

STEERING, SUSPENSION, TIRES AND WHEELS

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SECTION 3

STEERING, SUSPENSION, TIRES AND WHEELS DIAGNOSIS

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

Since the problems in steering, suspension, tire and wheel assemblies involve several systems, they must all be considered when diagnosing a complaint. To avoid using the wrong symptom, always road test the vehicle first. Proceed with the following preliminary checks and correct any substandard conditions which are found.



Inspect

- Wrong pressure and uneven wear on tires.
- Loose connections or wear on joints from the steering column assembly to the steering gear assembly.

- Loose or damaged parts on the front and rear suspension or steering gear assembly.
- Out-of-round or out-of-balance tires, bent wheel assemblies and loose and/or rough wheel bearing assemblies.
- Leaks in power steering system. Also check the power steering fluid level and the accessory drive belt condition and tension. Refer to "Power Steering Pump Assembly Diagnosis" in this section.

The following symptom diagnosis tables may help you find the cause of a problem. The tables list a number of symptoms, along with associated possible causes. More information on any particular listing can be found in the sections referenced in the "Refer To" column.

GENERAL DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO (SECTION)
BODY/CHASSIS – GENERAL		
Vehicle Pulls or Leads	• Misaligned front tire and wheel assembly. • Mismatched or uneven tires. • Broken or sagging spring. • Radial tire lead/pull. • Unbalanced steering gear valve spool. • Dragging front brake assembly.	3A 3E 3C, 3D 3E 3B, 3B1A 5
Shimmy, Shake or Vibration	• Bent tire and wheel assembly rim. • Excessive tire and wheel assembly runout. • Out-of-balance tire or wheel assembly. • Excessive wheel bolt runout. • Excessive brake drum assembly or brake rotor assembly imbalance. • Worn steering linkage components. • Worn lower control arm ball stud assembly. • Excessive loaded radial runout of tire. • Worn suspension bushings. • Blister or bump on tire. • Out-of-balance propeller shaft assembly. • Foreign material lodged in wheel rim.	3E 3E 3E 3E 5 3B1A 3C 3E 3C, 3D – 4A –
Abnormal Noise at Front End	• Damaged suspension components. • Worn control arm bushings or steering linkage. • Loose stabilizer shaft assembly or broken stabilizer shaft links. • Loose wheel nuts. • Loose suspension bolts/screws. • Misadjusted steering gear assembly. • Worn shock absorber assemblies or mountings. • Improperly positioned spring. • Scuffed tires.	3C, 3D 3B1A, 3C, 3D 3C, 3D 3E 3C, 3D 3B, 3B1A 3C, 3D 3C, 3D –

SYMPTOM	POSSIBLE CAUSE	REFER TO (SECTION)
Low or Uneven Trim Height	● Broken, incorrect, or sagging spring. ● Overloaded vehicle.	3C, 3D —
Body Leans or Sways in Corners	● Loose stabilizer shaft assembly or broken stabilizer shaft links. ● Worn shock absorber assemblies or mountings. ● Broken or sagging spring. ● Overloaded vehicle.	3C, 3D 3C, 3D 3C, 3D —
Suspension Bottoms	● Overloaded vehicle. ● Worn shock absorber assemblies. ● Incorrect, broken or sagging spring.	— 3C, 3D 3C, 3D
“Dog” Tracking	● Damaged rear control arm or worn control arm bushing assembly. ● Bent rear axle assembly.	3D 4B

TIRES/WHEELS – GENERAL

Abnormal or Excessive Tire Wear	● Misaligned tire and wheel assembly. ● Excessive toe. ● Sagging or broken spring. ● Out-of-balance tire or wheel assembly. ● Worn shock absorber assemblies. ● Hard driving. ● Overloaded vehicle. ● Tires not rotated. ● Low or excessive inflation pressure. ● Bent suspension components.	3A, 3E 3A 3C, 3D 3E 3C, 3D — — 3E 3E 3C, 3D
Wheel Assembly Tramp	● Out-of-balance tire or wheel assembly. ● Improper shock absorber assembly action. ● Blister or bump on tires.	3E 3C, 3D —
Cupped Tires	● Misaligned tire and wheel assembly. ● Weak shock absorber assemblies. ● Worn wheel bearing assembly. ● Excessive tire or wheel assembly runout. ● Worn control arm ball stud assembly. ● Loose steering gear assembly adjustment.	3A 3C, 3D 3C 3E 3C 3B, 3B1A

STEERING/STEERING WHEEL ASSEMBLY – GENERAL

Poor Returnability	● Incorrect caster setting. ● Lack of lubrication at control arm ball stud assembly or tie rod ends. ● Bind in control arm ball stud assembly. ● Bind in steering column assembly. ● Misadjusted steering gear assembly. ● Incorrect steering gear valve spool. ● Intermediate steering shaft joints binding.	3A 0B 3C 3F, 3F5B 3B, 3B1A 3B, 3B1A 3B
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3-4 STEERING, SUSPENSION, TIRES AND WHEELS DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO (SECTION)
Hard Steering	● Hydraulic system – Perform test as outlined in “Power Steering System Test Procedure” in this section. ● Misadjusted steering gear assembly. ● Bind or catch in steering gear assembly. ● Loose steering gear assembly mounting. ● Faulty pipe fitting seat.	– 3B, 3B1A 3B, 3B1A 3B, 3B1A 3B, 3B1A
Too Much Play in Steering	● Loose steering gear assembly mounting. ● Loose or worn joints from steering column assembly to steering gear assembly. ● Misadjusted steering gear assembly.	3B, 3B1A 3B, 3B1A, 3F 3B, 3B1A
Wander or Poor Steering Stability	● Mismatched or uneven tires. ● Worn shock absorber assemblies. ● Loose stabilizer shaft assembly. ● Broken or sagging spring assembly. ● Misadjusted steering gear assembly. ● Misaligned tire and wheel assembly.	– 3C, 3D 3C, 3D 3C, 3D 3B, 3B1A 3A, 3E
Erratic Steering When Braking	● Worn wheel bearing assembly. ● Broken or sagging spring assembly. ● Warped brake rotor assembly. ● Sticking brake caliper piston. ● Leaking wheel cylinder or brake caliper assembly. ● Incorrect or uneven caster.	3C 3C, 3D 5 5 5 3A
Steering Wheel Assembly Kickback	● Air in power steering system. ● Loose steering gear assembly mounting. ● Loose or worn joints from steering column assembly to steering gear assembly. ● Loose tie rod ends. ● Worn or missing pipe fitting seat. ● Worn wheel bearing assembly. ● See “Too Much Play in Steering” for other possible causes.	3B 3B, 3B1A 3B, 3B1A, 3F 3B1A 3B, 3B1A 3C –
Steering Wheel Assembly Surges or Jerks	● Bad or defective tire. ● Sluggish steering gear valve spool. ● Loose or oil soaked accessory drive belt. ● Air in power steering system.	– 3B, 3B1A 3B, 3B1B 3B
RIDE		
Too Soft (Vehicles with FE1 suspension are designed for soft ride.)	● Incorrect shock absorber assemblies. ● Incorrect or sagging spring assembly.	3C, 3D 3C, 3D
Too Harsh	● Incorrect shock absorber assemblies. ● Incorrect spring assembly. ● Incorrect tires or tire pressure.	3C, 3D 3C, 3D 3E

POWER STEERING GEAR ASSEMBLY DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO (SECTION)
Hissing Noise	This is commonly heard when steering wheel assembly is turned and vehicle is not moving, and especially so if brakes are applied. If noise is very objectionable, replace the gear with a partial service gear assembly. (A replacement gear will also have a slight noise, and is not always a cure for the condition.)	3B, 3B1A
	Loose intermediate steering shaft universal joints.	3B
Rattle or Chucking Noise	Outlet (pressure) hose assembly contacting frame.	3B, 3B1A
	Loose tie rod ends.	3B1A
	Loose steering gear assembly attachment.	3B, 3B1A
	Loose pinion shaft assembly.	3B, 3B1A
If a rattle occurs when driving over bumps, check front brake linings for loose fit and missing antirattle clips.		
Poor Return of Steering Wheel Assembly to Center	Misaligned front tire and wheel assembly.	3A
	Worn wheel bearing assembly.	3C
	Binding tie rod ends.	3B1A
	Binding control arm ball stud assembly.	3C
	Steering wheel assembly rubbing against turn signal switch housing.	3F
	Misadjusted steering gear assembly.	3B, 3B1A
	Tight or frozen steering gear coupling shaft assembly.	3F
	Sticky or plugged steering gear valve spool.	3B, 3B1A
Momentary Increase in Effort When Turning Steering Wheel Assembly Fast to Right or Left	High internal leakage.	3B, 3B1A, 3B1B
	Sticking or damaged steering gear valve spool.	3B, 3B1A
	Insufficient pump assembly pressure.	3B, 3B1B
	Low fluid level.	3B, 3B1B
Steering Wheel Assembly Surges or Jerks When Turning with Engine Running, Especially During Parking	Insufficient pump assembly pressure.	3B, 3B1B
	Sticky flow control valve.	3B, 3B1B
Excessive Steering Wheel Assembly Kickback or Loose Steering	Air in power steering system.	3B
	Loose steering gear assembly adjustment.	3B, 3B1A
	Loose tie rod ends.	3B1A
	Worn wheel bearing assembly.	3C
	Coupling assembly loose on stabilizer shaft assembly.	3B, 3C
	Loose thrust bearing preload adjustment.	3B, 3B1A
	Worn pipe fitting seat.	3B, 3B1A

3-6 STEERING, SUSPENSION, TIRES AND WHEELS DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO (SECTION)
Hard Steering or Lack of Assist, Especially During Parking	● Brake assemblies applied while turning steering wheel assembly.	—
	● Damaged or worn steering gear coupling shaft assembly.	3F
	● Sticky flow control valve.	3B, 3B1B
	● Insufficient pump assembly pressure.	3B, 3B1B
	● Excessive internal pump assembly leakage.	3B, 3B1B
	● Excessive internal steering gear assembly leakage.	3B, 3B1A

STEERING LINKAGE DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO (SECTION)
Excessive Play or Looseness in Power Steering System	● Worn control arm ball stud assembly.	3C
	● Worn tie rod sockets.	3B1A
Excessive Looseness in Tie Rod Assemblies	● Damaged and leaking seal resulting in loss of lubricant, corrosion and excessive wear.	3B1A
Hard Steering	● Tight or frozen tie rod assemblies	3B1A
	● Steering gear assembly adjusted too tight.	3B, 3B1A

POWER STEERING PUMP ASSEMBLY DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3B, 3B1B
Foamy, Milky Fluid, Low Fluid Level, Low Pressure	● Air in fluid. ● Internal pump assembly leakage. ● Extremely cold temperatures will cause air bubbles if fluid level is low. ● If fluid level is correct and pump assembly still foams, remove pump assembly; then remove reservoir assembly from pump assembly on 3.4L L32 engine. On 5.7L LT1 engine, remove pump assembly and remote reservoir assembly. Check soft plug and housing for cracks. If cracked, replace housing on 3.4L L32 engine or remote reservoir assembly on 5.7L LT1 engine.	
Low Pressure Due to Pump Assembly	● Stuck or inoperative flow control valve. ● Pressure plate not flat against ring. ● Extremely worn ring. ● Scored pressure plate, thrust plate or rotor. ● Vanes sticking in rotor slots. ● Cracked or broken thrust plate or pressure plate. ● High internal leakage.	
Low Pressure Due to Steering Gear Assembly	● Scored housing bore. ● Leakage at valve rings or seals.	

