C. ENGINE COMPARTMENT
1. Steering

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a. Play		
Check for play in the steering system, at the steering wheel, using the following procedures:		
1) Visual check - from inside bus with engine running, rotate steering wheel lightly from side to side until the turning motion can be observed at tires and note free play (lash) at steering wheel outer diameter. This procedure must be performed with the vehicle on the ground.	Steering wheel plastic is cracked (repair).	Free play (lash) exceeds amounts specified in Chart 8, page 86. Plastic is cracked or missing so that metal steering wheel reinforcement is exposed. Steering wheel is loose on column. Steering wheel is non-O.E.M. design.
2) To check power assist operation run engine at fast idle, turn steering wheel a full right and left turn, and feel for binding, jamming, or belt slippage.		Power assist is inadequate, or there is binding, jamming, or belt slippage.
b. Column		
Check steering column inside bus for up and down play (parallel to shaft), side to side play (perpendicular to shaft), and for proper mounting.		Side to side play in steering column exceeds 1/4 inch or up and down play exceeds 1 inch. Column assembly mounting (including floor mounting plate) or fasteners are loose.

(Continued on Page 87)

CHART 8

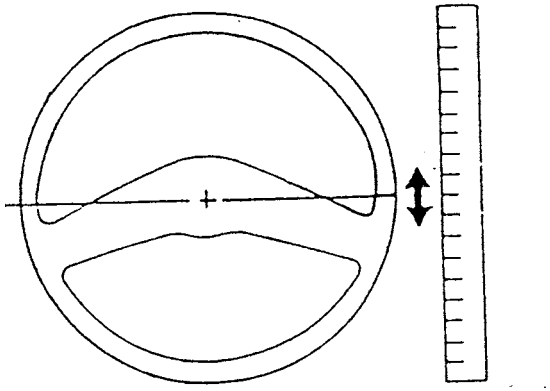
STEERING WHEEL PLAY (LASH) MEASUREMENTS

Steering Wheel Size

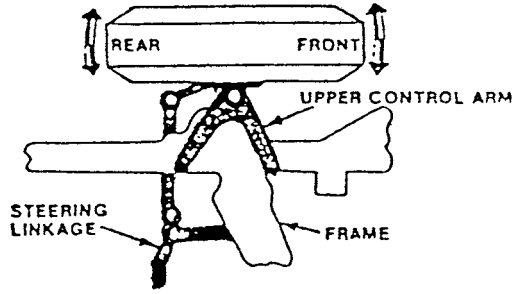
15 inches - 1 3/4” (4.4 cm)
16 inches - 2” (5.1 cm)
18 inches - 2 1/4” (5.7 cm)
20 inches - 2 1/2” (6.4 cm)
22 inches - 2 3/4” (7.0 cm)

Wheel Size:

16 inches or less - 1/4” (6.5 mm)
17 to 18 inches - 3/8” (9.5 mm)
Over 18 inches - 1/2” (13 mm)



STEERING LASH



STEERING LINKAGE PLAY - TOP VIEW

C. ENGINE COMPARTMENT
1. Steering

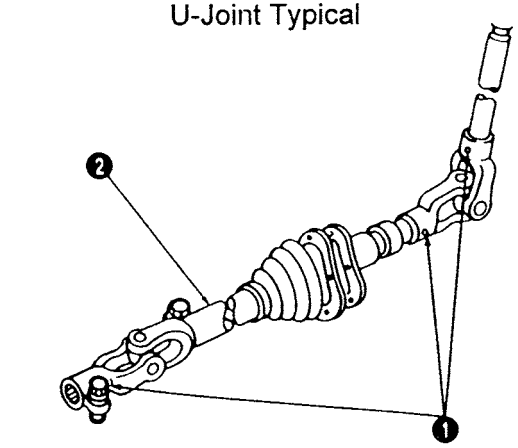
Inspection Procedures:	Repair (or note) if:	Out of Service if:
		Tilt/telescopic assembly (if equipped) will not stay locked in position. Steering column U-joint inside the bus (if equipped) is loose, damaged, or noisy after lubrication. Firewall rubber boot at floor (if equipped) is torn, or ripped, or missing.
c.-h. Steering Gear Box and other external components will be checked using the following procedure: 1) Vehicle should be on ground (not suspended).		Column U-joint (if equipped; see Figure 1, page 89) is loose, damaged, or noisy after lubrication.
2) With engine running have assistant move steering wheel back and forth repeatedly to load steering components.		Flexible coupling, if equipped (rag joint, Figure 2, page 89) has loose or missing fasteners, damaged flexible disc, or elongated holes.
3) Visually observe the following external steering and related suspension and frame components for looseness while assistant works steering (also see specific procedures under each component):		Any column U-bolt, pinch bolt, other column fasteners, or input shaft coupling is loose, damaged, or missing.

