



TROUBLESHOOTING

Vehicle inspection

To assist the service advisor and the technician, check the suspension and wheel/tire condition with the questions listed below by filling them. It serves as a place to record information as well as data from the testing to be carried out. To begin a successful diagnosis, fill out the questions.

WHEEL/TIRE/CHECK :

Balance Check **Yes / No**

Maximum Runout Allowed :

Wheel : Radial _____ Lateral _____

Tire : Radial _____ Lateral _____

Measured Runout :

Tire/Wheel Radial : LF _____ LR _____ RF _____ RR _____

Lateral : LF _____ LR _____ RF _____ RR _____

Wheel Only Radial : LF _____ LR _____ RF _____ RR _____

Lateral : LF _____ LR _____ RF _____ RR _____

SUSPENSION INSPECTION :

Can Cause Shimmy Clunk Squeak Harshness

Suspension Bushing : Loose Worn Missing OK

Front stabilizer Rear stabilizer (sway bar) Rear trailing arm

Front lower arm Rear suspension front Rear suspension rear arm

Other _____

Suspension/Components : Loose Worm Missing OK

Ball Joint Shock absorbers F/R Springs F/R The rod ends/sleeve

SYMPTOM CHART

Symptom	Suspect Area	Remedy (See page)
Squeak or grunt-noise from the front suspension, occurs more in cold ambient temperatures-more noticeable over rough roads or when turning	Front stabilizer bar	Under these conditions, the noise is acceptable.
Clunk-noise from the front suspension, occurs in and out of turns	Loose front struts or shocks	Inspect for loose nuts or bolts. Tighten to specifications. See page SS-27.

Clunk-noise from the rear suspension, occurs when shifting from reverse to drive	Loose rear suspension components	Inspect for loose or damaged rear suspension components. Repair or install new components as necessary. See page SS-44.
Click or pop-noise from the front suspension-more noticeable over rough roads or over bumps	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-34.
Click or pop-noise occurs when vehicle is turning	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-35.
Click or snap-occurs when accelerating around a corner	Damaged or worn Birfield joint	Repair or install a new Birfield joint as necessary. See DS group - driveshaft.
Front suspension noise-a squeak, creak or rattle noise-occurs mostly over bumps or rough roads	Steering components Loose or bent front struts or shock absorbers Damaged spring or spring mounts Damaged or worn arm bushings Worn or damaged stabilizer bar bushing or links	Go to detailed test A. See page SS-12.
Groaning or grinding-noise from the front strut, occurs when driving on bumpy roads or turning the vehicle	Uneven seating surface between the insulator and panel by the burrs around the strut insulator mounting bolts and the insulator boltes mounting holes	Repair or install a new parts as necessary. See page SS-28.
Rear suspension noise - a squeak, creak or rattle noise - occurs mostly over bumps or rough roads	Loose or bent rear shock absorbers Damaged spring or spring mounts Damaged or worn control arm bushings	Go to detailed test B. See page SS-13.
Shudder-occurs during acceleration from a slow speed or stop	Rear axle assembly mispositioned Damaged or worn front suspension components	Check the axle mounts and Rear suspension the rear suspension for damage or wear. Repair as necessary. Check for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. Inspect the steering linkage for wear or damage. Repair or Install new components as necessary.
Shimmy-most noticeable on coast/ deceleration-also hard steering condition	Excessive positive caster	Check the caster alignment angle. Correct as necessary. See page SS-58.

