* TM 5-3895-360-13

TECHNICAL MANUAL

OPERATOR'S, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL

TAMPER, BACKFILL: GASOLINE ENGINE DRIVEN, HAND-OPERATED, RAM-TYPE (CCE)

MODEL VR11C (NSN 3895-01-151-2749)
MODEL VR11 (NSN 3895-01-013-4328)

● This manual supersedes TM5-3895-360-14, 15 June 1985; also, this manual and TM5-3895-360-24P, 20 April 1993 supersede TM5-3895-345-14&p, 30 January 1981 and all changes

HEADQUARTERS, DEPARTMENT OF THE ARMY

25 OCTOBER 1993

WARNING PAGE

FOR INFORMATION ON FIRST AID, REFER TO FM 21-11.

WARNING

BASE PLATE

Base plate is under spring tension. Use care when releasing pressure on plate. Plate may spring up and cause injury to personnel.

WARNING

CLEANING AGENTS

- Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38" C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.
- Carburetor cleaning compound is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin, it can cause serious burns. Always wear protective goggles or lenses, rubber apron, and rubber gloves. If accidentally splashed in eyes or on skin, flush with clean, cool water. Refer to FM 21-11 for first aid information and seek medical attention immediately,

WARNING

COMPRESSED AIR

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

WARNING

EYE PROTECTION

Wear eye protection when performing the following maintenance:

- Cleaning with wire brushes
- Striking metal parts with hammer or chisel
- Using chisel or drill
- Using compressed air

Failure to follow this warning could result in eye injury or loss of vision.

WARNING

FUEL HANDLING

- DO NOT smoke when handling fuel containers or when located within 50 ft (15.3 m) of fueling or fuel storage areas. Failure to follow this warning may cause a fire and explosion, resulting in serious injury or death to personnel.
- DO NOT breathe fuel fumes, They are toxic and can cause serious medical problems. Failure to follow this warning may result in serious injury or death to personnel.
- Give IMMEDIATE medical attention to personnel exposed to hydrocarbon or toxic vapors. Signs of distress are weakness, nausea, coughing or intoxication, nosebleed or cramps, or other unusual symptoms. Qualified personnel able to administer artificial respiration and simple first aid must be present,

WARNING

GENERAL OPERATION

Tamper operator must wear steel-toed shoes. Failure to follow this warning could result in injury.

WARNING

LIVE STEAM

Avoid contact with live steam. Live steam can bum skin, cause blindness, and cause other serious Injuries. Be sure to wear protective apron, gloves, and safety goggles when using live steam.

WARNING

MUFFLER

Before attempting to replace any part of the exhaust system, allow exhaust system to cool. Failure to follow this warning may result in serious bums.

WARNING

NOISE

Always wear ear plugs or other types of hearing protection while engine is running. Failure to use hearing protection will result in hearing loss.

WARNING

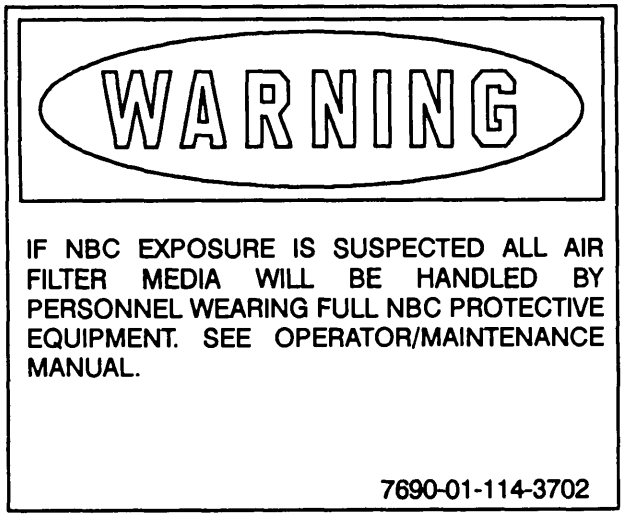
UNAUTHORIZED CLEANING METHODS

Improper cleaning methods and use of unauthorized cleaning liquids or solvents can injure personnel and damage equipment. To prevent this, refer to TM 9-247 for further instructions.

WARNING

NBC EXPOSURE

If NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.



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TECHNICAL MANUAL

TM 5-3895-360-13

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., *25 October 1993*

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MODEL VR11C (NSN 3895-01-151-2749)
MODEL VR11 (NSN 3895-01-013-4328)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve 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, direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

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Approved for public release; distribution is unlimited.

***This manual supersedes TM5-3895-360-1 4, 15 June 1985; also, this manual and TM5-3895-360-24P, 20 April 1993 supersede TM5-3895-345-14&p, 30 January 1981 and all changes**

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LIST OF ILLUSTRATIONS (Con't)

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

a. This manual describes the operation and Unit and Direct Support Maintenance for:

- Tamper, Backfill: Gasoline Engine Driven, Hand-operated, Ram Type, VR11C.
- Tamper, Backfill: Gasoline Engine Driven, Hand-operated, Ram Type, VR11.

b. This manual is divided into chapters and sections. Each chapter covers a major component or operating system. Each section within a chapter covers Operator Maintenance, Unit Maintenance, or Direct Support Maintenance procedures for the tamper.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS.

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

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

For destruction of Army materiel to prevent enemy use, refer to TM 750-244-3.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs).

If your tamper 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 Form 388 *(Product Quality Deficiency Report).* Mail it to us at: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MP Warren, Ml 48397-5000. We will send you a reply.

1-5. SAFETY CARE, AND HANDLING.

a. This paragraph contains safety regulations which must be followed when operating or maintaining the VR11C and VR11 tampers. Personnel who fail to follow these regulations endanger the mission, equipment, and safety of themselves and other personnel.

1-5. SAFETY, CARE, AND HANDLING (Con't).

b. Read and become familiar with all WARNINGS in the Warning Summary at the front of this manual.

c. Throughout this manual, WARNINGs are placed as they pertain to specific operational or maintenance procedures. Read these warnings and follow them exactly.

d. The following are safety regulations which must be followed when operating or maintaining the tampers:

(1) Read through this manual and become familiar with its contents before operating or performing any maintenance on the tamper.

(2) Before performing any maintenance on the tamper, ensure that the engine is shut down and spark plug cable is disconnected,

(3) Never operate the tamper in an explosive atmosphere, near combustible materials, or where ventilation is not sufficient to carry away exhaust fumes.

(4) Ensure that all safety guards are in proper position and secure. Keep hands, feet, and clothing away from moving parts when starting and operating the tamper.

(5) Never leave the tamper running unattended.

(6) Do not operate the tamper on any surface where it can tip or become out of control.

(7) Keep work area free of all bystanders.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-6. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. The VR11C and VR11 tampers are intended for use in construction missions where compacting of confined areas such as footings, abutments, trenches, and concrete slab bases is required. The tampers are designed to compact a variety of soil substances such as clay lumps, silt, loam, and all granular materials.

b. The VR11C is equipped with:

(1) A 4 in. (10 cm) and a 6 in. (15 cm) accessory tamper shoe with 14 in. (36 cm) extensions for use in tamping shallow trenches.

(2) A carrying case for storage of the tamper and accessory tamper shoes.

c. The VR11C and VR11 are equipped with:

(1) An 11 in. (28 cm) general purpose tamper shoe that is used for any type surface large enough to accommodate the tamper shoe dimension.

(2) A throttle control used to manually control engine rpm.

(3) A hand-operated, automatic rewind starter.

(4) A two-cycle engine which consists of a cylinder, piston, rod, crankshaft, and crankcase.

(5) A shorting switch mounted on the fan housing which, when pushed, shorts out the ignition system and stops the engine from running.

NOTE

- **Refer to Figure 1-1, Locating Major Components (VR11C), for location of major components.**
- **Refer to Figure 1-2, Locating Major Components (VR11), for location of major components.**

1-7. LOCATION OF MAJOR COMPONENTS.

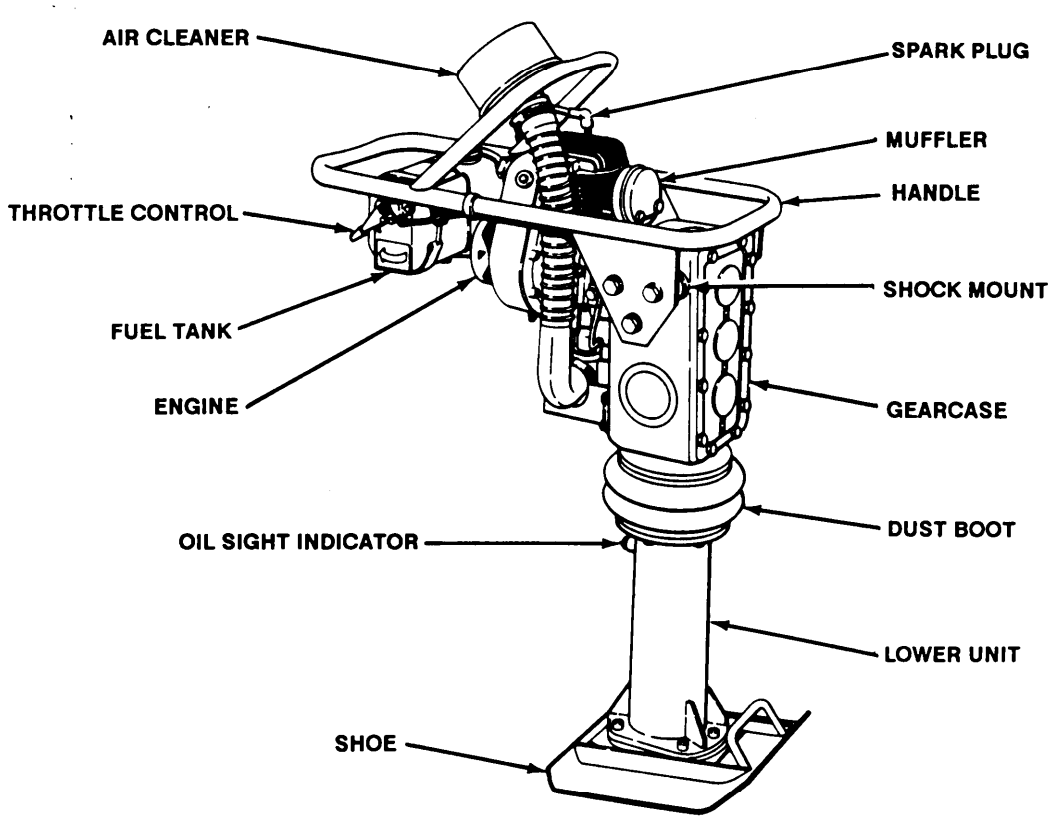

Figure 1-1. Location of Major Components (VR11C).

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1-7. LOCATION OF MAJOR COMPONENTS (Con't).

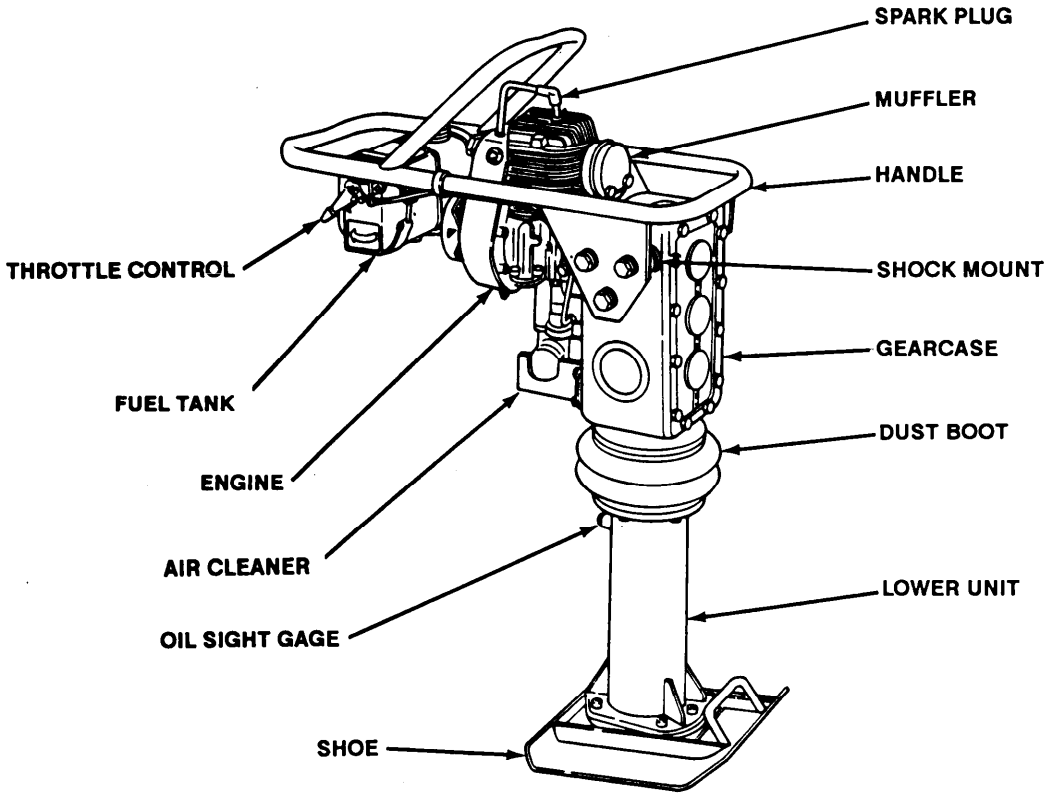

Figure 1-2. Location of Major Components (VR11).

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1-8. EQUIPMENT DATA.

Common Components

Manufacturer	Stone Construction Equipment Inc.
Type	Gasoline Engine Driven, Hand-operated, Ram Type

Capacity:

Fuel Tank	0.62 gl (2.35 l)

Engine:

Manufacturer	Chrysler Marine Corp,
Model	58037
Displacement	5.80 cu in. (95.06 cu cm)
Horsepower	4.0 at 5500 rpm
Type	2-cycle, Air-Cooled, Cross-scavenged

VR11C

Weight and Dlmensions:

Weight	120 lb (54 kg)
Length	26.5 in. (67.3 cm)
width	11 in. (28 cm)
Height	42.5 in. (108 cm)

Capacity:

Lower Unit Oil	7 qt (6.6 l)

Performance:

Impact Force	2200 lb (999 kg)
Compact Frequency	700 Cycles/Minute

Section Ill. TECHNICAL PRINCIPLES OF OPERATION

1-9. GENERAL.

a. The tamper is hand-operated and controlled and can be operated by one operator.

b. The tamper is driven by a 2-cycle, air-cooled,gasoline engine.

c. Compact frequency is 700 cycles per minute at an impact force of 2200 lb (999 kg).

1-10. TAMPER.

A tamping shoe is mounted at the lower end of a cylindrical spring housing. A piston, installed between large opposing springs inside the spring housing, is put into action by a connecting rod and crank assembly through a gear train and centrifugal clutch. The piston alternately loads and unloads the springs resulting in a rapid lifting and dropping action of the tamping shoe. This action compacts the underlying material.

1-11. ENGINE ASSEMBLY

When the engine is started, the crankshaft turns and the piston rises, uncovering the intake ports. This allows a fuel and air mixture to enter the combustion chamber. When the piston approaches Top Dead Center (TDC), the fuel and air mixture is compressed in the combustion chamber. A spark plug then ignites the fuel and air mixture.Theresulting explosion forces the piston down and rotates the crankshaft. As the piston moves down, it uncovers the exhaust ports. This allows the exhaust to escape and the pressure in the combustion chamber to fall.

Afresh supply of fuel and air mixture is compressed In the crankcase by the downstroke of the piston. As the piston nears the bottom of this stroke, it uncovers the intake ports. Thetiel and air mixture rushes into the combustion chamber equalizing the pressure between the crankcase and combustion chamber. The fuel and air mixture flows up and around the baffles, then down and out the exhaust ports. This pushes the burned exhaust gases from the cylinder.

The compression stroke now begins with the intake ports and exhaust ports covered by the rising piston. As pressure increases in the combustion chamber, it decreases in the crankcase allowing a new fuel and air mixture from the carburetor to enter through the reed valve, preparing for the next cylinder charge.

1-12. STARTER.

The starter rope is wound around a pulley. As the rope is pulled, the pulley is turned clockwise, The dog retainer and spring holding the dogs in the cutouts of the pulley hub allow the dogs to move out of the retracted position. The sharp edges of the dogs dig into the side of the starter cup. The flywheel turns, providing the starting force. As the rope is released, the dogs retract, allowing the rope to automatically rewind on the pulley.

1-13. FUEL SYSTEM.

The fuel system is operated by crankcase pressure and vacuum pulses from the engine crankcase. The pulses are transferred to the fuel pump diaphragm causing fuel to be pulled through the inlet flipper of the pump and then through the outlet flipper of the pump.

The carburetor is a demand-type carburetor. No fuel flows to the engine until the engine is cranked or operating. Lower pressure in the throttle bore, or venturi, causes the main metering diaphragm to depress the inlet liner. This allows the inlet needle to unseat and permits fuel to fill the fuel chamber. Fuel flows through the calibrated holes for low speed or the nozzle for high speed, based on engine demand and throttle shutter opening, The fuel pump aids fuel flow by furnishing larger quantities of fuel to the engine than would be possible without a fuel pump. The fuel pump cannot move fuel unless the fuel tank is vented.

Fuel flow through supply openings depends partly on main (high) or idle (low) adjustment needle settings. Fuel flow through discharge ports varies with the position of the throttle shutter. The throttle shutter blocks off or exposes ports to the engine demand and determines the mode of operation. Fuel flow is enhanced by the throttle bore, or venturi, a narrowing in opening that causes air to flow faster and a drop in pressure.

a. **Starting Choke Operation.** During starting choke operation, the choke shutter is closed and the throttle shutter is open. The fuel passes through main, primary idle, and secondary idle fuel discharge ports.

b. **Idle Operation.** During idle operation. the choke shutter is open and the throttle shutter is slightly open. This prevents fuel from passing through the secondary idle discharge port.

c. **Intermediate Operation.** During intermediate operation, the choke shutter is open and the throttle shutter is open approximately halfway. Engine speed and air flow increase as the throttle shutter opens. The amount of fuel delivered increases as the throttle shutter uncovers the secondary discharge port, exposing it to engine suction.

d. **High Speed Operation.** During high speed operation, the choke shutter and the throttle shutter are open. The amount of fuel delivered reaches a maximum when the throttle is fully open. All discharge ports are fully exposed to engine demand and to venturi effect.

1-14. REED VALVE ASSEMBLY

The reed valve is between the carburetor and the crankcase of the engine. It times the injection of the fuel and air mixture from the carburetor into the crankcase. The reed valve opens only when pressure in the crankcase drops to a predetermined point on the compression stroke. The reed valve maintains contact with the reed plate until pressure changes in the crankcase. Reed valve travel away from the plate is limited by the reed stop. When crankcase pressure increases, the built-in spring action of the reed valve returns and holds it against the plate.

1-15. IGNITION SYSTEM.

The ignition system consists of six major components: the flywheel, condenser, coil, breaker points, ignition or shorting switch, and spark plug.

The rotation of magnets along the outer edge of the flywheel creates a rotating magnetic field that cuts through the coil winding, building a very strong magnetic field. As the magnets pass the coil, the magnetic field collapses, sending a high voltage charge to the spark plug.

CHAPTER 2
OPERATING INSTRUCTIONS AND MAINTENANCE

2-1. GENERAL.

a. This chapter contains instructions for safely operating the tamper.

b. Perform PMCS in Table 3-1 before operating the tamper.

2-2. LUBRICATION.

a. Tamper oil level should rechecked before first use of tamper. Thereafter, it should be checked before operation.

b. Use the following instructions to check tamper oil level.

(1) Stand tamper upright so that oil drains freely into spring housing. Oil should be present halfway up oil sight indicator.

(2) If oil level is low, remove oil sight indicator and add oil as necessary.

2-3. FUEL MIXTURE.

a. Recommended fuel mixture is 24 parts gasoline (Item 9,Appendix E) to lpart lubricating oil (Item 11 or Item 13, Appendix E).

Table 2-1. Fuel Mixture.

Gasoline	Lubricating Oil
5 gl (18.9 l)	1 2/3 pt (0.79 l)
1 gl (3.79 l)	1/3 pt (157 ml)
2 qt (1 .89 l)	2 2/3 oz(78 ml)

WARNING

DO NOTsmoke when handllng fuel containers or when located within 50 ft (15.3 m) of fuellng or fuel storage areas. Failure to follow this warning may cause a fire and explosion, resulting in serious injury or death to personnel.

2-3. FUEL MIXTURE (Con't).

WARNING

- **DO NOT breathe fuel fumes. They are toxic and can cause serious medical problems. Failure to follow this warning may result In serious Injury or death to personnel.**
- **Give IMMEDIATE medical attention to personnel exposed to hydrocarbon or toxic vapors. Signs of distress are weakness, nausea, coughing or Intoxication, nosebleed or cramps, or other unusual symptoms. Qualified personnel able to administer artificial respiration and simple first aid must be present.**

b. To obtain the proper fuel mixture, thoroughly mix the following quantities of gasoline (Item 9, Appendix E) and lubricating oil (Item 11 or Item 13, Appendix E) in a suitable container.

2-4. STARTING TAMPER.

NOTE

- **Refer to Figure 2-1, *Starting Tamper,* for steps a through h.**
- **The VR11C and VR11 tampers are started the same way. The VR11C is illustrated.**

a. Open fuel valve (4).

b. Open fuel tank cap vent (5).

c. Raise throttle lever (3) approximately halfway.

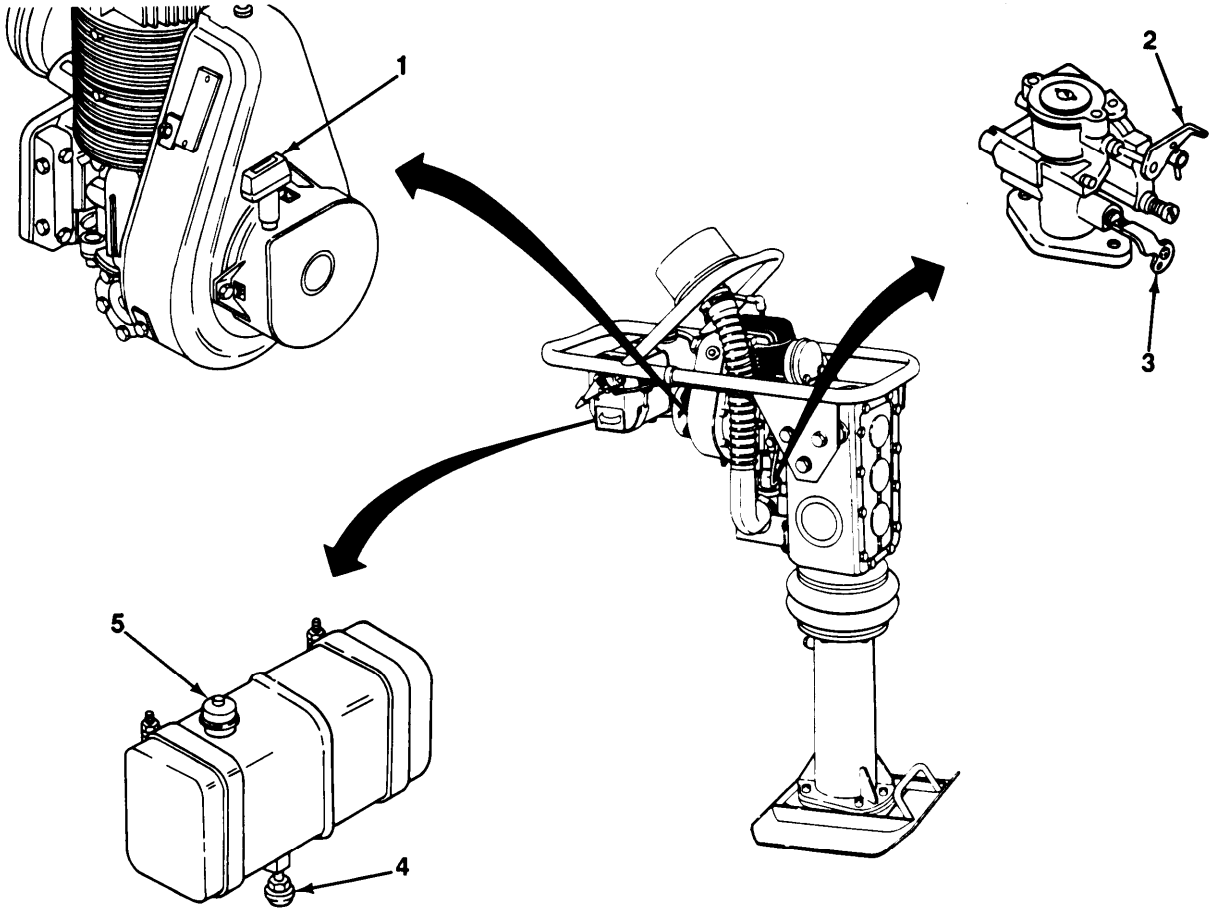

Figure 2-1. Starting Tamper.

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2-4. STARTING TAMPER (Con't).

NOTE

Perform step d only If engine Is cold.

d. Raise choke lever (2).

e. Pull starter cable (1) briskly one or twice to prime engine.

f. Position choke lever (2) approximately halfway and pull starter cable (1) until engine starts.

g. Lower choke lever (2). Allow engine to warm at idle speed.

h. Raise throttle lever *(3)* to full throttle position.

2-5. OPERATING TAMPER.

a. **General.** Become familiar with the normal operation of the tamper. Damage to equipment, extensive repairs, and downtime can be avoided by an alert operator who can detect problems in early stages and help Unit Maintenance correct them before they become serious.

b. **Operation.**

CAUTION

DO NOT operate tamper on hard, unyielding surfaces. Failure to follow this caution may result in damage to tamper.

(1) During operation, guide the tamper, *but* allow the tamper to do the work. Bearing down on the handle is not necessary and limits the shoe jump.

(2) The tamper moves forward in rapid jumps on level surfaces. On uneven surfaces or inclines it may be necessary to rock the handle slightly to assist the tamper to move forward.

(3) Always guide the tamper so that the whole shoe, not just the front or back edges, does the impacting.

2-6. STOPPING TAMPER.

NOTE

- **Refer to Figure 2-2, *Stopping Tamper,* for steps a through d.**
- **The VR11C and VR11 tampers are stopped the same way. The VR11C is illustrated.**

a. Lower throttle control lever (2).

b. Push shorting switch (3).

NOTE

Perform steps c and d only if tamper will remain out of service due to job completion and/or storage.

c. Close fuel tank cap vent (1).

d. Close fuel valve (4).

2-6. STOPPING TAMPER (Con't).

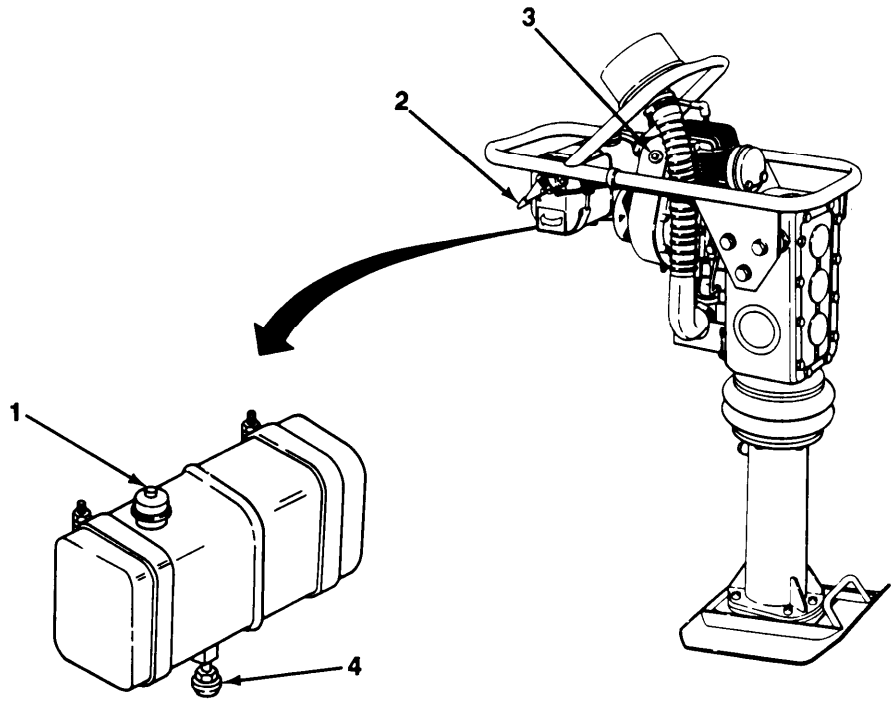

Figure 2-2. Stopping Tamper.

2-7. CLEANING AIR CLEANER FILTER (VR11C).

WARNING

If NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

NOTE

Refer to Figure 2-3, Cleaning *Air Cleaner Filter (VR11C),* for steps a through d.

a. Remove wing nut (l), access cover (2), and filter (3) from handle (4).

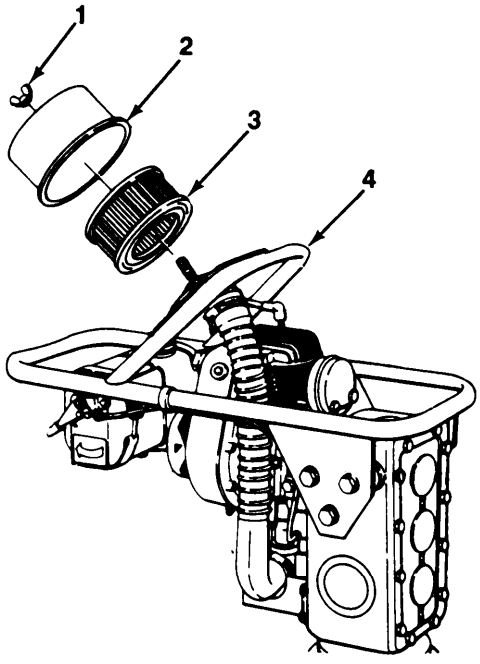

Figure 2-3. Cleaning Air Cleaner Filter (VR11 C).
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2-7. CLEANING AIR CLEANER FILTER (VR11C) (Con't).

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

b. Direct compressed air up and down pleats of filter (3) from inside to outside to remove dirt.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38 °C-59°C). if you become dizzy while using cleaning solvent, immediately get fresh air and medical help. if solvent contacts eyes, immediately wash your eyes and get medical aid.

c. Clean access cover (2) with dry cleaning solvent (item 16, Appendix E) and allow to dry.

d. Install filter (3) and access cover (2) on handle (4) with wingnut (1).

2-8. CLEANING AIR CLEANER FILTER (VR11).

WARNING

if NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

NOTE

Refer to Figure 2-4, *Cleaning Air Cleaner Filter (VR11),* for steps a through d.

a. Remove retainer (2), filter pin (1), and filter (3) from filter housing (4).

b. Clean filter (3) with clean water and allow to dry.

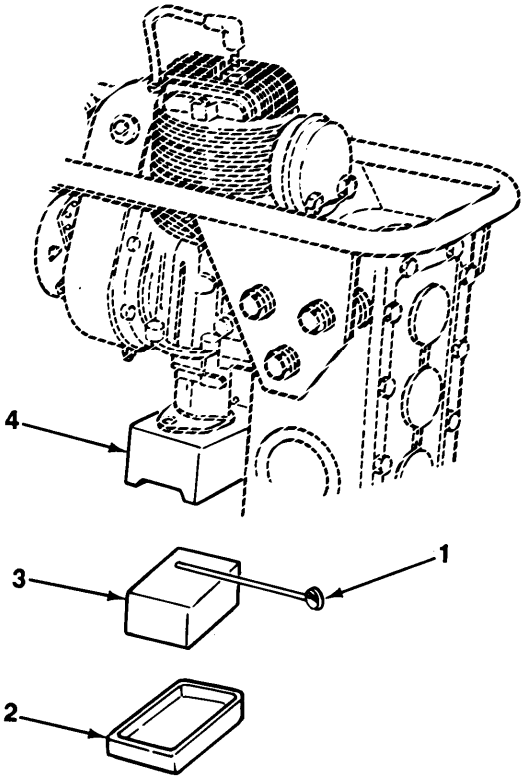

Figure 2-4. Cleaning Air Cleaner Filter (VR11).

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors: DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). if you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

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2-8. CLEANING AIR CLEANER FILTER (VR11) (Con't).

c. Clean filter pin (l), retainer (2), and filter housing (4) with dry cleaning solvent (Item 16, Appendix E) and allow to dry

d. Install filter pin (1) and filter (3) in filter housing (4) with retainer (2).

2-9. DISCONNECTING AND CONNECTing SPARK PLUG.

NOTE

- **Refer to Figure 2-5, DIsconnecting and Con*necting Spark Plug.***
- **Spark plug must be disconnected while performing any maintenance procedures.**

DISCONNECTING SPARK PLUG

Remove terminal (1) from spark plug (2).

CONNECTING SPARK PLUG

Install terminal (1) on spark plug (2).

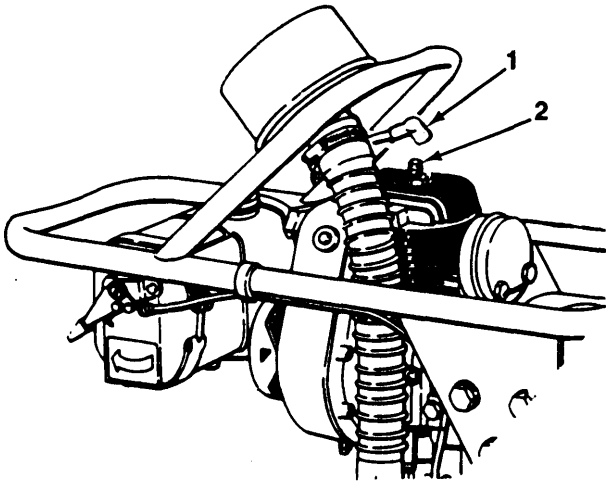

Figure 2-5. Disconnecting and Connecting Spark Plug.