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3B, 3B1B
Growling Noise in Pump Assembly	● Restricted hoses or steering gear assembly causing excessive back pressure. ● Scored pressure plates, thrust plate or rotor. ● Worn ring.	
Groaning Noise in Pump Assembly	● Air in fluid. ● Low fluid level. ● Loose pump assembly mounting.	
Rattling Noise in Pump Assembly	● Vanes sticking in rotor slots. ● Improperly installed vane. ● Damaged pump bearings.	
Swishing Noise in Pump Assembly	● Damaged flow control valve.	
Whining Noise in Pump Assembly	● Scored pump shaft bushing. ● Scored pressure plates and vanes.	

STEERING COLUMN ASSEMBLY DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3F, 3F5B (except where noted)
LOCK SYSTEM		
Will Not Unlock	● Collapsed shear flange on sector shaft. ● Damaged lock bolt. ● Damaged lock cylinder. ● Damaged housing. ● Damaged sector. ● Damaged rack. ● Damaged or incorrectly cut key.	
Will Not Lock	● Broken or worn lock bolt spring. ● Damaged sector. ● Damaged lock cylinder. ● Burr on lock bolt. ● Damaged housing. ● Damaged rack. ● Interference between bowl and rack coupling. ● Stuck ignition switch. ● Restricted actuator rod. ● Incorrectly installed sector.	

3-8 STEERING, SUSPENSION, TIRES AND WHEELS DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3F, 3F5B (except where noted)
High Lock Effort	● Damaged lock cylinder. ● Damaged ignition switch. ● Broken or deformed rack preload spring. ● Burrs on sector, rack, housing, support or actuator rod coupling. ● Bent sector shaft. ● Damaged rack. ● Park lock cable damaged or misadjusted. ● Extreme misalignment of housing to cover. ● Distorted coupling slot in rack. ● Bent actuator rod. ● Bent ignition switch mounting bracket. ● Restricted actuator rod. ● Worn or damaged key.	
Will Stick in "START"	● Deformed actuator rod. ● Check items under "High Lock Effort."	
Key Cannot Be Removed in "OFF-LOCK"	● Incorrectly set ignition switch. ● Damaged lock cylinder.	
Lock Cylinder Can Be Removed	● Missing lock cylinder retaining screw.	
High Effort in Lock Cylinder Between "OFF" and "OFF-LOCK"	● Distorted rack.	
Lock Bolt Hits Shaft Lock in "OFF" and "PARK"	● Incorrectly set ignition switch.	
STEERING COLUMN ASSEMBLY		
Noise in Steering Column Assembly	● Loose joints from steering column assembly to steering gear assembly. ● Incorrectly aligned steering column assembly. ● Unlubricated horn contact ring. ● Lack of grease on bearings. ● Loose sight shields. ● Worn or broken upper or lower steering shaft bearing assembly. ● Unseated lock plate retainer ring. ● Unlubricated spherical joint.	3B, 3B1A 0B 0B 0B
High Steering Shaft Assembly Effort	● Misaligned steering column assembly. ● Improperly installed or deformed dust seal. ● Damaged upper or lower steering shaft bearing assembly. ● Flash on inside diameter of shift tube. ● Tight universal joint.	4A

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3F, 3F5B (except where noted)
Lash in Steering Column Assembly	● Loose IP-to-steering column assembly upper and lower bracket mounting bolts/screws. ● Broken weld nuts on jacket. ● Sheared IP upper bracket capsule. ● Loose shoes in housing. ● Loose pivot pins. ● Loose lock pin in housing support. ● Loose housing support bolts/screws. ● Loose steering column assembly upper and lower bracket-to-jacket bolts/screws. ● Loose lower bracket-to-adaptor and bearing assembly mounting bolts/screws.	
Housing Scraping Bowl	● Bent bowl or bowl not concentric with hub. ● Improperly installed cover and housing end cap.	
Loose Steering Wheel Assembly	● Excessive clearance between holes in housing support or housing and pivot pin diameters. ● Damaged or missing anti-lash spring in spheres. ● Steering shaft upper bearing assembly not seated in housing. ● Missing steering shaft upper bearing inner race. ● Loose housing support bolts/screws. ● Missing or broken bearing preload spring.	
Loose Steering Wheel Assembly (Every Other Tilt Position)	● Loose fit between shoe and pivot pins. ● Shoe not free in slot.	
Steering Column Assembly Not Locking in Any Tilt Position	● Shoe seized on pivot pin. ● Burrs or dirt on shoe grooves. ● Weak or broken shoe lock spring.	
Steering Wheel Assembly Fails to Return to Top Tilt Position	● Bound up pivot pins. ● Broken or weak wheel tilt spring. ● Tight turn signal switch assembly wires.	
Noise When Tilting Steering Column Assembly	● Worn upper tilt bumpers. ● Shoe lock spring rubbing in housing.	

TURN SIGNAL SWITCH ASSEMBLY

**Important**

- This diagnosis covers mechanical problems only. Refer to SECTION 8A for turn signal switch electrical diagnosis.

Turn Signal Will Not Stay in Turn Position

- Foreign material or loose parts impeding movement of yoke.
- Broken or missing detent or canceling spring.
- None of the above; replace switch.

3-10 STEERING, SUSPENSION, TIRES AND WHEELS DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3F, 3F5B (except where noted)
Turn Signal Will Not Cancel	● Loose switch mounting screws. ● Broken switch or anchor bosses. ● Broken, missing or out-of-position detent, return or canceling spring. ● Worn canceling cam.	
Turn Signal Difficult to Operate	● Loose turn signal switch arm. ● Broken or distorted yoke; replace switch. ● Loose or misplaced springs. ● Foreign parts and/or material. ● Loose turn signal switch mounting screws.	
Turn Signal Will Not Indicate Lane Change	● Broken lane change pressure pad or spring hanger. ● Broken, missing or misplaced lane change spring. ● Jammed base or wires.	
Hazard Switch Cannot Be Turned "OFF"	● Foreign material between hazard support canceling leg and yoke. ● If no foreign material is found, replace turn signal switch.	
Hazard Switch Will Not Stay "ON" or Difficult to Turn "OFF"	● Loose turn signal switch. ● Interference with other components. ● Foreign material interference. ● None of the above; replace turn signal switch.	
No Turn Signal Lamps	● Electrical failure in chassis harness. ● Inoperative turn signal flasher. ● Loose chassis-to-column connector. Disconnect chassis-to-column connector and connect new turn signal switch to chassis and operate switch by hand. – If vehicle lamps now operate normally, turn signal switch is inoperative. – If vehicle lamps do not operate, refer to SECTION 8A.	
Turn Indicator Lamps "ON," But Not Flashing	● Inoperative turn signal flasher. ● Loose chassis-to-column connection. ● Inoperative turn signal switch. ● To determine if turn signal switch is inoperative, substitute new turn signal switch into circuit and operate switch by hand. If vehicle lamps operate normally, turn signal switch is inoperative.	

SYMPTOM	POSSIBLE CAUSE	REFER TO SECTION 3F, 3F5B (except where noted)
Front or Rear Turn Signal Lamps Not Flashing	● Burned-out or damaged turn signal bulb. ● High resistance connection to ground at bulb socket. ● Loose chassis-to-column connector. Disconnect chassis-to-column connector and connect new turn signal switch into system and operate switch by hand. – If turn signal lamps are now “ON” and flashing, turn signal switch is inoperative. – If vehicle lamps do not operate, refer to SECTION 8A.	
No Turn Indicator Panel Lamps	● Burned out bulbs or opens, grounds in wiring harness from front turn signal bulb socket to indicator lights. Refer to SECTION 8A.	
Stoplamp Not “ON” When Turn Indicated	● Loose chassis-to-column connection. ● Disconnect chassis-to-column connector and connect new turn signal switch into system and operate switch by hand. – If brake lamps work when switch is in turn position, turn signal switch is inoperative.	
Turn Signal Lamps Flash Very Slowly	● Loose chassis-to-column connection. ● Disconnect chassis-to-column connector and connect new turn signal switch into system and operate switch by hand. – If lamps flash at a normal rate, turn signal switch is inoperative. – If lamps still flash very slowly, refer to SECTION 8A.	
Hazard Signal Lamps Will Not Flash – Turn Signal Functions Normally	● Blown fuse. ● Inoperative hazard warning flasher. ● Loose chassis-to-column connection. ● Disconnect column-to-chassis connector and connect new turn signal switch into system, then press in hazard warning button and watch hazard warning lights. – If lamps now work normally, turn signal switch is inoperative. – If lamps do not flash, check wiring harness. Refer to SECTION 8A.	
IGNITION SWITCH		
Electrical System Will Not Function	● Damaged ignition switch. ● Improperly adjusted ignition switch. ● Loose connector at ignition switch.	
Switch Will Not Turn	● Damaged ignition switch. ● Damaged lock cylinder.	
Switch Cannot Be Set Correctly	● Deformed switch actuator rod. ● Sector to rack engaged in wrong tooth.	

KEY REMINDER

Figures 1 through 10

Reminder Continues to Operate with Key Out, but Stops When Driver's Door is Closed



Inspect

- Chips, foreign material in lock cylinder bore.
- Sticky lock cylinder actuator tip.
- Damaged or broken reminder switch (3).

Reminder Does Not Sound with Key Fully Inserted in Lock Cylinder and the Driver's Door Open



Inspect

NOTICE: If you are using a multimeter to check continuity with voltage present in circuits, be sure to use a voltage setting. A multimeter set on a resistance scale will be damaged by the voltage from live circuits.

1. Reminder to see if power is available. Refer to SECTION 8A.
2. Chassis wiring for open circuit.
 - A. Separate chassis connector (1) from column connector (2).
 - B. Connect female contacts of terminals "E" and "F" on chassis connector (1). A bent paper clip will work as a jumper.
 - If reminder sounds, repair chassis wiring.
 - If reminder does not sound, go to step 3.

