

Condition	Possible Sources	Actions
	- Insufficient vacuum for brake booster operation - Brake booster manifold vacuum hose - Brake booster - Brake booster check valve - Brake booster vacuum pump	CARRY OUT the Brake Booster Component Test in this section.
	Brake pads	INSPECT the brake pads. INSTALL new components as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation). REFER to: Brake Pads (206-04 Rear Disc Brake, Removal and Installation).

Symptom Chart: NVH

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Actions
Vibration when the brakes are applied	- Brake disc(s)/ - Suspension components	GO to Pinpoint Test A
Brake vibration/shudder “ occurs when the brake pedal is released	Brake drag	REFER to Symptom Chart: Brake System
Rattling noise	- Caliper guide pins or guide pin bolts - Missing or damaged anti-rattle clips or springs - Loose brake disc shield	- INSPECT the caliper guide pins and guide pin bolts. INSTALL new components as necessary. - INSPECT the brake pads for missing clips or broken springs. INSTALL new components as necessary. - TIGHTEN the brake disc shield bolts to specification. REFER to: Brake Disc Shield (206-03 Front Disc Brake, Removal and Installation). REFER to: Brake Disc Shield (206-04 Rear Disc Brake, Removal and Installation).
Squealing noise “ occurs on first (morning) brake application	Brake pads	Acceptable condition. Caused by humidity and low brake pad temperature.
Squealing noise “ a continuous squeal	Brake pads	INSPECT the brake pads. INSTALL new components as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation). REFER to: Brake Pads (206-04 Rear Disc Brake, Removal and Installation).
Squealing noise “ an intermittent squeal	Brake pads	Acceptable condition. Caused by cold, heat, water, mud or snow.
Groaning noise “ occurs at low speeds with brake lightly applied (creeping)	Brake pads	Acceptable condition.
Grinding/moaning noise “ continuous	- Brake pads - Brake disc	INSPECT the brake pads, brake discs and attaching hardware for damage. VERIFY brake components are within specifications. INSTALL new components as necessary.

Pinpoint Tests

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PINPOINT TEST A : VIBRATION WHEN BRAKES ARE APPLIED

Normal Operation and Fault Conditions

During moderate to heavy braking, noise from the HCU and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation or steering wheel nibble when the brakes are applied (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component.

Possible Sources

- Brake disc(s)/drums(s)
- Suspension components

A1 ROAD TEST THE VEHICLE -LIGHT BRAKING

- Road test the vehicle. Warm the brakes by slowing the vehicle from 80 to 32 km/h (50 to 20 mph) using light brake force. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using light pedal force.

Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?

Yes	GO to A4
No	GO to A2

A2 ROAD TEST THE VEHICLE -MODERATE TO HEAVY BRAKING

- Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force.

Is there a vibration/shudder?

Yes	GO to A3
No	The concern is not present at this time.

A3 CHECK ABS (ANTI-LOCK BRAKE SYSTEM) OPERATION

NOTE: During moderate to heavy braking, noise from the Hydraulic Control Unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct operation of the ABS. Pedal pulsation or steering wheel nibble with the frequency proportional to vehicle speed indicates a concern with a brake or suspension component.

- Road test the vehicle and apply the brakes on a dry, firm surface, then apply the brakes on a wet, snowy or loose surface (such as gravel).

Is the vibration/shudder only present on a wet, snowy or loose surface?

Yes	This is a normal operating condition of the ABS.
No	GO to A5

A4 ISOLATE BRAKE VIBRATION

NOTE: This test step is not applicable to vehicles with drum-in-hat type or electronic parking brakes. For vehicles with drum-in-hat or electronic parking brakes, proceed to the next test step. For all other vehicles, apply the parking brake to identify if the problem is in the front or rear brake.

- Apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89-97 km/h (55-60 mph), lightly apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test.

Is there a vibration/shudder?

Yes	GO to A7
No	GO to A5

A5 CHECK THE FRONT SUSPENSION

- Check the front suspension.

Are all the suspension components in satisfactory condition?

Yes	GO to A6
No	REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

A6 CHECK THE FRONT BRAKE DISCS

- Inspect the front brake discs. MACHINE or INSTALL new brake discs as necessary.
REFER to: Brake Disc Machining (206-00 Brake System - General Information, General Procedures).
REFER to: Brake Disc (206-03 Front Disc Brake, Removal and Installation).
- Road test the vehicle.

Is the vibration/shudder present?

Yes	GO to A7
No	The concern has been repaired.

A7 CHECK THE REAR SUSPENSION

- Check the rear suspension.

Are all the suspension components in satisfactory condition?

Yes	INSPECT the rear brake discs. MACHINE or INSTALL new brake discs as necessary. REFER to: Brake Disc Machining (206-00 Brake System - General Information, General Procedures). REFER to: Brake Disc (206-03 Front Disc Brake, Removal and Installation).
No	REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

Component Test- Brake Booster

1. Disconnect the brake booster vacuum sensor/check valve from the brake booster and connect a suitable vacuum/pressure tester to the booster side of the vacuum sensor/check valve.
2. Apply the parking brake, start the engine and place the transmission in NEUTRAL.
 - Allow the engine to reach normal operating temperature.