2-10. DRAINING AND FILLING FUEL SYSTEM.

WARNING

- **DO NOT smoke when handling fuel containers or when located within 50 ft (15.3 m) of fueling or fuel storage areas. Failure to follow this warning may cause a fire and explosion, resulting In serious Injury or death to personnel.**
- **DO NOT breathe fuel fumes. They are toxic and can cause serious medical problems. Failure to follow this warning may result in serious Injury or death to personnel.**
- **Give IMMEDIATE medical attention to personnel exposed to hydrocarbon or toxic vapors. Signs of distress are weakness, nausea, coughing or intoxication, nosebleed or cramps, or other unusual symptoms. Qualified personnel able to administer artificial respiration and simple first aid must be present.**

NOTE

- **Refer to Figure 2-6, Draining and Filling Fuel *System.***
- **A suitable container should be used to catch any draining fuel. Ensure that all spills are properly cleaned.**

DRAINING FUEL SYSTEM

a. Close fuel valve (3).

b. Remove fuel tank cap (1) from fuel tank (2).

c. Slide clamp (4) back on fuel line (5) and remove fuel line from fuel valve (3).

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2-10. DRAINING AND FILLING FUEL SYSTEM (Con't).

d. Remove fuel valve (3) from fuel tank (2) and allow all fuel to drain.

e. Install fuel valve (3) on fuel tank (2).

f. Install fuel line (5) on fuel valve (3) with clamp (4),

FILLING FUEL SYSTEM

a. Mix fuel (see paragraph 2-3).

b. Remove fuel tank cap (1) from fuel tank (2).

c. Use a funnel with removable strainer to transfer fuel into fuel tank.

d. Install fuel tank cap (1) on fuel tank (2).

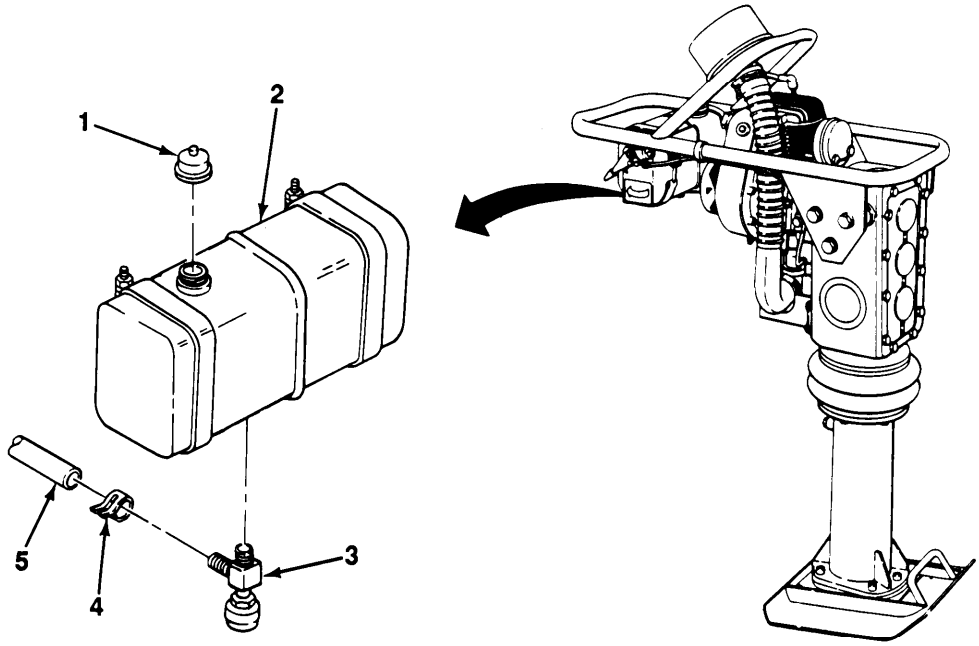

Figure 2-6. Draining and Filling Fuel System.

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CHAPTER 3
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Section I. OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

3-1. GENERAL.

a. To ensure that the tamper is ready for operation a tall times, it must be inspected on a regular basis so that defects maybe found before they result in serious damage, equipment failure, or injury to personnel. This section contains systematic instructions on inspections, adjustments, and corrections to be performed by the operator/crew.

b. When performing PMCS, read and follow all safety instructions found in the Warning Summary at the front of this manual. Keep in mind all WARNINGS and CAUTIONS.

3-2. SERVICE INTERVALS.

Perform PMCS, found in Table 3-1, at the following intervals:

(1) Perform *Before (B)* PMCS just before operating the tamper.

(2) Perform *During (D)* PMCS while operating the tamper.

(3) Perform *After (A)* PMCS right after operating the tamper.

3-3. REPORTING REPAIRS.

All defects which the operator cannot fix must be reported on a DA Form 2404, *Equipment Inspection and Maintenance Worksheet,* immediately after completing PMCS. If a serious problem is found, IMMEDIATELY report it to your supervisor.

3-4. GENERAL PMCS PROCEDURES.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point iS 100°F-138°F (38 °C-59°C). if you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. if solvent contacts eyes, immediately wash your eyes and get medical aid.

a. Keep equipment clean. Dirt, oil, and debris may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (Item 16, Appendix E) on ail metal surfaces. Use dishwashing compound (Item 7, Appendix E) and water on rubber, plastic, and painted surfaces.

b. While performing specific PMCS procedures, inspect the following components:

(1) **Bolts, Nuts, and Screws.** Ensure that they are not loose, missing, bent, or broken. Report loose or missing bolts, nuts, and screws to Unit Maintenance.

(2) **Welds.** Inspect for gaps where parts are welded together. Check for loose or chipped paint, rust, and cracks. Report bad welds to Unit Maintenance.

(3) **Electrical Conduit, Wires, and Connectors.** Inspect for cracked or broken conduit insulation, bare wires, and loose or broken connectors. Report loose connections and faulty wiring to Unit Maintenance.

(4) **Hoses, Lines, and Fittings.** inspect for wear, damage, and leaks. Ensure that clamps and fittings are tight. Report any damage, leaks, or loose fittings and clamps to Unit Maintenance.

3-5. SPECIFIC PMCS PROCEDURES.

a. Operator/Crew PMCS are provided in Table 3-1. Always perform PMCS in the order listed. Once it becomes a habit, anything that is not right can be spotted in a minute.

b. Before performing PMCS, read all the checks required for the applicable interval and prepare all the tools needed. Have several clean rags (Item 15, Appendix E) handy. Perform ALL inspections at the applicable interval.

c. If anything wrong is discovered through PMCS, perform the appropriate troubleshooting tasks in Chapter 4, Section I. if any component or system is not serviceable, or if a given service does not correct the problem, notify your supervisor.

d. The columns in Table 3-1 are defined as follows:

(1) **Item No.** Provides a iogical sequence for PMCS to be performed and is used as a source of item numbers for the "TM ITEM NO. " column when recording PMCS results on DA Form 2404,

(2) **Interval.** Specifies the intetval at which PMCS is to be performed.

(3) **Item To Be inspected.** Lists the system and common name of items that are to be inspected. Included in this column are specific servicing, inspection, replacement, or adjustment procedures to be followed.

NOTE

The terms "ready/available" and "mission-capable" refer to the same status: Equipment is on hand and is able to perform its combat mission (see AR 700-138).

(4) **Equipment is Not Ready/Avallabie if.** Explains when and why the tamper cannot be used.

3-6. LEAKAGE DEFINITIONS.

a. It is important to know how fluid leakage affects the status of the tamper. Following are types/classes of leakages an operator must know to determine whether the tamper is mission-capable. Learn these leakage definitions. When in doubt, notify your supervisor.

Leakage Definitions for Operator/Crew PMCS:

Class 1 Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

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

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

CAUTION

When operating with Class I or II leaks, continue to check fluid levels in addition to that required in PMCS. Parts without fluid will stop working or maybe damaged.

b. Equipment operation is allowed with minor (Class I or II) leakage. Fluid levels in an item/system affected with such leakage must be checked more frequently than required in PMCS. When in doubt, notify ycur supervisor.

c. Report Class Ill leaks IMMEDIATELY to your supervi-ser.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services (PMCS).

B-BEFORE **D-DURING** **A-AFTER**

ITEM NO.	INTERVAL B	INTERVAL D	INTERVAL A	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed.	EQUIPMENT iS NOT READY/AVAILABLE iF:
				NOTE **Perform Weekly (W) as well as Before (B) PMCS it** **a. You are the assigned operator but have not operated the tamper unit since the last Weekly.** **b. You are operating the tamper for the first time.**	
1				**TAMPER EXTERIOR**	
	•			a. Check for fluid leakage or appearance of fluid leakage.	Any Class Ill leaks are found.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services (PMCS) (Con't).

B-BEFORE **D-DURING** **A-AFTER**

ITEM NO.	INTERVAL B	INTERVAL D	INTERVAL A	ITEM TO BE INSPECTED PROCEDURE Check for and have rapaired, filled, or adjusted as needed.	EQUIPMENT IS NOT READY/AVAILABLE IF:
1				**TAMPER EXTERIOR (Con't)**	
	●			b. Visually check for damaged hoses and loose, missing, or damaged parts.	Hoses are leaking or broken. Parts are missing or damaged.
2				**AIR CLEANER** **WARNING** **If NBC exposure Is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.**	
	●			Remove and check air cleaner element. Clean air cleaner element as necessary (see paragraph 2-7 or 2-8).	
3				**TAMPER OIL LEVEL**	
	●			Check tamper oil level in oil sight plug. Oil must be present in oil sight indicator.	No oil is present in oil sight indicater.
4				**LOWER UNIT BELLOWS**	
	●			Inspect lower unit bellows for cracks and damage.	Lower unit bellows cracked or tom.
5				**FUEL SYSTEM** **WARNING** ● DO NOT smoke when handling fuel containers or when located within 50 ft (15.3 m) of fueling or fuel storage areas. Failure to follow this warning may cause a fire and explosion, resulting In serious injury or death to personnel. ● DO NOT breathe fuel fumes. They are toxic and can cause serious medical problems. Failure to follow this warning may result In serious lnjury or death to personnel.	

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services (PMCS) (Con't).

B-BEFORE **D–DURING** **A-AFTER**

ITEM NO.	INTERVAL B	INTERVAL D	INTERVAL A	ITEM TO BE INSPECTED PROCEDURE Check for and have ropaired, filled, or adjusted as needed.	EQUIPMENT IS NOT READY/AVAILABLE IF:
5				**FUEL SYSTEM (Con't)**	
				WARNING	
				• **Give IMMEDIATE medical attention to personnel exposed to hydrocarbon or toxic vapors. Signs of distress are weakness, nausea, coughing or intoxication, nosebleed or cramps, or other unusual symptoms. Qualified personnel able to administer artificial respiration and simple first aid must be present.**	
	•			a. Visually inspect fuel system for signs of leakage.	Any fuel leakage is present.
	•			b. Visually inspect fuel tank for damage.	Fuel tank damage which could result in fuel leakage.
	•			c. Check fuel level in fuel tank.	Fuel tank is empty.
			•	d. Drain fuel tank and close fuel tank cap vent before putting tamper into carrying case.	
6				**THROTTLE**	
	•			a. Check throttle control for freedom of movement and proper operation.	Throttle binds or does not operate properly.
	•			b. Check throttle cable for breaks, kinks, and wear.	Throttle cable is damaged.
7				**STARTER RECOIL**	
	•			a. Check cord for fraying and breaks.	Cord is frayed or broken.
	•			b. Check rewind spring for proper recoil action.	Cord does not recoil.

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

3-7. GENERAL.

To ensure that the tamper is ready for operation at all times, it must be inspected on a regular basis so that defects may be found before they result in serious damage, equipment failure, or injury to personnel. This section contains systematic instructions on inspections, adjustmerits, and corrections to be performed by Unit Maintenance.

3-8. SERVICE INTERVALS.

Perform PMCS, found in Table 3-2, at the following intervals:

(1) Perforrn *Quarterly(Q)* PMCS once every three months.

(2) Perform *Semiannual (S)* PMCS once every six months.

(3) Perform *Annual (A)* PMCS once each year.

(4) Perform *Hourly (H)* PMCS based upon number of operating hours listed in column.

3-9. REPORTING REPAIRS.

Report all defects and corrective action on DA Form 2404. if a serious problem is found, IMMEDIATELY report it to your supervisor.

3-10. GENERAL PMCS PROCEDURES.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

3-10. GENERAL PMCS PROCEDURES (Con't).

a. Keep equipment clean. Dirt, oil, and debris may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (Item 16, Appendix E) on all metal surfaces. Use dishwashing compound (Item 7, Appendix E) and water on rubber, plastic, and painted surfaces.

b. While performing specific PMCS procedures, inspect the following components:

(1) **Bolts, Nuts, and Screws.** Ensure that they are not loose, missing, bent, or broken. Tighten any that are loose.

(2) **Welds.** Inspect for gaps where parts are welded together, Report bad welds to your supervisor.

(3) **Electrical Wires or Connectors.** Inspect for corroded, cracked, or broken conduit insulation, bare wires, and loose, broken, or cracked connectors. Tighten loose connectors and make repairs or replace items as required.

(4) **Hoses, Lines, and Fittings.** Inspect for wear, damage, and leaks. Ensure that clamps and fittings are tight. If a leak is caused by a loose fitting or connector, tighten it. If a component is broken or worn, correct problem if authorized by the Maintenance Allocation Chart (MAC) (see Appendix B). If not authorized, report it to your supervisor.

3-11. SPECIFIC PMCS PROCEDURES.

a. Unit PMCS is provided in Table 3-2. Always perform PMCS in the order listed, Once it becomes a habit, any deficiency can be spotted in a minute. If anything wrong is discovered through PMCS, perform the appropriate troubleshooting task in Chapter 4, Section II. If any component or system is not serviceable, or if a given service does not correct the deficiency, notify your supervisor.

b, Before performing preventive maintenance, read all the checks required for the applicable interval and prepare all the tools needed to make all checks, Have several clean rags (Item 15, Appendix E) handy. Perform ALL inspections at the applicable interval.

c. The columns in Table 3-2 are defined as follows:

(1) **Item No.** Provides a logical sequence for PMCS to be performed and is used as a source of item numbers for the "TM ITEM NO." column when recording PMCS results on DA Form 2404.

(2) **Interval.** Specifies the interval at which PMCS is to be performed.

(3) **Item To Be Inspected.** Lists the system and common name of items that are to be inspected.

(4) **Procedures.** Tells you how to perform required check or service.

Table 3-2. Unit Preventive Maintenance Checks and Services (PMCS).

Q-QUARTERLY **S-SEMIANNUAL** **A-ANNUAL** **H-HOURLY**

ITEM NO.	INTERVAL				ITEM TO BE INSPECTED	PROCEDURES
	Q	S	A	H		
1				200	TAMPER OIL	Change oil and inspect tamper for oil leaks (see paragraph 13-2). **WARNING** **If NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.**
2				100	AIR CLEANER	Replace air cleaner element (see paragraph 7-3 or 7-4).
3	•				SPARK PLUG	a. Check spark plug for gap of 0.040 in. (1.016 mm).
			•			b. Replace spark plug (see paragraph 9-3).
4	•				CARBURETOR	Adjust carburetor (see paragraph 7-2).
5		•			STARTER SCREEN	Inspect screen for dirt and debris.
6			•		MAGNETO	Check and adjust breaker point gap to 0.020 in. (0.508 mm).

CHAPTER 4
TROUBLESHOOTING PROCEDURES

Section 1. OPERATOR/CREW TROUBLESHOOTING

4-1. GENERAL.

a. This section provides information for identifying and correcting malfunctions which may develop while operating the tamper.

b. The Troubleshooting Symptom Index in paragraph 4-3 lists the common malfunctions which may occur and refers you to the proper page in Table 4-1 for a troubleshooting procedure.

c. If you are unsure of the location of an item mentioned in the troubleshooting procedure, refer to paragraph 1-7 or to the maintenance task where the item is replaced.

d. Before performing a troubleshooting procedure, read and follow all safety instructions found in the Warning Summary at the front of this manual.

e. This section cannot list all malfunctions that may occur, nor ail probable causes and test procedures/ remedies. If a malfunction is not listed or is not corrected by listed test procedures/remedies, notify your supervisor.

f. When troubleshooting a malfunction:

(1) Locate the symptom or symptoms in paragraph 4-3 that best describes the malfunction.

(2) Turn to the page in Table 4-1 where the troubleshooting procedures for the malfunction in question are described. Headings at the top of each page show how each troubleshooting procedure is organized: *Problem, Probable Cause,* and *Test Procedure/Remedy.*

(3) Perform each step in the order listed until the malfunction is corrected. Do not perform any maintenance task unless the troubleshooting procedure tells you to do so.

4-2. EXPLANATION OF COLUMNS.

The columns in Table 4-1 are defined as follows:

(1) **Problem.** A visual or operational indication that something is wrong with the tamper.

(2) **Probable Cause.** A list of the system or component likely to be causing the problem.

(3) **Test Procedure/Remedy.** A procedure to isolate and correct the problem.

4-3. TROUBLESHOOTING SYMPTOM INDEX.

Table 4-1. Operator/Crew Troubleshootlng.

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
ENGINE		
1. Engine will not start.	a. Fuel is not present in fueltank.	a. Fill fuel tank (see paragraph 2-10).
	b. Fuel tank cap vent is closed.	b. Open fuel tank cap vent.
	c. Fuel valve is closed.	c. Open fuel valve.
	d. Engine is flooded.	d. Close carburetor main adjustment needle and crank until engine starts. Turn carburetor main adjustment needleonetum counterclockwise.
	e. Engine is overloaded.	e. Allow engine to cool.
	f. Fuel mixture is incorrect.	f. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).
2. Engine is hard to start.	a. Engine is overcooked.	a. Close carburetor main adjustment needle and crank until engine starts. Turn carburetor mainadjustment needleonetum counterclockwise.

Table 4-1. Operator/Crew Troubleshooting (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
Engine is hard to start (Con't).	b. Engine is under choked.	b. Move choke lever to closed position and crank two to three times.
	c. Water is present in fuel system or fuel mixture is stale.	c. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).
	d. Too much oil is present in fuel mixture.	d. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).
3. Engine starts but will not continue to run.	s. Fuel tank cap vent is closed.	a. Open fuel tank cap vent.
	b. Fuel system leaks.	b. inspect fuel system for leaks. Notify Unit Maintenance if leaks are present.
	c. Fuel mixture is incorrect.	c. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).
4. Engine lacks power.	a. Fuel tank cap vent is closed.	a. Open fuel tank cap vent.
	b. Fuel system leaks.	b. Inspect fuel system for leaks. Notify Unit Maintenance if leaks are present.
	c. Air cleaner filter is dirty or clogged.	c. Clean air cleaner filter (see paragraph 2-7 or 2-8).
	d. Fuel mixture is incorrect.	d. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).
5. Engine stalls under load.	a. Fuel tank cap vent is closed.	a. Open fuel tank cap vent.
	b. Engine is overloaded.	b. Allow engine to cool.
	c. Airflow is obstructed.	c. Clean cylinder toolings.
6. Engine misses.	a. Spark plug is fouled.	a. Notify Unit Maintenance.
	b. Fuel mixture is incorrect.	b. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).

Table 4-1. Operator/Crew Troubleshooting (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
7. Engine overheats.	a. Engine is overloaded.	a. Allow engine to cool.
	b. Insufficient oil is present in fuel mixture.	b. Drain fuel system and fill fuel tank with fresh fuel and oil mixture (see paragraph 2-10).
	c. Air flow is obstructed.	c. Clean cylinder cooling fins.
8. Engine has poor acceleration.	a. Spark plug is fouled.	a. Notify Unit Maintenance.
	b. Air cleaner filter is dirty or clogged.	b. Clean air cleaner filter (see paragraph 2-7 or 2-8).

Section II. UNIT TROUBLESHOOTING

4-4. GENERAL.

a. This section provides inforrnation for identifying and correcting malfunctions which may develop while operating or maintaining the tamper.

b. The Troubleshooting Symptom Index in paragraph 4-6 lists the common malfunctions which may occur and refers you to the proper page in Table 4-2 for a troubleshooting procedure.

c. This section cannot list all malfunctions that may occur, nor all probable causes and test procedures/ remedies. If a malfunction is not listed or is not corrected by listed test procedures/remedies, notify your supervisor.

d. When troubleshooting a malfunction:

(1) Question the operator to obtain any information that might help determine the cause of the problem. Before continuing, ensure that all applicable operator/crew troubleshooting was performed.

(2) Locate the symptom or symptoms in paragraph 4-6 that best describes the malfunction. If appropriate symptom is not listed, notify your supervisor.

(3) Turn to the page in Table 4-2 where troubleshooting procedure for the malfunction in question is described. Headings at the top of each page show how each troubleshooting procedure is organized: *Problem, Probable Cause,* and *Test Procedure/Remedy.*

(4) Perform each step in order listed until the malfunction is corrected. Do not perform any maintenance task unless the troubleshooting procedure tells you to do so.

4-5. EXPLANATION OF COLUMNS.

The columns in Table 4-2 are defined as follows:

(1) Problem. A visual or operational indication that something is wrong with the tamper,

(2) Probable Cause. A list of the system or component likely to be causing the problem.

(3) Test Procedure/Remedy. A procedure to isolate and correct the problem.

4-6. TROUBLESHOOTING SYMPTOM INDEX.

Table 4-2. Unit Troubleshooting.

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
ENGINE		
1. Engine will not start.	a. Spark plug is not firing.	a. Check for incorrect, defective, or fouled spark plug. Clean and adjust spark plug gap as necessary. Check for spark by performing the following. Remove spark plug (see paragraph 9-3) and attach lead wire and ground plug against cylinder. Crank engine to determine if spark will jump gap on plug. If no spark or weak spark, remove flywheel (see paragraph 9-2) and check wiring, connections, hi-tension lead wire, lead wire spark plug connector, coil, condenser, and points.
	b. Carburetor is out of adjustment.	b. Adjust carburetor (see paragraph 7-2).
	c. Fuel line is pinched.	c. Replace fuel line (see paragraph 7-6).

Table 4-2. Unit Troubleshootlng (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
Engine will not start (Con't).	d. Fuel filter is dirty or clogged.	d. Remove fuel filter (see paragraph 7-6) and clean or replace as necessary.
	e. Breaker points are out of adjustment.	e. Adjust breaker points (see paragraph 9-2).
2. Engine is hard to start.	a. Spark plug is defective or fouled.	a. Replace spark plug (see paragraph 9-3).
	b. Spark plug is not firing.	b. Check for incorrect, defective, or fouled spark plug. Clean and adjust spark plug gap as necessary. Check for spark by performing the following. Remove spark plug (see paragraph 9-3) and attach lead wire and ground plug against cylinder. Crank engine to determine if spark will jump gap on plug. If no spark or weak spark, remove flywheel (see paragraph 9-2) and check wiring, connections, hi-tension lead wire, lead wire spark plug connector, coil, condenser, and points.
	c. Carburetor gasket is leaking.	c. Replace carburetor gasket (see paragraph 7-1).
	d. Carburetor is out of adjustment.	d. Adjust carburetor (see paragraph 7-2).
	e. Breaker points are out of adjustment.	e. Adjust breaker points (see paragraph 9-2).
	f. Reed valve is open or broken.	f. Remove reed valve and inspect (see paragraph 6-4) and adjust or replace as necessary.
3. Engine starts but will not continue to run.	s. Spark plug is defective or fouled.	a. Replace spark plug (see paragraph 9-3).
	b. Carburetor is out of adjustment.	b. Adjust carburetor (see paragraph 7-2).
	c. Fuel line is restricted.	c. Remove fuel line from carburetor (see paragraph 7-6) and see if fuel flows freely. Clear restriction or replace fuel line as necessary (see paragraph 7-6).

Table 4-2. Unit Troubleshooting (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
Engine starts but will not continue to run (Con't).	d. Fuel filter is dirty or clogged.	d. Remove fuel filter (see paragraph 7-6) and clean or replace as necessary.
	e. Ignition is faulty.	e. Check ignition wiring and coil and replace as necessary (see paragraph 9-2).
4. Engine lacks power.	a. Sparkplug is defective or fouled.	a. Replace spark plug (see paragraph 9-3).
	b. Breaker points are out of adjustment.	b. Adjust breaker points (see paragraph 9-2).
	c. Carburetor is out of adjustment.	c. Adjust carburetor (see paragraph 7-2).
	d. Fuel line is restricted.	d. Remove fuel line (see paragraph 7-6) and clear restriction. Replace fuel line as necessary (see paragraph 7-6).
	e. Fuel filter is dirty or clogged.	e. Remove fuel filter (see paragraph 7-6) and clean or replace as necessary. **WARNING** **Carburetor cleaning compound is a corrosive liquid. If splashed In eyes, It can cause blindness. If splashed on skin, It can cause serious burns. Always wear protective goggles or lenses, rubber apron, and rubber gloves. If accidentally splashed in eyes or on skin, flush with clean, cool water. Refer to FM 21-11 for first old information and seek medical attention Immediately.**
	f. Muffler is clogged.	f. Clean carbon from muffler using carburetor cleaning compound (Item 6, Appendix E).

Table 4-2. Unit Troubleshooting (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
Engine lacks power (Con't).		**WARNING** **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid lnjury to personnel.** **CAUTION** **Use care not to scratch or damage piston or cylinder walls when removing carbon.**
	g. Exhaust ports are clogged.	g. Remove muffler (see paragraph 8-2) and rotate engine until piston is at bottom of cylinder. Using scraper, remove carbon from exhaust ports and clear with compressed air. Start engine (see paragraph 2-4) and run briefly to remove all carbon. Install muffler (see paragraph 8-2).
	h. Ignition is faulty.	h. Check ignition wiring and coil and replace as necessary (see paragraph 9-2).
5. Engine stalls under load.	a. Carburetor main adjustment is too lean.	a. Adjust carburetor (see paragraph 7-2).
	b. Fuel line is restricted.	b. Remove fuel line (see paragraph 7-6) and clear restriction, Replace fuel line as necessary (see paragraph 7-6).
6. Engine misses.	a. Sparkplug is defective or fouled.	a. Replace spark plug (see paragraph 9-3).
	b. Spark plug gap is out of adjustment.	b. Clean spark plug points and set gap at 0.040 in. (1.02 mm)

Table 4-2. Unit Troubleshooting (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
Engine misses (Con't).	c. Carburetor is out of adjustment.	c. Adjust carburetor (see paragraph 7-2).
	d. Fuel filter is dirty or clogged.	d. Remove fuel filter (see paragraph 7-6) and clean or replace as necessary.
	e. Ignition is faulty.	e. Check ignition wiring and coil and replace as necessary (see paragraph 9-2).
7. Engine overheats.	a. Spark plug used is incorrect.	a. Replace spark plugs (see paragraph 9-3).
	b. Carburetor adjustment is too lean.	b. Adjust carburetor (see paragraph 7-2).
8. Engine Is noisy or knocking.	a. Spark plug used has incorrect heat range.	a. Replace spark plug (see paragraph 9-3).
	b. Fan housing is bent.	b. Replace fan housing (see paragraph 9-2).
	c. Flywheel is loose.	c. Tighten flywheel nut (see paragraph 9-2).
9. Engine continues to run after shorting switch is pushed.	a. Spark plug is dirty or spark plug used is incorrect.	a. Replace spark plug (see paragraph 9-3).
	b. Carburetor adjustment is too lean.	b. Adjust carburetor (see paragraph 7-2).
10. Engine has poor high speed performance.	Carburetor is out of adjustment.	Adjust carburetor (see paragraph 7-2).
11. Engine has poor acceleration.	a. Carburetor is out of adjustment.	a. Adjust carburetor (see paragraph 7-2).
	b. Exhaust is restricted.	b. Replace muffler (see paragraph 8-2) .
	c. Breaker points are out of adjustment.	c. Adjust breaker points (see paragraph 9-2).
	d. Reed valve is chipped or broken.	d. Replace reed valve (see paragraph 6-4).

Section III. DIRECT SUPPORT TROUBLESHOOTING

4-7. GENERAL.

a. This section provides information for identifying and correcting malfunctions which may develop while operating or maintaining the tamper.

b. The Troubleshooting Symptom Index in paragraph 4-9 lists common malfunction swhich may occur and refers you to the proper page in Table 4-3 for a trouble shooting procedure.

c. This section cannot list all malfunctions that may occur, nor all probable causes and test procedures/ remedies. If a malfunction is not listed or is not corrected by listed test procedures/remedies, notify your supervisor.

d. When troubleshooting a malfunction:

(1) Question Unit Maintenance to obtain any information that might help determine the cause of the problem. Before continuing, ensure that all applicable Unit Maintenance troubleshooting was performed.

(2) Locate the symptom or symptoms in paragraph 4-9 that best describes the malfunction. If appropriate symptom is not listed, notify your supervisor.

(3) Turn to the page in Table 4-3 where troubleshooting procedure for the malfunction in question is described. Headings at the top of each page show how each troubleshooting procedure is organized: *Problem, Probable Cause,* and Test *Procedure/Remedy.*

(4) Perform each step in order listed until the malfunction is corrected. Do not perform any maintenance task unless the troubleshooting procedure tells you to do so.

4-8. EXPLANATION OF COLUMNS.

The columns in Table 4-3 are defined as follows:

(1) **Problem.** A visual or operational indication that something is wrong with the tamper.

(2) **Probable Cause.** A list of the system or component likely to be causing the problem.

(3) **Test Procedure/Remedy.** A procedure to isolated and correct the problem.

4-9. TROUBLESHOOTING SYMPTOM INDEX.

Table 4-3. Direct Support Troubleshooting.

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
ENGINE		
1. Engine will not start.	a. Engine compression is low.	a. Check engine compression (see paragraph 6-5). Replace piston rings if compression is low (see paragraph 6-3).
	b. Dirt present in carburetor.	b. Disassemble and clean carburetor (see paragraph 7-8).
2. Engine starts but will not continue to run.	Fuel pump is faulty or carburetor is dirty.	Remove and disassemble carburetor and inspect (see paragraph 7-8). Replace fuel pump as necessary (see paragraph 7-8).
3. Engine lacks power.	a. Engine compression is low.	a. Check engine compression (see paragraph 6-5). Replace piston rings if compression is low (see paragraph 6-3).
	b. Piston or cyiinder wall is scored.	b. Check engine compression (see paragraph 6-5). Replace piston rings or cylinder if compression is low (see paragraph 6-3).

Table 4-3. Direct Support Troubleshooting (Con't).

PROBLEM	PROBABLE CAUSE	TEST PROCEDURE/REMEDY
ENGINE (Con't)		
4. Engine stalls under load.	Fuel pump is faulty.	Remove and disassemble carburetor (see paragraph 7-8). Replace fuel pump as necessary (see paragraph 7-8).
5. Engine is noisy or knocking.	Bearings, piston rings, or cylinder wall is worn.	Disassemble engine and replace worn parts (see paragraph 6-3).
6. Engine has poor acceleration.	a. Fuel pump is faulty or carburetor is dirty.	a. Remove and disassemble carburetor and inspect (see paragraph 7-8) .Replace fuel pump as necessary (see paragraph 7-8).
	b. Engine compression is low.	b. Check engine compression (see paragraph 6-5). Replace piston rings if compression is low (see paragraph 6-3),
DRIVE MECHANISM		
7. No tamping operation while engine running.	a. Transmission clutch is faulty.	a. Disassemble the transmission clutch (see paragraph 10-3).
	b. Lower unit springs are faulty.	b. Disassemble lower unit (see paragraph 13-3 or 13-4).

CHAPTER 5
GENERAL MAINTENANCE INSTRUCTIONS

5-1. GENERAL.

a. These general maintenance instructions contain general shop practices and specific procedures you must be familiar with to properly maintain your tamper. You should read and understand these practices and methods before performing any maintenance tasks.

b. Before beginning a task, find out how much repair, modification, or replacement is needed to fix the equipment. Sometimes the reason for equipment failure can be seen right away and complete teardown is not necessary. Disassemble equipment only as far as necessary to repair or replace damaged parts.

c. In some cases, a part may be damaged during removal.If the part appears to be good, and other parts behind lt are not defective, leave the part on and continue with the procedure. The following are a few simple rules:

(1) Do not remove dowel pins or studs unless loose, bent, broken, or other wise damaged.

(2) Do not remove bearings or bushings unless damaged. If you need to remove them to access parts behind, carefully pullout bearings and bushings.

(3) Replace all gaskets, Iockwashers, locknuts, seals, cotter pins, and preformed packings.

d. All tags and forrns attached to equipment must be checked to learn the reason for removal of equipment from service. Modification Work Orders (MWOs) and Technical Bulletins (TBs) must also be checked for equipment changes and updates.

5-2. WORK SAFETY.

a. Before beginning a procedure, think about the safety risks and hazards to yourself and others. Wear protective gear such as safety goggles or lenses, safety shoes, rubber apron, or gloves.

b. Observe all WARNINGS and CAUTIONS,

c. Immediately cleanup spilled fluids to avoid slipping.

d. Always use power tools carefully.

5-3. CLEANING INSTRUCTIONS.

WARNING

Improper cleanig methods and use of unauthorized cleaning liquids or solvents can Injure personnel and damage equipment. To prevent this, refer to TM 9-247 for further Instructions.

a. **General.** Cleaning instructions will be the same for the majority of parts and components which make up the tamper. The following applies to all cleaning operations:

(1) Clean all parts before inspection, after repair, and before assembly.

(2) Keep hands free of grease which can collect dust, dirt, and grit.

(3) After cleaning, all parts should be covered or wrapped to protect them from dust and dirt. Parts that are subject to rust should be lightly oiled (see paragraph 5-4).

b. **Steam Cleaning.**

(1) Before steam cleaning exterior of tamper, protect all electrical equipment which could be damaged by steam or moisture.

WARNING

Avoid contact with live steam. Live steam can burn skin, cause blindness, and cause other serious Injury. Be sure to wear protective apron, gloves, and safety goggles when using live steam.

(2) Place disassembled parts in a suitable container to steam clean. Parts that are subject to rust should be dried and lightly oiled after cleaning (see paragraph 5-4).

c. Castings, Forgings, and Machined Metal Parts.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, Immedlatety get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes and get medical aid.

