APPENDIX G
LUBRICATION INSTRUCTIONS

G 1. SCOPE

This appendix gives lubrication requirements for the M998 series vehicles which are the responsibility of the operator/crew.

G-2. GENERAL LUBRICATION REQUIREMENTS

a. Maintaining Lubricant Levels. Lubricant levels must be checked as specified in the PMCS (Chapter 2, Section 2) and Table G-I, Lubrication. Steps must be taken to replenish and maintain lubricant levels.

WARNING

- Drycleaning solvent P-D-680 is TOXIC and flammable. Wear protective goggles and gloves, use only in well-ventilated area, avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat and flame. Never smoke when using solvent. The flashpoint for type I drycleaning solvent is 100°F (38°C), and for type II, is 138°F (50°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get medical attention.

b. Cleaning Fittings Before Lubrication. Clean parts with drycleaning solvent P-D-680 or equivalent. Dry before lubricating. Dotted arrow points indicate lubrication on both sides of the equipment.

c. Lubrication After Fording. If fording operation occurs, lubricate all fittings below fording depth and check submerged gear boxes for presence of water.

d. Lubrication After High-Pressure Washing. After a thorough washing, lubricate all grease fittings and oil can points outside and underneath vehicle.

e. Localized Views. A reference to the appropriate localized view is given after most lubrication entries. Localized views begin on page G-11.

G-3. LUBRICATION INTERVALS

a. Service Interval Under Normal Conditions. Service intervals listed are for normal operation in moderate temperatures, humidity, and atmospheric conditions. Hard time intervals may be shortened if your lubricants are contaminated or if you are operating the equipment under adverse conditions, including longer-than-usual operating hours. Hard time intervals may be extended during periods of low activity, though adequate preservation precautions must be taken. Perform semi-annual service intervals every six months, or 3,000 miles (4,827 km), whichever comes first.

b. Service Interval Under Unusual Conditions. Increase frequency of lubricating service when operating under abnormal conditions such as high or low temperatures, prolonged high speed driving, or extended cross-country operations. Such operation can diminish lubricant's protective qualities. More frequent lubricating service intervals are necessary to maintain vehicle readiness when operating under abnormal conditions.

c. Hard Time Intervals. Intervals shown in this appendix are based on mileage and calendar times. An example of mileage and calendar interval is: 3/S, in which 3 stands for 3,000 mi (4,827 km), and S stands for semiannually (every six months). The lubrication for the vehicle is to be performed at whichever interval occurs first. For equipment under manufacturer's warranty, hard time oil service intervals shall be followed.

d. Army Oil Analysis Program (AOAP). HMMWV engines and transmissions are enrolled in the Army Oil Analysis Program (AOAP). The sampling interval for the engine is every six months or 3,000 miles (4,827 km) (or 100 hours if hour meter is installed) of operation. For the transmission, the sampling interval is every 12 months or 6,000 miles (9,654 km) (or 300 hours if hour meter is installed) of operation.

G-4. LUBRICATION FOR OPERATION UNDER EXTREME TEMPERATURES

a. Changes in Lubricant Grades. Lubricant grades change with weather conditions. Refer to Lubrication Table for lubricant grade changes.

b. Arctic Conditions. Refer to FM 9-207, Operation and Maintenance of Ordnance Materiel in cold Weather (0°F to -65°F) (-18°C to -54°C), or the Lubrication Table.

G-5. CORROSION CONTROL

Refer to para 2-4 for appropriate corrosion control procedures.

