SECTION 00-04 Noise, Vibration and Harshness

VEHICLE APPLICATION

Capri.

DIAGNOSTIC THEORY

Diagnosis is more than just following a series of interrelated steps in order to find the solution to a specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also, it is knowing how the system **should** work, and whether it is working correctly.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition is usually found the first time through the system.

Know the System

This means know how the parts go together. Know how the system operates as well as its limits, and what happens when something goes wrong. Sometimes this means checking the system against one that is known to be working properly.

Know the History of the System

How old or new is the system? What kind of treatment has it had? Has it been serviced in the past in such a manner that might relate to the present condition? What is the service history? A clue in any one of these areas might save time.

Know the History of the Condition

Did it start suddenly? Or did it appear gradually? Was it related to some other occurrence like an accident or previous part replacement? Know how the condition made itself known; it may be an important clue to the cause.

Know the Probability of Certain Conditions Developing

It is true that most conditions are caused by simple things rather than by complex ones, and they occur in a fairly predictable pattern. Electrical problem conditions, for instance, usually occur at connections rather than in components. An engine "no-start" is more likely to be caused by a loose wire or some component out of adjustment than a sheared-off camshaft. Know the difference between **impossible** and **improbable**. Many technicians have spent hours diagnosing a system because they thought certain failures were "impossible," only to eventually find out the failures were just "improbable" and actually had happened. Try to remember that new parts are just that: new. It does **not** mean they are always good functioning parts.

Do Not Cure the Symptom and Leave the Cause

Lowering the air pressure in a front tire may correct the condition of a vehicle leaning to one side, but it does not correct the original concern.

Be Positive the Cause is Found

Double check findings. If a worn component is found or something is out of adjustment, determine what else could be wrong. If one of the engine mounts was loose, could the other one be loose, too? What about the transaxle mounts?

Diagnosis Charts

No matter what form charts may take, they are simply a way of expressing the relationship between basic logic and a physical system of components. They help locate the cause of a condition in the **shortest possible amount of time**. Diagnosis charts combine many areas of diagnosis into one visual display.

- **Probability** of certain things occurring in a system.
- **Speed** of checking certain components or functions before others.
- **Simplicity** of performing certain tests before others.

DIAGNOSTIC THEORY (Continued)

- **Elimination** of checking huge portions of a system by performing simple tests.
- **Certainty** of narrowing down the search to a small portion before performing in-depth testing.

The fastest way to find a condition is to work with the tools that are available, which means working with proven diagnosis charts and the proper special tools for the system being worked on.

HOW TO USE THIS DIAGNOSTIC PROCEDURE SECTION

Noise, vibration and harshness (NVH in engineering shorthand) is becoming more and more important because vehicles are becoming more sensitive to these vibrations. This Section is designed to give a working knowledge of the process of diagnosing noise and vibration situations. It is divided into several sections **based on the description of the condition**. If a shake occurs at high speed, for instance, the most likely place to start is under High-Speed Shake. The Road Test Form will tell how to sort out the conditions into categories and how to tell a **vibration** from a **shake**. It will give a few hints on quick checks to make sure that a source is either pinpointed or eliminated.

Become familiar with the terms. Use the Glossary Section to find the descriptive name of conditions not encountered before. After naming it, proceed to Diagnosis and Testing. Remember, just by beginning at that point, most other systems in the vehicle have been eliminated. When the proper Section is identified, the job is partially done. Follow the steps within the Section. Quick Checks are described within the step, while more involved tests and adjustments are outlined under Services and Adjustments. Always follow each step exactly, and make notes along the way to recall important findings.

GLOSSARY

Acceleration

1. **Light**: Part throttle increase in speed such as 0-97 km/h (0-60 mph) in approximately 30 seconds.
2. **Heavy**: One-half to full throttle increase in speed such as 0-97 km/h (0-60 mph) in approximately 20 seconds.

Ambient Temperature

Surrounding or prevailing temperature. Normally, the temperature in the service area or outdoors, depending on where testing is taking place.

Boom

A cycling, rhythmic noise often accompanied by a sensation of pressure on the ear drums.

