The repair section of the course deals with the techniques that are specific to NVH repairs and require additional information. Many of the solutions covered in Section 3 are obvious, after an inspection reveals the cause of the condition. The repair manual should be consulted for the specific procedures relating to these repairs.

For example:

If a pinpoint diagnosis requires an inspection of a motor mount and it is found to be worn, then replacement is the obvious repair.

The technician should next determine why the mount became defective, such as an oil leak causing the rubber to deteriorate. In this case the oil leak would be repaired to insure long term customer satisfaction.

In both of these cases the repair manual would be the best resource for the appropriate repair procedures.

The following is the list of NVH repair techniques that are covered in this section either in the Repair Techniques Chart, the worksheets or both:

Driveline
- Propeller shaft balancing
- Runout
- Angle

Wheel and tire
- Balance
- Runout lateral/radial

Squeaks, Rattles and Wind Noise
- Diagnosis
- Repair
## Repair Techniques Chart

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driveline Propeller Shaft Imbalance</td>
<td>Propeller shaft imbalance is one of the major causes of a first order driveline vibration.</td>
</tr>
<tr>
<td>Driveline Runout</td>
<td>Runout can also cause a first order driveline vibration.</td>
</tr>
<tr>
<td></td>
<td>Runout conditions can be in the shaft or in the mounting flanges/splines on the end of the shaft. It is important that both are checked before servicing the shaft.</td>
</tr>
</tbody>
</table>


### REPAIR TECHNIQUE

When servicing a driveline condition be sure to perform a **thorough visual inspection** for:

- component condition or damage
- excessive undercoating or other foreign material
- evidence of a collision which would explain component alignment conditions

For example:

- If a U-joint is found to be worn and loose then it must be repaired before checking the runout of the shaft.

Propeller shaft balancing is a technique that requires the use of specialized equipment to determine the location and the amount of the imbalance.

Equipped with the details from the NVH diagnostic procedures the technician can call the FTS (Field Technical Specialist) or the FPE (Field Product Engineer) with the balancing equipment for assistance.

Once the location and the amount of imbalance has been determined, there are three options:

- weighted bolts can be used to offset the imbalance condition
- the shaft can be sent out to a specialty shop for service
- the shaft can be replaced

### REMARKS

**Always** refer to the repair manual for the proper procedures, specifications and cautions specific to the vehicle and components being serviced.

**CAUTION:**

During any propeller shaft service off the vehicle, do **not** use excessive force when clamping a shaft in a vise. Damage could result.

When servicing components in a vehicle that require disconnecting part of a propeller or a driveshaft, do **not** let the shaft hang freely in the vehicle. Damage may occur to U-joints, centering pins or CV joints causing new complaints.

After the repair, be sure to **perform the verification procedures while the balancing equipment is available** to insure customer satisfaction.

A **dial indicator** is used to measure the amount of runout. Proper mounting is important for accurate readings. It can be mounted to a solid part of the vehicle or on a stand from the floor. The dial indicator or mount should **not** move while taking readings and the indicator must be perpendicular to the surface being measured.

The surface of the shaft **must be smooth and free of irregularities** such as undercoating or corrosion.

Each shaft should be measured at **several locations** which will help determine the actual cause of the runout.

For example:

- If the runout is greater in the middle than on either end then the shaft is likely the problem and should be measured on the bench in “V” blocks.

- If the runout is greater on one end then in the other two locations the flange should be checked for runout before servicing the shaft.

If runout is determined to be associated with the mounting surface at the flanges, rotate the shaft 180° which may bring the runout within specification. If not measure the runout of the flanges to determine the problem.