(1) Clean inner and outer surfaces with dry cleaning solvent (Item 16, Appendix E) and a clean rag (Item 15, Appendix E).

(2) Remove grease and accumulated deposits with a scrub brush (Item 3, Appendix E).

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

(3) Clean all threaded holes with compressed air to remove dirt and cleaning fluids.

CAUTION

DO NOT wash oil seals, electrical cables, and flexible hoses with dry cleaning solvent or mineral spirits. Serious damaged or destruction of material will result.

d. **Oil Seals, Electrical Cables, and Flexible Hoses.** Wash oil seals, electrical cables, and flexible hoses with a solution of dishwashing compound (Item 7, Appendix E) and water and wipe dry with clean rag (Item 15, Appendix E).

e. **Bearings.** Clean bearings in accordance with TM 9-214.

5-3. CLEANING INSTRUCTIONS (Con't).

f. General Cleaning Covered by Other Manuals.

(1) TB 750-1047, *Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks.*

(2) TM *9-247, Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Items Including Chemicals.*

5-4. PRESERVATION OF PARTS.

Unpainted metal parts that will not be installed immediately after cleaning may be covered with a thin coat of lubricating oil (Item 13, Appendix E).

5-5. INSPECTION INSTRUCTIONS.

NOTE

All damaged areas should be marked for repair or replacement.

a. All components and parts must be carefully checked to determine if they are serviceable for use, can be repaired, or must be scrapped.

b. Inspect drilled and tapped (threaded) holes for the following:

(1) Wear distortion, cracks, and any other damage in or around holes.

(2) Threaded areas for wear distortion (stretching) and evidence of cross-threading.

c. Inspect metal lines, flexible hoses, and metal fittings and connectors for the following:

(1) Metal lines for sharp kinks, cracks, bad bends, and dents.

(2) Flexible lines for fraying, evidence of leakage, and loose metal fittings or connectors.

(3) Metal fittings and connectors for thread damage and worn or rounded hex heads.

d. Inspect castings, forgings, and machined metal parts for the following:

(1) Machined surfaces for nicks, burrs, raised metal wear, and other damage.

(2) Inner and outer surfaces for breaks and cracks.

e. Inspect bearings in accordance with TM 9-214.

5-6. REPAIR INSTRUCTIONS.

Repair castings, forgings, and machined metal parts using the following instructions:

(1) Repair minor cracked castings or forgings in accordance with TM 9-237.

(2) Repair minor damaged to machined surfaces with a fine mill file or an abrasive cloth (Item 5, Appendix E).

(3) Replace any deeply nicked machined surface that could affect the assembly operation.

(4) After repair, thoroughly clean all parts to prevent dirt, metal chips, and other foreign matter from entering any working parts.

5-7. TAGGING PARTS.

a. Use marker tags (Item 17, Appendix E) to identify any parts which may be hard to identify or replace later. Fasten tags to parts during removal by wrapping wire fasteners around or through parts and twisting ends together. Position tags to be out of the way during cleaning, inspection, and repair. Mark tags with a pencil, pen, or maker.

b. Identify and tag parts as required by name and installed location.

5-8. APPLICATION OF ADHESIVES.

a. **General.** Loctite adhesive must be applied to all tamper fasteners except self-tapping screws.

5-8. APPLICATION OF ADHESIVES (Con't).

b. **Loctite Adhesive.** Loctite (Item 2, Appendix E) provides a seal against leakage and resistance to loosening when used in the assembly of threaded, slip-fitted, or press-fitted parts. Always use grade of Loctite specified and never use when other retaining means are provided, such as lockwires, lockwashers, lockplates, and fasteners. Do not use Loctite on brass fittings, plugs, or items that need frequent servicing, or when operating temperatures exceed 300°F (149°C). Apply Loctite as follows:

(1) Before application, clean threads to remove oil, grease, and metal chips.

(2) Apply Loctite to second and third threads, Do not apply to first thread to ensure system cleanliness.

(3) Loctite will dry in 6-24 hours at room temperature.

(4) Adjustments for elbows, gages, and valves can be made up to 24 hours after application without affecting the seal.

5-9. FLUID DISPOSAL.

Dispose of contaminated drained fluids in accordance with the Standard Operating Procedures (SOP) of your unit.

CHAPTER 6
ENGINE ASSEMBLY MAINTENANCE

Section I. UNIT MAINTENANCE

6-1. ENGINE STARTER MAINTENANCE

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Torque wrench, 0-200 lb.-in. . . . . SC 4910-95-CL-A72

REMOVAL

a. Disconnect spark plug (see paragraph 2-8).

NOTE

Refer to Figure 6-1, Engine *Starter Replacement,* for step b.

b. Remove four screws (4) and engine starter (2) from fan housing (1).

NOTE

Refer to Figure 6-2, Engine *Starter Screen Replacement,* for steps c and d.

c. Remove nut (9) and Iockwasher (8) from engine crankshaft (5). Discard Iockwasher.

d. Remove starter cup (7) and starter screen (6) from flywheel (10).

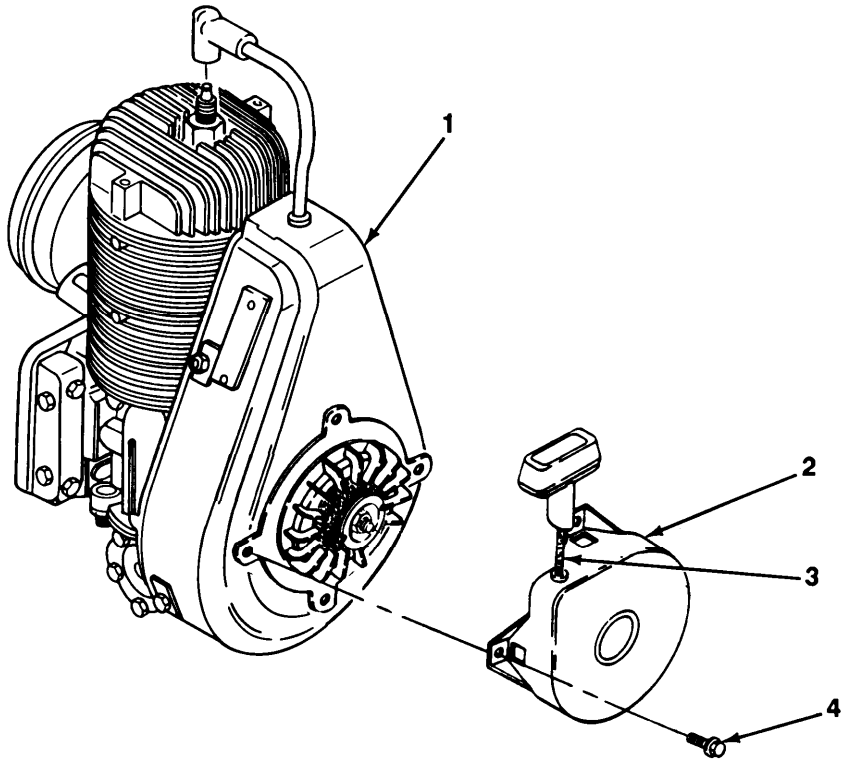

Figure 6-1. Engine Starter Replacement.

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6-1. ENGINE STARTER MAINTENANCE (Con't).

DISASSEMBLY

NOTE

Refer to Figure 6-3, Starter Dog Set Replacement, for step a.

a. Remove screw (1 1), dog retainer (12), spring (13), dog set (14), and three springs (15) from starter cover (16).

NOTE

Refer to Figure 6-4, *Starter Pulley Replacement,* for steps b through f.

b. Remove cap (17) from handle (18).

c. Push rope (3) up through handle(18) and untie knot.

d. Remove handle (18) from rope (3).

e. Pull starter pulley (21) approximately ½ in. (12.7 mm) from starter cover (16) and remove spring (20) from starter pulley.

f. Remove starter pulley (21), spring (20), and retainer (19) from starter cover (16).

g. Remove rope (3) from starter pulley (21).

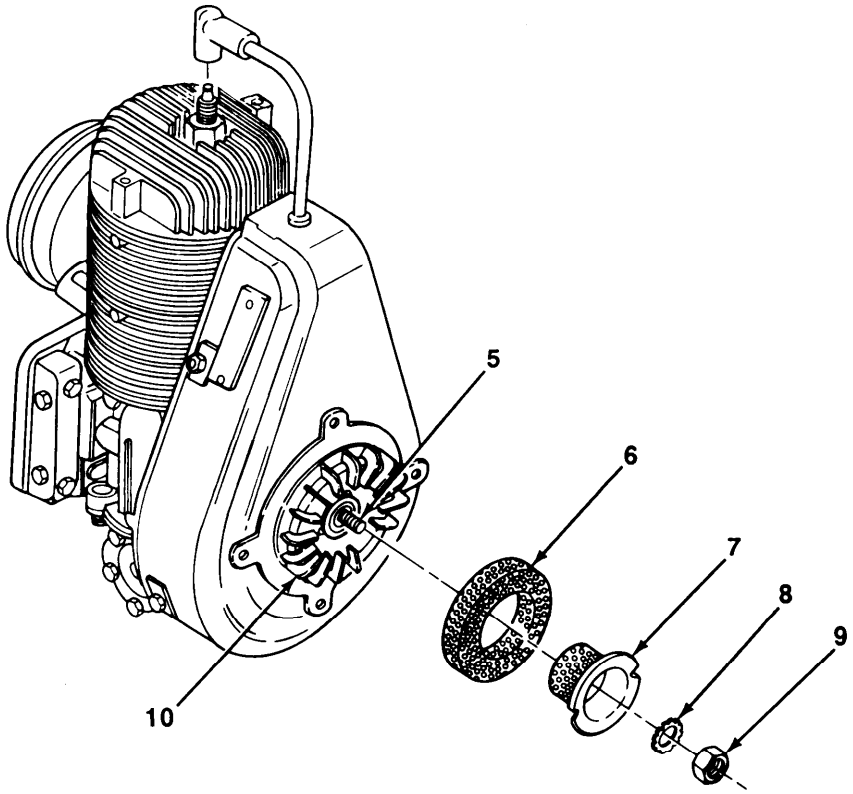

Figure 6-2. Ermine Starter Screen Replacement.

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6-1. ENGINE STARTER MAINTENANCE (Con't).

CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

a. Clean all parts with dry cleaning solvent (Item 16, Appendix E) and allow to air dry.

b. Inspect all parts for wear and damage. Replace worn or damaged parts.

c. Inspect rope for fraying. Replace rope if fraying.

d. Measure rope length. Length must be 48 in. (122 cm). Replace rope if length is not as specified.

ASSEMBLY

NOTE

Refer to Figure 6-4, *Starter Pulley Replacement,* for steps a through i.

a. Tie knot in one end of rope (3) and thread other end through hole in starter pulley (21) until knot is seated firmly in hole. Wind rope clockwise around starter pulley.

b. Wind spring (20) counterclockwise in retainer (19).

c. Apply a light coat of lubricating oil (Item 12, Appendix E) to spring (20).

d. Apply a light coat of grease (Item 10, Appendix E) to shaft on starter cover (16).

e. Install retainer (19) on starter pulley (21) by alining notches and pushing together.

f. Thread rope (3) through starter cover (16).

g. Install starter pulley (21) on starter cover (16) and turn pulley until end of spring (20) engages notch in starter cover.

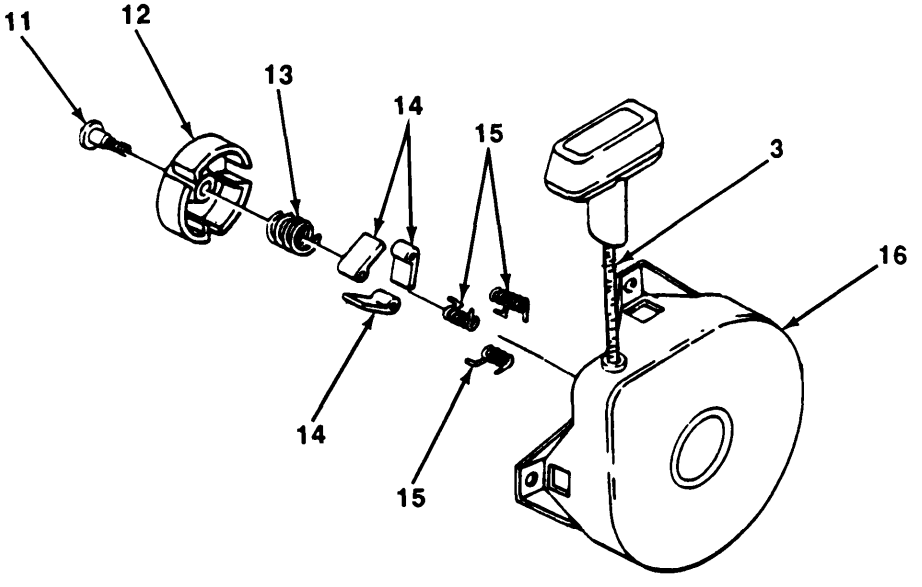

Figure 6-3. Starter Dog Set Replacement.

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6-1. ENGINE STARTER MAINTENANCE (Con't).

h. Thread rope (3) through handle (18) and tie knot at end of rope.

i. Install cap (17) on handle (18).

NOTE

Refer to Figure 6-3, *Starter Dog Set Replacement,* for steps j through l

j. install three springs (15) in starter cover (16) with angled ends up in cut outs.

k. Install dog set (14) in cutouts by moving ends of springs out and away from starter cover. Dogs should now be held in place by springs.

1. Apply adhesive (Item 2, Appendix E) to threads of screw (11), and install spring (13) and dog retainer (12) on starter cover (16) with screw.

INSTALLATION

NOTE

Refer to Figure 6-2, Engine Starter Screen Replacement, for steps a and b.

a. Position starter screen (6) and starter cup (7) on flywheel (10).

b. Install new Iockwasher (8) and nut (9) on engine crankshaft (5).

NOTE

Refer to Figure 6-1, *Engine Stater Replacement,* for step c through e.

c. install engine starter (2) on fan housing (1) with four screws (4). Tighten screws fingertight.

CAUTION

Perform step d to center starter on engine. Failure to center starter on engine will result In damage to equipment.

d. Pull rope (3) until dogs engage cup.

e. Torque four screws (4) to 30 lb.-in. (3.39 N•m).

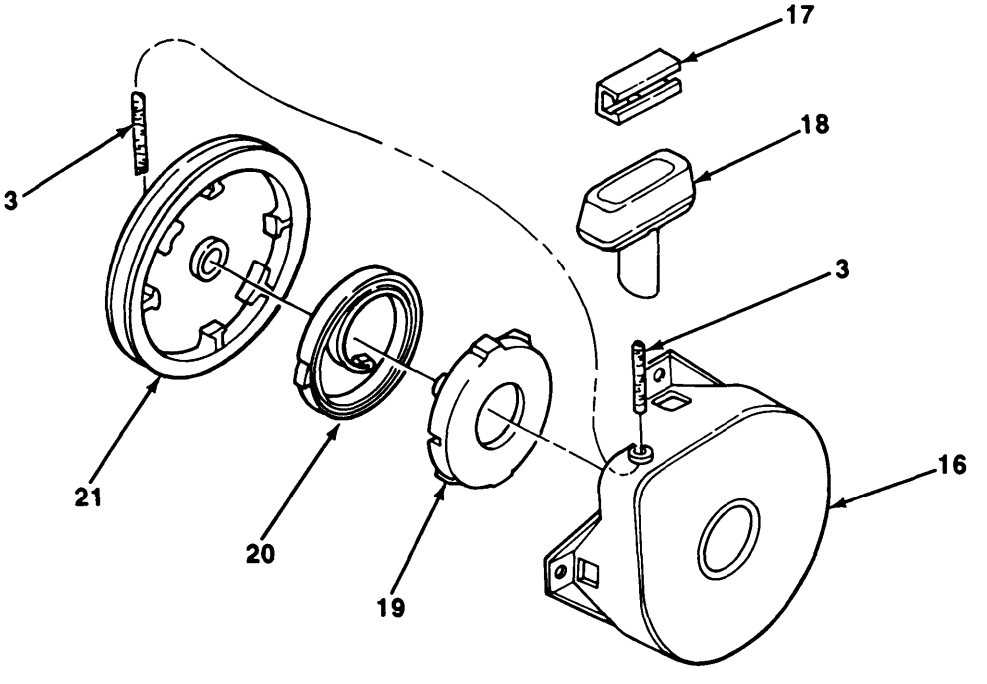

Figure 6-4. Starter Pulley Replacement.

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Section II. DIRECT SUPPORT MAINTENANCE

6-2. ENGINE ASSEMBLY REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 4910-95-N26

REMOVAL

a. Remove reed plate assembly (see paragraph 6-4).

b. Remove fuel tank (see paragraph 7-5).

c. Remove throttle control cable (see paragraph 7-7).

d. Remove muffler (see paragraph 8-2).

e. Remove air cleaner (see paragraph 7-3 or 7-4).

NOTE

Refer to Figure 6-5, *Engine Assembly Replacement,* for steps f and g.

f. Remove four screws (6), lockwashers (7), engine assembly (5), and gasket (8) from transmission (1). Discard lockwashers and gasket.

g. Remove four bolts (2), engine adapter (3), and gasket (4) from engine assembly (5). Discard gasket.

NOTE

Refer to Figure 6-6, Engine *Bracket Replacement,* for step h.

h. Remove four screws (9), lockwashers (10), and two engine brackets (11) from engine assembly (5). Discard lockwashers.

6-2. ENGINE ASSEMBLY REPLACEMENT (Con't).

INSTALLATION

NOTE

Refer to Figure 6-6, Engine *Bracket Replacement,* for step a.

a. Install two engine brackets (11) on engine assembly (5) with four new lockwashers (10) and screws (9).

NOTE

Refer to Figure 6-5, *Engine Assernbly Replacement,* for steps b and c.

b. Install new gasket (4) and engine adapter (3) on engine assembly (5) with four bolts (2).

c. Install new gasket (8) and engine assembly (5) on transmission (1) with four new iockwashers (7) and screws (6).

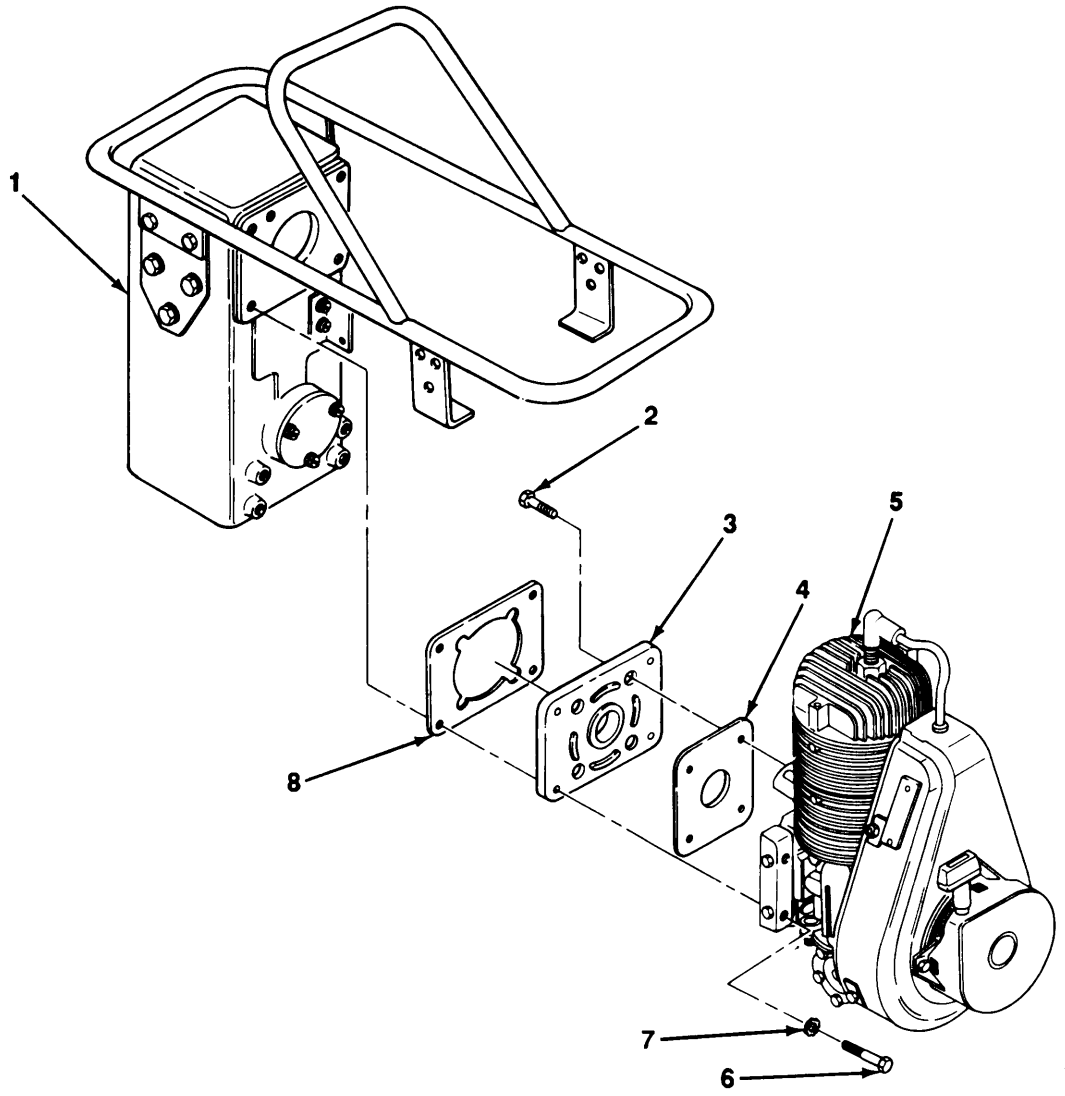

Figure 6-5. Engine Assembly Replacement.

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6-2. ENGINE ASSEMBLY REPLACEMENT (Con't).

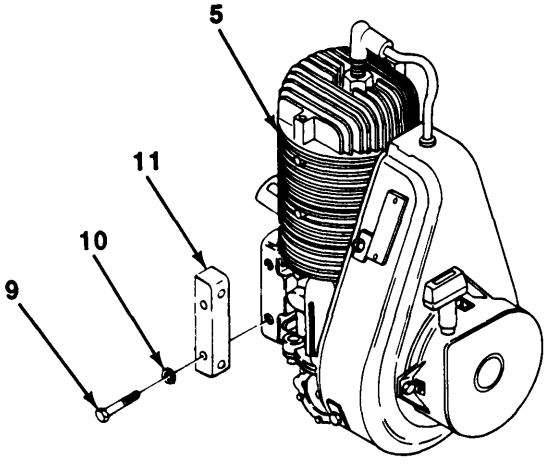

Figure 6-6. Engine Bracket Replacement.

d. Install air cleaner (see paragraph 7-3 or 7-4).

e. Install muffler (see paragraph 8-2).

f. Install throttle control cable (see paragraph 7-7).

g. Install fuel tank (see paragraph 7-5).

h. Install reed plate assembly (see paragraph 6-4).

6-3. ENGINE CRANKSHAFT, PISTON, AND CONNECTING ROD Replacement

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Air compressor . . . . . SC 4910-95-CL-A62
Feeler gage . . . . . SC 4910-95-A31
Flexible carbon scraper . . . . . SC 4910-95-A31
Honing unit . . . . . SC 4910-95-A31
Inside caliper micrometer. . . . . SC 4910-95-A31
Mechanical puller kit:
  Gear and bearing . . . . . SC 4910-95-A31
Outside caliper micrometer . . . . . SC 4910-95-A31
Piston ring expander. . . . . SC 4910-95-A31
Piston ring compressor . . . . . SC 4940-95-CL-B02
Retaining ring pliers . . . . . SC 4910-95-A31
Torque wrench, 0-300 lb.-in. . . . . SC 4910-95-A31

REMOVAL

a. Remove engine assembly from transmission (see paragraph 6-2).

NOTE

Refer to Figure 6-7, *Crankshaft Support Replacement* for steps b and c.

b. Remove six screws (6), crankshaft support (4), and gasket (2) from cylinder (1). Discard gasket.

c. Remove seal (5) and bearing (3) from crankshaft support (4). Discard seal.

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6-3. ENGINE CRANKSHAFT, PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

NOTE

Refer to Figure 6-8, *Crankshaft Replacement,* for steps d through g.

d. Remove two screws (11), connecting rod cap (10), and roller and cage set (8) from crankshaft (9).

e. Push connecting rod (7) into cylinder (1) as far as possible.

f. Remove retaining ring (12) from crankshaft (9).

g. Rotate crankshaft (9) until counterweights clear connecting rod (7) and carefully remove crankshaft from cylinder (1).

NOTE

Refer to Figure 6-9, *Piston Replacement,* for step h.

h. Remove piston (13) from cylinder (1).

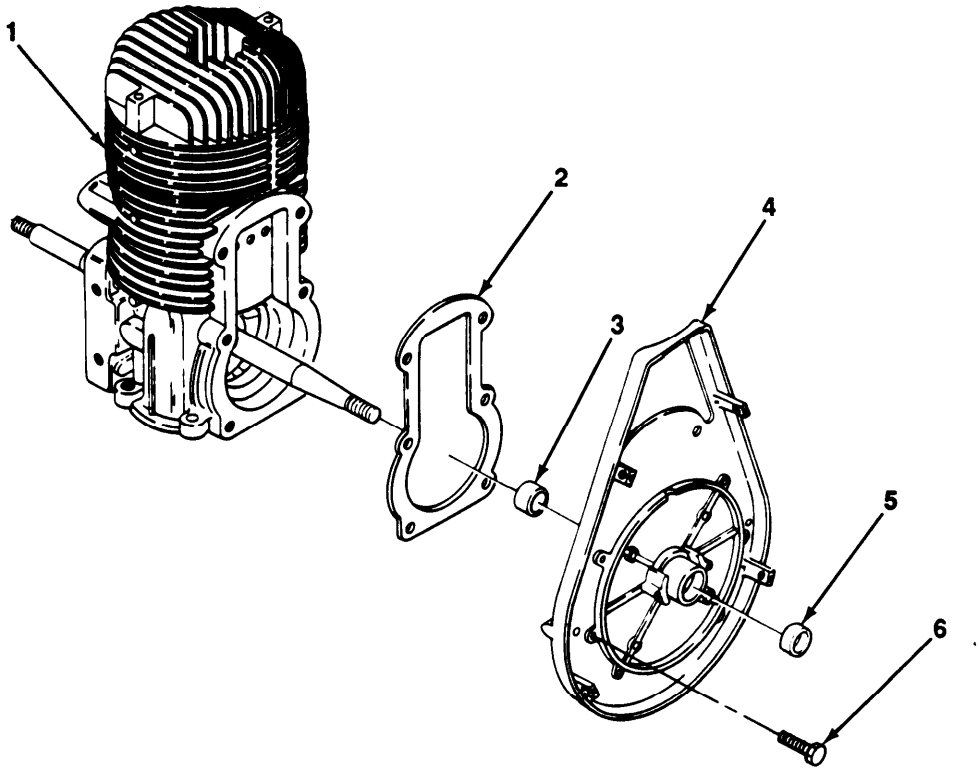

Figure 6-7. Crankshaft Support Replacement.

6-3. ENGINE CRANKSHAFT PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

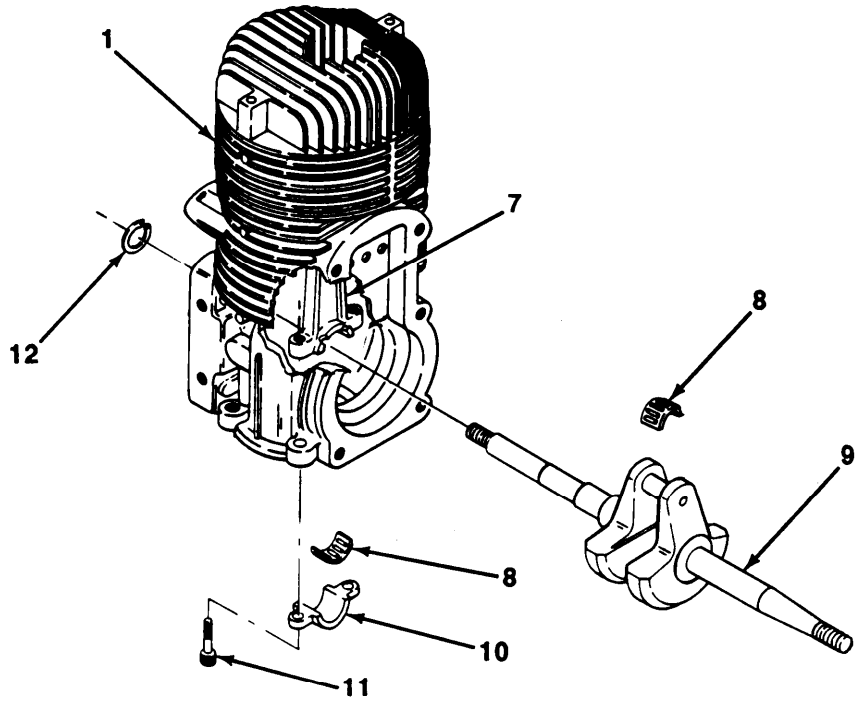

Figure 6-8. Crankshaft Replacement.

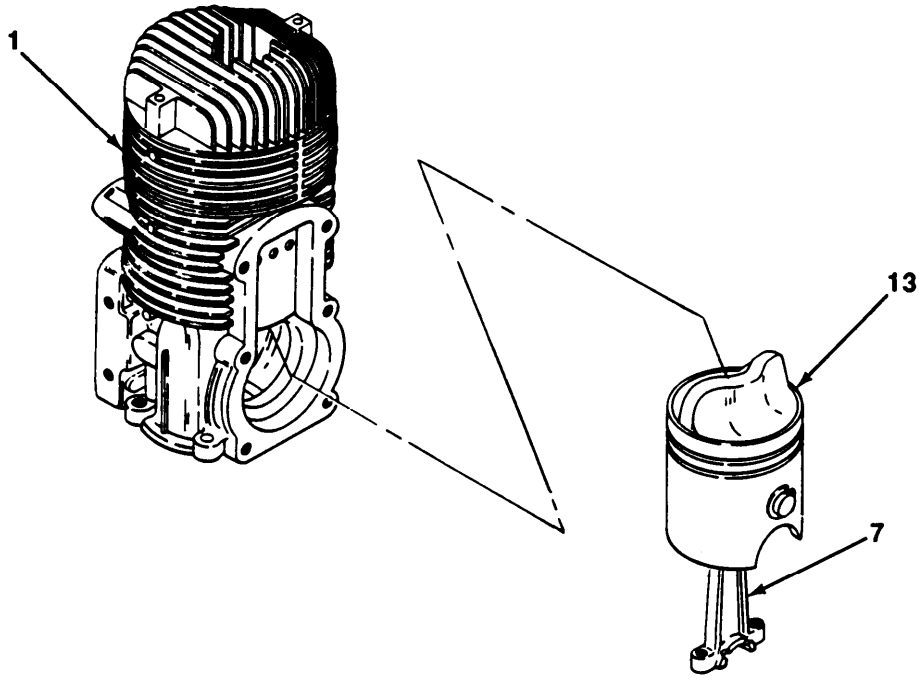

Figure 6-9. Piston Replacement.

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6-3. ENGINE CRANKSHAFT PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

NOTE

Refer to Figure 6-10, Crankshaft *Bearing Replacement,* for step il.

i. Remove bearing (14), retaining ring (15), and seal (16) from cylinder (1). Discard seal.

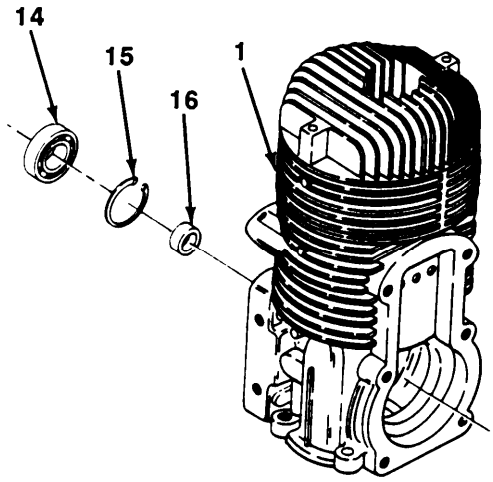

Figure 6-10. Crankshaft Bearing Replacement.

NOTE

Refer to Figure 6-11, *Connecting Rod Replacement,* for step j.

j. Remove two retaining rings (17), piston pin (18), and connecting rod (7) from piston (13).

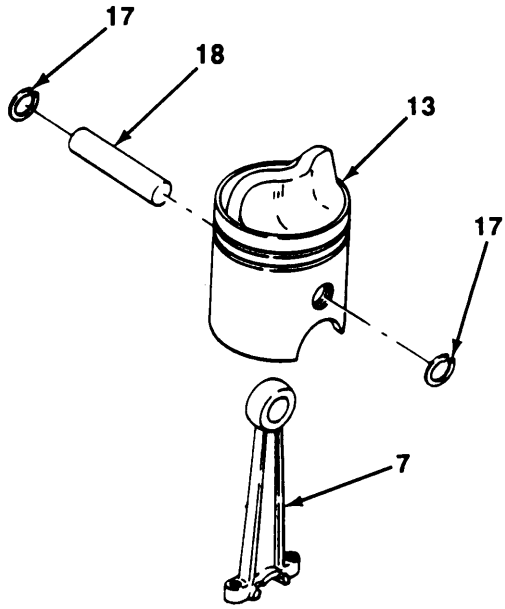

Figure 6-11. Connecting Rod Replacement.

NOTE

Refer to Figure 6-12, *Piston Rings Replacement,* for step k.

k. Remove two piston rings (19) from piston (13).

