

Technical Service Bulletin



44 Steering wheel shimmy, vibration and/or oscillation

44 13 35 2022563/5 January 18, 2013. Supersedes Technical Service Bulletin Group 44 number 11-18 dated April 14, 2011 for reasons listed below.

Model(s)	Year	VIN Range	Vehicle-Specific Equipment
All	2008 - 2014	All	All

Condition

REVISION HISTORY		
Revision	Date	Purpose
5	-	Revised header data (Added model years) Revised <i>Service</i> (Revised repair procedure)
4	4/15/2011	Revised <i>Warranty</i>
3	4/7/2011	Revised header data
2	1/24/2011	Revised <i>Warranty</i> (Service Number, Labor Operation)
1	1/27/2010	Original publication

Customer feels vibration from 55 – 80 mph (88 – 128 km/h) in the seat, vehicle floor, footwell, pedals, or steering wheel. This condition does not result in any handling concerns or loss of vehicle control.

Complaints may occur in one or both of the following circumstances:

- When driving at highway speeds from 55 – 80 mph (88 – 128 km/h).
- When applying low brake pedal pressure with minor slow down.

Technical Background

Explanations and definitions:

Radial force variation (RFV)

The radial force or wheel load is the force with which a tire is compressed (Figure 1, 1).

Tires have softer and stiffer areas along their circumference, which is illustrated using springs (Figure 1, A and B).

Figure 1 shows the same tire at different points of rotation (A and B), as it rolls on level road with constant load (radial force).

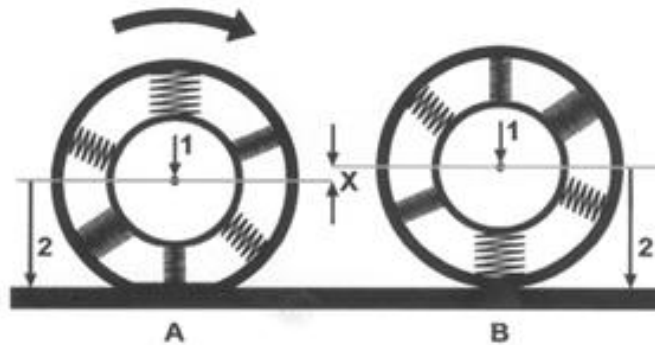


Figure 1. Wheel position (A), wheel position (B), wheel load (1), compressed amount (2), and rise and fall difference (x).

If this wheel rolls, with constant wheel load / radial force (Figure 1, arrow) the center of the wheel rises and falls on level road because of the different spring hardness of the tire by the amount x . The change by the amount x can be felt in the vehicle as vibration or shaking of the steering wheel. The change of the compression force of the tire is the RFV.

To measure RFV a constant force is applied to a rotating tire using a VAS 6230 / Hunter GSP9700 Road Force Measurement® System. This simulates the force on the tire from the road surface. The fluctuation of the radial force is independent of the turning direction and is measured as the difference of maximum and minimal radial force (peak to peak value).

On Audi vehicles the peak to peak value must be 27lbs (120N) or less.

First Harmonic

The wheel force fluctuations during the turn of the wheel can be mathematically divided into individual harmonic vibrations. For an objective assessment of the tire stiffness the first harmonic (the basic vibration) is used. The first harmonic is the share of the radial force fluctuation which causes the strongest vibrations.

On Audi vehicles the first harmonic must be 18 lbs. (80N) or less.

Production Solution

Not applicable.

Service

A structured procedure is critical.

For all repairs, follow the procedure described below. In the case of a repeat repair with original equipment tires with AO marking on the sidewall, complete these steps in addition to the procedure described below:

1. Open an Audi Technical Assistance Center ticket.
2. Ensure that the road force values are printed with the before and after values for each wheel and attached to the repair order.
3. Complete the *Vibration Questionnaire.doc* and attach to the TACS ticket.

Procedure

1. Eliminate flat spots

Flat spots are created after the warm tire has cooled down after a stationary period of only a few hours. Flat spots will vary based on the type, size, and make of the tire. Flat spots falsify the radial force fluctuation and must be driven out before checking balance or road force. A test drive of at least 12 miles (20 km) at various speed ranges (up to 62 mph / 100 km/h) is necessary.

Raise the vehicle on a lift/hoist immediately after the test drive then check balance and road force immediately since flat spots may reappear as the tires cool down.