(Continued on Next Page)

C. ENGINE COMPARTMENT
1. Steering

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a) Column shaft and hardware. b) Column U-joints or flexible coupling (as equipped). c) Coupling at gear box. d) Gear box. e) Pitman arm. f) Drag link. g) Steering knuckle or arms. h) Tie rod ends. i) Idler arm (as equipped) j) Vehicle frame crossmembers and frame cross-members and frame braces (including associate rivets and fasteners for looseness and condition).	Pot joint (shell coupling) rubber is damaged or torn (repair).	Pot joint if equipped (shell coupling; See Figure 3, page 89) is loose. Pot joint (shell coupling) rubber is missing. Steering gear box is loose on frame, or fasteners, or lock tabs are loose or missing. Frame braces or crossmembers are cracked. Rivets or other fasteners at frame braces or crossmembers are loose or missing. Any axle or suspension component is loose beyond specifications prescribed elsewhere in this manual.
4) Have assistant carefully operate steering to full left and right turn and check for power assist pop-off and steering stops.		
5) As follow-up to the above steering check, also perform a visual and hands-on check of each of the listed components. See the following details on pages 91 through 93.		

Figure 1 - Column with Yoke or U-Joint Typical



❶ YOKE BOLT
❷ SOME VEHICLES ALSO HAVE A BOLT ON THIS END

Figure 2 - Typical Flexible Type Steering Coupling

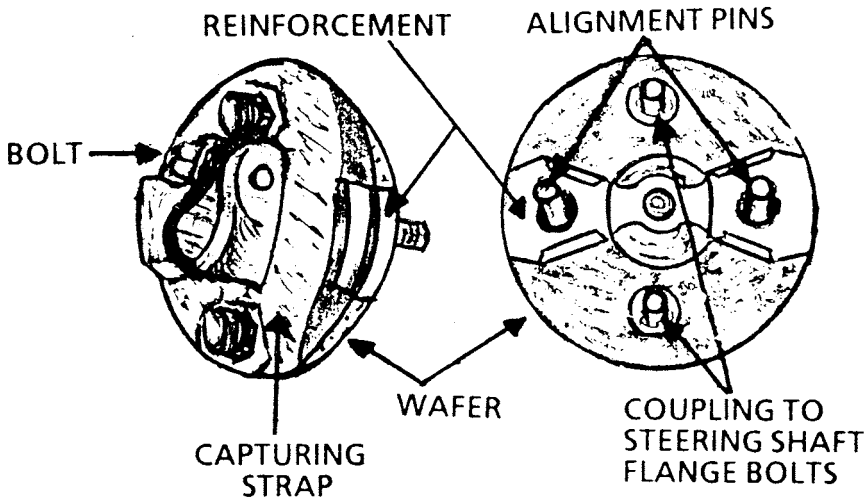
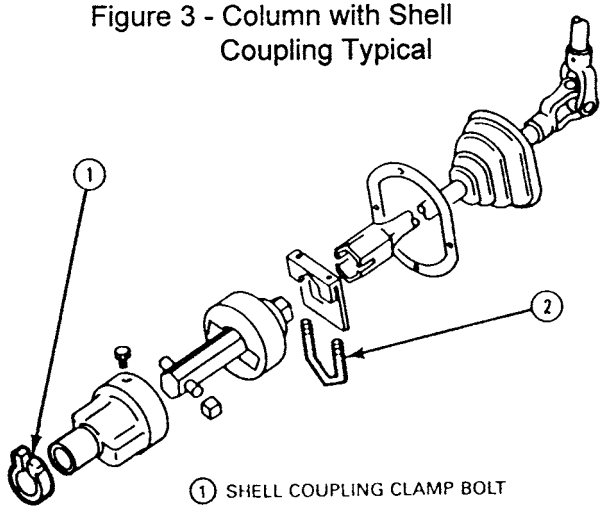


Figure 3 - Column with Shell Coupling Typical



① SHELL COUPLING CLAMP BOLT
② U-BOLT

TIGHTENING STEERING COLUMN JOINT BOLTS

WARNING - FAILURE TO MAINTAIN THE STEERING SYSTEM IN PROPER CONDITION CAN CAUSE REDUCED STEERING ABILITY RESULTING IN PERSONAL INJURY AND PROPERTY DAMAGE.

As good maintenance practice, it is recommended that steering column joint bolts be checked for tightness every 80,000 km (50,000 miles) or annually, whichever occurs first. DO NOT OVER TIGHTEN.