Table G-1. Lubrication

USAGE	FLUID/LUBRICANT	CAPACITIES	EXPECTED TEMPERATURES
Engine Oil (MIL-L-2104) (MIL-L-46167)	OE/HDO 30 OE/HDO 10 OEA	Crankcase: w/o filter 7 qt (6.6 L) w/ filter 8 qt (7.6 L) Dry System 10 qt (9.5 L)	Above + 15° F (-9° C) +40° to -15° F (+4° to -26° C) +40° to -65° F (+4° to -54° C)
Engine Coolant	Ethylene Glycol and Water 1/4 Ethylene Glycol, 3/4 Water 2/5 Ethylene Glycol, 3/5 Water 3/5 Ethylene Glycol, 2/5 Water	Radiator: 5 qt (4.7 L) Complete System: 26 qt (24.6 L)	 Above +15° F (-9°C) +40° to -15° F (+4° to -26° C) +40° to -65° F (+4° to -54° C)
Transmission (3L80)	Dexron® II or Dexron® III	Dry 11 qt (10.4 L) Drain & Refill 6 qt (5.7 L)	All Temperatures (except arctic)
(4L80-E)	Dexron® III	Dry 13.5 qt (12.8 L) Drain & Refill 7.7 qt (7.3 L)	All Temperatures (except arctic)
	OEA		Arctic Temperatures
Steering System	Dexron® II or Dexron® III	1 qt (0.95 L) w/Cooler 1.25 qt (1.18 L)	All Temperatures
Upper Ball Joints (all vehicles), Lower Ball Joints (A2 and M1123 vehicles only), Tie Rod Ends, Pitman Arm, Propeller Shafts, etc.	GAA	As Required	All Temperatures
Hinges, Cables, and Linkages	OE/HDO	As Required	All Temperatures
OE/HDO 15/40 (Grade 15W-40) lubricant may be used when expected temperatures are above +5°F (–15°C). If OEA lubricant is required to meet the temperature ranges prescribed in the Lubrication Table, then the OEA lubricant is to be used in place of OE/HDO 10 lubricant for all temperature ranges. If operating conditions are severe or abnormal, service chassis lubrication points at 1,000 mi (1,609 km).			

Table G-1. Lubrication (Cont'd)

LUBRICANTS	EXPECTED TEMPERATURES
GAA-GREASE, AUTOMOTIVE AND ARTILLERY (MIL-G-10924)	ALL TEMPERATURES
PL-S-LUBRICATING OIL, GENERAL PURPOSE, PRESERVATIVE, (WATER DISPLACING LOW TEMPERATURE) (VV-L-800A)	ALL TEMPERATURES
GWR-GREASE, WIRE ROPE (MIL-G-18458)	ALL TEMPERATURES

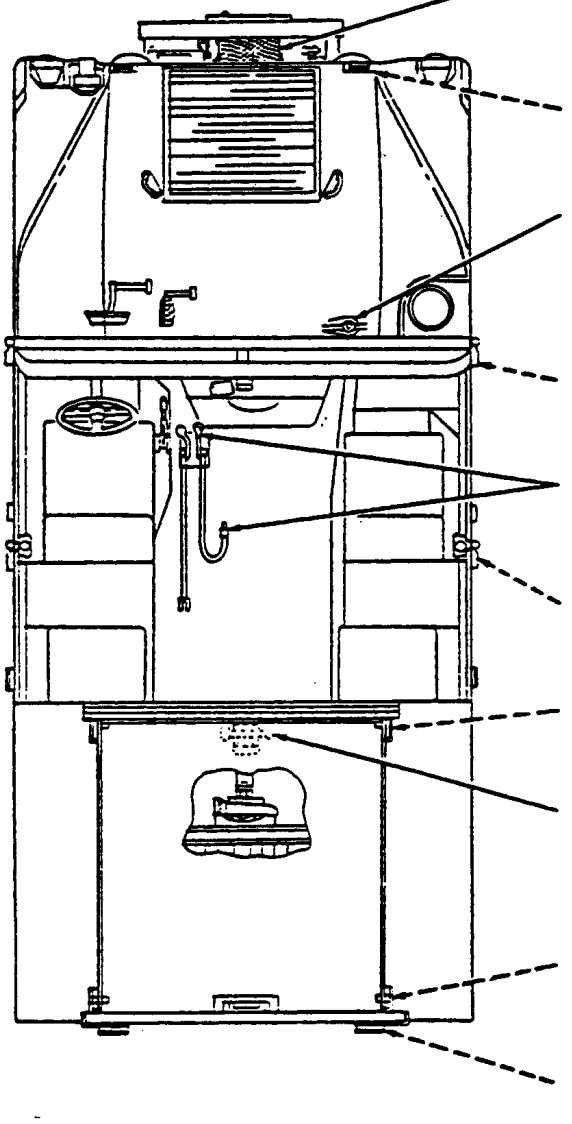
FUEL REQUIREMENTS — TEMPERATURE LIMITS (VV-F-800)

Grade DF2 Fuel	For use above +10°F (-12°C)*
Grade DF1**	For use below +10°F (-12°C) to above -20°F (-29°C)
Grade DFA	For use below -20°F (-29°C)

* Temperature limits may vary dependent on the cloud point of the actual DF2 fuel being supplied in the geographical area.

** DF1 is not normally procured in CONUS or OCONUS. Refineries will blend DF2 with kerosene to meet temperature requirements of DF1.