**Do not** remove the flange with a hammer as damage could result.

Specifications for runout and other driveline service procedures are available in the repair manual.
<table>
<thead>
<tr>
<th>CONDITION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| Driveline Angle           | Driveline angle conditions or working angle may cause a **second order vibration**. Any vibration associated with a condition in a propeller shaft joint will be a second order vibration because the vibration occurs **twice per revolution**. A joint accelerates and decelerates twice per revolution. As the working angle increases the acceleration and deceleration rate increases causing the vibration. Correcting a vibration caused by an improper working angle involves a series of measurements on two planes to determine the angles that exist in a vehicle. The two planes are:  
  • horizontal  
  • vertical  

A constant rotation of the output shaft of the transmission changed to two accelerations and decelerations at the U-joint as the angle changes. The greater the angle the greater the change in speeds. The second joint is designed to counteract this change in speed and provide a smooth constant rotation to the differential. In order to do this the working angle must be as close to the same as possible. |
| Wheel and Tire Imbalance  | Wheel and tire imbalance is one of the most common causes of **first order wheel vibrations**.  

There are three styles of balancing:  
  • static (bubble balancing) not recommended  
  • dynamic balancing off car  
  • dynamic balancing on car  

Static balancing is a technique that was common in the past but does not provide the quality balance that a dynamic balancer is able to achieve. An on-car balancer or finish balancer will take into consideration all components that rotate with the wheel such as the hub, rotor/drum, and axle. |
<table>
<thead>
<tr>
<th>REPAIR TECHNIQUE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Horizontal</strong></td>
<td>A thorough visual inspection is very important to uncover clues for changes in the angles. If a condition is discovered that caused the angle change, such as collision damage, then it must be corrected before proceeding with the measurements and adjustments.</td>
</tr>
</tbody>
</table>
| Horizontal
Horizontal measurements involve plumb bobs and tape to determine the centerline of the engine and transmission. The center line needs to be checked for position in the vehicle to determine if a condition exists such as a worn mount or a bent frame. For frame measurement, a body service technician with proper measuring equipment should be consulted. When checking the differential, the center line of the axle must be perpendicular with the center line of the driveline.
| For example:
A two piece shaft with a center carrier bearing could be misaligned at the center point of the carrier bearing. Adjusting the carrier will bring the shaft into alignment and reduce the working angle of the joints. |
| **Vertical**      | The joint angle should not exceed 5°. Front and rear joint angles should be within 1/2° of each other. |
| Vertical
Vertical measurements require an SST 09370-50010-10 which measures the angle of a component in reference to a horizontal line. The horizontal line is established with a plumb bob or a bubble level depending on the style of tool used.
| The SST measures the angle of the engine/transmission, propeller shafts and the differential and compares them to each other. The object is to cancel out the effect of the working angles of the joints.
| If the working angle is found to be excessive then the technician must determine the best location for adjustment to minimize the difference in the angles. Experience with non-customer complaint vehicles is very helpful in determining angles that are acceptable. Comparing these angles with those of a complaint vehicle will help determine which angle should be adjusted, how far and in what direction. |
| **Before** balancing a tire and wheel the following should be checked:
- damage or deformed tires and wheels
- foreign matter on the rim especially on the inside of the rim
- all the existing weights are removed
- foreign material inside the tire like water, stop leak or loose rubber, especially if the balance position and weight amount changes on a re-check
- the tread for plugs that may cause an imbalance or locate a broken cord
- heavy or large custom and locking lug nuts
| This course is an advanced level course and not intended to train the technician in tire balancing. |
| While balancing a tire note the amount of weight required to balance the tire. An excessive amount will indicate a tire that should be replaced because the vibrations will never be completely resolved. | The remarks in this section are intended to help the technician pay attention to the details that are required to ensure customer satisfaction. |
| There are many styles of wheels and wheel weights available especially when considering the aftermarket. It is important that the proper style of weight be used on a wheel to pay attention to the details that are required to ensure customer satisfaction. | |

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Noise, Vibration, and Harshness - Course 472
## Repair Techniques Chart (continued)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel and Tire Runout</td>
<td>Wheel and tire runout (lateral/radial) will also generate a <strong>first order vibration</strong> and can often be diagnosed with a good visual inspection if the runout is great enough. This is usually the case when there is tire damage. If the tire is damaged then replacement is the best repair.</td>
</tr>
</tbody>
</table>
| Squeaks, Rattles and Wind Noise                | Squeaks, Rattles and Wind Noise discussed in this section are those that are **not** diagnosed with the NVH Analyzer because their frequency is **above 500 Hz**. Noises below 500 Hz are discussed in Section 3.  

