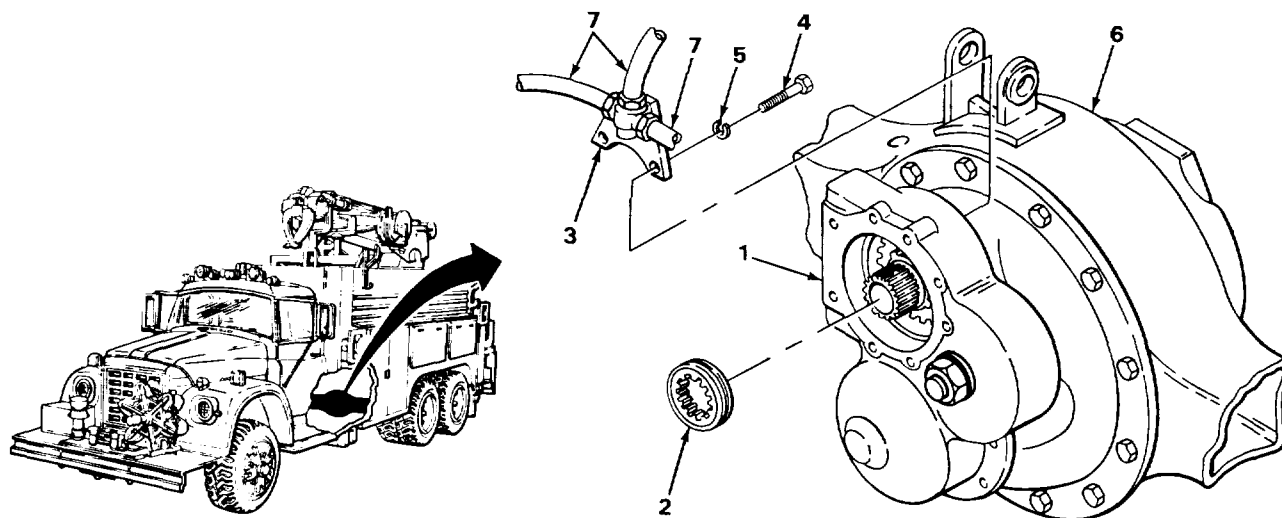
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Equipment Condition

Interaxle differential removed (page 2-875).
 Power divider lockout assembly removed
 (page 2-897).

INTERMEDIATE DIFFERENTIAL - CONTINUED

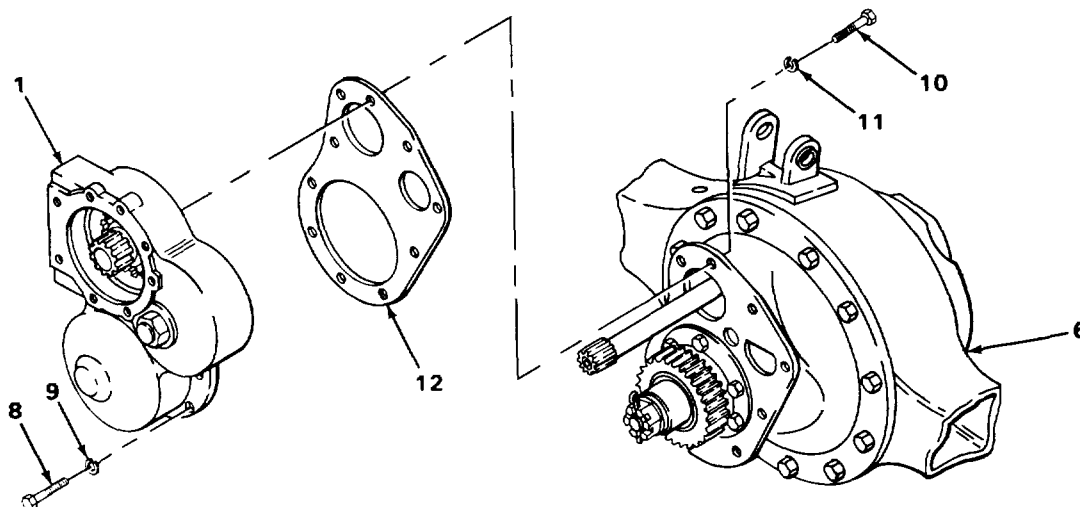
LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1.	Intermediate differential (1)	Take off.	
2.	Bracket (3)		
	Collar (2)		
	Two screws (4) and lockwashers (5)	a. Using 9/16-inch socket, ratchet handle with 1/2-inch drive, and 9/16-inch open-end wrench, unscrew and take out. b. Get rid of lockwashers (5).	
3.	Differential	Take off.	
	Bracket (3) carrier (6)	with hoses (7)	



4.	Intermediate differential (1)	Five screws (8) and lockwashers (9)	a. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off. b. Get rid of lockwashers (9).
5.	Differential carrier (6)	Three screws (10) and lockwashers (11)	a. Using 9/16-inch open-end wrench, unscrew and take off. b. Get rid of lockwashers (11).
6.		Intermediate differential (1) and gasket (12)	a. Take off. b. Get rid of gasket (12).

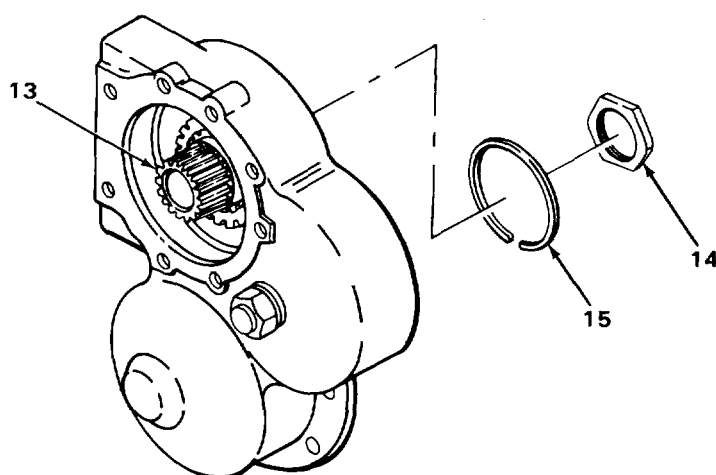
INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			



DISASSEMBLY

7.	Input gear (13)	Locknut (14)	a. Use wood block to jam gears. b. Using 3 1/8-inch socket and ratchet handle with 1-inch drive, unscrew and take off. c. Take out wood block.
8.		Snapping (15)	a. Using arbor press, press down on gear (13) until snapping (15) is free. b. Using snapping pliers, take out snapping (15).



INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
9.	Intermediate differential case (1)	Input gear (2) of case (1).	Using arbor press, press out toward front
10.	Input gear (2)	Rear bearing (3)	Using bearing puller, pull off.
11.	Idler shaft (4) washer (6)	Nut (5) and	Using 1 5/8-inch socket and torque multiplier wrench with 3/4-inch drive, unscrew and take off.
		Use adjustable wrench to hold onto flats at rear of shaft to keep shaft from turning.	
12.	Intermediate differential case (1)	Idler shaft (4)	a. Support rear face of case (1) on arbor press. b. Using press, press shaft (4) out from front to rear of case (1).
13.		Idler gear (7)	Take out.
14.	Idler gear (7)	Front cone bearing (8), and spacer (9), and rear cone bearing (10)	Take off.
15.		Two bearing cups (11)	Using bearing puller, pull out.
CLEANING			
16.		Three bearings (8), (10), and (3)	Clean (TM 9-214).

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING - CONTINUED**WARNING**

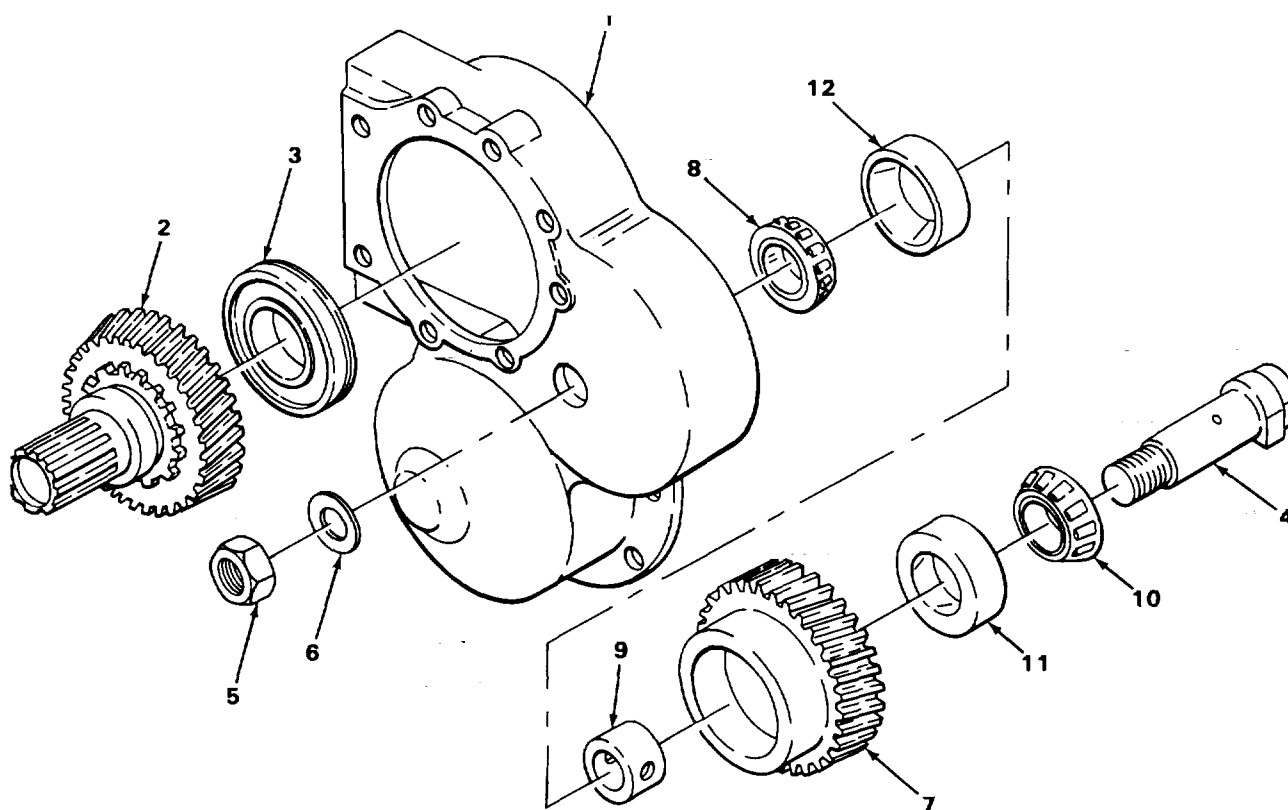
Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

17.	All metal parts	a. Clean in drycleaning solvent.
		b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT**NOTE**

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.



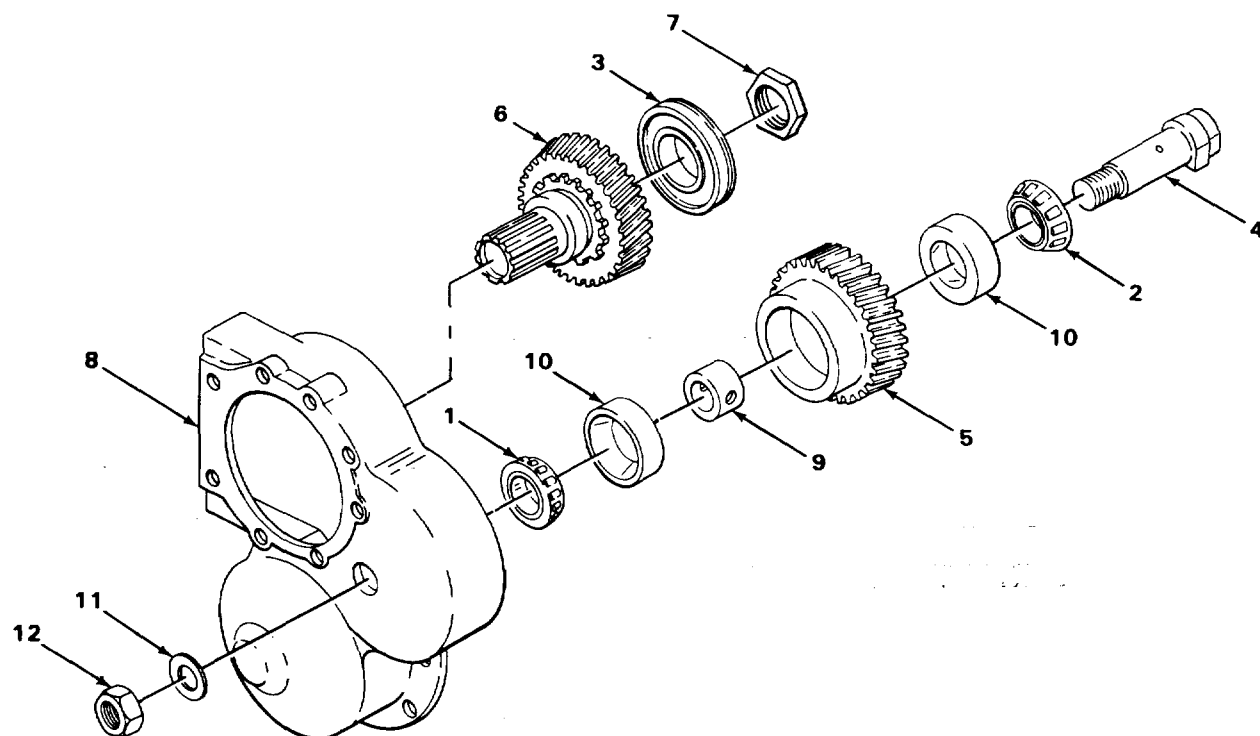
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INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION REMARKS
INSPECTION/REPLACEMENT- CONTINUED		
18.	Three bearings (1), (2), and (3)	Inspect (TM 9-214).
19.	Idler shaft (4)	a. Look for scratches, nicks, and breaks. b. Look for damaged threads.
20.	Idler gear (5) and Input gear (6)	Look for nicked, chipped, and scratched teeth and discoloration.
21.	Locknut (7)	Look for damaged threads.
22.	Intermediate differential case (8)	Look for cracks, breaks, and large dents.
ASSEMBLY		
23.	Idler gear (5)	Put in.
24.	Two bearing cups (10)	Press in using arbor press.
25.	Front and rear cone bearings (1) and (2)	Put in position.
26.	Intermediate differential case (8) and idler gear (6)	Put in position.
27.	Idler shaft (4)	With front face case (8) supported on arbor press, press shaft (4) into gear (6).
28.	Idler shaft (4) and nut (12)	a. Screw on, and tighten to 250 - 300 ft-lb (339 - 407 N m) of torque using 1 5/8-inch socket and torque multiplier with 3/4-inch drive. Hold onto flats at rear of shaft with adjustable wrench.