See information on flat spots in the Repair Manual under *Suspension, Wheels, Steering >> Wheel and Tire Guide >> 44 Wheels, Tires, Wheel Alignment >> Diagnosis and Testing >> Wheel and Tire Vibration >> Tire Flat Spots from Standing*.



Tip: Flat spots are not a sign of a defect and therefore are not a warrantable condition.

2. Measure and reduce the radial force variation

Before starting work, ensure that flat spots have been eliminated.

Effects of increased radial forces on the vehicle:

Condition/Symptom	Possible cause
Vibration in the steering wheel at constant speed	Increased radial forces on the front tires
Vibration in the steering wheel when braking	Increased or critical radial forces on the front tires which are amplified when braking
Vibration in the complete vehicle	Increased or critical radial forces on the rear tires, possible also on front tires

Mounting wheels on the balancer

When tightening the wheel on the balancing machine, make sure the contact surfaces of flange and wheel are clean.

It is mandatory to use the appropriate centering cone and a five-finger style clamping plate (Figure 2, A) (VAS 6243 or similar) when mounting wheel on the balancer.

Five-finger style clamp centers the wheel on the balancer the same way the wheel is centered on the vehicle.

It also prevents damaging the wheel by not contacting the face of the wheel (Figure 2, B).

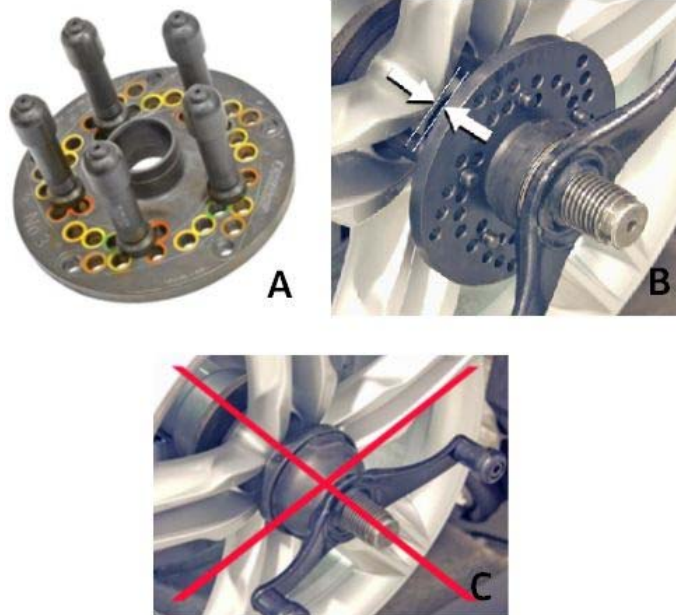


Figure 2. Five-finger style clamping plate (A), wheel properly mounted with a five-finger style clamp (B), and wheel mounted using a wrong clamping tool/method (C).



Tip: Do not use “Quick Match” mode; this mode does not measure road force. Also turn off “Smart Weight” balance feature, which can cause inaccurate readings.



Tip: Use adequate lubrication to ensure that tires are properly seated when they are installed on the wheel or are moved on a wheel to change mounting position. Be aware that excessive lubricant can cause a tire to slip on the wheel, which will have an impact on the balance and road force values.

Optimizing the radial forces using the VAS 6230 / Hunter GSP9700 Road Force Measurement® System

1. Set the tire pressure of every wheel to 36 PSI (2.5 bar).
2. Measure, balance, and, if necessary, match the wheel according to the instructions of the machine. Use 18lbs (80N) or less for the first harmonic vibration as the maximum.



Tip: The tire that is the source of vibration should be replaced if the first harmonic of the radial force cannot be reduced to 18lbs (80N) or below. This only applies to tires originally installed at the factory.

3. Reinstalling the wheel and tire assemblies

1. Install the wheels according to VAS 6230 instructions for lowest vibration. The wheel/tire assembly with the lowest road force values should be installed closest to the driver.
 - Lowest road force value – left front
 - Second lowest road force value – right front
 - Third lowest road force value – left rear
 - Highest road force value – right rear
2. Reinstall the wheels according to the instructions in *Repair Manual >> Running gear >> 44 wheels, tires, wheel alignment >> Installation of wheels/ tires/ tire pressure warning >> Instructions on wheel change/installation.*
3. Adjust tire pressures according to the pressures listed in the owner's manual.
4. Drive the vehicle in the speed range where complaints occurred to verify repairs.



Tip: If vibrations persist, open an Audi Technical Assistance Center ticket and include completed questionnaires.