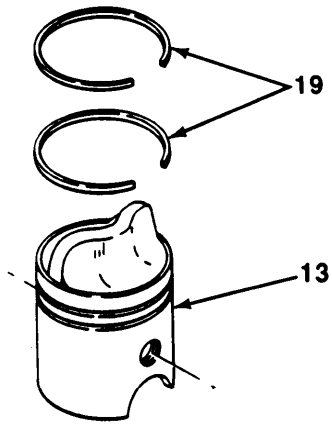

Figure 6-12. Piston Rings Replacement.

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6-3. ENGINE CRANKSHAFT PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

CLEANING AND INSPECTION

WARNING

- **Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38 °C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes and get medical aid.**

- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

a. Clean parts with dry cleaning solvent (Item 16, Appendix E) and dry with compressed air.

b. Using honing unit, clean carbon from exhaust ports and exhaust passages.

WARNING

Carburetor cleaning compound is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin, It can cause serious burns. Always wear protective goggles or lenses, rubber apron, and rubber gloves. if accidently splashed in eyes or on skin, flush with clean, cool water. Refer to FM21-11 for first aid information and seek medical attention immediately.

c. Soak piston in carburetor cleaning compound (item 6, Appendix E). Using flexible carbon scraper, scrape piston head clean and rise with water.

d. Using flexible carbon scraper and wire brush (Item 4, Appendix E), clean piston ring grooves.

e. Inspect piston for cracks, scoring, and excessive wear or scorching. Replace piston if badly scored below top ring groove.

NOTE

Refer to Figure 6-13, *Measuring Piston Ring Grooves,* for step f.

f. Using feeler gage, measure piston ring grooves (20). Measurement must be 0.065-0.067 in. (1.65-1.70 mm). Replace piston if measurement is not within specification.

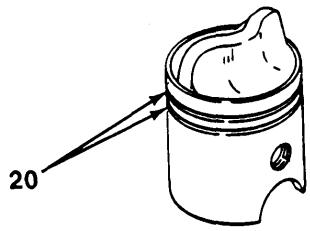

Figure 6-13. Measuring Piston Ring Grooves.

g. Inspect piston pin for cracks, bends, and breaks. Using outside caliper micrometer, measure outside diameter. Outside diameter must be 0.50000-0.50015 in. (12.70000-12.70381 mm). Replace piston pin if measurement is not within specification,

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6-3. ENGINE CRANKSHAFT, PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

h. Inspect connecting rod for cracks, breaks, and damaged threads. Restore damaged threads using die and tap threading set.

NOTE

Refer to Figure 6-14, *Measuring Connecting Rod Bores,* for steps i through n.

i. Using inside caliper micrometer, measure piston pin bore diameter of connecting rod (7). Measurement must be 0.6870-0.6875 in. (17,4498-17.4625 mm). Replace connecting rod if measurement is not within specification.

j. Place connecting-rod (7) in vise with caps,

k. install connecting rod cap (10) on connecting rod (7) with two screws (11).

l. Using inside caliper micrometer, measure bore diameter of connecting rod (7) and connecting rod cap (10). Diameter must be 0.9399-0.9403 in. (23.8735-23.8836 mm).

m. Remove two screws (11) and connecting rod cap (10) from connecting rod (7).

n. Remove connecting rod (7) from vise.

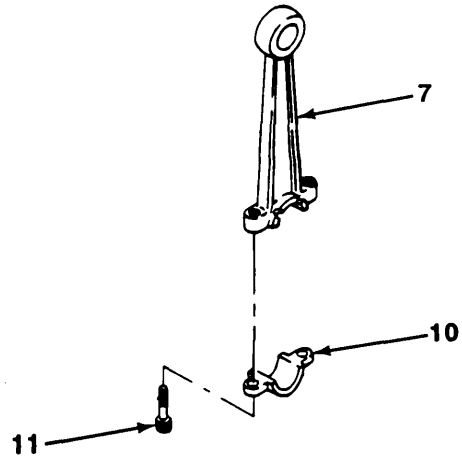

Figure 6-14. Measuring Connecting Rod Boxes.

NOTE

Refer to Figure 6-15, *Measuring Crankshaft,* for step o.

o. Using outside caliper micrometer, measure connecting rod surface of crankshaft (9). Measurement must be 0.7493-0.7496 in, (19.0322-19.0398 mm). Replace crankshaft if measurement is not within specification.

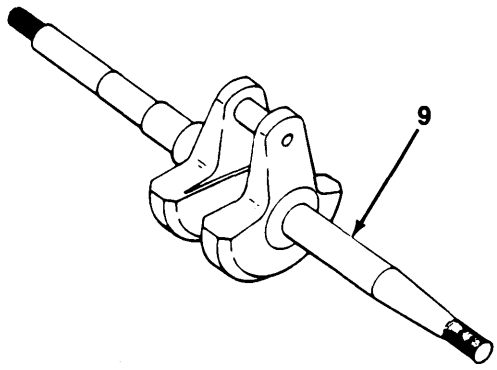

Figure 6-15. Measuring Crankshaft.

p. Using inside caliper micrometer, measure cylinder bore diameter at three points:

(1) Measure ¼ in. (6.35 mm) down from top of cylinder.

(2) Measure ¼ in. (6.35 cm) up from exhaust port.

(3) Measure $^{3}/_{16}$ in. (4.76 mm) down from lower edge of intake port

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6-3. ENGINE CRANKSHAFT, PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

q. Difference between largest and smallest measurement instep p must not exceed 0.005 in. (0.127 mm). Replace cylinder if measurement is not within specification.

r. Clean and inspect bearings in accordance with TM 9-214.

s. Inspect crankshaft support for cracks and other damage. Replace crankshaft support if cracked or damaged.

t. Inspect crankshaft for scoring, wear, and damaged threads. Repair damaged threads with die and tap threading set, Replace crankshaft if scored or worn.

INSTALLATION

NOTE

Refer to Figure 6-11, *Connectlng Rod Replacement,* for steps a and b.

a. Coat piston pin (18) with lubricating oil (item 12, Appendix E) and install piston (13) on connecting rod (7) with piston pin.

b. Install two retaining rings (17) on ends of piston pin (18).

NOTE

Refer to Figure 6-12, *Piston Rings Replacement,* for step c.

c. Apply light coat of lubricating oil (Item 12, Appendix E) to two piston rings (19) and using piston ring compressor, install piston rings on piston (13) with beveled side up and piston ring gaps offset.

NOTE

Refer to Figure 6-10, *Crankshaft BearIng Replacement,* for step d.

d. Apply light coat of grease (item 10, Appendix E) to new seal (16) and install seal, retaining ring (1 5), and bearing (14) in cylinder (1).

NOTE

Refer to Figure 6-9, *Piston Replacement,* for steps e and f.

e. Apply light coat of lubricating oil (item 12, Appendix E) on cylinder (1).

CAUTION

Closed end of piston pin must face support plate.

f. Insert piston (13) and connecting rod (7) into cylinder (1) and guide piston into cylinder using piston ring compressor. Push piston and connecting rod into cylinder as far as possibie.

NOTE

Refer to Figure 6-8, *Crankshaft Replacement,* for steps g and h.

g. Position crankshaft (9) in cylinder (1) and install retaining ring (12).

h. Apply light coat of adhesive (item 2, Appendix E) to two screws (11) and install roller and cage set (8) and connecting rod cap (10) on crankshaft (9) with two screws. Tighten screws gradually and evenly while moving connecting rod cap back and forth until it is properly alined with connecting rod (7). Torque screws to 80-90 lb.-in. (9.04-10.17 N•m).

6-3. ENGINE CRANKSHAFT, PISTON, AND CONNECTING ROD REPLACEMENT (Con't).

NOTE

Refer to Figure 6-7, *Crankshaft Support Replacement,* for steps i and j.

i. Install bearing (3) and new seal (5) in crankshaft support (4).

j. Install new gasket (2) and crankshaft support (4) on cylinder (1) with six screws (6). Torque screws to 70-85 lb.-in. (7.91-9.61 N•m).

k. Install engine assembly on transmission (see paragraph 6-2).

6-4. ENGINE REED AND REED PLATE REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

REED PLATE REMOVAL

a. Remove carburetor (see paragraph 7-2).

NOTE

Refer to Figure 6-16, *Reed Plate Replacement,* for step b.

b. Remove four screws (3), reed plate (2), and gasket (1) from cylinder (4). Discard gasket.

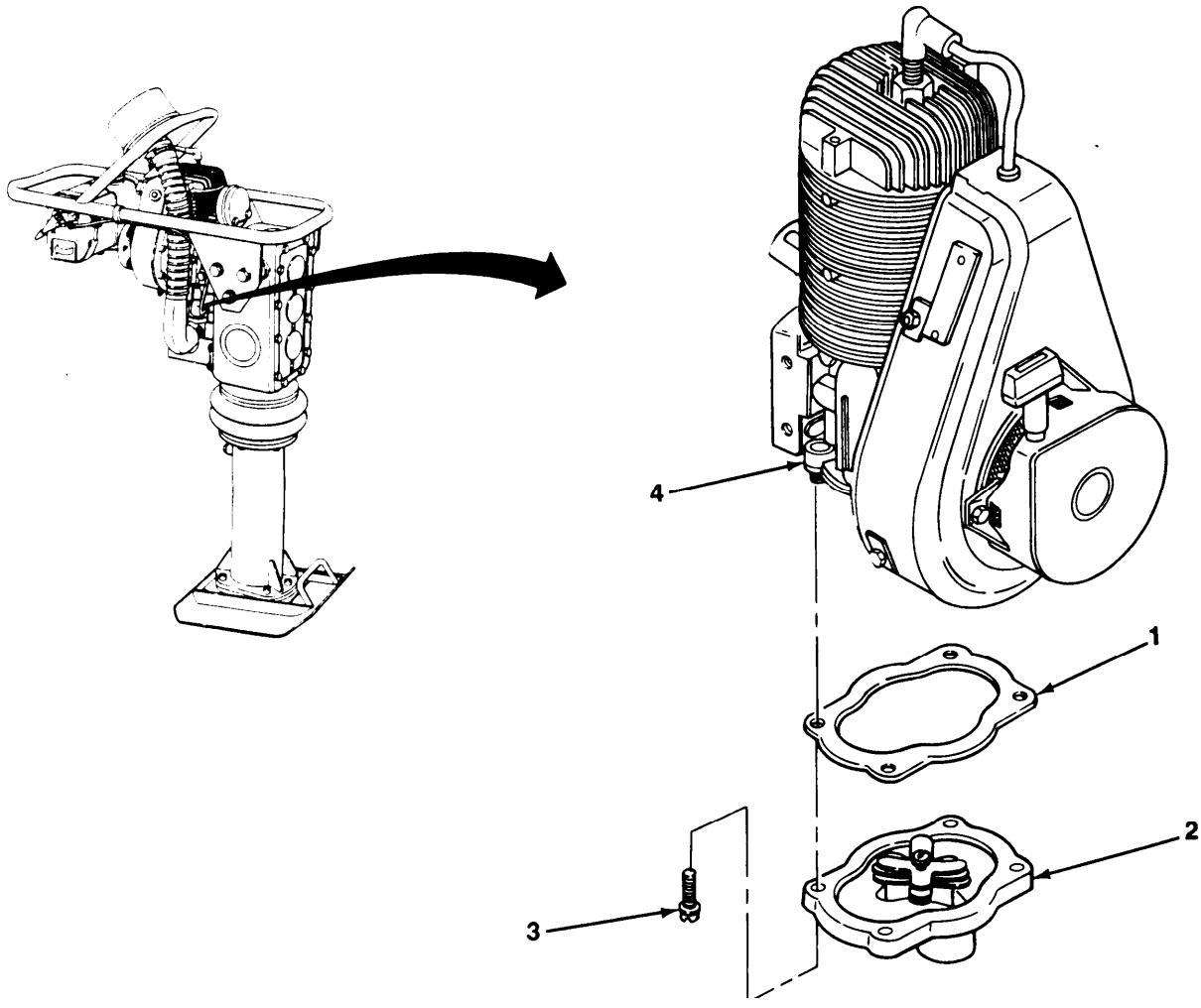

Figure 6-16. Reed Plate Replacement.

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6-4. ENGINE REED AND REED PLATE REPLACEMENT (Con't).

ENGINE REED INSPECTION

NOTE

Refer to Figure 6-17, *Engine Reed Inspection,* for steps a through d.

a. Press lightly on center of reed stop (5) with finger. No movement is permitted. Replace reed stop if movement is detected.

b. Check reed stop (5) opening. Opening measurement must be ¼ in. (6.35 mm). Replace reed stop if measurement is not within specification.

c. Check that engine reed (6) closes easily and completely. Replace engine reed if it does not close properly.

d. Inspect reed stop (5) and engine reed (6) for cracks and other damage. Replace reed stop or engine reed if damaged.

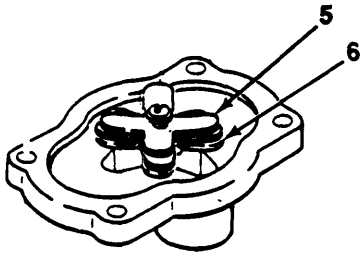

Figure 6-17. Engine Reed inspection.

ENGiNE REED REMOVAL

NOTE

Refer to Figure 6-18, *Engine Reed Replacement.*

Remove screw (7), reed stop (5), and engine reed (6) from reed plate (2).

ENGINE REED INSTALLATION

NOTE

Refer to Figure 6-18, Engine *Reed Replacement.*

Install engine reed (6) and reed stop (5) on reed plate (2) with screw (7).

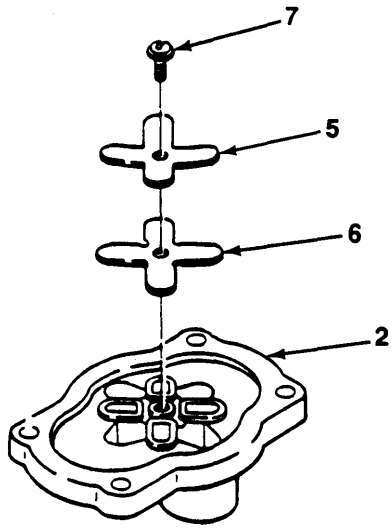

Figure 6-18. Engine Reed Replacement.

REED PLATE iNSTALLATION

NOTE

Refer to Figure 6-16, *Reed Plate Replacement,* for step a.

a. Install new gasket (1) and reed plate (2) on cylinder (4) with four screws (3).

b. Install carburetor (see paragraph 7-2).

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6-5. ENGINE COMPRESSION TEST

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Cylinder compression tester . . . . . SC 4910-95-A31

NOTE

The VR11C and VR11 engine compression tests are performed the same way. VR11C Is Illustrated.

COMPRESSION TEST

a. Remove spark plug (see paragraph 9-3).

NOTE

Refer to Figure 6-19, *Engine Compression Test,* for steps b through d.

b. Insert tip of compression tester into cylinder (1).

c. Set throttle to wide open position.

d. Crank engine (see paragraph 2-4) several times to ensure that cylinder comes up for the compression portion of its stroke. Note reading on compression tester. Reading must be 90-110 psi (621-756 kPa). If compression pressure is not within specification, inspect cylinder (see paragraph 6-3) and replace as required.

e. Install spark plug (see paragraph 9-3).

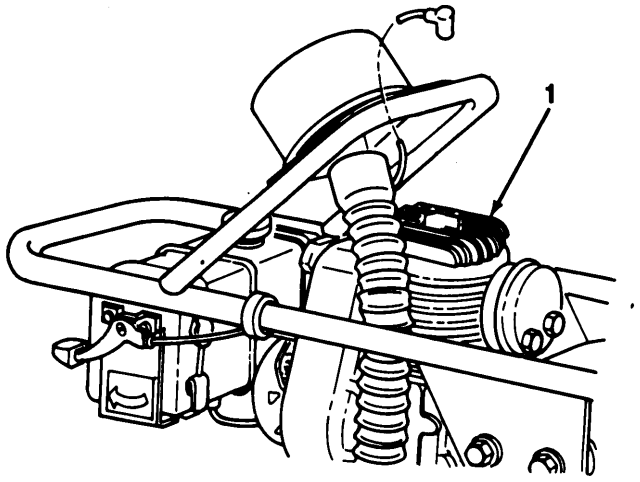

Figure 6-19. Engine Compression Test.

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CHAPTER 7
FUEL SYSTEM MAINTENANCE

Section I. UNIT MAINTENANCE

7-1 CARBURETOR REPLACEMENT

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

REMOVAL

a. Remove air cleaner (see paragraph 7-3 or 7-4).

b. Disconnect fuel line from carburetor (see paragraph 7-6).

c. Disconnect throttle control from carburetor (see paragraph 7-7).

NOTE

Refer to Figure7-1, *Carburetor Replacement,* for step d.

d. Remove two nuts (3), carburetor (2), and gasket (1) from reed plate (4). Discard gasket.

7-1. CARBURETOR REPLACEMENT (Con't).

INSTALLATION

NOTE

Refer to Figure 7-1, *Carburetor Replacement,* for step a.

a. Install new gasket (1) and carburetor (2) on reed plate (4) with two nuts (3).

b. Connect throttle control to carburetor (see paragraph 7-7).

c. Connect fuel line to carburetor (see paragraph 7-6).

d. Install air cleaner (see paragraph 7-3 or 7-4).

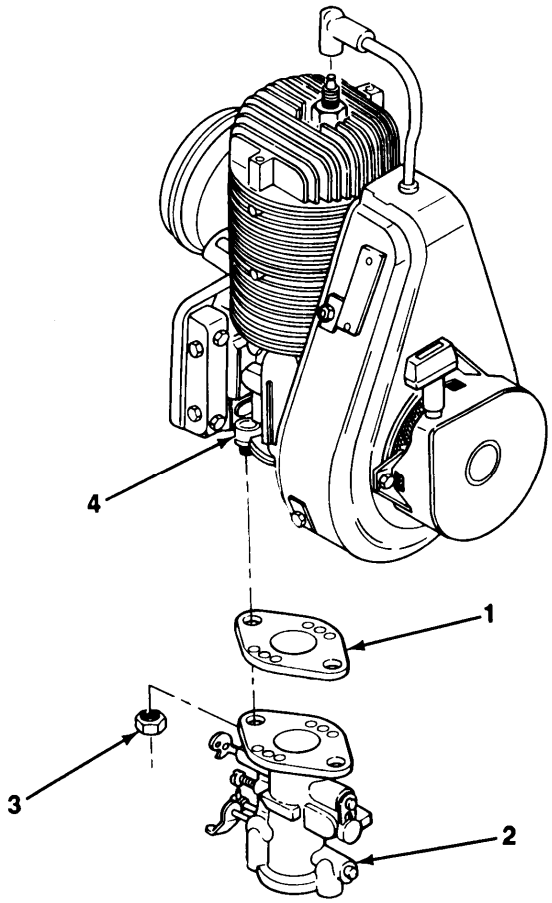

Figure 7-1. Carburetor Replacement.

7-2. CARBURETOR ADJUSTMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

ADJUSTMENT

CAUTION

Use care when turning adjustment screws. Failure to follow this caution may result In damage to needle and seats.

NOTE

- **Refer to Figure 7-2, *Carburetor Adjustment,* for steps a through f.**
- **Correct carburetor adjustment Is Important. Adjustments may be necessary as operating conditions change. In warm weather, set carburetor $^1/_8$ turn leaner, or counterclockwise. In cold weather, set carburetor $^1/_8$ turn richer, or clockwlse.**

a. Turn high speed adjustment screw (2), idle mixture adjustment screw (3), and idle stop adjustment screw (4) clockwise until fully closed.

b. Turn high speed adjustment screw (2) and idle mixture adjustment screw (3) one turn counterclockwise.

c. Start tamper (see paragraph 2-4) and allow engine to warm.

d, Accelerate and decelerate engine using throttle lever (1). If engine falters or accelerates slowly, turn idle mixture adjustment screw (3) counterclockwise until performance is improved.

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7-2. CARBURETOR ADJUSTMENT (Con't).

CAUTION

DO NOT set carburetor any leaner than necessary. Failure to follow this caution may cause piston to seize.

e. Turn high speed adjustment screw (2) clockwise until engine runs smoothly at high speed.

f. Turn idle stop adjustment screw (4) to obtain dependable idle.

7-3. AIR CLEANER MAINTENANCE (VR11C).

TOOLS:

General mechanics. tool kit . . . . . SC 5180-90-N26

WARNING

If NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

AIR CLEANER FILTER REPLACEMENT

NOTE

Refer to Figure 7-3, *Air Cleaner Filter Replacement (VR711C),* for steps a through c.

a. Remove wingnut (1), access cover (2), and filter (3) from handle (4). Discard filter.

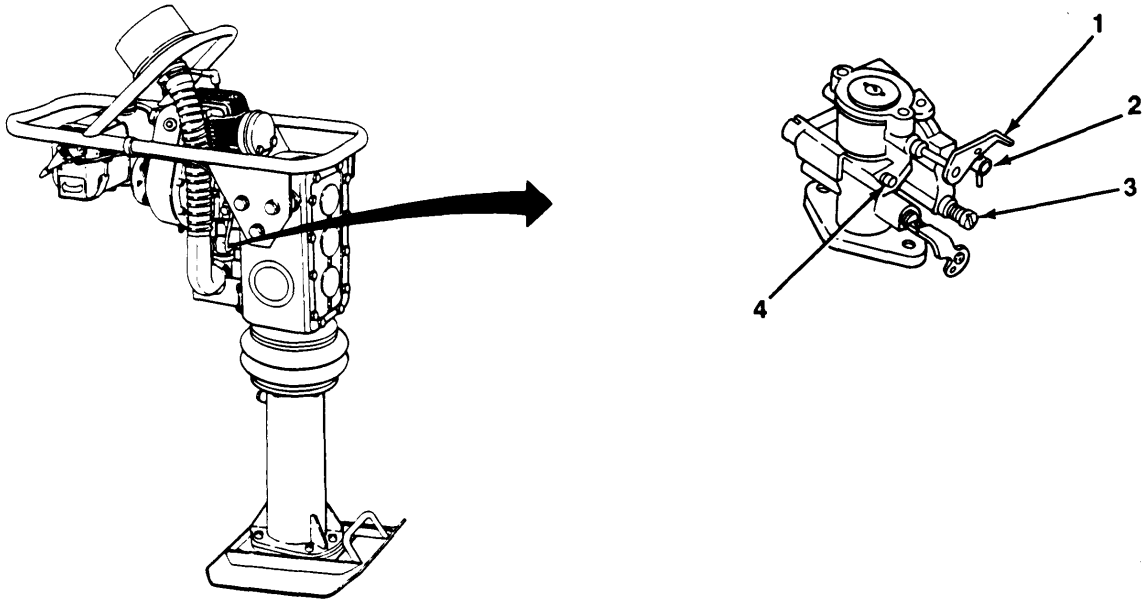

Figure 7-2. Carburetor Adjustment.

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7-3. AIR CLEANER MAINTENANCE (VR11C) (Con't).

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38 °C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

b, Clean access cover *(2)* with dry cleaning solvent (Item 16, Appendix E) and allow to dry.

c. Install new filter (3) and access cover (2) on handle (4) with wingnut (1).

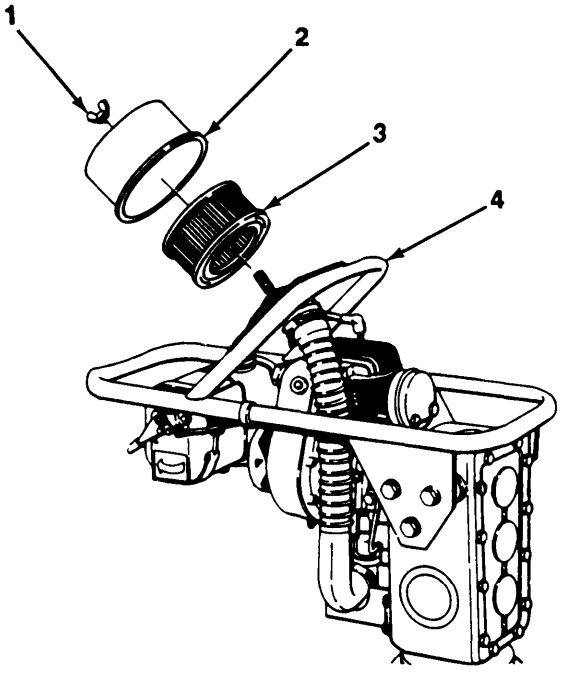

Figure 7-3. Air Cleaner Air Fitter Replacement (VR11C).

AIR CLEANER REMOVAL

NOTE

Refer to Figure 7-4, *Air Cleaner Replacement (VR11C),* for steps a through c.

a. Loosen two clamps (11). Remove hose (12) and clamps from handle (4) and elbow (8).

b. Remove two screws (10), Iockwashers (9), elbow (8), and gasket (7) from carburetor (6). Discard lockwashers and gasket.

c. Remove air cleaner filter (5).

AIR CLEANER INSTALLATION

NOTE

Refer to Figure 7-4, Air *Cleaner Replacement (VR11C),* for steps a through c.

a. Install air cleaner filter (5).

b. Install new gasket (7) and elbow (8) on carburetor(6) with two new Iockwashers (9) and screws (10).

c. Position hose (12) and two clamps (11) on handle (4) and elbow (8). Tighten two clamps.

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7-4. AIR CLEANER MAINTENANCE (VR11).

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

WARNING

If NBC exposure Is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

AIR CLEANER FILTER REPLACEMENT

NOTE

Refer to Figure 7-5, *Air Cleaner Filter Replacement (VR11),* for steps a through c.

a. Remove retainer (2), filter pin (1), and filter (3) from filter housing (4),

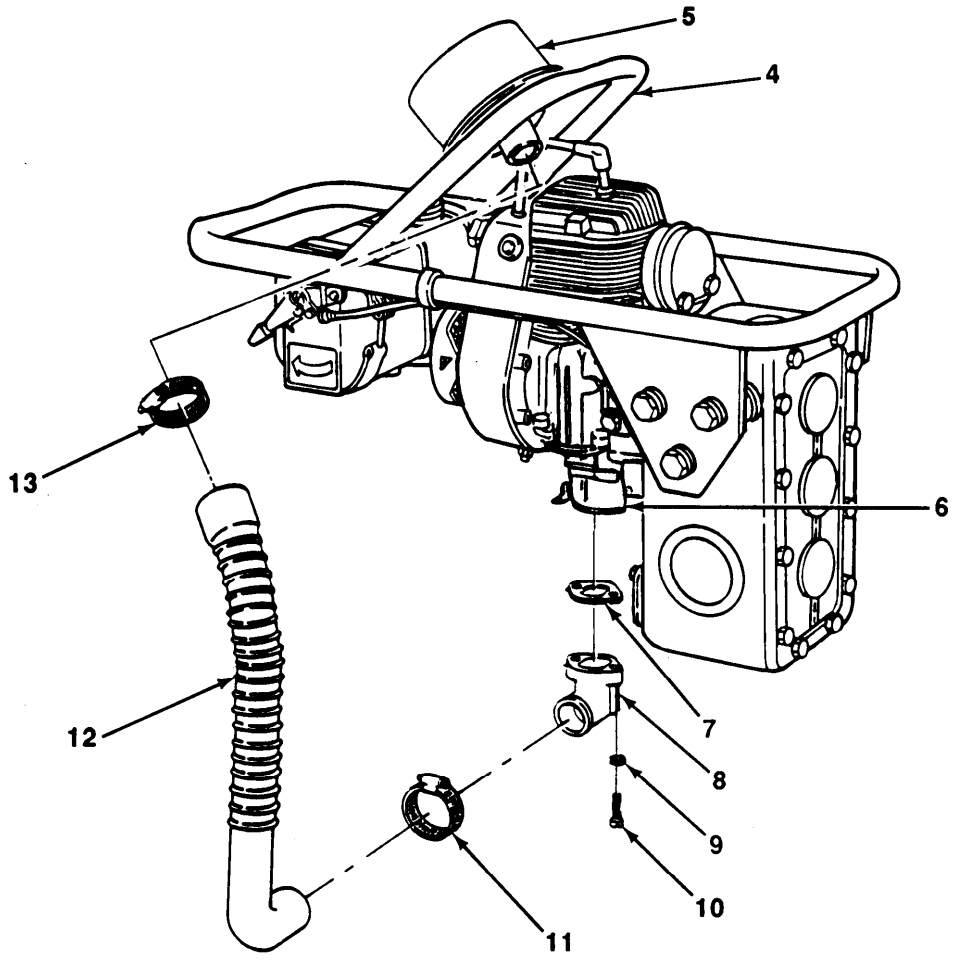

Figure 7-4. Air Cleaner Replacement (VR11C).

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7-4. AIR CLEANER MAINTENANCE (VR11) (Con't).

WARNING

Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). if you become dizzy while using cleaning solvent, immediately get fresh air and medical help. if solvent contacts eyes, immediately wash your eyes and get medical aid.

b. Clean filter pin (1), retainer (2), and filter housing (4) with dry cleaning solvent (Item 16, Appendix E) and allow to dry.

c. Install filter pin (1) and filter (3) in filter housing (4).

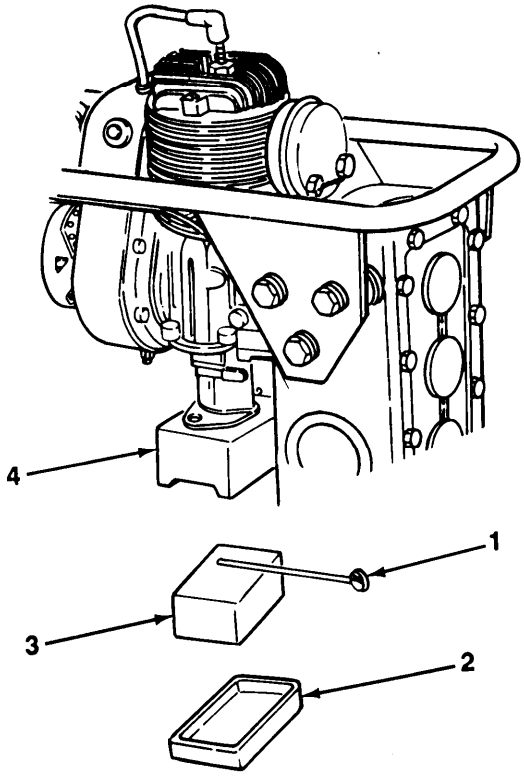

Figure 7-5. Air Cleaner Filter Replacement (VR11).

AIR CLEANER REMOVAL

NOTE

Refer to Figure 7-6, *Air Cleaner Replacement (VR11),* for steps a and b.

a. Remove air cleaner filter.

b. Remove filter housing (4) from carburetor (5).

AIR CLEANER INSTALLATION

NOTE

Refer to Figure 7-6, *AIr Cleaner Replacement (VR11),* for steps a and b.

a. install filter housing (4) on carburetor (5).

b. Install air cleaner filter.

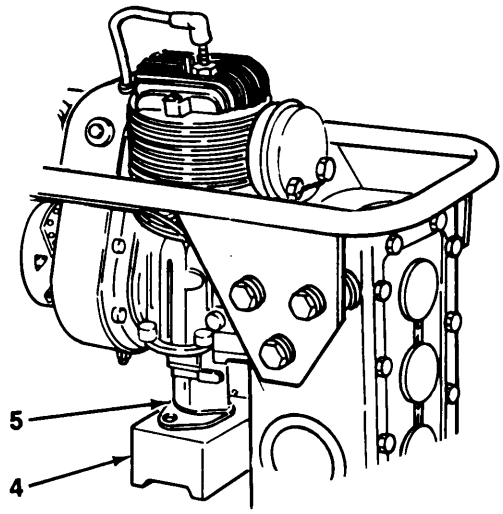

Figure 7-6. Air Cleaner Replacement (VR11).

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7-5. FUEL TANK REPLACEMENT

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

NOTE

VR11C and VR11 fuel tanks are replaced the same way. VR11C Is Illustrated.

REMOVAL

a. Drain fuel tank (see paragraph 2-10).

b. Disconnect spark plug (see paragraph 2-9).

c. Remove fuel line (see paragraph 7-6).

d. Remove throttle control (see paragraph 7-7).

NOTE

Refer to Figure 7-7, *Fuel Tank Replacement,* for step e.

e. Loosen two nuts (2). Remove two straps (3) and fuel tank (4) from frame assembly (1).

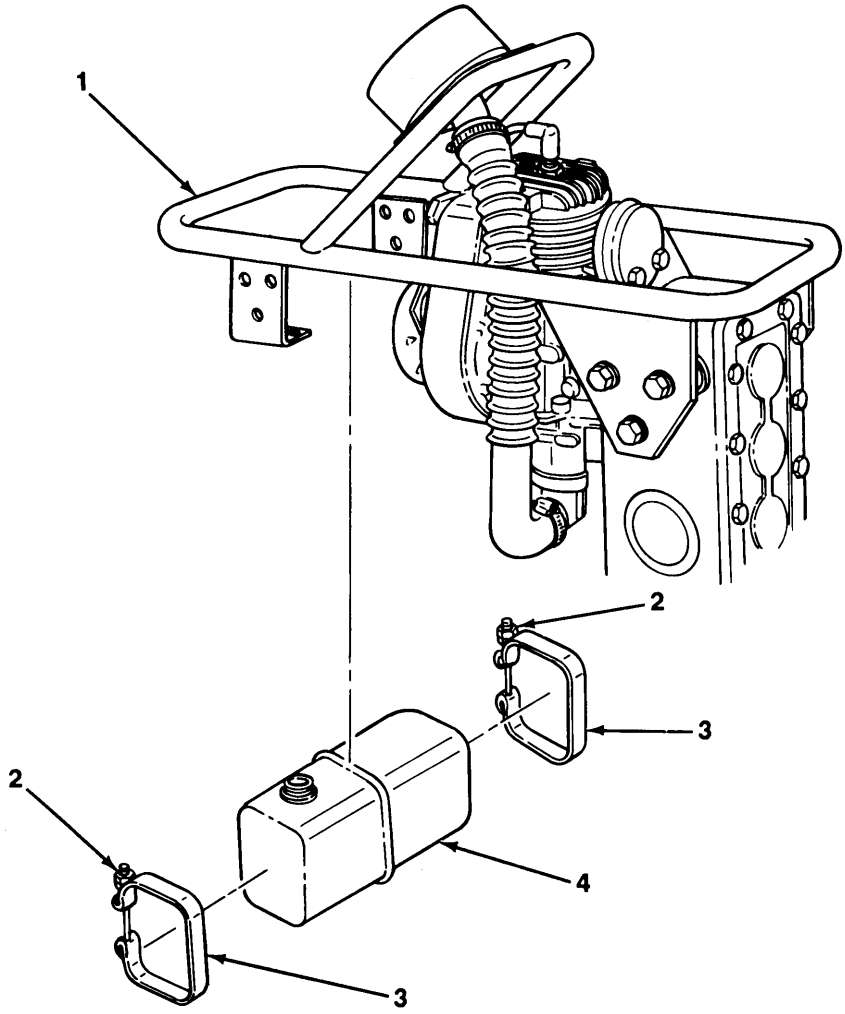

Figure 7-7. Fuel Tank Replacement.