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C. ENGINE COMPARTMENT
1. Steering

Inspection Procedures:	Repair (or note) if:	Out of Service if:
c. Steering Gear Box Mounting Check mounting, condition, and tightness of steering gear box, and check frame, frame braces, and associated rivets or fasteners for looseness and condition.		Steering gear box is loose. There is any binding in steering gear box. Frame, frame braces, and associated rivets or fasteners are loose, damaged, or missing.
d. Pitman Arm Check the Pitman arm for looseness or misalignment at sector shaft splines and looseness at all joints. Check looseness of pinch bolt and fasteners and condition of Pitman arm.	Pitman arm grease fitting (if originally equipped) is loose or missing (repair).	Any play is observed between Pitman arm and sector shaft. Pinch bolt at sector shaft is loose or missing. Pitman arm to sector shaft-timing marks is misaligned. Pitman arm ball-joint (if equipped) has more than 1/16 inch play (axial, i.e., in and out play between the ball stud and socket). (See Figure 4, page 94). Pitman arm ball-joint (if equipped) has loose or missing nut, or cotter pin is missing. Pitman arm is cracked or damaged.

C. ENGINE COMPARTMENT
1. Steering

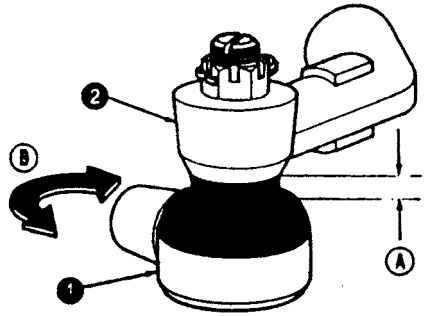
Inspection Procedures:	Repair (or note) if:	Out of Service if:
e. Drag Link		
Check the drag link ends, shaft, and fasteners for looseness and condition (on vehicles with I-beam suspension).	Any drag link end grease fitting (as equipped) is loose, missing, or will not take grease (repair).	Drag link ball stud is loose in pitman arm or upper steering arm.
	Drag link end boot is damaged or missing (repair).	Any nut is loose or missing, or cotter pin is missing.
	Drag link needs lubrication (repair).	Drag link shaft is damaged or bent.
		Drag link end (nonadjustable type) has more than 1/16-inch axial play (See Figure 4, page 94).
	Drag link dust boot (as originally equipped) is cut, damaged, or missing (repair).	Horizontal socket type (adjustable) drag link end has more than 1/16-inch axial or lateral play.
f. Steering Arm		
1) Check upper steering arm (Ackerman arm) and left and right side lower steering arms for securement and condition.		Any steering arm has been bent, is cracked, or is damaged. Any steering arm attachment point is loose, or any fasteners or cotter pins are missing.
2) Check condition and securement of steering stops and lock nuts.		Either steering stop or lock is loose, damaged, or missing.

(Continued on Next Page)

C. ENGINE COMPARTMENT
1. Steering

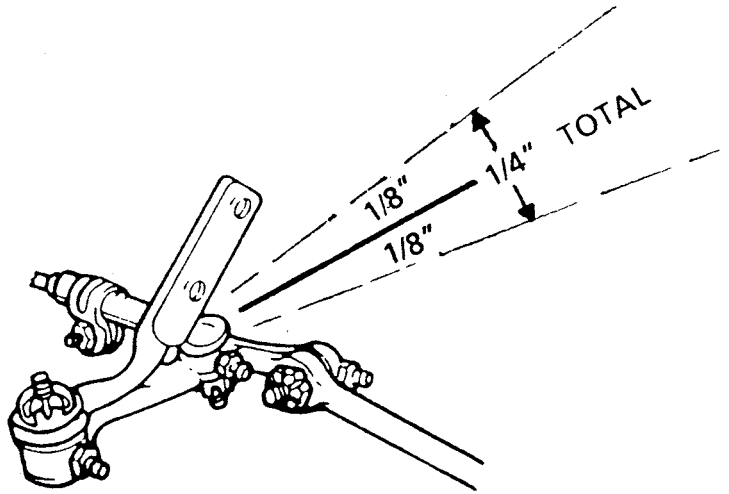
Inspection Procedures:	Repair (or note) if:	Out of Service if:
g. Tie Rod and Ends Check tie rod ends, tie rod, dust boots, and clamps or fasteners (as equipped) for looseness, damage, and condition.	Tie rod end dust boot is cut, damaged, or missing (repair). Tie rod end needs lubrication (repair). Any tie rod end grease fitting is loose, missing, or will not take grease (repair).	Tie rod clamps, fasteners, or cotter pin is stripped, missing, or loose. Any clamp (as equipped) is improperly positioned. Any tie rod or end is cracked or damaged. Any tie rod end has more than 1/16 inch axial play (See Figure 4, page 94). Tie rod end ball stud is loose in steering arm or idler arm.
h. Idler Arm Check idler arm assembly (as equipped) for looseness, damage, and condition.	Idler arm needs lubrication (repair). Idler arm grease fitting is loose, missing, or will not take grease (repair).	Any idler arm fasteners are loose or missing. Idler arm is cracked, or damaged, or cotter pin is missing. Idler arm up and down play is greater than 1/4 inch total (1/8 inch either direction). (See Figure 5, page 94.)