Technical Service Bulletin



Warranty

Claim Type:	Use applicable claim type. If vehicle is outside any warranty, this Technical Service Bulletin is informational only.		
Service Number:	4412		
Damage Code:	0013		
Labor Operations:	Balance and road force balance all 4 wheels. A copy of the before-and-after road force and balance values must be attached to the Repair Order. <i>Includes additional time for extended road test prior to service procedure.</i>	4412 9999	190 TU
	2 wheels, remove and reinstall	4405 2000	20 TU (per axle)
Diagnostic Time:	GFF	No allowance	0 TU
	Road test prior to service procedure	0121 0002	10 TU
	Road test after service procedure	0121 0004	10 TU
	Technical diagnosis at dealer's discretion (Refer to Section 2.2.1.2 and Audi Warranty Online for DADP allowance details)		
Claim Comment:	As per TSB #2022563/5		

All warranty claims submitted for payment must be in accordance with the *Audi Warranty Policies and Procedures Manual*. Claims are subject to review or audit by Audi Warranty.

Audi Tire Warranty Assistance Program (ATAP)

The Audi Tire Assistance Program is not an Audi of America, Inc. factory warranty. Audi of America, Inc. does not warranty tires originally installed or sold as replacement for use on Audi vehicles. Individual tire manufacturers provide all the underlying tire warranties.

Please refer to Audi Tire Center website for warranty coverage and claim submission details.

Dealer Tire 1-866-487-2834

Audi warranty 1-866-677-AUDI

Required Parts and Tools

Tools

- Use VAS 6230 / Hunter GSP9700 Road Force Measurement® System to check balance, Road Force values, and to make necessary adjustments.
- Use centering hub in conjunction with VAS 6243 model-specific clamping plate (5 finger clamping device) or similar device to ensure proper mounting of wheel and to prevent damage to wheels.
- Vetronix MTS 4100 NVH Analyzer is helpful when diagnosing vibration concerns and can help narrow down the list of possible sources of the vibration.

Additional Information

More information can be found in the following resources:

- ElsaWeb: *Wheel and Tire Guide >> Diagnosis and Testing*
- SSP: *Noise, Vibration, and Harshness 961403*

The following repair procedure(s) will be necessary to complete this procedure:

- *Chassis >> Wheel and Tire Guide >> Diagnosis and Testing*

All parts and service references provided in this TSB are subject to change and/or removal. Always check with your Parts Department and service manuals for the latest information.

Vibration Questionnaire

A test drive with the customer is necessary

1. Vehicle information

VIN: _____ Vehicle mileage: _____ Repair date: _____
RO #: _____ TACS Access Code: _____

2. Wheels & tires

Factory installed wheels Wheel part number: _____
Audi Original Accessories wheels Wheel part number: _____
Aftermarket (non-Audi)¹
Tire brand: _____ Tire model: _____
Tire size: _____ Manufacturer code: AO R01 None
Originally installed tires Audi approved replacement tires Aftermarket non-Audi approved tires¹

3. Road Force balancer

Type of balancer:
VAS 6230 Hunter GSP9700 Road Force Measurement® System Other _____
Date of last calibration: _____

¹TSB 2022563/5 is only applicable to vehicles equipped with Audi factory installed or Audi accessory wheels.

Vibration Questionnaire

A test drive with the customer is necessary

4. Complaint information

Fill out as much information as possible.

The complaint occurs ...

- at the beginning of the drive and gradually goes away or completely disappears
- consistently at a certain speed mph, or within a certain speed range: mph to mph
 - while accelerating or coasting in Neutral or with the clutch pedal pressed
 - while accelerating or coasting, but not in Neutral or with clutch pedal pressed
 - while accelerating or coasting. There is juddering in forward and backward motion
 - with the clutch pedal pressed or in Neutral at an engine speed (RPM) range of rpm to rpm.
- occurs while accelerating (mostly) or coasting, but is reduced with clutch pedal pressed or in Neutral
- only when braking, when pedal pressure is light, medium, strong
- when braking the complaint gets worse, when pedal pressure is light, medium, strong

The complaint can be felt in the*:

- driver or passenger seat, steering wheel, shift lever, pedals, footwell, centre console, rear seats.

It involves*:

- vehicle vibrations, steering wheel vibrations, vehicle pulling , juddering, misfiring, humming or droning noises.

