Chapter 5

OVERHAUL PROCEDURES

5-1 GENERAL.

The purpose of this chapter is to present information, illustrations and procedural steps for the overhaul of all repairable assemblies.

5-2 SCOPE.

This chapter provides information of a general nature as well as specific overhaul procedures. These types of maintenance information are divided into the following two groups:

(1) General Maintenance Procedures

(2) Overhaul Procedures

5-2.1 ***General Maintenance Procedures.*** These procedures cover information that constitutes typical or standard shop practices involved in repair operations. Information under this heading will be presented in the following order:

(1) General Removal Instructions

(2) General Disassembly Instructions

(3) General Cleaning Instructions

(4) General Inspection Instructions

(5) General Repair Instructions

(6) General Reassembly and Installation Instructions

5-2.2 ***Overhaul Procedures.*** Overhaul procedures cover specific repair and/or overhaul procedures that can be performed on each subassembly or component. Information under this heading will be presented, as required, in the following order:

(1) Removal

(2) Disassembly

(3) Repair and Replacement

(4) Assembly

(5) Test

(6) Installation

5-3 CONSUMABLE MATERIALS.

The following table contains all consumable materials to be used in servicing the vehicle.

Table 5-1. Consumable Materials

Item	Nomenclature	Specification	Commercial Source
1.	Preservation Oil	Military Spec. MIL-0-8188 MIL-0-6083	
2.	Creosol Base Cleaning Compound	Military Spec. MIL-C-5546	
3.	Aircraft Cleaning Compound	Military Spec. MIL-C-25769	
4.	Rust Preventative	Military Spec. MIL-C-16173	
5.	1,1,1- Trichloroethane	Federal Spec. 0-T-620	
6.	Light Lubricating Oil	VV-L-800	
7.	Cleaning Solvent	Federal Spec. P-D-680 Type II	

Table 5-1. Consumable Materials-Continued

Item	Nomenclature	Specification	Commercial Source
8.	Sodium Carbonate	Federal Spec. O-S-571	
9.	Soap Chips	Federal Spec. P-S-579	
10.	Fluorescent Penetrant	Military Spec. MIL-T25135	
11.	Paint Thinner	Military Spec. MIL-T-81772	Part No. TL-102 for Paint, Item Bostic-Finch Inc. FSCM 98502
12.	Fingerprint Remover Compound	Military Spec. MIL-C-15074	
13.	Corrosion Preventative Compound	Military Spec. MIL-C-6529	
14.	Antiseize Compound	Military Spec. MIL-T-5544	
15.	Pipe-Joint Nonhardening Compound		
16.	Mineral Oil		
17.	Isopropyl Alcohol	TT-I-735	
18.	Rosin Core Solder	ASTM B 284-79	
19.	Lubricant		
20.	Teflon Tape		
21.	Petroleum Jelly		
22.	Chassis Grease		
23.	Loctite 271 Adhesive/Sealant		
24.	Silicone Sealer		RTV732 Dow Corning FSCM 71984
25.	General Purpose Grease	Military Spec. MIL-G-18709	

Table 5-1. Consumable Materials-Continued

Item	Nomenclature	Specification	Commercial Source
26.	Gear Lubricant, SAE 80W-140		
27.	Brake Fluid		
28.	Silicone Lubricant		
29.	Wheel Bearing Grease		
30.	Exterior Spray Paint		
31.	Spray Lubricant		
32.	Bedding and Glazing Compound		
33.	General Purpose Adhesive Cleaner		
34.	Green Paint	Federal Spec. 595	Color No. 24052

5-4 GENERAL MAINTENANCE PROCEDURES.

In addition to procedures for each repairable assembly, this chapter includes general instructions under each of the headings. These instructions apply to all procedures in this manual and no references will be made to them in other procedures. When general instructions are adequate, no reference will be made to those particular operations under the component heading. In addition, Table 5-1 provides a list of consumable materials.

5-4.1 ***General Removal Instructions***. Before removing any part, check the testing and troubleshooting data to determine if the trouble is actually in the component. Also, carefully observe the following procedures.

5-4.1.1 *System Depressurization*. Make sure the system is not energized or pressurized. Disconnect the battery ground cable; relieve all pressure from the hydraulic system and air system. Be sure all controls are in the OFF position before starting any removal procedure.

5-4.1.2 *Clearance*. Ensure that adequate clearance exists for removal of the component. Remove adjacent components if necessary to provide adequate working clearance.

5-4.1.3 *Lifting Devices*. Use a chain hoist, jack or other aid when lifting heavier components.

5-4.1.4 *Identifying Parts*. To facilitate reassembly and installation, apply identifying tags to mating ends of electric and hydraulic lines as they are removed or disconnected.

5-4.1.5 *Valves*. Carefully note or diagram the relationship of valve actuating handles to the body in open and closed position before disassembling these units. At reassembly, make certain that the original relationship is restored.

5-4.1.6 *Salvage*. Assemblies that are removed, even though defective, should be saved for possible reclamation or salvage.

5-4.2 ***General Disassembly Instructions***. The following disassembly instructions apply to all procedures in this chapter. Keep the work area clean to avoid contamination of the internal parts. This is especially important for control valves, cylinders, or hydraulic system components.

5-4.2.1 *Tools*. Do not use any metal tool when removing gaskets, packings, or seals to avoid scratching the sealing surfaces. Use a pointed wooden dowel to remove packings from their grooves. Use wooden or plastic scrapers on gasket surfaces.

5-4.2.2 *Use of Illustrations*. Before disassembly of any item, study the exploded view illustration carefully, paying particular attention to the relationship of internal parts.

5-4.2.3 *Identifying Parts*. To facilitate reassembly and installation, apply identifying tags to mating ends of electric and hydraulic lines when they are

disconnected. Identify parts of similar configuration to ensure correct reassembly.

5-4.2.4 *Storage of Removed Parts*. To prevent moisture and foreign matter from entering open housings, lines and other openings, apply protective covers after disassembly. Wrap all parts in clean paper or dip parts in preservation oil (1, table 5-1).

5-4.2.5 *Limiting Removal of Parts*. Remove only the parts requiring repair or replacement. Do not disassemble a component any further than is necessary.

5-4.3 ***General Cleaning Instructions***. Where instructions call for solvent, use Federal Specification P-D-680 Type II (2, table 5-1) in tanks or spray booth. Do not use gasoline for cleaning. Prior to removal from the truck, the exterior parts of the equipment should be thoroughly cleaned to remove accumulated mud, tar and grease. This procedure will facilitate inspection and disassembly. Use a vapor pressure spray rinse cleaner to clean exterior parts. The following warnings apply to these general cleaning instructions.

WARNING

Spray booth operations must be approved by local bioenvironmental engineer prior to operating.

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and goggles are required.

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

1,1,1-Trichloroethane is toxic to skin, eyes, and respiratory tract. Avoid prolonged or repeated skin contact. Assure adequate ventilation.

5-4.3.1 *Removal of Solvent After Soaking*. After soaking parts in solvent, wash away deposits by slushing or spraying and, where necessary, by brushing with a soft-bristle brush (not wire) moistened in the solvent. Use a jet of dry compressed air to dry parts, except bearings, after cleaning. Bearings must be allowed to drip and air dry.

5-4.3.2 *Removal of Carbon Deposits*. To remove carbon deposits from metal parts, soak parts for at least 75 minutes in a heated mixture of one part creosol base cleaning compound (2, table 5-1) and four parts water. The solution container should be equipped with an exhaust system to expel fumes and should be able to heat the solution to 140°F. Avoid skin and eye contact with aerosol solution.

5-4.3.3 *Dilution of Carbon Cleaning Solution*. All parts that have been soaked in carbon removal solution should be rinsed with cleaning solvent (7, table 5-1). Rinsing should be accomplished in a solvent spray booth equipped with filter and hand spray gun. After soaking, use a soft-bristle brush to remove carbon deposits. A cloth buffing wheel may also be used.

CAUTION

Do not clean tires, lubricant seals, rubber hose or electrical components with cleaning solvent.

WARNING

Aircraft cleaning compound (MIL-C-25769) and P-D-680 Type II are toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

5-4.3.4 *Aircraft Cleaning Compound*. Use aircraft cleaning compound (3, table 5-1), one part compound with four to nine parts cleaning solvent (7, table 5-1), for cleaning rubber, plastic and rubber components. Allow compound to remain on item surface for about 10 minutes before rinsing. Rinse with hot or cold water under pressure. If available, use hot water under 80 to 120 pounds pressure. An ordinary garden hose with nozzle may be used if other equipment is not available. Rinse thoroughly. Aircraft cleaning compound is suitable for rubber or plastic items.

5-4.3.5 *Use of Tools in Cleaning*. Do not use scrapers, wire brushes, abrasive wheels or compounds in cleaning parts, unless these procedures are specifically approved in the detailed instructions. These procedures normally alter the dimensional characteristics of machined surfaces and may weaken a highly stressed part.

WARNING

Rust preventative (MIL-C-16173) is flammable and toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Keep away from open flames and other ignition sources. Good general ventilation is generally adequate.

CAUTION

To prevent corrosion, parts should be dipped in rust preventive (4, table 5-1) within 2 hours of degreasing.

5-4.3.6 *Use of Degreasing Machine.* A degreasing machine may be used to remove heavy grease and oil from metal parts. 1,1,1- Trichloroethane, Federal Specification O-T-620 (5, table 5-1), is used as a degreasing agent.

5-4.3.7 *Bearings.* When cleaning ball or roller bearings, place them in a basket and suspend them in a container of cleaning solvent (7, table 5-1); soak as required. If necessary, use a brush to remove caked grease, chips, etc. Avoid rotating the bearings before solid particles are removed. When bearings have been cleaned, spin them immediately in light lubricating oil (6, table 5-1) to remove solvent.

5-4.3.8 *Preformed Packings.* Do not clean preformed packings or other rubber parts in cleaning solvent. These parts should be wiped clean with a clean, dry, lint-free cloth.

WARNING

Make sure that spray cleaning operation has been evaluated or reviewed by the local bioenvironmental engineer.

5-4.3.9 *Oil Passages.* On removal of parts from degreasing machine and immediately prior to coating with rust preventive, check all oil passages and cavities for cleanliness and freedom from obstructions. A thin, flexible wire should be run through oil passages to make certain that they are not clogged. Using a pressure spray gun and cleaning solvent, clean dirty passages.