Bound Up

Refers to a stressed, rubber-mounted component that transmits any NVH which would normally be absorbed by the mount. Refer to Neutralize.

Brakes Applied

When vehicle is stationary, service brakes applied with enough force to hold vehicle against acceleration with transaxle in gear.

Coast/Neutral Coast

Engine/transaxle taken out of gear by placing transaxle selector in the NEUTRAL position or by depressing clutch in manual transaxle.

CPS

Cycles Per Second (Hz).

Cruise

Steady highway speed, neither accelerating nor decelerating; even pressure on accelerator pedal on level ground.

Deceleration

Slowing of vehicle by releasing accelerator at cruise and allowing engine to slow vehicle without application of brakes.

Drivetrain

Includes all power transmitting components from the rear of the engine to the wheels, including clutch/torque converter and transaxle halfshafts.

Engine Imbalance

Some component in the engine which is normally smoothly balanced now causing a perceptible vibration in the vehicle.

Engine Misfire

One or more cylinders in the engine fails to fire at the proper time.

Engine Runup Test

Operation of engine through normal rpm range while vehicle is sitting still. Used for engine vibration check.

Gravelly Feel

A grinding or growl in a component, similar to the feel experienced while driving on gravel.

Harshness

A harder than usual behavior of a component, like riding a vehicle with overinflated tires usually associated with road impacts.

Hz

Hertz (Cycles Per Second).

Imbalance

Out of balance; more weight on one side of a rotating component causing shake or vibration.

Inboard

Toward the centerline of the vehicle. Refer to Outboard.

GLOSSARY (Continued)

Isolate

Separate from the influence of other components.

NVH

Noise, Vibration, Harshness.

Neutralize (Normalize)

To return to unstressed position. Used to describe mounts. Refer to Bound Up.

Outboard

Toward the outside of the vehicle, rather than toward the centerline. Refer to Inboard.

Pumping Feel

A very slow vibration that results in a movement of vehicle components similar to pumping the service brakes slightly.

Radial/Lateral

Radial is in the plane of rotation, while lateral is at 90 degrees to the plane of rotation.

Road Test

Operation of vehicle under conditions designed to recreate the symptom/condition.

Runout

Out of round or wobble.

Shake

Low frequency vibration; usually results in visual movement of components.

Tire Force Vibration

Tire vibration caused by variations in the construction of the tire, resulting in a vibration when the tire rotates against the pavement. This condition may be present on perfectly round and perfectly balanced tires because of variations in the inner construction.

Tire Deflection

Bending of the body of the tire during rotation.

T.I.R.

Total indicator runout.

Tip-In Moan

A light moaning noise heard when the vehicle is lightly accelerated between 40-64 km/h (25-40 mph).

Tires—Flat Spots

Commonly caused by letting vehicle stand when tires are warm. Can be cured by operating vehicle until tires are warm and then raising vehicle immediately.

Two-Plane Balance

Radial and lateral balance.

Vibration

Regular movement of a component that results in a sound or feel of movement.

NVH DIAGNOSIS

NVH diagnosis should always start with the road test. Noise, vibration and harshness (NVH) usually occur in four areas: tires, engine accessories, suspension and drivetrain. It is important; therefore, that an NVH problem is isolated into its specific area as soon as possible. The easiest and quickest way to do this is to perform a road test as outlined.

Transaxle Noise

1. **Gear noise** is the typical "howling" or "whining" due to an improper gear pattern, gear damage, or improper bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.
2. **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 the speed of the vehicle.
3. **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.
4. **Clunk** may be a metallic noise heard when the automatic transaxle is engaged in the REVERSE or DRIVE positions, or it may occur when throttle is applied or released. It is caused by backlash somewhere in the driveline; it is "felt" or heard in the transaxle.
5. **Bearing whine** is a high-pitched sound similar to a whistle. It is usually caused by worn or damaged bearings. Bearing noise occurs at **all driving speeds;** this distinguishes it from gear whine, which usually comes and goes as speed changes.
6. **Bearing rumble** sounds like marbles being tumbled. This condition is usually caused by a worn or damaged wheel bearing. The lower pitch occurs because the wheel bearing turns at only about one-third of driveshaft speed.
7. **Chatter on corners** is a condition where the whole rear end vibrates only when the vehicle is moving. The vibration is plainly felt as well as heard.
8. **Click at engagement** is a condition of a slight noise, distinct from a "clunk," that happens in REVERSE or DRIVE engagement.

