

## Chapter 2 OPERATION

### 2-1 GENERAL.

This section contains information and instructions for the safe and efficient operation of the Flightline Tow Tractor, Model No. 3. Operators and maintenance personnel must be thoroughly familiar with the safety precautions, principles of operation, location and use of controls and accessories and handling characteristics of the vehicle before attempting any operation or service procedure. Only licensed and qualified personnel should attempt to operate this vehicle.

### 2-2 SAFETY PRECAUTIONS.

The use of powered equipment is subject to certain hazards that cannot be overcome by purely mechanical means. The exercise of intelligence, care and common sense by the operator is essential to minimize the hazards of overloading, slipping, obstructions in the path of travel, or the use of equipment in operations for which it is not intended or designed. Listed below are a few suggestions that should be followed in the operation of this vehicle.

#### WARNING

Do not inhale exhaust gases. They contain carbon monoxide, a colorless, odorless gas that can kill. Carbon monoxide is not always easily detected. Do not run the engine in a closed area, such as a garage. If the vehicle is stopped in an open area with the engine running for more than a short period, adjust the ventilation system to force fresh, outside air into the vehicle.

- (1) The operator should be qualified and drive in accordance with safety rules.
- (2) If the vehicle does not operate properly, report to proper authority. A minor adjustment now may save a major repair later.
- (3) Avoid sudden stops or starts. When backing up, check for obstructions or personnel in the path of the vehicle before moving.
- (4) Drive carefully at all times. Exercise caution at cross aisles, sounding horn for safety.
- (5) Do not allow riders on exterior of vehicle.
- (6) Operate the vehicle at a safe distance behind other vehicles.
- (7) Do not operate vehicle with wet or greasy hands.

- (8) Observe flightline traffic rules in the operation of the vehicle.
- (9) Drive carefully on wet or slippery surfaces.
- (10) Keep feet within perimeter of floor board.
- (11) Observe the Operating Instructions and Preventive Maintenance Instructions given in this manual.
- (12) Avoid overloading the vehicle — this is a hazardous practice, for the operator as well as the equipment. Overloading shortens the life of the vehicle and increases maintenance costs.

#### WARNING

Never remove or by pass grounding prong. Failure to comply can result in personal injury or death from electrocution.

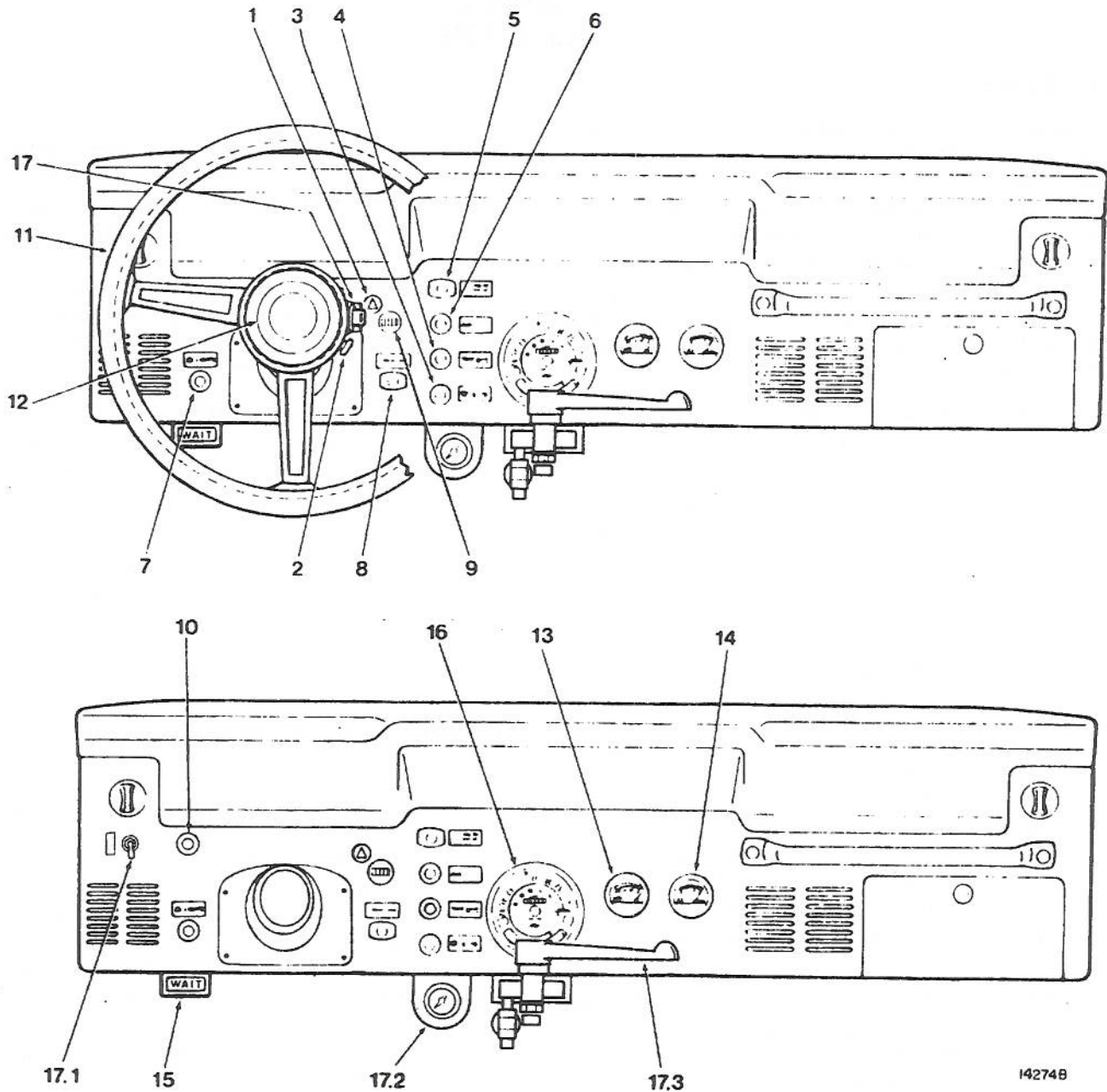
- (13) Use caution when plugging in the winterization system. Do not allow body to come into contact with 115 VAC system. Be sure heavy duty extension cord and 115 VAC receptacles are completely dry before connecting system. Make sure system is disconnected before moving vehicle.

### 2-3 PRINCIPLES OF OPERATION.

This vehicle provides a means for towing trailers, ground support equipment and other wheeled loads. The vehicle engine provides power for movement of the tractor and towing operations involving loads of up to 40,000 pounds with a drawbar pull of up to 4000 pounds. Torque generated by the engine is multiplied by the torque converter as required in the lower speed ranges when the engine is under load. The automatic transmission combines two multiple disc clutches, two bands and actuating servos, an overrunning clutch and two planetary gear sets to provide three forward gear ratios, neutral and one reverse ratio.

Drive torque is transmitted through the transmission output shaft to the transfer case input gear. The transfer case is a chain drive unit which locks the vehicle into a low gear range providing a reduction ratio of 2.61 to 1.

Torque is further transmitted from the transfer case through a tubular propeller shaft to the rear axle. A splined slip yoke is used at one end of the propeller shaft to compensate for changes in shaft length caused by suspension spring movement.