Tire noise-hum/moan at constant speeds	Abnormal wear patterns	Spin the tire and Check for tire wear. Install a new tire as necessary. Inspect for damaged/worn suspension components. Carry out wheel alignment. See page SS-58, SS-62.
Tire noise-noise tone lowers as the vehicle speed is lowered	Out-of-balance tire	Balance the tire and road test. Install a new tire as necessary. See page SS-62.
Tire noise - ticking noise, change with speed	Nail puncture or stone in tire tread	Inspect the tire. Repair as necessary. See page SS-62.
Wheel and tire-vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating	Damaged or worn tire	Go to detailed test C. See page SS-14.
Tire wobble or shudder - occurs at lower speeds	Damaged wheel bearings	Spin the tire and check for abnormal wheel bearing play or roughness. Adjust or Install new wheel bearings as necessary. See DS group - front/rear axle.
	Damaged wheel	Inspect the wheel for damage. Install a new wheel as necessary. See page SS-60.
	Damaged or worn suspension components	Inspect the suspension components for wear or damage. Repair as necessary. See page SS-27, SS-44.
	Loose wheel nuts	Check the wheel nuts. Tighten to specification. See page SS-60.
	Damaged or uneven tire wear	Spin the tire and Check for abnormal tire wear or damage. Install a new tire as necessary. See page SS-62
Tire shimmy or shake - occurs at lower speeds	Wheel/tire out of balance	See page SS-58.
	Uneven tire wear	Check for abnormal tire wear. Install a new tire as necessary. See page SS-62.

	Excessive radial runout of wheel or tire	Carry out a radial runout test of the wheel and tire. Install a new tire as necessary. See page SS-60.
	Worn or damaged wheel studs or elongated stud holes	Inspect the wheel studs and wheels. Install new components as necessary. See page SS-60.
	Excessive lateral runout of the wheel or tire	Carry out a lateral runout test of the wheel and tire. Check the wheel, tire and hub. Repair or Install new components as necessary. See page SS-60.
	Foreign material between the brake disc and hub.	Clean the mounting surfaces of the brake disc and hub. See DS group - front/rear axle.
High speed shake or shimmy-occurs at high speeds	Excessive wheel hub runout Damaged or worn tires Damaged or worn wheel bearings Worn or damaged suspension or steering linkage Brake disc or drum imbalance	Go to detailed test D. See page SS-17.
Drift left or right	Tires Steering linkage Alignment Base brake system	Go to detailed test E. See page SS-19.
Steering wheel	Alignment Steering linkage Front lower arm ball joint	Go to detailed test F. See page SS-20.
Tracks incorrectly	Rear suspension Caster	Go to detailed test G. See page SS-21.
Rough ride	Front strut and spring assembly Rear shock absorber and spring assembly	Go to detailed test H. See page SS-22.
Excessive noise	Front or rear stabilizer bar components Springs Suspension components Shock absorbers	Go to detailed test I. See page SS-22.

Incorrect tire wear	Tire or unbalanced wheels Tire inflation Strut Alignment	Go to detailed test J. See page SS-23.
Vibration	Wheel/tire Front wheel drivshaft(s) Steering system Strut and spring assembly Spring and strut mounting Front lower arm ball joint Front lower arm mounting bolt bushing Stabilizer bar bushings Wheel hubs and bearing Rear suspension arms and bushings	Go to detailed test K. See page SS-24.
Vehicle leans	Tire/wheel Vehicle load Suspension components Incorrect ride height	Inflate tires to specification. See page SS-62. Redistribute the load as necessary. Visually inspect the suspension system Correct the ride height as necessary
Poor returnability	High knuckle rotating torque Alignment	Go to detailed test E. See page SS-19.

DETAILED TEST A : FRONT SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → YES . → NO The suspension system is OK. Conduct a diagnosis on other suspect systems.
INSPECT THE STEERING SYSTEM	

1. Check the steering system for wear or damage.
Carry out a steering linkage test.
2. Inspect the tire wear pattern. See page SS-26.
 - Are the steering components worn or damaged ?
→ **YES**
Repair the steering system. Install new components as necessary. Test the system for normal operation
 - **NO**
Go to

FRONT SHOCK ABSORBER/STRUT CHECK

1. Check the front shock absorbers/strut mounts for loose bolts or nuts.
2. Check the front shock absorbers/struts for damage. Carry out a shock absorber check.
 - Are the front shock absorbers/struts loose or damaged ?
→ **YES**
Tighten to specifications if loose.
Install new front shock absorbers/struts if damaged. Test the system for normal operation.
 - **NO**
Go to

CHECK THE FRONT SPRINGS

- Check the front spring and front spring mounts/brackets for wear or damage
- Are the front springs or spring mounts/brackets worn or damaged ?
→ **YES**
Repair or Install new components as necessary. Test the system for normal operation.
 - **NO**
Go to **A5**.