Non-Transaxle Noise

There are a few other conditions that can sound just like transaxle noise and have to be considered in prediagnosis. The three most common are exhaust, tires, and trim mouldings.

NVH DIAGNOSIS (Continued)

1. In certain conditions, the pitch of the **exhaust** may sound very much like gear whines. At other times, it can be mistaken for a wheel bearing rumble.
2. **Tires**, especially snow tires, can have a high-pitched tread whine or roar, similar to gear noise. Radial tires, to some degree, have this characteristic. Also, any non-standard tire with an unusual tread construction may emit a roar or whine-type noise.
3. **Trim and mouldings** can also cause whistling or whining noise.

Therefore, make sure that none of these is the cause of the noise before proceeding with diagnosis.

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. The slight noise is in no way detrimental and must be considered normal. Camshaft belt whine is most often associated with new belts used on smaller engines. Whine will usually go away after belt break-in.

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

1. Make notes throughout diagnosis routine. Use a Road Test Form that includes space for comments. Write down even the smallest bit of information; it may turn out to be most important.
2. Road test the vehicle, and define the condition by reproducing it several times during the road test.
3. Perform the road test quick checks as soon as the condition is reproduced. This will identify the proper section of the diagnosis procedure. Run through the quick checks, more than once, to make sure they are providing a useable result. Remember, the road test quick checks may not tell where the concern is, but they will tell where it **is not.**
4. Do not touch anything until a road test and a thorough visual inspection of the vehicle has been performed. Do not change tire pressure or vehicle load. Adjusting tire pressure, 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 proper diagnosis. 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/or bolts, or bright spots where components may be rubbing against each other. Check luggage compartment or cargo area for unusual loads.

ROAD TEST (Continued)

ROAD TEST FORM

1. Did condition exist when vehicle was new? ☐ Yes ☐ No

   How did condition begin?

   ☐ Gradually occurred Mileage _____

   ☐ Suddenly occurred Mileage _____

2. Vehicle vibrates between _____ MPH and _____ MPH and _____ gear.

3. Neutral engine run-up vibration? ☐ Yes ☐ No

4. What driving conditions affect the vibration?

   ☐ Light to medium acceleration

   ☐ Hard acceleration

   ☐ Deceleration (foot off accelerator pedal)

   ☐ Constant speed

5. Where is the vibration noticed?

   ☐ Seat

   ☐ Steering Wheel

   ☐ Instrument panel pad

   ☐ Floor

   ☐ Hood and fenders

6. Is there a sound or *sensation of sound*?

   ☐ Buzz ☐ Clicking

   ☐ Moan ☐ Popping

   ☐ Rumble ☐ Grinding

   ☐ Hum

   ☐ Other Describe: _____

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ROAD TEST (Continued)

Road Test Quick Checks

1. **24-80 km/h (15-50 mph):** With light acceleration, a moaning noise is heard, and possibly a vibration is felt in the floorpan. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed.

   Refer to Tip-in-Moan Diagnosis charts.

2. **High Speed:** With slow acceleration and deceleration, a shake is sometimes noticed in the steering wheel / column, seats, floorpan, trim panels 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 brakes lightly.

   Refer to High-Speed Shake Diagnosis charts.

3. **High Speed:** A vibration is felt in the floorpan or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with clutch depressed or automatic transaxle selector in the neutral position and engine idling. If vibration is still evident, it may be related to wheels, tires, brake rotors, hubs or bearings.

   Refer to High-Speed Shake Diagnosis charts.

4. **O-High-Speed:** A vibration is felt whenever the engine reaches a particular rpm. It will disappear in neutral coast. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is sitting still. It can be caused by any component, from the accessory drive belts to the clutch or torque converter which turns at engine speed when the vehicle is stopped.