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|--|--|-------------------------|
| 1. Emergency Flasher Indicator Light   | 10. Work Light Switch  | 17.1 Tank Heater Switch |
| 2. Emergency Flasher                   | 11. Steering Wheel   | 17.2 Air Pressure Gauge |
| 3. Defroster Switch                    | 12. Horn   | 17.3 Air Valve          |
| 4. Temperature Control                 | 13. Voltmeter  |                         |
| 5. Fan Speed Control                   | 14. Oil Pressure Gauge   |                         |
| 6. Fresh Air Control                   | 15. Glow Plug Wait Light   |                         |
| 7. Headlight Switch                    | 16. Instruments Cluster (Speedometer, Odometer,<br>Fuel Level, Engine Temperature Gauge) |                         |
| 8. Windshield Wiper and Washer Control | 17. Key Switch   |                         |
| 9. Hour Meter                          |  |                         |

Figure 2-1. Tractor Controls and Instruments  
(Sheet 1 of 2)

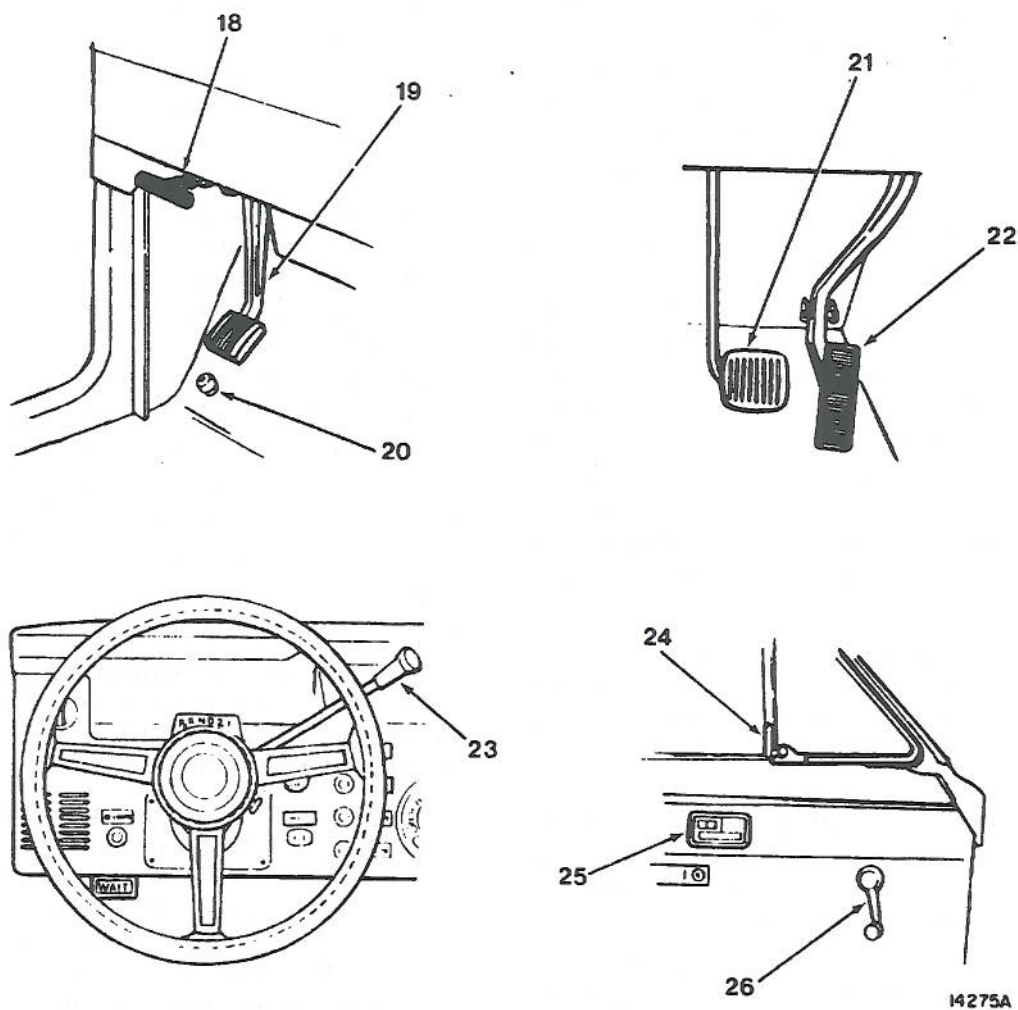


## 2-4 CONTROLS AND INSTRUMENTS.

Operation of this vehicle is very much like a conventional diesel truck. The vehicle is equipped with hydraulic power steering, power brakes, and a three-speed automatic transmission. Figure 2-1 shows all the vehicle controls and instruments. The following paragraphs discuss all items the operator will need to know for safe and efficient operation of the vehicle.

### 2-4.1 Equipment Familiarization.

2-4.1.1 *Switch.* The switch is located on the right side of the steering column. To operate the switch, insert the square-head key fully and rotate to one of the five positions: ACCESSORY, LOCK, OFF, ON, or START.



- 18. Parking Brake Release Handle
- 19. Parking Brake
- 20. Headlight Dimmer Switch
- 21. Brake
- 22. Accelerator Pedal

- 23. Shifter
- 24. Vent Handle
- 25. Door Handle
- 26. Window Handle

Figure 2-1. Tractor Controls and Instruments  
(Sheet 2 of 2)

**WARNING**

Do not turn key to LOCK position while vehicle is moving. Loss of steering control could result.

**CAUTION**

Do not attempt to move the shifter lever out of PARK before turning key to ON position to release steering lock. Damage to steering column or shifter may result.

The LOCK position locks the switch, prevents normal steering wheel operation and locks the shift controls. This is the normal parking position.

The ON position unlocks the steering wheel and automatic transmission shift controls. The ON position connects battery power to ignition and electrical systems. This is the normal run position.

The START position engages the starter motor. This position is spring-loaded and will return to the ON position when the key is released. The ACCESSORY position connects battery power to electrical accessories when engine is not running. Key must be turned counterclockwise to engage the position.

**2-4.1.2 Automatic Transmission.** The transmission has six positions: P for PARK, R for REVERSE, N for NEUTRAL, D for DRIVE, 2 for DRIVE 2 and 1 for DRIVE 1.

**2-4.1.3 Power Steering.** The steering wheel is located on the left side of the vehicle. Steering effort is greatly reduced by the engine-driven power steering pump.

**2-4.1.4 Brakes.** The brake pedal is located on the floor, immediately to the left of the accelerator, and the parking brake is located on the far left side. The parking brake release handle is located above the parking brake pedal, under the dash panel.

**2-4.1.5 Accelerator.** The accelerator pedal is located on the floor on the right of the operator's side of the vehicle.

**2-4.1.6 Seat Belts.** Three lap belts are located on the occupant seats.

**2-4.2 Gauges and Instruments.** Gauges and instruments located in the operator's compartment provide information concerning the performance, operation and control of vehicle.

**2-4.2.1 Brake Warning Light.** The brake warning light is located on the instrument cluster on the dash panel and illuminates when there is a loss or

difference in hydraulic pressure or to indicate that the parking brake is on. It also illuminates when the ignition switch is turned to the START position.

**2-4.2.2 Oil Pressure Gauge.** This gauge indicates oil pressure, but not oil level, and is located on the right side of the instrument panel. Normal oil pressure reading for low-to-moderate rpm is 20 to 60 psi and for high rpm is 50 to 60 psi.

**2-4.2.3 Voltmeter.** The voltmeter is located on the right side of the instrument panel, just to the left of the oil pressure gauge. This gauge indicates available battery voltage and charging system operation. Normal voltmeter reading is between 12 and 15 volts.

**2-4.2.4 Instrument Cluster.** The instrument cluster is located to the right of the steering column and contains the speedometer, fuel gauge, temperature gauge, turn signal, hazard warning flasher indicators, headlight high beam indicators, brake warning light and odometer.

**2-4.2.5 Hour Meter.** The hour meter is located to the right of the key switch. It is activated by the ignition switch and records actual vehicle operating time.

**2-4.2.6 Air Pressure Gauge.** This gauge indicates air pressure and is located below the instrument panel.

**2-4.2.7 Low Air Buzzer.** The low air buzzer is located to the right of the air valve and sounds an audible warning when the air pressure drops too low.

**2-4.3 Supplemental Equipment Operation.** The following paragraphs describe how to operate various light controls, horn, wind-shield wipers, cab climate controls, and air brakes.

**2-4.3.1 Light.** Headlights, parking lights and interior lights, including dome light, are controlled by a pull switch located on the left side of the instrument panel. All lights are off when the switch is completely depressed; parking lights, instrument lights, and tail lights come on when the switch is pulled out one detent; headlights, instrument lights and tail lights are turned on when switch is pulled out completely (or two detents). Instrument lights may be adjusted by rotating the pull switch. The dome light is turned on by rotating the pull switch completely clockwise, past the detent.

**2-4.3.2 Horn.** The horn button is located in the center of the steering wheel.

**2-4.3.3 Turn Signal Lever.** The turn signal lever is located on the left side of the steering column.



2-4.3.4 Hazard Warning Flasher. The hazard warning flasher button is located on the steering column right side. Pressing it actuates all four turning signals. Pulling out on the button turns off the flashers.

2-4.3.5 Backup Lights. The backup lights operate when the transmission select lever is placed in reverse with the ignition switch ON.