CHECK THE STABILIZER BAR

1. Check the stabilizer bar bushing and links for damage or wear.
2. Check the stabilizer bar for damage.
3. Check for loose or damaged stabilizer brackets.
 - Are the stabilizer bar/tracker bar components loose, worn or damaged ?
→ **YES**
Repair or Install new components as necessary. Test the system for normal operation.
 - **NO**
Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST B : REAR SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	<p>1. Test drive the vehicle.</p> <p>2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating.</p> <p>● Is there a squeak, creak or rattle noise ?</p> <p>→ YES</p> <p>Go to</p> <p>→ NO</p> <p>The suspension system is OK. Conduct a diagnosis on other suspect systems.</p>
REAR SHOCK ABSORBER/STRUT CHECK	
	<p>1. Raise and support the vehicle. See GI group - lift support point.</p> <p>2. Check the rear shock absorber/strut mounts for loose bolts or nuts.</p> <p>3. Check the rear shock absorbers/strut for damage. Carry out a shock absorber check.</p> <p>● Are the rear shock absorbers/struts loose or damaged ?</p> <p>→ YES</p> <p>Tighten to specifications if loose.</p> <p>Install new rear shock absorbers/struts if damaged. Test the system for normal operation.</p> <p>→ NO</p> <p>Go to</p>
CHECK THE REAR SPRINGS	
	<p>Check the rear springs and rear spring mounts/brackets for wear or damage.</p> <p>● Are the rear springs or spring mounts/brackets worn or damaged ?</p> <p>→ YES</p> <p>Repair or Install new components as necessary. Test the system for normal operation.</p> <p>→ NO</p> <p>Go to B4.</p>
CHECK THE TRAILING ARMS	

1. Inspect the trailing arm bushings for wear or damage. Check for loose trailing arm bolts.
2. Inspect for twisted or bent trailing arms.
 - Are the trailing arms loose, damaged or worn ?
 - **YES**
Repair or Install new components as necessary. Test the system for normal operation.
 - **NO**
Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST C : WHEEL AND TIRE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	<p style="text-align: center;">NOTE</p> <p>Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle.</p> <p>Test drive the vehicle at different speed ranges.</p> <p>During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires.</p> <ul style="list-style-type: none"> ● Is there a vibration and noise ? → YES Go toC2. → NO The wheel and tires are OK. Conduct a diagnosis on other suspect systems.
CHECK THE FRONT WHEEL BEARINGS	
	<p>Check the front wheel bearings. Refer to Wheel Bearing Check (See DS group - front axle).</p> <ul style="list-style-type: none"> ● Are the wheel bearing OK ? → YES Go toC3. → NO Inspect the wheel bearings. Adjust or Repair as necessary. Test the system for normal operation.
INSPECT THE TIRES	

1. Check the tires for missing weights.
2. Check the wheels for damage.
3.
 - Do the tires have an abnormal wear pattern ?
 - **YES**
 - Correct the condition that caused the abnormal wear. Install new tire(s).
 - Test the system for normal operation.
 - **NO**
 - Go to

TIRE ROTATION DIAGNOSIS

1. Spin the tires slowly and watch for signs of lateral runout.
2. Spin the tires slowly and watch for signs of radial runout.
 - Are there signs of visual runout ?
 - **YES**
 - Go To
 - **NO**
 - Check the wheel and tire balance.
 - Correct as necessary. Test the system for normal operation.

RADIAL RUNOUT CHECK ON THE TIRE

Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.15mm (0.059 inch).