LUBRICATION POINTS



INTERVAL	LUBRICANT	
3/S	GWR	Winch Wire Rope (See note 2)
3/S	OE/ HDO	Hood Hinges (See note 1)
3/S	OE/ HDO	Heater Control Shutoff Valve Lever and Pin (LV-A) (See note 1)
3/S	OE/ HDO	Door Hinges (See note 1)
3/S	OE/ HDO	Transmission Shift Linkage (See note 1)
3/S	OE/ HDO	Door Hinges (See note 1)
3/S	PL-S	Cargo Shell Door Latches (See note 1)
3/S	PL-S	Cargo Shell Door Front Paddle Lock (See note 1)
3/S	PL-S	Cargo Shell Door Latches (See note 1)
3/S	OE/ HDO	Tailgate Hinges (See note 1)

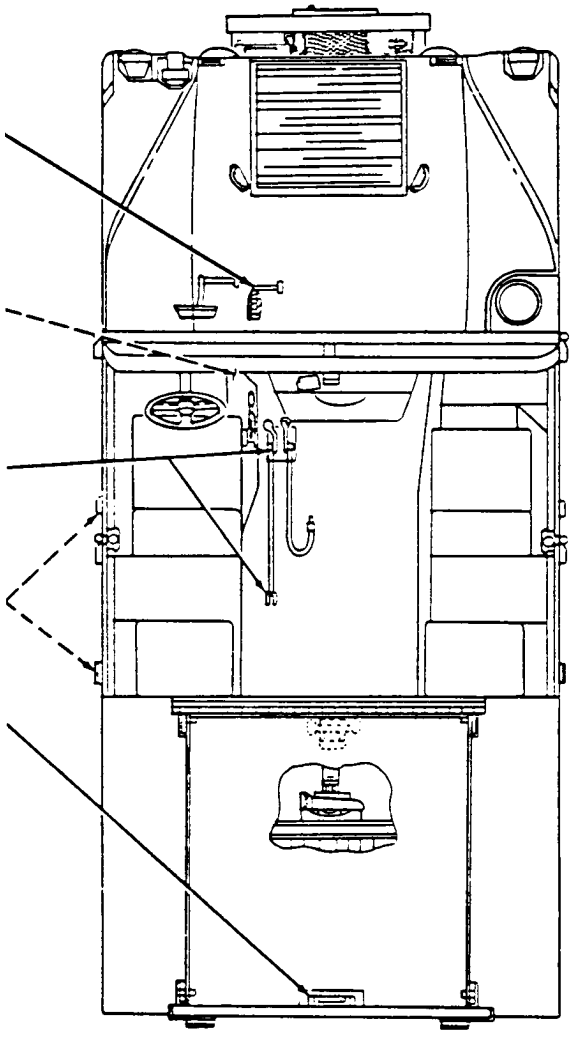
NOTE

A REFERENCE TO THE LOCALIZED VIEW (LV) IS PROVIDED AFTER LUBRICATION POINT ENTRY, WHERE APPLICABLE.

LUBRICATION POINTS (Cont'd)

LUBRICANT • INTERVAL

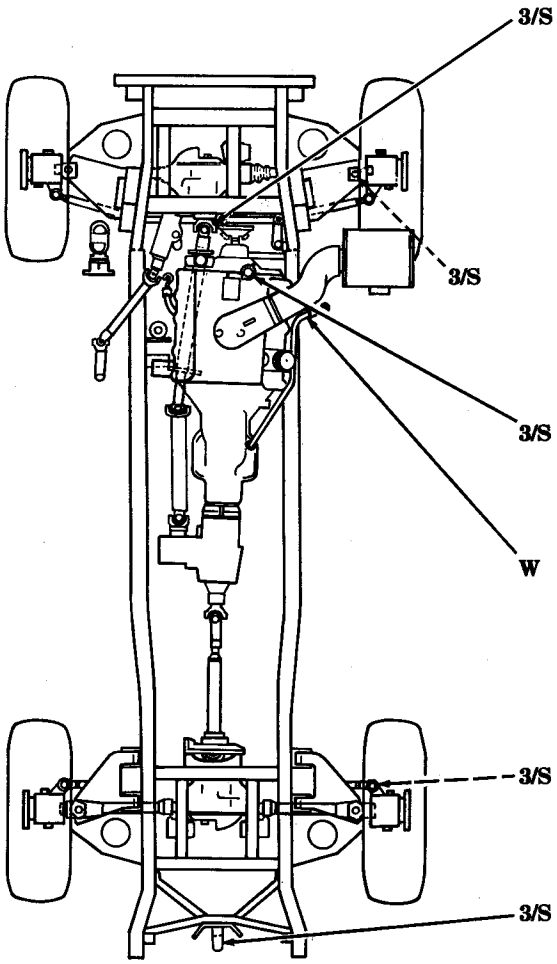
Accelerator Linkage (LV-B) (See note 1)	**OE/ HDO**	**3/S**
Heater Control Knob and Plunger (LV-C) (See note 1)	**OE/ HDO**	**3/S**
Transfer Case Shift Linkage (See note 1)	**OE/ HDO**	**3/S**
Door Handles (See note 1)	**OE/ HDO**	**3/S**
Cargo Shell Door Rear Wire Handle Lock (See note 1)	**PL-S**	**3/S**