2-4.3.6 Windshield Wipers/Washers. The switch controlling the windshield wipers and washer is located immediately to the right of the steering column. To operate the two-speed wipers, turn the control knob clockwise. To operate the washer feature, depress the control knob and release.



Do not operate the fan with the air control knob pushed in or fan motor may overheat and be damaged.

2-4.3.7 Heating and Ventilation Controls. The heating and ventilation controls are located to the left of the instrument cluster. The fan switch is operated by turning clockwise and controls the blower speeds. The air control knob is operated by pulling. The first position selects heat and the second position selects fresh air ventilation. The temperature control knob regulates the air temperature. The defroster knob directs air to the windshield when pulled.

2-4.3.8 Dimmer Switch. The dimmer switch is located on the cab floor beneath the parking brake lever and controls the selection of high or low headlamp beams.

2-4.3.9 Air Value. The air valve is located in front of the instrument panel and controls air flow to the left hand side gladhand couplings.

2-4.3.9.10 Air Tank Heater Switch. The toggle switch that controls the heaters attached to the air tanks is located on the left side of the instrument panel.

## 2-5 STARTING THE EQUIPMENT.

The following paragraphs describe prestart checks, engine starting, and post-start checks.

### NOTE

This checklist does not provide performance of any services required by Table 3-2, Operator's Inspection Table.

2-5.1 Prestart Checks. The following checks should be performed prior to engine start.

- (1) Check beneath vehicle for leakage of fuel, oil, hydraulic fluid or water.
- (2) Check for adequate oil, fuel and coolant level.

- (3) Inspect tires for damage, foreign objects and tire pressure.
- (4) Check for fraying and tension of belts, alternator and fan, and engine driven hydraulic pumps.
- (5) Check operation of horn and lights.
- (6) Inspect and service vehicle as required by the Operator's Daily Inspection Table.

2-5.2 Starting Engine. The following steps should be followed to start the engine.

- (1) Insert key in starting switch.
- (2) Place automatic transmission lever in PARK (P).
- (3) Set parking brake.
- (4) Turn starting switch to ON position and wait until orange WAIT light goes out, signifying the glow plugs have warmed up.

### NOTE

Do not pump accelerator prior to engine start.

- (5) Depress accelerator halfway to the floor and hold in that position.



Do not operate starter motor for more than 30 seconds continuously. If engine fails to start after 30 seconds, allow the starter motor to cool for at least two minutes before attempting to start the engine again.

- (6) Turn starting switch to START position and hold until engine starts, then release.

2-5.3 Post-start Checks. The following steps should be performed after engine start, but prior to moving vehicle.

- (1) Check all instruments and controls for correct readings and operation.
- (2) Check reaction of wheel brakes by engaging transmission, allowing vehicle to move forward slowly and then applying brake pedal.
- (3) Record all malfunctions and discrepancies on appropriate form.

## 2-6 NORMAL OPERATION.

The following paragraphs describe normal vehicle operations, including how to drive and how to tow loads using the vehicle.



**WARNING**

- Do not coast in NEUTRAL. It is an unsafe practice and it may cause transmission damage.
- Driveshaft(s) must be removed before towing.
- Do not downshift on slippery roads, since engine braking may cause a skid.
- Do not use the PARK position as a substitute for the parking brake. Apply the parking brake fully when parked.

**CAUTION**

- Do not drive in 1st or 2nd gears at sustained high speeds or damage to transmission may result.
- Do not place the gearshift lever in PARK or DRIVE while moving in REVERSE or transmission damage may result.
- Do not place the gearshift lever in PARK or REVERSE while moving forward or transmission damage may result.
- Do not race the engine before shifting from NEUTRAL or PARK or transmission damage may result.
- Do not race the engine with the brakes on and the vehicle in gear or hold the vehicle on an incline without applying the brakes. This can overheat and damage the transmission.
- Operation of the vehicle is essentially the same as that for any automotive type equipment, all controls and instruments are positioned conveniently for operator's use and in approximately the same location or relationships as that used in an ordinary truck or passenger car. Operators should familiarize themselves with the steering and performance characteristics of the vehicle before attempting to perform any actual towing operations. Sudden starts, stops, and turns are to be avoided, except in cases of emergency.

**2-6.1 Mobile Operation.** To move the vehicle, the transmission must be placed in one of four possible positions: REVERSE, for backing the vehicle; D - DRIVE, for all normal operations (The shift into D from DRIVE 1 or DRIVE 2

can be made at any time); 2 - DRIVE 2, for moderate grades and to assist braking on dry pavement or in mud or snow; 1 - DRIVE 1, for hard pulling at low speeds, in mud, sand or snow, or on steep grades. Lift the gearshift lever slightly when shifting. No lift is required for N (NEUTRAL) to D (DRIVE). A safety switch prevents engine starting unless the gear selector is in P (PARK) or N (NEUTRAL). To move the vehicle after engine start, apply the brake and move the shifter to the desired position. During normal driving, the transmission will automatically change gears to meet varying requirements.

## **2-6.2 Description of Extendable Hitch Function.**

### **2-6.2.1 For Non-nuclear Towing only.**

- The rear of the FLTT is equipped with a center-mounted, extendable pintle hook, and hitch assembly (extendable unit). The extendable unit consists of a self-locking, sliding bar that allows the pintle hook backward movement and a lateral swing movement in either direction from the centerline of the tow tractor. This feature facilitates connection of the pintle hook to the lunette or towing eye of the towed load by a single operator, rather than a method requiring two users.
- The normal towing position for this extendable unit is in the retracted and straight positions (closed), rather than in the extended and swung positions (open). Once the lunette or towing eye of the towed load is secured in the pintle hook, the extendable unit shall be engaged in the retracted and straight positions (closed) by pulling the tow tractor/trailer assembly forward to straighten the unit and by backing the FLTT rearward to retract the unit.
- Once done, the extendable unit is secured in the closed position, and the tow tractor/trailer assembly is ready for the towing exercise. This procedure only applies to the towing of non-nuclear certified loads and equipment.

**2-6.2.2 For Nuclear Towing.** Nuclear Towing is authorized only when center pintle hook is locked into position, both fully retracted and centered. Positioning and locking of pintle assembly by towing is not authorized. Consult the MNCL for further information on use with nuclear weapons.

**2-6.3 Towing Operations.** During towing operations, keep the vehicle in a gear range that will provide adequate torque for negotiation of grades. Vehicle speed must be kept low enough that the vehicle and load can be safely stopped within an assured clear distance. Always check the pintle hook connection to see that the hook is properly engaged with the drawbar lunette eye or coupling. Always check the gladhand connections to be sure they are properly engaged with air lines of towed vehicle. When negotiating turns or operating in areas

where clearances are restricted, always take into consideration the physical size and steering characteristics of the load being towed.

## 2-7 OPERATION UNDER UNUSUAL CONDITIONS.

The following paragraphs provide information on fluid levels, lubricants, subassemblies and systems that can be adversely affected due to extreme climatic conditions.

### 2-7.1 Extreme Heat.

#### 2-7.1.1 Cooling System. Check cooling system as follows:

- a. Make sure fan belts are properly adjusted.
- b. Check coolant level frequently, and be sure radiator cap is secure.
- c. Keep exterior of radiator clean and free of foreign matter which might effect circulation of air.

#### 2-7.1.2 Battery. Check electrolyte level daily and maintain at proper levels.

#### 2-7.1.3 Lubrication. Observe instructions in Figure 3-1, Lubrication Chart.

#### 2-7.1.4 Fuel System. Fill fuel tank at end of day to expel moisture which may collect in vapor form inside the tank.

### 2-7.2 Extreme Cold.

#### 2-7.2.1 Shelter. The vehicle should be sheltered in a closed building with some heat, if possible. If this is not possible, cover with a tarpaulin or similar kind of material.

#### 2-7.2.2 Cooling System. Add proper amount of ethylene glycol antifreeze to cooling system. If antifreeze is not available, drain radiator and cylinder block when ambient temperature is expected to drop below 32°F. Never add water to the cooling system without subsequently checking the antifreeze solution for adequate strength and adding antifreeze if necessary.