- Is the radial runout within specifications ?
 - **YES**
 - Go to **C8**.
- **NO**
- Go to **C6**.

RADIAL RUNOUT CHECK ON THE WHEEL

Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14mm (0.045 inch.).

- Is the radial runout within specifications ?
 - **YES**
 - Install a new tire. Test the system for normal operation.
- **NO**
- Go to **C7**.

CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT

Measure the pilot or bolt circle runout. A typical specification for radial runout is :

- pilot runout - less than 0.15mm (0.006 inch.)
- bolt circle runout - less than 0.38 mm (0.015 inch.)
- Is the radial runout within specification ?

→ **YES**

Install a new wheel. Test the system for normal operation.

→ **NO**

Repair or Install new components as necessary. See page SS-27 for the front suspension or SS-43 for the rear suspension.

LATERAL RUNOUT CHECK ON THE TIRE

Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 2.5mm (0.098 inch).

- Is the lateral runout within specifications ?

→ **YES**

Wheel and tires are OK. Conduct diagnosis on other suspect systems.

→ **NO**

Go to **C9**.

LATERAL RUNOUT CHECK ON THE WHEEL

Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.2mm (0.047 inch.)

- Is the lateral runout within specifications ?

→ **YES**

Install a new tire. Test the system for normal operation.

→ **NO**

Go to **C10**.

CHECK THE FLANGE FACE LATERAL RUNOUT

Measure the flange face lateral runout. A typical specification for lateral runout is :

- hub/brake disc - less than 0.13mm (0.005 inch)
- Is the lateral runout within specifications ?

→ **YES**

Install a new wheel. Test the system for normal operation.

→ **NO**

Repair or Install new components as necessary. See page SS-27 for the front suspension or SS-44 for the rear suspension.

DETAILED TEST D : HIGH SPEED SHAKE OR SHIMMY

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK FOR FRONT WHEEL BEARING ROUGHNESS	

1. See GI group - lift support point.
2. Spin the front tires by hand.
● Do the wheel bearings feel rough ?
→ **YES**
Inspect the wheel bearings. Repair as necessary. Test the system for normal operation.
→ **NO**
Go to

CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS

Check the end play of the front wheel bearings.
● Is the end play OK ?
→ **YES**
Go to **D3**.
→ **NO**
Adjust or Repair as necessary. Test the system for normal operation.

MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE

Measure the lateral runout and the radial runout of the front wheels on the vehicle. Go to detailed test C.
● Are the measurements within specifications ?
→ **YES**
Go to **D4**.
→ **NO**
Install new wheels as necessary and Balance the assembly. Test the system for normal operation.

MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE

Measure the lateral runout of the front tires on the vehicle. Go to detailed test C.
● Is the runout within specifications ?
→ **YES**
Go to **D5**.
→ **NO**
Install new tires as necessary and Balance the assembly. Test the system for normal operation.

MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE

Measure the radial runout of the front tires on the vehicle. Go to detailed test C.

● Is the runout within specifications ?

→ **YES**

Balance the front wheel and tire assemblies. If any tire cannot be balanced, Install a new tire. Test the system for normal operation.

→ **NO**

Go to**D6**.

MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY

Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout.

● Is the runout within specifications ?

→ **YES**

Balance the assembly. Test the system for normal operation.

→ **NO**

If the high spot is not within 101.6mm (4 inches) of the first high spot on the tire, Go to**D7**

MEASURE THE WHEEL FLANGE RUNOUT

Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Go to detailed test C.

● Is the runout within specifications ?

→ **YES**

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→ **NO**

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CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE

Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle.

● Is the vibration present ?

→ **YES**

Substitute known good wheel and tire assemblies as necessary. Test the system for normal operation.

→ **NO**

Check the driveline components. Test the system for normal operation.

DETAILED TEST E : DRIFT LEFT OR RIGHT

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE TIRES	

Inspect the tires for excessive wear or damage.

● Are the tires excessively worn or damaged ?

→ **YES**

Install new tires.

→ **NO**

Go to **E2**.

