

T-SB-0178-13

December 12, 2013

Steering Wheel Flutter at Highway Speeds

Service Category Steering

Section Steering Gear/Linkage

Market USA



Applicability

YEAR(S)	MODEL(S)	ADDITIONAL INFORMATION
2010 – 2013	FJ Cruiser	

Introduction

Some vehicles may exhibit excessive steering flutter condition, while being driven at approximately 55 – 70 mph. In some cases, this condition is caused by a wheel imbalance or RFV (Radial Force Variation) that is out of range. If the tire and wheel assembly is satisfactory, a steering control valve preload spring is available to reduce the steering flutter felt through the steering wheel.

Production Change Information

This bulletin applies to vehicles produced **BEFORE** the Production Change Effective VINs shown below.

TRANSMISSION	DRIVETRAIN	PRODUCTION CHANGE EFFECTIVE VIN
5AT	4WD	JTEBU4BF#DK170179
6MT		JTEBU4BF#DK170230
5AT	2WD	JTEZU4BF#DK013406

Parts Information

PART NUMBER	PART NAME	QTY
44215-60040	Spring, Control Valve Pre-Set	1
90460-60008	Clamp, Hose	2

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Warranty Information

OP CODE	DESCRIPTION	DRIVETRAIN	TIME	OFF	T1	T2
ST1310	R & R Steering Rack Preload Spring	4WD	4.0	44200-35100	9B	42
ST1311		2WD	3.8	44200-35101		

NOTE

Use the Op Code above **ONLY** for steering control valve preset spring replacement. For all other repairs, use the Flat Rate Manual to select the Op Code relevant to the work performed.

APPLICABLE WARRANTY

- This repair is covered under the Toyota Basic Warranty. This warranty is in effect for 36 months or 36,000 miles, whichever occurs first, from the vehicle's in-service date.
- Warranty application is limited to occurrence of the specified condition described in this bulletin.

Required Tools & Equipment

SPECIAL SERVICE TOOLS (SST)	PART NUMBER	QTY
Rack & Pinion Holding Tool*	09612-00012-01	1
Hex Wrench	09612-10022-02	1
Steering Socket	09616-00010-02	1
Variable Open Wrench*	09922-10010-01	1
Beam Torque Wrench*	00002-02955	1
Drive Shaft Boot Clamping Tool (or equivalent)	09521-24010	1
Haweka Flange Plate #2 (40 mm)*	02002-02400	1
Oil Filter Wrench*	09228-06500-02 or 09228-06501	1

* Essential SST.

NOTE

Additional SSTs may be ordered by calling 1-800-933-8335.

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Required Tools & Equipment (Continued)

REQUIRED TOOLS & EQUIPMENT	QUANTITY
High Lift Transmission Jack	1
Utility Stand	1
Hunter Low Taper Cone #169 (or equivalent)	1

REQUIRED MATERIAL	QUANTITY
Toyota Genuine Adhesive 1344, Three Bond 1344, Loctite® 242, or equivalent	As Needed
Toyota Genuine Differential Gear Oil LT SAE 75W-85 API GL-5, or equivalent	1.43 to 1.53 U.S. qts (1.35 to 1.45 liters, 1.18 to 1.27 Imp. qts.)
Power Steering Oil, Dexron II, III, or equivalent	As Needed
MP (Multi-Purpose) Grease	As Needed
0W-20 Synthetic Oil (Only)	6.4 qts

Repair Procedure Overview

1. Check for source of steering flutter — if tires/wheels or other causes are eliminated as the source of flutter, proceed to next step.
2. Remove the steering rack.
3. Replace the rack guide preload spring with updated spring.
4. Check steering rack preload.
5. Reinstall the steering rack.

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Repair Procedure

Preparation: Measuring Balance and RFV

1. Confirm vibration/flutter complaint.
2. Warm up tires to normal operating temperatures to remove cold-soak flat spots. (Drive 10 minutes at 65 mph.)

NOTE

Road test the vehicle at the same speeds and on the same type of road surfaces as the customer complaint.