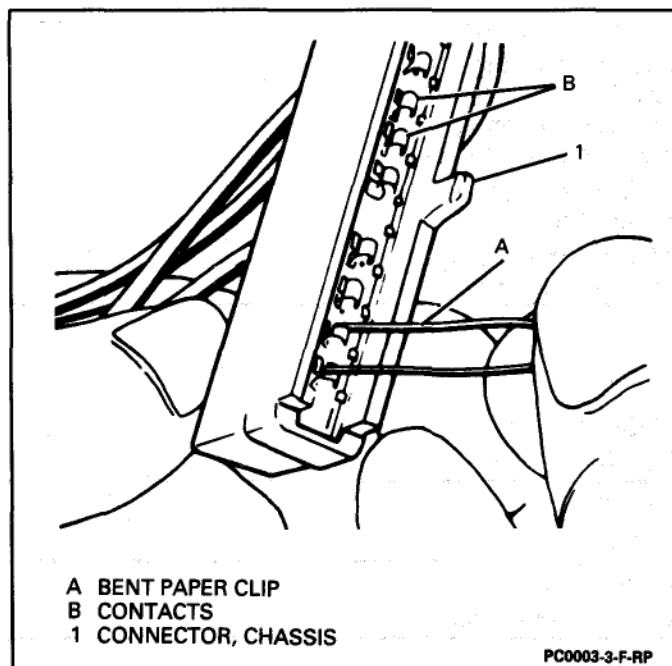


Figure 1 – Checking Reminder at Chassis Connector

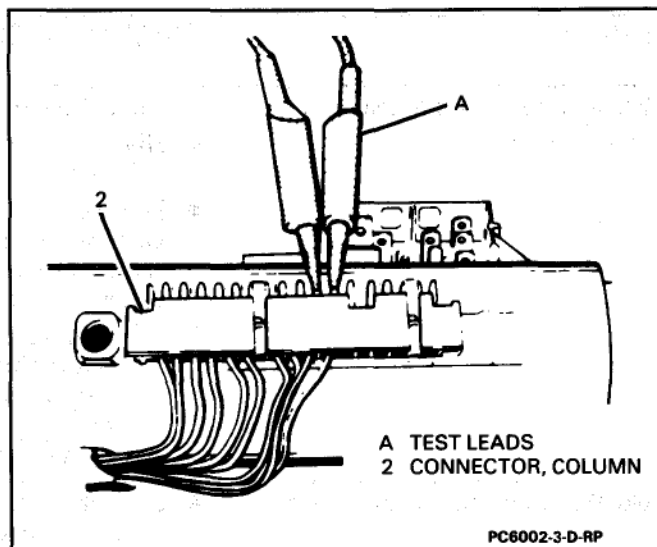


Figure 2 – Checking Reminder at Column Connector

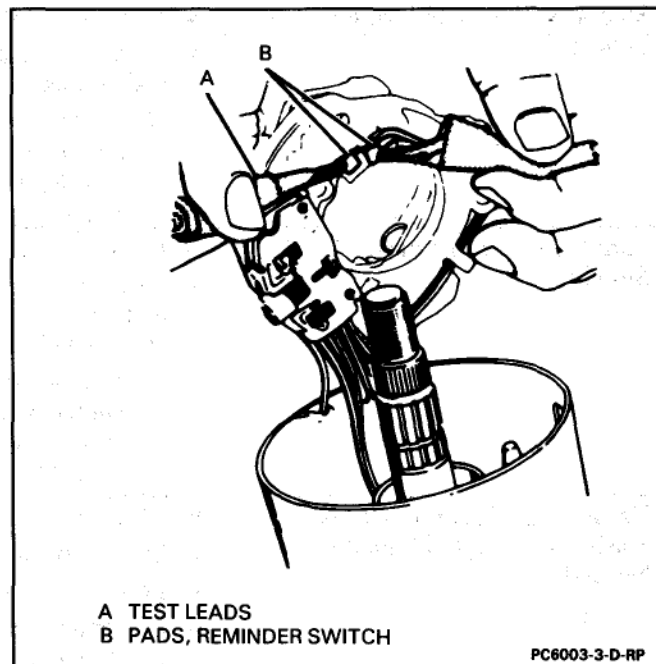


Figure 3 – Checking Reminder Switch Pads

3. Continuity between male "E" and "F" column connector contacts with a multimeter (or test light).
 - Push key all the way into lock cylinder (4).
 - If there is continuity when key is in, and off when key is out, function is normal.
 - If there is no continuity, fault is in column. Go to step 4.
4. Probes of reminder switch (3) to ensure good contact with pads on signal switch.
 - A. Disassemble upper end of column assembly until turn signal switch mounting bolts/screws have been removed.
 - B. Lift turn signal switch to gain access to probes.
 - C. Bend probes, if needed, then replace turn signal switch and tighten three bolts/screws.
 - D. Check function as in step 3.

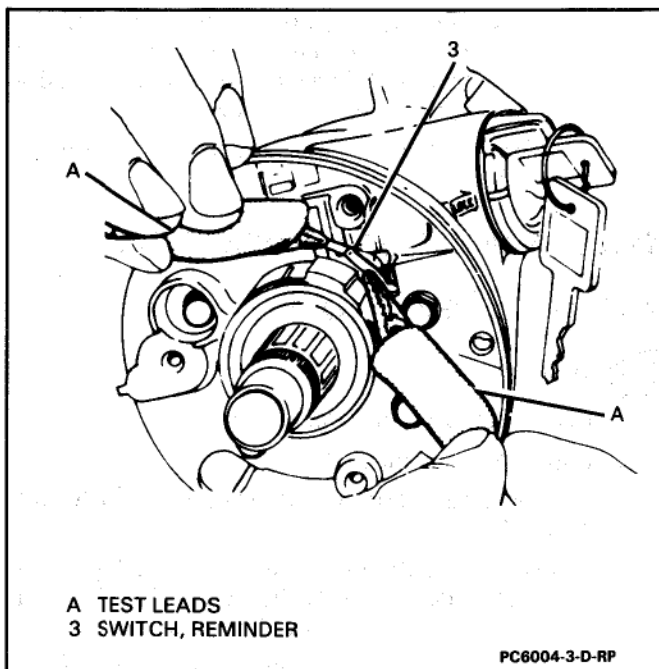


Figure 4 – Checking Reminder Switch

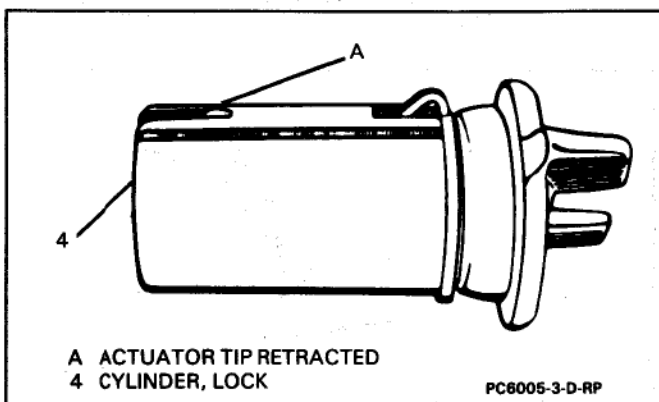


Figure 5 – Lock Cylinder Actuator – Key Removed

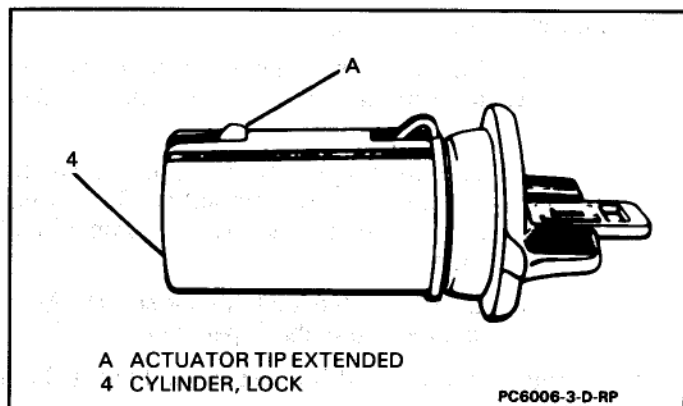


Figure 6 – Lock Cylinder Actuator – Key in Place

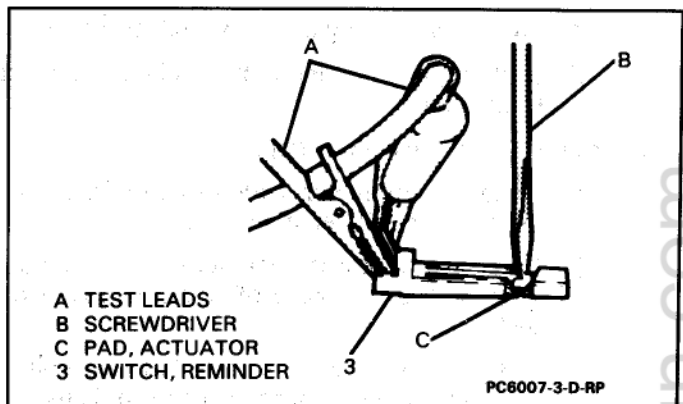


Figure 7 – Checking Key Reminder Switch Continuity

5. Turn signal switch wiring for short or fault.
 - A. Connect male contacts of terminals "E" and "F" of column connector (2) with a jumper.
 - B. Check key reminder switch pads on turn signal switch with multimeter.
 - If there is continuity, function is normal.
 - If there is no continuity, replace turn signal switch.
6. Continuity of check key reminder switch probes, if problem has not been found.
 - A. Connect a multimeter to probes on reminder switch (3).
 - B. Fully insert and remove key from lock cylinder (4).
 - If there is continuity when key is in lock cylinder (4) and no continuity when key is out, function is normal. Retrace diagnostic steps starting at step 3.
 - If there is no continuity, fault is in lock cylinder (4) or reminder switch (3).

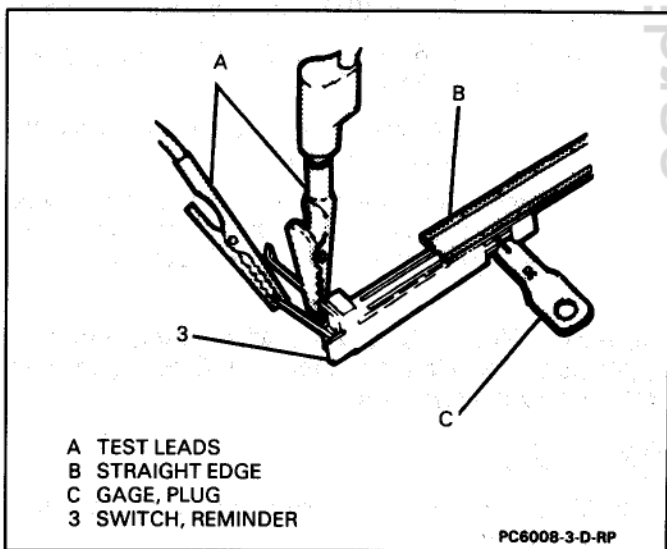


Figure 8 – Checking Contact Gap

7. Lock cylinder (4) for chips, burrs, or foreign material that may prevent actuator tip function.
 - A. Key must be removed, or lock cylinder (4) must be in "RUN" position, before lock cylinder can be removed.
 - B. Remove chips, burrs or foreign material.
 - C. Reassemble and recheck (step 6).

8. Lock cylinder for damage.

- With lock cylinder removed, push key all the way in, turn to "RUN" position and then remove it.

A. The lock cylinder actuator tip should extend and retract smoothly. Total extension of tip should be 1.27 mm (0.050 inch).

B. If not, replace lock cylinder (4). Reassemble and recheck per step 4.

9. Reminder switch (3) if it appears good but will not operate.

A. Connect multimeter leads to reminder switch probes on reminder switch (3).

B. Press on actuator pad until switch points touch.

C. If there is no continuity, replace reminder switch (3).

10. Reminder switch contact gap.

A. Connect multimeter leads to reminder switch probes on reminder switch (3).

B. Press a 0.76 mm (0.030-inch) wire type plug gage with a flat piece of stock onto actuator pad.

- If contact is not made (no continuity), decrease switch contact gap until positive contact is made.