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7-5. FUEL TANK REPLACEMENT (Con't).

INSTALLATION

NOTE

Refer to Figure 7-7, *Fuel Tank Replacement,* for step a.

a. Position fuel tank (4) and two straps (3) on frame assembly (1) and tighten two nuts (2).

b. Install throttle control (see paragraph 7-7).

c. Install fuel line (see paragraph 7-6).

d. Connect spark plug (see paragraph 2-9).

e. Fill fuel tank (see paragraph 2-10).

7-6. FUEL LINE REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

WARNING

- **DO NOT smoke when handling fuel containers or when located within 50 ft (15.3 m) of fueling or fuel storage areas. Failure to follow this warning may cause a fire and explosion, resulting In serious Injury or death to personnel.**
- **DO NOT breathe fuel fumes. They are toxic and can cause serious medical problems. Failure to follow this warning may result In serious Injury or death to personnel.**
- **Give IMMEDIATE medical attention to personnel exposed to hydrocarbon or toxic vapors. Signs of distress are weakness, nausea, coughing or intoxication, nosebleed or cramps, or other unusual symptoms. Qualified personnel able to administer artificial respiration and simple first aid must be present.**

NOTE

- **Refer to Appendix F for instructions on manufacturing fuel lines.**
- **The VR11C and VR11 fuel lines are replaced the same way. VR11C is illustrated.**

REMOVAL

a. Disconnect spark plug (see paragraph 2-9).

NOTE

Refer to Figure 7-8, *Fuel Line Replacement,* for steps b through d.

b. Close fuel valve (7).

NOTE

A suitable container should be used to catch any draining fuel. Ensure that all spills are properly cleaned.

c. Slide two clamps (5) on fuel line (6) and remove fuel - line from fuel valve (7) and fuel filter (4).

NOTE

A suitable container should be used to catch any draining fuel. Ensure that all spills are properly cleaned.

d. Slide two clamps (2) on fuel line (3) and remove fuel line from carburetor (1) and fuel filter (4).

INSTALLATION

NOTE

Refer to Figure 7-8, *Fuel Line Replacement,* for steps a through c.

a. Install fuel line (3) on carburetor (1) and fuel filter (4) with two clamps (2).

b. install fuel line (16) on fuel valve (7) and fuel filter (4) with two clamps (5).

c. open fuel valve (7).

d. Connect spark plug (see paragraph 2-9).

7-7. THROTTLE CONTROL REPLACEMENT

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

NOTE

The VR11C and VR11 throttle controls are replaced the same way. VR11C Is illustrated.

REMOVAL

a. Disconnect spark plug (see paragraph 2-9).

NOTE

Refer to Figure 7-9, *Throttle Control Replacement,* for steps b through d.

b. Remove cotter pin (7) and clevis (5) from throttle lever (6). Discard cotter pin.

c. Remove two nuts (1), lockwashers (2), and throttle control (8) from fuel tank (3). Discard lockwashers.

d. Remove clip (9) and throttle control (8) from frame assembly (4).

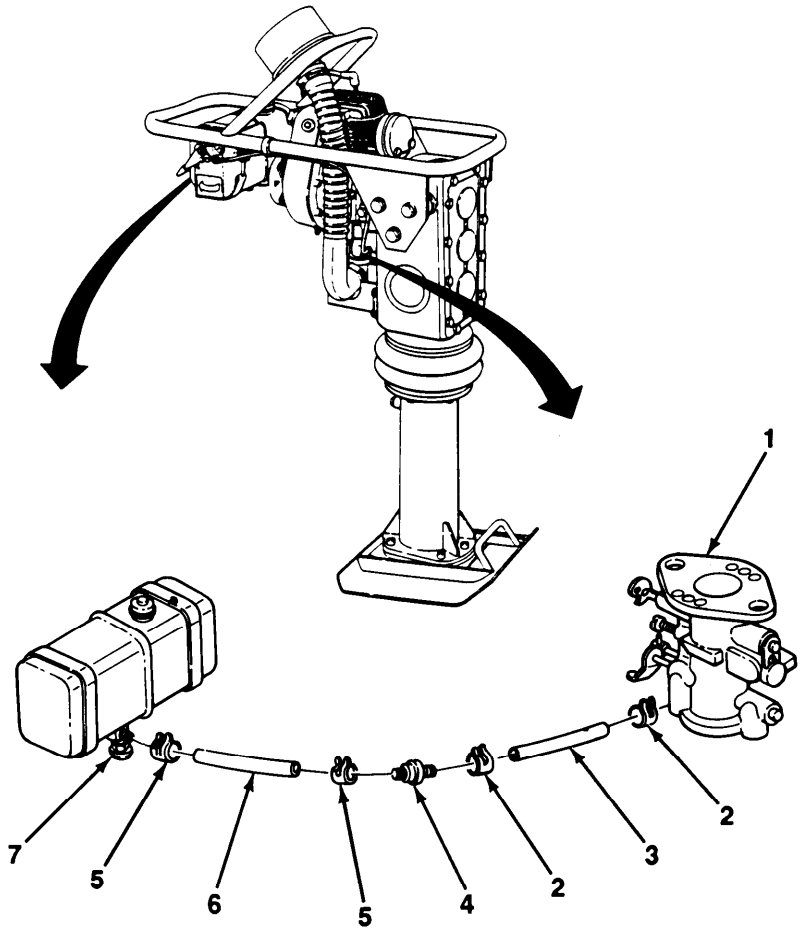

Figure 7-8. Fuel Line Replacement.

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7-7. THROTTLE CONTROL REPLACEMENT (Con't).

INSTALLATION

NOTE

***Refer to Figure 7-9, Throttle Control Replacement,* for steps a through c.**

a. Install throttle control (8) on fuel tank (3) with two new lockwashers (2) and nuts (1).

b. Install clevis (5) on throttle lever (6) with new cotter pin (7).

c. Install throttle control (8) on frame assembly (4) with clip (9).

d. Connect spark plug (see paragraph 2-9).

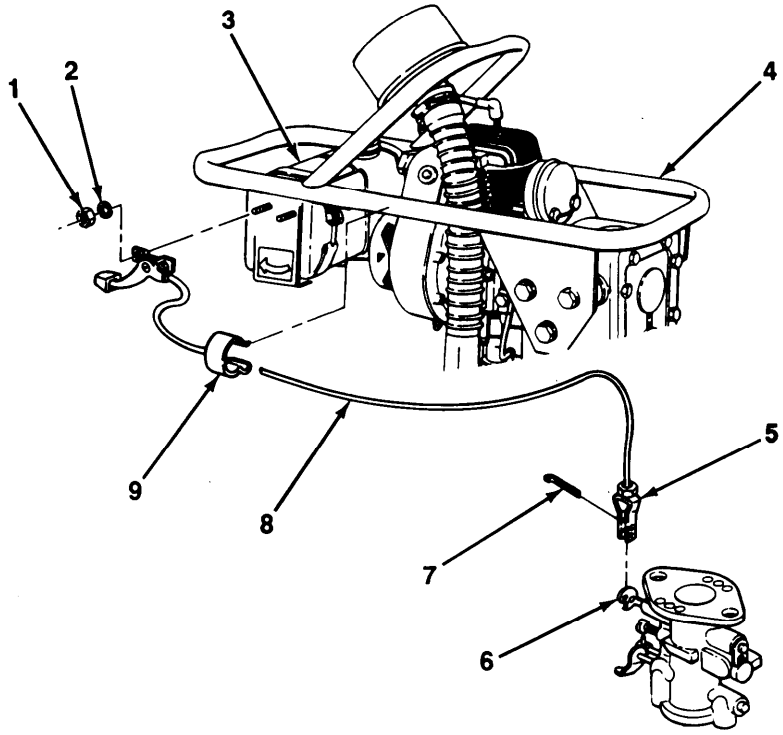

Figure 7-9. Throttle Control Replacement.

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Section II. DIRECT SUPPORT MAINTENANCE

7-8. CARBURETOR REPAIR.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Air compressor . . . . . SC 4910-95-CL-A62

DISASSEMBLY

NOTE

Refer to Figure 7-10, *Carburetor Strainer Replacement,* for step a.

a. Remove screw (5), strainer cover (4), gasket (3), and strainer (2) from carburetor (1). Discard screw, gasket, and strainer.

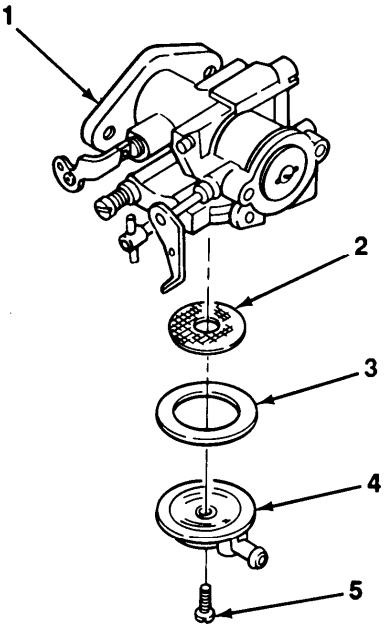

Figure 7-10. Carburetor Strainer Replacement.

NOTE

Refer to Figure 7-11, *Carburetor Diaphragm Replacement,* for steps b and c.

b. Remove six screws (12), pump body (11), diaphragm (10), and gasket (9) from carburetor (1). Discard diaphragm and gasket.

c. Remove diaphragm cover (8), diaphragm (7), and gasket (6) from carburetor (1), Discard diaphragm and gasket.

NOTE

Refer to Figure 7-12, *Carburetor Adjustment Screw, Idle Adjuster Screw, Regulating Screw, Inlet Needle, and Inlet Control Lever Replacement,* for steps d through l.

d. Remove screw (30) and pin (29) from carburetor (1).

e. Remove inlet control lever(18) and spring (19) from carburetor (1). Discard inlet control lever and spring.

f. Remove needle valve(17) and gasket (16) from carburetor (1). Discard needle valve and gasket.

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7-8. CARBURETOR REPAIR (Con't).

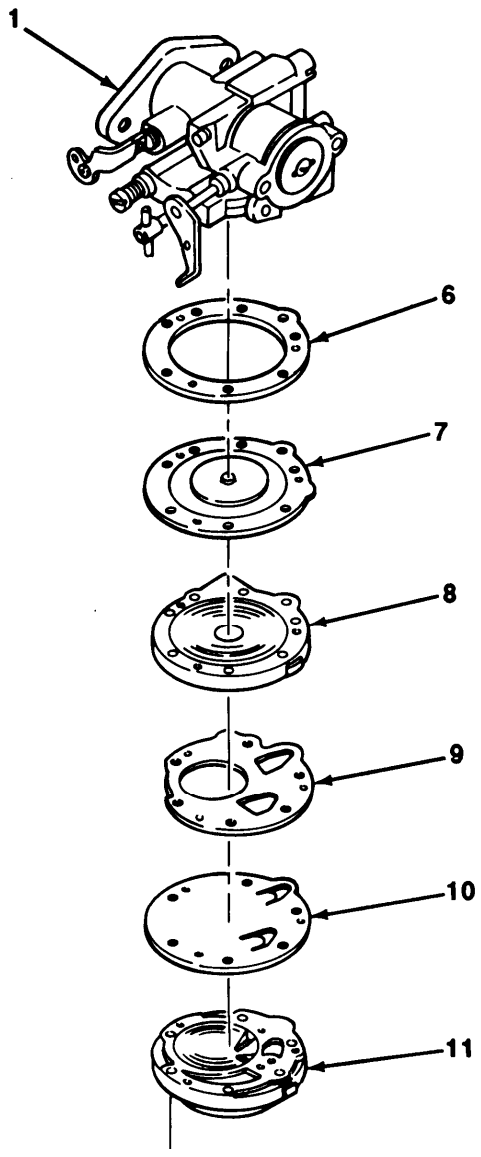

Figure 7-11. Carburetor Diaphragm Replacement.

g. Remove speed adjustment screw (24), washer (23), spring (22), washer (21), and packing (20) from carburetor (1). Discard speed adjustment screw, spring, washer (21), and packing.

h. Remove idle adjuster screw (25), spring (26), washer (27), and packing (28) from carburetor (l). Discard spring, washer (21), and packing.

i. Remove regulating screw (13), spring (14), and washer (15) from carburetor (1). Discard regulating screw and spring.

NOTE

Refer to Figure 7-13, *Throttle Shutter, Throttle Lever, Choke Valve, and Choke Lever Replacement,* for steps j through o.

j. Remove screw (33) and throttle shutter (34) from carburetor (1) and throttle shaft (31). Discard screw.

k. Remove screw (37), lockwasher (36), clip (35), throttle shaft (31), and spring (32) from carburetor (1). Discard lockwasher.

l. Remove screw (40) and choke valve (39) from carburetor (1) and choke lever (43).

m. Remove choke lever (43) from carburetor (1).

n. Remove two sleeve bushings (38) from carburetor (1).

o. Remove choke ball (41) and spring (42) from carburetor (1).

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7-8. CARBURETOR REPAIR (Con't).

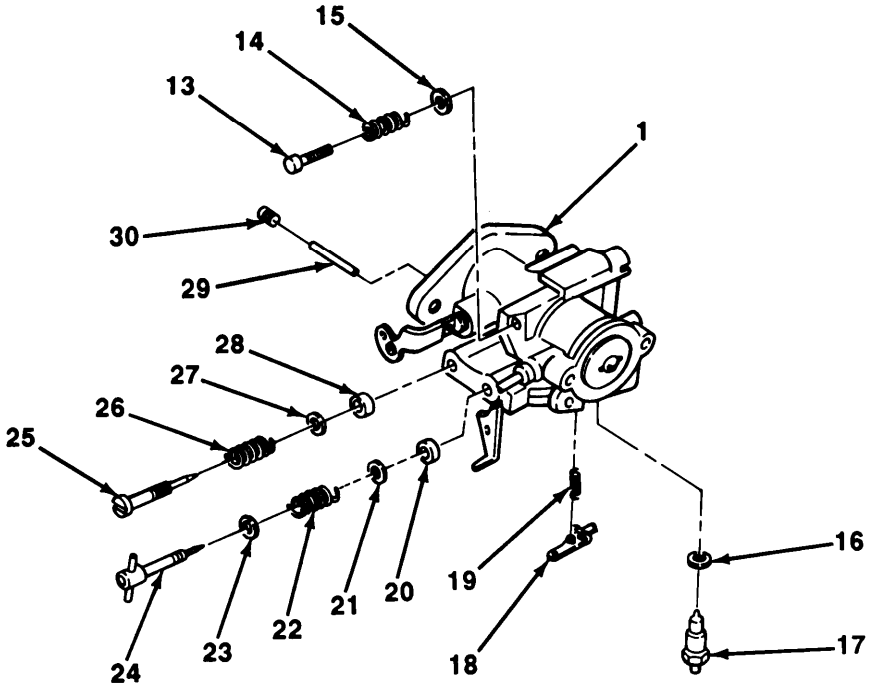

Figure 7-12. Carburetor Adjustment Screw, Idle Adjuster Screw, Regulating Screw, Inlet Needle, and Inlet Control Lever Replacement.

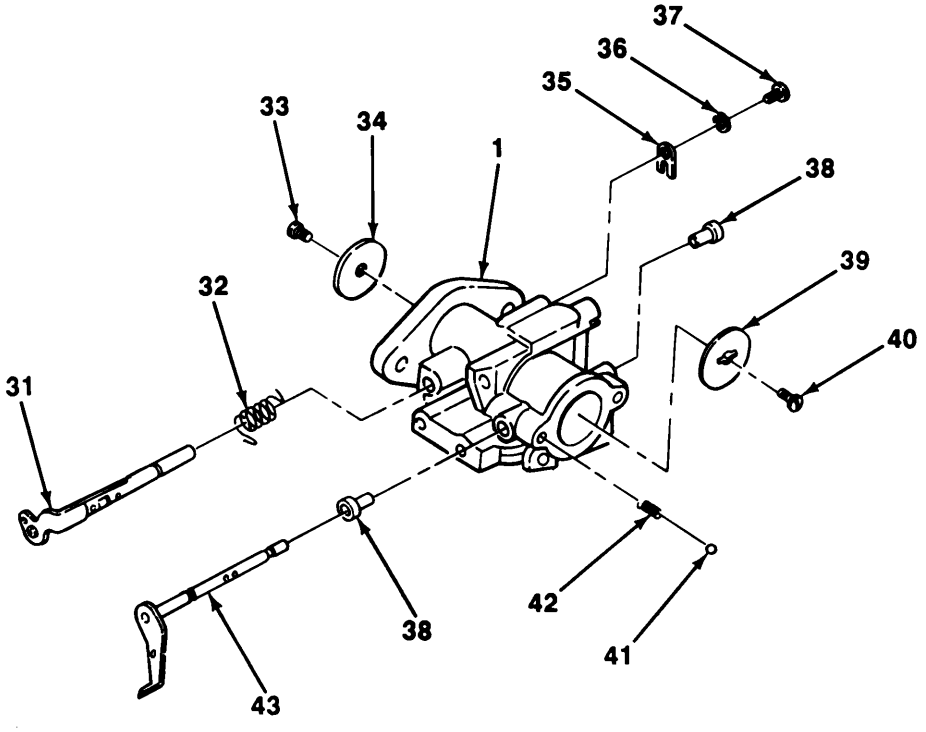

Figure 7-13. Throttle Shutter, Throttle Lever, Choke Valve, and Choke Lever Replacement.

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7-8. CARBURETOR REPAIR (Con't).

NOTE

Refer to Figure 7-14, *Body Channel Plug and Welch Plug* Replacement, for steps p and q.

p. Remove body channel plug (44) from carburetor (1). Discard body channel plug.

q. Remove welch plug (45) from carburetor(1). Discard welch plug.

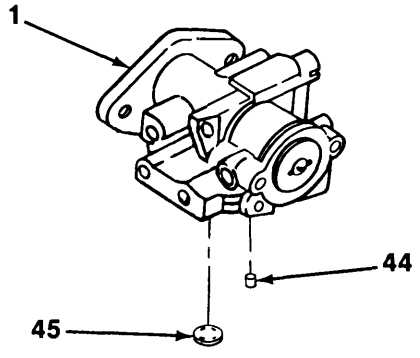

Figure 7-14. Body Channel Plug and Welch Plug Replacement.

CLEANING AND INSPECTION

WARNING

- **Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°"F-138°F (38°C-59°C). if you become dizzy while using cleaning solvent, immediately get fresh air and medical help. if solvent contacts eyes, immediately wash your eyes and get medical aid.**

- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shieid, gloves, etc.) and use caution to avoid Injury to personnel.**

a. Clean carburetor with dry cleaning solvent (Item 16, Appendix E) and dry with compressed air.

b. Inspect carburetor for damage. Replace carburetor if damaged.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. if solvent contacts eyes, lmmediately wash your eyes and get medical aid.

c. Clean all parts with dry cleaning solvent (Item 16, Appendix E) and dry with clean rags (item 15, Appendix E).

d. Inspect parts for damage. Replace damaged parts.

ASSEMBLY

NOTE

Refer to Figure 7-14, *Body Channel Plug and Welch* Plug *Replacement,* for steps a and b.

a. Install new welch plug (45) in carburetor (1).

b. Install new body channel plug (44) in carburetor (1).

NOTE

Refer to Figure 7-13, *Throttle Shutfer, Throttle Lever Choke Valve, and Choke Lever Replacement,* for steps c through h.

c. Install spring (42) and choke ball (41) in carburetor (1).

d. Install two sleeve bushings (38) on carburetor (1).

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7-8. CARBURETOR REPAIR (Con't).

e. Install choke lever (43) on carburetor (1).

f. Install choke valve (39) on carburetor (1) and choke lever (43) with screw (40).

g. Install spring (32) and throttle shaft (31) on carburetor (1) with clip (35), new Iockwasher (36), and screw (37).

h. Install throttle shutter (34) on carburetor (1) and throttle shaft (31) with new screw *(33).*

NOTE

Refer to Figure 7-12, *Carburetor Adjustment Screw, Idle Adjuster Screw, Regulating Screw, Inlet Needle, and Inlet Control Lever Replacement,* for steps I through n.

i. Install washer (15), new spring (1 4), and new regulating screw (13) in carburetor (1).

j. Install new packing (28), new washer (27), new spring (26), and idle adjuster screw (25) on carburetor (1).

k. Install new packing (20), new washer (21), new spring (22), washer (23), and new speed adjustment screw (24) on carburetor (1).

l. Install new gasket (16) and new needle valve (17) in carburetor (1).

m. Install new spring (19) and new inlet control lever (18) in carburetor (1).

n. Install pin (29) and screw (30) in carburetor (1).

NOTE

Refer to Figure 7-11, Carburetor *Diaphragm Replacement,* for steps o and p.

o. Install new gasket (6), new diaphragm (7), and diaphragm cover (8) on carburetor (1).

P. Install new gasket (9), new diaphragm (10), and pump body (11) on carburetor (1) with six screws (12).

NOTE

Refer to Figure 7-10, *Carburetor Strainer Replacement,* for step q.

q. Install new strainer (2), new gasket (3), and strainer cover (4) on carburetor (1) with new screw (5)

CHAPTER 8
EXHAUST SYSTEM MAINTENANCE

8-1. GENERAL.

All maintenance procedures in this chapter are to be performed by Unit Maintenance.

8-2. MUFFLER REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Torque wrench, 0-200 lb.-in. . . . . SC 4910-95-CL-A72

WARNING

Before attempting to replace any part of the exhaust system, allow exhaust system to cool. Failure to follow this warning may result in serious burns.

NOTE

Refer to Figure 8-1 *,Muffer Replacement.*

REMOVAL

Remove two screws(1), lockwashers (2), muffler (3), and gasket (4) from engine (5). Discard lockwashers and gasket.

INSTALLATION

Install new gasket (4) and muffler (3) on engine (5) with two new lockwashers (2) and screws (1). Torque screws to 70 lb.-in. (8 N•m).

8-2. MUFFLER REPLACEMENT (Con't).

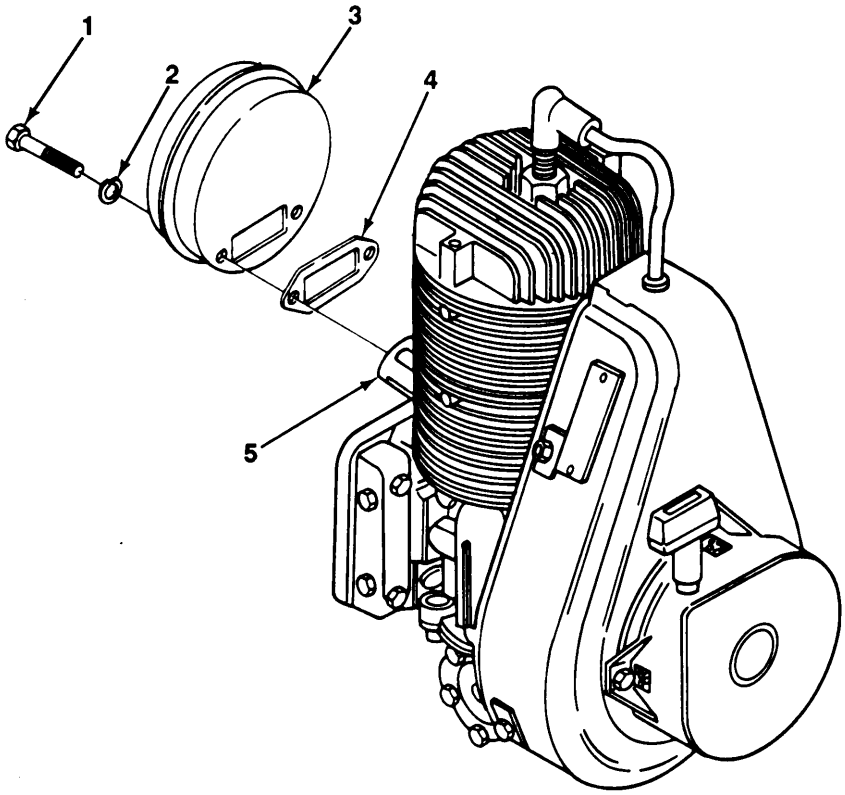

Figure 8-1. Muffler Replacement

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CHAPTER 9
ELECTRICAL SYSTEM MAINTENANCE

9-1. GENERAL.

All maintenance procedures in this chapter are to be performed by Unit Maintenance.

9-2. IGNITION REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Mechanical puller kit . . . . . SC 4910-95-CL-A72
Feeler gage . . . . . SC 4910-95-CL-A72
Multimeter . . . . . SC 4910-95-CL-A72
Compressor unit . . . . . SC 4910-95-A74

REMOVAL

a. Remove engine starter (see paragraph6-1).

NOTE

Refer to Figure 9-1,Fan Housing Replacement, for steps b through d.

b. Remove terminal (4) from wire (3).

c. Remove four nuts (10), lockwashers (9), washers (8), and fan housing (1) from crankshaft support (6). Discard lockwashers,

d. Remove four studs (7) from crankshaft support (6).

e. Remove grommet (2) and switch (5) from fan housing (1).

NOTE

Refer to Figure 9-2, *Stator Plate Replacement,* for steps f through m.

f. Remove flywheel (31) and woodruff key (30) from crankshaft (20). Discard woodruff key.

g. Move one end of breaker cover spring (25) to the side and remove cover (29) and gasket (28) from stator plate (23). Discard gasket.

h. Remove nut (11), lockwasher (12), connector (13), and capacitor wire lead (14) from stator plate (23). Discard iockwasher.

9-2. IGNITION REPLACEMENT (Con't).

i. Remove screw (32), capacitor (33), two connectors (15 and 16), and screw (22) from stator plate (23).

j. Remove spring wedge (18) and coil assembly (19) from stator plate (23).

k. Remove screw (27), contact set (26), and cam (17) from stator plate (23).

l. Remove two screws (24) and stator plate (23) from crankshaft support (6).

m. Remove cam (21) from crankshaft (20).

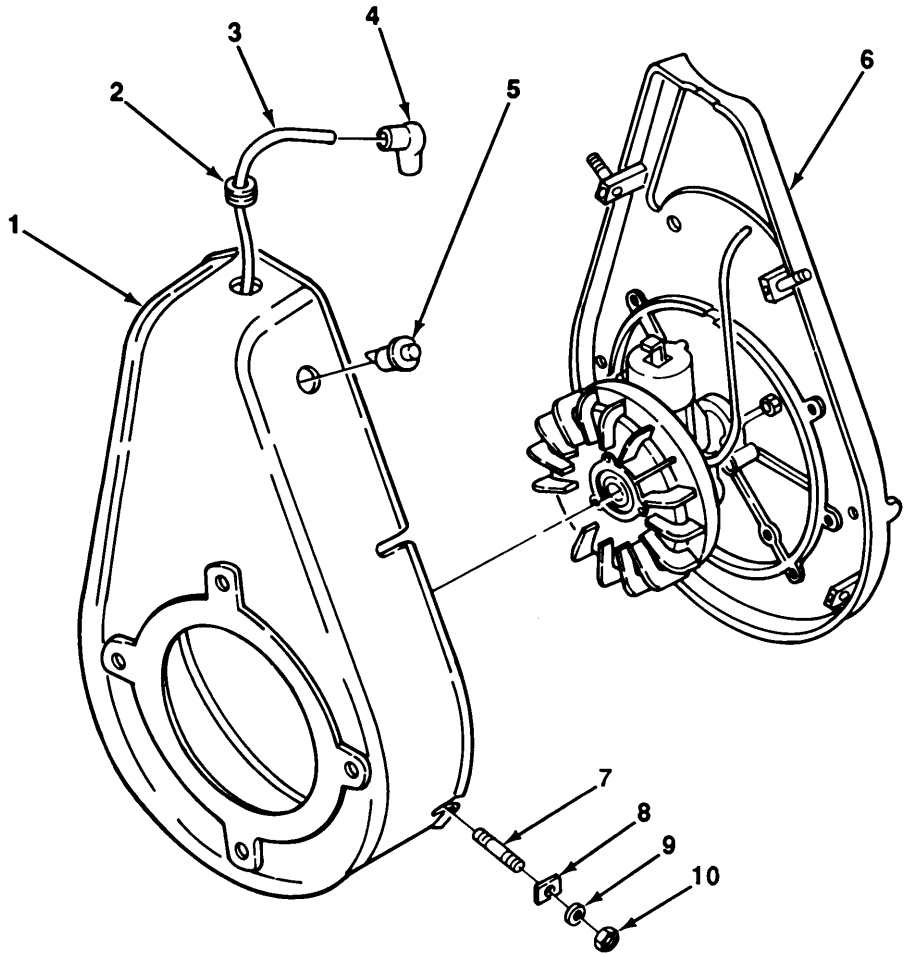

Figure 9-1. Fan Housing Replacement.

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9-2. IGNITION REPLACEMENT (Con't).

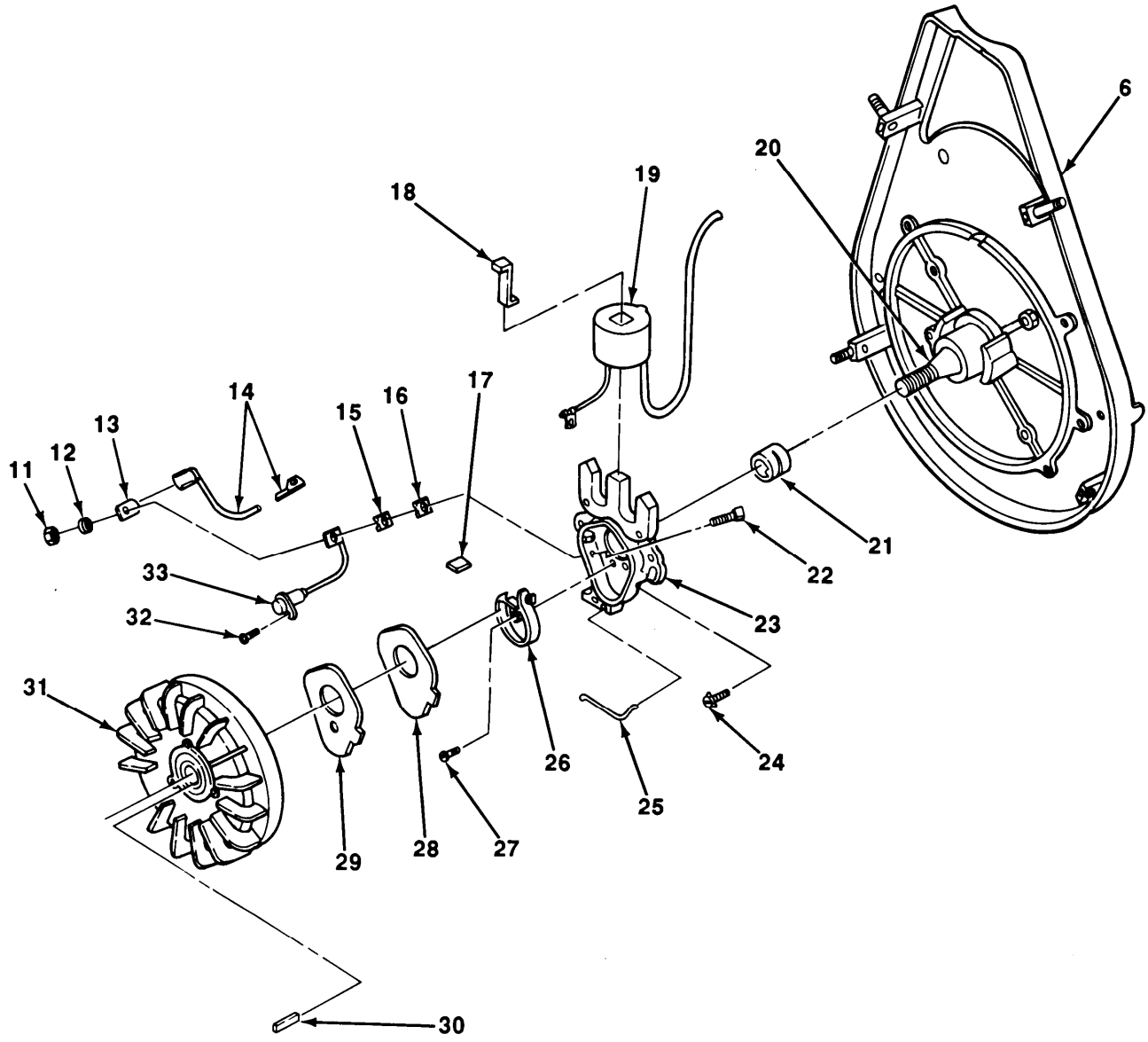

Figure 9-2. Stator Plate Replacement.

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9-2. IGNITION REPLACEMENT (Con't).

CLEANING AND INSPECTION

WARNING

- **Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.**

- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (gogglesIshieid, gloves, etc.) and use caution to avoid injury to personnel.**

a. Clean flywheel and crankshaft with dry cleaning solvent (item 16, Appendix E) and dry with compressed air.

b. Inspect flywheel for cracks and breaks. Replace flywheel if cracked or broken.

c. Using a pencil (item 14, Appendix E), draw three vertical lines on tapered end of crankshaft approximately 120° apart.

d. Install flywheel on crankshaft and turn clockwise one full turn. Remove flywheel.

e. Inspect vertical lines on crankshaft. if 80% or more of the lines are rubbed off, contact is acceptable.