CAUTION

Do not use soap or alkalies to clean tank interiors.

5-4.3.10 *Tanks and Reservoirs.* Oil and fuel tanks and similar reservoirs should be flushed, using a spray gun and cleaning solvent (7, table 5-1).

WARNING

Steam or vapor pressure cleaning creates hazardous noise levels and severe burn potential. Eye, skin and hearing protection are required.

5-4.3.11 *Cooling System.* The cooling system radiator core should be cleaned with steam or hot water. If sediment cannot be completely removed by this method, boil the core in a solution of sodium carbonate and water. Use a solution of 1 pound of sodium carbonate (8, table 5-1) to each gallon of water. Flush with clean hot water or steam.

5-4.3.12 *Electrical Parts.* Electrical parts, such as coils, junction blocks and switches, should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean lint-free cloth moistened with cleaning solvent (7, table 5-1).

5-4.3.13 *Batteries.* Clean electrical system battery exterior with a weak solution of baking soda and water. Apply the solution with a bristle brush to remove any corrosive buildup on the battery cable clamps, terminals and battery tray. Rinse thoroughly with fresh water.

5-4.3.14 *Exterior of Vehicle.* Wash painted surfaces of truck with a solution of 1/4 pound of soap chips (9, table 5-1) to 1 gallon of water.

5-4.4 ***General Inspection Instructions.*** Inspection consists of checking for physical distortion, wear, cracks and pitting and of checking dimensions of parts for compliance with requirements of the Table 6-1, Table of Limits. Parts subjected to heavy load pressure must be thoroughly inspected by performing surface temper, magnetic particle or fluorescent penetrant procedures where necessary. Clean all parts before inspection.

NOTE

Defects which may cause bearing binding or misalignment are cause for rejection. Nicks or gouges outside race load areas are not cause for rejection.

The following inspection procedures apply to all subassemblies and parts on the vehicle.

5-4.4.1 *Sealing Surfaces.* Inspect all surfaces in contact with gaskets, packings or seals for nicks, burrs, scratches, etc., which might damage the new seals upon reassembly. If any defect is found, remove it, as outlined under "General Repair Instructions" before reassembly.

5-4.4.2 *Bearings.* Examine bearings for rusted or pitted balls, races or separators. Examine balls and races for brinelling, abrasion and serious discoloration. The following are causes for bearing rejection:

(1) Cuts or grooves parallel to ball or roller rotation.

(2) Fatigue pits (as opposed to minor machine marks or scratches).

(3) Cracks detected during magnetic particle inspection.

5-4.4.3 *Drain Plugs.* When removing drain plugs from engine system components, inspect the sediment adhering to the plug. Accumulations of grit or fine metal particles may indicate actual or potential component failure. A few fine particles are normal. This inspection is effective in determining defective parts before internal inspection of the component.

5-4.4.4 *Gears.* Parameters for rejection of gears by visual inspection are not listed because of varying conditions for gear application. The following descriptions of wear conditions may help to determine when parts are defective.

(1) Normal wear loss of metal from surface of gear tooth resulting from unavoidable abrasion, but to a degree that prevents gear from performing satisfactorily.

(2) Initial pitting - pitting that may occur when gears are first started in service. It may continue only to a stage when local high spots have been worn down so there is still enough contact area to carry load without further impairment. This pitting is not necessarily serious.

(3) Destructive pitting - pitting that continues to progress after initial period of operation, and to such a degree, that there is not enough contact area remaining to carry the load. Rapid destruction may occur from continued operation.

(4) Abrasive wear - surface damage caused by fine particles carried in lubricant or by particles imbedded in tooth surfaces. Particles may be metal detached from gear tooth or bearings, abrasives not completely removed before assembly, sand or scale from castings, or other impurities in oil or surrounding atmosphere.

(5) Slight scoring (scuffing, seizing, galling, etc.) minor impairment of surface, or a welding nature, showing slight tears and scratches in direction of sliding. It starts in area having high combination of surface stress and sliding velocity. It usually occurs at or near the tip of the tooth.

(6) Burning - discoloration and loss of hardness from excessive temperature. This is caused by friction resulting from overload, overspeed, lack of backlash or faulty lubrication. If discoloring can be wiped off with clean cloth, such discoloring usually can be traced to oil-burn stains which are not serious.

(7) Rolling - form of plastic yielding (continuous and permanent deformity in any direction without rupture). This results from heavy, even loads and from sliding.

NOTE

If visual inspection indicates that the gears are unserviceable, perform surface temper or magnetic particle inspection, or both.

5-4.4.5 *Shafts and Splines.* Inspect shaft splines for wear, pitting, rolling or peening and for fatigue cracks. In many instances, the same inspection procedure will apply as for gears. The condition, if still present, will usually be much less pronounced. When serviceability of splines is doubtful, perform a magnetic particle inspection.

5-4.4.6 *Hoses and Tubing.* Check all hose surfaces for broken or frayed fabric. Check for breaks caused by sharp kinks or contact with other parts of the truck. Inspect copper tubing lines for kinks. Inspect the fitting threads for damage. Replace any defective part. Following reassembly and during initial truck operation period, check for leaks.

5-4.4.7 *Wiring Harness.* Inspect all wiring harnesses for chaffed or burned insulation. Inspect all terminal connectors for loose connections and broken parts.

5-4.4.8 *Castings and Weldments.* Visually inspect all castings and weldments for cracks. Parts under great stress may be inspected further, using the magnetic particle inspection method. Critical nonferrous parts may be fluorescent penetrant-inspected.

5-4.4.9 *Steel Components.* A magnetic particle inspection may be performed on steel parts which are not 100 percent replaceable. Such steel parts that have been reworked or reground, or parts containing areas where fatigue can be expected, may be tested. Shear sections and reground contact surfaces shall show no defects. Any evidence of cracks is cause for rejection. Since some stainless steel materials cannot be magnetized, do not perform this inspection on such parts. This inspection shall be performed on all parts as specified in Military Specification MIL-I-6870 and MIL-I-6868 inspection requirements by qualified operators and inspectors. Equipment maintenance and operations shall be in accordance with Military Specification MIL-M-6867. On completion of inspection, pass parts through a demagnetizing field. Then wash and airblow dry.

5-4.4.10 *Foreign Bodies.* Parts shall be rejected if there are indications of nonmetallic foreign bodies gaseous, liquids, or solids longer than 1 inch; if all indications total more than 2 inches; or if indications total less than 1/8 inch apart. Parts shall also be rejected if the following patterns appear:

(1) Bursts - scattered, short sharp lines. Bursts are

caused by high temperatures. Such discontinuities usually are internal and are seldom detected by magnetic particle inspection until the surface is cut to burst area.

(2) Flakes - separate short wavy lines, usually in same general direction. Flakes are caused by improper cooling. Such discontinuities are usually internal and are seldom detected by magnetic particle inspection until surface is cut to flake area.

(3) Grinding cracks - fine sharp lines, tightly packed. In some surfaces, cracks may be shallow and hard to see. Grinding cracks are usually caused by a glazed wheel. Instead of cutting, wheel rubs surface and overheats parts. Such discontinuities are thermal cracks similar to heat-treat and hardening cracks. Grinding cracks also may be caused by too little coolant, too much feed or too much speed.

WARNING

Fluorescent penetrant (10, table 5-1) may cause personal injury. Avoid skin contact. In case of skin contact, wash with warm water and soap.

5-4.4.11 *Fluorescent Penetrant Inspection.* A fluorescent penetrant inspection may be performed on non-steel metallic parts if deemed necessary. Some stainless steel materials cannot be magnetized; perform fluorescent penetrant inspection on such parts. After fluorescent penetrant (10, table 5-1) has been applied and pattern has developed, any evidence of cracks is cause for rejection. This inspection shall be performed on all parts, as described in Military Specification MIL-I-6870, by operators and inspectors certified in accordance with MIL-C-25343 (USAF), as required by Military Specification MIL-I-6870. Equipment maintenance and operations shall follow Military Specification MIL-I-6866.

5-4.5 ***General Repair Instructions.*** The following general repair instructions should be followed when working on, or overhauling, any assembly on the vehicle.

5-4.5.1 *Gear Teeth.* Remove burrs from gear teeth with a fine-cut file or hand grinder.

5-4.5.2 *Starter Commutator.* Starter commutator may be polished in a lathe, using a strip of 00 sandpaper. After polishing, blow all dust and residue from commutator with compressed air.

CAUTION

Precautions should be taken to guard other parts of the vehicle from abrasive dust. Do not work near exposed parts and openings which would allow the dust to reach working parts.

5-4.5.3 *Refinishing.* Chassis and exterior painted parts may be resurfaced where paint is damaged, or where parts have been repaired, by using an abrasive disc.

5-4.5.4 *Bearings.* Remove residue and oil stain from bearing races with crocus cloth.

WARNING

Paint thinner is flammable and toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Keep away from open flame or other ignition sources. Good general ventilation is usually adequate.

5-4.5.5 *Preparation of Surfaces for Painting.* Before resurfacing, scrape loose any blistered paint from damaged areas. Sand or buff area to be painted. Remove any residual cleaning material with paint thinner (11, table 5-1) and dry thoroughly.

NOTE

Polished and machined steel parts are not protected by cadmium, tin, copper or other plating or surface treatment. Bare metal surfaces must be free of moisture. Acid from perspiration and skin oils may attack steel surfaces if fingerprints are not removed. Dip parts in fingerprint remover compound (12, table 5-1) after handling to prevent such action.

5-4.5.6 *Preservation of Steel Parts.* Bare steel surfaces shall be protected from oxidation while awaiting any repair step, reinspection or reassembly by dipping the parts in, or spraying them with, corrosion preventive compound (13, table 5-1). The same protective coating shall be applied to other metal parts in accordance with prevailing climatic or atmospheric conditions. Aluminum parts may require protection in high salt atmospheres. Steel parts must be protected in all instances.

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with the proper tinted lens are required. Also, gloves, apron and welding boots are required.

5-4.5.7 *Welding and Brazing.* Welding and brazing processes may be used to repair cracks in external steel parts, such as brackets, panels and light framework. However, the time required, the difficulty of working with the metal, and the chance of embrittlement and subsequent failure make such repairs of questionable value. Hence they should be attempted only when replacement parts are not available. Welding and brazing of castings and running parts or parts under great stress is not permissible, except in emergencies.