NOTE

A REFERENCE TO THE LOCALIZED VIEW (LV) IS PROVIDED AFTER LUBRICATION POINT ENTRY, WHERE APPLICABLE.

LUBRICATION POINTS (Cont'd)



INTERVAL	LUBRICANT	
GAA		Front Propeller Shaft Universal Joint and Slip Yokes (3 fittings) (LV-D, LV-E) (See note 4)
GAA		Upper Control Arm Ball Joints (all vehicles). Lower Control Arm Ball Joints (A2 and M1123 vehicles only) (LV-S, T) (See note 4)
OE/ HDO		Crankcase Fill (LV-F) (See note 7)
Dexron® II or III for 3L80 Dexron® III for 4L80-E		Transmission Fill and Level (Check Level) (LV-G) (See note 6)
GAA		Radius Rods (LV-H) (See note 4)
OE/ HD0		Pintle (See note 3) (LV-I)

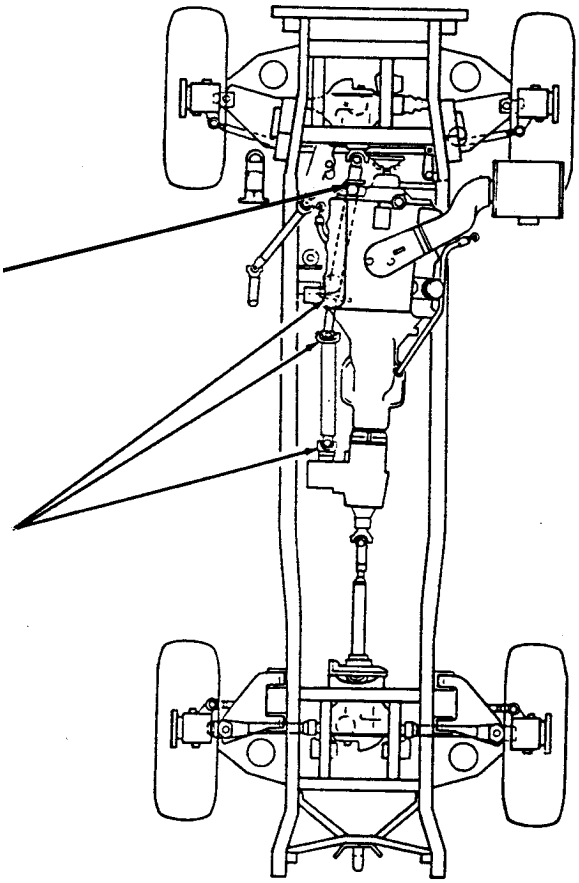
NOTE

A REFERENCE TO THE LOCALIZED VIEW (LV) IS PROVIDED AFTER LUBRICATION POINT.

LUBRICATION POINTS (Cont'd)

LUBRICANT • INTERVAL

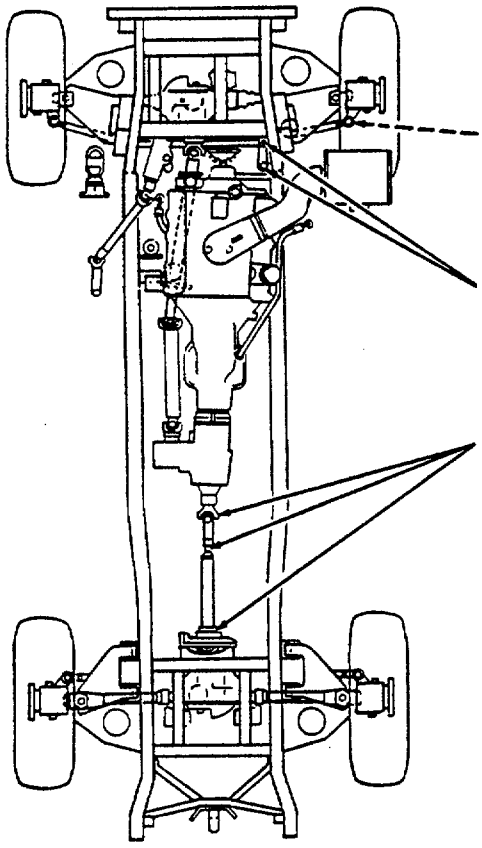
Power Steering Reservoir Fill and Level (Check level) (LV-J) (See note 5)	**Dexron® II or Dexron® III**	**D**
Front Propeller Shaft, Universal Joints and Slip Yokes (3 fittings) (LV-D, E) (See note 4)	**GAA HDO**	**3/S**