NOTE

Perform steps f through h only If flywheel contact is not within specification.

f. Apply an even, light coat of lapping compound (item 8, Appendix E) on crankshaft.

g. install flywheel on crankshaft and gentl`y rotate flywheel ¼ turn back and forth on crankshaft. Repeat every 90° until entire crankshaft has been covered.

h. Remove flywheel from crankshaft and wipe lapping compound with clean rag (item 15, Appendix E).

i. Using multimeter, test capacitor. Multimeter should show low resistance at first and then a quick rise to a high value. Replace capacitor if reading is not as specified.

j. Using multimeter, test resistance of coil assembly. Resistance reading should be 0.7-0.9 ohms. Replace coil assembly if reading is not within specification.

INSTALLATION

NOTE

Refer to Figure 9-2, Stator Plate Replacement, for steps a through i.

a. Install can (21) on crankshaft (20).

b. install stator plate (23) on crankshaft support (6) with two screws (24).

c. install cam (17).

d. install contact set (26) on stator pi ate (23) with screw (27).

e. Using feeler gage, set breaker point to 0.020 in. (0.508 mm).

f. install coil assembly(19) and spring wedge (18) on stator plate (23).

g. install capacitor (33) on stator plate (23) with screw (32).

h. install two connectors (15 and 16), capacitor (33) and connector (13) on stator plate (23) with screw (22), new lockwasher (12), and nut (11).

i. install capacitor wire lead (14) on connector (13).

j. install new gasket (28) and cover (29) on stator plate (23) with breaker cover spring (25).

9-2. IGNITION REPLACEMENT (Con't).

k. Install flywheel (31) on crankshaft (20).

l. Install woodruff key (30) on crankshaft (20).

NOTE

Refer to Figure 9-1, *Fan Housing Replacement,* for steps m through p.

m. Install grommet (2) and switch (5) on fan housing (1).

n. Thread wire (3) through grommet (2) and install terminal (4) on wire.

o. Install four studs (7) on crankshaft support (6).

P. Install fan housing (1) on crankshaft support (6) with four washers (8), new lockwashers (9), and nuts (10).

q. Install engine starter (see paragraph 6-1).

9-3. SPARK PLUG REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Torque wrench, 0-200 lb.-in. . . . . SC 4910-95-CL-A72
Feeler gage . . . . . SC 490-95-CL-A72

NOTE

- **Refer to Figure 9-3, *Spark Plug Replacement.***
- ***The* VR11C and VR11 spark plugs are replaced the same way. VR11C is illustrated.**

REMOVAL

a. Remove terminal (1) from spark plug (2).

b. Remove spark plug (2) from cylinder (3).

INSTALLATION

a. Using feeler gage, set spark plug (2) gap to 0.040 in. (1.02 mm).

b. Install spark plug (2) in cylinder (3). Torque spark plug to 120-180 lb.-in. (13.56-20.34 N•m).

c. Install terminal (1) on spark plug (2).

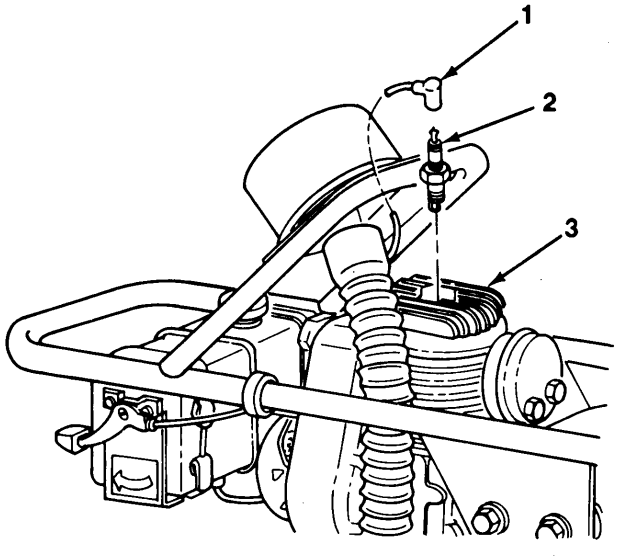

Figure 9-3. Spark Plug Replacement.

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CHAPTER 10
TRANSMISSION ASSEMBLY MAINTENANCE

10-1. GENERAL.

All maintenance procedures in this chapter are to be performed by Direct Support Maintenance.

10-2. TRANSMISSION ASSEMBLY MAINTENANCE.

TOOLS:

General mechanic's tool kit . . . . . SC 4910-95-N26
Retaining ring pliers . . . . . SC 491095-A31
Mechanical puller kit:
Gear and bearing . . . . . SC 4910-95-A31

REMOVAL

a. Remove lower unit (see paragraph 13-3 or 13-4).

b. Remove engine assembly (see paragraph 6-2).

NOTE

- **Refer to Figure 10-1, Transmission Replace-*ment (VR11C),* for step c.**
- **Perform step c for VR11 C only.**

c. Remove six screws (1), Iockwashers (2), washers (3), resilient mounts (6), and transmission assembly (5) from handle (4). Discard Iockwashers.

10-2. TRANSMISSION ASSEMBLY MAINTENANCE (Con't).

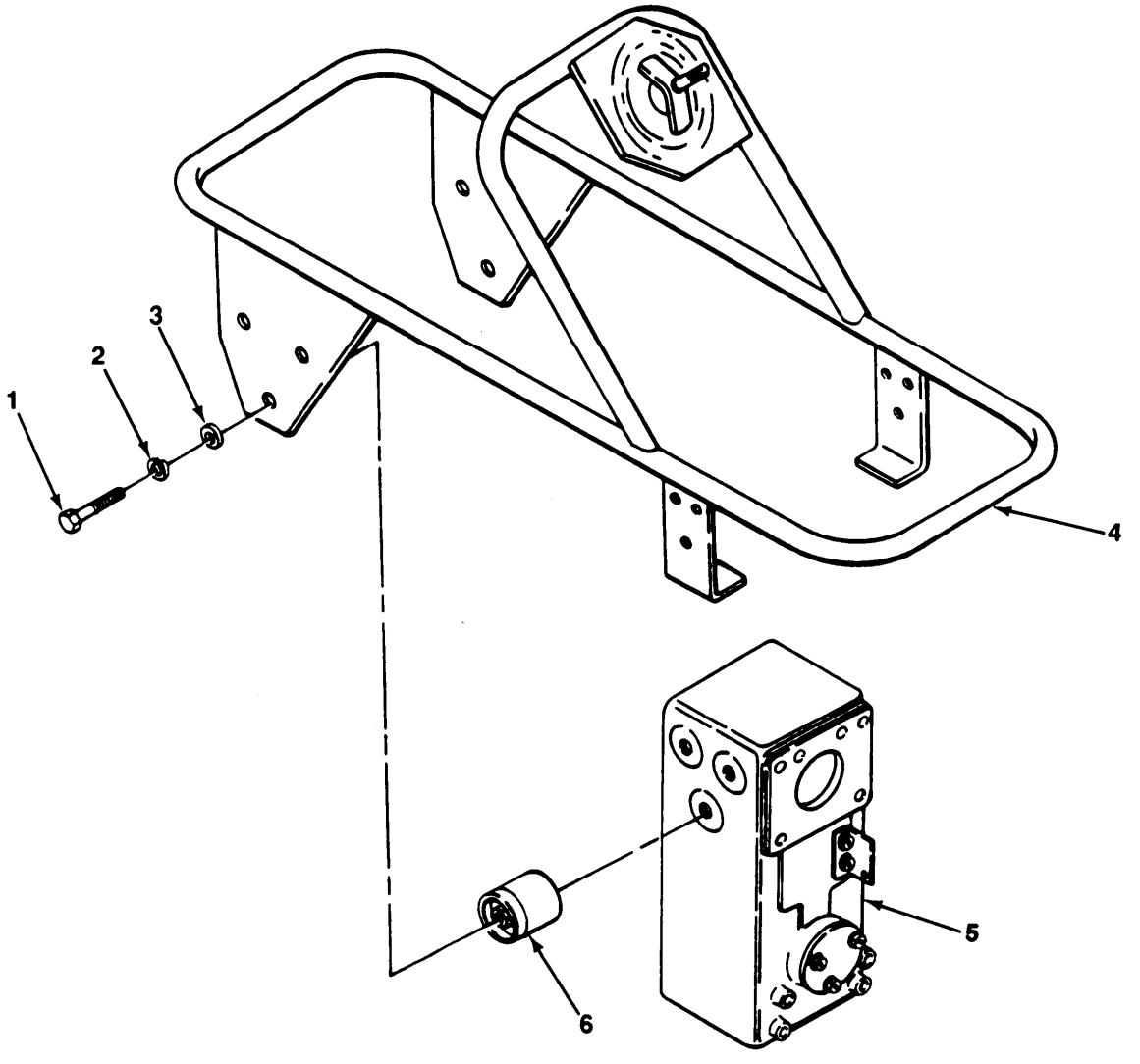

Figure 10-1. Transmission Replacement (VR11C).

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10-2. TRANSMISSION ASSEMBLY MAINTENANCE (Con't).

NOTE

- **Refer to Figure 10-2, *Transmission Replacement (VR11),* for step d.**
- **Perform step d for VR11 only.**

d. Remove six nuts (7), resilient mounts (10), and transmission assembly (9) from handle (8).

DISASSEMBLY

NOTE

Refer to Figure 10-3, *Transmission Gearcase* Cover *Replacement,* for step a.

a. Remove 14 screws (15), two pins (11), gearcase cover (12), and gasket (13) from gearcase (14). Discard gasket.

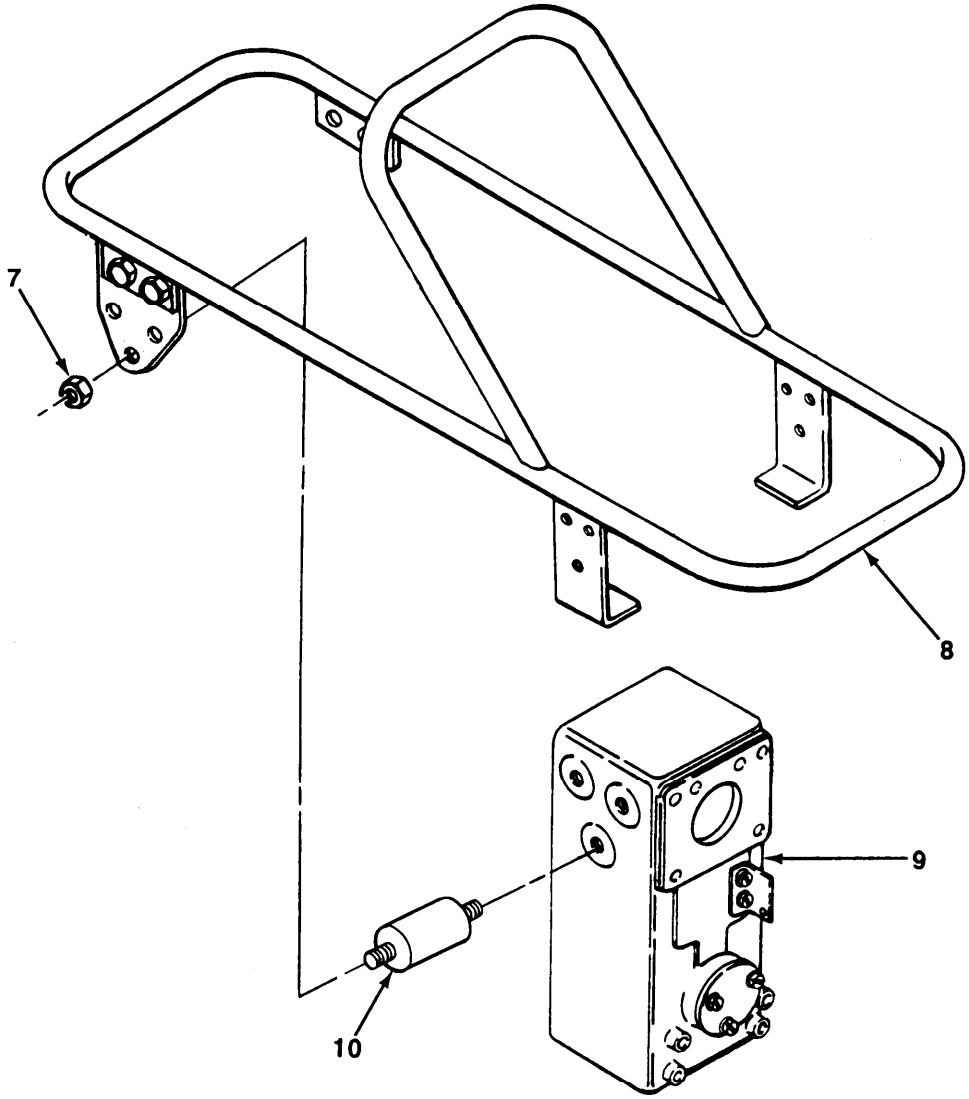

Figure 10-2. Transmission Replacement (VR11).

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10-2. TRANSMISSION ASSEMBLY MAINTENANCE (Con't).

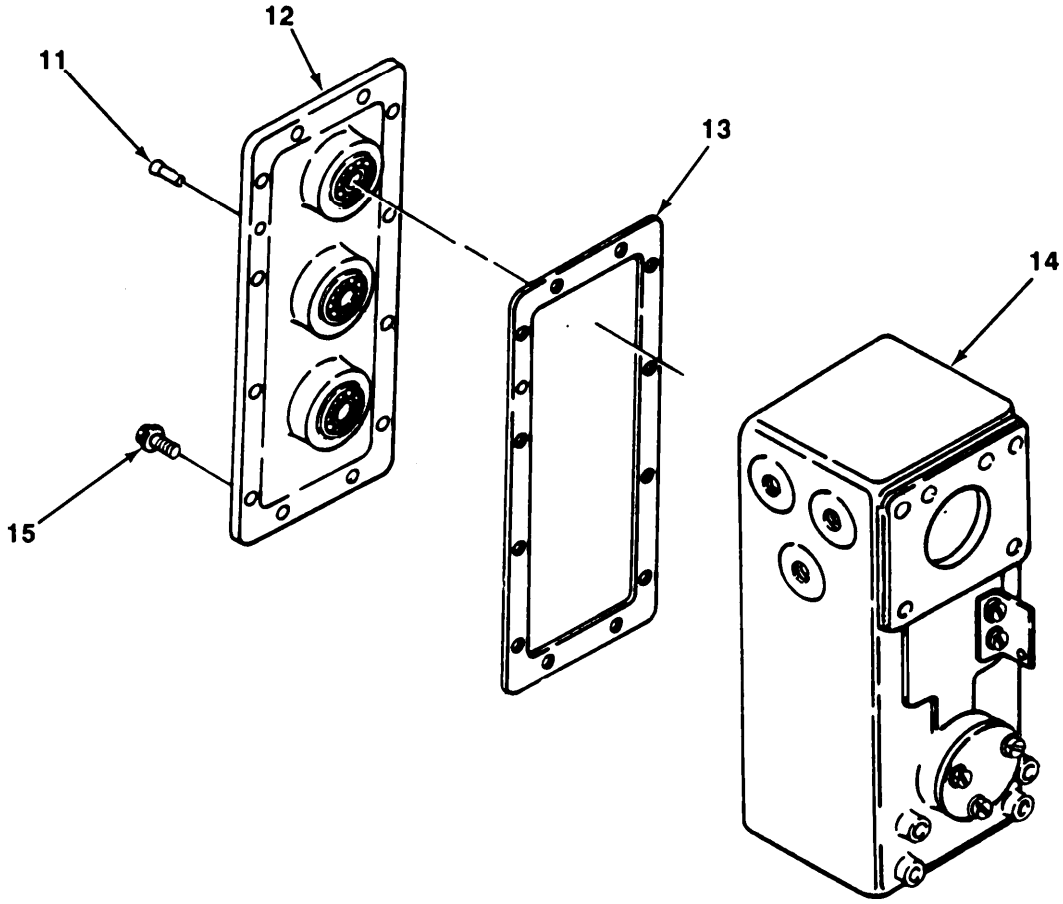

Figure 10-3. Transmission Gearcase Cover Replacement.

NOTE

Refer to Figure 10-4, *Transmlsslon Gearcase Cover Bearings Replacement,* for step b.

b. Remove three bearings (16) from gearcase cover (12).

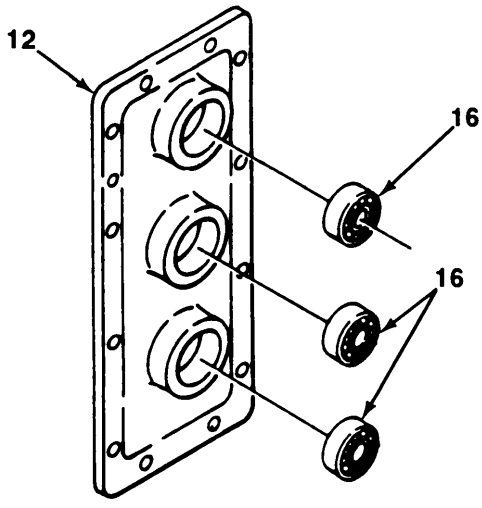

Figure 10-4. Transmission Gearcase Cover Bearings Replacement.

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10-2. TRANSMISSION ASSEMBLY MAINTENANCE (Con't).

NOTE

Refer to Figure 10-5, *Transmlssion Gears Replacement,* for steps c through j.

c. Remove crankshaft (27) and bearing (25) from gearcase (14).

d. Remove bushing (26) from crankshaft (27).

e. Remove retaining ring (17) and spur gear (18) from shaft (21).

f. Remove woodruff key (19) from shaft (21),

g. Remove shaft (21) from gearcase (14).

h. Remove retaining ring (23) and pinion gear (22) from shaft (21).

i. Remove woodruff key (20) from shaft (21).

j. Remove bearing (24) from gearcase (1 4).

NOTE

Refer to Figure 10-6, *Gearcase Speed Cover and Angle Bracket Replacement,* for steps k through m.

k. Remove three screws (32), cover (31), and gasket (30) from gearcase (14). Discard gasket.

1. Remove bearing (33) from gearcase (14).

m. Remove two screws (29) and bracket (28) from gearcase (14).

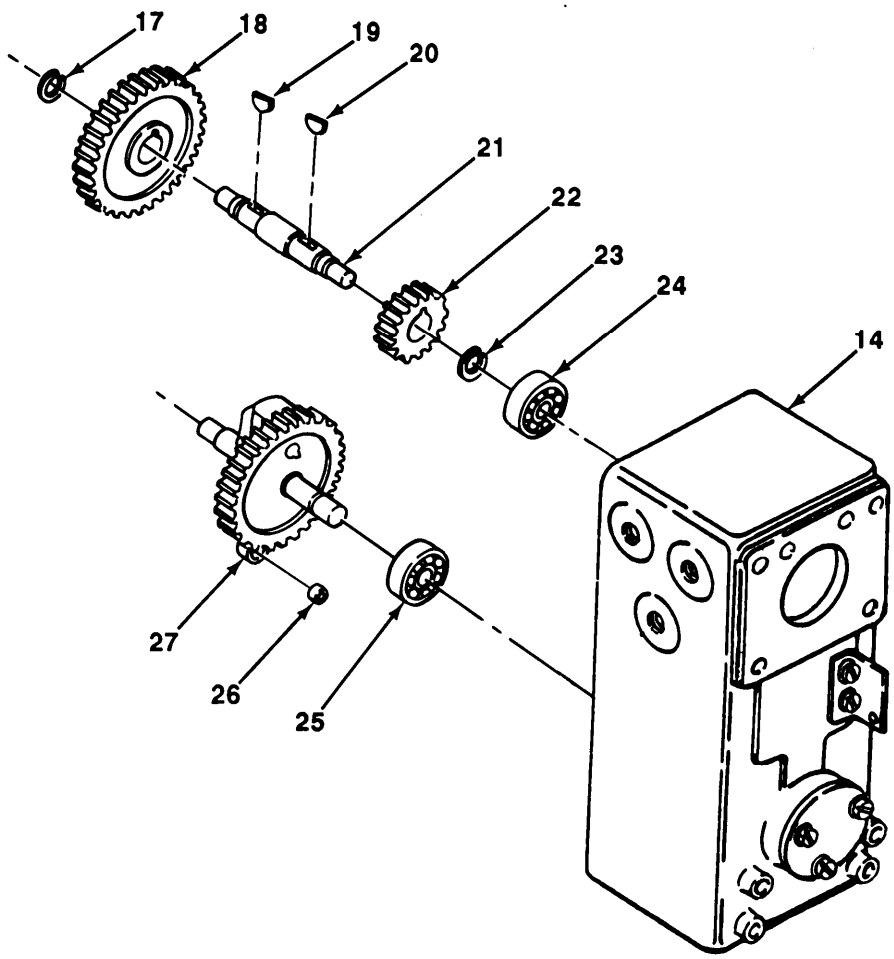

Figure 10-5. Transmission Gears Replacement.

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10-2. TRANSMISSION ASSEMBLY MAINTENANCE (Con't).

CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100°F-138°F (38°C-59"C). if you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

a. Clean parts with dry cleaning solvent (Item 16, Appendix E) and dry with clean rags (Item 15, Appendix E).

b. Inspect parts for damage. Replace damaged parts.

ASSEMBLY

NOTE

Refer to Figure 10-6, *Transmission Gearcase Speed Cover and Angle Bracket Replacement,* for steps a through c.

a. Install bracket (28) on gearcase (14) with two screws (29).

b. Install bearing (33) in gearcase (14).

c. Install new gasket (30) and cover (31) on gearcase (14) with three screws (32).

NOTE

Refer to Figure 10-5, *Transmission Gears Replacement,* for steps d through k.

d. Install bearing (24) In gearcase (14).

e. Install woodruff key (20) on shaft (21),

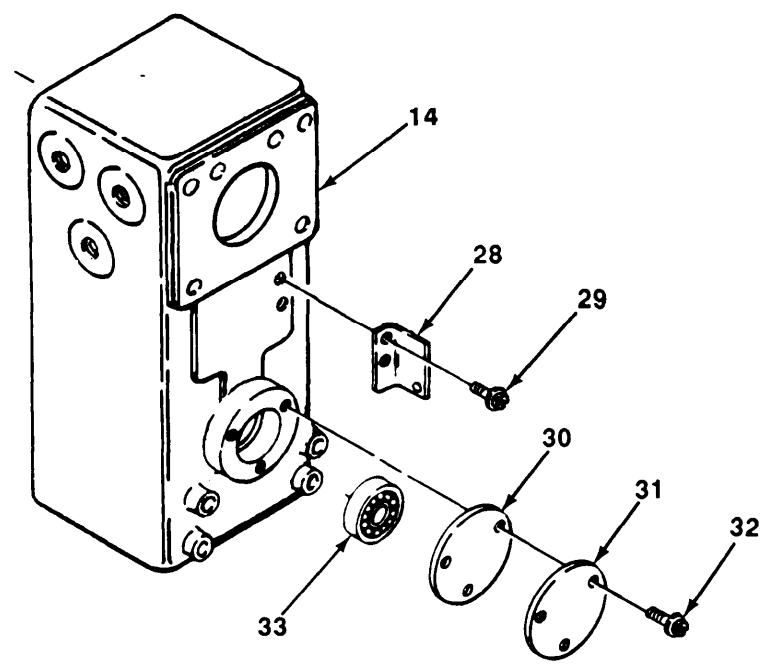

Figure 10-6. Transmission Gearcase Speed Cover and Angle Bracket Replacement.

10-2. TRANSMISSION ASSEMBLY MAINTENANCE (Con't).

f. Install pinion gear (22) on shaft (21) with retaining ring (23).

g. Position shaft (21) in gearcase (14).

h. Install woodruff key (19) in shaft (21).

l. Install spur gear (18) on shaft (21) with retaining ring (17).

j. Install bushing (26) in crankshaft (27).

k. Install bearing (25) and crankshaft (27) in gearcase (14).

NOTE

Refer to Figure 10-4, *Transmlsslon Gearcase Cover Bearings Replacement,* for step l.

1. Install three bearings (16) In gearcase cover (12).

NOTE

Refer to Figure 10-3, *Transmlsslon Gearcase Cover Replacement,* for step m.

m. Install new gasket (13) and gearcase cover (12) on gearcase(14) with 14 screws(15) and two pins (11).

INSTALLATION

NOTE

. Refer to Figure 10-2, *Transmission Replacement (VR11),* for step a.

- Perform step a forVR11 only.

a. Install six resilient mounts (10) and transmission assembly (9) on handle (8) with six nuts (7).

NOTE

- **Refer to Figure 10-1, *Transmlsslon* Replacement *(VR11C),* for step b.**

- Perform step b for VR11 C only.

b. Install six resilient mounts (6) and transmission assembly (5) on handle (4) with six washers (3), new Iockwashers (2), and screws (1).

c. Install engine assembly (see paragraph 6-2).

d. Install lower unit (see paragraph 13-3 or 13-4).

10-3. TRANSMISSION CLUTCH REPLACEMENT

TOOLS:

General mechanic's tool kit . . . . . SC 4910-95-N26
Retaining ring pliers . . . . . SC 4910-95-A31
Mechanical puller kit:
Gear and bearing ., ... SC 4910-95-A31

REMOVAL

a. Remove handle (see paragraph 11-2 or 11-3).

b. Remove engine assembly (see paragraph 6-2).

NOTE

Refer to Figure 10-7, *Transmission Gearcase Cover Replacement,* for step c.

c. Remove 14 screws (5), two pins (1), gearcase cover (2), and gasket (3) from gearcase (4). Discard gasket.

10-3. TRANSMISSION CLUTCH REPLACEMENT (Con't).

NOTE

Refer to Figure 10-8, *Transmlsslon Clutch Shaft Replacement,* for steps d through g.

d. Remove retaining ring (10) and pinion gear (9) from clutch shaft (8).

e. Remove woodruff key (6) from clutch shaft (8). Discard woodruff key.

f. Remove clutch shaft (8) from gearcase (4).

g. Remove bearing (7) from clutch shaft (8).

NOTE

Refer to Figure 10-9, *Tansmlssion Clutch Replacement* for steps h through j.

h. Remove locknut (11) and sleeve spacer (12) from engine (16) crankshaft. Discard locknut.

i. Remove woodruff key (14) and clutch (13) from engine (16) crankshaft. Discard woodruff key.

j. Remove sleeve spacer (15) from engine (16) crankshaft.

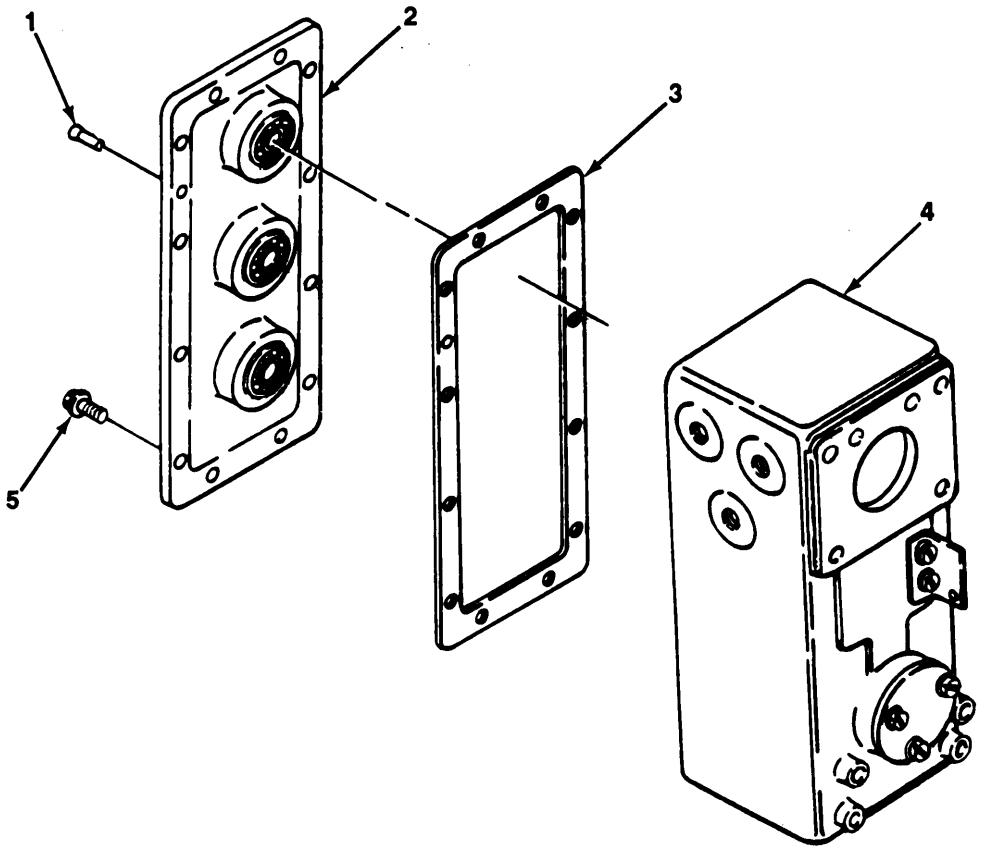

Figure 10-7. Transmission Gearcase Cover Replacement.

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10-3. TRANSMISSION CLUTCH REPLACEMENT (Con't).

INSTALLATION

NOTE

Refer to Figure 10-9, *Transmission Clutch Replacement,* for steps a through c.

a. Install sleeve spacer (15) and clutch (13) on engine (16) crankshaft.

b. Install new woodruff key (14) on engine (16) crankshaft.

c. Install sleeve spacer (12) and new locknut (11) on engine (16) crankshaft.

NOTE

Refer to Figure 10-8, *Transmlsslon Clutch Shaft Replacement,* for steps d through g.

d. Install bearing (7) and clutch shaft (8) in gearcase (4).

e. Install new woodruff key (6) on clutch shaft (8).

f. Install pinion gear (9) on clutch shaft (8).

g. Install retaining ring (10) on clutch shaft (8).

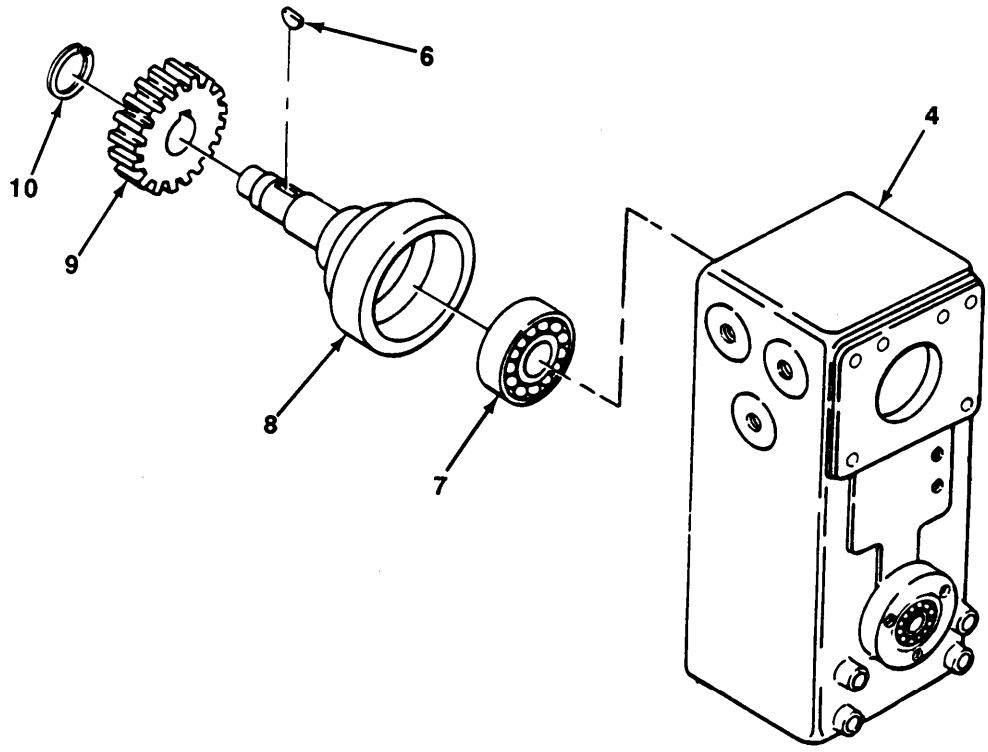

Figure 10-8. Transmission Clutch Shaft Replacement.

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10-3. TRANSMISSION CLUTCH REPLACEMENT (Con't).

NOTE

Refer to Figure 10-7, *Gearcase Cover Replacement,* for step h.

h. Install new gasket (3) and gearcase cover (2) on gearcase (4) with 14 screws (5) and two pins (l).

i. Install engine assembly (see paragraph 6-2).

j. Install handle (see paragraph 11-2 or 11-3).

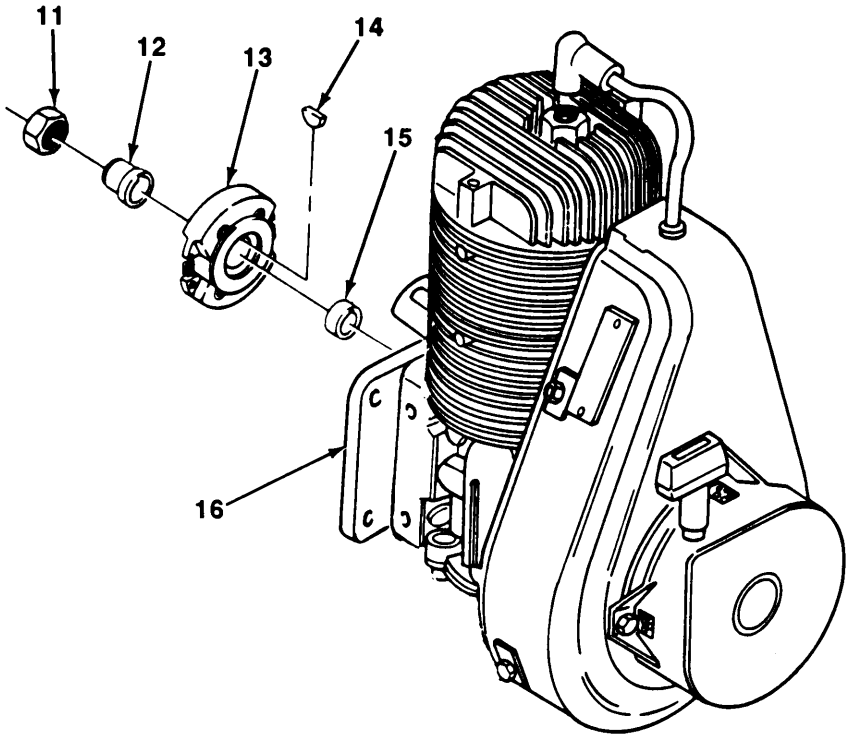

Figure 10-9. Transmission Clutch Replacement.