5-4.5.8 *Stud Installation.* When installing studs in engine block and axle housings, use a proper driver. A worn stud driver may damage the end thread, making it necessary to use a chasing die before a nut can be screwed on. This procedure will remove cadmium plating and allow corrosion, which will make future disassembly difficult, and will cause the stud to be backed out with nut. Before driving a stud, inspect hole for chips and liquid. Blow out any foreign matter. Start stud by hand. If it will not start into hole, it is too large or has a defective end thread. Before final insertion, coat thread with a film of antiseize compound (14, table 5-1). Turn stud in slowly to prevent overheating and galling of casting metal. Drive stud to proper "setting height", which is the total projecting length. While driving, observe torque required. This must be greater than nut tightening torque for same size, but not enough to damage casting as stud approaches its correct engagement depth.

5-4.5.9 *Electrical Wiring.* Replace all broken, worn or burned electrical wiring. Wires with several broken strands must be replaced. Broken strands increase the resistance of the wire and impair efficiency of the electrical components, especially the ignition system.

5-4.5.10 *Hydraulic Lines and Hoses.* Replace all broken, frayed, crimped or soft flexible lines and hoses. Replace fittings which are stripped or damaged. Replace entire flexible hose if fittings are damaged. Make sure the hose clamps do not crimp hoses.

5-4.5.11 *Thread Repair.* Replace any bolt, screw, nut or fitting with damaged threads. Inspect tapped holes for thread damage. At times, merely chasing the threads with the proper size tap or die will be adequate. If cross-threading or spalling is evident, retap the hole for the next oversize screw or stud. When retapping will result in weakening the part, or when the cost of the part makes retapping impractical, replace the damaged part.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required.

5-4.5.12 *Body Repair.* Straighten minor body dents by bumping with a soft-faced hammer while using a wooden block backing. Repair minor skin cracks by installing patches according to standard shop practice. Reshape elongated mounting holes to round. Drill to receive bushing with required inner diameter. Stake bushing in place with center punch.

5-4.5.13 *Air Hoses.* Replace all broken, frayed, crimped or soft hoses. Replace fittings which are stripped or damaged. Replace entire hose if fittings are damaged.

5-4.6 ***General Reassembly and Installation Instructions.*** Before installing any item according to the following procedures, be sure parts are clean and protective grease coatings on new parts are removed.

5-4.6.1 *Mandatory Replacement Parts.* Whenever possible, replace all gaskets, packings and seals removed during repair work. Similarly all lockwire, lockwashers, cotter pins and like items should be replaced at time of reassembly.

5-4.6.2 *Installing Preformed Packings.* To replace a preformed packing, first dovetail groove, then stretch packing and place into position. Rotate component on flat surface and apply a downward pressure to uniformly press the packing into position.

5-4.6.3 *Pipe Fittings.* Use pipe-joint nonhardening compound (15, table 5-1) or teflon tape (20, table 5-1) when joining pipe fittings.

5-4.6.4 *Installation of Oil Seals.* Install oil seals with seal lip facing in, applying an even force to the outer edge of seal. Coat oil seals evenly with oil or grease before installing. If oil seals are to be installed over keyed or splined shafts, use a guide to prevent sharp edge of the keyway of splines from cutting the leather and neoprene seal. Guides can be constructed of very thin gauge sheet metal and shaped to the required diameter. However, make certain the guide edges are not sharp and are bent slightly inward so they do not cut the seal.

5-4.6.5 *Installation of Bearings.* When mounting bearings on shafts, always apply force to the inner races. When mounting bearings into housing, always apply the force to the outer race.

5-4.6.6 *Lubrication of Preformed Packings.* Lubricate all preformed packings with a thin coat of mineral oil (16, table 5-1) before installation.

5-4.6.7 *Lubrication of Bearings.* Lubricate bearings before reassembly with the lubricant normally used in the related housing or container. This will provide lubrication during the first run-in until lubricant from the system can reach the bearings.

5-4.6.8 *Use of Identification Data in Installation.* Refer to identifying tags and sketches made at removal to assist in installation of parts.

5-4.6.9 *Testing.* Test operation of parts after installation. Inspect for leaks, vibration, noise, misalignment, etc. Recheck after a few days operation.

5-5 OVERHAUL PROCEDURES.

The following paragraphs contain overhaul procedures for systems and components of the vehicle. The major assemblies are covered by the following groups of procedures:

(1) Engine (paragraph 5-5.1)
(2) Transmission (paragraph 5-5.2)
(3) Transfer Case and Propeller Shaft (paragraph 5-5.3)
(4) Steering (paragraph 5-5.4)
(5) Front Axle and Suspension (paragraph 5-5.5)
(6) Rear Axle and Suspension (paragraph 5-5.6)
(7) Brakes and Wheels (paragraph 5-5.7)
(8) Frame (paragraph 5-5.8)
(9) Body (paragraph 5-5.9)
(10) Cab Interior (paragraph 5-5.10)

Figure 5-1 shows the general location of each of the ten preceding major assemblies. Refer to the Table of Contents to find the desired component coverage.

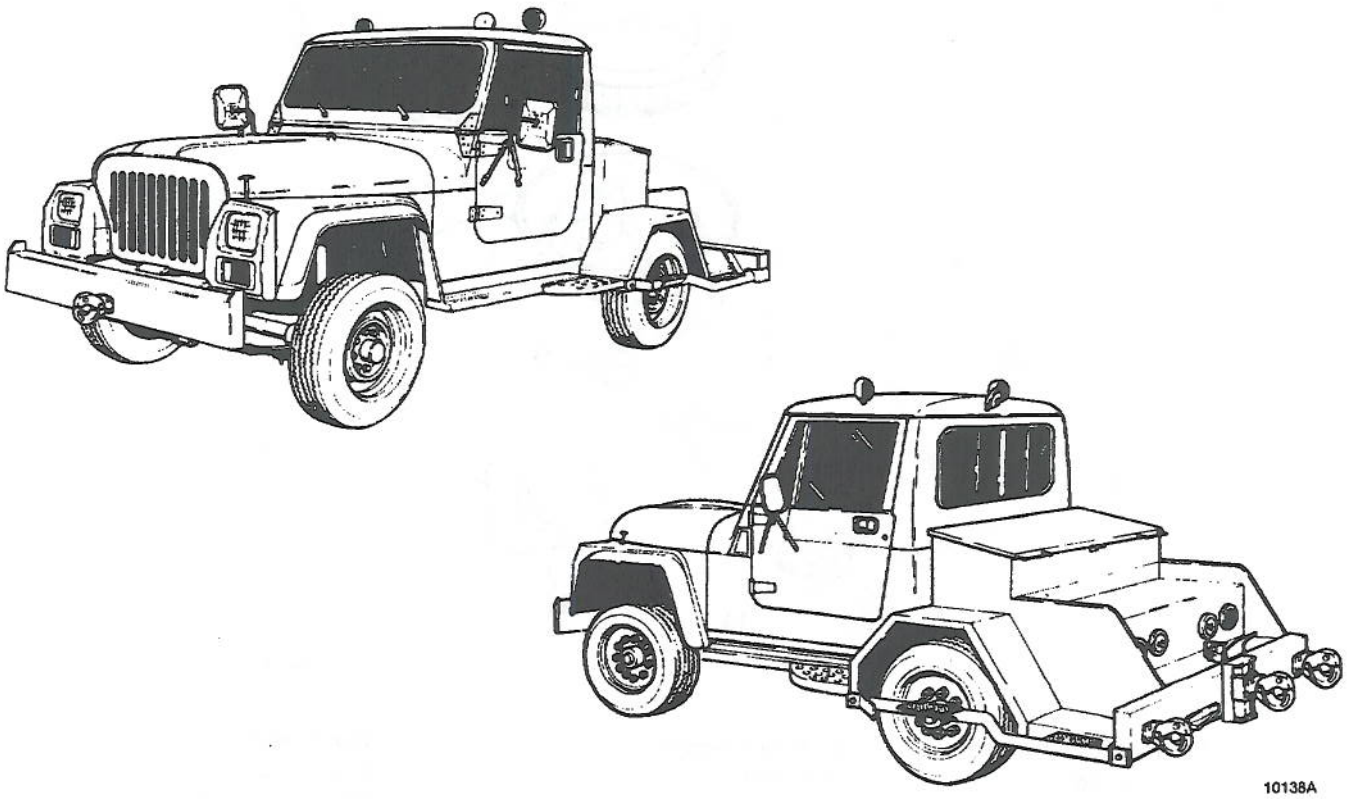


Figure 5-1. Flightline Tow Tractor, Model No. 3

5-5.1 *Engine*. The following procedures are for components that make up the engine assembly. These components are mounted on or near the engine assembly or are needed to allow engine operation as provided in the following paragraphs.

