

Diagnosis and Testing

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and REFER to the Symptom Chart.

How to Use this Diagnostic Procedure Section

- Noise, vibration and harshness (NVH) concerns have become more important as vehicles have become more sensitive to these vibrations. This section is designed to aid in identifying these concerns.
- The section provides diagnostic procedures based on symptom. If the condition occurs at high speed, for instance, the most likely place to start is under Shake and Vibration While Driving.
- The road test procedure will tell how to sort the conditions into categories and how to tell a vibration from a shake.
- A series of Road Test Quick Checks are provided to make sure that a cause is either pinpointed or eliminated.
- Name the condition, proceed to the appropriate section and locate the correct diagnosis. When the condition is identified, the job is partly done.
- Follow the diagnostic procedure as outlined.
- Quick Checks are described within the step, while more involved tests and adjustments are outlined in General Procedures.
- Always follow each step exactly and make notes to recall important findings later.

Customer Interview

The road test and customer interview (if available) provide information that will help identify the concern and will provide direction to the correct starting point for diagnosis.

Identify the Condition

NVH usually occur in four areas:

- tires
- engine accessories
- suspension
- driveline

It is important, therefore, that an NVH concern be isolated into its specific area(s) as soon as possible. The easiest and quickest way to do this is to carry out the Road Test as outlined. To assist in the diagnosis and testing procedure(s), use a suitable approved NVH diagnosis tester.

Noise Diagnostic Procedure

Non-Axle Noise

The five most common sources of non-axle noise are exhaust, tires, roof racks, trim panels and transmission.

Therefore, make sure that none of the following conditions are the cause of the noise before proceeding with a driveline teardown and diagnosis.

- In certain conditions, the pitch of the exhaust may sound very much like gear noise. At other times, it can be mistaken for a wheel bearing rumble.
- Tires, especially snow tires, can have a high pitched tread whine or roar, similar to gear noise. Radial tires may have this characteristic. Also, any non-standard tire with an unusual tread construction may emit a roar or whine noise.
- Trim panels can also cause whistling or whining noise.
- Clunk may be a metallic noise heard when the automatic transaxle is engaged in "R" (REVERSE) or "D" (DRIVE) or it may occur when the throttle is applied or released. It is caused by backlash somewhere in the driveline.
- Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a damaged wheel bearing.

Noise Conditions

- Gear noise is typically a howling or whining due to gear damage or incorrect bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.
- Chuckle is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 64 km/h (40 mph) and can usually be heard all the way to a stop. The frequency varies with vehicle speed.
- Knock is very similar to chuckle, though it may be louder and occurs on acceleration or deceleration. The teardown will disclose what has to be corrected.

Clicking, popping or grinding noises may be caused by the following:

- worn, damaged or incorrectly installed wheel bearing, suspension or brake component.

Check and rule out tires, exhaust and trim items before disassembling the transmission to diagnose and correct gear noise.

The noises described under Road Test usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard on the road test and driving conditions.

Vibration Conditions

Vibration at highway speeds may be caused by the following:

- out-of-balance front or rear wheels.
- out-of-round tires.

Shudder or vibration during acceleration may be caused by the following:

- damaged powertrain/drivetrain mounts.
- excessively high constant velocity (CV) joint operating angles caused by incorrect ride height. Check ride height, verify correct spring rate and check items under inoperative conditions.

Road Test

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and may be audible at certain speeds or under various driving conditions, as on a newly paved asphalt road. The slight noise is in no way detrimental and must be considered normal.

The road test and customer interview (if available) provide information needed to identify the condition and give direction to the correct starting point for diagnosis.

1. Make notes throughout the diagnosis routine. Make sure to write down even the smallest bit of information, because it may turn out to be the most important.
2. Do not touch anything until a road test and a thorough visual inspection of the vehicle have been carried out. Leave the tire pressures and vehicle load just where they were when the condition was first observed. Adjusting tire pressures, vehicle load or making other adjustments may reduce the condition(s) intensity to a point where it cannot be identified clearly. It may also inject something new into the system, preventing correct diagnosis.