The most difficult task in servicing interior and wind noise is **locating** the source. Some noises are very illusive and seem to be coming from different areas of the vehicle depending on the customers location in the vehicle. This is caused by different transmission paths from the same source. |
### REPAIR TECHNIQUE

For runout conditions that are not obvious, a dial indicator is used to measure both radial and lateral runout. Mounting the dial indicator on a stand provides good results. A wheel adaptor for the dial indicator allows easy movement of the indicator over the rubber surface.

A smooth surface will provide the most accurate readings. Lateral runout measurements are taken from the side wall of the tire where a smooth surface can be found. Radial runout is measured on the tread. Tape can be wrapped around the tread to provide a smooth surface.

Radial and lateral runout can also be measured on a rim using a stand and the wheel adaptor for the dial indicator. See fig. 3-34.

Some radial runout conditions can be resolved by phase matching the tire and rim. The use of a radar chart can help match the runout of the rim 180° from the runout of the tire which will minimize the total runout and the associated vibration.

The tire and rim should be marked in 12 locations and the runout recorded on the radar chart for the tire and rim corresponding to those locations. The chart will have two sets of marks one relating to the tire and one to the rim which can be connected showing the runout of each from center and their relationship to each other.

The spot of the greatest runout from center should be marked on the tire and rim. Dismount the tire and rotate the tire so that the marks are 180° apart. Remount the tire and measure the radial runout with the dial indicator to determine if the total runout has been reduced.

An axle could also be the cause of excessive lateral and radial runout.

For example: A vehicle could have slid into a curb with enough force to bend the axle or spindle. A damaged wheel and tire is easily replaced by the customer without noticing the damage to the axle. A visual inspection may spot a tire and wheel that is newer than the others indicating the need for closer inspection for runout.

Radial runout should be measured on the wheel lugs as well as the axle flange.

Lateral runout is measured on the face of the flange.

The mating surfaces of the wheel and flange should be checked to ensure a flush fit. Any contamination could cause a lateral runout condition.

---

### REMARKS

The technician must keep in mind that runout, visible at the tire, can also be caused by other components such as the rim or axle.

Toyota has published two programs to assist the technician in diagnosing and repairing interior and wind noise.

- Interior Noise P/N 00501-42857-R92
- Wind Noise P/N 00401-42979

These programs outline diagnostic procedures and illustrate techniques to isolate and locate the noises. They also include service tips specific to models for known sources of noise and the appropriate repair. These programs are updated periodically providing current information on the latest models.
WORKSHEET #5
Propeller Shaft Runout

Repair Technique: Propeller Shaft Runout Measurement

First order driveline vibrations are commonly caused by propeller shaft imbalance or runout. Second order is commonly associated with U-joint conditions.

This worksheet will provide practice using the skills to measure the runout of the propeller shaft and companion flanges with a dial indicator. You will also determine the best plan to resolve the condition. i.e. component replacement or phase matching the companion flanges.

Instructions

1. Use a dial indicator to measure the runout of a propeller shaft in the vehicle and record your readings on the chart. Mark the rear point on the shaft of greatest runout.

2. Remove the propeller shaft, while referring to the repair manual procedures, and measure vertical and horizontal runout of the differential companion flange.

3. Determine if phase matching the shaft and the flange will improve the total runout.

4. Measure the runout of the propeller shaft, in the same three locations, using “V” blocks on the bench and compare your reading to those taken while in the vehicle.

5. Compare your readings to the specifications to determine serviceability.
## Questions

1. What **two** important factors must be considered when **setting up and measuring** a shaft with a **dial indicator**?