NOTE

A REFERENCE TO THE LOCALIZED VIEW (LV) IS PROVIDED AFTER LUBRICATION POINT.

LUBRICATION POINTS (Cont'd)

	INTERVAL • LUBRICANT		
	3/S	GAA	Tie Rod Ends (2 fittings) (LV-K) (See note 4)
	3/S	GAA	Idler Arm (2 fittings) (LV-M) (See note 4)
	3/S	GAA	Rear Propeller Shaft Universal Joints and Slip Yokes (3 fittings) (LV-N, O)

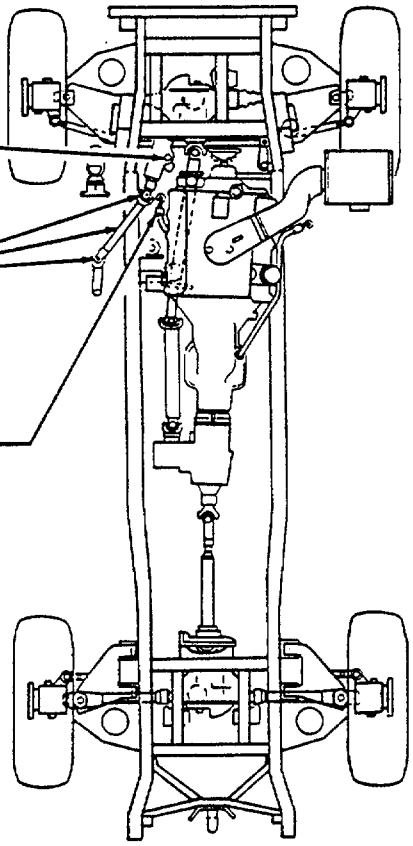
NOTE

A REFERENCE TO THE LOCALIZED VIEW (LV) IS PROVIDED AFTER LUBRICATION POINT.

LUBRICATION POINTS (Cont'd)

LUBRICANT • INTERVAL

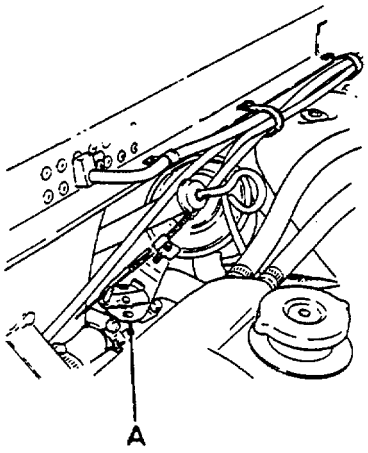
Pitman Arm (LV-L) (See note 4)	**GAA**	**3/S**
Intermediate Steering Shaft (3 fittings) (LV-P, Q) (See note 4)	**GAA**	**3/S**
Crankcase Level (LV-R) (See note 7)	**OE/ HDO**	**D**



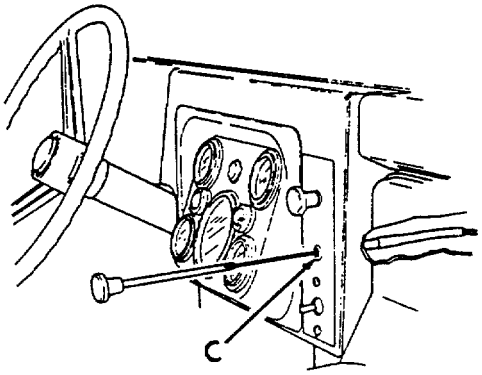
NOTE

A REFERENCE TO THE LOCALIZED VIEW (LV) IS PROVIDED AFTER LUBRICATION POINT.