3. Make a visual inspection as part of the preliminary diagnosis routine, writing down anything that does not look right. Note tire pressures, but do not adjust them yet. Note leaking fluids, loose nuts and bolts, or bright spots where components may be rubbing against each other. Check the load space for unusual loads.
4. Road test the vehicle and define the condition by reproducing it several times during the road test.
5. Carry out the Road Test Quick Checks as soon as the condition is reproduced. This will identify the correct diagnostic procedure. Carry out the Road Test Quick Checks more than once to verify they are providing a valid result. Remember, the Road Test Quick Checks may not tell where the concern is, but they will tell where it is not.

Road Test Quick Checks

1. 24-80 km/h (15-50 mph): with light acceleration, a moaning noise is heard and possibly a vibration felt in the front floor panel. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed. It may also produce a moaning sound, depending on what component is causing it. REFER to Tip-in Moan in the Driveline Noise and Vibration Symptom Chart.
2. Acceleration/Deceleration: With slow acceleration and deceleration, a shake is sometimes noticed in the steering wheel/column, seats, front floor panel, front door trim panel or front end sheet metal. It is a low frequency vibration (around 9-15 cycles per second). It may or may not be increased by applying the brakes lightly. REFER to Idle Boom/Shake/Vibration in the Driveline Noise and Vibration Symptom Chart.
3. High Speed: A vibration is felt in the front floor panel or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with the clutch pedal depressed (manual transmission) or shift control selector lever in "N" (NEUTRAL) (automatic transmission) and engine idling. If vibration is still evident, it may be related to wheels, tires, front brake discs, wheel hubs or front wheel bearings. REFER to Shake and Vibration While Driving in the Driveline Noise and Vibration Symptom Chart.
4. Engine rpm Sensitive: A vibration is felt whenever the engine reaches a particular rpm. It will disappear in neutral coasts. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is stationary. It can be caused by any component, from the accessory drive belt to the clutch or torque converter which turns at engine speed when the vehicle is stopped. REFER to Shake and Vibration While Driving in the Driveline Noise and Vibration Symptom Chart.
5. Noise and Vibration While Turning: Clicking, popping or grinding noises may be due to the following:
 - worn, damaged or incorrectly installed front wheel bearing.
 - damaged powertrain/drivetrain mounts.

Road Conditions

An experienced technician will always establish a route that will be used for all NVH diagnosis road tests. The road selected should be reasonably smooth, level and free of undulations (unless a particular condition needs to be identified). A smooth asphalt road that allows driving over a range of speeds is best. Gravel or bumpy roads are unsuitable because of the additional road noise produced. Once the route is established and consistently used, the road noise variable is eliminated from the test results.

NOTE: Some concerns may be apparent only on smooth asphalt roads.

If a customer complains of a noise or vibration on a particular road and only on a particular road, the source of the concern may be the road surface. If possible, try to test the vehicle on the same type of road.

Vehicle Preparation

Carry out a thorough visual inspection of the vehicle before carrying out the road test. Note anything which is unusual. Do not repair or adjust any condition until the road test is carried out, unless the vehicle is inoperative or the condition could pose a hazard to the technician. After verifying that the condition has been corrected, make sure all components removed have been installed.

Power Steering Conditions

Check for the noise in the following conditions to verify the customer concern.

- Check for the noise in several temperature conditions.
- Is the noise from when the vehicle was new?
- Can the noise be repeated constantly or is it random?
- Check the condition of the vehicle age, mileage and service record.
- Interview the customer to find the operating condition in which the noise will occur. Test the vehicle based on the detail(s) from the customer interview.
- Follow the power steering operation noise condition tables below, to find which condition the noise will occur.

Power Steering Operation Noise Check

Step 1: Check for NVH concerns from non-steering components, which may sound like noises coming from the steering system.