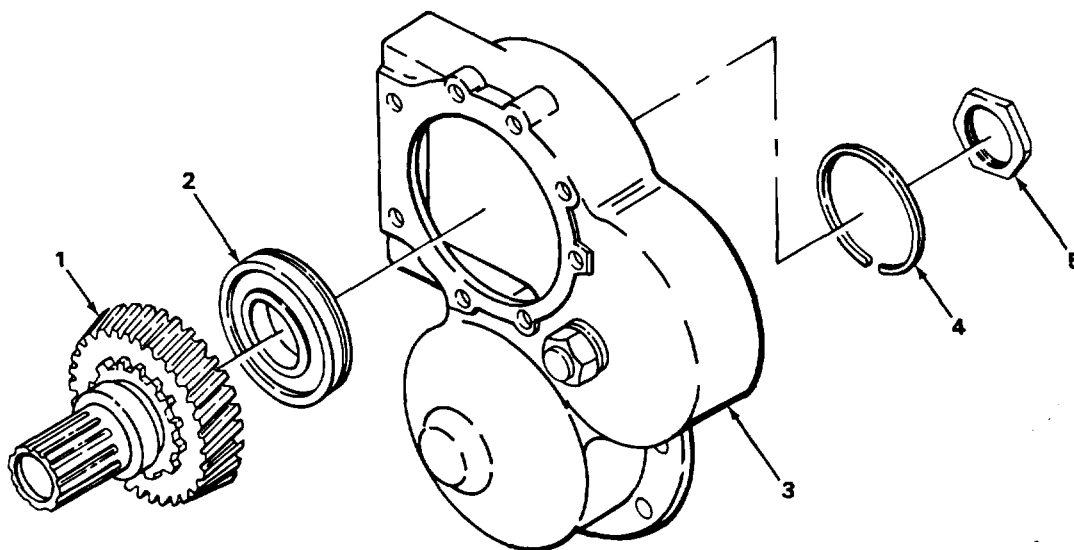
INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
28.	Continued	b.	Measure end play using dial indicator. End play should be within 0.000 to 0.003 inch (0.000 to 0.07 mm). while 0.000 end play for idler shaft is allowed. It is important that bearings not be loaded with side thrust.
		c.	If end play is not within tolerance, the spacer (11) must be changed. End play can be reduced by installing a thinner spacer and increased by installing a thicker spacer. Use micrometer to measure spacer thickness and make new selection accordingly.
		d.	If spacer (4) must be changed, go back to DISASSEMBLY, step 11.
		e.	If end play is within tolerance, go to step 30.



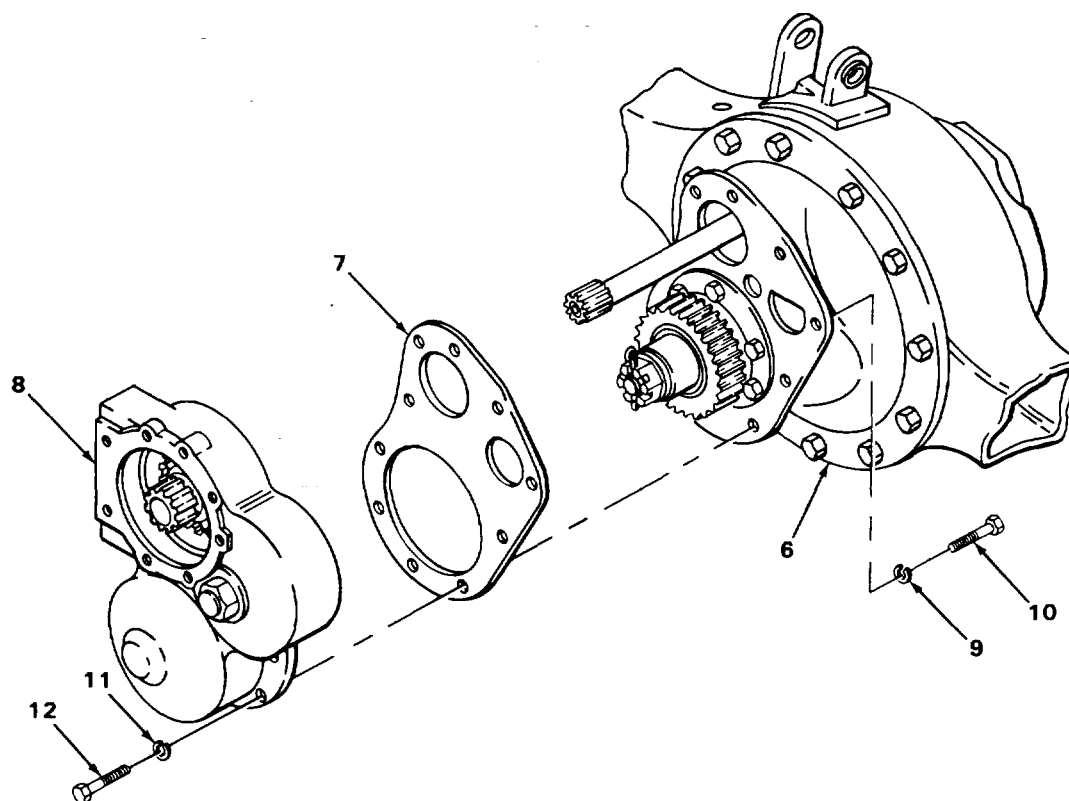
INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
29.	Idler gear (1)	New bearing (2)	Using arbor press, press on.
30.	Intermediate differential case (3)	Input gear (1)	- Support rear face of case (3) on arbor press. - Position gear (1) on case (3) and, using press, press in gear (1) as far as possible.
31.	Idler gear (1)	Snapring (4)	- Put on snapring (4) using snapring pliers. - Take case (3) out of press and turn over, bearing side up. - Press on gear (1) until snapring (4) seats firmly against shoulder of case (3) using arbor press. - Take case (3) out of press, and turn right side up.
32.		Locknut (5)	- Using wood block, jam gears. - Screw on, and tighten using 3 1/8-inch socket and ratchet handle with 1-inch drive. - Take out wood block. - Using 3-lb ball-peen hammer and 3/8-inch drive-pin punch, stake nut.



INTERMEDIATE DIFFERENTIAL - CONTINUED

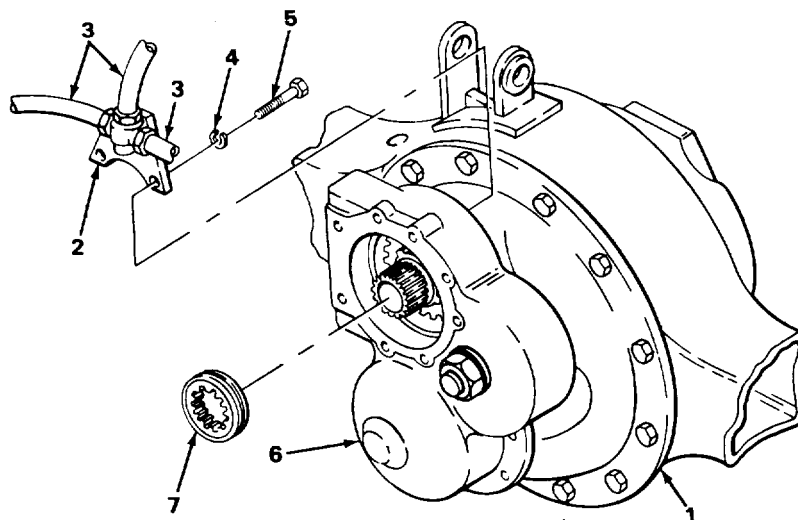
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
33. Differential carrier (6) and differential (8)	New gasket (7) and intermediate	a. Apply 1/8-inch (3.1-mm) bead of gasket sealant on differential carrier (6) and intermediate differential (8). b. Put on gasket (7). c. Place intermediate differential (8) in position.	
34.	Five new lockwashers (9) and screws (10)	Using 9/16-inch socket and ratchet handle with 1/2-inch drive, screw in and tighten.	
35. Intermediate differential (8) and screws (12)	Three new lockwashers (11)	Using 9/16-inch socket open-end wrench, screw in and tighten.	
36. Differential carrier (6) and inter-	Eight screws (10) and (12)	Using 9/16-inch crowfoot attachment and torque wrench with 1/2-inch drive, tighten to 75 - 85 ft-lb(101 - 115 N m)	



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INTERMEDIATE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
37. Differential	Bracket (2) carrier (1)	Place in position. with hoses (3)	Using 9/16-inch socket and torque wrench
38. Bracket (2) washers (4) and screws (5)	Two new lock- with 1/2-inch drive, screw in and tighten to 75 - 85 ft-lb (101 - 115 N m) of torque.	Put in.	
39. Intermediate differential (6)	Collar (7)		

**NOTE****FOLLOW-ON MAINTENANCE:**

1. Install power divider lockout assembly (page 2-897).
2. Install interaxle differential (page 2-875).
3. Lubricate intermediate differential (LO 9-2320-269-12).

TASK ENDS HERE

POWER DIVIDER LOCKOUT ASSEMBLY

This task covers:

a. Removal (page 2-898)	d. Inspection/Replacement (page 2-901)
b. Disassembly (page 2-899)	e. Assembly (page 2-902)
c. Cleaning (page 2-900)	f. Installation (page 2-904)

INITIAL SETUP**Tools**

Driftpin, brass, 1/2-inch
 Face, hammer, inserted, medium-plastic
 Hammer, ball-peen, machinist's, 3-lb
 Hammer, plastic-face, medium
 Handle, ratchet, 3/8-inch drive
 Holder, inserted hammer face
 Puller, slide hammer
 Screwdriver, flat-tip, 1/4-inch
 Scribe, machinist's
 Socket, 3/8-inch drive, 7/16-inch
 Socket, 3/8-inch drive, 9/16-inch
 Socket, deep well, 3/8-inch drive,
 9/16-inch
 Wrench, open-end, 9/16-inch
 Wrench, open-end, 7/8-inch

Materials/Parts

Gasket, shift fork housing
 Felt strip, piston (two required)
 Filter, shift cylinder body
 Lockwasher, hose clip
 Lockwasher, shift cylinder cover
 (four required)
 Packing, preformed, piston
 Packing, preformed, shift fork body
 Packing, preformed, shift fork shaft
 Packing, preformed, shift cylinder cover
 Rags, wiping (item 42, appendix B)
 Seal, oil, shift fork housing (as needed)
 Solvent, drycleaning (item 49, appendix B)

Personnel Required

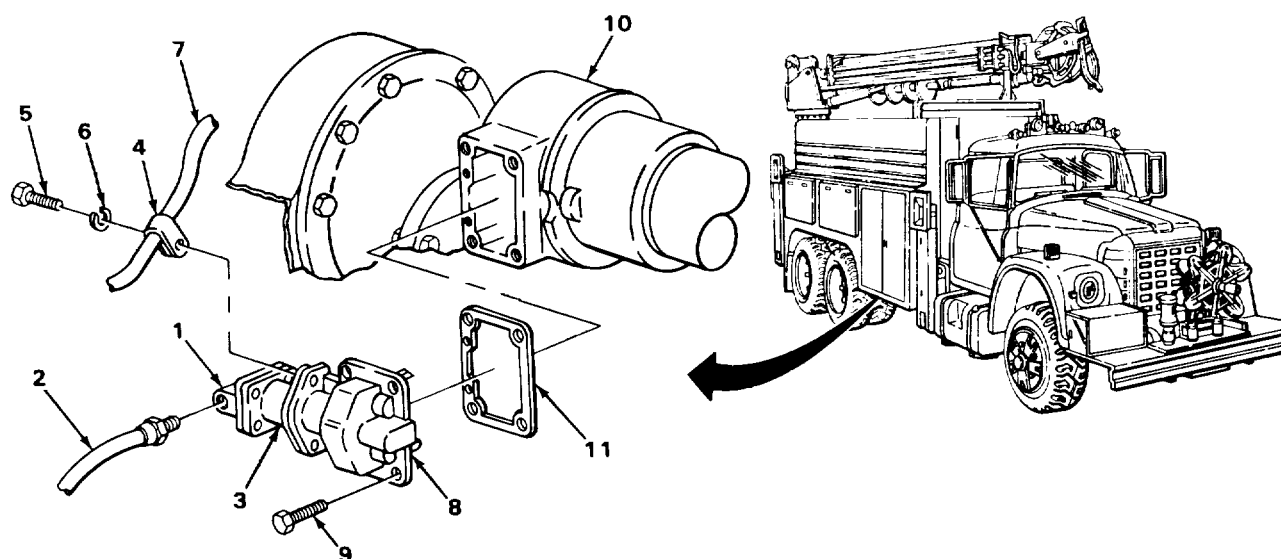
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Equipment Condition