Additional information*:

- in which gears or driving modes (e.g. 1st, Drive, Sport):
- when did the complaint start?
(e.g. since x weeks, since vehicle purchase, tire rotation,...)
- only with summer, all season , winter, or all tires
- driving characteristic: stop and go %, City %, Highway %

*multiple selection possible

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Vibration Questionnaire

A test drive with the customer is necessary



5. Wheel and tire information - before and after balancing

Tires must be warmed up with a test drive prior to checking balancing and checking road force.

(Minimum of 12 miles at ≥ 62 mph)

WHEEL AND TIRE CONDITION												
	LEFT FRONT			RIGHT FRONT			RIGHT REAR			LEFT REAR		
Mileage of effected tires (if different from vehicle mileage)	█			█			█			█		
Wheel damage	Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>		
Tire damage	Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>		
DOT	█			█			█			█		
Are tire pressures correct based on owner's manual?	Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>			Y <input type="checkbox"/> N <input type="checkbox"/>		
Tire Pressures – before (PSI)	█			█			█			█		
Tread depth <input type="checkbox"/> mm <input type="checkbox"/> inches Outer / center / inner	█	█	█	█	█	█	█	█	█	█	█	█
Original wheel weights <input type="checkbox"/> Oz <input type="checkbox"/> grams	Outer		Inner		Outer		Inner		Outer		Inner	
	█	█	█	█	█	█	█	█	█	█	█	█
Balance weights used <input type="checkbox"/> Oz <input type="checkbox"/> grams	Outer		Inner		Outer		Inner		Outer		Inner	
	█	█	█	█	█	█	█	█	█	█	█	█
Road Force (lbs.)	Before		After		Before		After		Before		After	
	█	█	█	█	█	█	█	█	█	█	█	█
Tire Pressures – after (PSI)	█			█			█			█		

WHAT IMPROVED THE CONDITION?*
<input type="checkbox"/> Tire(s) replaced <input type="checkbox"/> Tires switched between wheels <input type="checkbox"/> Tires & wheels balanced <input type="checkbox"/> Warming up tires with road test <input type="checkbox"/> Repositioning tire(s) on a wheel

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7.4 Service Mode Setup and Features

By pressing K2 and K3 during boot up or reset twice, the GSP9700 will enter its “Service Mode” enabling the selection of:

Setting Up the Runout & Road Force™ Limits

Selects the amount of road force and runout needed to exceed limits.

Balancer Set Up (Service Mode)

Runout & Road Force Limits Set Up

The P/SUV or LT choices can be removed from the selector switch on the balance screen by setting the corresponding limits multiplier to 1.0.

Limits Multiplier For LT Tires:

Limits Multiplier For P/SUV Tires:

Measurement	Road Force Limits			Rim Runout Limits		
	P Tires	P/SUV Tires	LT Tires	P Tires	P/SUV Tires	LT Tires
Radial 1st Harmonic	26 lbs	26 lbs	39 lbs	4.01mm	4.01 mm	4.52 mm
Radial 2nd Harmonic	26 lbs	26 lbs	39 lbs	4.01mm	4.01 mm	4.52 mm
Radial 3rd Harmonic	22 lbs	22 lbs	33 lbs	4.01mm	4.01 mm	4.52 mm
Radial 4th Harmonic	19 lbs	19 lbs	29 lbs	4.01mm	4.01 mm	4.52 mm
Radial T.I.R.	60 lbs	60 lbs	90 lbs	1.27mm	1.27 mm	1.51 mm
Lateral 1st Harmonic				1.44mm	1.44 mm	1.71 mm
Lateral 2nd Harmonic				1.44mm	1.44 mm	1.71 mm
Lateral 3rd Harmonic				1.44mm	1.44 mm	1.71 mm
Lateral 4th Harmonic				1.44mm	1.44 mm	1.71 mm
Lateral T.I.R.				1.38mm	1.38 mm	2.09 mm

Select and change items with knob, then press "OK".

Setting the “P” Limits

The control knob changes the “P” (passenger) tire limits. Push the control knob in to select the measurement limit you desire to change. For more restrictive passenger tire limits, rotate the control knob counterclockwise. For less restrictive passenger tire limits, rotate the control knob clockwise. The light truck and sport utility vehicle limits are based on the limits set for the passenger tires. As the passenger tire limits change, the corresponding “LT” and “P/SUV” limits will also change.

Setting the “LT” Limits

The control knob controls the “LT” (light truck) tire multiplier. The multiplier is a figure that is multiplied to the passenger tire limit to obtain the “LT” tire limits. For more restrictive “LT” tire limits, rotate the control knob counter-clockwise. For less restrictive “LT” tire limits, rotate the control knob clockwise. As the multiplier changes, all of the “LT” limits will change corresponding to the current multiplier.