11. Reminder switch contact gap, with positive contact gap set at 0.76 mm (0.030 inch) as outlined above.

A. Use a 0.63 mm (0.025-inch) plug gap wire beneath flat stock.

- If contact is made (continuity), increase switch contact gap.

B. Reminder switch (3) is set properly when switch contact will touch 0.76 mm (0.030-inch) wire but not 0.63 mm (0.025-inch) wire.

- If reminder stops when key is in "RUN" position or when it is turned past "RUN" toward "START," problem is a sticky lock cylinder actuator.

For further diagnosis of key reminder, refer to SECTION 8A.

COLUMN-MOUNTED DIMMER SWITCH

No "LOW" or "HIGH" Beam

Inspect

1. Loose connector at dimmer switch.
2. Improper adjustment.
3. Internally damaged or worn switch. Refer to SECTION 8A.

- Check continuity on switch at light green and tan switch terminals by pushing in plunger all the way. A click should be heard.

– If there is no continuity, replace dimmer switch.

– If there is continuity, refer to SECTION 8A.

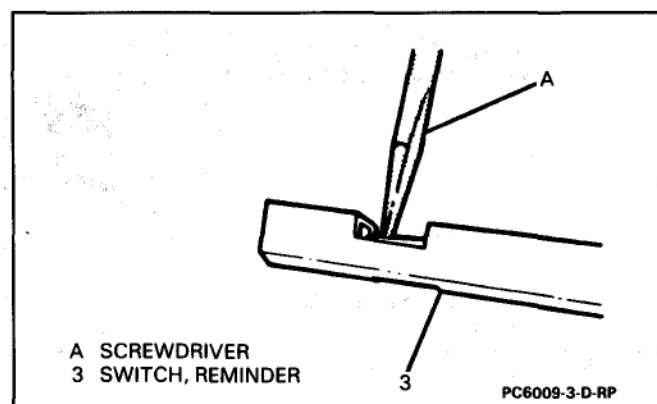


Figure 9 – Decreasing Switch Contact Gap

Reminder Keeps Operating with Key in Lock Cylinder, Driver's Door Open or Closed; Ceases When Key is Removed

Inspect

- Misadjusted or inoperative door jamb switch on driver's side.
- Shorted wire from signal switch to door jamb switch.

A. This condition indicates lock cylinder (4) or reminder switch (3) is at fault. To verify, check for continuity at "E" and "F" male column connector contacts, with key removed from lock cylinder (4).

- If continuity exists, fault is in column.

B. Insert key into lock, then turn lock toward "START" position.

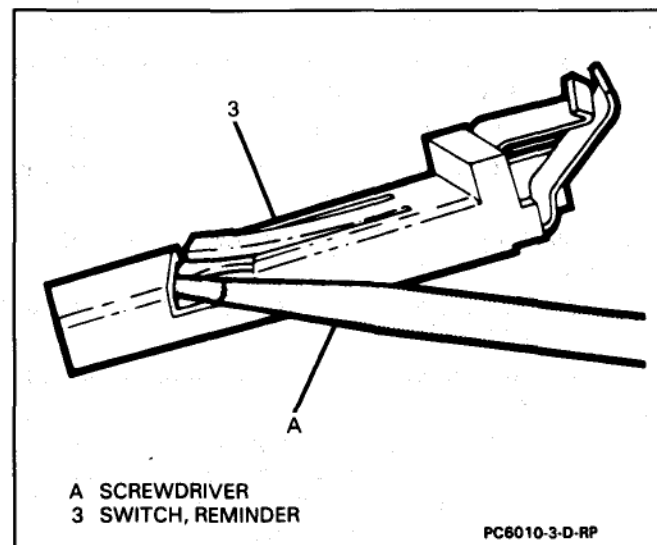


Figure 10 – Increasing Switch Contact Gap

PIVOT AND SWITCH ASSEMBLY

Switch Inoperative: No "LOW," "HIGH" and/or "WASH"

Inspect

1. Loose body-to-switch connector.
2. Broken or damaged switch.
3. Internally damaged or worn switch.
 - Connect a new switch without removing old one.
 - If system functions, replace switch.
 - If system doesn't function, refer to SECTION 8A.

POWER STEERING GEAR AND PUMP ASSEMBLIES LEAK

GENERAL PROCEDURE

Inspect

- For these common complaints about the power steering system:
 - Fluid leakage on garage floor.
 - Fluid leaks visible on steering gear assembly or pump assembly.
 - Growling noise, especially when parking or when engine is cold.
 - Loss of power steering when parking.
 - Excessive steering effort required.
- For an overfilled reservoir assembly.
- For fluid aeration and overflow.
- Hose connections.
- Identify exact point of leakage. Refer to "External Leakage Check" in this section.
 - Point from which fluid is dripping is not necessarily point where system is leaking. It is important to identify exact point of leakage.

EXTERNAL LEAKAGE CHECK

Figure 11

This procedure will help identify exact location of leak. Some leaks can easily be located but seepage type leaks may be more difficult. To locate seepage leaks, use the following method:

1. With engine off, wipe dry complete power steering system.
2. Check fluid level. Adjust fluid level as necessary.
3. Start engine, then turn steering wheel assembly from stop to stop several times.
 - Do not hold it at a stop for any length of time as this can damage pump assembly (5).
 - It is easier for someone else to operate steering wheel assembly while you search for seepage.
4. Find exact location of leak and repair.

SEAL REPLACEMENT RECOMMENDATIONS

Lip Seals

Lip seals, which seal rotating shafts, require special treatment. This type of seal is used on the hydraulic pump shaft and the pinion shaft of the steering gear assembly. When leakage occurs in this area, always replace the seal or seals, after inspecting and thoroughly cleaning the sealing surfaces. Replace the shaft if pitting is found. If corrosion in the lip seal contact zone is slight, clean the surface of the shaft with crocus cloth. Replace the hydraulic pump shaft or complete gear assembly only if the leakage cannot be stopped by smoothing with crocus cloth first.

O-Ring Seals

Whenever a part which forms a sealing surface for an O-ring is removed, the O-ring seal should also be removed and replaced with a new O-ring seal. Lubricate all new O-ring seals with power steering fluid to ease assembly.

POWER STEERING SYSTEM TEST PROCEDURE

Tools Required:

- J 5176-D Power Steering Pressure Tester 0-2000 PSI and
- J 5176-92 18 mm Power Steering Gauge Adapter
- J 25323-A Power Steering System Analyzer
- J 29525-92 Power Steering Analyzer 18 mm Adapter

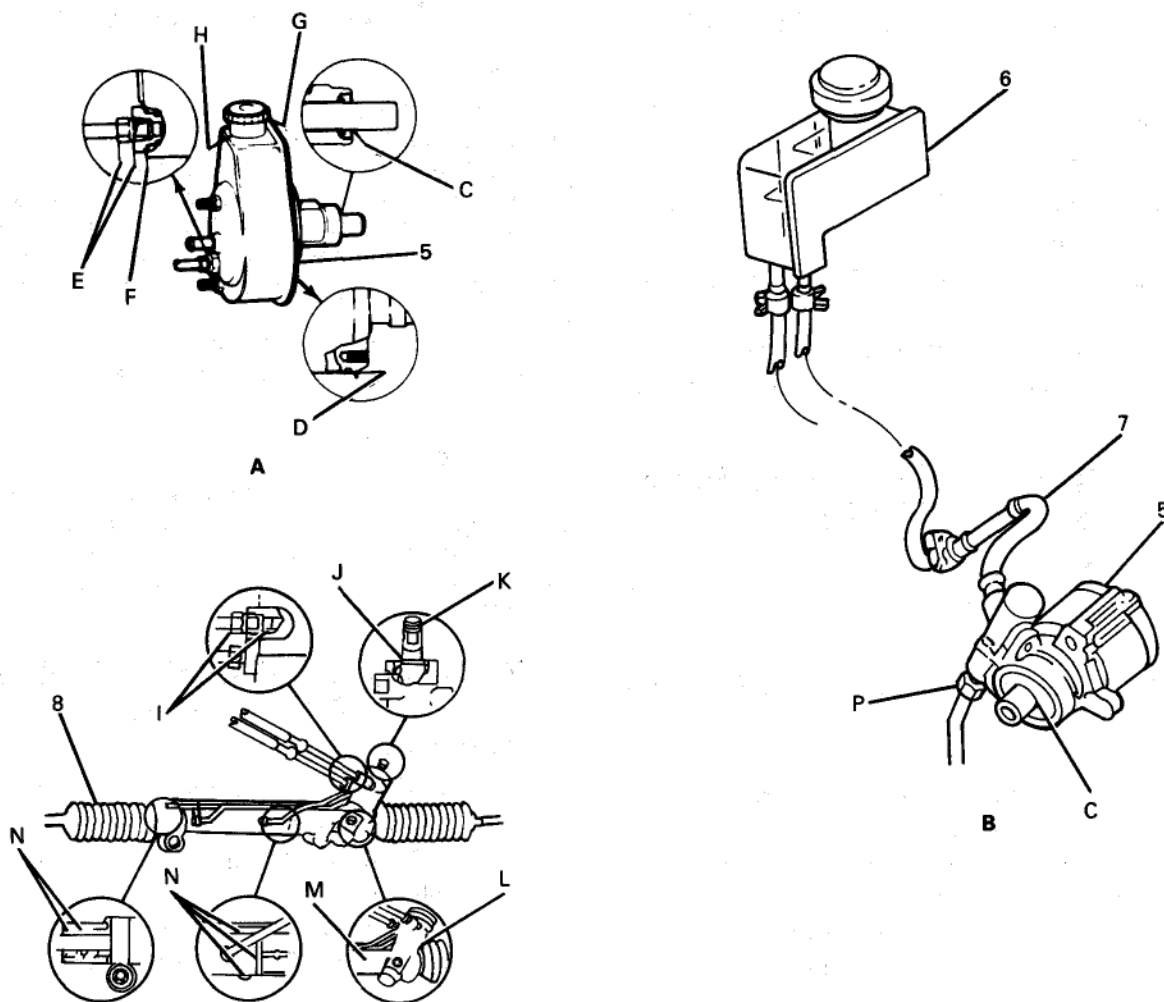
If a hydraulic or mechanical malfunction of the pump assembly or power steering gear assembly is suspected, perform the following procedure to determine the cause.

NOTICE: See "Notice" on page 3-1 of this section.

1. Disconnect outlet hose assembly at pump assembly on 3.4L L32 engine or remote reservoir assembly on 5.7L LT1 engine.
2. Place drain pan under pump assembly on 3.4L L32 engine or remote reservoir assembly on 5.7L LT1 engine.
3. Connect spare pressure hose to pump assembly on 3.4L L32 engine or remote reservoir assembly on 5.7L LT1 engine.

Important

- The power steering system may be tested using J 5176-D or J 25323-A. Testing with J 25323-A will measure flow rate as well as pressure.
4. Connect J 5176-D and J 5176-92 or J 25323-A and J 29525-92 to outlet hose assembly and spare pressure hose.
 5. Open valve on J 5176-D or J 25323-A.
 6. Start engine and allow engine to reach normal operating temperature.