Power assisted steering operating condition			
Parking		Driving	
Steering central/slightly off center	Steering at a steering lock stop	Driving straight ahead	Cornering condition
REFER to NVH concerns from other components column A	REFER to NVH concerns from other components column B	REFER to NVH concerns from other components column C	REFER to NVH concerns from other components column D

NVH CONCERNS FROM OTHER COMPONENTS

NVH concerns from other condition (column A to D)					
Noise	Driving Condition	A	B	C	D
Pedal box knocking	Drive off, stop driving and slow cornering over uneven roads	X	X	O	X
Stabilizer bar link knocking	Drive off, driving and cornering	X	O	O	X
Engine support insulator knocking	Drive off, driving, acceleration and deceleration	X		X	
Air conditioning knocking	Engine on, activate switch for air conditioning	X	X	O	O
Suspension knocking (Subframe, Springs)	Drive off, driving, cornering, acceleration and deceleration	X		O	X
Constant velocity (CV) joint knocking	Drive off, driving, cornering, acceleration and deceleration	X	O		X
Washer bottle	Deceleration, acceleration and single impact	O		X	
Loose suspension bolts	All driving conditions	O		O	X
Instrument panel rattle/squeak	All driving conditions. Engine rpm dependant	X	X	X	X

- X = Noise will most likely occur in this operating condition.
- O = Noise can possibly occur in this operating condition.
- Blank = Noise is unlikely to occur in this operating condition.

Step 2: Check for steering system NVH concerns according to operation condition described at the customer interview.

Power assisted steering operating condition					
Parking		Driving		Vehicle stationary with engine off	
Steering central/slightly off center	Steering at a steering lock stop	Steering central/slightly off center	Steering at a steering lock stop	Steering central/slightly off centre	Steering at a steering lock stop
REFER to steering system NVH concerns column A	REFER to steering system NVH concerns column B	REFER to steering system NVH concerns column C	REFER to steering system NVH concerns column D	REFER to steering system NVH concerns column E	REFER to steering system NVH concerns column F

STEERING SYSTEM NVH CONCERNS

Steering System operation condition (column A to F)							
Noise	Driving condition	A	B	C	D	E	F
Moan	Parking between lock stops, at engine idle and also increased engine speed	X	O				
Whine	Driving, high engine rpm. Must be present from new	O	O	X	X		
Hiss	a) Parking between lock stops. Must be present from new	X	X	O	O		
	b) Holding steering wheel against lock stops. Must be present from new		X				
Lock stop impact knock	a) Parking at lock stop. Must be present from new		X				X
Mechanical knock (power assisted steering (PAS) off)	b) Parking between lock stops, engine OFF. Must be present from new					X	
Mechanical Knock (PAS on)	c) Parking between lock stops, engine ON (ball joint knock)	X					
Hammer knock	d) Parking into lock stop and release (vehicle with hydraulic power assisted steering (HPAS) only, not for vehicles with electro-hydraulic power assisted steering (EHPAS))		X				
Hydraulic knock (clonk)	e) Driving, cobble stones, rough road (clonk). Must be present from new			O	X		
Column knock	f) Parking, driving, cobble stones and rough roads	X	X	O	X	X	X
Column rattle	Mainly driving on rough roads	O		X	X	O	
Toc-toc	Steering left and right at high frequency. Must be present from new	X					
Grinding	When turning steering wheel	X			O	X	
Zip	At engine start, low temperatures below -10°C only	X	O				

- X = Noise will most likely occur in this operating condition.
- O = Noise can possibly occur in this operating condition.
- Blank = Noise is unlikely to occur in this operating condition.

Step 3: According to each identified operating condition (Column A, B, C, D, E, F), check each possible Steering System NVH concern with the detail symptom charts below.

Before conducting a vehicle test to identify a NVH concern carry out the following checks.