#### 2-7.2.3 Electrical System. Check the battery as follows:

- a. Test the specific gravity of the electrolyte in the battery, using a hydrometer. Specific gravity reacting should be between 1.260 and 1.275 at 80°F.
- b. Electrolyte level of battery must be maintained at 1 1/2 inch above plates. Do not add water to a battery which has been exposed to cold temperature, except when engine is to be operated immediately.

- c. Remove battery and store it in a warm place when shelter for truck is not available. The efficiency of the battery decreases at lower temperatures, and a completely discharged battery will freeze at 20°F.

- d. Be sure that wires and cables are in good condition and that all connections are clean, dry and secure.

#### 2-7.2.4 Lubrication. Follow lubrication instructions in Figure 3-1, Lubrication Chart.

#### 2-7.2.5 Fuel system. Use grade of fuel prescribed for the climate and fill fuel tank at the end of the day to expel moisture.

#### 2-7.2.6 Winterization System. During extreme cold this system will heat engine oil, coolant, and battery. To engage the system perform the following:

### WARNING

Never remove or bypass grounding prong. Failure to comply can result in personal injury or death from electrocution.

- a. Open receptacle cover at front of vehicle.
- b. Plug heavy duty extension cord into receptacle. Plug other end of extension cord into a 115 VAC grounded outlet.

#### 2-7.3 Humid Climates. In tropical areas, if paint is chipped or scratched, the affected area should be refinished immediately to prevent rapid formation of rust. Remove all loose paint with paint remover, sandpaper or sandblasting equipment. Apply two coats of red lead primer and, when dry, apply finishing coat of paint.

#### 2-7.4 Dusty Conditions. Operators of trucks used in extremely dusty conditions should check the air cleaner daily to ensure that excessive buildup of dust or dirt, which would restrict air flow, is not permitted. Lubrication service intervals for all items should be reduced to one-half the normal period, or as short as 50 hours, depending upon the severity of the service.

## 2-8 STOPPING THE EQUIPMENT.

The following paragraphs describe how to park and stop the vehicle, including any post-operative checks.

- a. Parking vehicle. To park the vehicle, perform the following procedures:



- (1) Remove foot from accelerator pedal.
- (2) Apply gradual foot pressure to the brake pedal to bring the vehicle to a smooth, safe stop. Avoid sudden application of full braking effort, except in cases of emergency.
- (3) Shift to PARK and apply parking brake.



If the engine has been operating at, or near, full load, it should be allowed to run at fast idle for several minutes after the load is removed before being stopped. This allows internal engine temperatures to equalize.

- b. Engine shutdown. Turn ignition switch to OFF to shut down engine.
- c. Post-operative checks. When shutting down the vehicle for overnight or weekend storage, perform the following procedures:
  - (1) Make certain that lights, heater and all electrical accessories are turned OFF. Engage parking brake.
  - (2) Close all cab windows.
  - (3) Fill fuel tank.
  - (4) If ambient temperatures near 0°F are anticipated, plug in winterization system to a 115 VAC supply to improve starting after vehicle has been parked overnight.



## Chapter 3 OPERATOR INSPECTION, MAINTENANCE AND LUBRICATION

### 3-1 INTRODUCTION.

This section provides instructions for troubleshooting, inspecting, maintaining and servicing the vehicle. All procedures shall be performed by operating personnel. All maintenance and servicing must be performed at the intervals specified for optimum vehicle performance and minimum downtime.

### 3-2 TROUBLESHOOTING.

Refer to table 3-1 for assistance in diagnosing and correcting malfunctions that occur during normal operations. This troubleshooting chart provides information on the probable causes and remedial action required for various service troubles. Troubles that may be observed by the operator, but considered beyond his scope of maintenance, will note, "Refer to maintenance."

*Table 3-1. Operator's Troubleshooting Table*

Trouble	Probable Cause	Checkout Procedure and Remedial Action
<b>Engine</b>		
Engine will not start.	<ol style="list-style-type: none"> <li>1. Out of fuel.</li> <li>2. Air in fuel system.</li> <li>3. Broken fuel line.</li> <li>4. Defective fuel pump.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check fuel level. Add fuel.</li> <li>2. Refer to maintenance.</li> <li>3. Check for leakage. Refer to maintenance.</li> <li>4. Refer to maintenance.</li> </ol>
Hard starting due to low starting rpm.	<ol style="list-style-type: none"> <li>1. Loose or corroded, shorted battery connections.</li> <li>2. Rundown battery(s).</li> <li>3. Low ambient temperature.</li> <li>4. Loose or corroded starter wiring connections.</li> <li>5. Starter dragging (excessive amperage draw).</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean and tighten terminals.</li> <li>2. Refer to maintenance.</li> <li>3. Cold climate starting procedures.</li> <li>4. Refer to maintenance.</li> <li>5. Refer to maintenance for repair.</li> </ol>
Low lubricating oil pressure (engine at operating temperature).	<ol style="list-style-type: none"> <li>1. Low oil level.</li> <li>2. Oil bypassing oil cooler.</li> <li>3. Faulty pressure gauge.</li> <li>4. Faulty pressure sender.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refill.</li> <li>2. Refer to maintenance. (Turn engine OFF.)</li> <li>3. Refer to maintenance. (Turn engine OFF.)</li> <li>4. Refer to maintenance. (Turn engine OFF.)</li> </ol>

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Engine-Continued		
Low lubricating oil pressure (engine at operating temperature)-cont.	5. Oil filter clogged.	5. Refer to maintenance. (Turn engine OFF.)
Uneven running and/or frequent stalling.	1. No fuel or insufficient fuel. 2. Coolant temperature below normal. 3. Dirty fuel filter. 4. Governor instability. 5. Moisture in fuel due to condensation. 6. Dirty air cleaner.	1. Fill fuel tank. 2. Check cooling system. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance. 6. Refer to maintenance.
Lack of power.	1. Incorrect fuel. 2. Incorrect governor adjustment. 3. Air cleaner damaged, dirty, or clogged. 4. Air cleaner intake obstructed.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Cooling Systems		
Engine coolant overheating.	1. Scale or deposits in cooling system. 2. Radiator clogged. 3. Loose fan belt. 4. Low coolant level. 5. Damaged coolant hose. 6. Damaged or inoperative thermostat. 7. Water pump failure.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Fill cooling system. 5. Refer to maintenance. 6. Refer to maintenance. 7. Refer to maintenance.



Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Cooling System-Continued		
Engine coolant too cool.	1. Thermostat stuck open.	1. Refer to maintenance.
Transmission		
No drive in one range.	1. Low oil level. 2. Manual selector lever not properly positioned. 3. Driveline failure.	1. Fill to proper level. 2. Refer to maintenance. 3. Refer to maintenance.
Steering System		
Wheel steering hard in one or both directions (engine running).	1. Steering gear sluggish.	1. Refer to maintenance.
Erratic power steering or no power steering at all.	1. Defective power steering gear. 2. Defective pump assembly. 3. Low fluid level	1. Refer to maintenance. 2. Refer to maintenance. 3. Fill to proper level.
Excessive backlash in steering system.	1. Excessive backlash in steering mechanism. 2. Worn or damaged steering components.	1. Refer to maintenance. 2. Refer to maintenance.
Brake System		
Brakes dragging.	1. Defective brake shoe return spring. 2. Loose or damaged wheel bearing. 3. Linings improperly adjusted. 4. Parking brake improperly adjusted.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Brakes "grab", vehicle pulls to one side on brake application.	1. Improperly inflated tires. 2. Linings grease soaked.	1. Inflate to correct pressure. 2. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Brake System-Continued		
Brakes "grab", vehicle pulls to one side on brake application-cont.	3. Linings improperly adjusted.	3. Refer to maintenance.
Erratic, uneven braking.	1. Soft tire	1. Inflate to correct pressure.
	2. Improper adjustment.	2. Refer to maintenance.
Slow brake application.	1. Low hydraulic pressure.	1. Refer to maintenance.
	2. Brake improperly adjusted.	2. Refer to maintenance.
Excessive pedal travel.	1. Low hydraulic pressure.	1. Refer to maintenance.
Brakes squeal on application.	1. Glazed or dirty linings.	1. Refer to maintenance.
	2. Lining worn to rivet heads.	2. Refer to maintenance.
Electrical System		
Batteries discharge rapidly.	1. Alternator, regulator or wiring faulty.	1. Refer to maintenance.
	2. Loose or corroded battery terminals.	2. Refer to maintenance.
	3. Voltage regulator not functioning properly.	3. Refer to maintenance.
	4. Short circuit in the electrical system.	4. Refer to maintenance.
	5. Battery cable or wiring resistance too high.	5. Refer to maintenance.
	6. Defective cell in battery.	6. Refer to maintenance.
No battery voltage.	1. Battery discharged.	1. Refer to maintenance.
	2. Circuit breaker open.	2. Refer to maintenance.
	3. Disconnected battery cable.	3. Refer to maintenance.
Improper system voltage.	1. Alternator belt slipping.	1. Refer to maintenance.
	2. Defective voltage regulator.	2. Refer to maintenance.



Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Electrical System-Continued		
Improper system voltage-cont.	3. Insufficient alternator output.	3. Refer to maintenance.
Lights dim.	1. Lower battery voltage. 2. Poor electrical connections. 3. Defective alternator.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance.
Lights inoperative.	1. Defective bulb. 2. Faulty circuit breaker. 3. Broken lead. 4. Defective switch.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Frequent lamp failures.	1. Improper electrical system voltage. 2. Poor battery connections.	1. Refer to maintenance. 2. Refer to maintenance.
Windshield Wipers		
No action.	1. No electrical connection. 2. Defective motor. 3. Defective switch.	1. Connect connector. 2. Refer to maintenance. 3. Refer to maintenance.
Drive Shaft		
Noisy drive line.	1. Out of balance. 2. Badly worn parts.	1. Refer to maintenance. 2. Refer to maintenance.
Driveline vibration.	1. Yokes out of line. 2. Shafts out of balance.	1. Refer to maintenance. 2. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Axles		
Noise from drive unit.	1. Lubricant not to specified level. 2. Incorrect lubricant.	1. Refer to maintenance. 2. Refer to maintenance.
Lubricant leaks through axle shafts.	1. Incorrect kind and weight of lubricant. 2. Lubricant above specified level.	1. Refer to maintenance. 2. Refer to maintenance.
Excessive tire wear.	1. Improper tire inflation. 2. Incorrect toe-in.	1. Correct. 2. Refer to maintenance.
Air System		
No air pressure at gladhand couplings.	1. Air tank(s) drain valve(s) open. 2. Air line broken or leaking. 3. Air governor improperly adjusted or defective. 4. Air compressor drive belt loose or broken. 5. Defective pop-off relief valve. 6. Defective air compressor.	1. Close drain valve(s). 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance. 6. Refer to maintenance.
No air pressure at service gladhand couplings.	1. Air line broken or leaking. 2. Defective air valve.	1. Refer to maintenance. 2. Refer to maintenance.
Air compressor fails to maintain air supply or pressure.	1. Air filter dirty. 2. Drive belt slipping. 3. System leaking. 4. Defective air compressor. 5. Defective air pressure gauge.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance.



Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Air System-Continued		
Air compressor noisy.	1. Loose drive belt.	1. Refer to maintenance.
	2. Loose drive pulley.	2. Refer to maintenance.
	3. Loose idler pulley.	3. Refer to maintenance.
	4. Defective air compressor.	4. Refer to maintenance.
Winterization System		
System inoperative.	1. Defective fuse.	1. Refer to maintenance.
	2. Defective extension cable.	2. Refer to maintenance.
	3. Defective wiring.	3. Refer to maintenance.
	4. Defective coolant heater, oil heater, or battery warmer.	4. Refer to maintenance.

**3-3 OPERATOR INSPECTION.**

All periodic inspections to be performed by the operator are listed in table 3-2. Intervals are based on normal conditions. These intervals should be adjusted for extreme climate conditions. Any defect or substandard condition revealed by the periodic inspection shall be reported immediately and remedied to ensure readiness of the vehicle and minimum downtime.

**3-4 OPERATOR MAINTENANCE AND SERVICING.**

Operator maintenance is limited to those items to be performed on a daily basis.

**3.4.1 Lubrication.** Figure 3-1 lists all items requiring periodic lubrication and the types of lubricants required. This information is presented by use of symbols on the chart which are identified and explained in the lubricant key. Details for items requiring supplemental information can be found under appropriate paragraph headings.

**NOTE**

Lubrication intervals given in the lubrication chart are for operating in normal climatic conditions and must be shortened accordingly when operating under conditions of extreme heat, cold, dust, or humidity.

**3-4.2 Battery Maintenance.** In order for the battery to give maximum service, it must be cared for according to the following instructions.

**WARNING**

Do not service the battery without wearing safety glasses, rubber gloves and protective clothing. Battery fluid contains sulfuric acid and must be kept away from eyes, skin, clothing and vehicle painted surfaces. If acid contacts any of these, flush immediately with large amounts of water. Get medical attention if acid contacts skin or eyes.

Batteries produce hydrogen gas and can explode and cause serious bodily injury. Don't smoke while checking or servicing the battery. Keep open flames or sparks away from battery filler caps because explosive gas is always present.

Do not allow tools or metal objects to contact the battery posts and the vehicle at the same time. Disconnect the battery negative cable when checking or servicing the battery.





Table 3-2. Operator's Inspection Table

## Daily Inspection (When Used)

**AXLES**

- Check differential for leaks.
- Check hub and flange for leaks.

**BRAKES - SERVICE & PARKING**

- Check for proper operation.

**CAB AND BODY**

- Check operation and general condition of compartment doors.
- Inspect weather seals around cab door for looseness, damage and deterioration.
- Inspect all glass for breaks or discoloration. Check operation of windows.
- Inspect for tears in seat. Check operation of seat adjusting mechanism.

**COOLING SYSTEM**

- Check coolant level.
- Check coolant color and cleanliness.
- Check all hoses and connections for leaks.

**ELECTRICAL**

- Battery:
  - Check water level (unless maintenance free).
  - Check terminals and cables for corrosion and tightness.
  - Inspect for chafed or broken wires.
  - Check retaining clips and grommets.
  - Check light assemblies for operation, cracked lenses.
  - Check operation of instruments.
  - Check all terminals and connections for corrosion and tightness.
  - Check alternator operation.

**ENGINE**

- Check crankcase oil level.
- Check power steering reservoir fluid level.
- Check drive belts for wear or defects.
- Inspect fuel lines and filter for leaks.

**TRANSMISSION**

- Check oil level.
- Inspect for fluid leaks.

**WHEELS AND TIRES**

- Check wheel nuts for tightness.
- Check tire condition.

**WINTERIZATION SYSTEM**

- Inspect extension cable for nicked or burned insulation, or damaged receptacles.
- Check all hoses and connections for leaks.

**AIR BRAKE SYSTEM**

- Check for proper operation.
- Check gladhands for physical damage.
- Inspect for air leaks.
- Drain air tanks.