- A 3.4L L32 ENGINE
- B 5.7L LT1 ENGINE
- C REPLACE DRIVESHAFT SEAL. MAKE CERTAIN THAT DRIVESHAFT IS CLEAN AND FREE OF PITTING IN AREA.
- D REPLACE HYDRAULIC PUMP FLOW CONTROL VALVE SEAL (O-RING).
- E TORQUE HYDRAULIC PUMP HOSE FITTING NUT TO 28 N·m (21 LB. FT.). IF LEAKAGE PERSISTS, REPLACE HYDRAULIC PUMP SEAL (O-RING).
- F TORQUE HYDRAULIC PUMP FITTING TO 75 N·m (55 LB. FT.). IF LEAKAGE PERSISTS, REPLACE HYDRAULIC PUMP SEAL (O-RING).
- G CHECK FLUID LEVEL. IF LEAKAGE PERSISTS WITH THE LEVEL CORRECT AND HYDRAULIC PUMP RESERVOIR CAP TIGHT, REPLACE HYDRAULIC PUMP RESERVOIR CAP.
- H IF A CRACKED OR BENT HYDRAULIC PUMP FLUID RESERVOIR IS DETECTED, REPLACE HYDRAULIC PUMP FLUID RESERVOIR.
- I TORQUE STEERING GEAR PIPE FITTING SEAT TO 28 N·m (21 LB. FT.). IF LEAKAGE PERSISTS, REPLACE STEERING GEAR PIPE SEAL (O-RING).

- J REPLACE GEAR WITH PARTIAL STEERING GEAR ASSEMBLY.
- K IF LEAKAGE IS OBSERVED BETWEEN TORSION BAR AND STEERING GEAR PINION SHAFT ASSEMBLY, REPLACE WITH PARTIAL STEERING GEAR ASSEMBLY.
- L IF LEAKAGE IS OBSERVED AT DRIVER SIDE AND IS NOT AFFECTED BY DIRECTION OF TURN, REPLACE WITH PARTIAL STEERING GEAR ASSEMBLY.
- M IF LEAKAGE IS OBSERVED AT STEERING GEAR HOUSING END AND SPURTS WHEN BOTTOMED IN LEFT TURN, REPLACE WITH PARTIAL STEERING GEAR ASSEMBLY.
- N IF LEAKAGE IS OBSERVED AT THESE POINTS, REPLACE WITH PARTIAL STEERING GEAR ASSEMBLY.
- P TORQUE HYDRAULIC PUMP FITTING TO 75 N·m (55 LB. FT.) AND HYDRAULIC PUMP HOSE FITTING NUT TO 28 N·m (21 LB. FT.). IF LEAKAGE PERSISTS, REPLACE HYDRAULIC PUMP SEAL (O-RING).
- 5 PUMP ASSEMBLY, POWER STEERING
- 6 RESERVOIR ASSEMBLY, POWER STEERING FLUID
- 7 HOSE ASSEMBLY, POWER STEERING FLUID OUTLET
- 8 GEAR ASSEMBLY, POWER STEERING

Figure 11 – Power Steering Gear and Pump Assemblies Leak Diagnosis

7. With engine at idle and valve open on J 5176-D or J 25323-A, pressure should be no more than 1 050 kPa (150 psi).

Important

- If pressure is more than 1 050 kPa (150 psi), check the hoses for restrictions and poppet valve on steering gear assembly for proper assembly.

NOTICE: Do not leave the valve fully closed for more than 5 seconds as the pump assembly could be damaged.

8. Fully close valve on J 5176-D or J 25323-A three times and record pressure reading each time. Each reading should show at least 6 895 kPa (1,000 psi). The three readings should be within 345 kPa (50 psi) of each other.

- If pressure readings are high enough and are within 345 kPa (50 psi) of each other, pump assembly is functioning properly.
- If pressure readings are high enough but are not within 345 kPa (50 psi) of each other, control valve in pump assembly is sticking.

A. Remove valve, clean it and remove any burrs using crocus cloth or fine hone.

B. If system contains some contamination, flush it.

- If pressure readings are less than 6 895 kPa (1,000 psi), replace flow control valve and recheck.

– If pressures are still low, replace rotor and vanes.

9. If pump assembly checks to specification, leave valve open and turn steering wheel assembly (or have someone else turn it) to both stops.

- Record highest pressures and compare with highest pump assembly pressure recorded earlier.

– If pressure at both stops is not same as maximum pressure, steering gear assembly is leaking internally and must be repaired.

10. Turn off engine.

11. Remove J 5176-D and J 5176-92 or J 25323-A and J 29525-92

12. Connect outlet hose assembly to pump assembly on 3.4L L32 engine or remote reservoir assembly on 5.7L LT1 engine.

Tighten

- Hydraulic pump hose fitting nut to 28 N•m (21 lb. ft.).

13. Bleed power steering system. Refer to SECTION 3B.

SHOCK ABSORBER ASSEMBLIES

The following procedure includes both on-vehicle and bench checks to be done when evaluating performance of shock absorber assemblies.

Important

- The single-tubed shock absorber assemblies are highly gas pressurized and require a force of 445 N (100 pounds) to initiate shock absorber rod movement. Be careful not to dent or puncture the shock absorber assemblies, or they must be replaced.

Weak

1. Check and adjust tire pressures to pressures shown on tire placard.
2. Note load conditions under which vehicle is normally driven.
3. If practical, ride with owner to be sure you understand complaint before proceeding to next step.
4. Test each shock absorber assembly in turn by quickly pushing down, then lifting up, corner of the bumper nearest the shock absorber assembly being checked.
 - A. Use same amount of effort on each test and note resistance on compression and rebound.
 - B. Compare this with a similar vehicle having acceptable ride quality.
 - Shock absorber assemblies on both vehicles should provide the same feeling of resistance. If there is much difference between the two vehicles, go to next step.

5. Support vehicle to expose shock mounts.
6. Remove shock absorber assemblies. Refer to SECTION 3C.

CAUTION: The shock absorber assemblies are highly pressurized. Be sure to properly disassemble module or personal injury could result.

7. Disassemble plastic dust tube.
8. Remove shock absorber rod washer.

Important

- Do not fully compress shock absorber assembly. Shock absorber assemblies are highly gas charged and will extend when released.
9. Turn shock absorber assembly so lower mount is up and upper mount is down.
 - Compress shock absorber assembly against ground at various rates of speed through approximately one-half the length of the exposed chromed shock absorber rod (75 mm (3 inches) – rear; 50 mm (2 inches) – front).
 10. Compare right and left shock absorber assemblies for compression resistance and rebound speed.
 - Right and left shock absorber assemblies should feel comparable.

- Differences between front and rear shock absorber assemblies are normal.
- If in doubt about condition, compare with a shock absorber assembly known to be good.

Noisy

1. Check all mountings for proper tightening.
 - A loose mounting will cause a noise.
2. If all mountings are intact, jounce vehicle as in step 4 in "Weak" above to isolate suspected unit.
3. If practical, ride with owner to be sure you understand complaint, before proceeding to next step.
4. Remove suspected shock absorber assembly. Refer to SECTION 3C.
5. Shake shock absorber assembly and listen for loose metallic parts inside shock absorber body.
 - If suspicious noise is heard, replace shock absorber assembly.
6. Turn shock absorber assembly so lower mount is up and upper mount and rod is down.
 - Slowly compress shock absorber assembly. Do not allow chromed portion of shock absorber rod to pass below black seal cover.
7. Replace shock absorber assembly if seize is encountered with more than 25 mm (1 inch) of chromed portion of shock absorber rod exposed above seal cover.

Leaks

1. Fully extend shock absorber assemblies (tire and wheel assemblies unsupported) to expose seal cover area for inspection.
2. Look for signs of leaks at top of shock absorber assembly.
 - A small amount of fluid is not cause for replacement. The seal permits some seepage to lubricate the shock absorber rod.
 - A leaking shock absorber assembly can easily be found because there will be an excessive amount of fluid on shock absorber assembly.
3. A leaking shock absorber assembly must be replaced.

TIRES

IRREGULAR OR PREMATURE WEAR

Figures 12 and 13

Irregular or premature tire wear has many causes. Some of them are: incorrect inflation pressures, lack of regular rotation, driving habits, or improper tire and wheel assembly alignment. If tire and wheel assembly alignment is reset due to a tire wear condition, always reset toe as close to zero degrees as the specification allows.

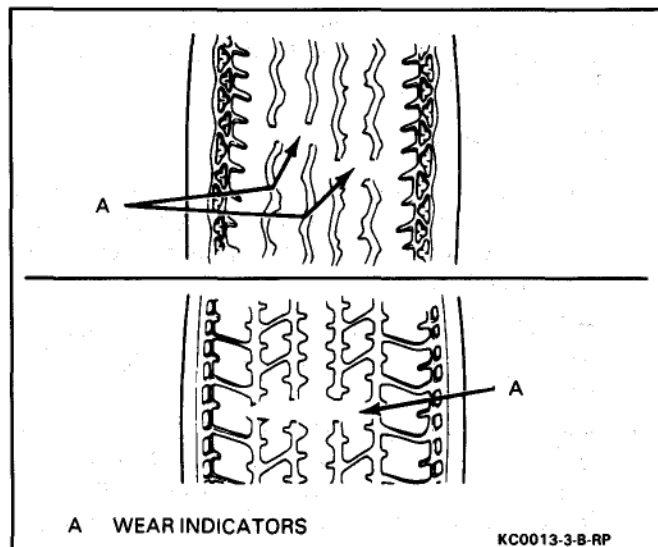


Figure 12 - Tread Wear Indicators

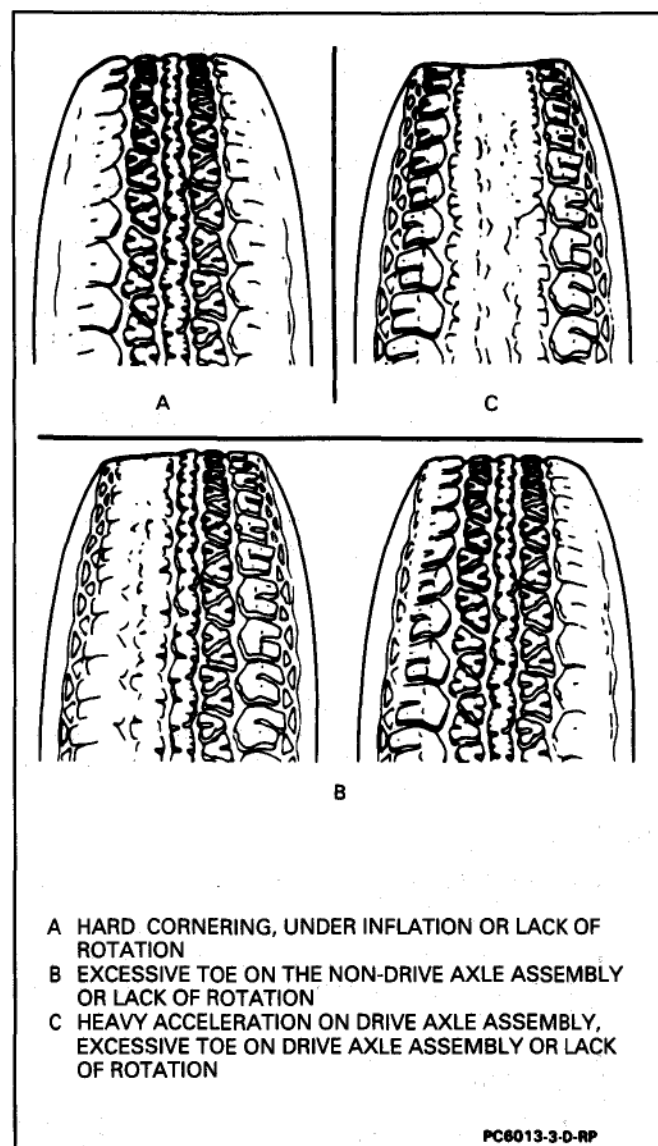


Figure 13 - Tire Wear Diagnosis

Rotate tires if following conditions are noted:

- Front and rear tire wear is unequal.
- Uneven wear exists across tread of any tire.
- Left and right front tire wear is unequal.
- Left and right rear tire wear is unequal.