NOTE: Selecting 1.0 for the multiplier for “LT” or “P/SUV” will disable the “LT” and/or “P/SUV” selection on the balance screens.

Setting the “P/SUV” Limits

The control knob controls the “P/SUV” (P-Rated tire on a Sport Utility Vehicle) tire multiplier. The multiplier is a figure that is multiplied to the passenger tire limit to obtain the “P/SUV” tire limits. For more restrictive “P/SUV” tire limits, rotate the control knob counter-clockwise. For less restrictive “P/SUV” tire limits, rotate the control knob clockwise. As the multiplier changes, all of the “P/SUV” limits will change corresponding to the current multiplier.

Setting the Limits to “Factory Default”

Selecting “Set Factory Defaults” from the second menu tier will return all of the limits to the factory default limits. “P/SUV” defaults to the disabled status as shown above.

Programmed Road Force™ Limits

The GSP9700 road force measurement default limit for P-metric tires is 26 lbs. and for LT tires is 39 lbs. These default limits should be considered only as specified guidelines. They are based on recommendations from many OE vehicle and tire manufacturers and are a conservative average. Limits are used with the GSP9700 as a point of reference so that diagnostic messages guide the operator in decision making processes.

Do not use these limits as the only basis for a tire or wheel replacement. It is up to the manufacturer of the tire or wheel to determine what is defective and what is acceptable if warranty returns become a concern.

Balancer Set Up (Service Mode)

Runout & Road Force Limits Set Up

The P/SUV or LT choices can be removed from the selector switch on the balance screen by setting the corresponding limits multiplier to 1.0.

Limits Multiplier For LT Tires:

Limits Multiplier For P/SUV Tires:

Measurement	Road Force Limits			Rim Runout Limits		
	P Tires	P/SUV Tires	LT Tires	P Tires	P/SUV Tires	LT Tires
Radial 1st Harmonic	26 lbs	26 lbs	39 lbs	0.040"	0.040"	0.060"
Radial 2nd Harmonic	26 lbs	26 lbs	39 lbs	0.040"	0.040"	0.060"
Radial 3rd Harmonic	22 lbs	22 lbs	33 lbs	0.040"	0.040"	0.050"
Radial 4th Harmonic	19 lbs	19 lbs	29 lbs	0.040"	0.040"	0.060"
Radial T.I.R.	60 lbs	60 lbs	90 lbs	0.050"	0.050"	0.075"
Lateral 1st Harmonic				0.045"	0.045"	0.060"
Lateral 2nd Harmonic				0.045"	0.045"	0.060"
Lateral 3rd Harmonic				0.045"	0.045"	0.060"
Lateral 4th Harmonic				0.045"	0.045"	0.060"
Lateral T.I.R.				0.055"	0.055"	0.083"

Select and change items with knob, then press "OK".

Print Screen Set Factory Defaults

Road force limit settings can be programmed into the GSP9700 for passenger tires (P tires), passenger/SUV tires (P/SUV tires), and light truck tires (LT tires).

Every vehicle platform has a different sensitivity level and tolerance to RFV and imbalance. **Known sensitive vehicles may require lower limits to resolve ride disturbance issues.** For example, in some cases, an extremely sensitive vehicle may be affected when the tire/wheel assembly is above 15 lbs. RFM. A setting of 26 lbs. for P Tires and P/SUV Tires is often used as a "middle of the road" limit and does a reasonable job of identifying tires or wheels that may cause a problem. Limits in the Light Truck column are set higher to address the decreased vehicle sensitivity.

Hunter Engineering suggests that advanced users consider setting the default specs to a lower value for "P" setting and use the limit title "P" for sensitive applications. P/SUV limit values may be set to the original 26 lbs. This will give the operator three selections to choose from, P, P/SUV and LT.

The lowest programmable radial 1st harmonic setting is 7 lbs, and the highest programmable radial 1st harmonic setting is 40 lbs.

P, P/SUV, and LT may be selected by using the control knob on the GSP9700.

Setting Up the Ounce Blind Amount

Selects the amount below which ounce weights show as zero. Ounce Blind Amount options include 0.58 ounces, 0.29 ounces, and 0.15 ounces.

Setting Up the Ounce Round Amount

Selects the amount to which ounce weights are rounded. Ounce Round Amount options include 0.01 ounces, 0.05 ounces, and 0.25 ounces.