File in Section: 03 - Suspension
Bulletin No.: 10-03-09-001B
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Service Bulletin

TECHNICAL

Subject: **Shake/Vibration in Steering Wheel, Boom/Moan Noise at Highway Speeds on Smooth Roads (Replace Engine Mounts, Propshaft, Balance Wheel and Tire Assemblies or Correct Brake Rotor Runout)**

Models: **2008-2009 Pontiac G8**

Attention: **It is requested that you become familiar with all the various concerns before attempting diagnosis or repair. In ALL cases, a propshaft is the last component replacement that should be attempted. Replacement propshafts are only available on an exchange basis directly through GM Brand Quality (except 2008 MY 3.6L V6 models). If it is determined that a propshaft replacement is required, you will be expected to furnish written data to GM Brand Quality validating diagnostics of the other possible components.**

This bulletin is being revised to update the contact information under the Propshaft Exchange section, add another balancer machine under Tire and Wheel Diagnosis and change the engine mount part number. Please discard Corporate Bulletin Number 10-03-09-001A (Section 03 – Suspension).

Condition

Some customers may comment on shaking/vibration in the steering wheel/driver seat and/or a boom/moan noise while driving at highway speeds (typically between 88-112 km/h (55-70 mph) on smooth roads.

Steering Wheel Vibration

Vibrations in the steering wheel may also be accompanied by vibration in the body and/or seat but may be more obvious to the driver due to contact with the steering wheel. When the steering wheel is held loosely on smooth roads, driving straight ahead, slight steering wheel oscillation may be visible.

Boom/Moan Noise

A “boom” or “moan” noise is a very low frequency sound that phases in and out. The customer may describe the noise as a loud continuous bass note produced by the radio that comes and goes. This type of noise may be mistaken for the feeling of objectionable pressure in the passenger compartment. Additionally, noises of this frequency range may make hearing other sounds, such as normal conversation, seem distorted. This noise may accompany vibration felt in the body, seat or steering wheel.

Cause

The vehicle may be sensitive to the balance of various rotating mass assemblies. This may include the following possible sources:

- **Wheel and Tire Assembly Balance and Road Force Variation**
  - – Tire and Wheel Diagnosis
  - – Measuring Wheel Runout and Assembly Radial Force Variation
- **Excessive Brake Rotor Runout or Imbalance**
- **Active Fuel Management (AFM)**
- **Propshaft Runout or Imbalance**

Correction

Road Testing

In order to provide the best diagnostic information, a road test with an EVA (Electronic Vibration Analyzer) or equivalent should be conducted. Convenient locations for the magnetic transducer are the steering column, the driver front seat track and the trunk floor pan over the rear of the propshaft. You should record your readings in each location between 80-112 km/h (50-70 mph). Each of the bold section headings above contain additional information and diagnostic tips.

Important: Be sure tire pressure is set to the placard values.

The following sections offers possible vibration sources (in order of the least intrusive service procedure), how to identify them and the proper corrections for each. The standardized GM Vibration Analysis Worksheet is included at the end of this bulletin to aid you in recording pertinent data.

– Road test the vehicle using the Electronic Vibration Analyzer (EVA) essential tool while driving for a sufficient distance on a known, smooth road surface to duplicate the condition. Determine if the vehicle is sensitive to brake apply. If the brakes are applied lightly and the pulsation felt in the steering wheel increases, refer to the Brakes section of SI that deals with brake-induced pulsation.
– Next, record the Hertz (Hz) reading as displayed by the EVA onto the tire data worksheet found at the end of this bulletin. This should be done after a tire break-in period of at least 16 km (10 mi) at 72 km/h (45 mph) or greater, in order to eliminate any possible tire flat-spotting. This reading confirms what the vehicle vibration frequency is prior to vehicle service and documents the amount of improvement occurring as the result of the various steps taken to repair.
– If flat-spotting is the cause, provide the explanation that this has occurred due to the vehicle being parked for long periods of time and that the nature of the tire is to take a set. Refer to the latest version of Corporate Bulletin Number 03-03-10-007: Information on Tire/Wheel Characteristics (Vibration, Balance, Shake, Flat Spotting) of GM Original Equipment Tires.