Air reservoir drained (TM 9-2320-269-20-1)

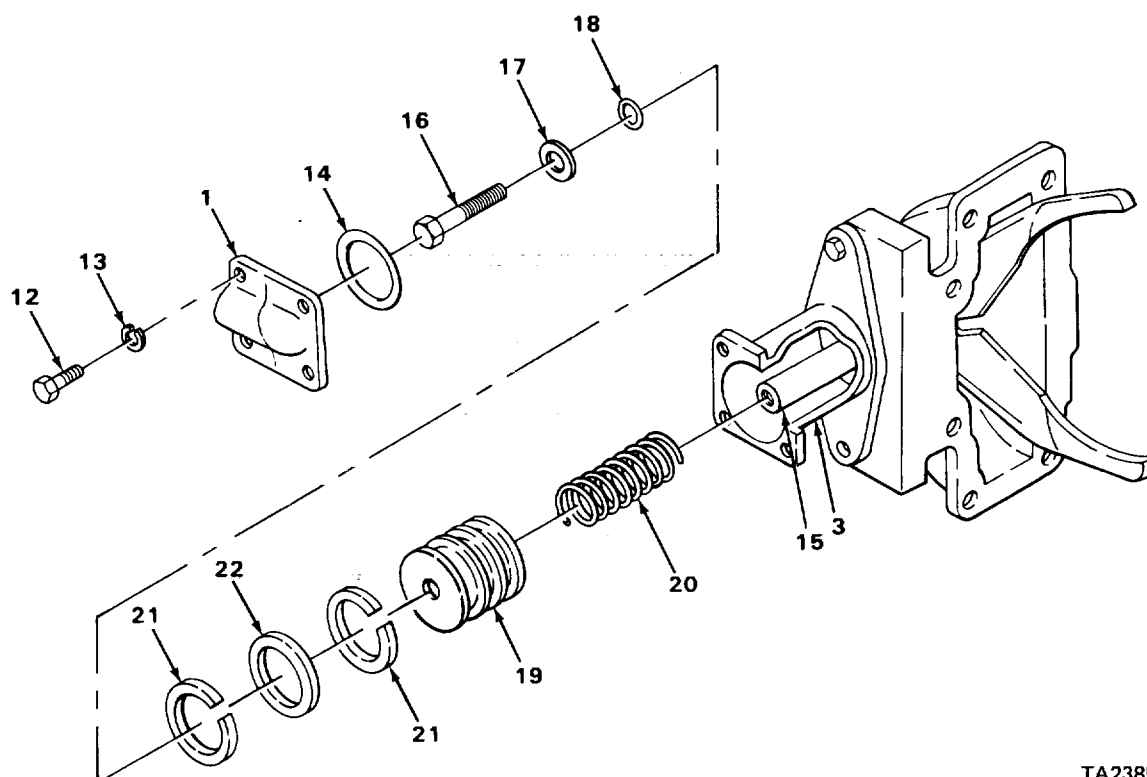
POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
NOTE			
If tandem axle assembly or differential has been removed, skip steps 1 thru 3 and begin removal at step 4.			
1.	Shift cylinder cover (1)	Hose assembly (2)	Using 7/8-inch open-end wrench, unscrew and take out.
2.	Shift cylinder body (3) and hose clip (4)	Screw (5) and lockwasher (6)	a. Using 9/16-inch open-end wrench, unscrew and take out.
3.	Shift cylinder body (3)	Hose clip (4) with hose assembly (7)	b. Get rid of lockwasher (6). Move away from.
4.	Shift fork housing (8)	Six screws (9)	Using 9/16-inch deep well socket and ratchet handle with 3/8-inch drive, unscrew and take out.
5.	Intermediate differential case (10)	Shift fork housing (8) and gasket (11)	a. Take off.
			b. Get rid of gasket (11).



POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
6. ratchet unscrew	Shift cylinder cover (1)	Four screws (12) and lockwashers (13)	a. Using 7/16-inch socket and handle with 3/8-inch drive, and take out. b. Get rid of lockwashers (13).
7.	Shift cylinder body (3) formed packing (14)	Shift cylinder cover (1) and pre-	a. Take off. b. Get rid of packing (14).
8. ratchet unscrew	Shift fork shaft (15) packing (18)	Screw (16), washer (17), and preformed	a. Using 9/16-inch socket and handle with 3/8-inch drive, and take out. b. Get rid of packing (18).
9.	Piston (19) and spring (20)	Take off.	
10.	Piston (19)	Two felt strips (21) and preformed packing (22)	a. Take off. b. Get rid of.



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POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED		
11.	Shift cylinder body (1)	Screw (2) Using 9/16-inch socket and ratchet handle with 3/8-inch drive, unscrew and take out.
12.	Shift fork housing (3) packing (4)	Shift cylinder body (1) and preformed a. Take off. b. Get rid of packing (4).
13.	Shift fork (5)	Setscrew (6) Using 1/4-inch flat-tip screwdriver, unscrew take out.
14.	Shift fork housing (3) and shift fork shaft (7)	Dust cap (8) Using 3-lb ball-peen hammer, tap on shaft (7) until cap (8) comes out.
15. 1/2-inch	Shift fork housing (3)	Shift fork shaft (7) Using 3-lb ball-peen hammer and brass driftpin, drive out.
16.	Shift fork (5)	Take out.
17.	Oil seal (9)	a. Using slide hammer puller, pull out. b. Get rid of.
18. out.	Shift cylinder body (1)	Two screens (10) and filter (11) a. Using machinist's scribe, pry b. Get rid of filter (11).

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

19.	All metal parts	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.

POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

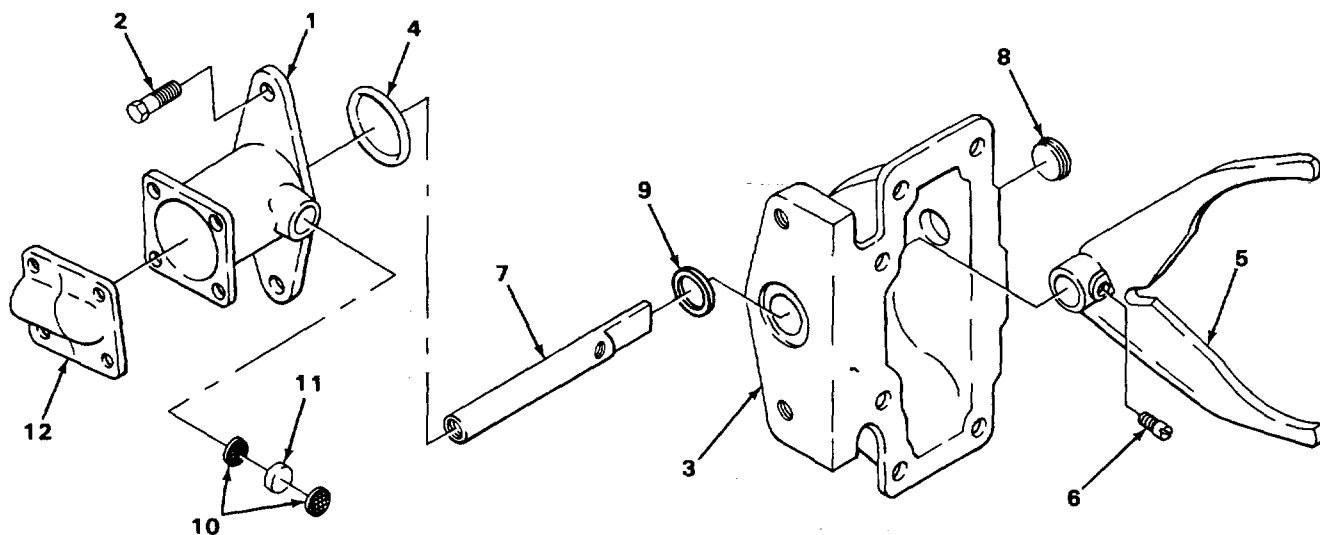
INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged or defective parts as needed.

20.	Shift cylinder cover (12), body (1), and shift fork housing (3)	Look for cracks, breaks, and damaged threads.
21.	Shift fork (5)	Look for cracks, bends, and damaged threads.
22.	Shift fork shaft (7)	Look for cracks, dents, bends, and damaged threads.



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TA238552

POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

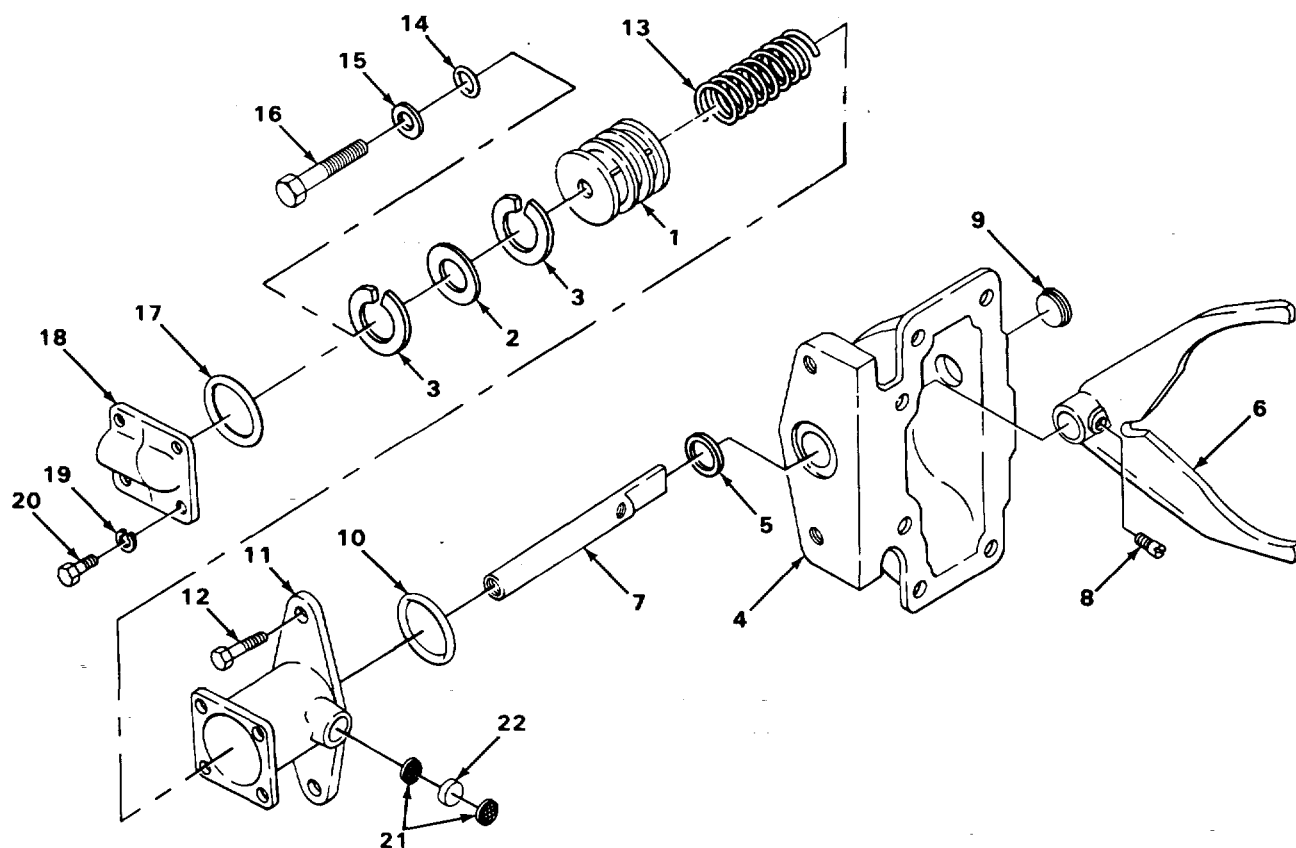
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
23.	Piston (1) ing (2) and two new felt strips (3)	New preformed pack-	Put on.
24. and	Shift fork housing (4)	New oil seal (5)	Drive in using 3-lb ball-peen hammer 1/2-inch brass driftpin.
25.	Shift fork (6)	Put in position.	
26. and	Shift fork (6) and shift fork housing (4)	Shift fork shaft (7)	Drive in using 3-lb ball-peen hammer 1/2-inch inch brass driftpin.
27.	Shift fork (6)	Setscrew (8) a. Line up holes. b. Screw in, and tighten using 1/4-inch flat-tip screwdriver.	
28.	Shift fork housing (4)	Dust cap (9)	Tap in using 3-lb ball-peen hammer.
29.	Shift fork housing (4) shift cylinder body (11)	New preformed packing (10) and	Place in position.
30.	Shift cylinder body (11)	Screw (12)	Screw in, and tighten using 9116-inch socket and ratchet handle with 3/8-inch drive.
31.	Shift fork shaft (7) piston (1)	Spring (13) and	Put on.
32.	New preformed packing (14), washer (15), and screw (16)	a. Push down on piston (1) and hold. b. Put on parts. c. Screw in, and tighten using 9116-inch socket and ratchet handle with 3/8-inch drive.	
33.	New preformed packing (17) and shift cylinder cover (18)	Place in position.	

POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

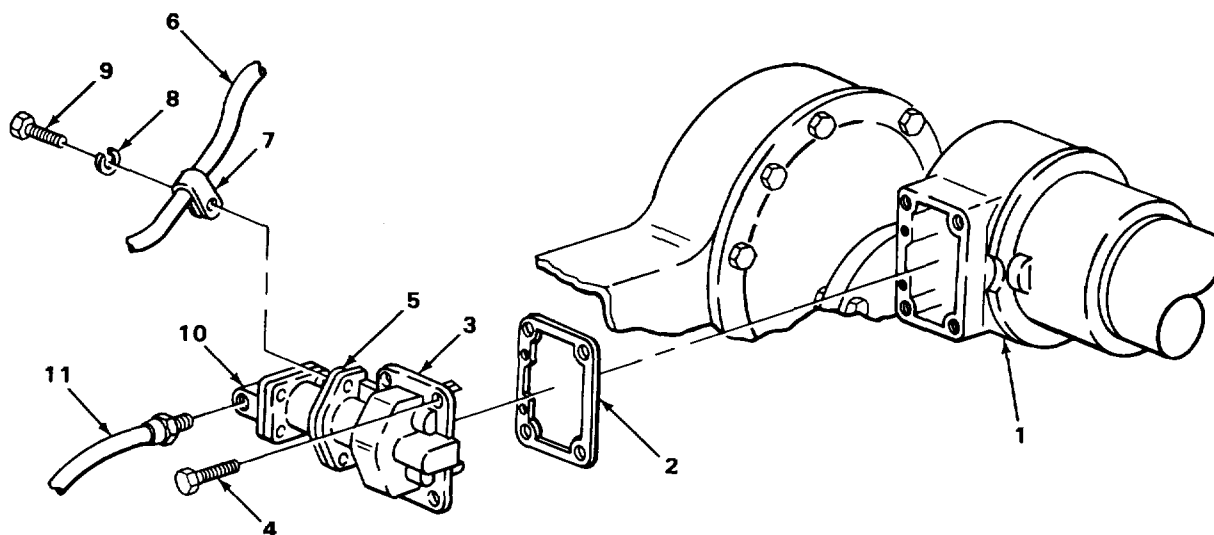
ASSEMBLY - CONTINUED

34.	Shift cylinder cover (18) screws (20)	Four new lock- Screw In, and tighten using 7/16-inch washers (19) and socket and ratchet handle with 3/8- inch drive.	
35.	Shift cylinder body (11)	Two screens (21) and new filter (22)	Tap in using medium plastic-face hammer.



POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
36.	Intermediate differential case (1)	New gasket (2) Place in position. and shift fork housing (3)	
37.	Shift fork housing (3)	Six screws (4) Screw in, and tighten using 9/16-inch deep well socket and ratchet handle with 3/8-inch drive.	
NOTE			
If tandem drive or differential has been removed from vehicle, task ends here.			
38.	Shift cylinder body (5)	Hose assembly (6) Place in position. with hose clip (7)	
39.	Hose clip (7) (8) and screw (9)	New lockwasher Screw in, and tighten using 9/16-inch open-end wrench.	
40.	Shift cylinder body (10)	Hose assembly (11) Screw in, and tighten using 7/8-inch open-end wrench.	



POWER DIVIDER LOCKOUT ASSEMBLY - CONTINUED**INSTALLATION - CONTINUED****NOTE**

FOLLOW-ON MAINTENANCE: Pressurize air system (TM 9-2320-269-20-1).

TASK ENDS HERE**REAR-REAR AXLE HOUSING**

This task covers:

a. Disassembly (page 2-906)	c. Inspection/Replacement (page 2-906)
b. Cleaning (page 2-906)	d. Assembly (page 2-907)
-

INITIAL SETUP**Tools**

Handle, ratchet, 1/2-inch drive
Wrench, open-end, 3/4-inch

Materials/Parts

Rags, wiping (item 42, appendix B)
Solvent, drycleaning (item 49,
appendix B)
Tape, teflon sealing (item 55,
appendix B)

Personnel Required

One

Equipment Condition

Tandem axle assembly removed (page 2-834).
Rear-rear axle differential removed
(page 2-908).
Equalizer beams removed (page 2-1124).
Airbrake chambers removed
(TM 9-2320-269-20-1).
Wheels and hubs removed
(TM 9-2320-260-20-1).
Backing plates and brakes removed
(TM 9-2320-269-20-1).

REAR-REAR AXLE HOUSING - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY		
1.	Housing (1) plug (2)	Magnetic drain Using ratchet handle with 1/2-inch drive, unscrew and take out.
2.	Plug (3)	Using ratchet handle with 1/2-inch drive, unscrew and take out.
3.	Breather cap (4)	Using 3/4-inch open-end wrench, unscrew and take out.

CLEANING

NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

4.	Housing (1), two plugs (2) and (3), and cap (4)	a. Clean with drycleaning solvent. b. Wipe dry with clean, dry rags.

INSPECTION/REPLACEMENT

NOTE

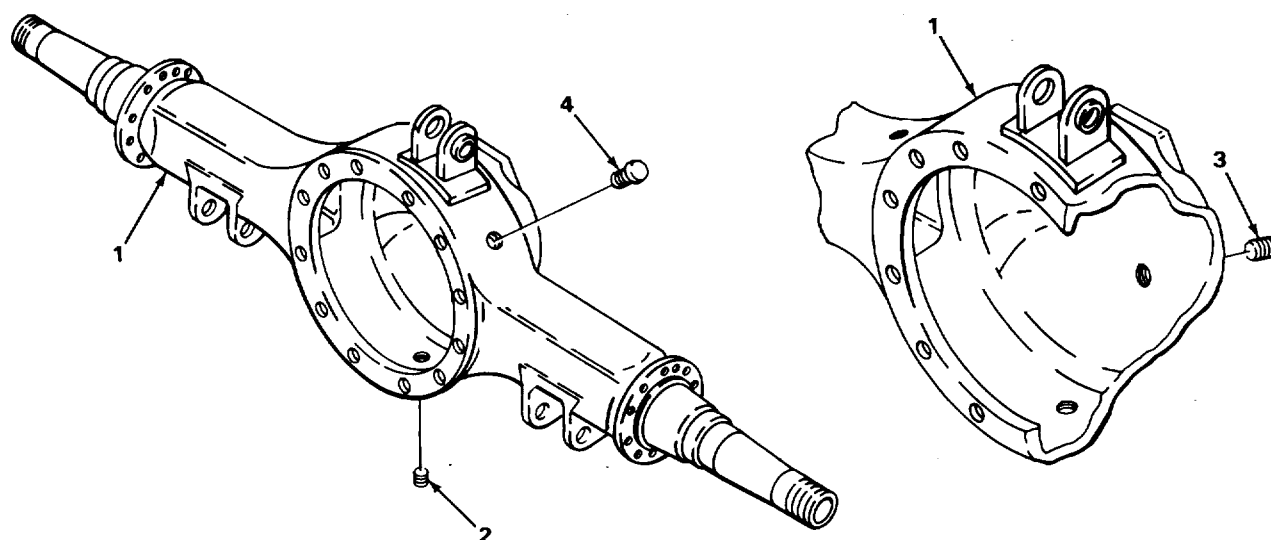
For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

5.	Housing (1)	a. Look for cracks, breaks, and dents. b. Look for broken welds. c. Look for damaged threads.
6.	Two plugs (2) and (3) and cap (4)	Check for damaged threads.

REAR-REAR AXLE HOUSING - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY			
7.	Housing (1)	Breather cap (4)	a. Wrap threads with teflon tape (page 2-46). b. Screw in, and tighten using 3/4-inch open-end wrench.
8.	Plug (3)	a. Wrap threads with teflon tape (page 2-46). b. Screw in, and tighten using ratchet handle with 1/2-inch drive.	
9.	Magnetic drain plug (2)	a. Wrap threads with teflon tape (page 2-46). b. Screw in, and tighten using ratchet handle with 11/2-inch drive.	



NOTE

FOLLOW-ON MAINTENANCE:

1. Install backing plates and brakes (TM 9-2320-269-20-1).
2. Install wheels and hubs (TM 9-2320-269-20-1).
3. Install brake chambers (TM 9-2320-269-20-1) TA238555
4. Install equalizer beam (page 2-1124).
5. Install rear-rear axle differential (page 2-908). 2-907
6. Install tandem axle assembly (page 2-834).

TASK ENDS HERE

TA238555

REAR-REAR AXLE DIFFERENTIAL

This task covers:

a. Removal (page 2-909) b. Disassembly (page 2-911) c. Cleaning (page 2-915)	d. Inspection/Replacement (page 2-916) e. Assembly (page 2-916) f. Installation (page 2-929)
-

INITIAL SETUP

Tools

Bar, cheater, 30-inch
 Bar, pry, 24-inch
 Block, wood
 Caliper, micrometer, OD
 Caps, vise jaw
 Driftpin, brass, 3/4-inch
 Fixture, riveting
 Gage, thickness, ribbon
 Grinder, pencil, portable
 Hammer, ball-peen, machinist's
 Handle, ratchet, 1/2-inch drive
 Handle, ratchet, 3/4-inch drive
 Hoist, with lifting cables, 4000-lb
 lifting capacity
 Indicator, dial
 Jack, dolly-type
 Jack, hydraulic hand, 10-ton
 Pinion setting gage set
 Pliers, slip-joint, angle-nose
 Press, arbor
 Press, hydraulic, 50-ton capacity
 Puller, gear and bearing
 Punch, drive-pin, blunt-point,
 3/8-inch
 Punch, drive-pin, 3/16-inch
 Screws, puller, 1/2-inch NC, 3-inch
 long (two required)
 Scribe, machinist's
 Sleeve, oil sealer installer
 Stand, overhaul
 Socket, 1/2-inch drive, 7/16-inch
 Socket, 1/2-inch drive, 9/16-inch
 Socket, 1/2-inch drive, 3/4-inch
 Socket, 1/2-inch drive, 15/16-inch
 Socket, 3/4-inch drive, 13/16-inch
 Socket, deep well, 3/4-inch drive,
 1 7/8-inch

Tools - Continued

Tester, spring scale
 Vise, machinist's
 Wire or strong cord, 36-inch
 Wrench, adjustable, 12-inch
 Wrench, open-end, 3/4-inch
 Wrench, torque, 1/2-inch drive,
 0 to 250 ft-lb capacity
 Wrench, torque multiplier, 3/4-inch drive,
 0 to 1000 ft-lb capacity

Materials/Parts

Cloth, emery (item 8, appendix B)
 Cups, bearing; bearing cage (two required)
 Gasket, differential carrier
 Lockwasher, oil scoop
 Lockwashers, carrier to housing
 (12 required)
 Lubricant, rear axle (item 28, appendix B)
 Paint, oiled red lead (item 37, appendix B)
 Pin, cotter, bearing locks (two required)
 Pin, cotter, yoke
 Plates, lock, upper and lower bearing caps
 Rags, wiping (item 42, appendix B)
 Rivets, flanged case (12 required)
 Sealant, gasket (item 44, appendix B)
 Seal, oil
 Solvent, drycleaning (item 49, appendix B)
 Spacer, pinion assembly
 Tag, marking (item 50, appendix B)
 Washers, thrust side (two required)
 Washers, thrust pinion (four required)

Personnel Required

One

REAR-REAR AXLE DIFFERENTIAL - CONTINUED

INITIALSETUP - CONTINUED

Equipment Condition

Rear-rear axle differential drained

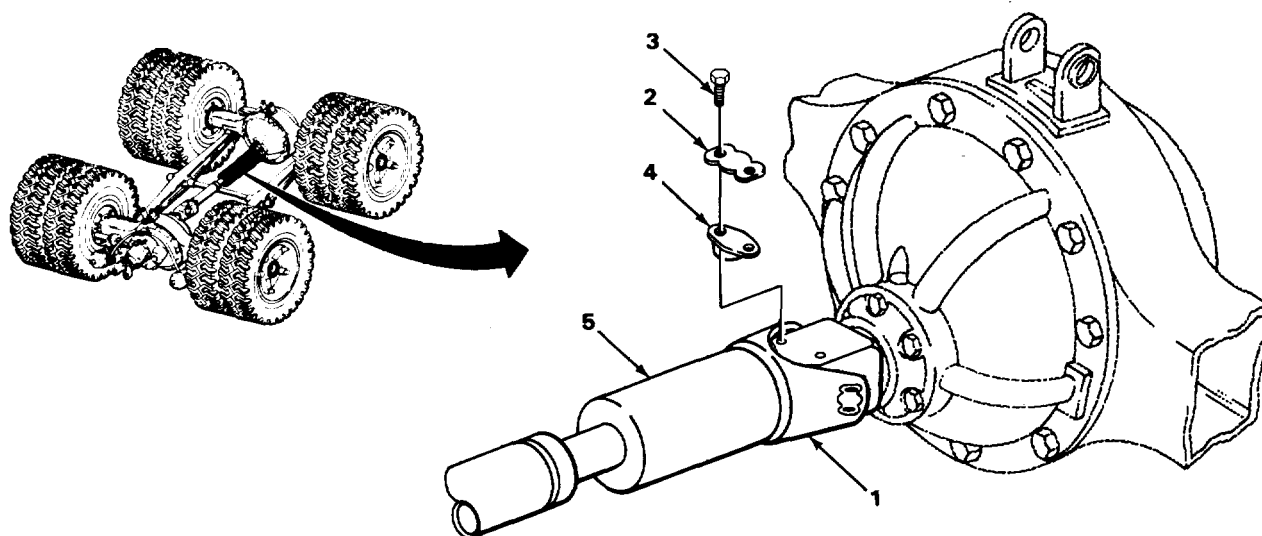
(LO 9-2320-269-12).