FIGURE 4 - Checking the Rod and Drag Link End Movement



A Movement in the axial direction must be less than 1/16 inch.
B Tie rod/drag link free to rotate within steering arm socket.
1 Tie rod/drag link end
2 Steering arm

FIGURE 5 - Checking Idler Movement, Typical



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C. ENGINE COMPARTMENT
2. Batteries

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a. Holddown Check for tightness, condition, and type of battery holddown.		Holddown assembly or tray is loose, corroded, or damaged causing insecure mounting of battery. Holddown is a flexible strap or other non-rigid design.
b. Battery Terminals Check terminals for cleanliness, tightness, and condition.		Any terminal is loose, damaged, corroded, or has missing hardware. Any positive terminal has missing insulation.
c. Battery Cables Check cable assemblies for routing, securement, condition, and size.		Cable or insulation is cracked or damaged, or cable is corroded. Cable is misrouted, unsecured, or grommet is missing to allow it to abrade on any metal or sharp edge. Cable is routed against the exhaust or any other extremely hot surface. Cable is smaller than original equipment size.

(Continued on Next Page)

C. ENGINE COMPARTMENT
2. Batteries

Inspection Procedures:	Repair (or note) if:	Out of Service if:
		Cable appears to be too small in diameter or of excessive length (See Chart 9, page 98). Flat braided engine ground cable is frayed, corroded, or ends are not secure.
d. Cleanliness Check cleanliness of battery or batteries.	Battery top or sides are corroded, greasy, dirty or wet with electrolyte (repair).	Battery is cracked or damaged.
e. Tray Check battery tray for operation, condition, and securement.	Battery slide tray is corroded, dirty, or hard to slide in and out (repair).	Battery slide tray securement device or tray stop is missing or nonfunctional. Battery tray does not slide in and out. Battery slide tray or box is damaged or deteriorated reducing security of battery or batteries. Battery box door does not open or will not stay latched.
f. Electrolyte Level Check electrolyte in battery or batteries for proper level (if applicable).	Electrolyte is low (repair). **(Continued on Page 99)**	Electrolyte is too low exposing plates.

CHART 9

CHARGING SYSTEMS CABLE SIZE CHART

SYSTEM VOLTAGE	RATED OUTPUT IN AMPERES	RECOMMENDED MINIMUM CHARGING CABLE GAUGE SIZE							
		UP TO 4 FT.	4 TO 7 FT.	7 TO 10 FT.	10 TO 13 FT.	13 TO 16 FT.	16 TO 19 FT.	19 TO 22 FT.	22 TO 28 FT.
12 VOLT	0 - 20	14	12	12	10	10	8	8	8
	20 - 35	12	10	8	8	6	6	6	4
	35 - 50	10	8	8	6	6	4	4	4
	50 - 65	8	8	6	4	4	4	4	2
	65 - 85	6	6	4	4	2	2	2	0
	85 - 105	6	6	4	2	2	2	2	0
	105 - 125	4	4	4	2	2	0	0	0
	125 - 150	2	2	2	2	0	0	0	00

MAXIMUM DIFFERENCE BETWEEN BATTERY VOLTAGE AND ALTERNATOR VOLTAGE IS 0.5 VOLT FOR 12 VOLT SYSTEMS AT FULL RATED OUTPUT.

MAXIMUM VOLTAGE DROP IN THE SENSE (#2-TERMINAL-LEAD) MUST NOT EXCEED 0.2 VOLT FOR 12 VOLT 3-WIRE SYSTEMS.

CABLE GAUGE SIZE CALCULATION TAKES INTO ACCOUNT TERMINAL CONNECTION RESISTANCE.

WHEN AN INSULATED (NO FRAME GROUND) CHARGING SYSTEM IS INSTALLED, LENGTH OF RETURN CIRCUIT MUST BE INCLUDED TO OBTAIN TOTAL CIRCUIT LENGTH TO DETERMINE PROPER WIRE SIZE.

C. ENGINE COMPARTMENT
2. Batteries

Inspection Procedures:	Repair (or note) if:	Out of Service if:
g. Load Test (Optional) Perform battery load test on battery or batteries to check condition. Check battery or batteries for proper type and load rating.	Battery cable length or battery mounting restricts access to battery or batteries for servicing (repair). **CHART 10** **BATTERY TEST** Remove surface-charge: Discharge at 300 amps for 15 seconds. Check for blue haze or smoke. **TEST** Measure electrolyte temperature. Discharge at 1/2 the CCA rating of the battery for 15 seconds. Battery voltage must not drop below the listed values during the 15 second test. **Degrees in F** — **Min.Voltage** 70 or over — 9.6 60 — 9.5 50 — 9.4 40 — 9.3 30 — 9.1 20 — 8.9 10 — 8.7 0 — 8.5	Battery or batteries is of insufficient CCA rating. Battery fails load test (See Chart 10, this page).