CHECK THE STEERING LINKAGE

1. Raise and support the vehicle.

2. Check the steering components for indications of excessive wear or damage. See ST group - specification.

● Is there an indication of excessive wear or damage ?

→ **YES**

Repair or Install new components as necessary.

→ **NO**

Go to

CHECK THE VEHICLE ALIGNMENT

1. Place the vehicle on an alignment rack.

Check the vehicle alignment.

● Is the alignment within specification ?

→ **YES**

Go to

→ **NO**

Adjust the alignment as necessary. See page SS-58 (wheel alignment)

BRAKE DRAG DIAGNOSIS

Apply the brakes while driving.

● Does drift or pull occur when the brakes are applied ?

→ **YES**

See BR group - specification.

→ **NO**

If the steering wheel is in the center, the vehicle is OK.

DETAILED TEST F : STEERING WHEEL OFF-CENTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
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CHECK THE CLEAR VISION

Place the vehicle on an alignment rack.

● Is the clear vision within specification ?

→ **YES**

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→ **NO**

Adjust the clear vision to specification.

INSPECT THE STEERING COMPONENTS

1. Raise and support the vehicle.
2. Inspect the steering components for excessive wear or damage. See ST group - specification.
 - Are the steering components excessively worn or damaged ?
 - **YES**
 - Repair or Install new components as necessary.
 - **NO**
 - If it tracks corectly, vehicle is OK.

DETAILED TEST G : TRACKS INCORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CASTER	
	Place the vehicle on an alignment rack. <ul style="list-style-type: none"> ● Are the caster within specification ? → YES Go toG2. → NO
CHECK THE REAR SUSPENSION	
	<ol style="list-style-type: none"> 1. Measure the vehicle wheel base for LH and RH. 2. Compare the measurements. <ul style="list-style-type: none"> ● Are the measurements the same ? → YES If the ride is smooth, vehicle is OK. → NO Inspect the rear suspension components for wear or damage. Repair or Install new components as necessary. See page SS-44 (rear suspension).

DETAILED TEST H : ROUGH RIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE FRONT SHOCK ABSORBER	

1. Raise support the vehicle.
2. Inspect the front shock absorber for oil leaks or damage.
 - Are the tires excessively worn or damaged ?
 - **YES**
 - Install new front shock absorbers.
 - See page SS-28 (front strut assembly).
 - **NO**

CHECK THE REAR SHOCK ABSORBERS

- Inspect the rear shock absorbers for oil leaks or damage.
- Are the rear shock absorbers leaking ?
 - **YES**
 - Install new rear shock absorbers.
 - See page SS-45 (rear strut assembly).
 - **NO**

DETAILED TEST I : EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE SUSPENSION	
	<ol style="list-style-type: none"> 1. Raise and support the vehicle. 2. Inspect the shock absorber mounting bolts. <ul style="list-style-type: none"> ● Are the mounting bolts loose or broken ? → YES Tighten or Install new shock absorber mounting bolts. See page SS-28 and SS-45 (front/rear strut assembly). → NO Go to
INSPECT THE SPRING AND TORSION BARS	
	<p>Inspect the springs and stabilizer bars for damage.</p> <ul style="list-style-type: none"> ● Are the spring or stabilizer bars damaged ? → YES Install new spring and/or stabilizer bars. See page SS-41, SS-55 (front/rear stabilizer bar). → NO
INSPECT THE FRONT SUSPENSION	

Inspect the front suspension components for excessive wear or damage.

● Are the front suspension components worn or damaged ?

→ **YES**

Install new front suspension components.

See page SS-27 (front suspension).