   Refer to Engine Accessory Diagnosis charts.

5. **Noise and Vibration while Turning:** Clicking, popping, or grinding noises may be due to the following:

   - Inadequate lube fill in CV joints
   - Worn, contaminated, or dry CV joints
   - Loose CV boot clamps
   - Other component contacting halfshaft assembly
   - Worn, damaged or improperly installed wheel bearing

DIAGNOSIS AND TESTING

These diagnosis charts are designed to follow 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. Perform only the steps necessary to correct the condition. Then check the operation of the system to make sure the cause has been found.

It is sometimes necessary to remove various components of a vehicle to gain access to the component to be tested. Refer to the applicable Section for the removal and installation of components. After verifying that the condition has been corrected, make sure all components removed have been installed.

When performing the High-Speed Shake Diagnosis, Engine Accessory Vibration Diagnosis or Halfshaft Balancing, observe the following precautions.

CAUTION: The suspension should not be allowed to hang free. When the constant velocity joint is run at a very high angle, extra vibrations as well as damage to seals and joints can occur.

The lower control arm should be supported as far outboard as possible. To bring the vehicle to its proper ride height, the full weight of the vehicle should be supported in front by floor jacks. Refer to Section 00-02 for jacking instructions.

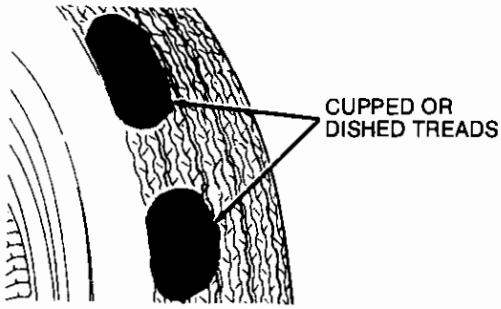
WARNING: IF ONLY ONE DRIVE WHEEL IS ALLOWED TO ROTATE, SPEED MUST BE LIMITED TO 55 KM/H (35 MPH) INDICATED ON THE SPEEDOMETER SINCE ACTUAL WHEEL SPEED WILL BE TWICE THAT INDICATED ON THE SPEEDOMETER. SPEED EXCEEDING 55 KM/H (35 MPH) OR ALLOWING THE DRIVE WHEEL TO HANG UNSUPPORTED COULD RESULT IN TIRE DISINTEGRATION OR CONSTANT VELOCITY JOINT AND HALFSHAFT FAILURE, WHICH COULD CAUSE SERIOUS PERSONAL INJURY AND EXTENSIVE VEHICLE DAMAGE.

PINPOINT TEST A: HIGH-SPEED SHAKE DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
A1	ROAD TEST		
	• Accelerate vehicle to the speed which the customer indicated the shake occurred. • Record the critical vehicle speed and / or engine rpm. • **Is a shake present?**	No ▶ Yes ▶	Vehicle OK. GO to **A2.**

DIAGNOSIS AND TESTING (Continued)

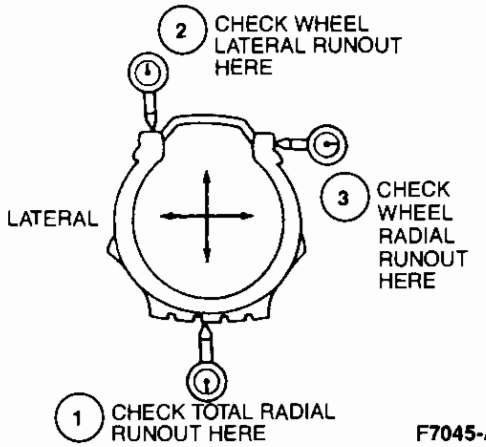
PINPOINT TEST A: HIGH-SPEED SHAKE DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A2	INSPECT TIRES		
	• Raise vehicle on hoist. Inspect tires for extreme wear or damage, cupping or flat spots. • **Is there tire wear indications?**  F7035-A	No ▶ Yes ▶	GO to **A3.** CHECK suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear. CORRECT suspension concerns and REPLACE damaged tires. PERFORM road test.
A3	INSPECT WHEEL BEARINGS		
	• Spin front tires by hand to check for wheel bearing roughness. Check bearing end play. Refer to Sections 04-01 or 04-02. • **Is bearing end play in specification?**	Yes ▶ No ▶	Go to **A4.** ADJUST/REPLACE and LUBRICATE bearings as necessary. PERFORM road test.
A4	TIRE/WHEEL BALANCE		
	• Check tire/wheel balance, correct as needed. • Road test. • Spin front tire by hand. Inspect CV Joint boots for evidence of cracks, tears, splits, splattered grease, or damaged, or missing clamps. • **Are tires and wheels balanced properly?**	Yes ▶ No ▶	Vehicle OK. GO to **A5.**