C. ENGINE COMPARTMENT
3. Fluid Levels and Conditions

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a. Brake Fluid Check brake fluid and brake power-assist hydraulic fluid (if equipped) for level and condition.		Level of brake fluid in either side of master cylinder reservoir is lower than 1/4 inch from top or below “Add” mark (if equipped). Brake fluid or power-assist fluid shows evidence of excessive water, oil, or dirt contamination. Brake power-assist hydraulic fluid is below cold “Add” mark.
b. Power Steering Fluid Check power steering fluid level and condition.		Power steering fluid is below cold “Add” mark. Power steering fluid shows evidence of excessive water, oil, or dirt contamination.
c. Oil Check level and condition of oil.	Engine oil is below “Add” mark (repair).	No oil is observed on dipstick. There is evidence of fuel or water contamination in the oil. Dipstick is missing.

C. ENGINE COMPARTMENT
3. Fluid Levels and Conditions

Inspection Procedures:	Repair (or note) if:	Out of Service if:
d. Transmission Fluid		
Check level and condition of transmission fluid.	Transmission fluid is below "Add" mark (repair).	Transmission fluid is not present on dipstick.
	Transmission fluid shows evidence of excessive water or dirt contamination (repair).	Transmission fluid above full mark (overfilled).
	Transmission fluid shows need of servicing (discoloration and/or burnt smell) (repair).	Dipstick missing.
e. Windshield Washer Fluid		
Check windshield washer fluid level.	Reservoir is low (note).	
	Windshield washer does not spray windshield (note).	

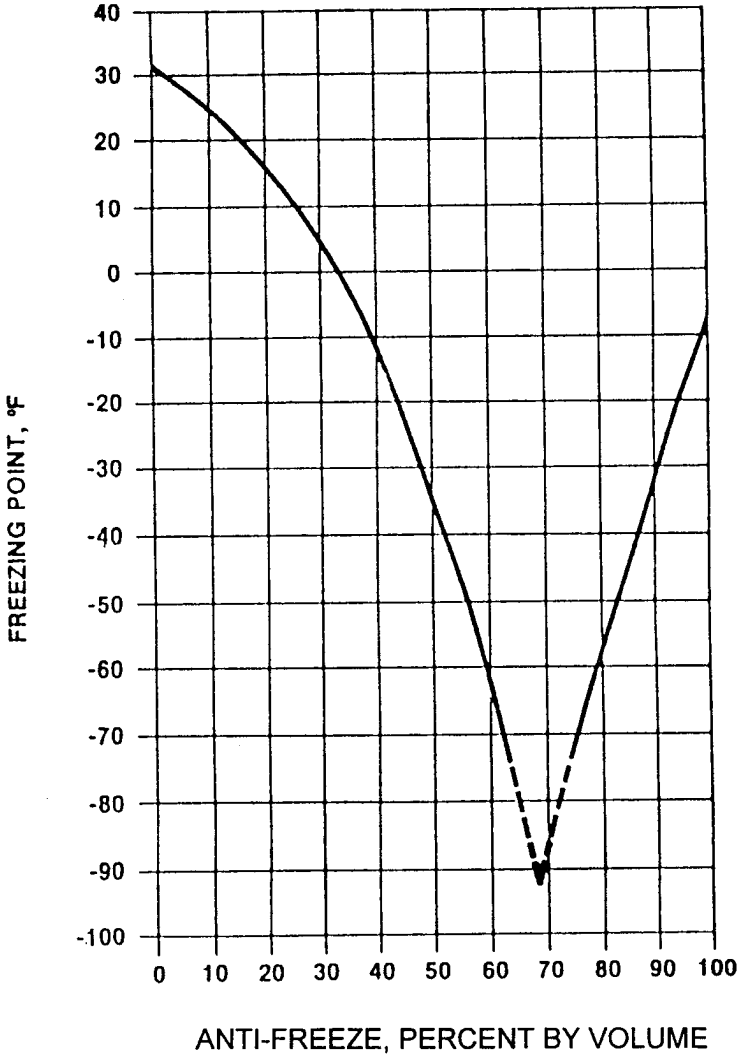
(Continued on Next Page)