→ **NO**

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DETAILED TEST J : INCORRECT TIRE WEAR

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE TIRES	
	1.Raise and support the vehicle. 2.Inspect the tires for uneven wear on the inner or outer shoulder. ● Is there uneven tire wear ? → YES Align the vehicle. Install new tires if badly worn. → NO Go to
UNEVEN TIRE WEAR	
	Inspect the tires for a feathering pattern. ● Do the tires have a feaehering pattern ? → YES Align the vehicle. Install new tires if badly worn. → NO .
CHECK FOR CUPPED TIRE	
	Inspect the tires for cupping or dishing. ● Are the tires cupped or dished ? → YES Balance and Rotate the tires. → NO .

DETAILED TEST K : VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST	

Accelerate the vehicle to the speed at which the customer indicated the vibration occurred.

● Is the vibration present ?

→ **YES**

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→ **NO**

The vehicle is OK. Go to **TROUBLESHOOTING**.

INSPECT THE TIRES

1. Raise and support the vehicle with a frame contact hoist.
2. Inspect the tires for extreme wear or damage, cupping, or flat spots.

● Are the tires OK ?

→ **YES**

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→ **NO**

Check the suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear.

Correct the suspension concerns and Install new tires.

INSPECT THE WHEEL BEARINGS

Spin the tires by hand to check for wheel bearing roughness.

● Is the front wheel bearing OK ?

→ **YES**

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→ **NO**

Install new front wheel bearings as necessary.

See DS group - front axle.

TIRE/WHEEL BALANCE

Check the tire/wheel balance.

● Are the tires balanced ?

→ **YES**

Go to **K5**.

→ **NO**

Balance the tires and wheels as necessary.

MEASURE THE RUNOUTS

For each wheel position measure, locate and mark the following items.

See page SS-58 (wheel/tire).

- High point of the tire/wheel assembly total radial runout
- High point of the wheel radial runout
- High point of the wheel lateral runout

● Are the runouts as specified ?

→ **YES**

Go to **K7**.

→ **NO**

Go to **K6**.

SUBSTITUTE THE WHEELS AND TIRE

1. Substitute a known good set of wheels and tires.

2. Carry out a road test.

3. If the vehicle still exhibits a shake or vibration, note the vehicle speed and/or engine rpm which it occurs.

● Is the vibration felt ?

→ **YES**

Engine/transmission imbalance.

See the specification of TR group, EM group, FL group and EC group.

→ **NO**

Install the original tire/wheel assemblies one by one, Road testing at each step until the damaged tire(s)/wheel(s) as necessary. Test the system for normal operation.

Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

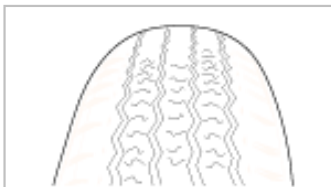
Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Carry out a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions.

WHEEL AND TIRE DIAGNOSIS

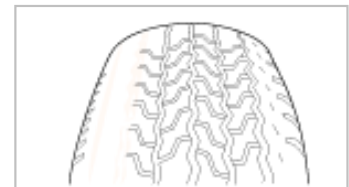
Rapid wear at the center



Rapid wear at both shoulders



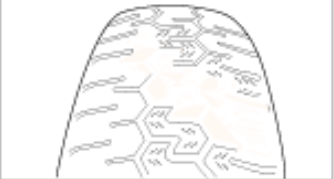


Wear at one shoulder



<ul style="list-style-type: none"> •Center- tread down to fabric due to excessive over inflated tires •Lack of rotation •Excessive toe on drive wheels •Heavy acceleration on drive 	<ul style="list-style-type: none"> •Underinflated tires •Worn suspension components •Excessive cornering speeds •Lack of rotation 	<ul style="list-style-type: none"> •Toe adjustment out of specification •Camber out of specification •Damaged strut •Damaged lower arm
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WHEEL AND TIRE DIAGNOSIS

Partial wear	Feather edges wheels	Wear pattern
		
<ul style="list-style-type: none"> •Cansed by irreqular burrs on brak drums. 	<ul style="list-style-type: none"> •Toe adjustment out of specification •Damaged or worn tie rods •Damaged knuckle 	<ul style="list-style-type: none"> •Excessive toe on non-drive wheels •Lack of rotation