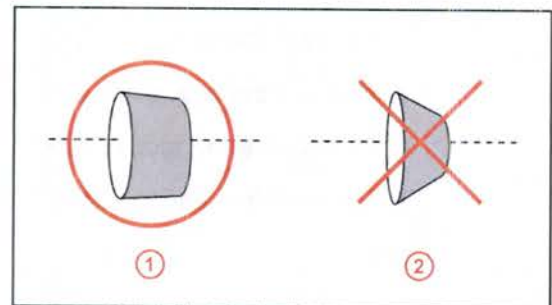
Does vibration/flutter decrease after the tires warm up?

- **YES** — Tires are temporarily flat spotting. This bulletin does NOT apply. Return vehicle to customer.
 - **NO** — Go to step 3.
3. If available, proceed with checking the wheel balance and RFV (Radial Force Variation). Balance the tire and wheel assembly using the correct wheel balance attachments.
 - A. Mount the tire/wheel assembly to the balancer machine as illustrated in Figure 2.

NOTE

When balancing the tire, ensure that the correct cone adapter is being used. Make sure to use a low taper balancer cone.

Figure 1.



1	Low Taper Balancer Cone
2	High Taper Balancer Cone

HINT

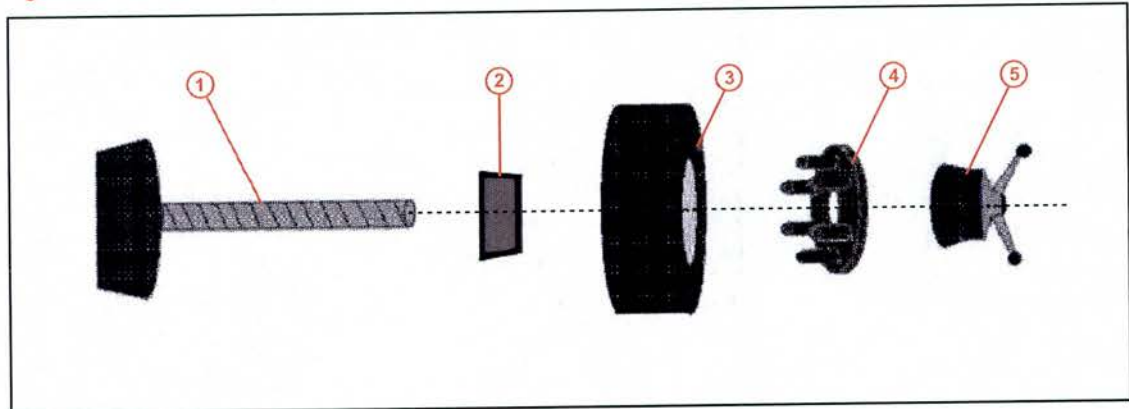
When using the balance machine, turn OFF the Weight Miser®, SmartWeight®, or other similar features for better accuracy.

Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preparation: Measuring Balance and RFV (Continued)

Figure 2.



1	Balancer
2	Low Taper Balancer Cone
3	Outside of Wheel

4	Haweka Adapter
5	Balancer Clamp

Is RFV within acceptable levels?

NOTE

RFV limit is 19 lbs. Be aware that this limit is based on recommendations from automotive industry standards and tire manufacturers. Do NOT use this limit as the only basis for tire replacement.

- **YES** — Continue to next step.
- **NO** — Phase match tires until the wheel tire assembly is within acceptable levels.

NOTE

If root cause was a balance or RFV out of range, use the Op Code listed in the Flat Rate Manual for wheel balance adjustment. Do NOT use the Op Code listed in this bulletin, if the steering control valve preset spring is NOT replaced.

B. Test drive the vehicle again. If a vibration remains, is the vibration/flutter felt primarily through the steering wheel?

- **YES** — Proceed to the next section to replace the power steering control valve preset spring.
- **NO** — Vibration source may be coming from elsewhere. Refer to the Repair Manual to diagnose source of vibration.