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A: HIGH-SPEED SHAKE DIAGNOSIS (Continued)

TEST STEP	RESULT ▶	ACTION TO TAKE
A5 MEASURE RUNOUTS • For each wheel position measure, locate and mark: — High point of tire / wheel assembly total radial runout. — High point of wheel radial runout. — High point of wheel lateral runout. Record all measures in chart below:	Fill in runout chart below ▶	After measuring all runouts, GO to **A6.**
A6 ANALYSIS OF RUNOUT MEASUREMENT • Compare each tire / wheel combination measurement with chart below. • Measurements will fall within one of the four conditions.	Condition 1 ▶ Condition 2 ▶ Condition 3 ▶ Condition 4 ▶	Good Assembly. GO to **A11.** REPLACE wheel. GO to **A7.** REPLACE wheel. GO to **A7.** INDEX tire / wheel. GO to **A8.**



ASSEMBLY POSITION	TIRE / WHEEL ASSEMBLY TOTAL RADIAL RUNOUT	WHEEL RADIAL RUNOUT	WHEEL LATERAL RUNOUT
LEFT FRONT			
RIGHT FRONT			
LEFT REAR			
RIGHT REAR			
EXAMPLE	1.52mm (0.060 inch)	.50mm (0.020 inch)	.63mm (0.025 inch)

Condition	Assembly Total Radial Runout	Wheel Radial Runout	Wheel Lateral Runout
1	Less than 2mm (0.079 inch)	Less than 2mm (0.079 inch)	Less than 2mm (0.079 inch)
2	Less than 2mm (0.079 inch)	More than 2mm (0.079 inch)	Less than 2mm (0.079 inch)
3	Less than 2mm (0.079 inch)	Less than 2mm (0.079 inch)	More than 2mm (0.079 inch)
4	More than 2mm (0.079 inch)	Less than 2mm (0.079 inch)	Less than 2mm (0.079 inch)
Example	MORE	LESS	LESS