1. Check the tire pressures and adjust to specification, as necessary.
2. Make sure the steering system fluid is correct, the system is free of leaks and is operating correctly.
3. Make sure the vehicle steering system temperature is the same as described at the customer interview.

4. All evaluations must take place in a relatively quiet location.
5. The heating - air conditioning (A/C) fan and radio must be turned off during evaluations and the windows closed.

Symptom Chart

Power Steering Moan Noise

Test Condition

Listen for steering moan noise with the vehicle parked, transmission in neutral and all windows closed in the following test conditions.

1. Engine speed at idle with no steering action.
2. Engine speed at idle with slow 90 degrees per second turning of the steering wheel.
3. Engine speed at 1250 +/- 50 rpm with no steering action.
4. Engine speed at 1250 +/- 50 rpm with slow 90 degrees per second turning of the steering wheel.

Symptom	Possible Sources	Action
Power steering system moan noise – A continuous low pitched humming noise occurs when the steering wheel is turned and the steering system is loaded. Noise frequency changes with engine rpm changes. Particularly annoying at lower engine speed.	Power steering lines.	• CHECK the routing of the power steering lines. • CHECK the power steering line clamps are secure. • CHECK the power steering lines for clearance from the vehicle body, front axle crossmember and steering gear.
	Incorrect power steering fluid.	FLUSH the power steering system. REFER to: Power Steering System Flushing (211-00 Steering System - General Information, General Procedures).
	Power steering pump.	Pressure pulses from the power steering pump. Certain amount of noise level acceptable, not a safety critical item.

Power Steering Whine Noise

Test Condition

Listen for steering whine noise with the vehicle parked, transmission in neutral and all windows closed in the following test conditions.

1. Engine speed at 1800 +/- 50 rpm with no steering action.
2. Engine speed at 1800 +/- 50 rpm with slow 90 degrees turning of the steering wheel.
3. Engine speed at 3000 +/- 50 rpm with no steering action.
4. Engine speed at 3000 +/- 50 rpm with slow 90 degrees turning of the steering wheel.

Symptom	Possible Sources	Action
Power steering system whine noise – a high pitched buzzing sound like an electric motor or	Power steering fluid aeration.	BLEED the power steering system. REFER to: Power Steering

Symptom	Possible Sources	Action
drill. Whine occurs at the higher engine rpm, 1500 - 5000 rpm, frequency does not change if system is loaded or not loaded.		System Bleeding (211-00 Steering System - General Information, General Procedures).
	Incorrect power steering fluid.	FLUSH the power steering system. REFER to: Power Steering System Flushing (211-00 Steering System - General Information, General Procedures).
	Overheated power steering fluid.	FLUSH the power steering system. REFER to: Power Steering System Flushing (211-00 Steering System - General Information, General Procedures).
	Hydraulic operating condition of the power steering pump.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Hiss Noise

Test Condition

Listen for steering hiss noise with the vehicle parked, transmission in neutral and all windows closed in the following test conditions.

Symptom	Possible Sources	Action
NOTE: Engine speed at idle turning the steering wheel slowly lock to lock. Power steering system hiss noise – a high frequency, continuous rush or swish noise like escaping air from a balloon. Hiss occurs while turning between the steering lock stops, all steering angles. Noise does not change with engine rpm and is worse at high operating temperatures.	Floor seal.	CHECK the installation and potential damage of the floor seal.
	Power steering gear valve design.	Certain amount of noise level acceptable, not a safety critical item.
	Power steering system hydraulic design.	Certain amount of noise level acceptable, not a safety critical item.
NOTE: Engine speed at idle holding the steering wheel against a steering lock for three seconds. Do not hold for more than five seconds. Power steering system hiss noise – a continuous noise like escaping air occurs while holding the steering against a steering lock stop.	Power steering pump pressure relief valve.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Lock Stop Impact Knock Noise

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions (noise also apparent with engine off).