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CHAPTER 11
FRAME MAINTENANCE

11-1. GENERAL.

All maintenance procedures in this chapter are to be performed by Unit Maintenance.

11-2. HANDLE REPLACEMENT (VR11C).

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

REMOVAL

a. Remove throttle control (see paragraph 7-7).

b. Remove fuel tank (see paragraph 7-5).

c. Remove air cleaner (see paragraph 7-3).

NOTE

Refer to Figure 11-1, *Handle Replacement (VR11C),* for step d.

d. Remove six screws (1), lockwashers (2), washers (3), resilient mounts (6), and handle (4) from transmission (5). Discard lockwashers.

INSTALLATION

NOTE

Refer to Figure 11-1, Handle *Replacement (VR11C),* for step a.

a. Install handle (4) on transmission (5) with six resilient mounts (6), washers (3), new lockwashers (2), and screws (1).

b. Install air cleaner (see paragraph 7-3).

c. Install fuel tank (see paragraph 7-5).

d. install throttle control (see paragraph 7-7).

11-3. HANDLE REPLACEMENT (VR11).

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

REMOVAL

a. Remove throttle control (see paragraph 7-7).

b. Remove fuel tank (see paragraph 7-5).

c. Remove air cleaner (see paragraph 7-4).

NOTE

Refer to Figure 11-2, *Handle Replacement (VR11),* for steps d and e.

d. Remove six nuts (7), handle (4), and six resilient mounts (6) from transmission (5).

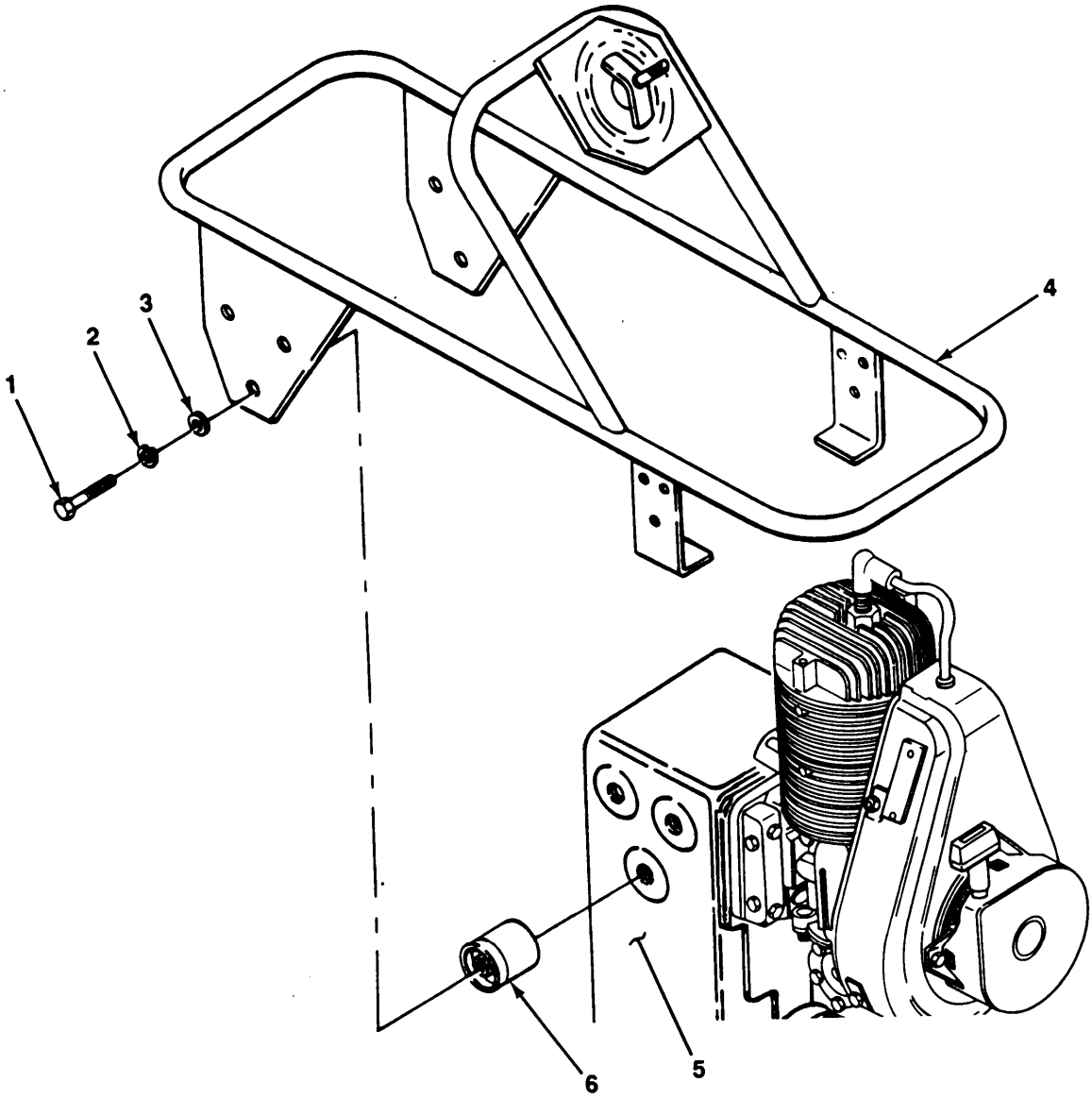

Figure 11-1. Handle Replacement (VR11C).

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11-3. HANDLE REPLACEMENT (VR11) (Con't).

e. Remove four nuts (3), screws (1), and two brackets (2) from handle (4).

INSTALLATION

NOTE

Refer to Figure 11-2, *Handle Replacement (VR11),* for steps a and b.

a. Install two brackets (2) on handle (4) with four screws (1) and nuts (3).

b. Install handle (4) on transmission (5) with six resilient mounts (6) and nuts (7).

c. Install air cleaner (see paragraph 7-4).

d. Install fuel tank (see paragraph 7-5).

e. Install throttle control (see paragraph 7-7)

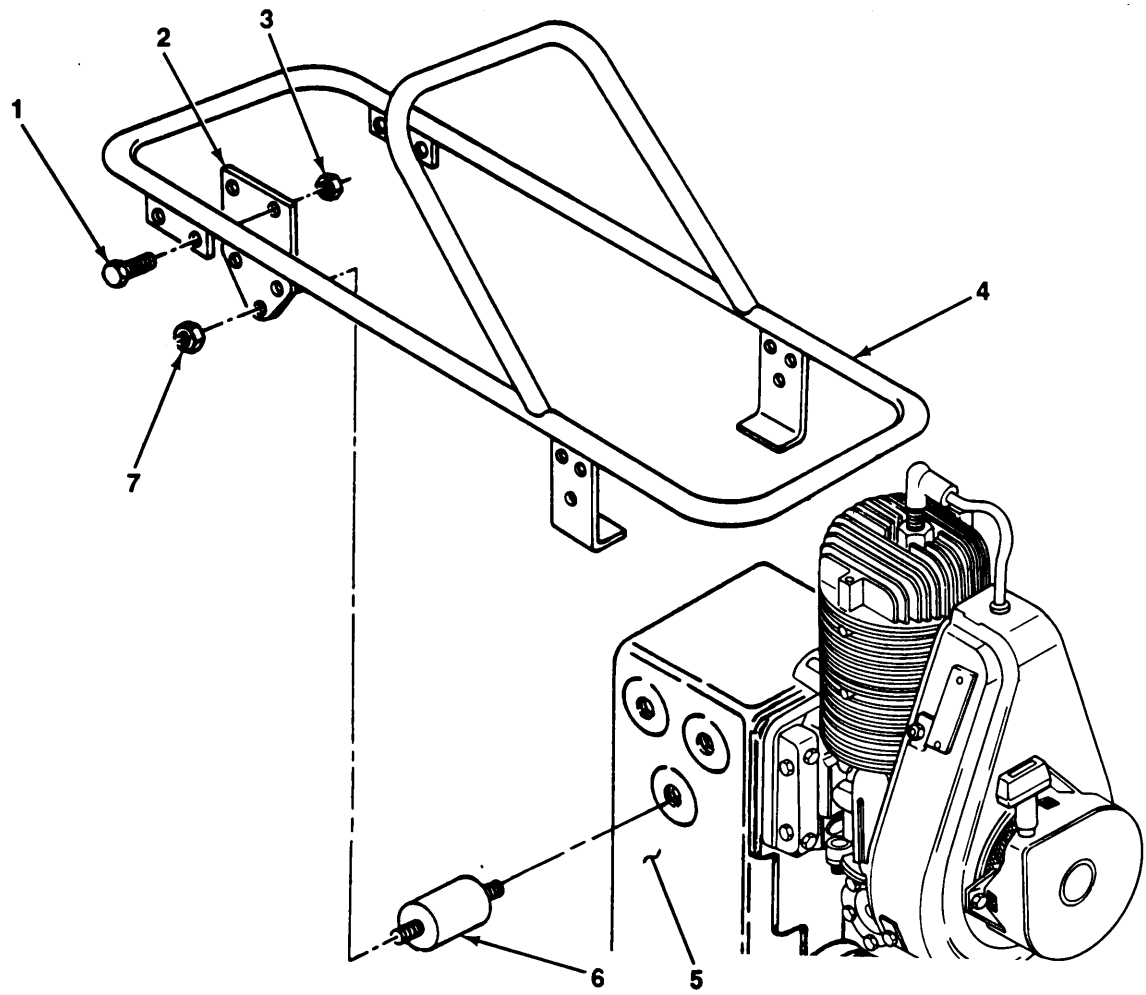


Figure 11-2. Handle Replacement (VR11).

CHAPTER 12
ACCESSORY ITEMS MAINTENANCE

12-1. GENERAL.

All maintenance procedures in this chapter are to be performed by Unit Maintenance.

12-2. DATA PLATES REPLACEMENT

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

NOTE

- **Refer to Figure 12-1, *Data Plate Replacement.***
- **All data plates are replaced the same way. Fuel tank data plate is illustrated.**

REMOVAL

a. Remove data plate (2) from fuel tank(1).

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). if you become dizzy while using cleaning solvent, immediately get fresh air and medical help. if solvent contacts eyes, immediately wash your eyes and get medical aid.

b. Remove remaining adhesive from fuel tank (1) with dry cleaning solvent (Item 16, Appendix E) and allow area to dry.

INSTALLATION

a. Apply adhesive (Item 1, Appendix E) to back of data plate (2).

b. Install data plate (2) on fuel tank (1).

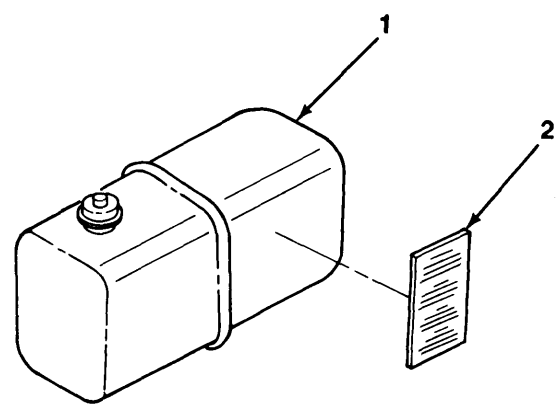


Figure 12-1. Data Plate Replacement.

TA708003

CHAPTER 13
DRIVE MECHANISM MAINTENANCE

Section I. UNIT MAINTENANCE

13-1. TAMPER SHOE REPLACEMENT.

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26

NOTE

- **Refer to Figure 13-1, *Tamper Shoe Replacement.***
- **VR11C and VR11 tamper shoes are replaced the same way. The VR11C is Illustrated.**

REMOVAL

a. Disconnect spark plug (see paragraph 2-9).

b. Remove six screws (3) and tamper shoe (2) from lower unit (1).

INSTALLATION

a. Install tamper shoe (2) on lower unit (1) with six screws (3).

b. Connect spark plug (see paragraph 2-9).

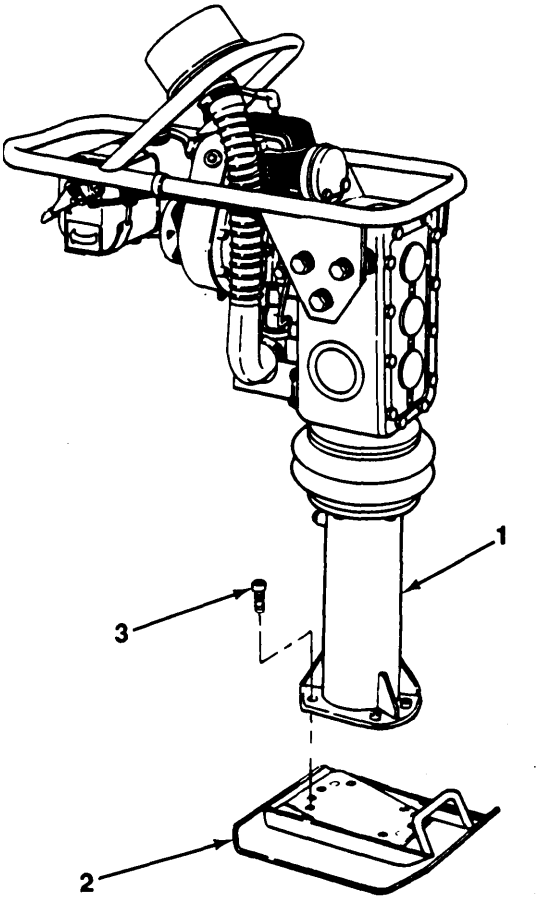


Figure 13-1. Tamper Shoe Replacement.

TA708004

13-2. CHANGING TAMPER OIL.

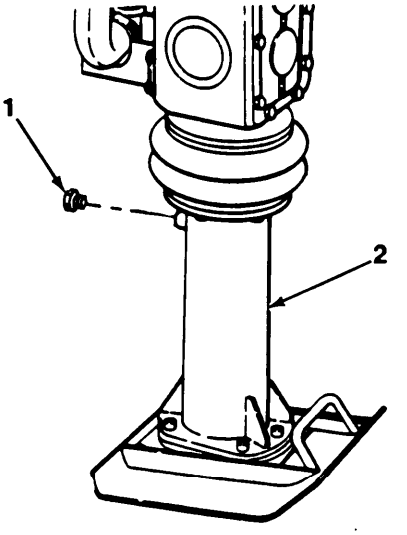
NOTE

- **Refer to Figure 13-2, *Changing Tamper Oil.***
- **The VR11C and VR11 tamper oil is changed the same way. The VR11C is illustrated.**
- **A suitable container should be used to catch any draining oil. Ensure that all spills are cleaned properly.**
- **It maybe necessary to tip the tamper to drain all oil.**

a. Remove oil sight indicator(1) from lower unit (2) and allow oil to drain.

b. Tip tamper on side and fill lower unit (2) with lubricating oil (Item 13, Appendix E) through oil sight indicator (1) opening.

c. Install oil sight indicator (1) on lower unit (2) and stand tamper upright. Oil should be present halfway up oil sight indicator. Add oil as necessary.



5-10#1

Figure 13-2. Changing Tamper Oil.

TA708005

Section II. DIRECT SUPPORT MAINTENANCE

13-3. LOWER UNIT MAINTENANCE (VR11C).

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Mechanical puller kit . . . . . SC 4910-95-CL-A31
Machine bolt (2) . . . . . TM 5-3895-360-24P

REMOVAL

a. Remove tamper shoe (see paragraph 13-1).

NOTE

- **Refer to Figure 13-3, *Draining and Filling Lower Unit 0// (VR11C),* for step b.**
- **A suitable container should be used to catch any draining oil. Ensure that all spills are properly cleaned.**

b. Remove oil sight indicator (2) from lower unit (1) and allow all oil to drain.

NOTE

Refer to Figure 13-4, Lower *Unit Replacement (V11C),* for steps c through e.

c. Remove six screws (7) from upper boot ring (6) and guide tube (11).

d. Push dust boot (8) and upper boot ring (6) down and remove four screws (9) from guide tube (11) and gearcase (3).

e. Remove lower unit (1) and preformed packing (12) from gearcase (3). Discard preformed packing.

f. Push guide tube (11) down and remove two expansion plugs (4) and pin (10) from piston rod (5).

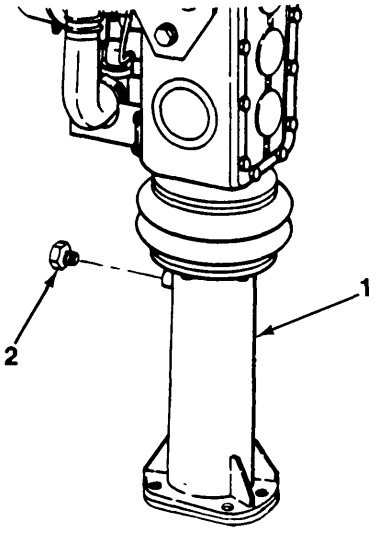


Figure 13-3. Draining and Filling Lower Unit Oil (VR11C).

TA708006

13-3. LOWER UNIT MAINTENANCE (VR11C) (Con't)

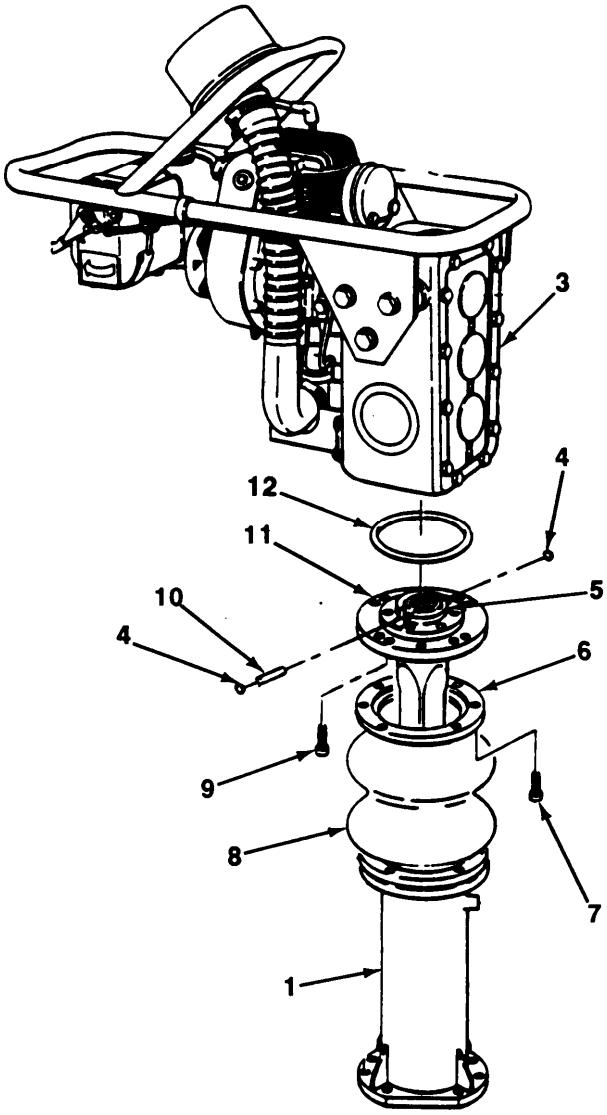


Figure 13-4. Lower Unit Replacement (VR11C).

DISASSEMBLY

NOTE

Refer to Figure 13-5, *Lower* Unit Dissassembly *Bolts Installation and Removal (VR11C),* for steps a and b.

a. Remove two screws (14) from base plate (15).

b. Install two machine bolts (13) on base plate (15).

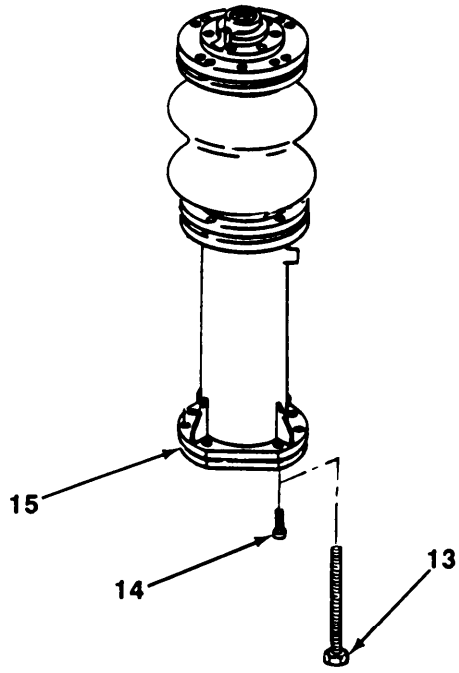


Figure 13-5. Lower Unit Disassembly Bolts installation and Removal (VR11C).

NOTE

Refer to Figure 13-6, Lower Unit *Lower Sprlngs Replacement (VR11C),* for steps c through e.

c. Remove two screws (21) from base plate (15).

WARNING

Base plate is under spring tension. Use care when releasing pressure on plate. Plate may spring up and cause injury to personnel.

d. Alternately remove two machine bolts(13) from base plate (15) approximately ½ in. (13 mm) at a time until all spring tension is released.

e. Remove base plate (15), preformed packing (20), and three springs (17, 18, and 19) from lower unit housing (16). Discard preformed packing.

TA708007

13-3. LOWER UNIT MAINTENANCE (VR11C) (Con't).

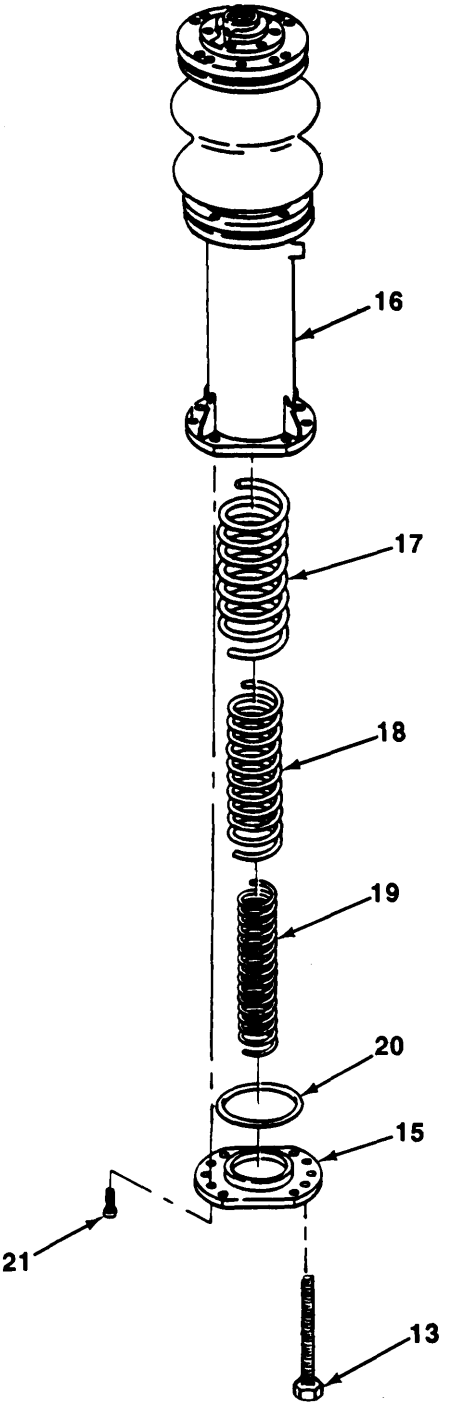


Figure 13-6. Lower Unit Lower Springs Replacement (VR11C).

NOTE

Refer to Figure 13-7, *Piston Rod Replacement (VR11C),* for steps f through L

f. Remove locknut (26), spacer ring (25), piston (24), and spacer ring (22) from piston rod (5). Discard locknut.

g, Remove piston ring (23) from piston (24).

h. Remove two springs (27 and 28), spacer (29), and piston rod (5) from lower unit housing (16).

NOTE

Sleeve bushing may remain With piston or guide tube.

i. Using mechanical puller, remove sleeve bushing (30) from piston rod (5) or guide tube (1 1).

NOTE

Refer to Figure 13-8, *Dust Boot Replacement (VR11C),* for steps J through I.

j. Remove guide tube (11), upper boot ring (6), and dust boot (8) from lower unit housing (16).

k. Remove six locknuts (34), screws (35), and lower boot ring *(31)* from lower unit housing (16), Discard locknuts.

1. Remove two sleeve bushings (33) and short tube guides (32) from lower unit housing (16).

TA708008

13-3. LOWER UNIT MAINTENANCE (VR11 C) (Con't).

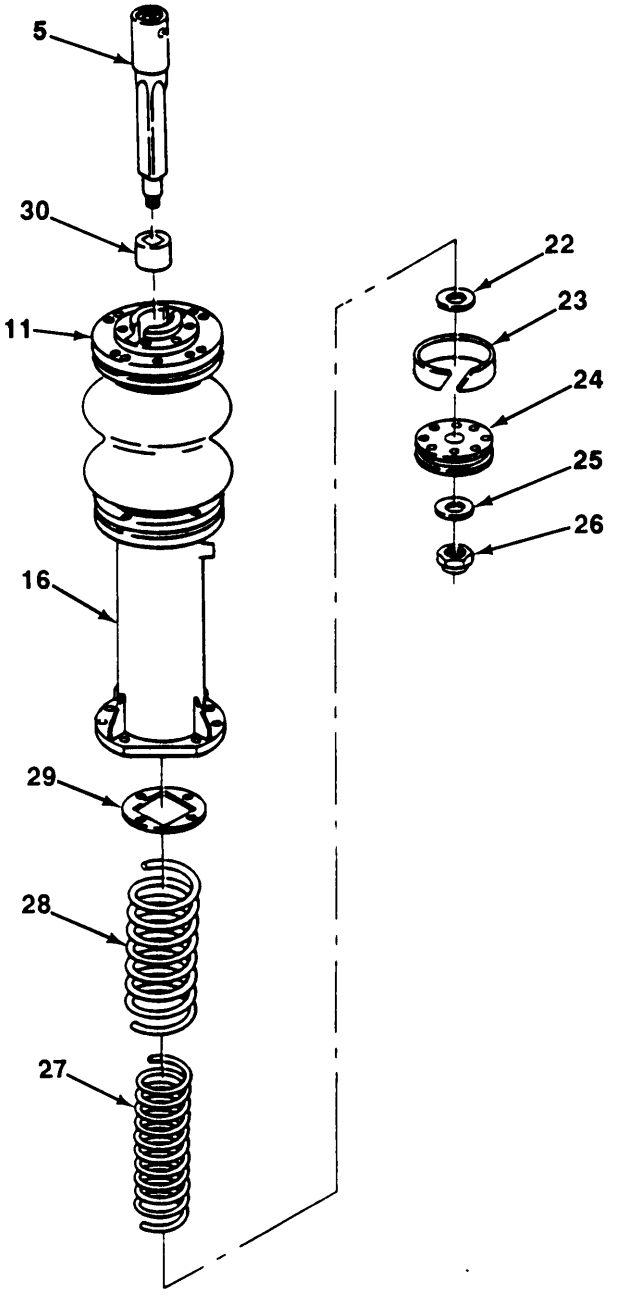


Figure 13-7. Piston Rod Replacement (VR11C).

CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

a. Clean all metal parts with dry cleaning solvent (Item 16, Appendix E) and dry with clean rags (Item 15, Appendix E).

b. Inspect parts for damage. Replace damaged parts.

c. Inspect springs for distortion. Replace springs if distorted.

d. Clean dust boot with dishwashing compound (Item 7, Appendix E) and water and allow to dry.

e. Inspect dust boot for cracks and tears. Replace dust boot if cracked or tom.

ASSEMBLY

NOTE

Refer to Figure 13-8, *Dust Boot Replacement (VR11C),* for steps a through c.

a. Install two short tube guides (32) and sleeve bushings (33) on lower unit housing (16).

b. Install lower boot ring (31) on lower unit housing (16) with six screws (35) and new locknuts (34).

c. Position dust boot (8), upper boot ring (6), and guide tube (11) on lower unit housing (16).

TA708009

13-3. LOWER UNIT MAINTENANCE ('VR11C) (Con't).

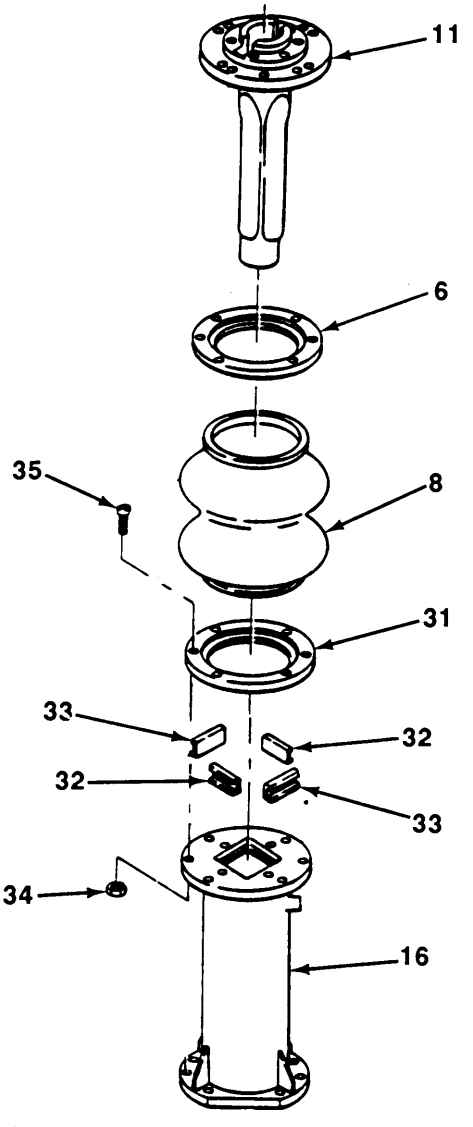


Figure 13-8. Dust Boot Replacement (VR11C).

NOTE

Refer to Figure 13-7, *Piston Rod Replacement (VR11C),* for steps d through g.

d. Install sleeve bushing (30) on piston rod (5).

e. Install piston rod (5), spacer (29), and two springs (27 and 28) in lower unit housing (16).

f. Install piston ring (23) on piston (24).

g. Install spacer ring (22), piston (24), spacer ring (25), and new locknut (26) on piston rod (5).

NOTE

Refer to Figure 13-6, *Lower Unit Lower Springs Replacement (VR11C),* for steps h through j.

h. Position three springs (17, 18, and 19) in lower unit housing (16).

i. Position new preformed packing (20) and base plate (15) on lower unit housing (16) and install two machine bolts (13) evenly.

j. Install two screws (21) on base plate (15).

NOTE

Refer to Figure 13-5, *Lower Unit Disassembly Bolts Installation and Removal (VR11C), for steps k and l*

k. Remove two machine bolts (13) from base plate (15).

l. Install two screws (14) on base plate (15).

INSTALLATION

NOTE

Refer to Figure 13-4, *Lower Unit Replacement (V11C),* for steps a through d.

a. Position new preformed packing (12) and lower unit (1) on gearcase (3).

b. Push down on guide tube(11) *and install pin (1 O) and* two expansion plugs (4) on piston rod (5).

c. install guide tube (11) on gearcase (3) with four screws (9).

d. Install upper boot ring (6) and guide tube (11) on gearcase (3) with six screws (7).

TA708010

13-3. LOWER UNIT MAINTENANCE (VR11C) (Con't).

NOTE

Refer to Figure 13-3, *Draining and Filling Lower Unit oil (V11C),* for steps e and f.

e. Fill lower unit (1) with lubricating oil (Item 13, Appendix E).

f. Install oil sight indicator (2) in lower unit (1).

g. Install tamper shoe (see paragraph 13-1).

13-4. LOWER UNIT MAINTENANCE (VR11).

TOOLS:

General mechanic's tool kit . . . . . SC 5180-90-N26
Mechanical puller kit . . . . . SC 4910-95-CL-A31
Machine bolt (2) . . . . . TM 5-3895-360-24P

REMOVAL

a. Remove tamper shoe (see paragraph 13-1).

NOTE

- **Refer to Figure 13-9, *Draining and FIlling Lower Unit Oil (VR11),* for step b.**
- **A suitable container should be used to catch any draining oil. Ensure that all spills are properly cleaned.**

b. Remove oil sight gage (2) from lower unit (1) and allow all oil to drain.

NOTE

Refer to Figure 13-10, *Lower Unit Replacement (VR11),* for steps c through e.

c. Remove four screws (6) from guide tube (8) and gearcase (3).

d. Push down on guide tube (8) and remove two solid disks (5) and rod pin (7) from piston rod (9).

e. Remove lower unit (1) and preformed packing (4) from gearcase (3). Discard preformed packing,

DISASSEMBLY

Refer to Figure 13-11, *Lower Unit Disassembly Bolts installation and Removal (VR11),* for steps a and b.

a. Remove two screws (11) from base plate (12).

b. Install two machine bolts (1 O) on base plate (1 2).