Tandem axle assembly removed (page 2-834).

Rear-rear axle shafts removed

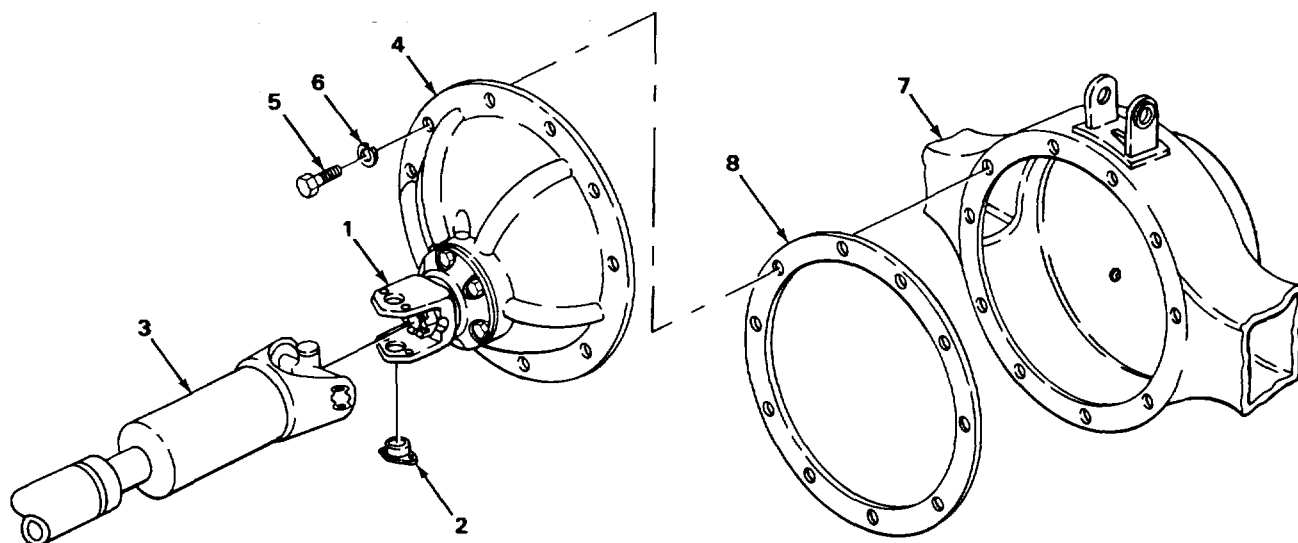
(TM 9-2320-269-20-1).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
1. 3/8-inch	Yoke (1) and four screws (3)	Two lockplates (2) a. Using ball-peen hammer and drive-pin punch, flatten tabs. b. Using 9/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off. c. Get rid of lockplates (2).	
2.	Upper bearing cap (4)	a. Place hydraulic jack under shaft (5) near yoke and fit wood block in between. b. Using hydraulic jack, raise shaft (5) until cap (4) is forced out. c. Using angle-nose slip-joint pliers, carefully twist out cap (4).	



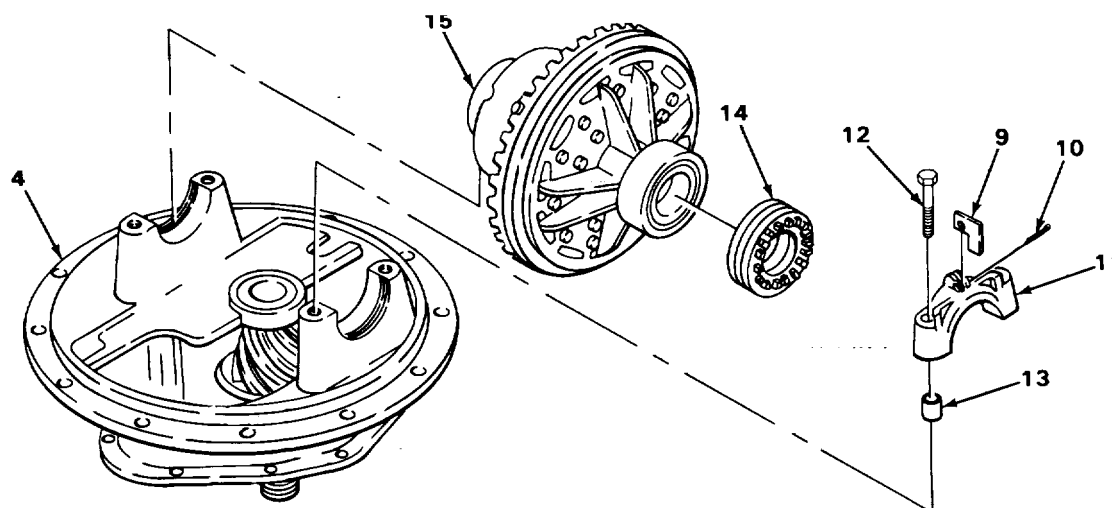
REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
REMOVAL - CONTINUED			
3.	Yoke (1) cap (2)	Lower bearing	a. Place wood block against yoke and using ball-peen hammer, tap sharply downward to force cap (2) out of yoke (1). b. Using angle-nose slip-joint pliers, carefully twist out cap (2).
4.	Shaft (3)		a. Take hydraulic jack out from under shaft (3). b. Tip cross and lower shaft (3) until yoke (1) is free.
5. underneath and	Differential carrier (4)	Twelve screws (5)	a. Place dolly-type jack and lockwashers (6) make sure jack is secure. b. Using 15/16-inch socket and handle with 1/2-inch drive, unscrew and take out. c. Get rid of lockwashers (6). d. Start two puller screws into holes 180 degrees apart. e. Using adjustable wrench, screw in puller screws until carrier (4) is free.
6. carrier (4)	Rear-rear axle housing (7)	Differential carrier	a. Using dolly-type jack, move (4) and gasket (8) away from housing (7). b. Mount carrier (4) in overhaul stand c. Get rid of gasket (8).



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
7. pliers,	Two locks (9)	Two cotter pins (10) a.	Using angle-nose slip-joint straighten pins and pull out. b. Get rid of. c. Take out two locks (9).
8. cap (11)	Two bearing caps (11)	Four screws (12) a.	Using scribe, matchmark one and carrier leg. b. Using 13/16-inch socket and ratchet handle with 3/4-inch drive, unscrew and take out.
9.	Differential carrier (4) dowels (13)	Two bearing caps (11) and four b.	Take off. Tag dowels.
10.	Two bearing adjusters (14)	Using pry bar, unscrew and take out.	
11.	Differential assembly (15)	a. Attach hoist with lifting cables. b. Using hoist, lift assembly (15) out of carrier (4) and place on bench. Tilt assembly to allow ring gear to clear radial bearing. c. Take off lifting device.	



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY - CONTINUED			
12.	Two bearing cones (1)	Two bearing cups (2)	Take off.
13.	Flanged case (3) and bearing case (4)	Two bearing cones (1)	Using gear and bearing puller, pull off.
14. cases	Bearing case (4) nuts (6)	Eight screws (5) and a.	Using scribe, matchmark both (3) and (4). b. Using 3/4-inch socket, ratchet handle with 1/2-inch drive, and 3/4-inch open-end wrench, unscrew and take out.
15.	Flanged case (3)	Bearing case (4)	Take off.
16.	Side thrust washer (7), side gear (8), and differential spider (9)	a. Take off. b. Get rid of washer (7).	
17.	Side gear (10) and side thrust washer (11)	a. Take out. b. Get rid of washer (11).	
18. and ratchet	Oil scoop (12) washer (14)	Screw (13) and lock- handle with 1/2-inch drive, unscrew and take out. b. Get rid of lockwasher (14).	a. Using 7/16-inch socket
19. Flanged case (3)	Oil scoop (12)	Take out.	

NOTE

Do not separate ring gear from flanged case unless the gear or case is damaged and must be replaced.

Do not use chisel to cut off rivet heads.

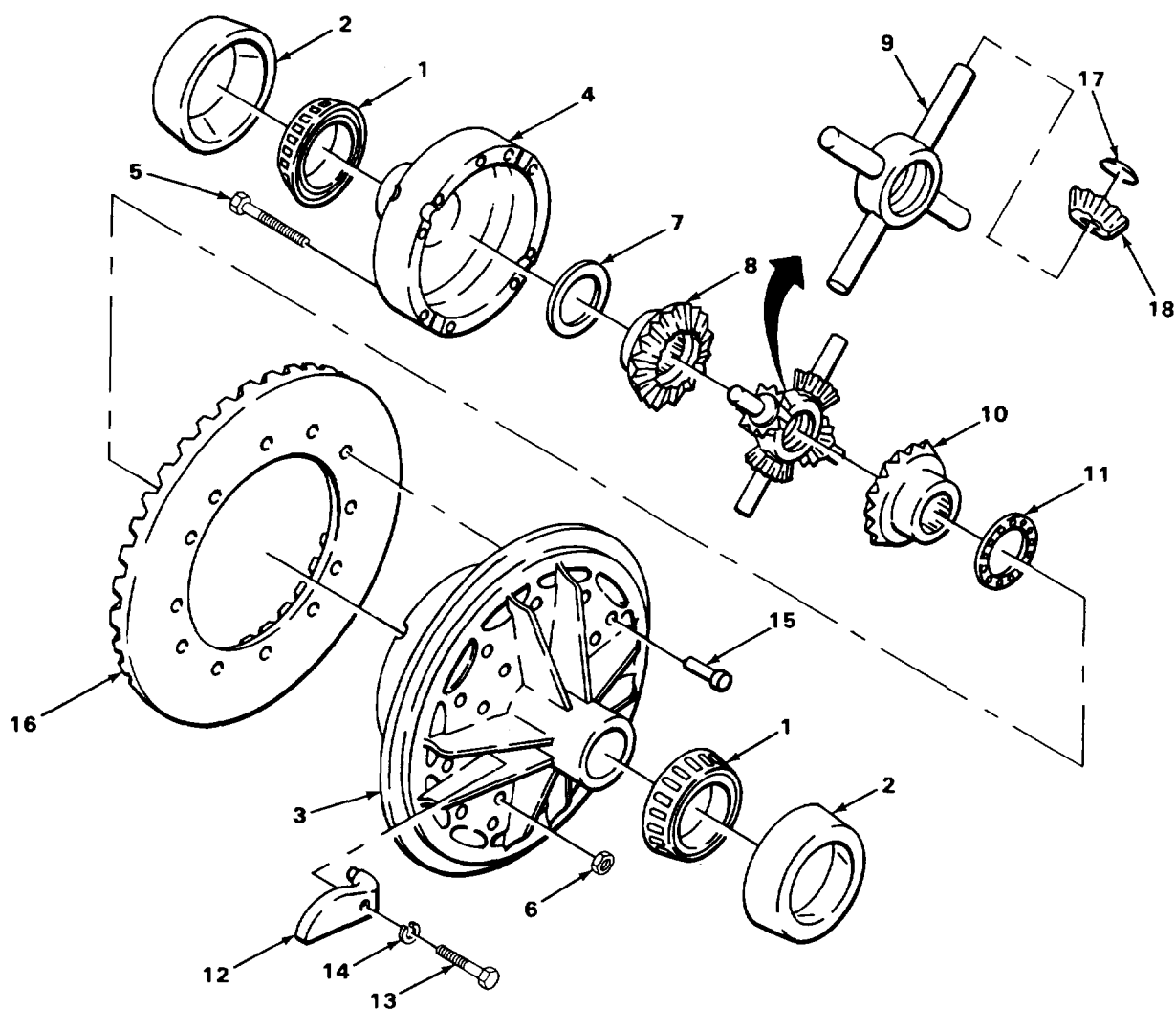
20.	Twelve rivets (15)	a. Using pencil grinder, grind off each head. b. Using ball-peen hammer and 3/8-inch blunt-point drive-pin punch, drive out rivets. c. Get rid of.

REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

DISASSEMBLY - CONTINUED

21.	Ring gear (16)	Take off.	
22.	Spider(9) (17) and four pinion gears (18)	Four thrust washers a. Take off. b. Get rid of washers (17).	