1. Turn the steering wheel to the left-hand and right-hand steering locks and listen for the impact noise.

Symptom	Possible Sources	Action
Power steering system knock noise – a heavy loud sound like a knock on a door that occurs in parking condition when hitting the lock stop.	Power steering gear mechanical noise, metal to metal at end of steering travel.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Mechanical Knock Noise (PAS off)

Test Condition

Listen for steering knock noise with the engine off in the following test conditions (no power assist).

1. Turn the steering wheel 90 degrees to the right, hold and then quickly release.
2. Turn the steering wheel 90 degrees to the left, hold and then quickly release.

Symptom	Possible Sources	Action
Power steering system knock noise – a heavy loud repeating sound like a knock on a door that occurs in several driving and steering conditions.	Power steering system knock noise – a damped, metallic knock noise which only occurs at steering condition with engine off (very high efforts).	Certain amount of noise level acceptable, not a safety critical item.
	Tolerances in the steering gear components.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Mechanical Knock Noise (PAS on)

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions (power assist).

1. Turn the steering wheel to a steering lock and return to center quickly.
2. Turn the steering wheel 90 degrees to the left and then 90 degrees to the right quickly.

Symptom	Possible Sources	Action
Power steering system knock noise – clear knock noise from steering gear linkage area.	Worn tie-rod ball joints (inner and outer ball joints).	REFER to Steering System. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Power Steering Hammer Knock (Hydraulic) Noise

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions (for vehicles with hydraulic power assisted steering only, not electro-hydraulic power steering).

1. Turn the steering wheel to a steering lock position and return quickly.

Symptom	Possible Sources	Action
Power steering system knock noise – loud, metallic sound if hitting the suspension crossmember with a hammer (sounds like metallic noise but is created by pressure impulse in gear and return line).	Hydraulic noise created by pressure impulses.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Hydraulic Knock/Clonk Noise

Test Condition

Listen for steering knock/clonk noise in the following test conditions with the windows closed.

1. Drive over cobbled roads at low speed 10-30 km/h (6-20 mph) with and without turning.
2. Drive over straight tar strips road rails or 25 mm tall harshness strips at low speed 10-30 km/h (6-20 mph) both driving straight and with moderate turning.

Symptom	Possible Sources	Action
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Symptom	Possible Sources	Action
Power steering system knock/clonk noise – sounds almost identical to column knock that occurs when driving and cornering over cobbled stones or rough roads. Noise may appear to emanate from a location closer to the floor than that for column knock (Sounds like metallic noise but is created by pressure impulse in gear and return line – similar to a sound like quickly turning off a water tap).	Power steering return lines.	Certain amount of noise level acceptable, not a safety critical item.
	High power assist gain of power steering gear valve (steering gear design - no quality issue).	Certain amount of noise level acceptable, not a safety critical item.
	High power steering pump flow rate (by design).	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Column Knock Noise

Test Condition

Listen for steering knock noise in the following test conditions with windows closed.

1. Drive over cobbled stones at low speed 16-40 km/h (10-25 mph) with and without steering input carefully listening for knock sounds.
2. Drive over straight tar strips, road rails or 25 mm tall harshness strips at low speed 16-40 km/h (10-25 mph) both driving straight and with moderate cornering.

Symptom	Possible Sources	Action
Power steering system column knock noise – a loose sounding rattle or vibration coming from the column. Noticeable by hearing and touch.	Steering column or steering column shaft.	CHECK the steering column retaining bolts and attachments to the steering column and secure if necessary.
		Check steering column and intermediate shaft for free play or loose components. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Power Steering Toc-Toc Noise

Test Condition

Listen for steering toc-toc noise with the engine speed at idle and the vehicle parked, automatic transmission in "P" (PARK) or manual transmission in neutral and the windows closed.

1. Turn the steering wheel from left to right abruptly changing direction.
2. Drive the vehicle for low speed parking manoeuvres constantly changing steering direction.