Wheel and Tire Assembly Balance & Road Force Variation

1. Visually inspect the tires and the wheels. Inspect for evidence of the following conditions and correct as necessary:
    - Missing balance weights
    - Bent rim flange
    - Irregular tire wear
    - Incomplete bead seating
    - Tire irregularities (including pressure settings)
    - Mud/ice build-up in wheel
    - Stones in the tire tread
    - Remove any aftermarket wheels and/or tires and restore vehicle to original condition prior to diagnosing a smooth road shake condition.
    - Ensure the wheels are centered on the hub by loosening all wheel nuts and hand tightening all nuts first by hand while shaking the wheel, then torque to specifications using a torque wrench, NOT a torque stick.
2. If corrections to any items were made, road test the vehicle to determine if the vehicle still exhibits the smooth road shake conditions.

If the smooth road shake/vibration still exists, continue below to diagnose wheel and tire concerns.

Tire and Wheel Diagnosis

1. If the road test indicates a shake/vibration exists, check the imbalance of each tire/wheel assembly on a known, calibrated, off-car dynamic balancer. If any assembly calls for more than ¼ ounce on either rim flange, remove all balance weights and rebalance to as close to zero as possible. If you can see the vibration (along with feeling it) in the steering wheel (driving straight without your hands on the wheel), it is very likely to be a tire/wheel first order (one pulse per revolution) disturbance. First order disturbances may be caused by imbalance as well as non-uniformities in tires, wheels or hubs. This first order frequency is too low for a human to hear, but if the amplitude is high enough, it can be seen.

Important: Some GM dealers may have a Hunter GSP9700 Road Force Balancer, John Bean/Snap-on RFV2000 or a Coats XR1850 Runout Balancer. If a Hunter GSP9700 or the John Bean/Snap-on RFV2000 machine is available, it may also be used to measure the radial force variation of the tire/wheel assembly. A guideline here is 18 lbs (8 kg) or less (12 lbs (5 kg) or less are preferable for sensitive customers).

2. After confirming the wheel balance; install wheel and tire assembly on the vehicle per service procedures with the specified tightening process. If any changes were made, road test the vehicle again.

If the smooth road shake/vibration still exists, continue below to measure wheel runout and assembly radial force variation.

Measuring Wheel Runout and Assembly Radial Force Variation

Important: The completed worksheet at the end of this bulletin must be attached to the hard copy of the repair order.

1. Measure radial force variation and radial runout.
    - If a road force/balancing machine is used, record radial force variation (RFV) on the worksheet at the end of this bulletin. If one or more of the tire/wheel assemblies read more than 18 lbs (8 kg), match mount the tire to the wheel to get below 18 lbs (8 kg) . Readings of 12 lbs (5 kg) or less are preferable for sensitive customers. If the machine is not available and the EVA data suggests there is an issue, swap the tire and wheel assemblies from the front to the back. Re-check on the EVA and if the problem still exists, test another vehicle to find tires that do not exhibit the same frequency and swap those tires onto the subject vehicle.

- If a runout/balancing machine is used, record radial runout of the tire/wheel assemblies on the worksheet at the end of this bulletin. If one or more of the tire/wheel assemblies are more than .040 in (0.10 cm), match mount the tire to the wheel to get below .040 in (0.10 cm). Readings of .030 in (0.08 cm) or less are preferable for sensitive customers.
- If the RFV or runout cannot be reduced to an acceptable level, replace the affected tire(s) under the guidelines of the GM Tire Warranty.

2. Place tires with lowest RFV on the front of the vehicle.
3. Road test the vehicle to determine if the shake/ vibration has been eliminated.