REAR.REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION REMARKS
DISASSEMBLY - CONTINUED		
23.	Nut (1)	Cotter pin (2) a. Using angle-nose slip-joint pliers, straighten and pull out. b. Get rid of.
24.	Yoke (3) washer (4)	Nut (1) and Using 1 7/8-inch deep well socket, torque multiplier wrench with 3/4-inch drive, and cheater bar, unscrew and take out.
25.	Dust shield (5)	Yoke (3) a. Take off. b. Take off dust shield (5).
26.	Bearing cage (6)	Six screws (7) Using 13/16-inch socket and ratchet handle with 1/2-inch drive, unscrew and take off.
27. and ball- sharply against	Differential carrier (8) gear (10)	Bearing cage (6), a. Using 3/4-inch brass driftpin shims (9), and pinion peen hammer, strike rear of ring and pinion gear (10) to start cage (6) off carrier. b. Take off cage (6), shims (9), and gear (10). c. Keep shims (9) together.
28.	Bearing cage (6)	Pinion gear (10) Take off.
29.	Bearing cone (11) and oil seal (12)	a. Using ball-peen hammer and oil seal installer sleeve, drive out. b. Get rid of oil seal (12).
30.	Pinion gear (10)	Spacer (13) Take off.
31.	Bearing cone (14) and pinion bearing (15)	Using rear and bearing puller, pull off.
32.	Bearing cage (6) cups (16)	Two bearing a. Using ball-peen hammer and 3/4-inch brass driftpin, tap out. b. Get rid of.

REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

CLEANING

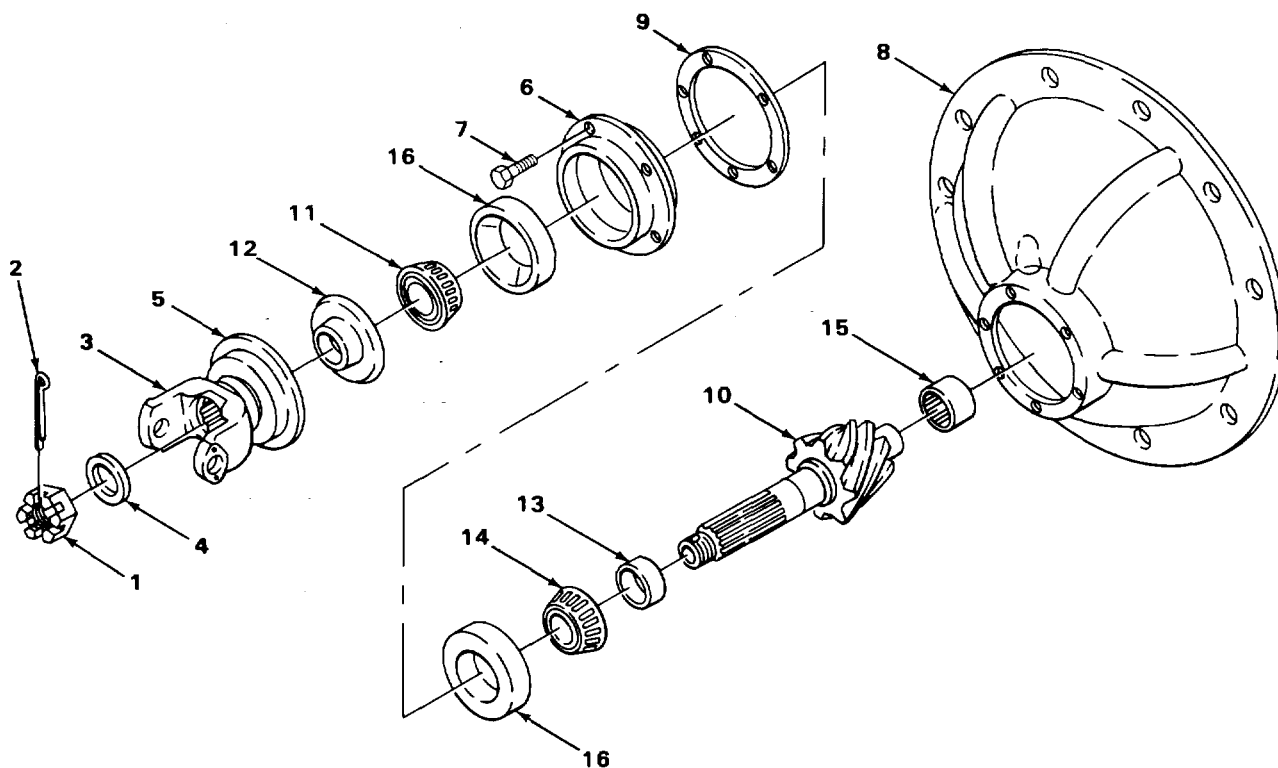
NOTE

For more information on how to clean parts, go to General Maintenance Instructions (page 2-46).

WARNING

Solvent burns easily. Solvent fumes can explode. Do not smoke or allow open flame nearby when using solvent. Failure to observe these precautions could cause serious injury or death.

33.	All metal parts except bearings	a. Clean in drycleaning solvent. b. Wipe dry with clean, dry rags.
34.	All bearings	Clean (TM 9-214).



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

INSPECTION/REPLACEMENT

NOTE

For more information on how to inspect parts, go to General Maintenance Instructions (page 2-46).

Replace damaged parts as needed.

35.	All bearings	Inspect (TM 9-214).
36.	All bearing cups	Look for signs of wear, scoring, and discoloration. If any bearing cone or bearing is damaged, replace both parts.
37.	All gears	a. Look for broken, nicked, and chipped teeth. b. Look for score marks. c. Look for cracks and distortion. d. Look for twisted splined. If any gear within any set is damaged, replace all gears in the set.
38.	Differential carrier (1)	a. Look for cracks, breaks, and dents. b. Look for nicks, burrs, and deep scratches on mating surfaces. c. Look for damaged threads.
39.	Bearing cage (2)	a. Look for cracks, scratches, and score marks. b. Look for discoloration due to overheating.

ASSEMBLY

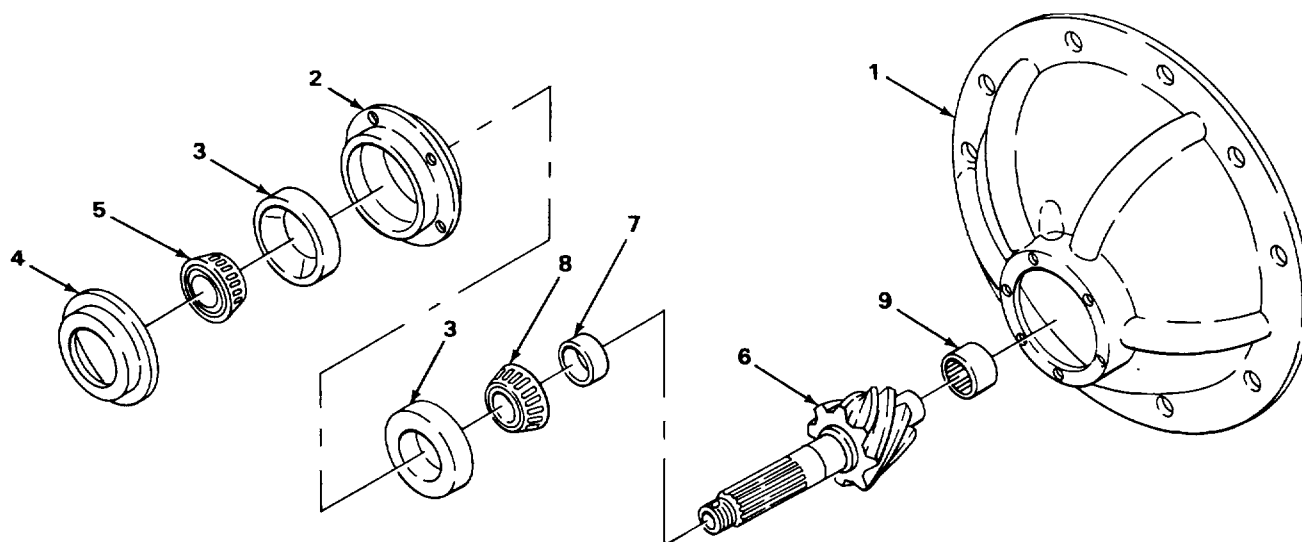
40.	Bearing cage (2) cups (3)	Two new bearing Using arbor press, press in.
41.	New oil seal (4) and bearing (5)	Using arbor press, press in.
42.	Pinion gear (6)	Spacer (7) a. Using micrometer caliper, measure thickness and record. b. Put on.
43.	Bearing cone (8)	Using arbor press, press on.

REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

44.	Pinion bearing (9)	a. Using arbor press press on until seated firmly against shoulder. b. Using 3/8-inch blunt-point drive-pin punch and ball-peen hammer, stake face of gear (6) in six evenly spaced places. c. Lubricate bearings (8) and (9) with rear axle lubricant.
45.	Bearing cage (2)	Pinion gear (6) Put in.

**NOTE**

The adjustments made on rear-rear axle differential carrier are performed to establish the proper gear tooth contact. Correct contact will result in a long wearing, quiet running rear axle assembly.

There are five adjustments to be performed and these adjustments are performed as the carrier is assembled. The adjustments are as follows:

1. Preloading the pinion gear bearing cones
2. Establishing the pinion nominal dimensions
3. Setting gear lash TA238561
4. Preloading the differential bearing
5. Checking the gear tooth contact

REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
NOTE			
Pinion gear bearing cones preload is established by choosing the correct size spacer that is located between the bearings, and tightening the drive pinion nut. The spacer is available in different thicknesses to obtain correct bearing preload. Steps 46 thru 48 outline the procedure for establishing correct bearing preload.			
46.	Bearing cage (1) and pinion gear (2)	Yoke (3) a. Put on. b. Put assembly in vise with soft jaws so gear (2) is held tight.	
47.	Washer (4) and nut (5)	Rotate cage (1) and, at the same time, screw on nut (5) and tighten to 325 ft-lb (441 N m) of torque using 1 7/8-inch deep well socket and torque multiplier wrench with 314-inch drive. Be sure to turn cage while tightening nut so bearing cones will line up and seat. Bearing rollers must be seated against face of cone.	
48. wrapping a	Pinion assembly (6)	Bearing cage (1) a. Measure bearing preload by strong cord or soft wire around cage (1) and attaching free end to suitable spring scale. b. Turn cage (1) and at the same time, pull on spring scale and note reading. Scale reading should show 3-8 lb (1.35 - 3.6 kg).	

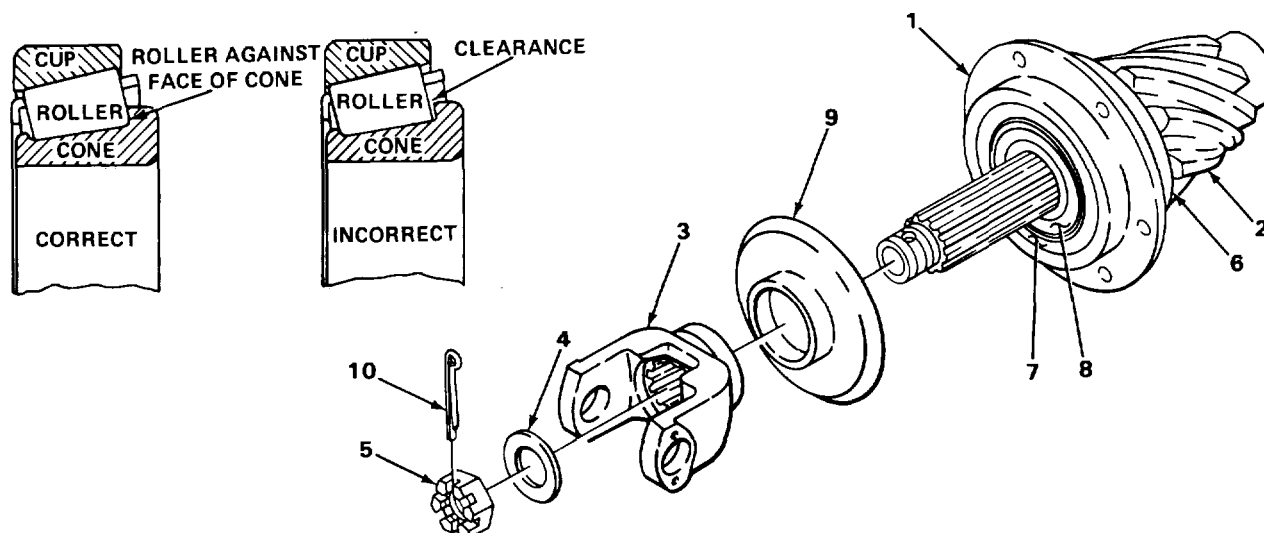
NOTE

When preload does not agree with specification (3 - 8 lb, 1.35 - 3.6 kg), bearing load may be increased by installing a thicker spacer. If necessary, go back to disassembly, steps 24 thru 29, to remove spacer. Measure thickness of old spacer with micrometer and select a different spacer. Spacers are available in various thicknesses, in gradations of 0.001-inch (0.025-mm). Closer adjustment can be made by working spacer to desired thickness using an emery cloth on flat surface. Be sure to clean off emery cuttings before installing spacer (steps 44 thru 46).

49.	Two bearing caps (7) cones (8)	Two bearing Check that rollers are in contact with cone face using thickness gage ribbon. There must be no clearance at ends of rollers.

REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
50.	Pinion gear (2) washer (4)	Nut (5) and	Unscrew and take off using 1 7/8-inch deep well socket, torque multiplier wrench with 3/4-inch drive, and cheater bar.
51.	Yoke (3)	Take off.	
52.	Dust shield (9)	Place in position.	
53.	Pinion gear (2)	Yoke (3) Place in position.	Yoke should be actual part, not temporary.
54.	Washer (4) and nut (5)	a. Make sure gear (2) is held tight in vise and will not turn. b. Screw on, and tighten to 300-350 ft-lb (406-474 N m) of torque using 1 7/8-inch deep well socket and torque multiplier wrench with 3/4-inch drive.	
55.	Nut (5)	New cotter pin (10) a. Put in. b. Separate ends and bend back over nut (5) using angle-nose slip-joint pliers.	Do not back off nut to line up holes. Increase torque as needed to line up holes and put in cotter pin.