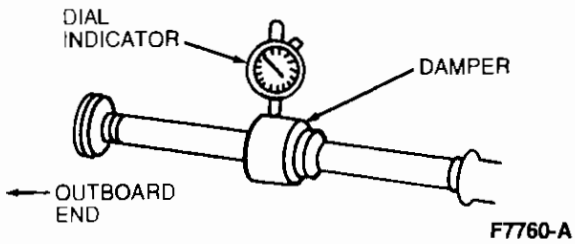
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A: HIGH-SPEED SHAKE DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A7	REPLACING A WHEEL		
	• Align the runout index mark of the new wheel 180 degrees away from the previously measured total assembly radial runout high point. • Measure the runouts on the new assembly. Refer to **A5** to check new assembly.	From A5 Assembly is within specification ▶ Assembly is not within specification ▶	GO to **A10.** Follow direction from **A6.**
A8	INDEX TIRE / WHEEL ASSEMBLY		
	• Align high point of total assembly radial runout 180 degrees away from high point of wheel radial runout. • Measure total assembly radial runout. • **Is radial runout less than 2mm (0.079 inch)?**	Yes ▶ No ▶	GO to **A10.** GO to **A9.**
A9	REPLACE A TIRE		
	• Align high point of wheel radial runout to runout index mark on new tire. • Measure total assembly radial runout. • **Is total radial runout less than 2mm (0.079 inch)?**	Yes ▶ No ▶	GO to **A10.** REPEAT Test Step **A9** with another new tire.
A10	NEW ASSEMBLY BALANCE		
	• Balance naw tire / wheel assembly. • **Is assembly balanced?**	Yes ▶	GO to **A11.**
A11	ROAD TEST		
	• After all assemblies have been checked and corrected, road test vehicle. • **Is vehicle operating properly?**	Yes ▶ No ▶	Vehicle OK. GO to **A12.**
A12	SUBSTITUTE WHEELS AND TIRES		
	• Substitute a known good set of wheels and tires. • Road test. • If the vehicle still exhibits a shake or vibration, note the vehicle speed and / or engine rpm that it occurs. • **Does vehicle shake or vibrate?**	No ▶ Yes ▶	INSTALL original tire wheel assemblies one by one, road testing at each step until the damaged tire(s) is identified. REPLACE tire(s) as necessary and RETEST. GO to **A13.**
A13	VIBRATION DIAGNOSIS OF ENGINE / TRANSAXLE VS. HALFSHAFT / SUSPENSION COMPONENTS		
	• Spin all four wheels independently to identify position generating problem vibration. • Rear wheels — use on-car balance machine. • Front wheels — Accelerate to half critical speed observed in road test.	All positions operating correctly ▶ Front wheel generates vibration ▶ Rear wheel generates vibration ▶	Engine / transaxle imbalance. REFER to Groups 03 and 07. GO to **A15.** GO to **A14.**
A14	REAR WHEEL HUB RUNOUT		
	• Inspect rear brake rotor / hub runout. Refer to Section 06-00. • **Is runout within specification?**	Yes ▶ No ▶	PERFORM road test. PERFORM road test. GO to **A20.**
A15	CV JOINT BOOT		
	• Inspect boot for cracks, tears, splits or spattered grease. • **Is damage apparent?**	No ▶ Yes ▶	GO to **A16.** REPLACE boot. CLEAN and INSPECT CV joint for damage. REPLACE CV joint as necessary. GO to **A16.**

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A: HIGH-SPEED SHAKE DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A16	RH HALFSHAFT DAMPER RUNOUT (NATURALLY ASPIRATED VEHICLES)		
	• Attach dial indicator to vehicle underbody. • Check radial runout at center of damper Max. — 6.4 mm (0.250 inch).  • **Is measurement within specification?**	Yes ▶ No ▶	GO to **A17.** REPLACE interconnecting shaft / damper assembly only. GO to **A17.**
A17	VIBRATION CHECK		
	• Accelerate front wheels to critical speed, checking for vibration. • **Does vehicle vibrate?** **CAUTION: Vehicle must be supported at suspension points to avoid damage to CV joints.**	No ▶ Yes ▶	PERFORM road test. GO to **A20.**
A18	FRONT ROTOR		
	• Remove front rotor. • Accelerate wheel to half critical speed checking for vibration. • **Does vehicle vibrate?**	No ▶ Yes ▶	PERFORM raod test. REPLACE hub. PERFORM road test.
A19	HUB RUNOUT (FRONT)		
	• Inspect front rotor / hub runout. Refer to Section 06-00. • **Is measurement within specification?**	Yes ▶ No ▶	PERFORM road test. REPLACE rotor / hub. PERFORM road test.
A20	ROAD TEST		
	• After checking all wheel positions and corrections as needed, road test vehicle. • **Is vehicle operating properly?**	Yes ▶ No ▶	Vehicle OK. Refer to Tip-in Moan Diagnosis.

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PINPOINT TEST B: TIP-IN MOAN DIAGNOSIS

TEST STEP		RESULT ▶	ACTION TO TAKE
B1	AIR CLEANER		
	• Check air cleaner for proper installation of base gasket, lid, element and air inlet duct assembly. • **Does everything check alright?**	Yes ▶ No ▶	GO to **B2.** CORRECT condition and PERFORM road test. If moan persists, GO to **B2.**
B2	POWERTRAIN RESONANCE		
	• Loosen all converter or clutch housing-to-engine attaching bolts 3 / 4 turn and road test. Tighten bolts after test. • **Does vehicle operate properly?**	Yes ▶ No ▶	Vehicle OK. GO to **B3.**
B3	ENGINE MOUNTS		
	• Loosen engine mounts. Jack up engine and transaxle assembly and shake. Tighten all engine mounts to specification. Refer to Section 02-03. • Road test. • **Does vehicle operate properly?**	Yes ▶ No ▶	Vehicle OK. GO to **B4.**