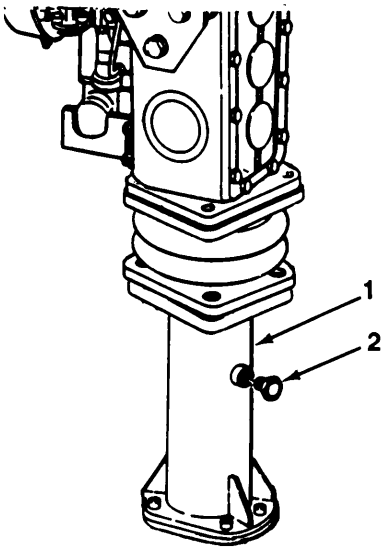


Figure 13-9. Draining and Filling Lower Unit Oil (VR11).

TA708011

13-4. LOWER UNIT MAINTENANCE (VR11) (Con't).

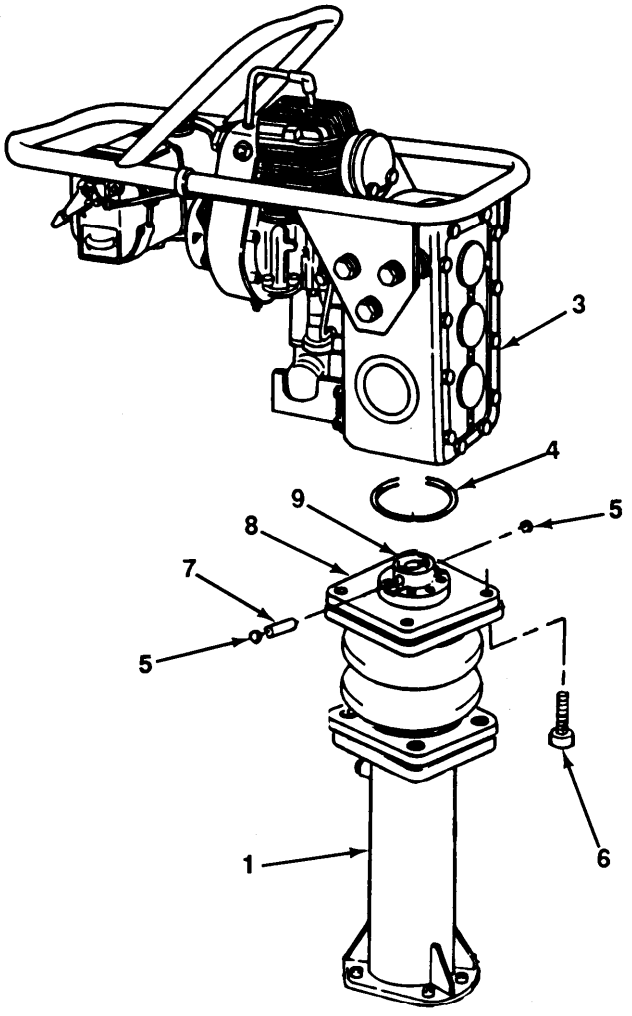


Figure 13-10. Lower Unit Replacement (VR11).

NOTE

Refer to Figure 13-12, *Lower* Unit *Lower Springs Replacement (VR11),* for steps c through e.

c. Remove two screws (18) from base plate (12).

WARNING

Base plate Is under spring tension. Use care when releasing pressure on plate. Plate may spring up and cause injury to personnel.

d. Alternately remove two machine bolts (10) from base plate (12) approximately ½ in. (13 mm) at a time, until all spring tension is released.

e. Remove base plate (12), preformed packing (17), and three springs (14, 15, and 16) from spring housing (13). Discard preformed packing.

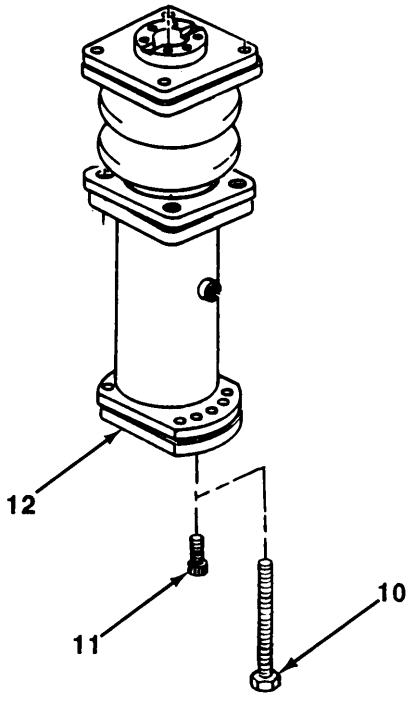


Figure 13-11. Lower Unit Disassembly Bolts Installation and Removal (VR11).

TA708012

13-4. LOWER UNIT MAINTENANCE (VR11) (Con't).

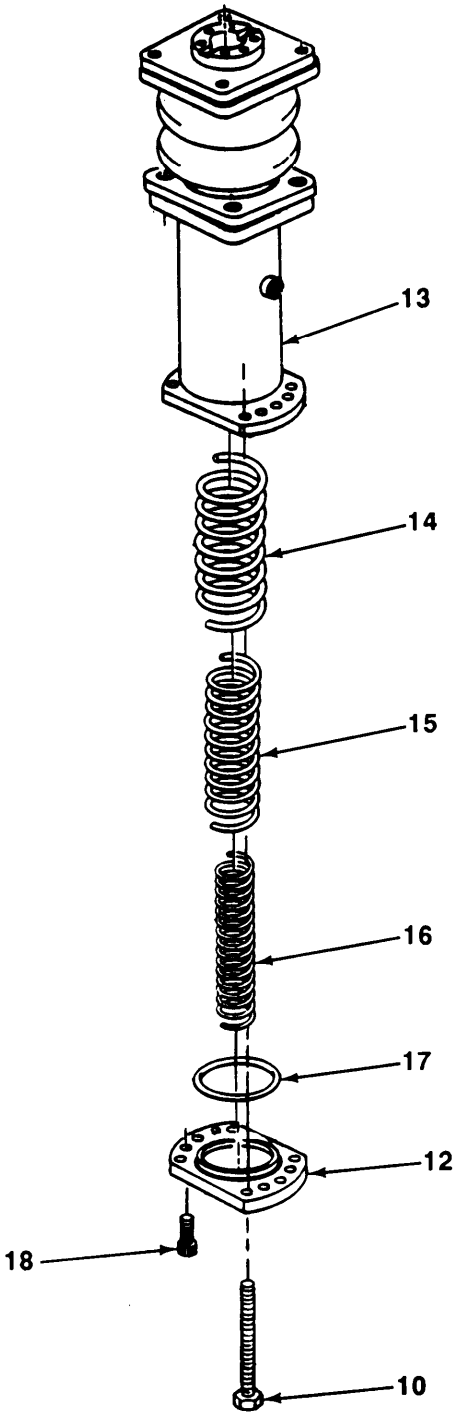


Figure 13-12. Lower Unit Lower Springs Replacement (VR11).

NOTE

Refer to Figure 13-13, *Piston Rod Replacement (VR11),* for steps f through h.

f. Remove locknut (24), piston (23), and washer (22) from piston rod (9). Discard locknut.

g. Remove two springs (20 and 21) and piston rod (9) from spring housing (13).

NOTE

Sleeve bushing may remain with piston rod or guide tube.

h. Using mechanical puller, remove sleeve bushing (19) from piston rod (9) or guide tube (8).

NOTE

Refer to Figure 13-14, *Dust Boot Replacement (VR11),* for steps I and j.

i. Remove guide tube (8), boot retainer (25), dust boot (26), and boot retainer (27) from spring housing (13).

j. Remove retaining ring (28) and sleeve bushing (29) from spring housing (13). Discard retaining ring.

CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

13-4. LOWER UNIT MAINTENANCE (VR11) (Con't).

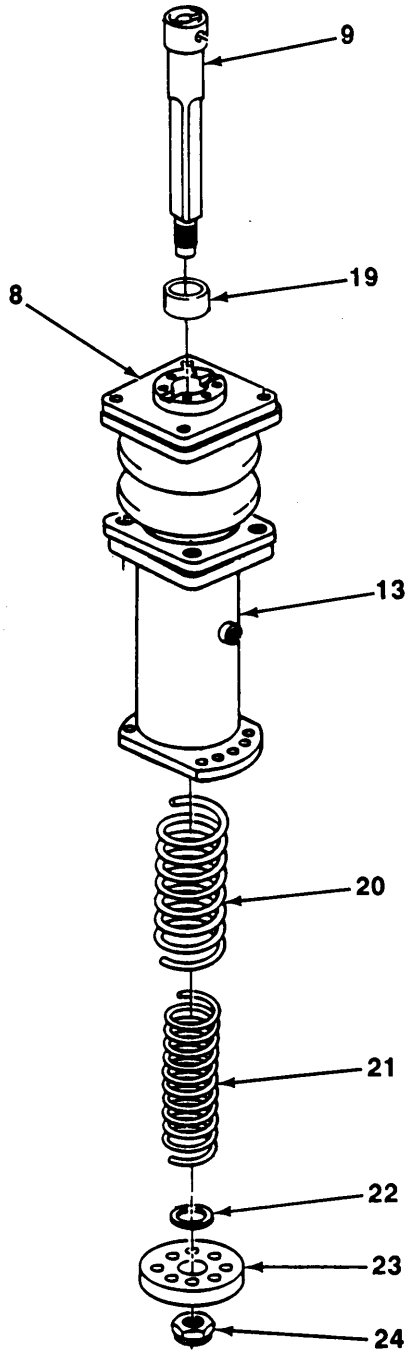


Figure 13-13. Piston Rod Replacement (VR11).

a. Clean all metal parts with dry cleaning solvent (Item 16, Appendix E) and dry with clean rags (Item 15, Appendix E).

b. Inspect parts for damage. Replace damaged parts.

c. Inspect springs for distortion. Replace springs if distorted.

d. Clean dust boot with dishwashing compound (Item 7, Appendix E) and water and allow to dry.

e. Inspect dust boot for cracks and tears. Replace dust boot if cracked or torn.

ASSEMBLY

NOTE

Refer to Figure 13-14, *Dust Boot Replacement (VR11),* for steps a and b.

a. Install sleeve bushing (29) on spring housing (13) with new retaining ring (28).

b. Position boot retainer (27), dust boot (26), boot retainer (25), and guide tube (8) on spring housing (1 3).

NOTE

Refer to Figure 13-13, *Piston Rod Replacement (VR11),* for steps c through e.

c. Install sleeve bushing (19) on piston rod (9).

d. Install piston rod (9) and two springs (20 and 21) in spring housing (13).

e. install washer (22), piston (23), and new locknut (24) on piston rod (9).

NOTE

Refer to Figure 13-12, *Lower Unit Lower Springs Replacement (VR11),* for steps f through h.

f. Position three springs (14, 15, and 16) in spring housing (13).

TA708014

13-4. LOWER UNIT MAINTENANCE (VR11) (Con't).

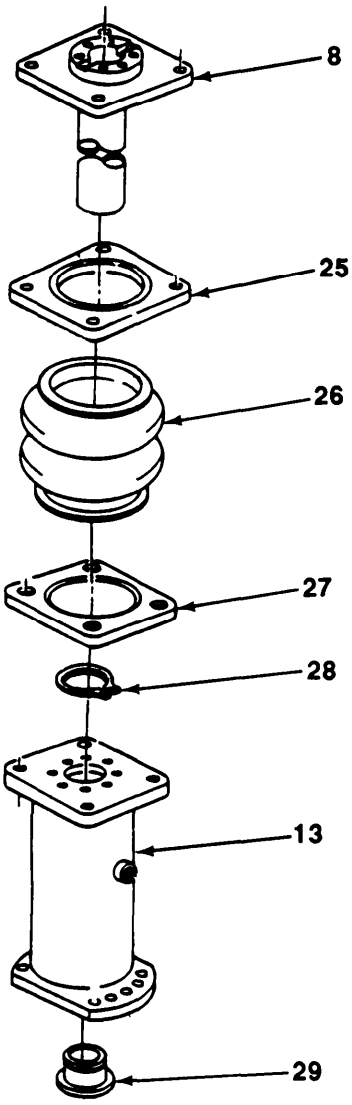


Figure 13-14. Dust Boot Replacement (VR11).

g. Position new preformed packing (17') and baseplate (12) on spring housing (13) and install two machine bolts (10) evenly.

h. Install two screws (18) on base plate (12).

NOTE

Refer to Figure 13-11, *Lower Unit Disassernbly Bolts Installation and Removal (VR11),* for steps I and J.

i. Remove two machine bolts (10) from base plate (12).

j. Install two screws (11) on base plate (1 2).

INSTALLATION

NOTE

Refer to Figure 13-10, *Lower Unit Replacement (VR11),* for steps a through c.

a. Position new preformed packing (4) and lower unit (1) on gearcase (3).

b. Push down on guide tube (8) and install rod pin (7) and two solid disks (5) on piston rod (9).

c. Install four screws (6) on guide tube (8) and gearcase (3).

NOTE

Refer to Figure 13-9, *Draining and Filling Lower Unit Oil (V11),* for steps d and e.

d. Fill lower unit (1) with lubricating oil (item 13, Appendix E).

e. Install oil sight gage (2) on lower unit (1).

f. Install tamper shoe (see paragraph 13-1).

TA708015

APPENDIX A
REFERENCES

A-1 . SCOPE.

This appendix lists all forms, field manuals, technical bulletins, technical manuals, and other publications referenced in this manual and which apply to the Operation, Unit Maintenance, and Direct Support Maintenance of the VR11C and VR11 Backfill Tampers.

A-2. PUBLICATION INDEX.

DA Pam 25-30, Consolidated Index of Army Publications and Blank Forms, should be consulted frequently for latest changes or revisions and for new publications relating to materiel covered in this technical manual.

A-3. FORMS.

Refer to DA Pam 738-750, The *Army Maintenance Management System (TAMMS),* for instructions on the use of maintenance forms.

Equipment Inspection and Maintenance Worksheet . . . . . DA Form 2404
Maintenance Request..... . . . . .. DA Form 5504
Product Quality Deficiency Report.. . . . . SF Form 368
Recommended Changes to Equipment Technical Publications . . . . . DA Form 2028-2
Recommended Changes to Publications and Blank Forms , ... DA Form 2028

A-4. FIELD MANUALS.

First Aid for Soldiers FM21-11
NBC Contamination Avoidance . . . . FM 3-3
NBC Decontamination . . . . FM 3-5
NBC Protection . . . . FM 3-4

A-5. TECHNICAL BULLETINS.

Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks . . . . . TB 750-1047
Presevation of USAMECOM Mechanical Equipment for Shipment and Storage . . . . . TB 740-97-2

A-6. TECHNICAL MANUALS.

Inspection, Care and Maintenance of Antifriction Bearings . . . . . TM 9-214
Materials Used for Cleaning, Preserving, Abrading, and Cementing
Ordnance Materiel and Related Items including Chemicals . . . . . TM 9-247
Operator's Manual for Welding Theory and Application . . . . . TM 9-237
Procedures for Destruction of Equipment to Prevent Enemy Use
(Mobility Equipment Command) . . . . TM 750-244-3
Unit, Direct Support, and General Support Maintenance Repair Parts and
Special Tools Lists for Tamper, Backfill: Gasoline Engine Driven,
Hand-Operated, Ram-Type Model VR11 and VR11C . . . . . TM 5-3895-360-24P

A-7. OTHER PUBLICATIONS.

Army Logistics Readiness and Sustainability . . . . . AR 700-138
Army Medical Department Expendable/Durable items . . . . . CTA 8-100
Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) . . . . . CTA 50-970

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1 . SCOPE.

a. This section provides a general explanation of all maintenance and repair functions authorized at the various maintenance levels,

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance Ievels.

c. Section Ill lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section Ii.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

(1) **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

(2) **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

(3) **Service.** Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

(4) **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters,

(5) **Aline.** To adjust Specified variable elements of an item to bring about optimum or desired performance.

(6) **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

(7) **Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install maybe the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

(8) **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place, “Replace” is authorized by the MAC and is shown as the third position of the SMR code.

B-2. MAINTENANCE FUNCTIONS (Con't).

(9) **Repair.** The application of maintenance services, including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

(10) **Overhaul.** That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i. e., DMWR), Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

(11) **Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. me rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. **Column 1, Group Number.** Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly, End item group number shall be "00."

b. **Column 2, Component/Assembly.** Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. **Column 3, Maintenance Function.** Column 3 lists the functions to be performed on the item listed in Column 2. (For a detailed explanation of these functions, refer to paragraph B-2.)

d. **Column 4, Maintenance Level.** Column 4 specifies, by the listing of a *work time* figure in the appropriate subcolumn (s), the level of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a servilceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembiy/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the Maintenance Allocation Chart. The symbol designations for the various maintenance levels are as follows:

C . . . . . *Unit (Operator or Crew)*
O . . . . . *Unit Maintenance*
F . . . . . Direct Support Maintenance
H . . . . . General Support Maintenance
D . . . . . Depot Maintenance

e. **Column 5, Tools and Equipment.** Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. **Column 6, Remarks.** This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. **Column 1, Tool or Test Equipment Reference Code.** The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. **Column 2, Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.

c. **Column 3, Nomenclature.** Name or identification of the tool or test equipment.

d. **Column 4, National/NATO Stock Number.** The National or NATO Stock Number of the tool or test equipment.

e. **Column 5, Tool Number.** The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. **Column 1, Reference Code.** The code recorded in Column 6, Section II.

b. **Column 2, Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section il.

Section II. MAINTENANCE ALLOCATION CHART (Con't)

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		DS	GS	Depot		
Group Number	Component/Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
01	**ENGINE**								
0100	*Engine Assembly*								
	Engine	Inspect		1.0					
		Service		0.5				1,2,3	
		Replace			3.0			1,4	
		Repair			1.5			1,5,7	
0101	*Crankcase, Block, Cylinder Head*								
	Cylinder	Replace			1.5			1,4,5,7	
		Repair			1.0			1,4	
0102	*Crankshaft*	Replace			1.0			1,4	
	Crankshaft Bearings	Replace			1.0			1,4	
0104	*Pistons and Connecting Rods*	Replace			1.0			1,4,5,7	
	Rings and Bearings	Replace			1.0			1,4,5,7	

Section II. MAINTENANCE ALLOCATION CHART (Con't)

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		DS	GS	Depot		
Group Number	Component/Assembly	Maintenance Function	c	o	F	H	D	Tools and Equipment	Remarks
0107	*Engine Starting Systems*								
	Starter	Replace		1.5				1,2	
		Repair		1.0				1,2	
03	**FUEL SYSTEM**								
0301	*Carburetor Fuel Injector*	Adjust		0.3				1	
		Replace		1.0				1	
		Repair			1.0			1,5	
0304	*Air Cleaner*	Service		0.5					
		Replace		0.5				1	
0306	*Tanks, Lines, Fittings, Headers*								
	Fuel Tank	Replace		1.0				1	
		Repair		1.0				6,8	
0312	*Accelerator Throttle, or Choke Controls*								
	Throttle Control Assembly	Adjust		0.5				1	
		Replace		0.5				1	
		Repair		0.5				1	
04	**EXHAUST SYSTEM**								
0401	*Muffler and Pipes*								
	Muffler	Replace		0.5				1,2	
06	**ELECTRICAL SYSTEM**								
0605	*Ignition Components*								
	Ignition	Replace		1.0				1,2,3	
		Repair		1.0				1,2,3	
	Spark Plug	Replace		0.5				1	
07	**TRANSMISSION**								
0700	*Transmission Assembly*								
	Gear Case	Service		0.3				1	
		Replace			2.0			1,4	

Section II. MAINTENANCE ALLOCATION CHART (Con't)

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintance Level					(5) Tools and Equipment	(6) Remarks
			Unit		DS	GS	DEPOT		
			C	O	F	H	D		
0703	*Transmission Clutch and Clutch Controls*								
	Clutch Shaft Assembly	Replace			2.0			**1,4**	
0719	*Reduction or Transfer Gears, Shafts, and Bearings*								
	Gears, Shafts, and Bearings	Replace			2.0			**1,4**	
15	**FRAME, TOWING ATTACHMENTS, DRAWBARS, AND ARTICULATION SYSTEMS**								
1501	*Frame Assembly*								
	Handle	Replace		1.5				**1**	
	Shock Mounts	Replace		1.5				**1**	
22	**BODY CHASSIS, AND HULL ACCESSORY TEMS**								
2202	Accessory *Items*								
	Carrying Case	Replace		0.5					
74	**CRANES, SHOVELS, AND EARTHMOVING EQUIPMENT COMPONENTS**								
7474	*Drive Mechanism*								
	Lower Unit	Service		0.5				**1**	
		Replace			3.0			**1**	
		Repair			3.0			**1,4**	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Tool or Test Equipment Reference Code	(2) Maintenance LEVEL	(3) Nomenclature	(4) Natlonal/NATO Stock Number	(5) Tool Number
1	0	Tool Kit, General Mechanic's: Automotive	5180-00-177-7033	W33004
2	0	Shop Equipment, Automotive Maintenance and Repair: Common No. 1, Less Power	4910-00-754-0654	W32593
3	0	Shop Equipment, Automotive Maintenance and Repair: Common No. 2, Less Power	4910-00-754-0650	W32730
4	F	Shop Equipment, Automotive Maintenance and Repair: Field Maintenance, Basic, Less Power	4910-00-754-0705	T24660
5	F	Shop Equipment, Automotive Maintenance and Repair: Field Maintenance, Supplemental No. 1, Less Power	4910-00-754-0706	T25619
6	F	Shop Equipment Welding, Field Maintenance	4940-00-357-7260	
7	F	Shop Equipment, General Purpose Repair, Semitrailer Mounted	4940-00-287-4894	T10549
8	F	Tool Kit, Welder's	5180-00-754-0661	

Section IV. REMARKS

Not Applicable.

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1 . SCOPE.

This appendix lists Components of End Item and Basic Issue Items for the VR11C and VR11 Backfill Tampers to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items for the VR11C and VR11 are divided into the following sections:

(1) **Section II Components of End Item (COEI). This listing is for informational purpose only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.**

(2) **Section Ill. Basic issue items (BII).** These are the minimum essential items required to place the tamper in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the tamper during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/ requisition replacement BII, based upon TOE/ MTOE authorizations of the end item.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listing:

(1) **Column (1)** - **Illustration Number (Illus Number).** This column indicates the number of the illustration in which the item is shown,

(2) **Column (2)** - **National Stock Number.** indicates the National Stock Number (NSN) assigned to the item and will be used for requisitioning purposes.

(3) **Column (3)** - **Description.** Indicates the Federal Item Name and, if required, a description to identify and locate the item. The last line for each item indicates the Commercial and Government Entity (CAGE) Code in parentheses, followed by the part number. If item needed differs for different models of this equipment, the model is shown under the “Usable On Code” heading in this column.

Code	Used On
T77	VR11
VRC	VR11C

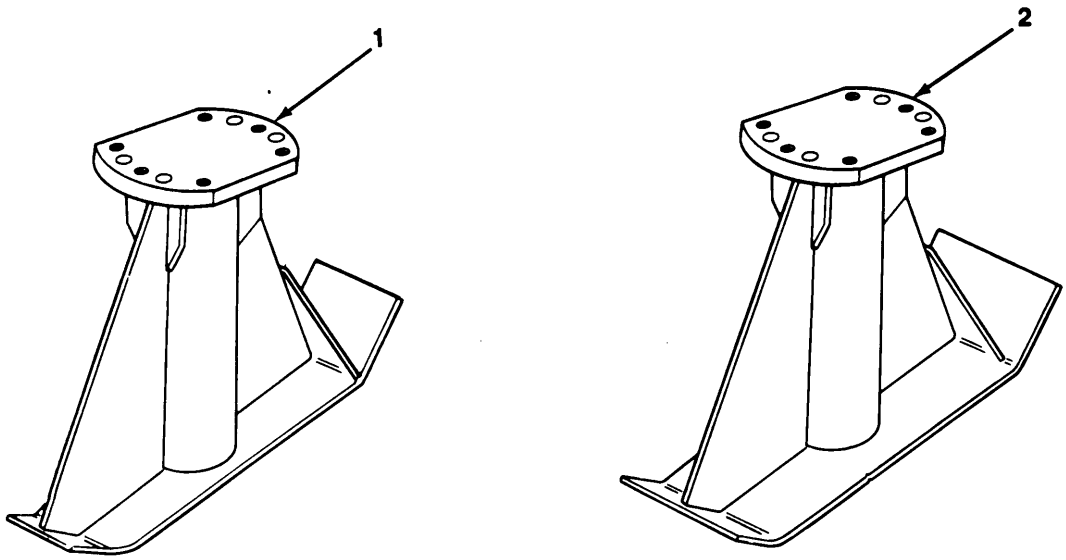
(4) **Column (4)** – **Unit of Measure (U/M).** indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr).

(5) **Column (5)** - **Quantity Required (Qty Req’d).** Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM

There currently are no components of End Item assigned to the VR11C and VR11 Backfill Tampers.

Section III. BASIC ISSUE ITEMS



(1) Illus Number	(2) National Stock Number	(3) Description CAGE and Part Number	Usable on Code	(4) U/M	(5) Qty Req'd
1	3040-01-170-9809	Shoe, Tamper, 4 in. with VRC 14 in. Extension (3341 3) 26889		ea	1
2	3040-01-170-0822	Shoe, Tamper, 6 in. with VRC 14 in. Extension (33413) 22148		ea	1

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APPENDIX D
ADDITIONAL AUTHORIZATION LIST

There currently is no Additional Authorization List assigned to the VR11 C and VR111 Backfill Tampers.

APPENDIX E
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1 . SCOPE.

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the VR11C and VR11 Backfill Tampers. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, *Expendable/Durab/e Items (Except Medical, Class V Repair Parts, and Heraldic Items),* or CTA 8-100, *Army Medical Department Expendable/Durable Items.*

E-2. EXPLANATION OF COLUMNS.

a. **Column (1)-Item Number.** This number is assigned to the entry in the listing and is referenced in the "Initial Setup" of maintenance paragraphs or narrative instructions to identify the material needed (e.g., Dry cleaning solvent, Item 16, Appendix E).

b. **Column (2)-Level.** This column identifies the lowest level of maintenance that requires the listed item.

C - *Operator/Crew*
O - *Unit Maintenance*
F - *Direct Support Maintenance*

c. **Column (3)-National Stock Number.** This is the National Stock Number assigned to the item. Use it to request or requisition the item.

d. **Column (4)-Description.** Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity (CAGE) Code in parentheses followed by the part number, if applicable.

e. **Column (5)-Unit of Measure (U/M).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description (CAGE) Part Number	(5) U/M
1	O	8040-00-664-4318	ADHESIVE: General Purpose, Type II (18876) 9995460 1 Pint Can	pt

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description (CAGE) Part Number	(5) U/M
2	O		ADHESIVE: Loctite (05972) 312-31	
		8040-01-024-6991	50 Milliliter Bottle	ml
3	O	7920-00-061-0038	BRUSH: Scrub (83421)7920-00-061-0038	ea
4	O	7920-00-900-3577	BRUSH: Wire (17987) 15SS	ea
5	F		CLOTH: Abrasive, Crocus (58536) A-A-1206	
		5350-00-221-0872	Package of 50	ea
6	O		COMPOUND: Carbon Removing (0AD61) CARB-N-R1D	oz
		6850-01-085-1423	13 Ounce Can	
7	O		COMPOUND: Dishwashing, Hand (83421) 7930-00-899-9M4	
		7930-00-899-9534	5 Gallon Can	gl
8	O	5350-00-233-7670	COMPOUND: Lapping (1 6587) USBSM30	ea
9	C		GASOLINE: Automotive (81349) MILG3066	
		9130-00-160-1818	1 Gallon Can	gl
		9130-00-160-1817	5 Gallon Can	gl
		9130-00-221-0680	55 Gallon Drum	gl
10	O		GREASE: Automotive and Artillery GAA (81349) MIL-G-1N24	
		9150-00-935-1017	14 Ounce Cartridge	oz
		9150-00-190-09 04	1¾ Pound Can	lb
		9150-00-190-0905	6 ½ Pound Can	lb
		9150-00-190-0907	35 Pound Pail	lb
		9150-00-530-736 9	120 Pound Drum	lb

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description (CAGE) Part Number	(5) U/M
11	C		OIL: Lubricating, Engine (29201) 23394A	
		9150-01-079-2160	8 Ounce Can	oz
12	O		OIL: Lubricating, Engine, OE/HDO 10 (81349) MIL-L-2104	
		9150-00-189-672 91 50-00-188-6668 9150-00-191-2772	1 Quart Can 5 Gallon Can 55 Gallon Drum	qt gl gl
13	O		OIL: Lubricating, Engine, OE/HDO 30 (81349) MIL-L-2104	
		9150-00-186-6681 9150-00-188-9858 9150-00-189-6729	1 Quart Can 5 Gallon Can 55 Gallon Drum	qt gl gl
14	O		PENCIL: Writing 74067) 58-0394-3H	
		7510-00-189-7881	Box of 12	ea
15	C		RAG: Wiping 84067) 7920-00-205-1711	
		7920-00-205-1711	50 Pound Bale	lb
16	O		SOLVENT Dry Cleaning, Type II B1349) P-D-680	
		6850-00-110-4498 6850-00-664-5685 6850-00-281-1985 1850-00-274-5421 850-00-110-4498	1 Pint Can 1 Quart Can 1 Gallon Can 5 Gallon Can 55 Gallon Drum	pt qt gl gl gl
17			TAG: Marker (81 349) MIL-T12755	
		9905-00-5374954	Bundle of 50	ea

APPENDIX F
ILLUSTRATED LIST OF MANUFACTURED ITEMS

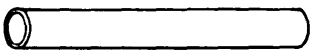
SECTION I. INTRODUCTION

F-1 . SCOPE.

a. This appendix includes complete Instructions for making items authorized to be manufactured or fabricated.

b. All bulk materiels needed for manufacture of an Item are listed by National Stock Number (NSN), part number, or specification number in the manufacturing instructions. All dimensions given are in standard units.

Section II. MANUFACTURING INSTRUCTIONS



1. Make from NSN 4720-00-242-3135, part number 801-4 stock.

2. Cut to proper length.

Figure F-1. Fuel Line.

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APPENDIX G
TORQUE LIMITS

G-1 . SCOPE.

This appendix lists standard torque values, as shown in Table G-1, and provides general information for applying torque. Special torque values and tightening sequences are indicated in the maintenance procedures for applicable components.

G-2. GENERAL.

a. Always use the torque values listed in Table G-1 when the maintenance procedure does not give a specific torque value.

b. Unless otherwise indicated, standard torque tolerance shall be ± 10%.

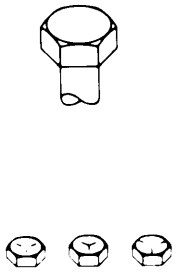
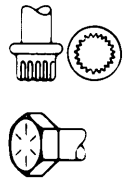
c. Torque values listed are based on clean, dry threads. Reduce torque by 10% when engine oil is used as a lubricant. Reduce torque by 20% if new plated capscrews are used.

d. Capscrews threaded into aluminum may require reductions in torque of 30% or more of Grade 5 capscrews torque. Capscrew threaded into aluminum must also attain two capscrew diameters of thread engagement.

CAUTION

If replacement capscrews are of higher grade than originally supplied, use torque specifications for the original. This will prevent equipment damage due to overtorquing.

Table G-1. Torque Limits.

Current Usage	Much Used	Much Used	Used at Times	Used at Times
Quality of Material	Indeterminate	Minimum Commercial	Medium Commercial	Best Commercial
SAE Grade Number	1 or 2	5	6 or 7	8
Capscrew Head Markings Manufacturer's marks may vary These are all SAE Grade 5 (3 line)				
Capscrew Body Size Inches - Thread	**Torque** lb.-ft. (N•m)	**Torque** lb.-ft. (N•m)	**Torque** lb.-ft. (N•m)	**Torque** lb.-ft. (N•m)
1/4 - 20	5 (7)	8 (11)	10 (14)	12 (16)
1/4 - 28	6 (8)	10 (14)		14 (19)
5/16 - 18	11 (15)	17 (23)	19 (26)	24 (33)
5/16 - 24	13 (18)	19 (26)		27 (37)
3/8 - 16	18 (24)	31 (42)	34 (46)	44 (60)
3/8 - 24	20 (27)	35 (47)		49 (66)
7/16 - 14	28 (38)	49 (66)	55 (75)	70 (95)
7/16 - 20	30 (41)	55 (75)		78 (106)
1/2 - 13	39 (53)	75 (102)	85 (115)	105 (142)
1/2 - 20	41 (56)	85 (115)		120 (163)
9/16 - 12	51 (69)	110 (149)	120 (163)	155 (210)
9/16 - 18	55 (75)	120 (163)		170 (231)
5/8 - 11	83 (113)	150 (203)	167 (226)	210 (285)
5/8 - 18	95 (129)	170 (231)		240 (325)
3/4 - 10	105 (142)	270 (366)	280 (380)	375 (508)
3/4 - 16	115 (156)	295 (400)		420 (569)
7/8 - 9	160 (217)	395 (536)	440 (597)	605 (820)
7/8 - 14	175 (237)	435 (590)		675 (915)
1 - 8	235 (319)	590 (800)	660 (895)	910 (1234)
1 - 14	250 (339)	660 (895)		990 (1342)

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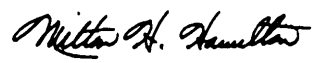

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
05396

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BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
8-2	8-2		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

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Callout (1) should be a screw.

SAMPLE

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THE METRIC SYSTEM AND EQUIVALENTS

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=0.0386 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

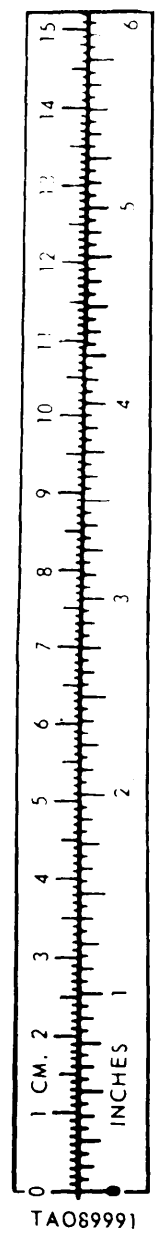
TEMPERATURE

5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 C° +32=F°

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
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

TO CHANGE	TO	MULTIPLY BY
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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