Symptom	Possible Sources	Action
Power steering system toc-toc noise – a metallic noise created when changing direction of steering wheel rotation during parking manoeuvre or at standstill.	Steering gear (design tolerance in steering rack).	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Grinding Noise

Test Condition

Listen for steering grinding noise with the engine speed at idle and the vehicle parked, automatic transmission in "P" (PARK) or manual transmission in neutral and the windows closed.

1. Slowly turn the steering wheel from lock to lock.
2. Tilt and extend the steering column in various positions and slowly turn the steering wheel from lock to lock.

Symptom	Possible Sources	Action
Power steering system grinding noise – an abrasive noise (like sand paper rubbing against wood) occurs between moving components such as steering wheel and the steering column shroud.	Steering wheel to shroud interference.	Certain amount of noise level acceptable, not a safety critical item.
	Steering column bearing.	Certain amount of noise level acceptable, not a safety critical item.
	Foreign material in contact with the steering column shaft.	CHECK if floor covering is obstructing the steering gear pinion. CHECK the installation of the floor seal.
	Clockspring.	CHECK the clockspring and secure if necessary. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

Power Steering Zip Noise

Symptom	Possible Sources	Action
Power steering system zip noise – occurs when hydraulic fluid does not flow freely through the power steering pump supply hose from steering fluid reservoir to power steering pump causing cavitation at the pump. Zip is primarily a cold weather start-up phenomenon (below -10°C).	High viscosity of power steering fluid at low temperature.	Certain amount of noise level acceptable, not a safety critical item.
	Aeration of the power steering fluid.	BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Driveline Noise and Vibration

Symptom	Possible Sources	Action
Shake and vibration while driving	• Wheel end vibration. • Engine/transmission.	GO to Pinpoint Test A .
Tip-in moan	• Air cleaner. • Power assisted steering. • Powertrain. • Powertrain/drivetrain mounts. • Exhaust system.	GO to Pinpoint Test B .
Idle boom/shake/vibration/shudder	• Cable(s)/hose(s). • Powertrain/drivetrain mounts. • Exhaust system. • Belt/pulleys.	GO to Pinpoint Test C .

Suspension Noise and Vibration

Symptom	Possible Sources	Action
Wheel end vibration analysis	• Suspension. • Wheel bearings.	GO to Pinpoint Test D .

Symptom	Possible Sources	Action
Non-axle noise	- Trim panels. - Air conditioning (A/C) system. - Accessories.	GO to Pinpoint Test E .

Pinpoint Tests

NOTE: These Pinpoint Tests are designed to take the technician through a step-by-step diagnosis procedure to determine the cause of a condition. It may not always be necessary to follow the chart to its conclusion. Carry out only the pinpoint test steps necessary to correct the condition. Then check the operation of the system to make sure the condition has been corrected.

After verifying that the condition has been corrected, make sure all components removed have been installed.

PINPOINT TEST A : SHAKE AND VIBRATION WHILE DRIVING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: NEUTRAL COAST	
	1 Carry out the neutral coast test.
	Does the vibration disappear during the neutral coast test? Yes GO to A2. No GO to Pinpoint Test D .
A2: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Carry out the powertrain/drivetrain mount neutralizing procedure
	Are the mounts OK? Yes Vehicle condition corrected. ROAD TEST as necessary. No INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST B : TIP-IN MOAN	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE AIR CLEANER	
	1 Check the condition of the air cleaner mounts, inlet tube, outlet tube, resonators and all other components associated with the air induction system for correct installation and tightness of all connections.
	Are the components OK? Yes GO to B2. No REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
B2: CHECK THE EXHAUST SYSTEM	
	1 Carry out the exhaust system neutralizing procedure. REFER to in this section.
	Is the exhaust system OK? Yes GO to B3. No REPAIR as necessary. ROAD TEST as necessary.
B3: CHECK THE POWER STEERING	
	1 Remove the accessory drive belt and test for tip-in moan. REFER to: Accessory Drive Belt (303-05B Accessory Drive, Removal and Installation),