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B: TIP-IN MOAN DIAGNOSIS (Continued)

	TEST STEP	RESULT ▶	ACTION TO TAKE
B4	EXHAUST SYSTEM		
	• Warm up system to normal operating temperature. Loosen all hanger attachments and reposition hangers until they hang free and straight. Then loosen all flange joints and with engine running, shift transaxle from NEUTRAL to DRIVE and back to NEUTRAL (or load engine with clutch), and retighten all hanger clamps and flanges. Road test vehicle. • **Does vehicle operate properly?**	Yes ▶ No ▶	Vehicle OK. REFER to Engine Accessory Vibration Diagnosis.

PINPOINT TEST C: ENGINE ACCESSORY VIBRATION DIAGNOSIS

	TEST STEP	RESULT ▶	ACTION TO TAKE
C1	ENGINE RUN-UP		
	• Run-up to problem rpm observed in road test, with vehicle stationary. • **Does vibration occur?**	Yes ▶ No ▶	GO to **C2.** PERFORM stall test in DRIVE with brakes locked (or load engine by slipping clutch in gear with manual transaxle). If vibration occurs, GO to Tip-In Moan Diagnosis.
C2	DRIVE BELTS AND PULLEYS		
	• With engine stopped, inspect all engine accessory drive belts and pulleys for wear or damage, and check belt tension, using Belt Tension Gauge T63L-8620-A or equivalent. • **Do all components check alright?**	Yes ▶ No ▶	GO to **C3.** REPLACE worn or damaged belts or pulleys. CORRECT belt tension. GO to **C3.**
C3	MOUNTING HARDWARE		
	• Inspect mounting brackets and adjusting hardware for proper alignment and **tightness.** • **Do all components check alright?**	Yes ▶ No ▶	GO to **C4.** ALIGN and TIGHTEN mounting hardware to specifications. CORRECT belt tension. START UP engine and run-up to problem rpm. If vibration still exists, GO to **C4.**
C4	ENGINE IDLING		
	• With engine idling, visually check all accessory drive belts and pulleys for misalignment, runout or irregular motion. Maximum runout is 3mm (1/8 inch). • **Do all components check alright?**	Yes ▶ No ▶	GO to **C5.** If pulley(s) exceeds maximum runout REPLACE pulley. If belt rides up and down in pulley, a variable-width condition exists. If it occurs on just one pulley, REPLACE that pulley. Otherwise, REPLACE the belt. RUN engine up to problem rpm. If belt whips, ADJUST belt tension to specification. If belt still whips, REPLACE belt. If vibration still exists, GO to **C5.**

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST C: ENGINE ACCESSORY VIBRATION DIAGNOSIS (Continued)

	TEST STEP	RESULT ▶	ACTION TO TAKE
C5	ACCESSORIES		
	• Run-up engine to problem rpm and, with stethoscope-type device, check each component. • If the source cannot be detected by probing, remove each belt, one at a time, until vibration goes away. • **Is noisy component located?**	Yes ▶	REPLACE belt. If vibration still exists, SERVICE or REPLACE component.
		No ▶	Possible engine component imbalance. This situation is possible, but unlikely.
C6	HALFSHAFT BALANCE		
	• Remove left and right halfshafts. Mark all joints for proper indexing during installation. • Road test. • **Is halfshaft the concern?**	Yes ▶	REPLACE and / or SERVICE worn or damaged halfshafts or CV joints
		No ▶	Driveline is not source of vibration. GO back to **C1**.

SPECIAL SERVICE TOOLS

Tool Number	Description
T63L-8620-A	Belt Tension Gauge
TOOL-4201-C	Dial Indicator with Bracketry

ROTUNDA EQUIPMENT

Model	Deecription
007-00014	Radial Runout Gauge