2. What should be checked **prior** to measuring a shaft for runout or balance?

3. Why is it recommended to check each shaft in **three locations**?

4. What are the **specifications** for propeller shaft and flange runout? List **two** locations for the specifications?

### Table

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>LOCATION</th>
<th>FRONT</th>
<th>CENTER</th>
<th>REAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERMEDIATE SHAFT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROPELLER SHAFT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In &quot;V&quot; BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIFFERENTIAL FLANGE</td>
<td></td>
<td>VERTICAL</td>
<td>HORIZONTAL</td>
<td></td>
</tr>
</tbody>
</table>

---

**Notes:**

- **important factors**
- **setting up and measuring**
- **dial indicator**
- **prior**
- **three locations**
- **specifications**
- **two**
Questions (continued)

5. What is your **plan of action** if you find **conflicting** specification?

6. Is there a **difference** in the readings taken **in** or **out** of the vehicle? If so, what is your **conclusion**?

7. List **two** considerations when servicing a propeller shaft.

8. What **areas** should be checked for runout in **addition** to the ones measured in the worksheet?

9. Which runout measurement **location** on the propeller shaft is most likely to indicate a possible **companion flange runout condition**? Explain.

10. What is the **advantage** of **marking** the **high point** on the **rear** of the propeller shaft?

11. If the high point is near the original high point after phase matching what is your **conclusion**?
Description: **Vertical Joint Angles**

A propeller shaft angle condition is one of the causes of a second order driveline vibration. Angle measurement and adjustment involves the use of the SST 09370-50010-10 and shims.

This worksheet is designed to provide practice in propeller shaft measurement and adjustment using the resources mentioned above.

**Instructions**

**Vertical angle Measurement**

Fig. 4-2

Horizontal surface
Measurement

1. Raise the vehicle maintaining the same suspension system load and position as when the condition exists.

2. Measure the joint angle of the engine and the intermediate shaft (A) using surfaces that are parallel to the engine crankshaft on the engine and the shaft surface for the intermediate shaft.
   - crankshaft pulley
   - oil pan mounting surface
   - bell housing mounting surface

3. Set the gauge to zero while on the engine and read the change on the gauge while on the intermediate shaft. The change is the joint angle (A). Record the results on the chart.

4. Measure the intermediate shaft and the propeller shaft angle (B) making sure the SST is directly against the shafts.

5. Set the gauge to zero while on the intermediate shaft and read the change on the gauge while on the propeller shaft. The change is the joint angle (B). Record the results on the chart.

6. Measure the propeller shaft and differential angle (C) using the parallel or perpendicular surfaces to the drive pinion.
   - companion flange surface
   - differential cover mounting surface
   - differential carrier mounting surface

7. Set the gauge to zero while on the propeller shaft and read the change on the gauge while on the differential. The change is the joint angle (C). Record the results on the chart.

8. Compare your results to the specifications and determine what adjustments that must be made.

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>JOINT ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGINE/INTERMEDIATE SHAFT</td>
<td>(A)</td>
</tr>
<tr>
<td>INTERMEDIATE/PROPELLER SHAFTS</td>
<td>(B)</td>
</tr>
<tr>
<td>PROPELLER SHAFT/DIFFERENTIAL</td>
<td>(C)</td>
</tr>
</tbody>
</table>
Questions

1. What lift points did you choose to maintain the suspension height while raising the vehicle?

2. What are the increments between the degree marks on the scale?

3. How do you know if the angle is positive or negative?

4. Does it make a difference which component you measure first when using the angle gauge?

5. What are the specifications that are acceptable?

6. How do your results compare to the specifications?
Correction

1. **Correction** is done by adjusting the **engine**, **center support bearing** or **differential**. The object is to:
   - equalize the engine and differential angle
   - reduce the joint noise

   **NOTE**
   Some vehicles require “0” angle installations while others allow for the engine and differential centerline to be parallel where the joint angle of the engine and the differential are equal. Consult your repair manual for the proper correction procedure.

2. From the **measurements** determine what **adjustments** are necessary to make the engine and differential joint angles **equal** i.e.
   - front of the engine
   - rear of the transmission
   - which differential mount

3. From the **measurements** determine the **impact** of raising or lowering the center support bearing.

4. Using the shims provided raise or lower the component necessary to correct the condition.

5. Perform the **verification procedures** discussed in section 3 to ensure the condition has been **corrected**.

<table>
<thead>
<tr>
<th>THICKNESS</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5 mm (0.177 in.)</td>
<td>90201-10008</td>
</tr>
<tr>
<td>6.5 mm (0.256 in.)</td>
<td>90201-10017</td>
</tr>
<tr>
<td>9.0 mm (0.354 in.)</td>
<td>90201-10033</td>
</tr>
<tr>
<td>11.0 mm (0.433 in.)</td>
<td>90201-10034</td>
</tr>
<tr>
<td>13.5 mm (0.532 in.)</td>
<td>90201-10035</td>
</tr>
</tbody>
</table>
Questions

1. What **adjustments** should be made to the following?
   - Engine mounts: Up or Down
   - Rear transmission mounts: Up or Down
   - Center carrier: Up or Down
   - Differential: Up or Down

2. What is the relationship between the thickness of the shim and the change in the joint angle? i.e. thousandths vs. degrees.