Check tire and wheel assembly alignment if following conditions are noted:

- Left and right front tire wear is unequal.
- Wear is uneven across tread of any front tire.
- Front tire treads have a scuffed appearance with "feather" edges on one side of tread ribs or blocks.

TREAD WEAR INDICATORS

Figure 12

The original equipment tires have built-in tread wear indicators to show when the tires should be replaced. These indicators will appear as 12.7 mm (1/2-inch) wide bands when the tire tread depth becomes 1.6 mm (1/16 inch). When the indicators appear in 2 or more grooves at 3 locations, replace the tire.

TIRE WADDLE COMPLAINT

Figure 14

Tire waddle is side-to-side movement at the front and/or rear of the vehicle. It can be caused by the steel belt not being straight within the tire; or by excessive lateral runout of the tire or wheel assembly. It is most noticeable at low speed, about 8 to 48 km/h (5 to 30 mph). It may also appear as a ride roughness at 80 to 113 km/h (50 to 70 mph).

The vehicle can be road tested to see which end of the vehicle has the faulty tire. If the tire causing the tire waddle is on the rear, the rear end of the vehicle will "waddle." From the driver's seat, it feels as if someone is pushing on the side of the vehicle.

If the faulty tire is on the front, the tire waddle is more easily seen. The front sheet metal appears to be moving back and forth. It feels as if the driver's seat is the pivot point in the vehicle.

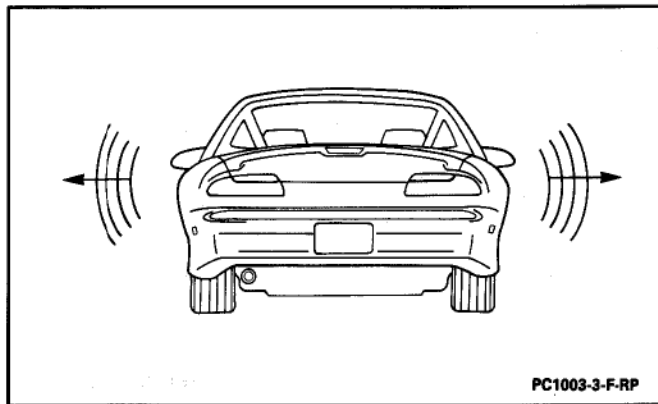


Figure 14 – Tire Waddle

A more time-consuming method of determining the faulty tire is substituting tire and wheel assemblies that are known to be good. Follow these steps:

1. Drive vehicle to determine if tire waddle is coming from front or rear.
2. Install tire and wheel assemblies known to be good from a similar vehicle in place of those on end of vehicle which is vibrating.
 - If tire waddle cannot be isolated to front or rear, start with rear tires.
3. Road test again.
 - If improvement is noted, install original tire and wheel assemblies one at a time until faulty tire is found.
 - If no improvement is noted, install tires known to be good in place of all four. Then, install originals one at a time until faulty tire is found.

RADIAL TIRE LEAD/PULL

Figure 15

Lead/pull is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel assembly.

Lead is usually caused by:

- Poor tire construction.
- Uneven brake assembly adjustment.
- Improper tire and wheel assembly alignment.

The way in which a tire is built can produce lead in a vehicle. An example of this is placement of the belt. Off-center belts on radial tires can cause the tire to develop a side force while rolling straight down the road and the tire will tend to roll like a cone.

The lead/pull correction chart should be used to make sure that the front tire and wheel assembly alignment is not mistaken for tire lead (Figure 15). Refer to SECTION 3A.

Rear tires will not cause lead.

VIBRATION

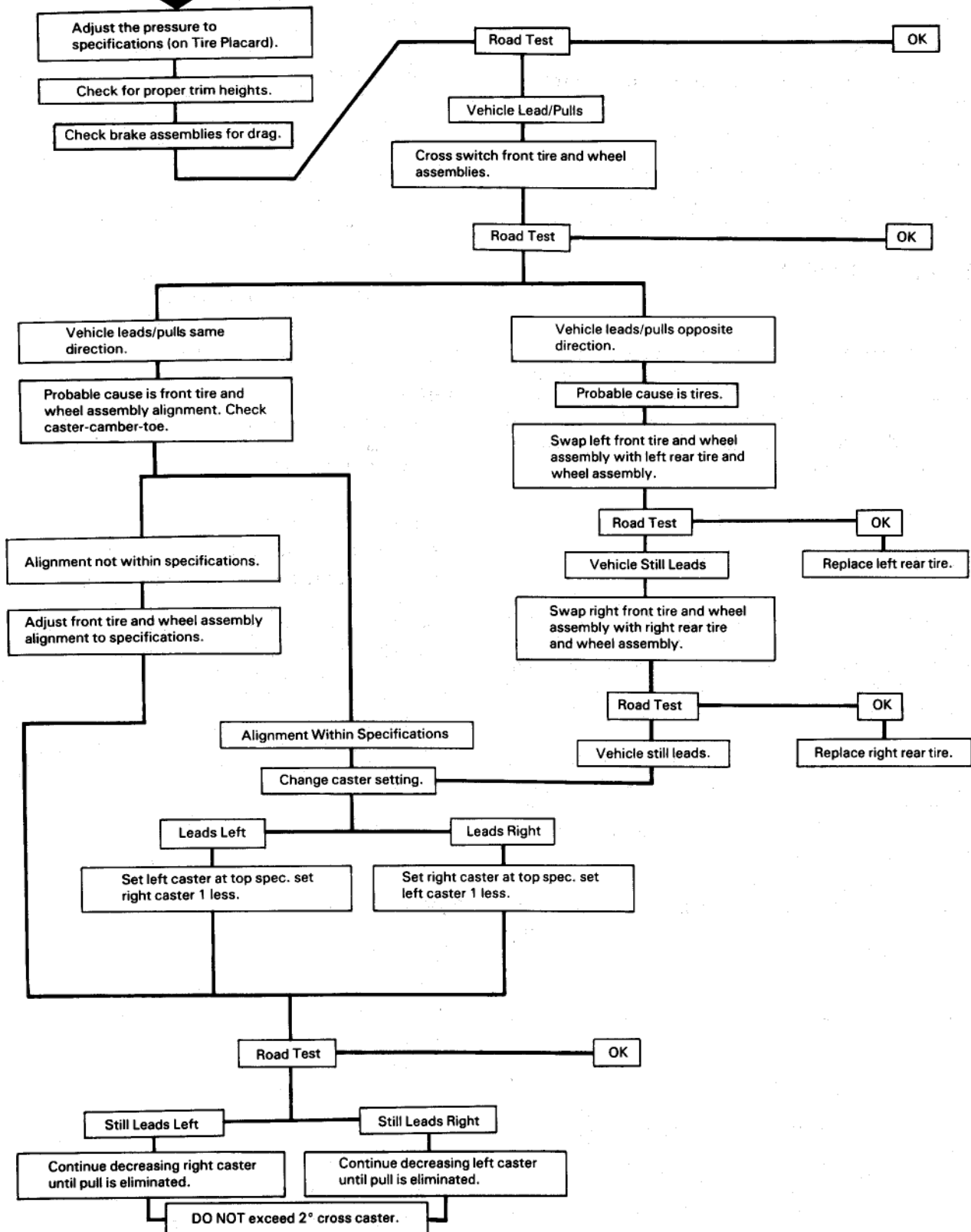
Figures 16 and 17



Inspect

- Improper tire inflation pressure.
- Bent rims from chuckhole or curb impact.
- Faulty tires, such as tread distortions, separations, or bulges.
 - Slight sidewall indentations are normal and will not affect ride.
 - Sidewall bulges are not normal and indicate impact damage.
- Mud or tar build-up on tire or wheel assembly.
- Replacement tire and wheel assembly does not conform to original part, or is of lesser quality or substitute design.
- Loose or missing balance weights or wheel nuts.
- Irregular or excessive tire wear.
- Bent or faulty drive axle assembly.