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
56.	Differential carrier (1) shims (3)	Pinion and cage assembly (2) and	Place in position.
57.	Pinion and cage assembly (2)	Six screws (4)	Screw in, and tighten to 100-120 ft-lb (135-163 N m) of torque, using 13/16-inch socket and torque wrench with 3/4-inch drive.

NOTE

Step 58 will establish pinion nominal dimension. This dimension is the distance of from the face or finished end of the installed pinion gear to the centerline of the ring gear.

58.	Differential carrier (1)	Pinion gear (5) a.	Using step plate and clamp assembly from pinion setting gage set, attach it to carrier (1), locating step plate screw over center of gear (5).
		b.	Install another step plate under clamp screw, and tighten screw to hold plate securely in place.
			Step plates are necessary to project the face of pinion gear so it can be measured.
		c.	Be sure lugs on step plate straddle the bearing staking marks on end of pinion gear (5).
		d.	Install assembled setting gage and discs (number D-2) in carrier (1) bearing bores.
			Make sure bearing bores are clean and free of nicks and burrs.
		e.	Adjust micrometer caliper so it is directly over end and at a 90° angle to step plate.
		f.	Run micrometer thimble down to measure distance between center of ring gear step plate.

LOCATION	ITEM	ACTION	REMARKS

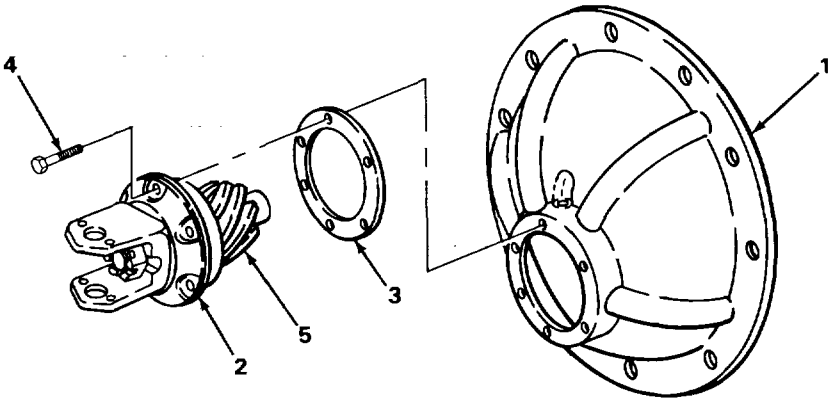
ASSEMBLY - CONTINUED

58.	Continued	g.	Note reading. Nominal dimension tolerance is 3.4725-inches (88.20-mm).
		h.	Look for etched markings on pinion gear (5) which show variations from zero cone setting.
		i.	If marking from step h above is a minus figure, subtract it from 3.4725-inches (88.20-mm).
		j.	If marking from step h above is a plus figure, add it to 3.4725-inches (88.20-mm).

NOTE

Comparison of corrected nominal dimension with the actual or measured dimension indicates the amount of change necessary for correct pinion gear position. It may be necessary to add or remove shims between pinion cage and carrier.

- k. If nominal dimension is not correct, go back to disassembly, steps 21 and 22 to change shims.
- l. If shims were changed go back to steps 56 and 57 for installation of cage on carrier.
- m. Remove pinion setting gage set.

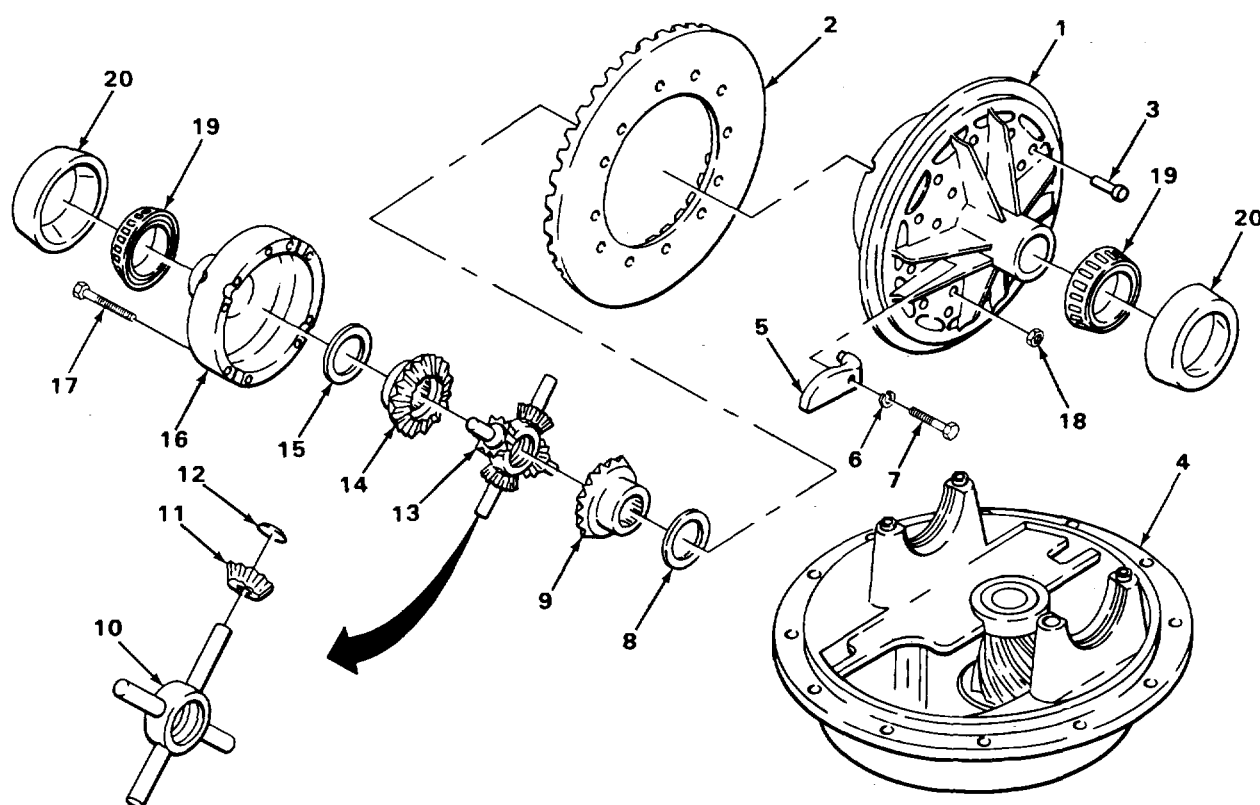


REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION REMARKS
ASSEMBLY - CONTINUED		
59.	Flanged case (1)	Ring gear (2) Lining up holes, place in position.
60.	Twelve new rivets (3)	Using riveting fixture and hydraulic press, press in.
61.	All parts	Apply rear axle lubricant to all parts, including inside walls of carrier (4).
62.	Oil scoop (5)	Put in position.
63.	Oil scoop (5) and screw (7)	New lockwasher (6) Screw in, and tighten using 7/16-inch socket and ratchet handle with 1/2-inch drive.
64.	Flanged case (1) (8) and side gear (9)	New thrust washer Place in position.
65.	Spider (10) (11) and four new thrust washers (12)	Four pinion gears Place in position.
66.	Flanged case (1) differential (13)	Spider Place in position.
67.	Spider differential (13) washer (15)	Side gear (14) Place in position. and new thrust
68.	Flanged case (1)	Bearing case (16) a. Line up matchmarks. b. Put in position. c. Turn gears to see if they mesh. d. If gears do not move freely, take off case and reseal them.
69. snug.	Bearing case (16) and nuts (18)	Four screws (17) a. Space evenly and screw in until Make sure gears mesh. b. If gears mesh properly, go on to step 70. c. If gears do not mesh, take out screws (17) and nuts (18), take off case (16), and reseal gears. d. Do steps a thru c again.

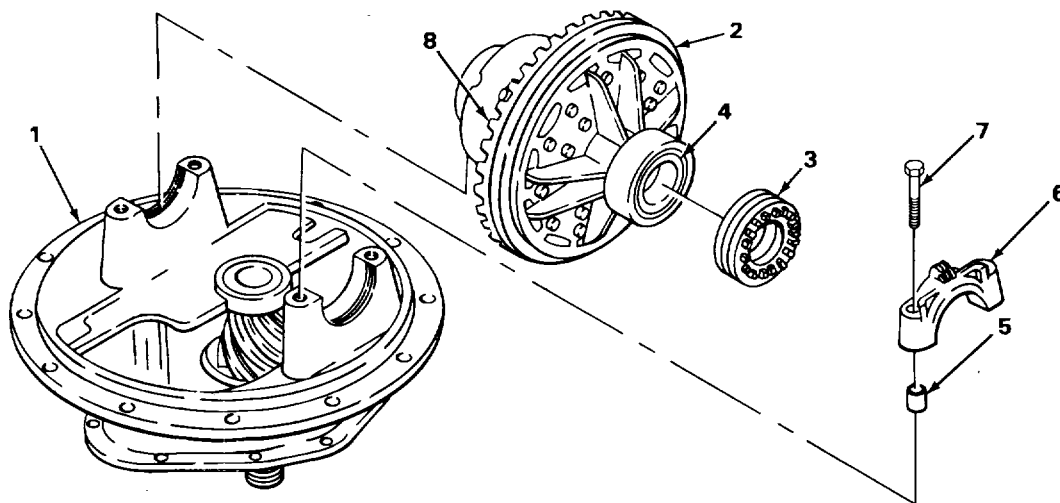
REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
70.	Four screws (17) and nuts (18)	a. Screw in until snug.	
71.	Bearing case (16) and flanged case (1)	Two bearing	Using arbor press, press on.
72.	Two bearing cones (19)	Two bearing cups (20) b.	Put on. Apply rear axle lubricant to bearings (19).



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

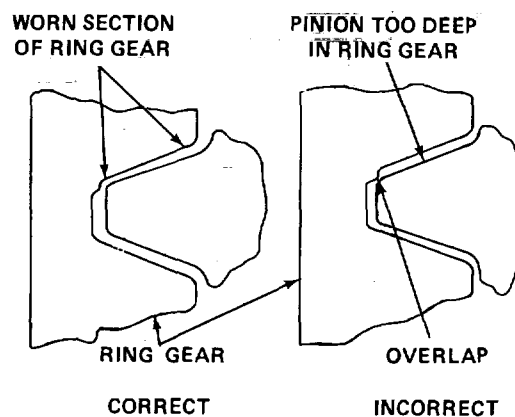
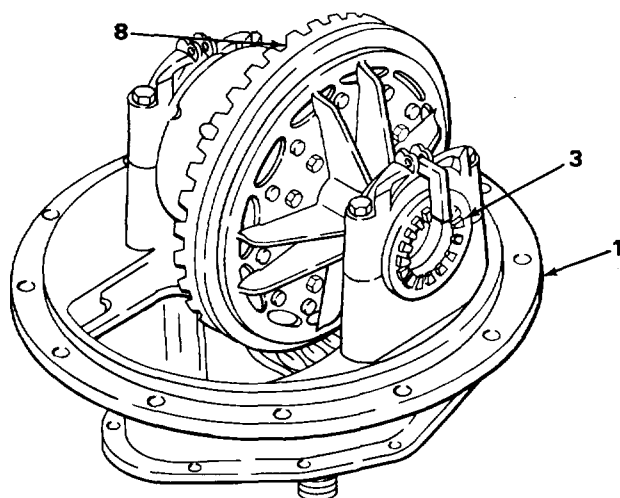
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
73.	Differential carrier (1)	Differential assembly (2)	a. Attach lifting cables and hoist. b. Using hoist, put in position. Tilt assembly to allow ring gear to pass pinion gear.
74.	Two bearing adjusters (3)	Screw in handtight against bearings (4).	
75.	Four dowels (5)	Note location, and put in place.	
76.	Two bearing caps (6)	a. Matchmark one cap to correct carrier leg. b. Place both caps (6) in position.	
77.	Two bearing caps (6)	Four screws (7) Screw in, and tighten to 150-160 ft-lb (203-217 N m) of torque using 13/16-inch socket and torque multiplier wrench with 314-inch drive.	
78.	Differential carrier (1) and two bearing caps (6)	Two bearing adjusters (3) Tighten each adjuster (3) alternately, and at the same time, turn ring gear (8) using pry bar. Tighten adjusters until all end play is gone.	