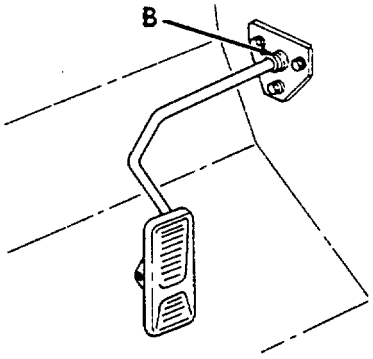
LOCALIZED LUBRICATION POINTS



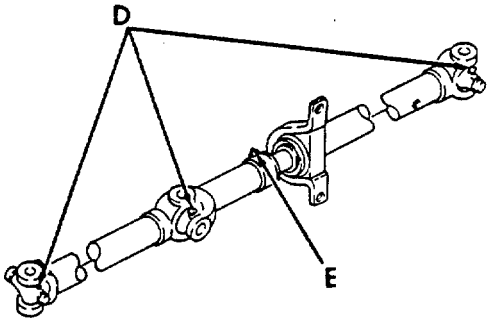
HEATER CONTROL SHUTOFF VALVE LEVER AND PIN



HEATER CONTROL KNOB AND PLUNGER

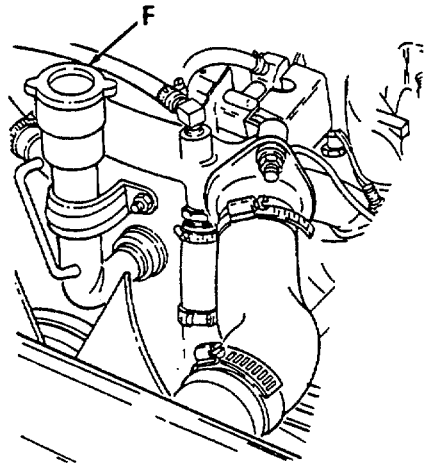


ACCELERATOR LINKAGE

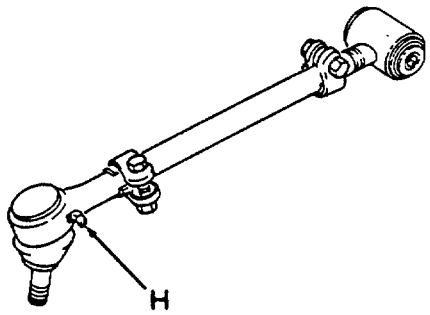


FRONT PROPELLER SHAFT UNIVERSAL AND SLIP JOINTS

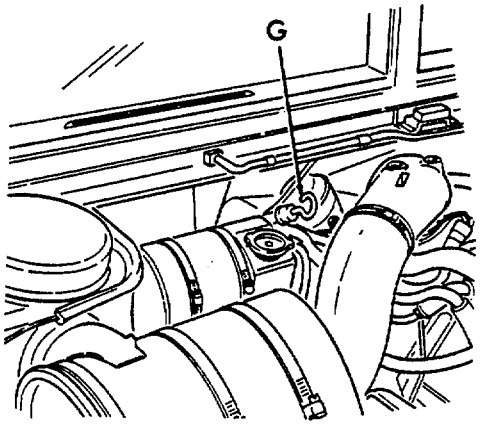
LOCALIZED LUBRICATION POINTS



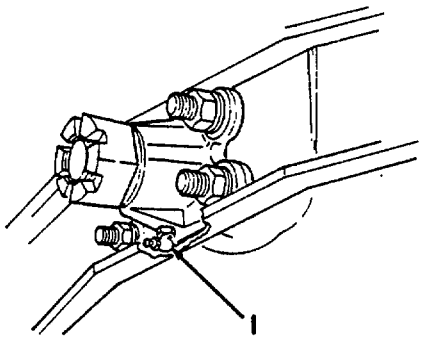
CRANKCASE FILL