C. ENGINE COMPARTMENT
3. Fluid Levels and Conditions

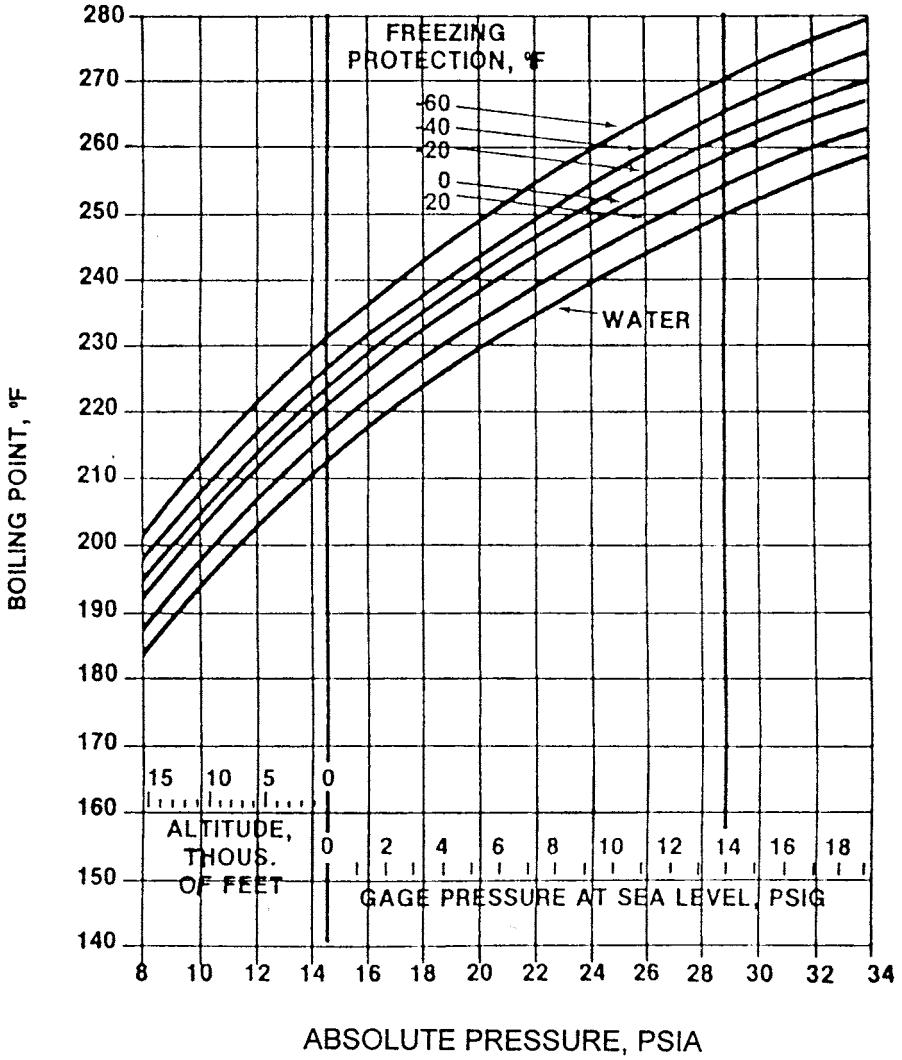
Inspection Procedures:	Repair (or note) if:	Out of Service if:
f. Coolant		
Check coolant (antifreeze) level, condition, and freeze protection.	Coolant level in radiator or reservoir is low (repair). Coolant shows evidence of excessive oil, dirt contamination, or rust and corrosion (repair). Coolant freeze/boil protection is inadequate (acceptable freeze protection - 20°F or lower (See Chart 11, page 103; repair). Coolant pH level is too high or too low (repair). Coolant additive package deteriorated (repair).	Coolant cannot be seen in reservoir or in radiator tank with cap removed.

CHART 11

FREEZING POINTS OF ANTI-FREEZE SOLUTIONS



BOILING POINTS OF ANTI-FREEZE SOLUTIONS AT VARIOUS PRESSURES



C. ENGINE COMPARTMENT
4. Belts and All Hoses

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a. Belt(s)		
1) Tightness		
Visually and physically check all drive belts for proper tension. If available, use a tension gauge (See Figure 9, page 106). If a gauge is not available, use a ruler to measure the deflection of the belt(s) up and down at the widest point between the drive and driven pulley(s) (See Figure 10, page 106).	Any belt exceeds tension reading recommended by manufacturer, if a tension gauge is used (See Figure 9, page 106; repair). Using ruler method, any belt is less than 1/2 inch deflection (too tight) when firm pressure is applied (See Figure 10, page 106; repair).	Any belt tensioner does not pivot or move freely and apply spring pressure on belt. Tension on any belt is too loose (based on specifications of type tension gauge used). Tension of any belt (using ruler method) is too loose when firm pressure is applied (greater than 3/4 inch deflection).
2) Condition		
Visually inspect belt(s) for glazing, oil contamination, dry rotting, cuts, and separation of plies. Check belts for twisting or distortion.	Any belt is glazed (note).	Any belt is oil saturated, dry-rotted, or cut or plies of belt(s) are separated. Any belt is twisted or distorted.
3) Routing		
Visually inspect belt(s) for rubbing or contact with objects other than pulleys and for routing around correct pulleys.		Any belt is making contact with objects other than pulley(s). Any belt is routed around incorrect pulley(s).