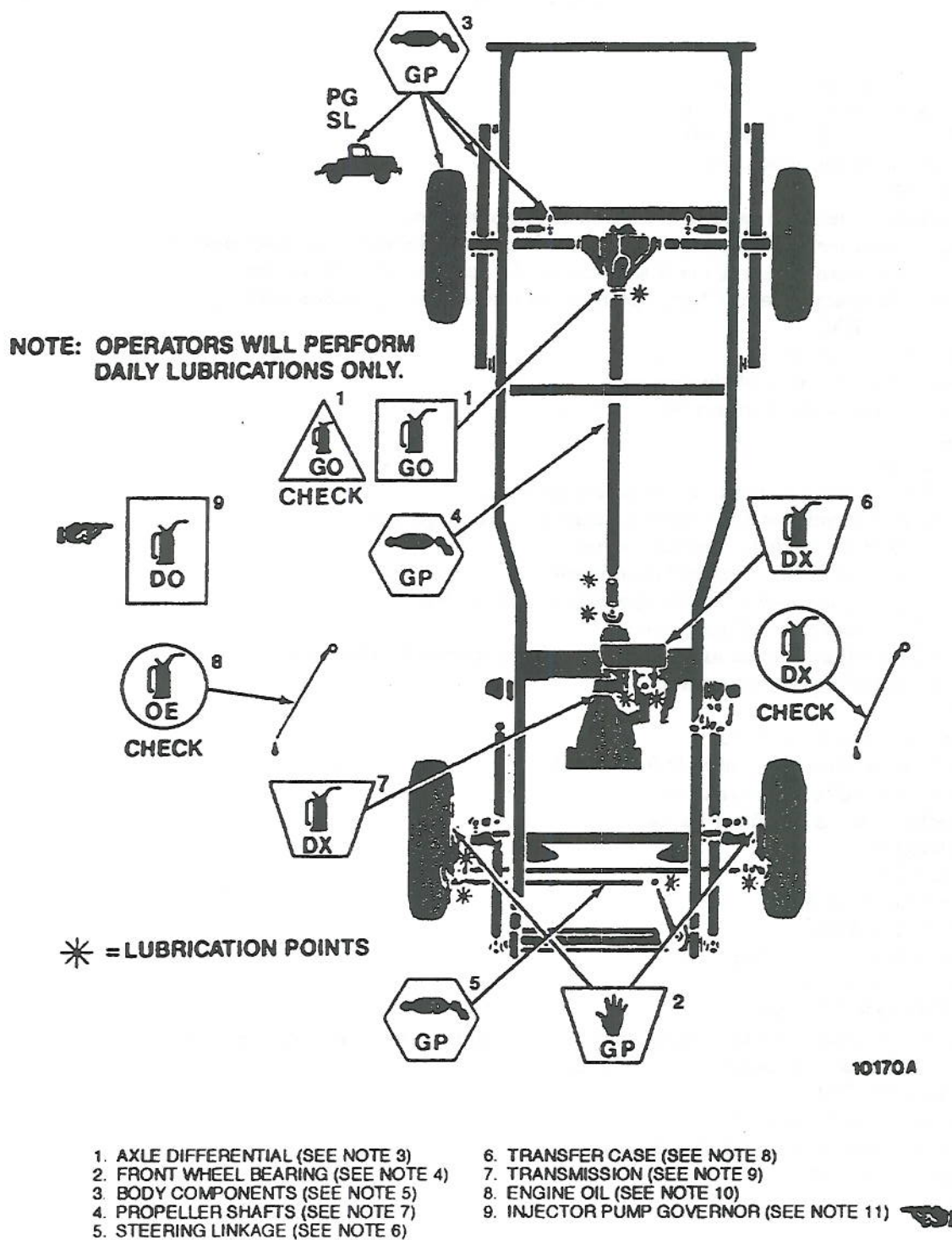




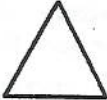


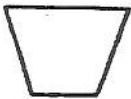



Figure 3-1. Lubrication Chart (Sheet 1 of 3)



## Lubricant Key

## Types Of Lubricants &amp; Symbols

Types Of Lubricants & Symbols	30°C and up	-7°C to +25°C	+5°C to +40°C	-18°C to +10°C
	15W40 or 20W/40	10W30		
	40W	30W	20W20	10W
ENGINE OIL, OE CC OR CD	Automatic Transmission Fluid	Automatic Transmission Fluid	Automatic Transmission Fluid	Automatic Transmission Fluid
OIL, GEAR, GO SAE 80W-140	Oil, Gear	Oil, Gear	Oil, Gear	Oil, Gear
LITHIUM-BASED CHASSIS LUBRICANT, GP	Grease, Chassis, General Purpose	Grease, Chassis, General Purpose	Grease, Chassis, General Purpose	Grease, Chassis, General Purpose
3M SPRAY LUBE 8902, SL	Lubricant, Spray	Lubricant, Spray	Lubricant, Spray	Lubricant, Spray
POWDERED GRAPHITE, AMC/JEEP Silicon Lubricant Spray or Light Oil PG	Graphite, Powdered	Graphite, Powdered	Graphite, Powdered	Graphite, Powdered
DIAPHRAGM OIL, DO (Cod Liver Oil or Equivalent)				

INTERVAL KEY						APPLICATION KEY	
							GREASE GUN
200 HR OR 5000 K OR 3100 MILES	DAILY	2500 MILES OR 3 MONTHS	5000 MILES OR 6 MONTHS	12,000 MILES OR 12 MONTHS	30,000 MILES OR 30 MONTHS		OIL CAN
							HAND

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Figure 3-1. Lubrication Chart (Sheet 2 of 3)

*Lubrication Notes*

1. Clean the lubrication fittings with dry cleaning solvent, Federal Specification PD680 Type II. Dry before applying lubricant.
2. Intervals specified are for normal operation. The maintenance office may adjust the intervals to compensate for unusual climatic or operating conditions.
3. Check axle differential fluid at 2500 miles or 3 months. Replace differential fluid at 30,000 miles or 30 months.
4. Lubricate every 12,000 miles or 12 months. Replace spindle oil and bearing seals on front wheel bearings (rear wheel bearings do not require periodic or scheduled lubrication).
5. Lubricate body components at 5000 miles or 6 months. Lubricate the following items with the recommended lubricants: hood, glove box door latch and hinge; locks; windshield hinges and holddown knobs.
6. Lubricate propeller shafts at 5000 miles or 6 months. Lubricate sleeve yokes (spline and U-joints).
7. Lubricate steering linkage at 5000 miles or 6 months. Lubricate ball joints. Lubricate every 12 months or 12,000 miles.
8. Check transfer case fluid level at 3 months or 2500 miles. Replace fluid at 1200 miles or 12 months.
9. Replace automatic transmission fluid at every 1200 miles or 12 months.
10. Change engine oil at 250 miles and every 1,000 miles afterward.
11. Lubricate the diaphragm for the governor every 200 hours. Remove the drain plug to remove the old oil, then replace the drain plug. Remove the fill plug and apply a few drops of diaphragm oil (cod liver oil) through the fill port. Replace the fill plug.

*Figure 3-1. Lubrication Chart (Sheet 3 of 3)***WARNING**

Do not attempt to charge or use a booster on a battery with frozen electrolyte. The frozen battery may explode.

- a. Check electrolyte level as follows.

**NOTE**

Electrolyte level inspection does not apply to maintenance-free batteries.

Uneven filling of cells will offset battery storage capacity and service life.

- (1) Remove battery fill caps and look into each filler well.

**NOTE**

In freezing weather, add water before driving to assure mixing with acid and to prevent freezing.

- (2) Add distilled water, or drinking water free of high mineral content, to maintain fluid level above battery plates and at the bottom of the filler well ring.
- b. Check specific gravity. Hydrometer readings should be used to determine the battery state of charge. This is particularly true in cold weather, as a partially charged battery may freeze at temperatures up to 20°F.
- (1) Draw in electrolyte, using hydrometer, as shown in figure 3-2.

- (2) Make sure float is free and take specific gravity reading at eye level.

**NOTE**

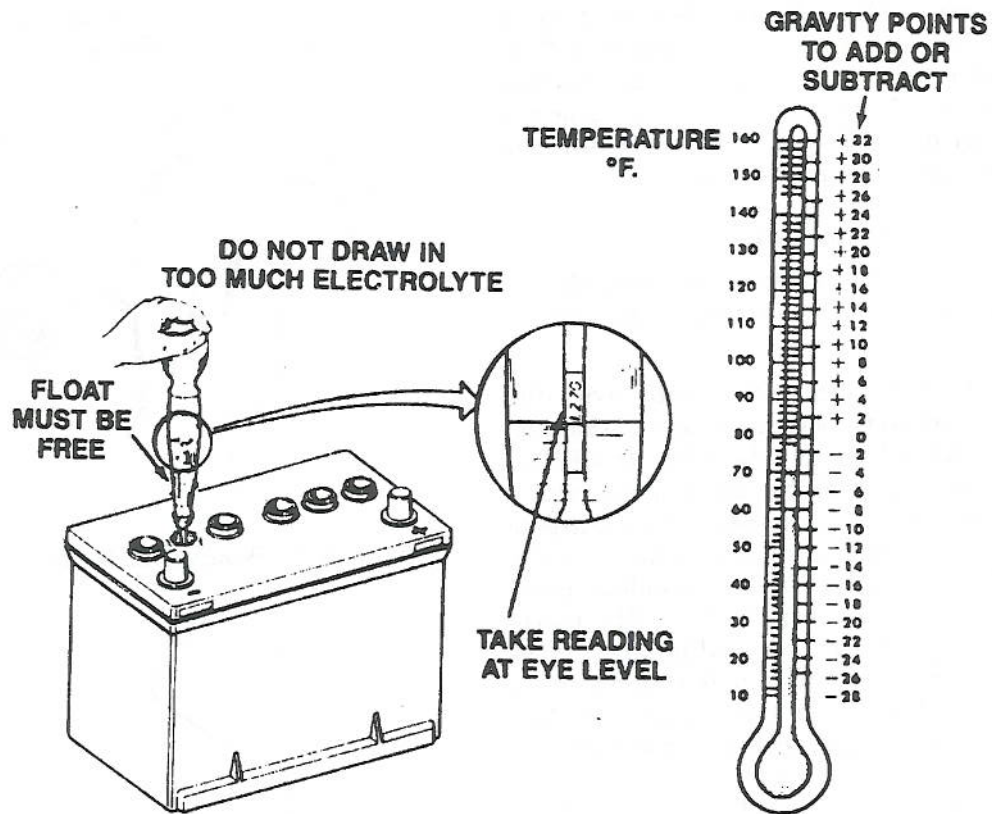
Do not add distilled water to electrolyte immediately after charging battery.