RADIAL TIRE LEAD/PULL CORRECTION CHART



PC6014-3-D-RP

Figure 15 – Radial Tire Lead/Pull Diagnosis

VIBRATION COMPLAINT DIAGNOSIS

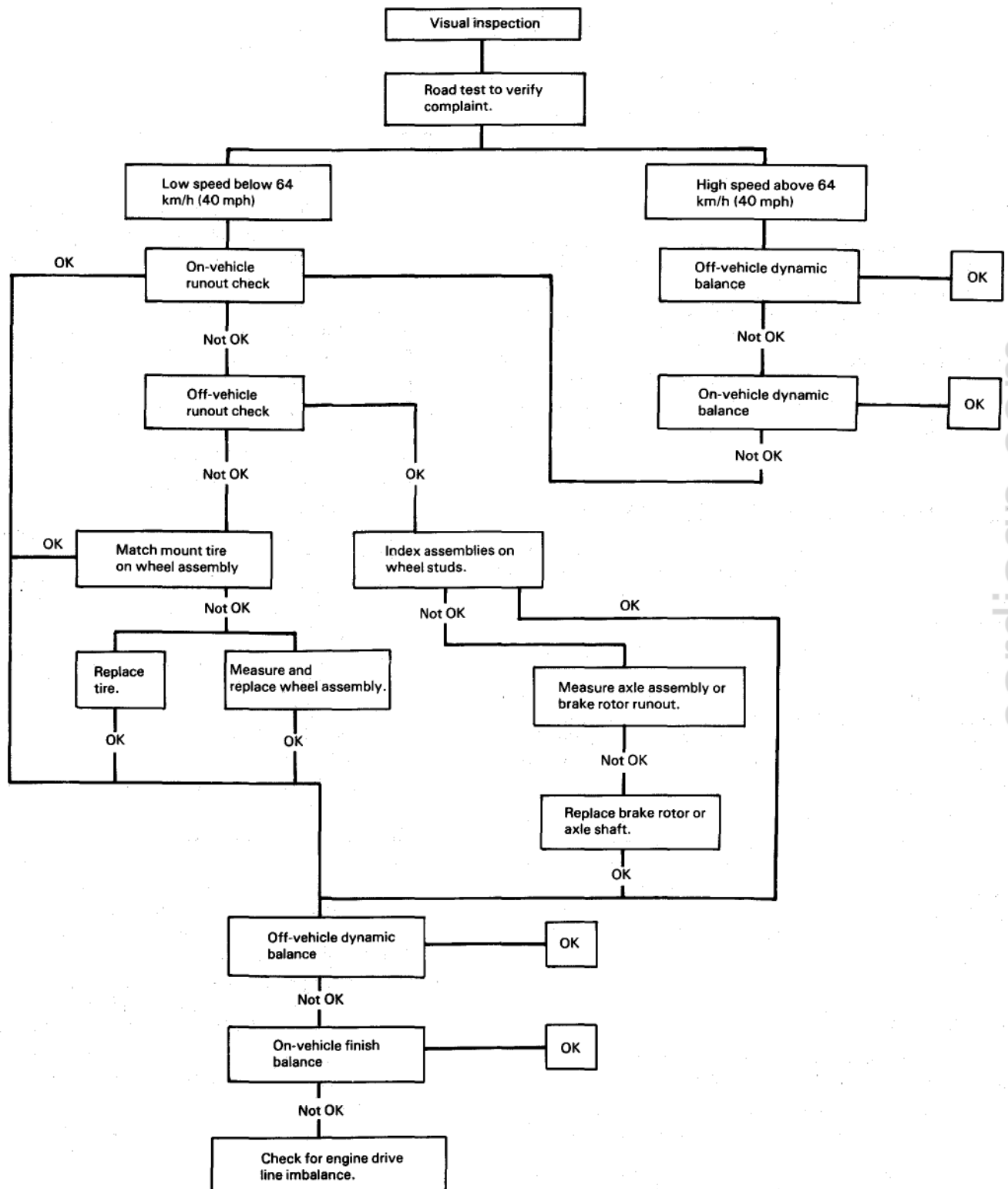


Figure 16 – Wheel and Tire Vibration

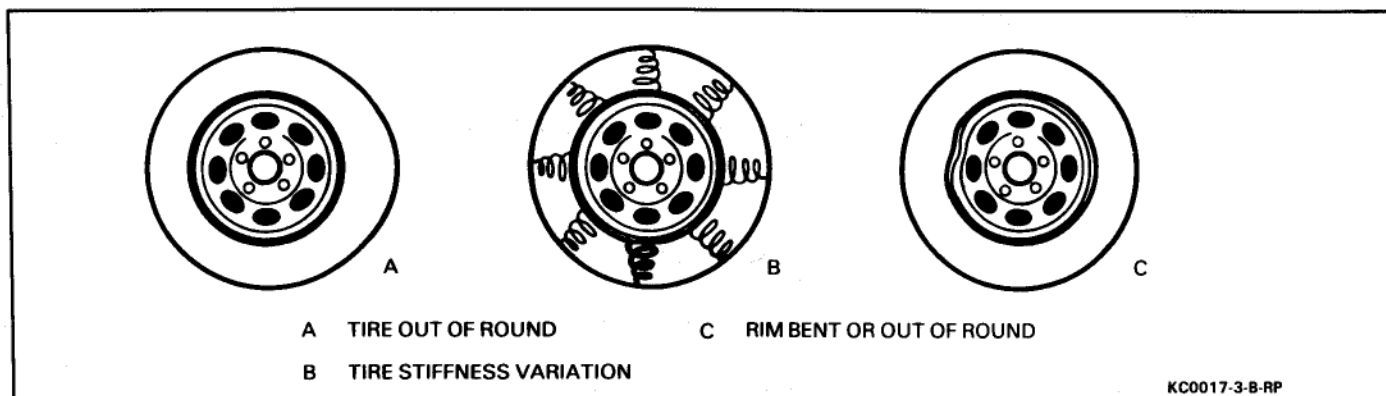


Figure 17 – Causes of Vibration/Runout

ROAD TEST

Before performing any work or testing, always road test the vehicle. Warming up the tires is necessary to eliminate any flat spotting. For vibrations that appear to be engine related, refer to SECTION 6. A road test is also necessary to determine the speed at which the vibration occurs. Low-speed vibration at speeds less than 64 km/h (40 mph) is usually related to runout. High-speed vibration at speeds greater than 64 km/h (40 mph) is usually the result of imbalance, but may be a product of both runout and imbalance.

TIRE AND WHEEL ASSEMBLY BALANCE

Before removing the tire and wheel assembly from the vehicle, mark the wheel bolt nearest the valve stem for future reference. Also mark the vehicle position (left front, etc.) on each tire.

Balance is the easiest procedure to perform and should be done first if the vibration occurs at highway speeds. An off-vehicle, two-plane dynamic balance should be performed first. This will correct any imbalance in the tire and wheel assembly. An on-vehicle finish balance may also be required. This may offset brake drum, rotor, drive axle, or wheel cover imbalance.

If balance does not correct the highway speed vibration, or if the vibration occurs at low speeds, runout may be the probable cause. Runout is the term used when components are checked for symmetry. Runout can be caused by the drive axle assembly, tire, the wheel assembly, the bearing assembly, or the way the wheel assembly attaches to the vehicle.

RUNOUT CHECK

This procedure may be stopped at whatever point the acceptable level of runout is reached.

1. Measure free runout of tire and wheel assembly on vehicle using a dial indicator with a roller wheel.

- Lateral runout (side to side) should be measured on tire's sidewall as close to tread shoulder as possible.
- Radial runout (up and down) should be measured on center tread rib.

– Some tread designs may require wrapping a piece of tape tightly around center tread circumference for better dial indicator contact.

2. Disregard any instantaneous indicator needle jumps due to sidewall depressions, tread blocks, etc.
3. Record total indicator reading, and location of high point of runout.
4. If radial or lateral runout exceeds 1.52 mm (0.060 inch), mount tire and wheel assembly on a dynamic balance machine and remeasure runout.
 - Make sure wheel is centered on machine by wheel center pilot hole.
5. Record total indicator reading, and location of the high point of runout.
6. If radial or lateral runout exceeds 1.27 mm (0.050 inch), break down assembly and rotate tire on rim 180 degrees.
 - In many cases, rotating tire on wheel assembly will bring runout to an acceptable range.
 - Whenever a tire is rotated on the wheel assembly, in this way, the assembly must be rebalanced.
7. Reinflate, mount on dynamic balance machine and remeasure runout.
8. Record total indicator reading and location of high point of runout.
9. If radial or lateral runout still exceeds 1.27 mm (0.050 inch) and high point has moved approximately 180 degrees, following tire around rim, tire is faulty and should be replaced.
10. If second high point still exceeds 1.27 mm (0.050 inch) and is close to original high point, relative to the rim, wheel is faulty and should be replaced.
 - A. Before replacing tire and wheel assembly, break down assembly and measure wheel separately.
 - B. Replace wheel if radial runout exceeds 1.02 mm (0.040 inch), or lateral runout exceeds 1.14 mm (0.045 inch).
11. If runout of tire and wheel assembly is within limits when measured off the vehicle, yet exceeds the limits when measured on the vehicle, the attachment of tire and wheel assembly to hub is probable cause.

12. Rotate assembly two wheel bolts and recheck runout.
 - Several positions may have to be tried to find best location.
13. If runout can not be reduced to an acceptable level, remove tire and wheel assembly and measure hub stud runout.
14. If runout exceeds 0.76 mm (0.030 inch), replace hub or drive axle shaft.

TIRE FORCE VARIATION CHECK

Tire stiffness variation, or loaded radial runout can also cause a vibration. However, this is difficult to measure without a tire problem detector or a loaded radial runout buffer.

The tire problem detector is simply a roller drum that slowly rotates the tire, while under load, (mounted on the vehicle) measuring spindle movement.

The loaded radial runout buffer is a more automated machine that slowly rotates the tire under load with a roller drum off the vehicle and measures the tire's stiffness. It will then "match" the tire to the wheel by buffing off small amounts of rubber from the outer tread rows at the stiff spot. This procedure is usually effective, especially when used as a measuring device and for fine

buffing only. This equipment requires careful use. Do not remove too much rubber.

Because this equipment is not always available, the most basic procedure of measuring free runout with a dial indicator, as previously detailed, is usually more practical. The free runout of the tire will usually correspond with the tire's stiff spot.

SUBSTITUTION METHOD

Install a known good set of tire and wheel assemblies. If these correct the vibration, the original tire and wheel assemblies should be reinstalled one at a time until the vibration returns.

TAPERED ROLLER BEARING DIAGNOSIS

Figure 18

When diagnosing a bearing condition:

1. Consider general condition of all parts during disassembly and inspection.
2. Identify bearing problem (Figure 18).
3. After identifying bearing problem, refer to diagnostic chart to identify cause and appropriate repair procedures.

TAPERED ROLLER BEARING DIAGNOSIS

CONDITION	CAUSE	REPAIR PROCEDURE
Bent Cage	Damage due to improper handling or tool usage.	Replace bearing.
Galling	Metal smears on roller ends due to overheating. Lubricant failure or overload.	Replace bearing. Check inner bearing seals and for proper lubrication.
Abrasive Step Wear	Pattern on roller ends caused by fine abrasives.	Clean all parts and housing. Check inner bearing seals and bearings. Replace if leaking, rough, or noisy.
Etching	Bearing surfaces appear gray or grayish black in color with related etching away of material usually at roller spacing.	Replace bearings. Check inner bearing seals for proper lubrication.
Misalignment	Outer race misalignment due to a foreign object.	Clean related parts and replace bearing. Make sure races are properly seated.
Indentations	Surface depressions on race and rollers caused by hard particles of foreign material.	Clean all parts and housings. Check inner bearing seals and replace bearings if rough or noisy.
Fatigue Spalling	Flaking of surface metal resulting from fatigue.	Replace bearing. Clean all related parts.
Brinelling	Surface indentations in raceway caused by rollers either under impact loading or vibration while bearing is not rotating.	Replace bearing if rough or noisy.
Cage Wear	Wear around outside diameter of cage and roller pockets caused by abrasive material and insufficient lubrication.	Replace bearings. Check inner bearing seals and for proper lubrication.
Abrasive Roller Wear	Pattern on races and rollers caused by fine abrasives.	Clean all parts and housings. Check inner bearing seals and bearings. Replace if leaking, rough, or noisy.

CONDITION	CAUSE	REPAIR PROCEDURE
Cracked Inner Race	Race cracked due to improper fit, cocking, or poor bearing seats.	Replace inner race.
Smears	Smearing of metal due to slippage. Slippage can be caused by poor fits, poor lubrication, overheating, overloads, or handling damage.	Replace bearings. Clean related parts and check for proper fit and lubrication. Replace shaft if damaged.
Fretting	Corrosion set up by small relative movement of parts with no lubrication.	Replace bearing. Clean related parts. Check inner bearing seals and for proper lubrication.
Heat Discoloration	Discoloration can range from faint yellow to dark blue and can result from overload or incorrect lubricant, and overheating. Excessive heat can cause softening of the races on rollers. To check for heat tempering on races or rollers a file test can be done. A file drawn over a tempered part will grab and cut metal. A file drawn over a hard part will glide easily without cutting the metal.	Replace bearings if overheating damage is indicated. Check inner bearing seals and for proper lubrication.
Stain Discoloration	Discoloration can range from light brown to black and can be caused by incorrect lubricant or moisture.	Reuse bearings if stains can be removed by light polishing and if there is no evidence of overheating. Check inner bearing seals and related parts for damage. Check for proper lubrication.