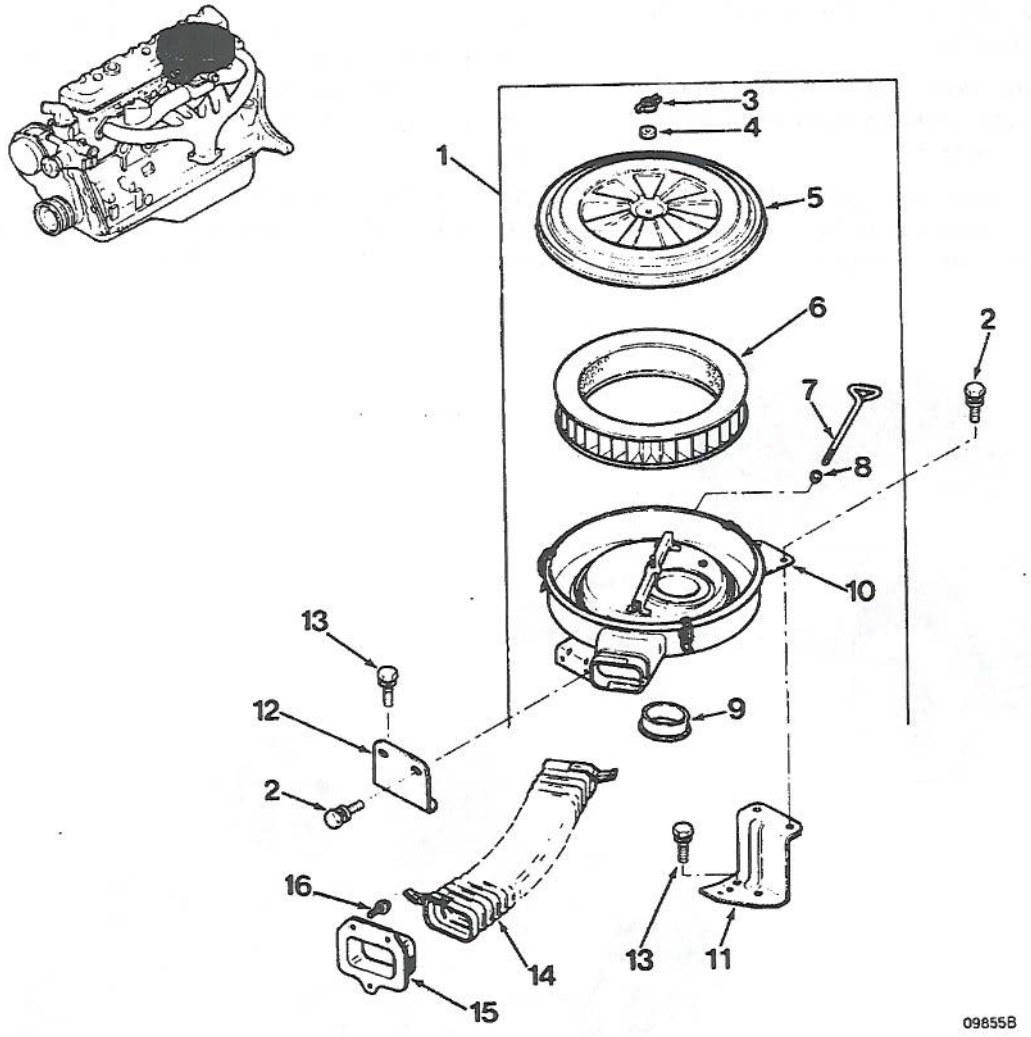
5-5.1.1 *Air Filter Assembly and Duct Group*. Refer to figure 5-2, and perform the following steps to overhaul the air filter assembly and duct group.

a. Removal and disassembly. Remove and disassemble the air filter assembly and duct group as follows:

(1) Remove capscrews (16) and air intake adapter (15).

(2) Remove screws and washers (2) from front support (12).

(3) Remove screws and washers (2) from rear support (11).



1. Air Cleaner Assembly
2. Screw and Washer
3. Wing Nut
4. Wing Nut Packing
5. Cover Assembly
6. Element Assembly
7. Band Bolt
8. Band Bolt Grommet
9. Air Cleaner Mounting Insulator
10. Air Cleaner Body
11. Rear Support
12. Front Support
13. Screw and Washer
14. Air Intake Duct Assembly
15. Air Intake Adapter
16. Capscrew

Figure 5-2. Air Filter Assembly and Duct Group

(4) Remove wing nut (3), wing nut packing (4) and cover assembly (5).

(5) Remove element assembly (6).

(6) Remove band bolt (7) and band bolt grommet (8).

(7) Remove air cleaner body (10) from engine.

(8) Remove air cleaner mounting insulator (9).

(9) Remove air intake duct assembly (14) from air cleaner body (10).

(10) Remove screws and washers (13) and front support (12).

(11) Remove screws and washers (13) and rear support (11).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, clean and inspect the following:

(1) Inspect air cleaner body (10), cover assembly (5), front support (12), rear support (11) and wing nut packing (4) for damage.

(2) Inspect air intake duct assembly (14) for damage or obstructions.

(3) Check element assembly (6) maintenance schedule.

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi. Eye protection is required.

(4) Clean serviceable element assembly (6) with compressed air blown through element assembly (6) in direction opposite normal airflow.

c. Repair and replacement. Replace all worn or damaged parts. Replace element assembly (6) at scheduled maintenance time or if extremely dirty or damaged. Refer to table 4-2 for maintenance schedule.

d. Assembly and installation. Assembly is accomplished during installation. Install the air filter assembly and duct group as follows:

(1) Install screws and washers (13) and rear support (11) on engine.

(2) Install screws and washers (13) and front support (12) on engine.

(3) Install air intake duct assembly (14) on air cleaner body (10).

(4) Install air cleaner mounting insulator (9).

(5) Install air cleaner body (10).

(6) Install band bolt (7) and band bolt grommet (8) on air cleaner body (10).

(7) Install element assembly (6).

(8) Install cover assembly (5), wing nut packing (4) and wing nut (3).

(9) Install screws and washers (2) through air cleaner body (10) to rear support (11).

(10) Install screws and washers (2) through air cleaner body (10) to front support (12).

(11) Install air intake adapter (15) and capscrews (16).

(12) Connect air intake duct assembly (14) to air intake adapter (15).

5-5.1.2 *Positive Crankcase Ventilation System.* Refer to figure 5-3, and perform the following steps to overhaul the PCV system.

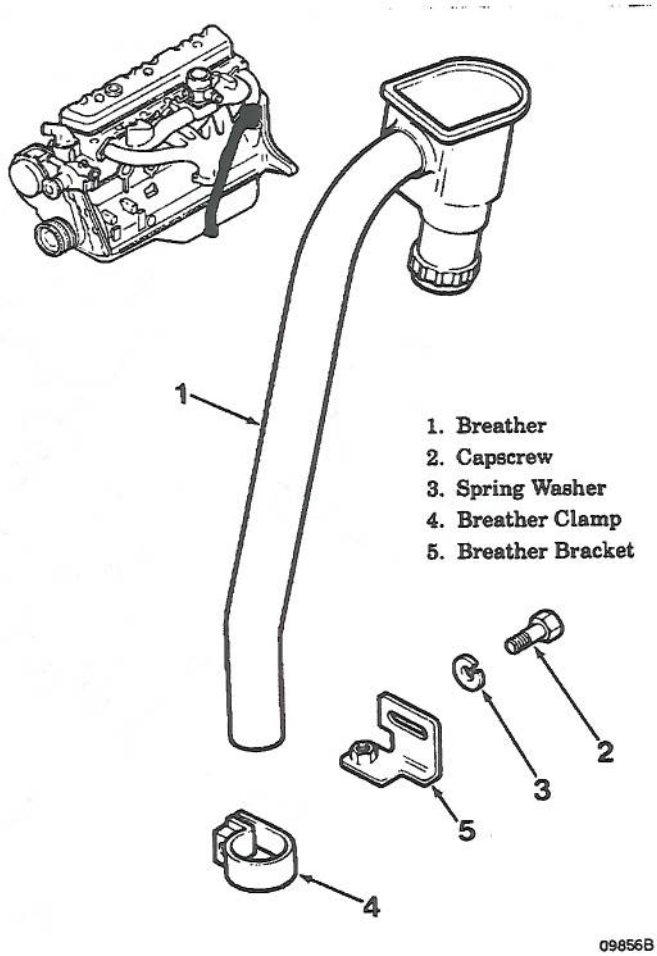


Figure 5-3. Positive Crankcase Ventilation System

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the PCV system as follows:

(1) Remove breather clamp (4) from breather (1) hose.

(2) Remove capscrew (2), spring washer (3) and breather bracket (5).

(3) Remove breather (1).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.

c. Repair and replacement. Replace all defective parts.

d. Assembly and installation. Assembly is accomplished during installation. Install as follows:

(1) Install breather bracket (5) and breather (1).

(2) Install spring washer (3) and capscrew (2).

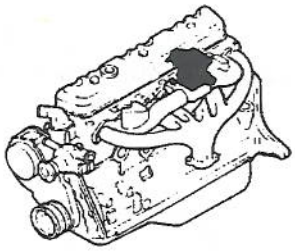
(3) Install clamp (4) on breather (1) hose.

5-5.1.3 *Venturi and Dashpot Assembly Group*. Refer to figure 5-4, and perform the following steps to overhaul the venturi and dashpot assembly group.

a. Removal. Remove the venturi as follows:

(1) Disconnect accelerator linkage from accelerator wire bracket (22).

(2) Remove vacuum hose from hose joint (7).



1. Venturi Assembly
2. Screw and Washer
3. Lever Stop Screw
4. Hex Nut
5. Pipe Joint Screw
6. Gasket
7. Hose Joint
8. Hex Nut
9. Spring Washer
10. Control Lever
11. Lever Spring
12. Split Pin
13. Spring
14. Valve Stopper
15. Taper Pin
16. Shim
17. Venturi Valve
18. Screw
19. Shaft
20. Venturi Gasket
21. Venturi Housing
22. Accelerator Wire Bracket
23. Dashpot Assembly

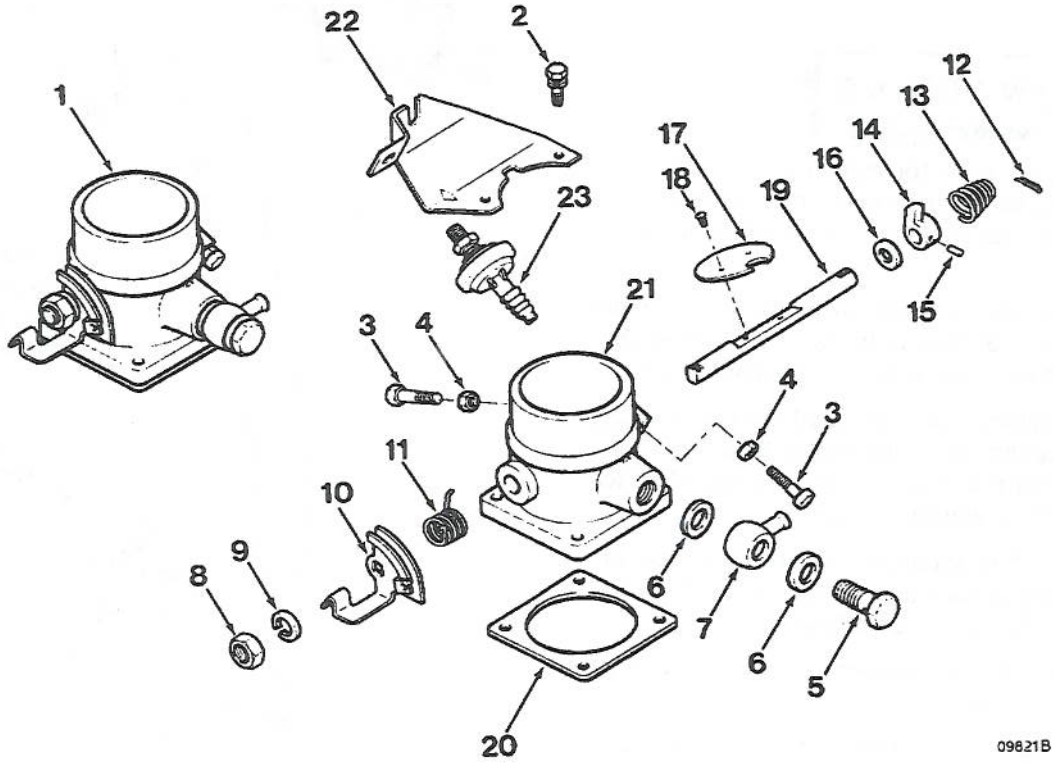


Figure 5-4. Venturi and Dashpot Assembly Group

(3) Remove screws with washers (2) from venturi assembly (1).