Brake Rotor Runout

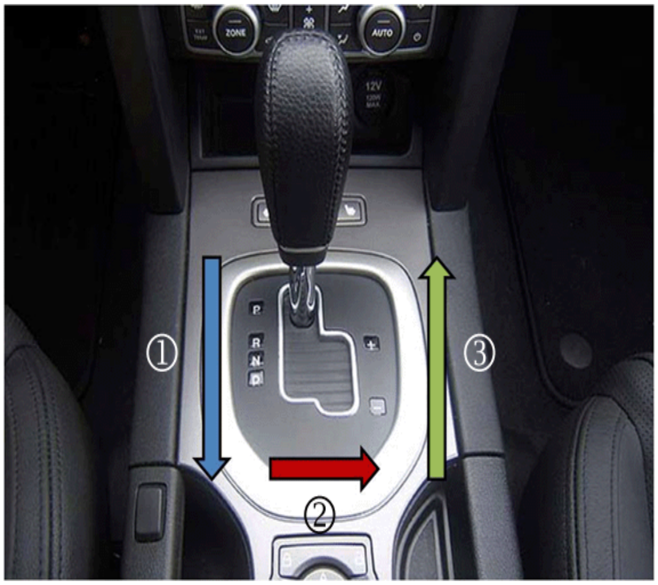
If the brake pedal does not pulsate objectionably, but the corrections above did not alleviate the condition, measure the radial runout of the brake rotors to see if one (or more) have elevated runout measurements. If the lateral run out (LRO) measurement is 0.050 mm (0.002 in) or LESS, no correction is necessary. If this measurement is greater, refer to the latest version of Corporate Bulletin Number 00-05-22-002: Disc Brake Warranty Service and Procedures for additional information on correcting rotor runout conditions.

Active Fuel Management (AFM) – G8 GT Only (6.0L V8)

Important: Active Fuel Management is only present on G8 GT models.

The engine in the G8 GT is an 8-cylinder unit that is capable of deactivating 4-cylinders to conserve fuel during periods of reduced power requirement. Some customers may be sensitive to the change in engine frequency (both in feel and exhaust tone) when Active Fuel Management is engaged. In order to minimize this sensation, 2009 Pontiac G8 GT models built with VIN 9L3 (2009.5 MY) have revised engine mounts that reduce the transmitted vibration from the engine. Vehicles equipped with these revised mounts should not be a concern.

During a road test (with or without the customer), this concern may be isolated by disabling Active Fuel Management. If the customer is available, it may be of value to let the customer drive the vehicle. In order to disable this feature, you will engage 6th gear manually by performing the following steps:



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1. Shift the transmission to “D” (1).
2. Accelerate on a suitable road to a sustainable 88-112 km/h (55-70 mph).
3. Adjust your speed until the objectionable vibration is felt.
4. Move the shifter to the manual shift gate (2). This will engage the “sport shift” mode and automatically initiate a downshift to 5th gear if the vehicle is in top gear.

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5. Move the shift lever forward to engage manual transmission control (3). The vehicle DIC will display “Active Select On.”

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6. Push the lever forward to engage 6th gear. The vehicle DIC will display a "6."
7. The vehicle will now remain in 6th gear and AFM will be disabled. Try to reproduce the customer complaint varying your speed within the customer specified speed range. Try coasting, holding speed and slight acceleration as well. By shifting the transmission selector back to "automatic" and repeating the above steps you should be able to tell if AFM is contributing to the objectionable vibration.

If AFM is decided to be the source of the vibration, the engine mounts should be replaced with the revised mounts used in the 2009.5 V8 models using the following procedure.

Notice: The replacement engine mounts are designed to absorb more vibration and further isolate the engine from the passenger compartment. While this procedure WILL very noticeably reduce the amount of engine vibration felt through the steering wheel, it does not eliminate the source. When Active Fuel Management is engaged, the 8-cylinder engine operates on 4-cylinders, changing the operating balance of the motor and likewise the "feel" of the powertrain. This is a normal operating characteristic.