RADIUS ROD

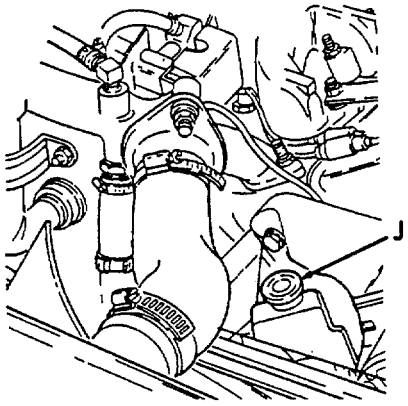


TRANSMISSION FILL AND LEVEL

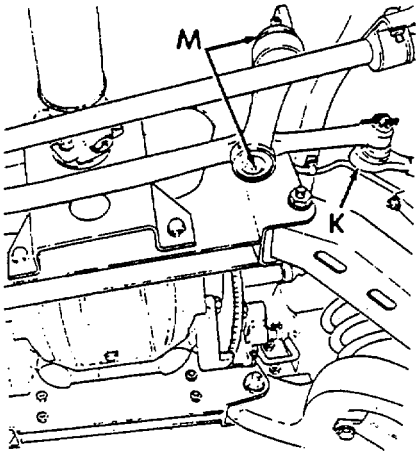


PINTLE

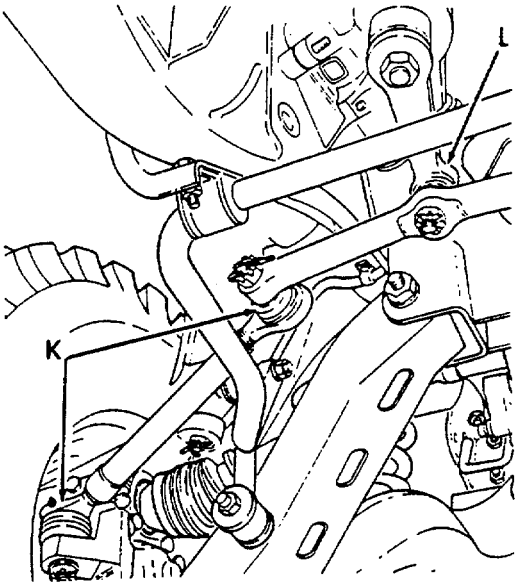
LOCALIZED LUBRICATION POINTS



POWER STEERING RESERVOIR FILL AND LEVEL

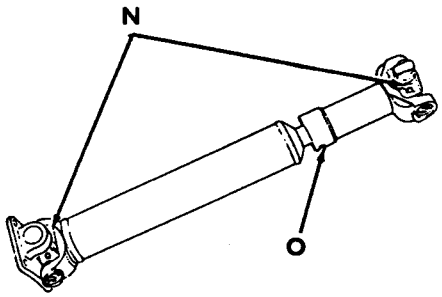


IDLER ARM AND TIE ROD

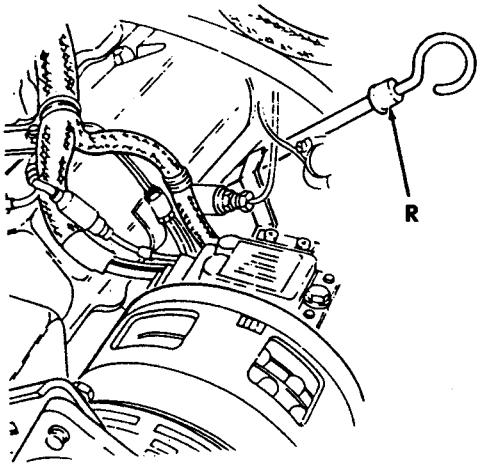


TIE ROD AND PITMAN ARM

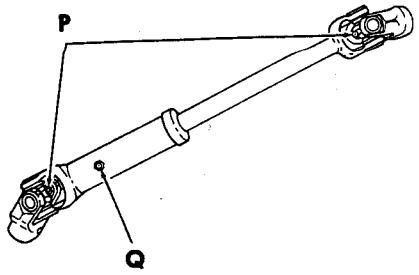
LOCALIZED LUBRICATION POINTS (Cont'd)