(4) Remove venturi assembly (1) from intake manifold.

(5) Remove venturi gasket (20).

(6) Remove accelerator wire bracket (22).

b. Disassembly. Disassemble venturi as follows:

(1) Remove split pin (12), spring (13), taper pin (15), valve stopper (14) and shim (16) from shaft (19).

(2) Remove hex nut (8), spring washer (9), control lever (10) and lever spring (11) from opposite end of shaft (19).

(3) Remove screws (18) and venturi valve (17).

(4) Clip lead seal wire and remove lever stop screw (3) and hex nut (4) from venturi housing (21).

(5) Remove opposite lever stop screw (3) and hex nut (4) from venturi housing (21).

(6) Slide shaft (19) out of venturi housing (21).

(7) Remove pipe joint screw (5), hose joint (7) and gaskets (6).

(8) Remove dashpot assembly (23).

c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.

d. Repair and replacement. Replace all worn or damaged parts.

e. Assembly. Assemble venturi as follows:

(1) Install dashpot assembly (23).

(2) Install gaskets (6) and hose joint (7) on pipe joint screw (5).

(3) Thread pipe joint screw (5) into venturi housing (21). Tighten securely.

(4) Slide shaft (19) into venturi housing (21). Turn shaft (19) until venturi valve (17) seat is up.

(5) Install hex nut (4) and lever stop screw (3).

(6) Install hex nut (4) with lead seal onto opposite lever stop screw (3) with lead seal.

(7) Install venturi valve (17) and screws (18). Tighten securely.

(8) Install lever spring (11), control lever (10), spring washer (9) and hex nut (8) on shaft (19).

(9) Install shim (16), valve stopper (14), taper pin (15), spring (13) and split pin (12) on shaft (19).

(10) Adjust the venturi assembly (1) as required.

(11) Crimp lead seal on lever stop screw (3).

f. Installation. Install the venturi as follows:

(1) Install venturi gasket (20), accelerator wire bracket (22) and venturi housing (21) on intake manifold. Align holes.

(2) Install screws with washers (2) on venturi assembly (1) and tighten securely.

(3) Attach vacuum hose to hose joint (7).

(4) Attach accelerator linkage to accelerator wire bracket (22).

5-5.1.4. *Intake and Exhaust Manifolds Group*. Refer to figure 5-5, and perform the following steps to overhaul the intake and exhaust manifolds group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the manifolds as follows:

(1) Refer to paragraph 5-5.1.3 and remove the venturi assembly.

(2) Remove hex nuts (3) and flat washers (6).

(3) Remove hex nuts (3), spring washer (4) and spacer (5).

(4) Remove studs (8).

(5) Remove intake manifold (2), exhaust manifold (1) and gasket (7).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.

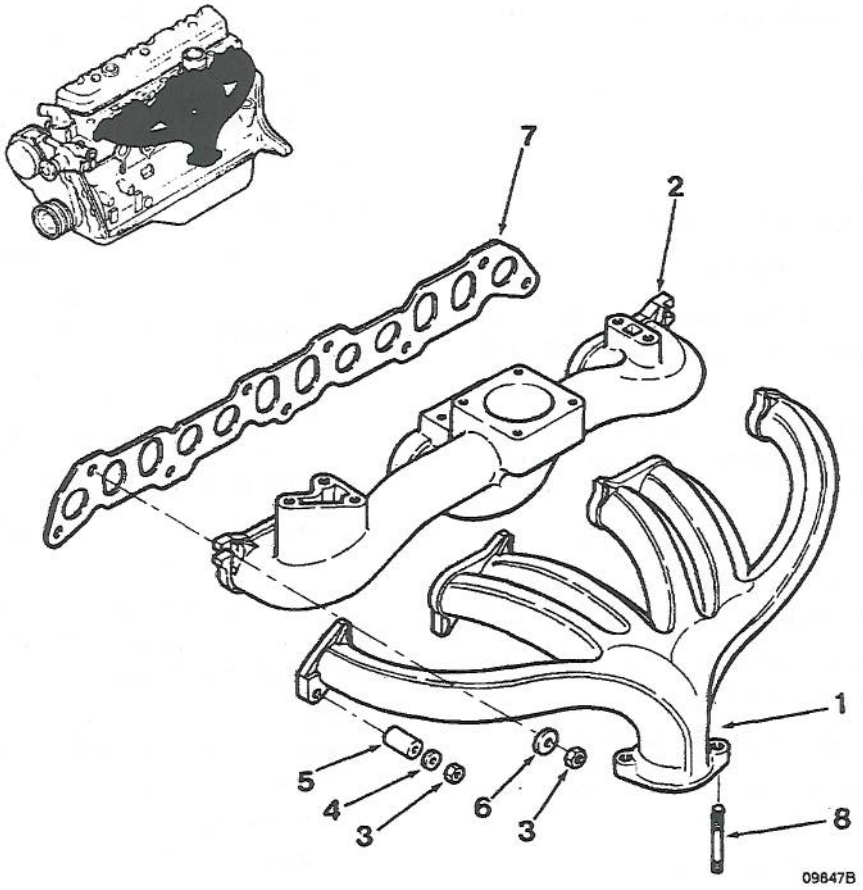
c. Repair and replacement. Replace all worn or damaged parts.

d. Reassembly and installation. Assembly is accomplished during installation. Install the manifolds as follows:

(1) Position gasket (7), intake manifold (2) and exhaust manifold (1) in place. Align all holes.

(2) Install studs (8).

(3) Install spacer (5), spring washer (4) and hex nuts (3).



1. Exhaust Manifold
2. Intake Manifold
3. Hex Nut
4. Spring Washer
5. Spacer
6. Flatwasher
7. Gasket
8. Stud

Figure 5-5. Intake and Exhaust Manifolds Group

(4) Install flat washers (6) and hex nuts (3).

(5) Refer to paragraph 5-5.1.3 and install venturi assembly.

5-5.1.5 *Exhaust System.* Refer to figure 5-6, and perform the following steps to overhaul the exhaust system.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove exhaust system as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands.

(1) Raise vehicle and support with jack stands.

(2) Remove capscrew (13) and self-locking nut (12).

(3) Remove reinforced plate (14) and tailpipe insulator and bracket assembly (11).

(4) Disconnect rear exhaust clamp (1).

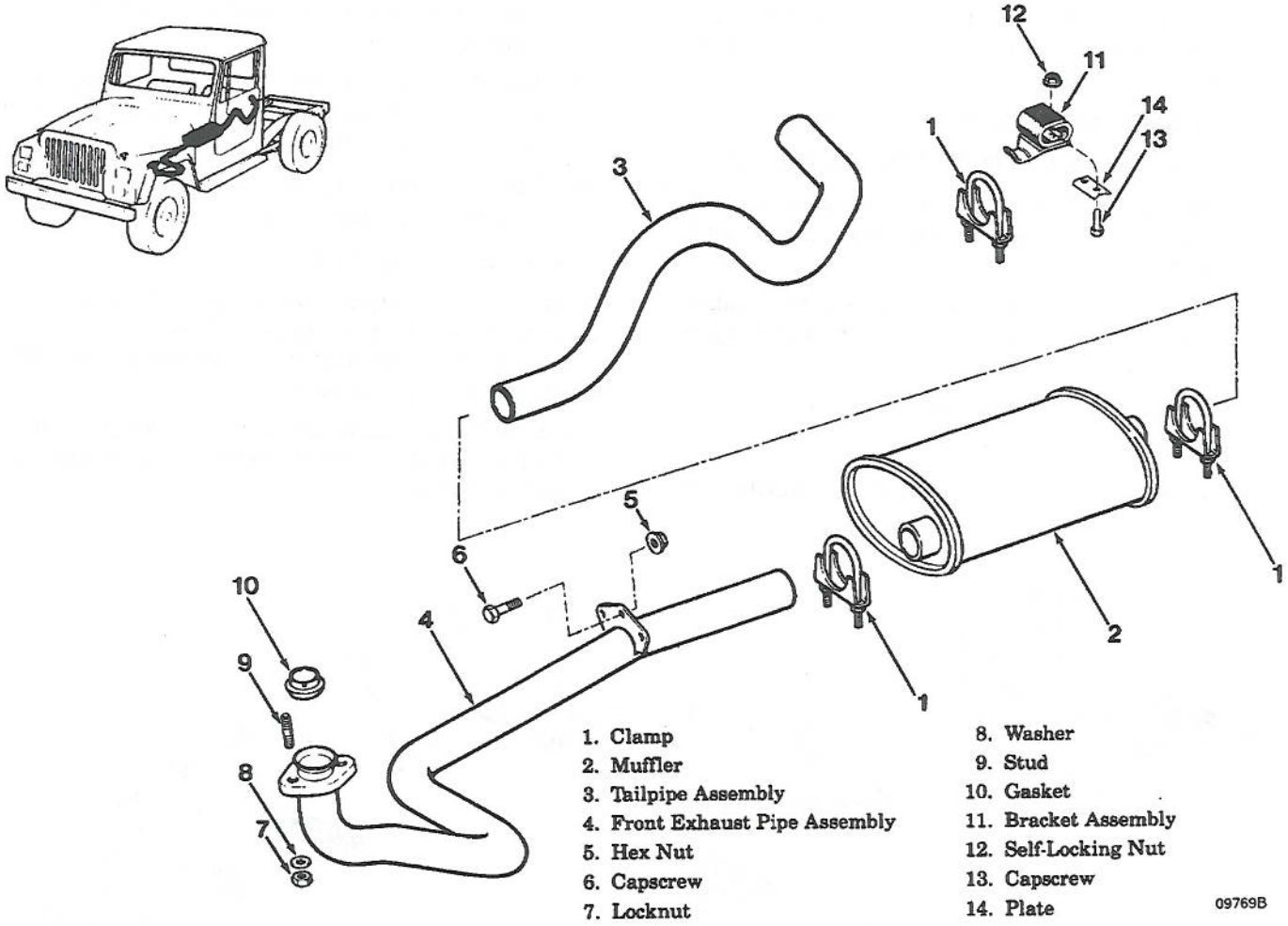


Figure 5-6. Exhaust System

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with the proper tinted lenses, gloves, apron or jacket, and welder's boots are required to protect the welder.