Engine Mount Replacement (Both)

1. Open the hood and install fender covers.
2. Open the trunk and disconnect the battery.
3. Remove the engine acoustic cover.
4. Remove the right side exhaust manifold-to-forward catalytic convertor bolts (from above using a long extension).
5. Raise and properly support the vehicle.
6. Disconnect the right side O2 sensor electrical connector.
7. Remove the right side forward catalytic convertor-to-intermediate pipe nuts.
8. Remove the right side forward catalytic convertor from the vehicle.
9. Remove the heat shield attaching nuts from the engine starter.
10. Remove the heat shield from the engine starter.
11. Disconnect the electrical leads from the starter.
12. Remove the engine starter attaching bolts and remove the starter.
13. Remove the engine mount to subframe nuts (both sides) .
14. Remove both side engine motor mount top attaching nuts,
15. Position and support the motor with a screw jack and appropriate wood block.
16. Remove the motor mount bracket bolts on both engine mounts.
17. Raise the engine in small increments to obtain clearance in order to remove the left side engine mount bracket.
18. Reposition the right engine mount bracket up the oil level indicator tube.
19. Remove both engine mounts and heat shields from the vehicle.
20. Transfer the engine mount heat shields to the replacement engine mounts.
21. Install both engine mounts and heat shields to the vehicle.
22. Reposition the right engine mount bracket down the oil level indicator tube.
23. Reposition the left side engine mount bracket and lower the engine onto the revised mounts.
24. Install the engine mount bracket bolts to both engine mounts.
25. Install both side engine motor mount top attaching nuts.
26. Install the engine mount-to-subframe nuts (both sides).
27. Install the engine starter and attaching bolts.
28. Connect the electrical leads to the starter.
29. Install the heat shield nuts to the engine starter.
30. Install the right side forward catalytic convertor to the vehicle.
31. Install the right side forward catalytic convertor-to-intermediate pipe nuts.
32. Connect the right side O2 sensor electrical connector.
33. Remove the screw jack under the engine and lower the vehicle.
34. Install the right side exhaust manifold-to-forward catalytic convertor bolts (from above with a long extension).
35. Install the engine acoustic cover.
36. Connect the battery and close trunk.
37. Remove the fender covers and close the hood.

Propeller Shaft Imbalance

Propeller shaft imbalance can be identified by the use of the EVA diagnostic tool. This type of vibration may be felt and/or heard. Compared with tire vibrations, this type of vibration is much higher in frequency and can often be felt more than seen in the steering wheel. However, steering wheel oscillation is still possible. The creation of boom or moan is not typically present with the other possible vibration sources.

If you can start to hear the vibration as a low boom noise (in addition to feeling it), but cannot see it, it likely has a first order (one pulse per propshaft revolution) driveline vibration. Driveline first order vibrations are high enough in frequency that most humans can start to hear them at highway speeds, but are too high to be able to be easily seen. These issues can be caused by driveline imbalance or misalignment. If the vehicle exhibits a low boom and the booming pulses in-and-out on a regular basis (like a throbbing), these are indications of driveline vibration.

EVA Transducer Locations

It may be preferred to start with the EVA magnetic transducer attached to the driver seat frame or the steering column tilt/telescope lever. At these locations, any tire vibrations should be sensed, as well as propshaft vibration, to help identify the proper source. If propshaft vibration is detected, it will center around the 46 HZ frequency range. This frequency may change with road speed from the 45-55 HZ range. However, there is a tendency in this vehicle structure to resonate centered at 46 HZ with amplitude increasing or decreasing as you drive into the target speed range of 88-112 km/h (55-70 mph). If propshaft vibration is detected, or any boom noise is part of the customer concern, move the sensor location to the trunk floorpan above the rear of the propshaft for secondary testing.

Tip:

You can utilize the rear seat trunk pass-through to easily locate the transducer to the trunk floor.