- (3) Battery needs charging if specific gravity reads 1.225 (or less) at 75°F. Correct the reading for current temperature using chart in figure 3-2.
- c. Check battery condition. Check condition of battery and cables as follows.
- (1) Check all battery cable connections periodically to make sure they are clean and tight.
- (2) Remove any corrosion from battery terminals by scrubbing with a solution of baking soda or ammonia and water.
- (3) Clean battery posts with a cleaning tool, as shown in figure 3-3, and clean the inside surfaces of the cable terminals, as shown in figure 3-4.
- (4) After cleaning, coat the exterior of the cable terminals with a light film of petroleum jelly to retard further corrosion.

**CAUTION**

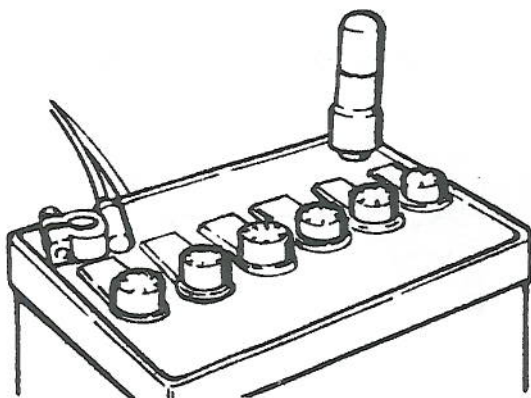
Do not use antifreeze or other solutions in windshield washer fluid reservoir that may damage paint.





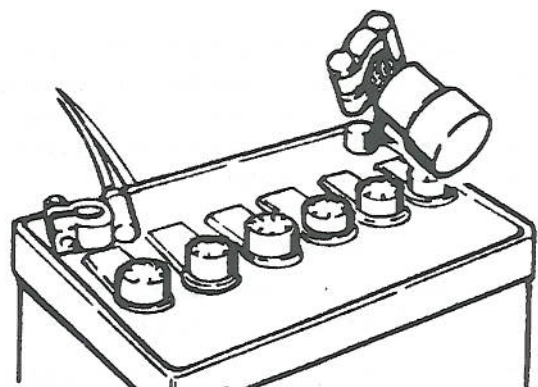
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Figure 3-2. Checking Battery Specific Gravity.



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Figure 3-3. Cleaning Battery Posts



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Figure 3-4. Cleaning Cable Terminals

**3-4.3 Windshield Fluid Level.** The windshield washer fluid reservoir, located under the hood (Figure 3-5), must be refilled periodically with water and a washer solvent. In freezing weather, warm the windshield with the defroster before using the washer to prevent icing on the glass.

#### WARNING

Do not remove the radiator cap when the engine is hot or injury to personnel may occur.

**3-4.4 Coolant Level.** Check the coolant level, (figure 3-6) at the recovery bottle, not at the radiator. The proper level is between the ADD and FULL marks with the engine at operating temperature. Add a 50/50 mixture of permanent-type antifreeze and water to the bottle, if necessary to raise the level. Do not remove the radiator cap unless necessary. Do not fill the reservoir above the FULL mark. A special radiator cap ensures sealing and allows the normal expansion of coolant to flow to the reservoir when hot and return as the engine cools. Use only the proper cap if replacement is necessary.

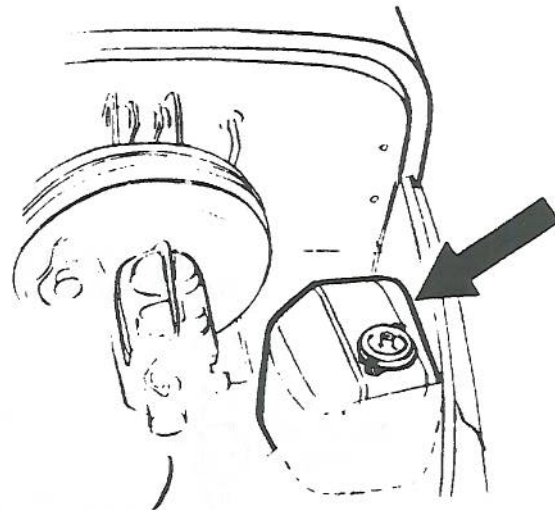
**3-4.5 Engine Oil Level.** Check oil level daily. Allow the oil to settle a few minutes after stopping the engine, remove the dipstick and wipe it clean. Insert the dipstick in the tube and remove it again. Check the oil level as shown on both sides of the stick (figure 3-7). Oil level should be between the ADD and FULL marks. If the level has dropped to the ADD mark, add one quart (0.95 L) to raise the level to the FULL mark (figure 3-8). Some oil is inevitably used in normal operation. A consumption rate of one quart (0.95 L) per 1000 miles (1600 km) is not excessive.

**3-4.6 Transmission Fluid Level.** Fluid level should be checked while transmission is at normal operating temperature (figure 3-9). At normal operating temperature, the gauge end of the dipstick will be too hot to handle comfortably.

#### WARNING

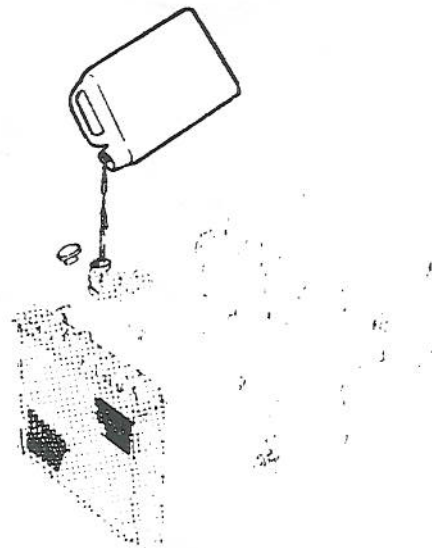
To guard against injury, stay clear of fan and drive belts when engine is running.

- Operate engine at idle speed and normal operating temperature.
- Place vehicle on level surface, apply parking brake fully and move gearshift lever through all ranges.
- Shift to NEUTRAL (not PARK).



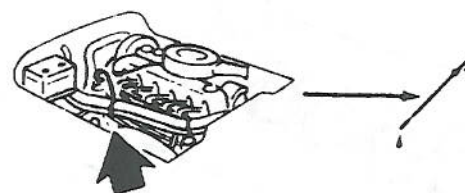
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Figure 3-5. Windshield Washer Fluid Reservoir



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Figure 3-6. Cooling System



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Figure 3-7. Oil Level Indicators