3. What determines this relationship between shim thickness and angle in question #2?

4. Did the condition improve after the adjustment?
   - differential cover mounting surface
   - differential carrier mounting surface
## WORKSHEET #6B

**Propeller Shaft Angle Measurement and Adjustment**

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Year/Prod. Date</th>
<th>Engine</th>
<th>Transmission</th>
</tr>
</thead>
</table>

### Description: **Horizontal Joint Angles**

Horizontal joint angles can have the same impact on vibration as the vertical joint angles but are more difficult to measure. Due to the acceleration and deceleration of a joint as it rotates it is important to ensure that the working angles cancel these changes in speed and provide a smooth output and no vibration.

The following sheet is designed to provide instruction and practice in measuring and correcting these horizontal joint angles.

### Instruction

**Horizontal Propeller Shaft angle**

Fig. 4-3

![Diagram of horizontal propeller shaft angles]

1. **Tape**
2. **Measuring points**
3. **Alignment checks**
4. **Adjustment procedures**
5. **Tool requirements**
6. **Safety precautions**
7. **Wiring diagrams**
Measurement Instructions

Engine
1. Raise the vehicle maintaining the same suspension system load and position as when the condition exists.

2. Drop a plumb line from the crank pulley and place a strip of tape under the plumb points. Mark the plumb points A and B on the tape.

3. Determine the mid-point (1) between points A and B.

4. Drop a plumb line from the transmission extension housing and place a strip of tape under the plumb points. Mark the plumb points C and D on the tape.

5. Determine the mid-point (2) between points C and D.

Intermediate and Propeller Shafts
6. Use the same techniques outlined above to determine the mid-points of the ends of each shaft.
   - mid-point (3) of E and F
   - mid-point (4) of G and H
   - mid-point (5) of I and J
   - mid-point (6) of K and L

Differential
7. The same techniques are used to measure the companion flange and both axle housings:
   - mid-point (7) of M and N
   - mid-point (8) of P and Q
   - mid-point (9) of R and S

8. (10) is the perpendicular intersection of the center line formed with (8) - (9) and the pinion drive through (7).

9. Connect all center lines with thread.

10. Place a protractor on the thread at joint angle (A), (B) and (C) to measure the angles. Record your readings on the chart.
<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>JOINT ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGINE/INTERMEDIATE SHAFT</td>
<td>(A)</td>
</tr>
<tr>
<td>INTERMEDIATE/PROPELLER SHAFTS</td>
<td>(B)</td>
</tr>
<tr>
<td>PROPELLER SHAFT/DIFFERENTIAL</td>
<td>(C)</td>
</tr>
</tbody>
</table>

**Correction Instructions**

1. Adjust the **engine** center line (1 - 2) and/or **differential** center line (7 - 10) to make them **parallel** to each other and joint angles (A) and (C) **equal**.

2. Adjust the **center lines** of the engine, intermediate shaft, propeller shaft, and differential to make them as **straight** as possible and **reduce** joint angle (A) and (C).

3. Perform the **verification procedures** discussed in Section 3 to ensure the condition has been **corrected**.

**Questions**

1. List what could cause the horizontal angle to change.
2. List the components and angle that would be effected.

3. What is the value of using a protractor in this worksheet?

4. What type of vibration would you read on the NVH Analyzer with a horizontal joint angle condition?
WORKSHEET #7
Tire Runout Measurement and Phase Matching

Repair Technique: **Tire Runout Measurement and Phase Matching**

Runout can be one of the causes of tire and wheel vibrations, though not as common as balance. The technician has to be able to determine the **amount of runout**, the **component** causing it and if it can be resolved through phase matching or component replacement.