(Continued on Next Page)

C. ENGINE COMPARTMENT
4. Belts and All Hoses

Inspection Procedures:	Repair (or note) if:	Out of Service if:
4) Belt Alignment Visually inspect belts for proper alignment.	Any belt is not inline (note).	Belt misalignment is excessive and could result in failure.

(Continued on Page 107)

CHECKING BELT TENSION AFTER TIGHTENING

FIGURE 9 - Checking Belt Tension Gauge Method

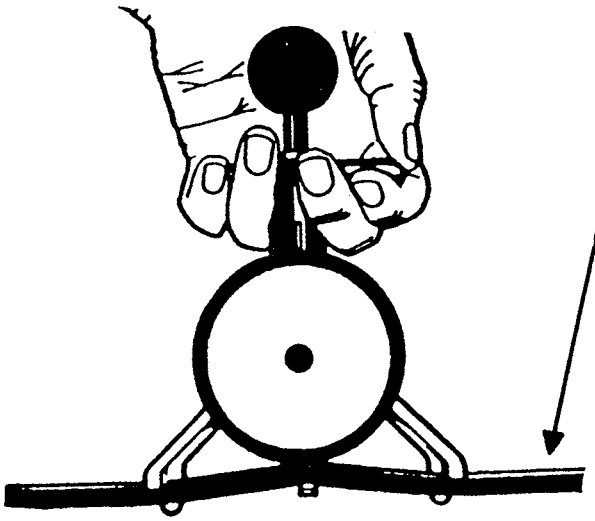
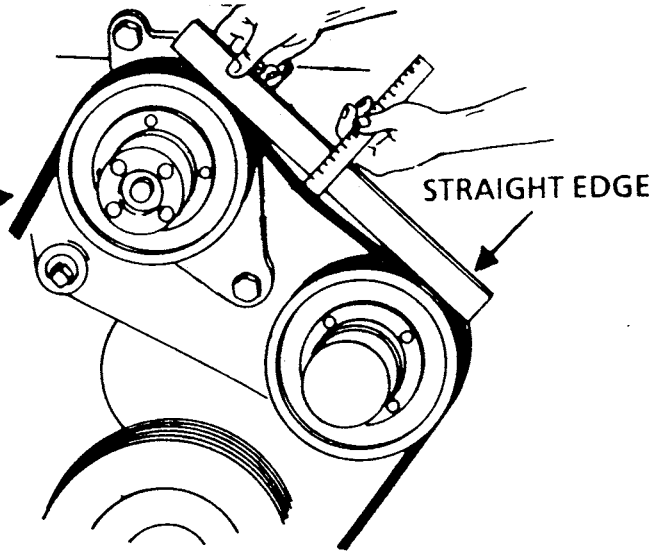


FIGURE 10 - Measuring Belt Tension Rule Method



C. ENGINE COMPARTMENT
4. Belts and All Hoses

Inspection Procedures:	Repair (or note) if:	Out of Service if:
b. Hose(s)		
1) Clamp(s) and Connections		
Visually and physically check that hose connections or clamp(s) are tight.	Any hose connection or clamp(s) is loose or is too tight digging into hose (repair).	Any hose connection or clamp(s) is stripped or damaged.
NOTE: References to hoses include all types of hoses located in the engine compartment, including power steering, coolant, air compressor intake, vacuum, brake hydraulic assist, engine oil, and transmission hoses.		
2) Condition		
Visually inspect all hoses for cuts, abrasions and wear, oil saturation, dry rotting, or “ballooning.”		Any hose is cut, abraded, worn, oil saturated, dry-rotted, or “ballooned” to the point that failure is imminent.
3) Routing		
Visually inspect routing and securement of all hoses.	Any hose is misrouted or unsecured so that heat damage, abrasion, or cuts could cause long-term failure (repair).	Any hose is misrouted or unsecured so that heat damage, abrasion, or cuts could cause imminent failure.