There is often some very small amount of vibration associated with nearly any spinning mass. Typically, EVA readings of 0.07g or lower indicate a value that is acceptable to the customer and do not necessarily identify a concern with this component.

If a higher value is detected and determined to be first order propshaft vibration, replace the propshaft. Please refer to the instructions under the Parts Information section below for propshaft exchange guidelines. Please refer to SI for Propshaft Replacement instructions.

Warning: When replacing the propshaft, DO NOT remove or torque the propshaft to rubber coupler bolts. Exchanged propshafts will come with the rubber couplers installed and torqued to specification.

Note: Replacement propshafts are only available on an exchange basis directly through GM Brand Quality (except for 2008 MY V6 equipped vehicles). If it is determined that a propshaft replacement is required, you will be expected to furnish written data to GM Brand Quality validating diagnostics of the other possible components.

Parts Information

Part Number	Description	Qty
92253030	Engine Mount	2

Propshaft Exchange

To qualify for a propshaft exchange, you must furnish your tire radial force variation numbers, along with the EVA numbers, collected during road testing as well as any vibration repair history on the vehicle. GM Brand Quality will request this information and make a determination on whether an exchange propshaft is required.

If it is determined that a replacement propshaft is required, please contact:

Contact	Phone Number	E-mail
Brad Thacher, Brand Quality	1-586-492-9168 (Work) 1-586-298-8010 (Cell)	bradley.w.thacher@gm.com

Warranty Information

For vehicles repaired under warranty, use:

Labor Operation	Description	Labor Time
E0901	Vibration Diagnosis	0.8 hr
Add	Measure Tire Wheel Asm., Runout and Re-Balance	1.3 hrs
Add	Replace Tire and/or Wheel – Each	0.2 hr
J7551	Engine Motor Mounts (Both)	1.5 hrs
F1280	Propeller Shaft Replacement	0.9 hr

Vibration Analysis Worksheet

When diagnosing vibration concerns, use the following worksheet in conjunction with the appropriate Vibration Analysis-Road testing procedure in the Vibration Correction sub-section in SI. FILL OUT ONLY THE APPLICABLE PORTION OF THE WORKSHEET THAT APPLIES TO THE VIBRATION / NOISE.

Refer to the appropriate section of SI for specifications and repair procedures that are related to the vibration concern.

Vibration Analysis Worksheet

To:
Dealer:
Fax Number:

VIN__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __

Procedure Performed By:
Date:
Model:
Year: Gear Ratio:
Odometer:
VIN __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __
TAC Case #, if applicable:

Conditions During Road Test Procedures

As condition occurs: Engine RPM_____________
Vehicle Speed__________________
Vibration/Noise detected during the following road test procedures:
Engine RPM_______________ Vehicle Speed_______________
Slow Acceleration Test: Yes__________ No__________
Neutral Coast-Down Test: Yes__________ No__________
Downshift Test: Yes__________ No__________
Neutral Run-Up Test: Yes__________ No__________
Brake Torque Test: Yes__________ No__________
Steering Input Test: Yes__________ No__________
Standing Start Acceleration (Launch Shudder) Test: Yes__________ No__________
Vibration/Noise Eliminated with TCC Commanded On: Yes__________ No__________

Vibration/Noise Eliminated with TCC Commanded Off: Yes__________ No__________
Vibration/Noise Duplicated on Hoist: Yes__________ No__________
When using the EVA, always take a snapshot. This will help determine which vibration shows up the most.

Important: Vibrate software can also be used to assist in vibration diagnosis. Refer to Vibrate Software Description and Operation in SI.

EVA Readings

Refer to Electronic Vibration Analyzer (EVA) Description and Operation in SI for more detailed information.

Important: As a reminder, place the EVA sensor where the vibration is mostly felt. Ensure the word “UP” on the sensor is physically facing up. The typical areas are the seat track, the steering column or the instrument panel. Locating the EVA sensor on additional area (i.e. the right fender, left fender, right quarter panel, left quarter panel, rear seat track, etc.) may also assist in determining the component causing the vibration/noise. The key is to look for the same Hz reading with the greatest amplitude G readings.