(5) Heat tailpipe-to-muffler joint with oxyacetylene torch until cherry red.

(6) Twist tailpipe assembly (3) back and forth to disengage.

(7) Remove front exhaust clamp (1).

(8) Place block of wood against front of muffler (2) and drive muffler (2) rearward to disengage.

(9) Remove muffler (2).

(10) Remove special locknuts (7) and washers (8).

(11) Disconnect front exhaust pipe assembly (4) and remove gasket (10).

(12) Remove flanged hex nut (5) and capscrew (6).

(13) Remove front exhaust pipe assembly (4).

(14) Remove mounting studs (9) from manifold.

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, clean front exhaust pipe mating surface on manifold.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install exhaust system as follows:

(1) Position muffler (2) and connect front exhaust pipe (4) to it. Install clamp (1), but do not tighten.

(2) Install mounting studs (9) in manifold.

(3) Install gasket (10) in front exhaust pipe (4).

(4) Install front exhaust pipe (4) on manifold using washers (8) and special locknuts (7), but do not tighten.

(5) Align exhaust pipe (4) and connect to underside of vehicle using capscrew (6) and flanged hex nut (5).

(6) Tighten clamp (1) at muffler.

(7) Tighten special locknuts (7).

(8) Connect tailpipe assembly (3) to muffler (2) and install clamp (1) at muffler (2), but do not tighten.

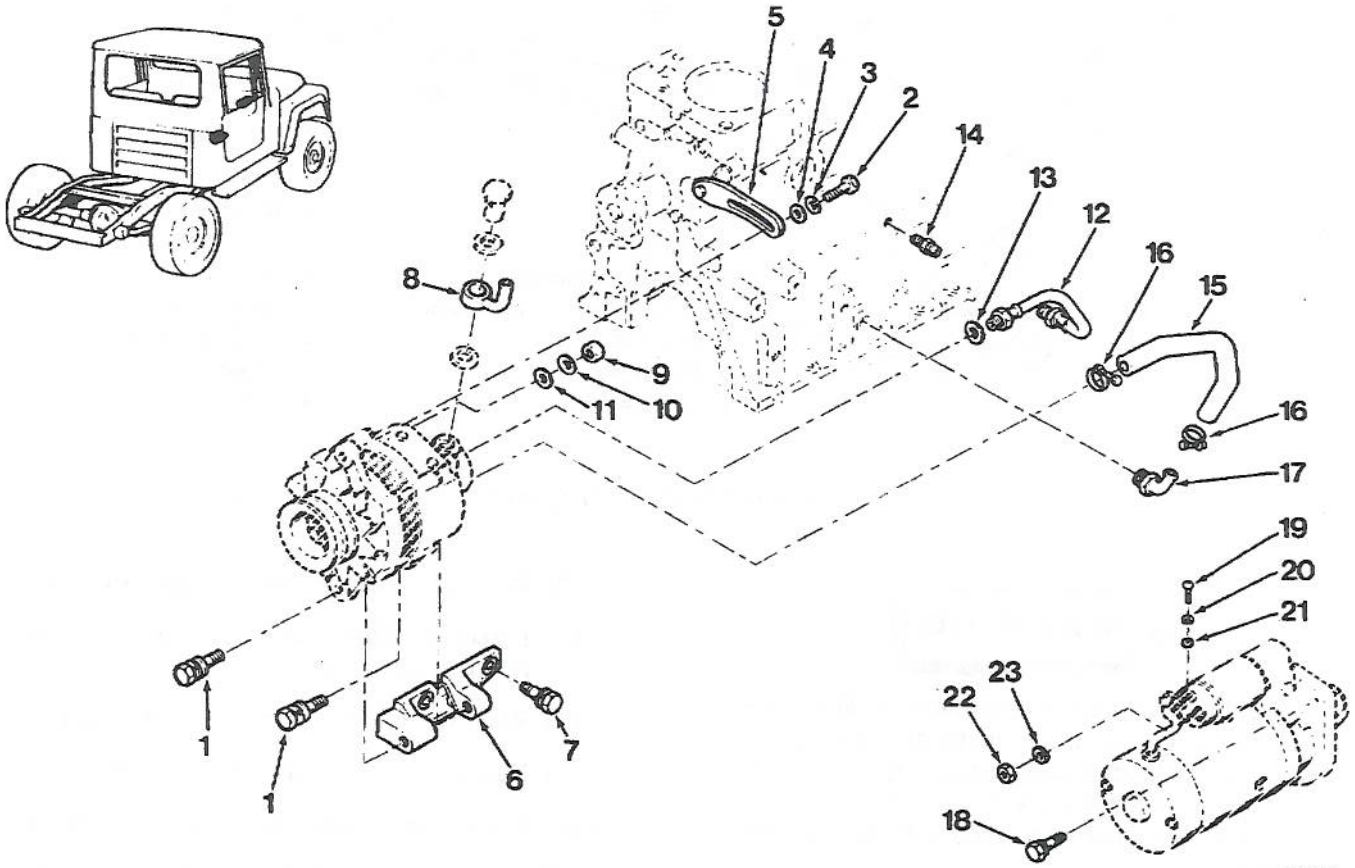
(9) Install tailpipe insulator and bracket assembly (11) and reinforcement plate (14) using capscrew (13) and self-locking nut (12).

(10) Install clamp (1) at tailpipe insulator and bracket assembly (11) and tighten.

(11) Tighten clamp (1) at muffler (2).

5-5.1.6 *Alternator, Starter and Vacuum Pump Mounting Parts Group*. Refer to figure 5-7, and perform the following steps to overhaul the alternator, starter, and vacuum pump mounting parts.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the mounting parts as follows:



1. Screw W/Washer
2. Capscrew
3. Spring Washer
4. Plain Washer
5. Adjusting Bar
6. Alternator Mounting Bracket
7. Screw W/Washer
8. Connector Assembly
9. Hex Nut
10. Spring Washer
11. Washer
12. Oil Tube
13. Oil Tube Gasket
14. Connector
15. Nonmetallic Hose
16. Hose Clamps
17. Hose Connector
18. Screw W/Washer
19. Machine Screw
20. Spring Washer
21. Plain Washer
22. Hex Nut
23. Spring Washer

Figure 5-7. Alternator, Starter and Vacuum Pump Mounting Parts Group

WARNING

Whenever disconnecting battery terminals, always disconnect negative GROUND terminal first. When reconnecting, reconnect GROUND terminal last.

(1) Disconnect battery negative (GROUND) cable.

(2) Disconnect all electrical leads from starter motor assembly.

(3) Remove screws and washers (18) from starter motor assembly, and remove starter motor assembly from engine.

(4) Remove machine screw (19), spring washer (20) and plain washer (21).

(5) Remove hex nut (22) and spring washer (23) from bottom terminal of magnetic switch assembly.

(6) Refer to paragraph 5-5.1.7 for disassembly of starter motor assembly.

(7) Disconnect alternator electrical connector.

(8) Remove connector assembly (8).

(9) Remove screws and washers (7) and alternator mounting bracket (6).

(10) Remove screws and washers (1).

(11) Remove capscrew (2), spring washer (3) and plain washer (4) from adjusting bar (5).

(12) Remove alternator drive belt from alternator pulley.

(13) Remove oil tube (12) and oil tube gasket (13) from connector (14) and vacuum pump.

(14) Loosen hose clamps (16) and remove nonmetallic hose (15) from hose connector (17) and vacuum pump.

(15) Remove alternator assembly and vacuum pump from engine.

(16) Remove hex nut (9), spring washer (10) and washer (11).

(17) Remove bolts securing vacuum pump to alternator assembly and remove vacuum pump.

(18) Remove connector assembly (8) from vacuum pump.

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during removal. Install starter/ alternator/ vacuum pump mounting parts as follows:

(1) Position magnetic switch assembly on starting motor and install hex nut (22) and spring washer (23) on bottom terminal of magnetic switch assembly.

(2) Install machine screw (19), spring washer (20) and plain washer (21).

(3) Install starting motor assembly on engine using screws and washers (18) tightened to torque specified in table 6-2.

(4) Connect all electrical leads to starting motor assembly.

(5) Install connector assembly (8) on vacuum pump.

(6) Install vacuum pump on alternator using bolts.

(7) Install washer (11), spring washer (10) and hex nut (9).

(8) Position alternator and vacuum pump on engine.

(9) Install nonmetallic hose (15) between hose connector (17) and vacuum pump and tighten hose clamps (16).

(10) Install oil tube gasket (13) and oil tube (12) between oil tube connector (14) and vacuum pump.

NOTE

All alternator mounting bolts should be finger tight at this stage of installation.

(11) Install capscrew (2), spring washer (3) and plain washer (4) through adjusting bar (5) into alternator.

(12) Install screws and washers (1).

(13) Install screws and washers (7) into alternator mounting bracket (6).

(14) Install alternator drive belt on pulley and tighten to tension specified in table 6-2.

(15) Tighten capscrew (2) to tension specified in table 6-2.

(16) Tighten screws and washers (7) and (1) to tension specified in table 6-2.

(17) Connect alternator electrical connector.

WARNING

When reconnecting battery terminals, always connect negative (GROUND) terminal last.

(18) Connect battery negative (GROUND) cable.