	Accessory Drive Belt (303-05B Accessory Drive, Removal and Installation), Accessory Drive Belt (303-05B Accessory Drive, Removal and Installation), Accessory Drive Belt (303-05B Accessory Drive, Removal and Installation), Accessory Drive Belt (303-05B Accessory Drive, Removal and Installation), Accessory Drive Belt (303-05B Accessory Drive, Removal and Installation).
	Is the tip-in moan OK? Yes REPAIR the power steering as necessary. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing). No GO to B4.
B4: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Carry out the powertrain/drivetrain mount neutralizing procedure
	Are the powertrain/drivetrain mounts OK? Yes Vehicle condition corrected. ROAD TEST as necessary. No INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.
PINPOINT TEST C : IDLE BOOM/SHAKE/VIBRATION/SHUDDER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE CABLE/HOSES	
	1 Check the engine compartment for any component that may have a touch condition between the engine and body or chassis. For example: control cable, air conditioning (A/C) hoses, acceleration cable.
	Are the components OK? Yes GO to C2. No REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
C2: CHECK THE ENGINE COOLING RADIATOR	
	1 Check the engine cooling radiator mountings and bushings for security and condition. Check the radiator installation for any component that may have a touch condition.
	Is the installation and bushings OK? Yes GO to C3. No REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
C3: CHECK THE EXHAUST SYSTEM	
	1 Carry out the exhaust system neutralizing procedure. REFER to in this section.
	Is the exhaust system OK? Yes GO to C4. No REPAIR as necessary. ROAD TEST as necessary.
C4: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Carry out the powertrain/drivetrain mount neutralizing procedure
	Are the powertrain/drivetrain mounts OK?

Yes	Vehicle condition corrected. ROAD TEST as necessary.
No	INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST D : WHEEL END VIBRATION ANALYSIS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: INSPECT THE WHEELS AND TIRES	
	1 Inspect the wheels and tires. REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).
	Are the wheels and tires OK? Yes GO to D2. No INSTALL new wheels or tires as necessary. REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation). ROAD TEST as necessary.
D2: INSPECT THE WHEEL BEARINGS	
	1 Inspect the wheel bearings.
	Are the wheel bearings OK? Yes GO to D3. No INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation). ROAD TEST as necessary.
D3: INSPECT THE WHEEL AND TIRE RUNOUT	
	1 Inspect the wheel and tire runout.
	Is the wheel and tire runout OK? Yes Balance the wheels and tires. Refer to the wheel balance equipment manufacturer's instructions. ROAD TEST as necessary. No INSTALL new wheels or tires as necessary. REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation). ROAD TEST as necessary.

PINPOINT TEST E : NON-AXLE NOISE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: INSPECT THE VEHICLE TRIM	
	1 Check the radiator grille and trim panels to see if they are the source of the noise.
	Are the vehicle trim components causing the noise? Yes INSTALL new trim components or REPAIR as necessary. ROAD TEST as necessary. No GO to E2.
E2: CHECK THE AIR CONDITIONING (A/C) SYSTEM FOR NOISE	
	1 Start the engine.
	2 Ignition ON.
	3 Check the A/C system components for noise by turning the A/C system on and off.

	Is the A/C system causing the noise? Yes INSPECT the A/C system. REFER to: Climate Control System (412-00 Climate Control System - General Information, Diagnosis and Testing), ROAD TEST as necessary. No GO to E3.
E3: CHECK NON-FACTORY FITTED ACCESSORIES	
	1 Check any non-factory installed accessories for being the source of the noise. For example: touch condition body-to-frame, antennas, deflectors and fog lights.
	Are the accessories the cause of the noise? Yes ADJUST, REPAIR, or INSTALL new accessories or fasteners as required. ROAD TEST as necessary. No VERIFY the customer concern.

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