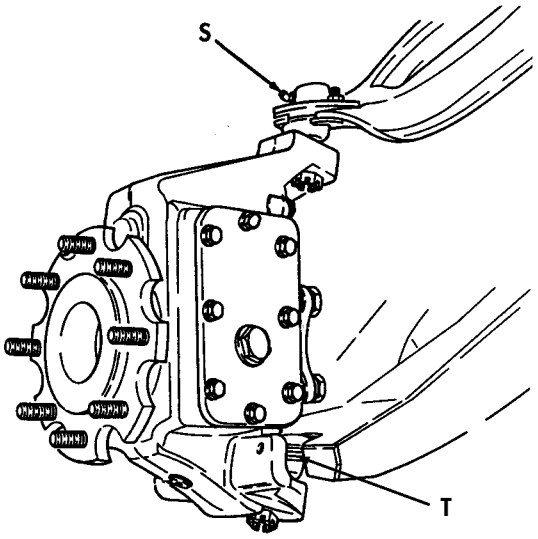
REAR PROPELLER SHAFT
UNIVERSAL JOINTS AND SLIP YOKES



CRANKCASE LEVEL



INTERMEDIATE
STEERING SHAFT



GEARED HUB AND
UPPER CONTROL ARM BALL JOINT

NOTES

1. Oil Can Points.

Lubricate all oil can points every 3,000 mi (4,827 km), or semiannually, whichever occurs first. Use seasonal grade OE on hood hinges, tailgate hinges, door hinges, door handles, transfer case shift linkage, accelerator linkage, transmission shift linkage, heater control shutoff valve lever and pin, and heater control knob and plunger. Lubricate cargo shell door front paddle lock, rear wire handle lock and cargo shell door latches with PL-S, (M996, M996A1, M1025, M1025A1, M1025A2, M1026, M1026A1, M1036, M1043, M1043A1, M1043A2, M1044, M1044A1, M1045, M1045A1, M1045A2, M1046, and M1046A1 only).

2. Winch Wire Rope.

WARNING

Wear leather gloves when handling winch wire rope. Do not handle wire rope with bare hands. Broken wires cause injury.

After each use, clean and lubricate winch wire rope. Clean entire wire rope with wire brush. Do not lubricate winch wire rope in dry, dusty conditions. Perform winch wire rope cleaning and lubrication every 3,000 mi (4,827 km) or semiannually, whichever occurs first, when wire rope is not used.

3. Pintle.

Every 3,000 mi (4,827 km), or semiannually, whichever occurs first, clean pintle with wire bush and lubricate rear plate fitting with seasonal grade OE.

4. Steering System.

CAUTION

Do not over lubricate tie rod ends and upper and lower ball joints. One or two shots is adequate. Excessive lubrication will result in the boot rupturing. Observe the boot during lubrication: a seeping condition indicates adequate lubrication; expansion of the boot indicates over lubrication.

Lubricate front propeller shaft, steering column, U-joints, slip yokes, tie rods, upper and lower ball joints, radius rods, pitman arm, intermediate steering shafts, and idler arm with GAA every 3,000 mi (4,827 km), or semiannually, whichever comes first.

5. Power Steering Reservoir.

CAUTION

Use Dexron® II or Dexron® III for filling power steering reservoir. Failure to use Dexron® II or Dexron® III will cause damage to power steering system.

Check the fluid level in the power steering reservoir and adjust level as necessary. Level must be above "ADD" mark. Fluid does not require periodic changing.

NOTES

6. Transmission.

CAUTION

- Do not overfill transmission. The fluid level rises as the fluid temperature increases. Therefore, do not check level before the transmission has reached normal operating temperature. The safe operating level is within the crosshatch marks on the dipstick. Overfilling will result in damage to transmission.
- Use Dexron® II (3L80) or Dexron® III (4L80-E) for filling transmission. Failure to use Dexron® II or Dexron® III will cause damage to transmission.

Check and fill transmission to proper level weekly. Operate transmission through all operating ranges to fill cavities and fluid passages. With vehicle positioned on level ground, allow engine to idle, shift transmission to neutral, and apply parking brake. Check fluid level on dipstick. It should register within the crosshatch marks under the conditions stated above. On vehicles equipped for deep water fording, the dipstick has a seal which fits into the opening of the dipstick tube. The dipstick handle must be turned counterclockwise to be released before dipstick is withdrawn. Turn dipstick handle clockwise to seat after installing dipstick. Have fluid changed every 12,000 mi (19,308 km), or biennially, whichever occurs first.

7. Crankcase Oil Level.

CAUTION

- There are two marks on the dipstick: "FULL" and "ADD 1 QT." The quantity of oil required to raise the oil level from "ADD 1 QT" mark to "FULL" mark is 1 qt (0.9 L). Do not overfill crankcase. Overfilling will result in damage to engine.

NOTE

- If oil level is above "FULL," it may be due to oil cooler drain back. Operate the engine for one minute, shut down, wait one minute, then recheck oil level.
- Oil is added to crankcase through fill tube which is located on top of engine.

Check crankcase oil level daily. Start engine and visually check for oil leaks at drain plug and oil filter. Stop engine and wait approximately one minute for oil to drain back into oil pan, then recheck oil level with dipstick. On vehicles equipped for deep water fording, the dipstick has a seal which fits into the opening of the dipstick tube. The dipstick handle must be turned counterclockwise to be released before dipstick is withdrawn. Turn handle clockwise to seat after installing dipstick. Have oil changed every 3,000 mi (4,827 km), or semiannually, whichever occurs first.