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

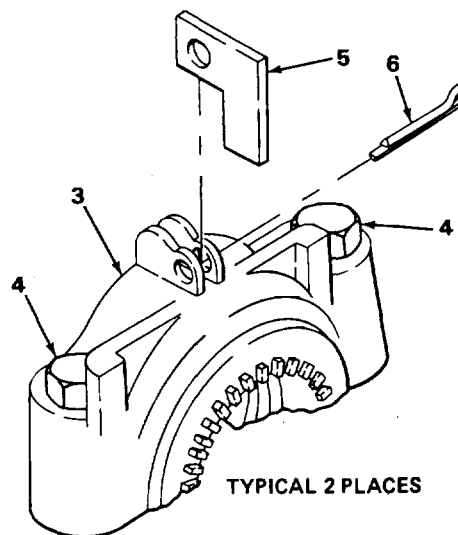
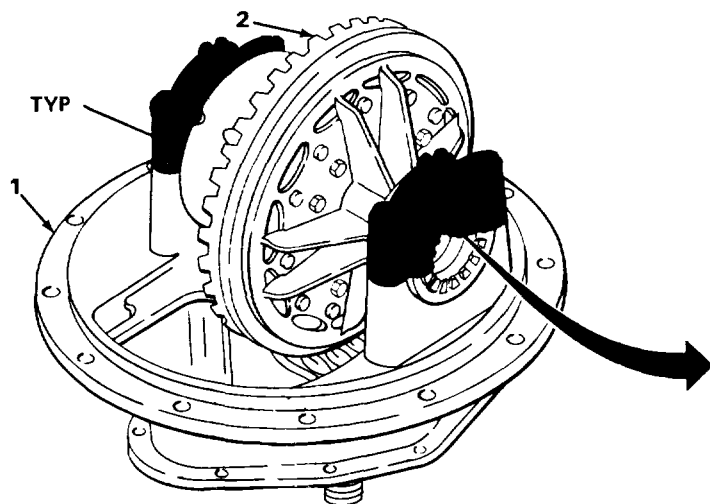
LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
NOTE			
A special effort should be made to set the backlash between pinion gear and ring gear to the same amount as was originally built into them: 0.006 - 0.012 inch (1.5 - 0.30 mm). Usually the amount of backlash is stamped or etched on the ring gear. When original pinion gear and ring gear sets are reinstalled, the wear pattern on the gear teeth must be considered in the backlash adjustment. Gears that have been in service for a long time form running contacts and should not be changed too much. If, in checking backlash, the amount measured is more than amount stamped on ring gear, the backlash may be reduced only by the amount that will avoid overlap of the worn tooth section. An overlap at the worn section will cause gear operation to be noisy and rough.			
79. (8)	Differential carrier (1) adjusters (3)	Ring gear (8) a. Mount dial indicator on carrier (1). and two bearing b. Measure backlash on ring gear using indicator.	Backlash tolerance is 0.008 - inch (0.20 - mm). c. To adjust backlash, use a 24-inch pry bar and back off one adjuster (3) while advancing the other adjuster (3) the same amount.

TOP



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
ASSEMBLY - CONTINUED			
80.	Differential carrier (1)	Ring gear (2)	Mount dial indicator at side of gear (2) to set bearing preload.
with 81.	Two bearing caps (3)	Four screws (4)	Using 13/16-inch socket and handle 3/4-inch drive, unscrew only enough to note end play on indicator.
82.	Differential carrier (1)	Ring gear (2)	a. While gear (2) is held at zero end play, and before loading bearings, check runout by turning ring gear (2). b. If runout is more than 0.008-inch (0.20-mm), remove differential assembly and check for cause.
83.	Two bearing caps (3)	Four screws (4)	a. Tighten to 150-160 ft-lb (203-N m) of torque using 13/16-inch socket and torque wrench with 1/2-inch drive. b. Recheck backlash, step 79.
84.	Two adjuster locks (5)	Put in.	
85.	Two adjuster locks (5)	Two new cotter pins (6)	Put in. Using angle-nose slip-joint pliers,



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

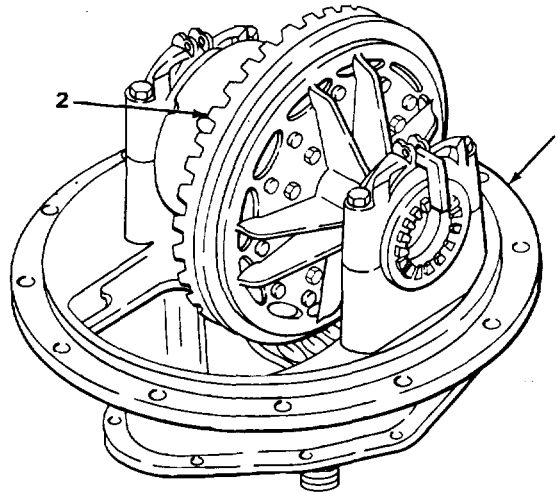
ASSEMBLY - CONTINUED

NOTE

The final check of the differential assembly is checking the gear tooth contact by paint impression method. When the ring is turned, the applied paint is squeezed away by the contact of the teeth, leaving bare spots the exact size, shape, and location of the contacts.

When making adjustment, check drive side of gear teeth. Coast side should be correct when drive side is correct. With all adjustments properly made, the result is a quiet running ring gear and pinion gear because the load is evenly distributed over all teeth.

86.	Differential carrier (1)	Ring gear (2) a. Apply oiled red lead paint lightly to 12 gear teeth. b. Turn gear (2) one complete turn. Sharper impressions can be made by applying some resistance to gear with a pry bar and using an open-end wrench to turn pinion gear.



REAR-REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS

ASSEMBLY - CONTINUED

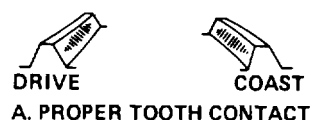
86.

Continued

- c. With adjustments made correctly, tooth contact should be similar to that shown in illustration A below.

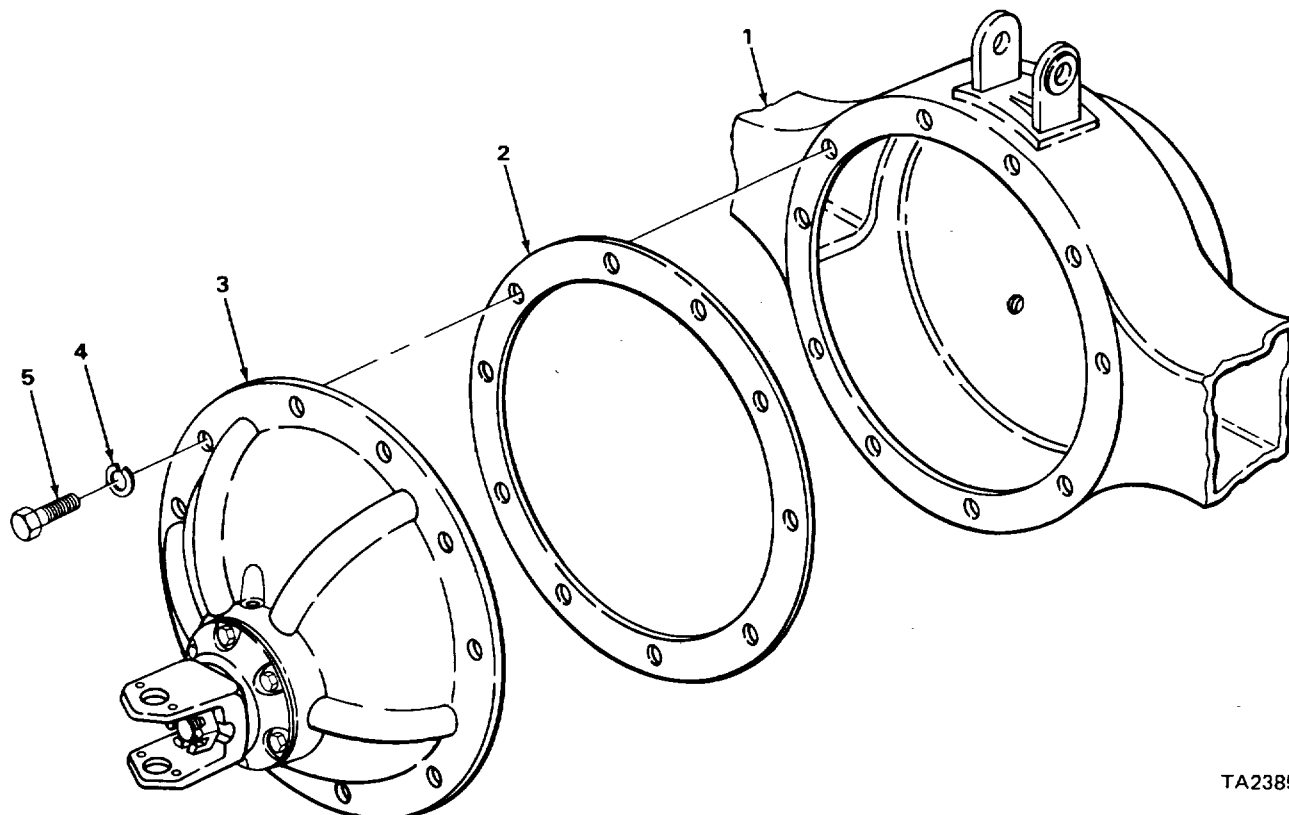
The contact area starts near the toe of the gear and extends about 62.5 percent of the tooth length. When checking paint impressions on gear teeth under heavy load, the impressions will spread longer than patterns made from bench test. This is normal. Mounted ring gear should show a bearing toward the toe (small) end of the tooth, never at heel (large) end. It is Impossible to make gears and gear mounting so rigid that no deflection will occur when full torque is applied. This deflection causes the bearing to approach the heel of the tooth, and the result is a concentration of load on the top corner of the heel and the tooth will break.

- d. If paint impressions are not correct, use examples of tooth contact impression shown below and make necessary corrections.



REAR - REAR AXLE DIFFERENTIAL - CONTINUED

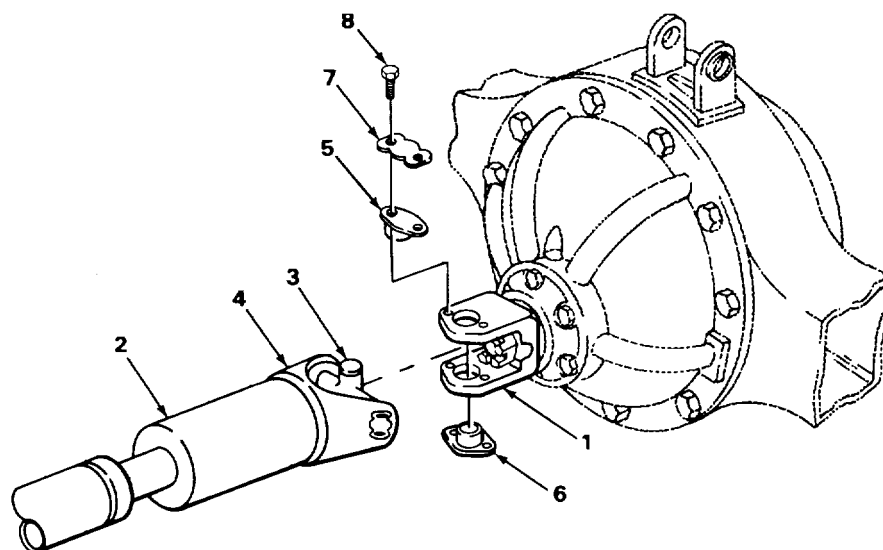
LOCATION	ITEM	ACTION	REMARKS
INSTALLATION			
87. Rear-rear axle housing (1)	New gasket (2) and differential carrier (3)	- Remove differential carrier (3) from overhaul stand and support on dolly-type jack. - Apply 118-inch (3.1-mm) bead of gasket sealant on housing (1). - Put on gasket (2). - Line up carrier (3) with housing (1) using dolly-type jack and roll into place.	Use a pry bar to help straighten carrier, but be careful not to damage mating surfaces.
88. Differential carrier (3)	Twelve new lock-washers (4) and screws (5)	Screw in, and tighten to 80-90 ft-lb (109-122 N m) of torque using 15/16-inch socket and torque wrench with 1/2-inch drive.	



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REAR - REAR AXLE DIFFERENTIAL - CONTINUED

LOCATION	ITEM	ACTION	REMARKS
INSTALLATION - CONTINUED			
89. Yoke (1)	Shaft (2)	a. Move into position. b. Tip universal cross (3) forward and slide yoke (4) into yoke (1).	
90	Upper bearing cap (5) and lower bearing cap (6)	a. Put cap (6) on yoke (1) and using ball-peen hammer and wood block tap sharply into place. b. Put cap (5) on yoke (1) and using ball-peen hammer and wood block tap sharply into place.	
91 Upper and lower bearing caps (5) and (6)	Two new lock-plates (7) and screws (8)	a. Put plates (7) in place. b. Screw in, and tighten screws using 9/16-inch socket and ratchet handle with 1/2-inch drive. c. Bend up tabs against screws (8) using ball-peen hammer and 3/16-inch drive-pin punch.	

**NOTES****FOLLOW-ON MAINTENANCE:**

1. Install rear-rear axle shafts (TM 9-2320-269-20-1).
2. Service rear-rear axle differential (LO 9-2320-269-12).
3. Install tandem axle assembly (page 2-834).

TASK ENDS HERE

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LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 Lb
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
 1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
 1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

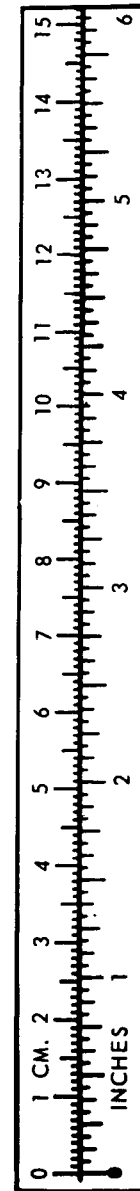
TEMPERATURE

$5.9^{\circ}\text{F} - 32 = ^{\circ}\text{C}$
 $212^{\circ}\text{Fahrenheit is equivalent to } 100^{\circ}\text{Celsius}$
 $90^{\circ}\text{Fahrenheit is equivalent to } 32.2^{\circ}\text{Celsius}$
 $32^{\circ}\text{Fahrenheit is equivalent to } 0^{\circ}\text{Celsius}$
 $9^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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