TRIM HEIGHT

Figure 19

Incorrect trim heights can produce symptoms similar to those produced when there is a problem with the tire and wheel assembly alignment. Trim heights should be checked when diagnosing steering and vibration complaints (Figure 19).

In order to measure trim height accurately, make sure:

- Tires are at correct pressure as shown on tire placard "up to vehicle capacity."
- Fuel tank assembly is full.
- Vehicle has no additional weight or passengers.
- Seat assemblies are in full back position.
- Rear compartment is empty except for spare tire and jack assembly and simulated fuel load if required.
- Vehicle is on a known level floor.
- All door assemblies, hood assembly and rear compartment lid assembly are closed.

All dimensions shown on Figure 19 are measured vertical to the ground. Trim heights should be within ± 10 mm (0.4 inch) to be considered correct.

Measuring "Z," "J" and "A" Dimensions

1. Lift front bumper of vehicle up approximately 38 mm (1 1/2 inches). Gently remove hands and let vehicle settle.
 - A. Repeat operation for a total of 2 times.
 - B. After second time, measure "Z," "J" and "A" dimensions.
2. Push front bumper down approximately 38 mm (1 1/2 inches). Gently remove hands and let vehicle rise on its own.
 - A. Repeat operation for a total of 2 times.
 - B. Measure "Z," "J" and "A" dimensions.
3. Calculate trim heights.
 - Trim heights are average of high and low measurements.
4. Verify trim heights with Figure 19.
5. Correct trim heights as necessary.

Measuring "D," "K" and "B" Dimensions

Repeat procedure as described for "Measuring "Z," "J" and "A" Dimensions" using the rear bumper and measuring "D," "K" and "B" at the appropriate times.

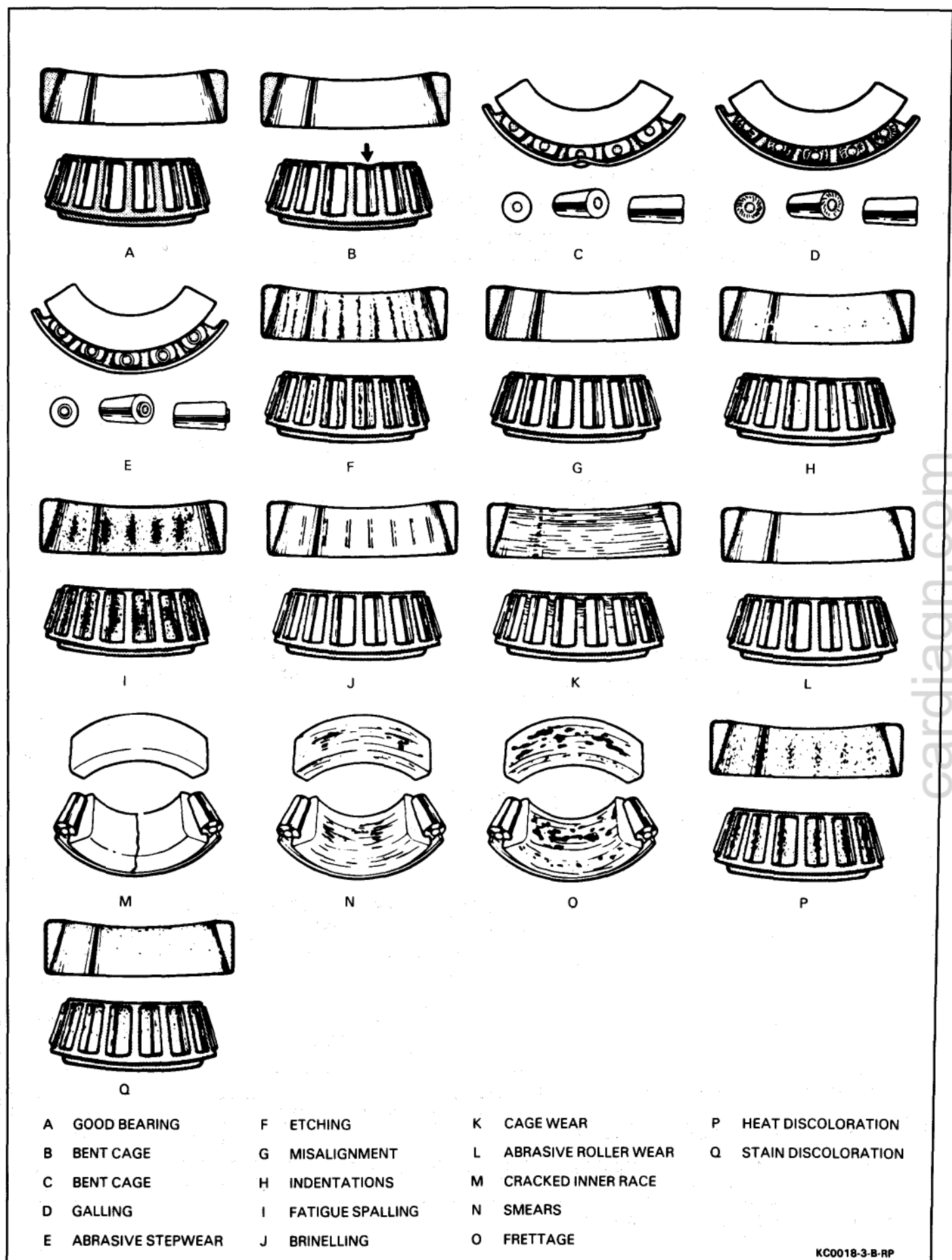
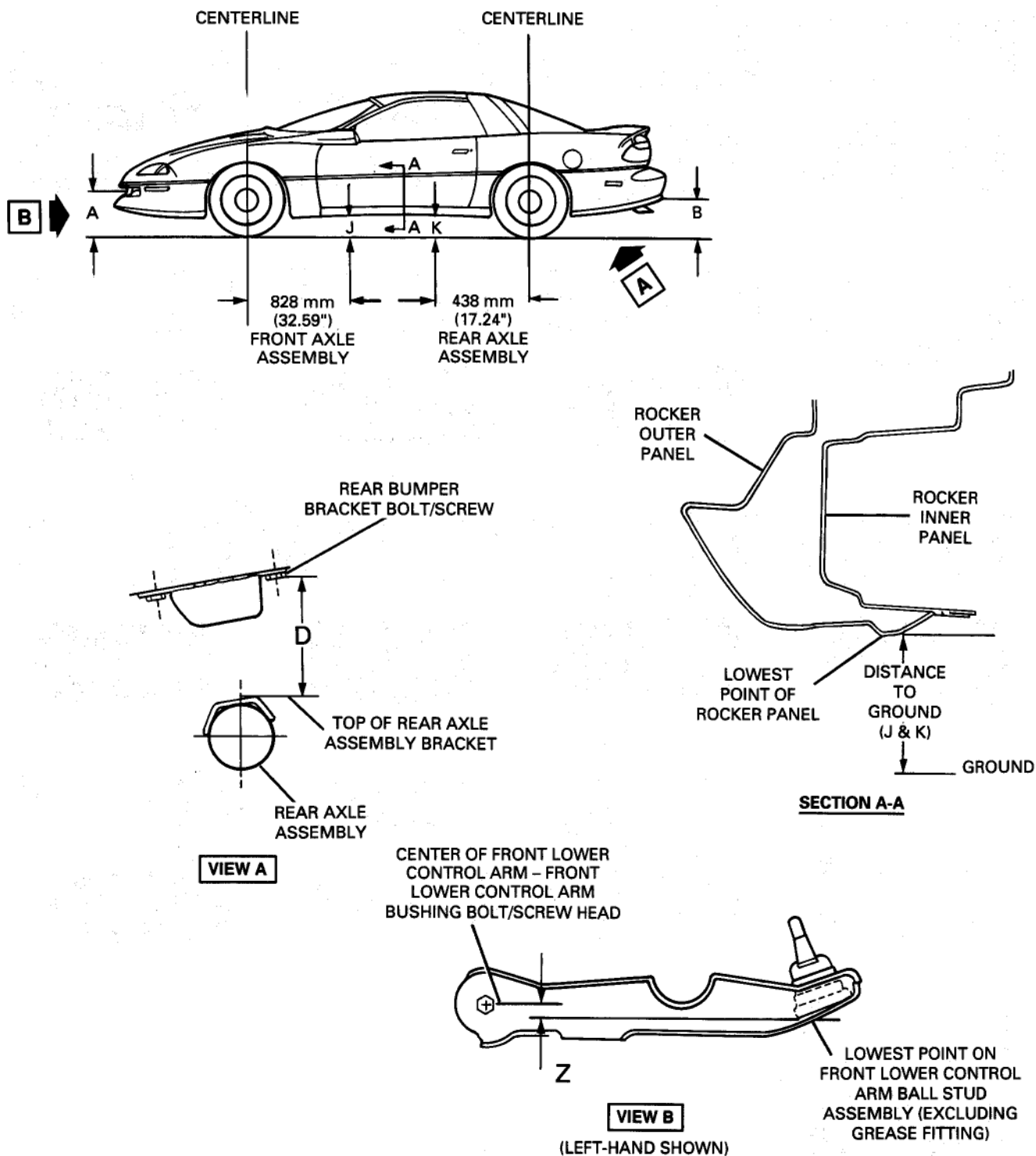


Figure 18 - Tapered Roller Bearing Diagnosis



SUSPENSION	TIRE	A	B	Z	D	J	K
		mm inch	mm inch	mm inch	mm inch	mm inch	mm inch
F41	215-60	420 16.5	367 14.4	32 1.3	121 4.8	204 8.0	208 8.2
	235-55	420 16.5	367 14.4	30 1.2	118 4.6	204 8.0	208 8.4
FE2	235-55	420 16.5	367 14.4	31 1.2	118 4.6	204 8.0	208 8.4
	245-50	420 16.5	367 14.4	37 1.5	125 4.9	204 8.0	208 8.4

NOTE: Trim heights should be within ± 10 mm (0.4 inch).

PC1004-3-F-RP

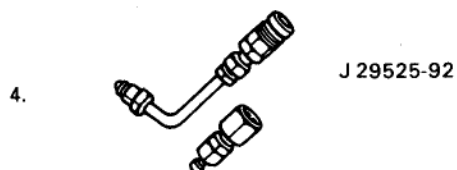
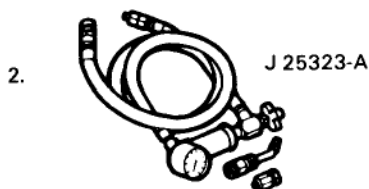
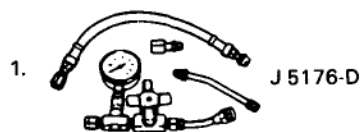
Figure 19 - Trim Height Diagnosis

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Hydraulic Pump Fitting	75 N•m (55 lb. ft.)
Hydraulic Pump Hose Fitting Nut	28 N•m (21 lb. ft.)
Power Steering Gear Pipe Fitting Seat	28 N•m (21 lb. ft.)

SPECIAL TOOLS



1. POWER STEERING PRESSURE TESTER 0 – 2000 PSI
2. POWER STEERING SYSTEM ANALYZER
3. POWER STEERING PRESSURE TESTER ADAPTER
4. POWER STEERING ANALYZER 18 mm ADAPTER

NC4005-3-B-RP

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