C. ENGINE COMPARTMENT
5. Accessory Mounting and Condition

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a. Air Cleaner		
Check air cleaner assembly (housing, lid, piping, gasket(s), seal, clamp(s)) for securement, condition, and record filter restriction. Check for presence of wing nut and seal (if equipped).	Any portion of air cleaner assembly or mounting is loose or damaged, including piping, nuts, bolts or clamps (repair). There are any worn or damaged seals or gaskets (repair). There are any air or vacuum leaks or missing components (repair).	Diesel air filter restriction exceeds manufacturer's specifications.
b. Power Steering Pump		
Check securement and condition of power steering pump.		Any portion of the power steering pump, mounting bracketry or fastener is cracked, loose, or missing.
c. Air Compressor and Filter		
Check securement and condition of air compressor and filter assembly.	Air compressor air filter (if equipped) is dirty (repair).	Any portion of the air compressor, compressor air filter (if equipped), filter and compressor mounting bracketry, filter cover, or fastener is cracked, loose, or missing. Hose from engine air cleaner to air compressor is damaged, torn, or missing.

C. ENGINE COMPARTMENT
5. Accessory Mounting and Condition

Inspection Procedures:	Repair (or note) if:	Out of Service if:
d. Water Pump		
Check condition of water pump and pulley.	There is evidence of coolant seepage from water pump, seal, gasket surface, or weep hole (repair). Water pump fasteners are loose, damaged, or missing (repair).	Water pump is noisy, bearing is damaged, or coolant is dripping out.
e. Fan		
Check fan blade and fan clutch assembly for securement and condition.		Fan has any cracked, bent, or broken blades. Any portion of fan mounting is loose. Fan clutch is seized or loose.
f. Alternator		
Check securement and condition of alternator assembly.	Alternator is noisy (repair).	Any portion of the alternator, mounting bracketry, or fastener is cracked, loose, or missing.

C. ENGINE COMPARTMENT
6. Wiring

Inspection Procedures:	Repair (or note) if:	Out of Service if:
Routing and Condition		
Check routing, securement, and condition of all wiring and any electrical cable in the engine compartment.	There is any loose, damaged, or corroded wiring connector or terminal end (repair).	There is any unsecured or poorly routed wiring that could cause potential short or fire due to abrasion or heat damage.
	Any repair has been made using improper gauge wiring (repair; see Chart 12, page 111).	There is any burnt wiring or wiring (other than ground wires) missing insulation.

CHART 12

PROPER WIRING GAUGE USAGE

MAXIMUM LENGTH OF CONDUCTOR IN FEET FROM POWER SOURCE TO LOAD

SAE Wire Size	20	18	16	14	12	10
Circuit Current in AMPS	ft	ft	ft	ft	ft	ft
1	36.4	52.3	78.0			
2	18.2	26.1	39.0	63.0	99.0	
3	12.2	17.4	26.0	42.0	66.0	
4	9.1	13.1	19.5	31.5	49.5	78.8
5	7.3	10.4	15.6	25.2	39.6	63.0
6	6.1	8.7	13.0	21.0	33.0	52.5
7	5.2	7.4	11.1	18.0	28.2	45.0
8		6.5	9.8	15.8	24.8	39.4
9		5.8	8.6	14.0	22.0	35.0
10		5.2	7.8	12.6	19.8	31.5
15			5.2	8.4	13.2	21.0
20				6.3	9.9	15.8
20					6.6	10.5

C. ENGINE COMPARTMENT
7. Fuel System and Lines

Inspection Procedures:	Repair (or note) if:	Out of Service if:
Fuel System and Lines Visually check the condition, operation, and securement of all fuel system components, including fuel lines and routing in the engine compartment.	There is evidence of dirt, algae, or water in the fuel water separator (if equipped (repair).	There is any unsecured, or poorly routed, or loose fuel line or hose that could cause potential fire due to abrasion or heat damage. Any fuel system connection is stripped, loose, cracked, or leaking. Any fuel system component is damaged or not mounted securely.

C. ENGINE COMPARTMENT
8. Radiator

Inspection Procedures:	Repair (or note) if:	Out of Service if:
a. Radiator Mounting		
Check radiator assembly and mounting for securement and condition.	Any portion of radiator or mounting system is cracked, damaged, or has loose or missing fasteners (repair).	
b. Cap		
Check condition of radiator cap.	Radiator cap is hard to open or close (repair).	Radiator cap is missing.
WARNING: ALWAYS USE PROPER PROCEDURES WHEN REMOVING RADIATOR CAP.	Radiator cap leaks down slowly at p.s.i. (pounds per square inch) rating (repair).	Radiator cap fails pressure test.
	Radiator cap is of the wrong pressure rating (repair).	
	There is any visible damage to the pressure seat or vacuum relief seat of the cap (repair).	
c. Reservoir		
Check coolant reservoir (including any deaeration or overflow tank) and sight glass (if equipped) for mounting and condition.	Any portion of coolant reservoir or mounting system is cracked or damaged, is leaking, or has loose or missing fasteners (repair).	
d. Fan Shroud		
Check fan shroud for mounting and condition.	Any portion of fan shroud or shroud mounting is cracked, damaged, or has loose, or missing fasteners (repair).	Fan shroud is missing.