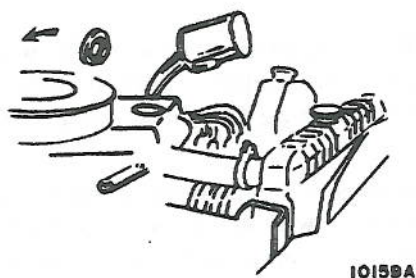


Figure 3-8. Engine Oil

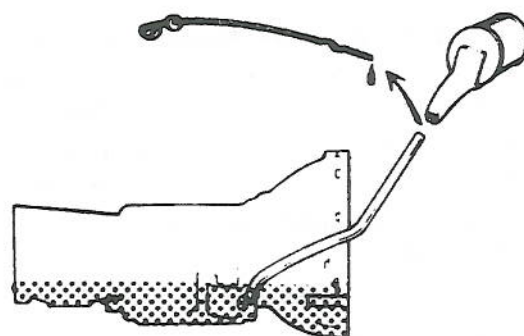


Figure 3-10. Transmission Fluid—Add

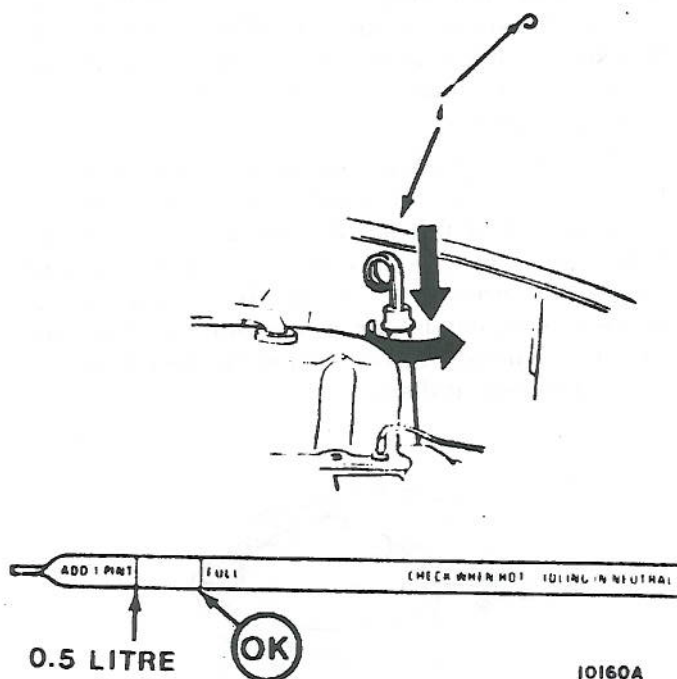


Figure 3-9. Transmission Fluid Level Indicators

- d. Remove dipstick cap. Wipe stick clean and insert fully. Remove dipstick again and note fluid level on both sides. Fluid level should be between the ADD and FULL marks at normal operating temperature. If fluid is low, add required amount of fluid into the dipstick tube as shown in figure 3-10. Do not overfill. Check for leaks.

#### WARNING

Stay clear of fan and drive belts when rotating or cranking engine.

**3-4.7 Drive Belts.** With ignition OFF, check tension and condition of belts (figure 3-11). Belts that are worn, cracked, or frayed must be replaced.

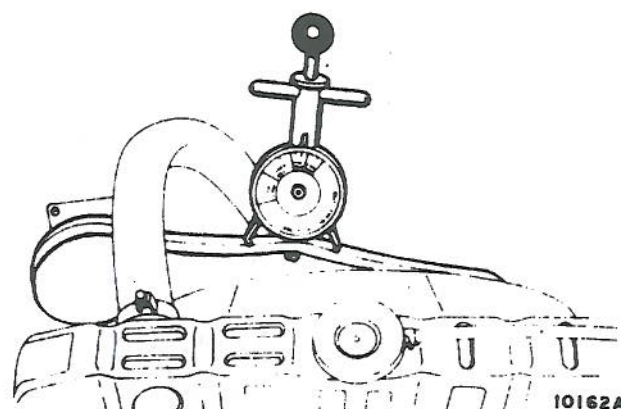
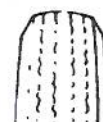


Figure 3-11. Drive Belt Tension Test

**3-4.8 Tires and Wheels.** Tire life may be greatly lengthened by proper inspection and rotation of tires and wheels.

- a. Perform tire and wheel checks as follows.
  - (1) Check tire wear, using tire wear indicators (figure 3-12), if present, to determine minimum tread level.
  - (2) Check cold tire pressure daily.
  - (3) Check valve stems for proper position and see that all caps are installed.
  - (4) Check condition and tightness of lug nuts.



TREAD STILL GOOD



TREAD WORN OUT

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Figure 3-12. Tire Tread Wear Indicators

**3-4.9 Windshield Wiper Replacement.** Washing windshield and rubber wiper element regularly with detergent will extend the life of wiper blades.

- Raise wiper arm (figure 3-13) away from windshield and push blade firmly against tip of arm.
- Hold arm stationary and rotate blade around tip of arm.

**NOTE**

Rubber element of wiper blade assembly is not replaceable separately.

- Install new wiper blade assembly.

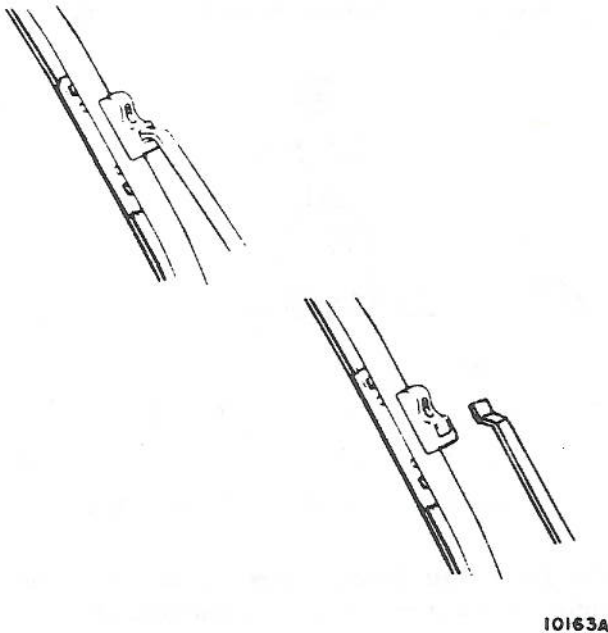


Figure 3-13. Windshield Wiper Blade Replacement

**3-4.10 Air Reservoir Check.** Remove drain fitting from drain valves (figure 3-14) and allow any accumulated moisture to drain from valves before operating vehicle.

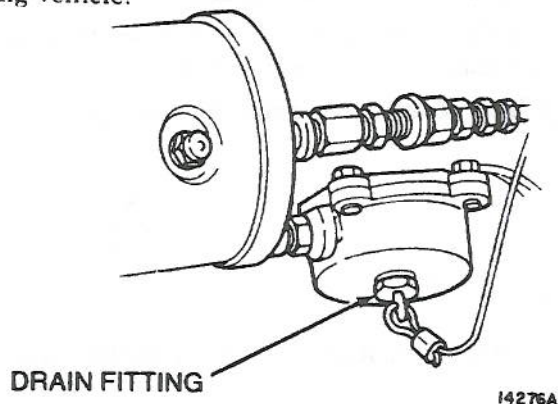


Figure 3-14. Air Reservoir Check

**3-4.11 Water Separator Check.** The water separator (figure 3-15) should be checked and drained once a month by turning the drain valve located at the base of the filter.

**3-4.12 Exterior Care.** Checking and cleaning exterior of vehicle will deter rust and prolong finish. Many chemicals applied to roads and sprayed into the air are highly corrosive and should be removed promptly from vehicle exterior. Extreme weather conditions also adversely affect the vehicle exterior. Steam-cleaning is suggested to remove dirt packed in wheel housings, bumpers, mufflers, tailpipes and brackets. Avoid spraying steam directly at electrical connectors. If undercoated, repair breaks in the sealer promptly.

**3-4.12.1 Paint.** Weekly washing with cold, clear water and polishing with a soft cloth or chamois will preserve original finish. Allow metal surfaces to cool before washing. Use care in removing stains and road film to prevent scratching finish. Avoid using abrasive compounds and power buffing that may thin out enamel. Paint scratches should be retouched as soon as discovered.

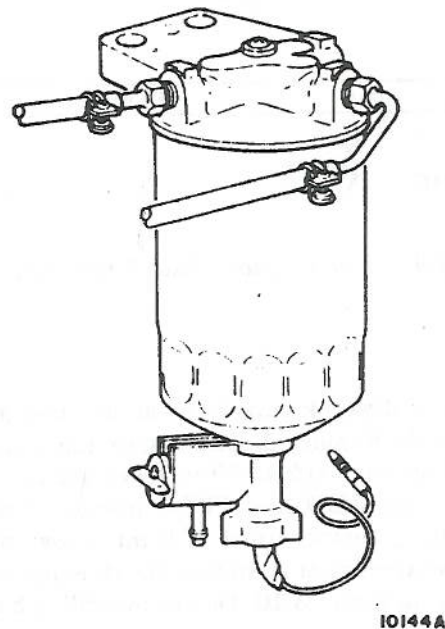


Figure 3-15. Water Separator