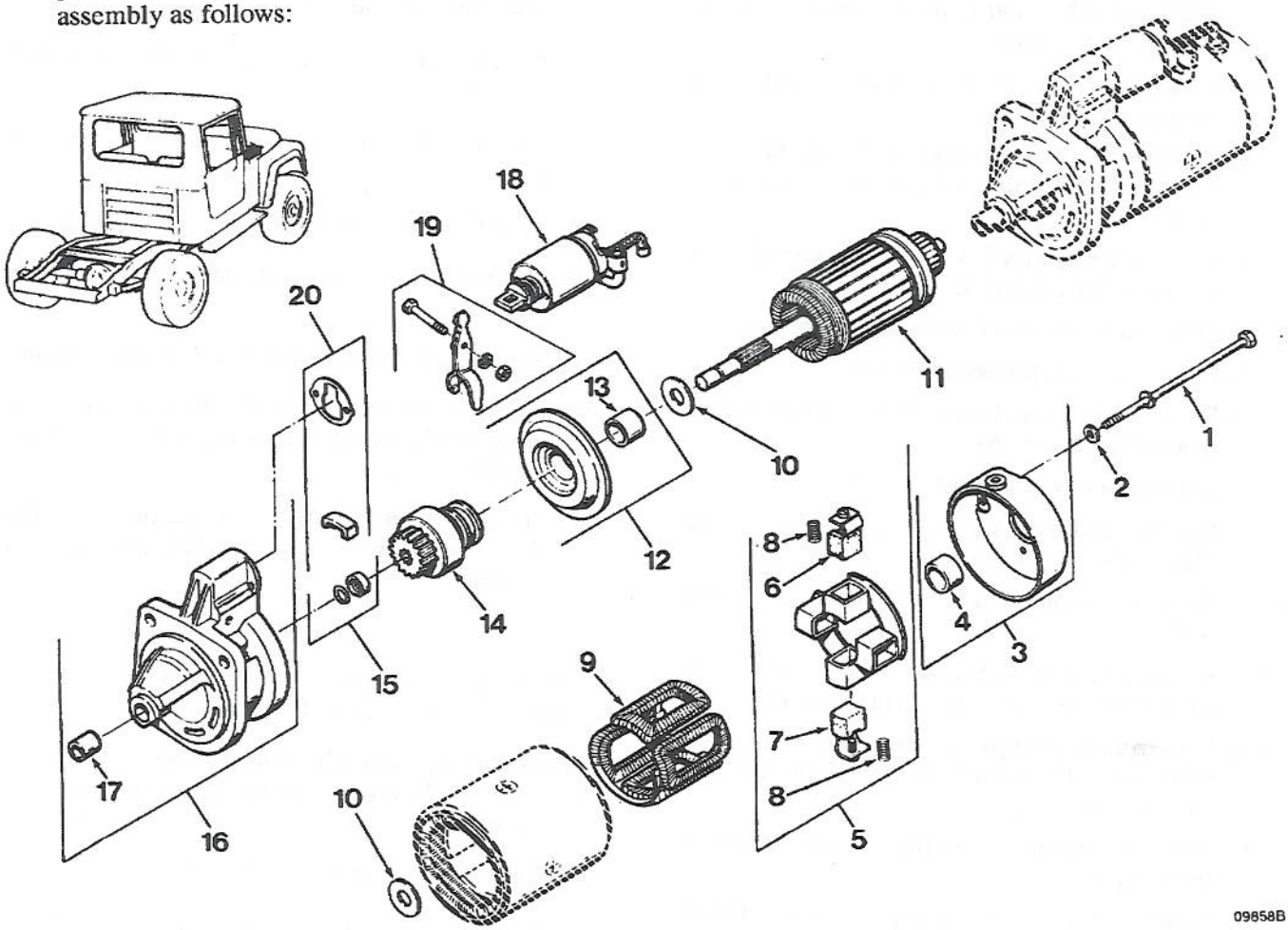
5-5.1.7 *Starting Motor Assembly*. Refer to figure 5-8, and perform the following steps to overhaul the starting motor assembly.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove starting motor assembly as follows:

(1) Remove nut from bottom terminal of magnetic switch assembly (18), and detach wire from terminal.

(2) Remove bolts attaching magnetic switch assembly (18) to dust cover (20), and remove magnetic switch assembly (18) from starting motor assembly.

(3) Remove thrust bolts (1) and washers (2) from rear cover assembly (3). Remove rear cover assembly (3).



1. Thrust Bolt W/Washer
2. Washer
3. Rear Cover Assembly
4. Rear Cover Bushing
5. Brush Holder Assembly
6. Brush
7. Brush
8. Brush Spring
9. Field Coil Assembly
10. Thrust Washer Kit
11. Armature Assembly
12. Center Bearing Assembly
13. Bearing
14. Pinion Assembly
15. Pinion Stopper
16. Gear Case Assembly
17. Bushing
18. Magnetic Switch Assembly
19. Shift Lever
20. Dust Cover

Figure 5-8. Starting Motor Assembly

CAUTION

Do not lift brushes by their pigtails while the brush spring is exerting pressure on the brush.

NOTE

For the following step, use short length of wire or other suitable implement.

(4) Lift brushes (6) and (7) out of brush holder assembly (5) in field coil assembly (9).

(5) Slide brush holder assembly (5) and thrust washers (10) off shaft of armature assembly (11), and remove brushes (6) and (7) and brush springs (8).

(6) Remove rear cover bushing (4) from shaft of armature assembly.

(7) Remove pin of shift lever (19) from gear case assembly (16).

(8) Slide field coil assembly (9) off armature assembly (11).

(9) Remove bushing (17) and separate gear case assembly (16) from armature assembly (11).

(10) Remove shift lever (19) from gear case assembly (16).

(11) Remove dust cover (20) from gear case assembly (16).

(12) Pry pinion stopper (15) from shaft of armature assembly (11).

(13) Slide pinion assembly (14) off shaft of armature assembly (11).

(14) Slide center bearing assembly (12) (including bearing (13)) off shaft of armature assembly (11).

(15) Slide thrust washers (10) off shaft of armature assembly (11).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and wearing of goggles is required.

(1) Use brush or air to clean field coil assembly (9), armature assembly (11), gear case assembly (16), magnetic switch assembly (18) and clutch portion of pinion assembly (14).

WARNING

P-D-680 Type 11 is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

CAUTION

Do not wash pinion clutch or drive assembly. If these components are washed, damage may result.

(2) Wash all parts, except pinion clutch and drive assembly, in P-D-680 Type II and dry.

(3) Inspect armature windings for broken or burned insulation and poor connections.

(4) Inspect armature windings for open and short circuits as outlined in paragraph 5-5.1.17c, Testing.

CAUTION

Do not use emery cloth to clean commutator. If emery cloth is used, damage to commutator could result.

(5) Clean dirty commutator with commutator paper.

(6) Check to see if commutator is worn, out of round, or has insulation protruding between contacts. If so, commutator must be replaced.

(7) Inspect shaft of armature (11) and bushings (4) and (17) for scoring and wear.

(8) Inspect drive assembly pinion clutch for damage. An engine that has repeated starting motor pinion clutch failures should be inspected for:

(a) Correct ring gear clearance in relation to starting motor mounting surface.

CAUTION

Inspect the entire circumference of the flywheel gear for damage when teeth of the drive assembly pinion gear are damaged. (Normal wear pattern extends approximately 2 inches along the circumference of the flywheel gear.)

(b) Missing or wrong parts and loose or misaligned flywheel.

(9) Inspect drive assembly pinion clutch by grasping and rotating pinion gear. Gear should rotate freely in one direction and lock in opposite direction.

(10) Inspect brush springs (8) for wear and damage.

(11) Inspect field windings for burned or broken insulation and for broken or loose connections. Examine field brush connections and wire insulation.

c. Testing. Refer to the figures in this section and perform the following test procedures:

(1) Armature coil short circuit test. See figure 5-9.

(a) Mount armature in growler and turn switch to GROWLER.

(b) Hold steel blade parallel to, and in contact with, armature.

(c) Slowly rotate armature. If steel blade vibrates at any time, armature is shorted and must be replaced.

(2) Armature coil open circuit test. See figure 5-10.

(a) Mount armature in growler and turn switch to TEST with voltage at highest setting.

(b) Place probes of test leads across adjacent commutator segments.

(c) Test each adjacent pair of commutator segments. A zero reading at any point indicates an open circuit. Commutator must be replaced.

(3) Armature coil insulation test. See figure 5-11.

(a) Place one ohmmeter lead on commutator segment.

(b) Place second ohmmeter lead on armature shaft. Continuity indicates faulty insulation. Armature must be replaced.

(4) Armature shaft-to-bushing clearance check. See figure 5-12.

(a) Measure armature shaft diameters at points A, B, C, D.

(b) Measure bushings at all points.

(c) Compare measurements with wear limits. If wear limits exceed specifications given in table 6-1, bushings must be replaced.

(5) Armature shaft alignment check. See figure 5-13.

(a) Support both ends of armature shaft in lathe or similar centering tool.