FILL OUT ONLY THE APPLICABLE PORTION OF THE WORKSHEET THAT APPLIES TO THE VIBRATION/NOISE:

Sensor at Steering Column:
1st Line MPH/KPH:__________ HZ:__________ Gs:__________
2nd Line MPH/KPH:__________ HZ:__________ Gs:__________

Sensor at Roof:
1st Line MPH/KPH:__________ HZ:__________ Gs:__________
2nd Line MPH/KPH:__________ HZ:__________ Gs:__________

Sensor at Passenger Seat Rail:
1st Line MPH/KPH:__________ HZ:__________ Gs:__________
2nd Line MPH/KPH:__________ HZ:__________ Gs:__________

Sensor at Pinion Nose (Rear Wheel Drive):
1st Line MPH/KPH:__________ HZ:__________ Gs:__________
2nd Line MPH/KPH:__________ HZ:__________ Gs:__________

Vibration Analysis Worksheet

Sensor at Pinion Nose Front Axle (Four Wheel Drive):
1st Line MPH/KPH:__________ HZ:__________ Gs:__________
2nd Line MPH/KPH:__________ HZ:__________ Gs:__________

Sensor at Crossmember/Cradle (Front Wheel Drive):
1st Line MPH/KPH:__________ HZ:__________ Gs:__________
2nd Line MPH/KPH:__________ HZ:__________ Gs:__________
Driveshaft Runout:
Is round out within specification? Yes__________ No__________
Initial: Frt:__________ Center:__________ Rear:__________ Stub Shaft:__________
Current: Frt:__________ Center:__________ Rear:__________ Stub Shaft:__________
Pinion Flange Runout Reading:__________
Has a system balance been attempted: Yes__________ No__________ (If no, perform a System Balance)
Were the drums removed to system balance? Yes__________ No__________
Initial: HZ__________ Gs__________
Current: HZ__________ Gs__________
Hose clamps added: Yes__________ No__________
Prop shaft indexed? Yes__________ No__________
If a System Balance has been attempted but the vibration is still present or system balance was not able to be achieved, check the ring gear backlash in eight different spots on the ring gear. Note that excessive ring gear runout may result in a first order tire speed or first order prop shaft speed concern.
Backlash in eight equal spots on the ring gear (readings should not vary more than 0.002 in (0.050 mm)):
1__________ 2__________ 3__________ 4__________ 5__________ 6__________ 7__________ 8__________
Does the vehicle have any of the following components attached?
Pinion damper: Yes__________ No__________
Pinion flange damper: Yes__________ No__________
Exhaust damper: Yes__________ No__________
Initial: Front angle:__________ Center Angle:__________ Rear Angle:__________
Current: Front angle:__________ Center Angle:__________ Rear Angle:__________
Were shims added to the following?
Transmission/transfer case mount: Yes__________ No__________
Pinion nose (rear springs): Yes__________ No__________
Center Support Mount: Yes__________ No__________
Tire Size and Brand:____________________________________
Wheel/Tire Runouts on vehicle (max. 0.050 in (1.27 mm))
Refer to Corporate Bulletin Number 00-03-10-006D for tire radial force variation.
Right rear: Inner lateral:__________ Center radial:__________
Left rear: Inner lateral:__________ Center radial:__________
Right front: Inner lateral:__________ Center radial:__________
Left front: Inner lateral:__________ Center radial:__________
Mounting surface runouts (max. 0.005 in (0.127 mm))
Flange, right rear:__________ Hub, right front:__________
Flange, left rear:__________ Hub, left front:__________
Wheel stud runouts (max. 0.008 in (0.203 mm))
Flange, right rear:__________ Hub, right front:__________
Flange, left rear:__________ Hub, left front:__________