3. Verify that vacuum is available at the vacuum sensor/check valve with engine running at normal idle speed.
 - The vacuum gauge should read between 51-74 kPa (15-22 in-Hg).
 - If specified vacuum is available, stop the engine, connect the vacuum sensor/check valve and continue with Step 5.
 - If specified vacuum is not available, continue with Step 4.
4. Disconnect the vacuum sensor/check valve from the vacuum hose and verify that the specified vacuum is available at the hose with the engine at idle speed and the transmission in NEUTRAL.
 - If specified vacuum is available, stop the engine, install a new check valve and continue with Step 5.
 - For vehicles equipped with a brake vacuum pump, if specified vacuum is not available, inspect the vacuum hose and install new as necessary. If the vacuum hose is ok, install a new vacuum pump.
REFER to: Brake Vacuum Pump - 2.7L EcoBoost (238kW/324PS) (206-07 Power Brake Actuation, Removal and Installation).
 - For vehicles not equipped with a brake vacuum pump, if specified vacuum is not available, stop the engine, connect the vacuum hose to the check valve and diagnose the no/low vacuum condition.
5. Apply the brake pedal several times to exhaust all vacuum from the system.
6. Apply the brake pedal and hold it in the applied position. Start the engine and verify that the brake pedal moves downward after the engine starts.
 - If the brake pedal moves, the brake booster is operating correctly.
 - If the brake pedal does not move, install a new brake booster.
REFER to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).
7. Operate the engine a minimum of 20 seconds at idle. Stop the engine and let the vehicle stand for 10 minutes, then apply the brake pedal. The brake pedal feel should be the same as that noted with the engine operating.
 - If the brake pedal feels hard (no power assist), install a new brake booster vacuum sensor/check valve and retest.
 - If condition still exists, install a new brake booster.
REFER to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).
 - If the brake pedal feels the same as noted with the engine operating, the vacuum sensor/check valve is functioning properly.

Component Test- Brake Master Cylinder - Bypass Condition

1. Inspect the master cylinder.
2. Disconnect the brake tubes from the master cylinder.
3. **NOTE:** *Make sure the outlet port plugs do not show signs of leakage.*

Plug the outlet ports of the master cylinder.
4. Lightly apply the brakes and hold for 10 seconds. Release the brakes and then reapply with heavy force. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new brake master cylinder must be installed.
 - If brake pedal height is maintained, reinstall brake tubes and tighten to specification.
REFER to: Brake Master Cylinder (206-06 Hydraulic Brake Actuation, Removal and Installation).
After installation, bleed the brake system. REFER to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

Component Test- Brake Master Cylinder - Compensator Port

1. Inspect the master cylinder.
2.
REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Apply and release the brakes.
4. With the brakes released, attempt to rotate each wheel and check for any brake drag.
 - If an excessive amount of brake drag exists at multiple wheels, continue to Step 5.
 - If an excessive amount of brake drag exists at only one wheel, it indicates a possible seized brake caliper, brake wheel cylinder or parking brake component. Repair or install new components as necessary.
5. Check the brake stoplamp switch and the brake pedal free play to verify the brake pedal is not partially applied.
6. Loosen the brake master cylinder nuts and position the brake master cylinder away from the brake booster.

7. With the brakes released, attempt to rotate each wheel and check for any brake drag.

- If the brake drag is no longer present, install a new brake booster.
REFER to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).
 - If the brake drag is still present, install a new master cylinder.
REFER to: Brake Master Cylinder (206-06 Hydraulic Brake Actuation, Removal and Installation).
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General Procedures

Brake Disc Machining

Repair

NOTE: *On-Vehicle Brake Lathe Training Videos*

1. Vehicle preparation.

□ [Click here to view a video version of this procedure.](#)

2. Mounting the machine.

□ [Click here to view a video version of this procedure.](#)

3. Lateral runout adjustment.

□ [Click here to view a video version of this procedure.](#)

4. Making the cut.

□ [Click here to view a video version of this procedure.](#)

5. Cutting the opposite side.

□ [Click here to view a video version of this procedure.](#)

6. Lathe maintenance.

□ [Click here to view a video version of this procedure.](#)

Repair

NOTE: *On-Vehicle Brake Disc Machining*

NOTE: *Do not use a bench lathe to machine the brake discs. Use an on-vehicle brake lathe only. Read the entire operating manual and/or view the video shipped with the lathe before installing, operating or repairing the lathe.*

NOTE: *Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe will make sure that these dimensions are within specification.*

1. □ **WARNING:** Service actions on vehicles equipped with electronic parking brakes may cause unexpected parking brake application, which could result in injury to hands or fingers. Put the electronic parking brake system into service mode prior to servicing or removing rear brake components. Failure to follow this instruction may result in serious personal injury.

If a rear brake disc is being machined, activate the EPB service mode.