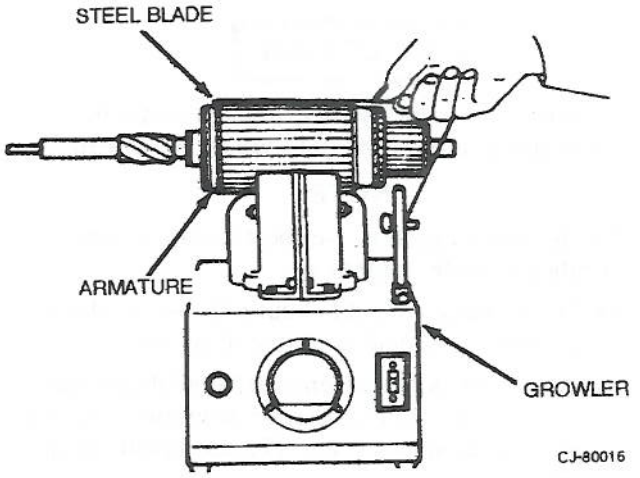


Figure 5-9. Coil Short Circuit Test

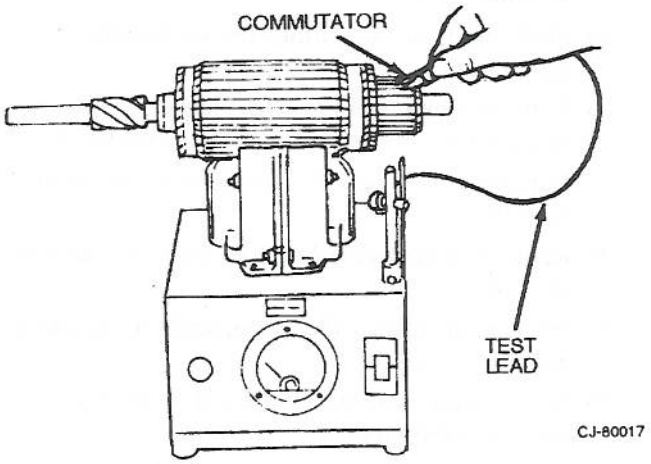


Figure 5-10. Coil Open Circuit Test

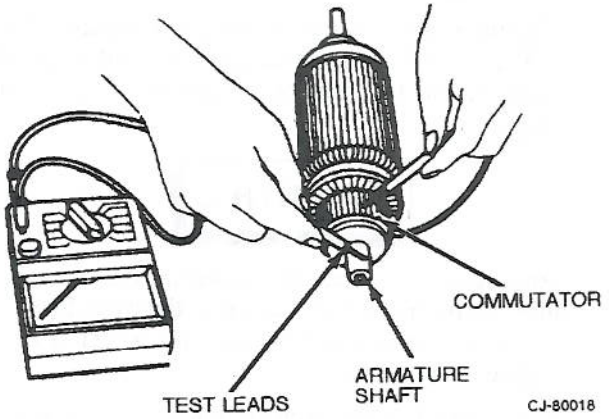


Figure 5-11. Coil Insulation Test

(b) Place dial indicator against sliding part of center bearing.

NOTE

Actual deflection is one-half of indicator reading.

(c) Check dial indicator while rotating armature. If deflection exceeds the measurement prescribed in table 6-1, shaft is out of alignment and must be replaced.

(6) Commutator wear test. See figure 5-14.

NOTE

If commutator segments are rough, polish them with commutator paper before testing.

(a) Mount dial indicator to measure eccentricity and taper of sliding surface of commutator.

(b) Rotate armature and note indicator reading. If deflection exceeds the figure prescribed in table 6-1, commutator is excessively worn and must be replaced.

(7) Commutator insulation test. See figure 5-15.

(a) Measure depth of insulating material between each commutator segment. If depth is less than the figure prescribed by table 6-1, commutator is excessively worn and must be replaced. If depth is greater than figure prescribed by table 6-1, commutator must be repaired.

(8) Field coil-to-coil continuity test. See figure 5-16.

(a) Connect leads of ohmmeter to field coil brush terminals.

(b) Continuity indicates either open or broken field coil. Interconnecting wire and field coil must be replaced.

(9) Field coil-to-frame continuity test. See figure 5-17.

(a) Connect leads of ohmmeter between field coil frame and either brush terminal.

(b) Continuity indicates open field coil circuit. Field coil must be replaced.

(10) Brush holder insulation test. See figure 5-18.

(a) Connect one lead of ohmmeter to insulation of brush holder and other lead to ground end of brush holder.

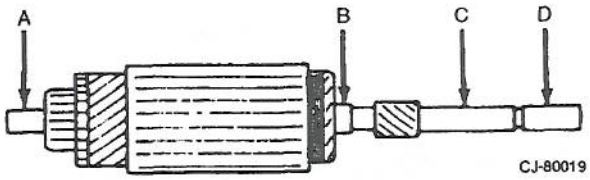


Figure 5-12. Shaft-to-Bushing Clearance Check

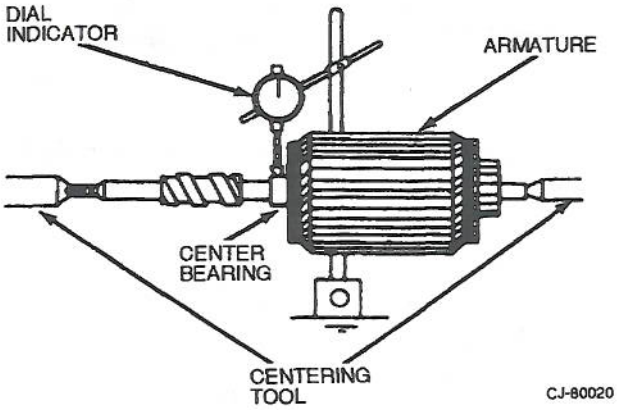


Figure 5-13. Armature Shaft Alignment Check

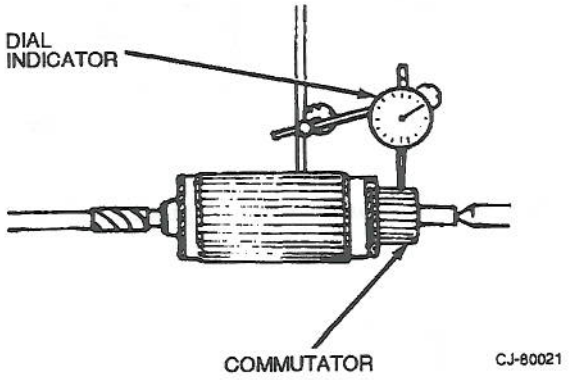


Figure 5-14. Commutator Wear Test

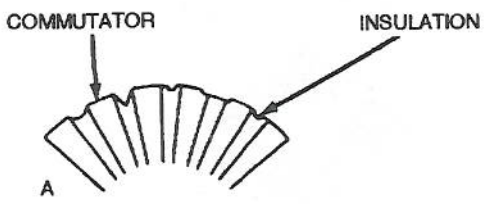


Figure 5-15. Commutator Insulation Test

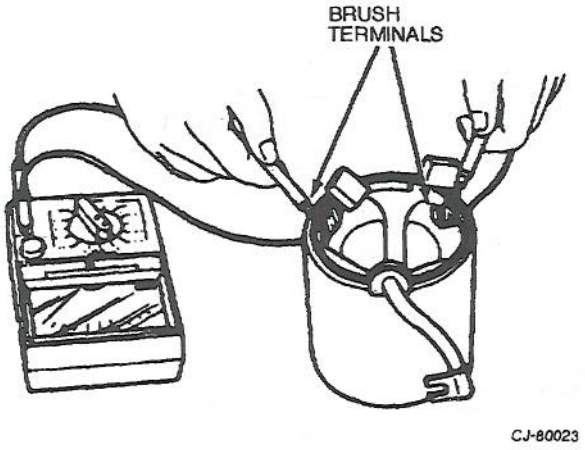


Figure 5-16. Field Coil-to-Coil Continuity Test

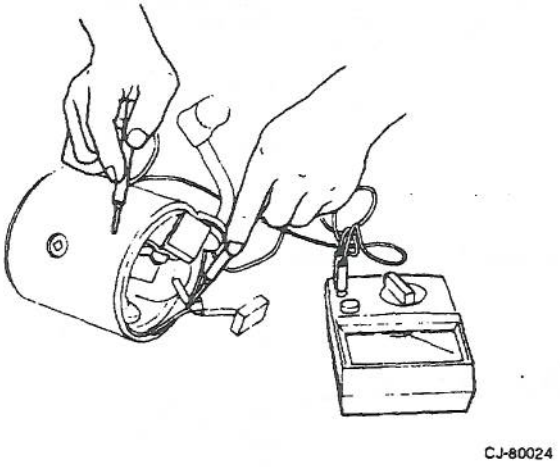


Figure 5-17. Coil-to-Frame Continuity Test

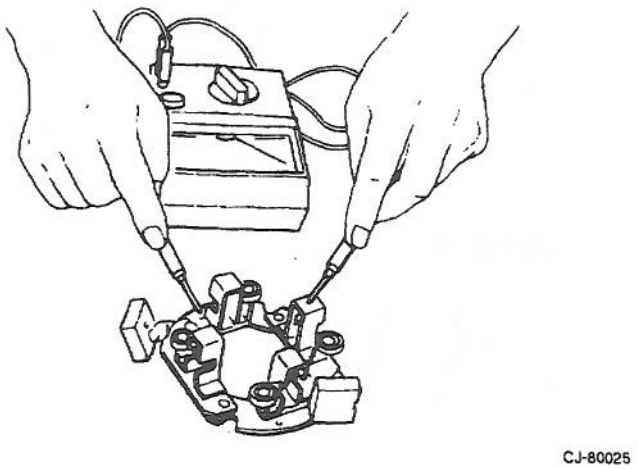


Figure 5-18. Brush Holder Insulation Test

(b) Continuity indicates faulty insulation. Brush holder must be replaced.

(11) Brush wear test. See figure 5-19.

(a) Measure brush length.

(b) If length is less than the figure prescribed in table 6-1, brush must be replaced.

(12) Brush spring tension test. See figure 5-20.

(a) Set up spring balance gauge.

(b) If tension is not within limits prescribed by table 6-1, brush must be replaced.

(13) Magnetic switch assembly shunt coil continuity test. See figure 5-21.

(a) Connect ohmmeter leads between magnetic switch assembly (18) and top terminal of magnetic switch assembly (18).

(b) Zero continuity indicates open shunt coil. Magnetic switch assembly (18) must be replaced.

(14) Magnetic switch assembly series coil continuity test.

(a) Connect ohmmeter leads between top and bottom terminals of the magnetic switch assembly (18).

(b) Zero continuity indicates open series coil. Magnetic switch assembly (18) must be replaced.

d. Repair and replacement. Replace all worn or damaged parts except as follows:

(1) If depth of commutator insulation is greater than the figure specified in table 6-1, remove insulation to depth specified in REPLACEMENT column of table 6-1.

(2) Bevel edges of commutator segments with commutator paper as shown in figure 5-22.

e. Assembly. Assemble starting motor assembly as follows:

(1) Slide thrust washers (10) on shaft of armature assembly (11).

(2) Slide center bearing assembly (12), including bearing (13), on shaft of armature assembly (11).

(3) Slide pinion assembly (14) on shaft of armature assembly (11).

(4) Press pinion stopper (15) and pinion stopper ring on shaft of armature assembly (11).

(5) Insert dust cover (20) in gear case (16).

(6) Insert shift lever (19) in gear case (16).