The following worksheet is designed to provide **experience** in:

- **Measuring** the runout of a tire and rim.
- Using the **radar chart** to determine relative location of the tire and rim runout.
- Determining component **serviceability**.

*Radar Chart, Tire and Wheel*  
Fig. 4-4
Instructions

1. Mark the tire into twelve equal segments.

2. Use a dial indicator to measure the lateral and radial runout of the tire and rim.

3. Record the readings from the twelve locations on the radar chart for both the tire and rim (attached). Use the “twelve” position on the tire and chart as the “0” point for the dial indicator. Each eleven positions will be plus or minus from that point.

4. Record the readings for the rim using a location on the chart inside the readings for the tire.

5. Draw lines to connect the readings in the twelve positions for the tire and rim.

6. Dismount the tire and remount lining up the lowest position of the rim with the highest position of the tire to achieve the lowest possible total runout.

7. Remeasure the total radial runout and determine serviceability of the tire and wheel.

<table>
<thead>
<tr>
<th></th>
<th>TOTAL RADIAL RUNOUT BEFORE PHASE MATCHING</th>
<th>TOTAL RADIAL RUNOUT AFTER PHASE MATCHING</th>
<th>LATERAL RUNOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIRE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions

1. Is it possible for a tire to indicate excessive runout and have nothing wrong with the tire? Explain.

2. List the components that could cause the condition in question #1.

3. What is the specification for checking the wheel centering with the hub or axle flange? Where did you find it?

4. What impact would wheel centering have on runout? Which one, lateral or radial?

5. How would you guard against a flat spot effecting your readings? Which readings would be effected, lateral or radial?
6. What makes a good reference or starting point when measuring runout?

7. Why is it important to make sure the reference point for the tire and rim measurement are the same on the chart?

8. How is the high and low points of the tire and wheel determined once the radar chart is completed?

9. Can you predict what the total runout will be after phase matching the tire and rim using the information on the completed chart?

10. What is the value of predicting the total runout?
Notes
Interior and wind noise complaints are usually not as difficult to repair as they are to find. The difficulty in finding the source of a noise is caused by the many possible transmission paths of the noise. As a result, people sitting in different locations in the vehicle will have different opinions on the location of the noise.

Toyota has published two excellent programs to assist the technician with diagnosing and repair of these conditions.

- Interior Noise  P/N 00401-42856-R92
- Wind Noise  P/N 00401-42968

This worksheet is designed to familiarize you with these programs and the skills required to successfully resolve interior and wind noise complaints.
Instructions

1. Review both the Interior and Wind Noise programs to become familiar with:
   - The contents
   - Diagnostic procedures
   - Repair techniques
   - The specification
   - Service tips
   - Check sheets
   - Body fit standards
   - Materials, tools and equipment

2. Use the diagnostic skills developed in this course, your experience in noise diagnosis and repair and the information above to answer the following questions.

Questions

1. What is the frequency range of wind noise?

2. What are the two conditions that effect wind noise?

3. At what speed does wind noise normally occur?

4. Why do the windows need to be shut?

5. What are the two major vibrating forces of wind noise?

6. What should a visual inspection include for wind noise?

7. What are two important characteristics of the tape used to diagnose the wind noise?
Questions (continued)

8. What are two values of the check sheets in the wind noise program?

9. What is the body fit standard for the gap between the top of the door and the roof line on a Paseo?

10. What is the advantage of having more than one person involved during the road test of a noise?

11. What is the part number for the kit available to repair noise complaints?

12. What is the value of the service tips section in the interior noise program?
Summary

This section completes the information required to successfully resolve most NVH complaints. You should have:

- A strong background in NVH principals and theory
- A diagnostic procedure including
  - Verification of the customer complaint
  - Classification of the symptom
  - A road test procedure with the NVH Analyzer
- A pinpoint diagnosis procedure
- NVH repair techniques

Success in NVH service and repair will require practice honing the skills developed in this course. Practice will provide the experience necessary to quickly resolve NVH complaints the first time and ensure long term customer satisfaction.