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Repair Procedure (Continued)

Power Steering Rack Removal

1. Place the front wheels in a straight ahead position.
2. Use a steering wheel holder to prevent steering wheel from turning.
3. Remove the engine under cover sub-assembly.
4. Remove the front wheels.
5. Remove fan shroud bolts.
6. Remove wiring harness ground bolt and wire harness mount.

Figure 3.



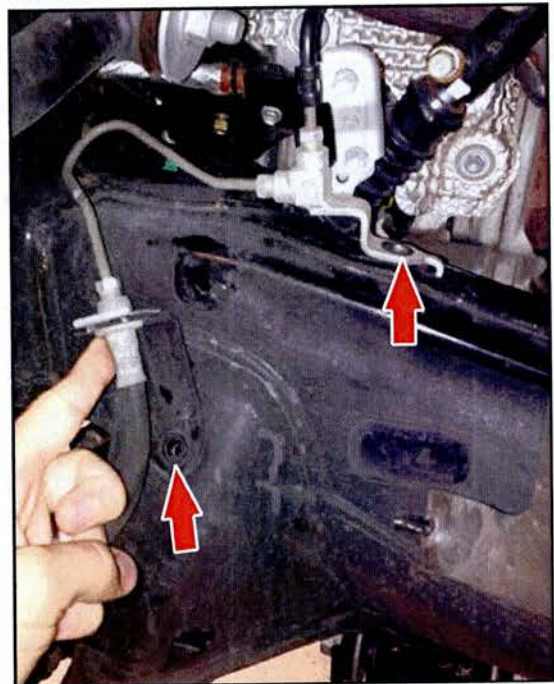
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

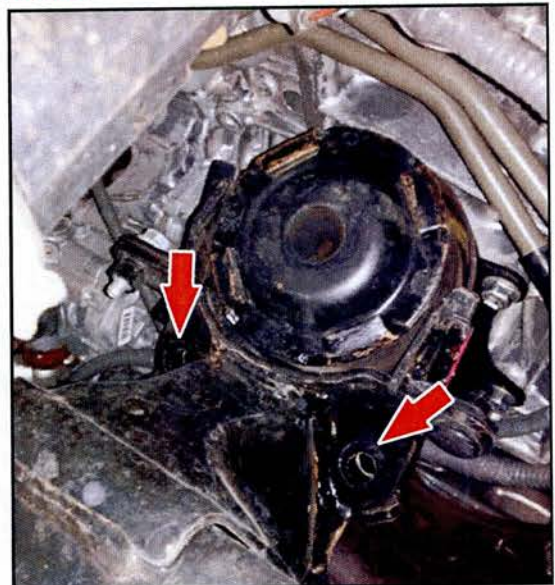
7. Remove brake line mounting bolts and loosen bolts on steering shaft.

Figure 4.



8. Remove 2 motor mount bolts.

Figure 5.



Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

9. Using the utility stand, lift engine/transmission assembly.

NOTICE

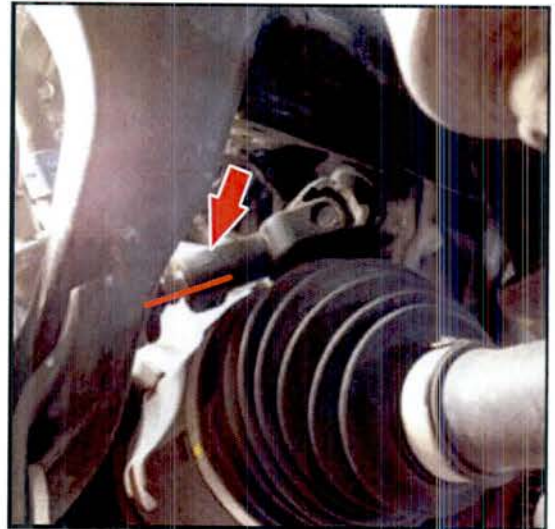
Watch fan and fan shroud clearance to insure shroud is NOT cracked or broken by fan while lifting.

Figure 6.



10. Put matchmarks on the No. 2 steering intermediate shaft and power steering rack to aid during reassembly.

Figure 7. Matchmark



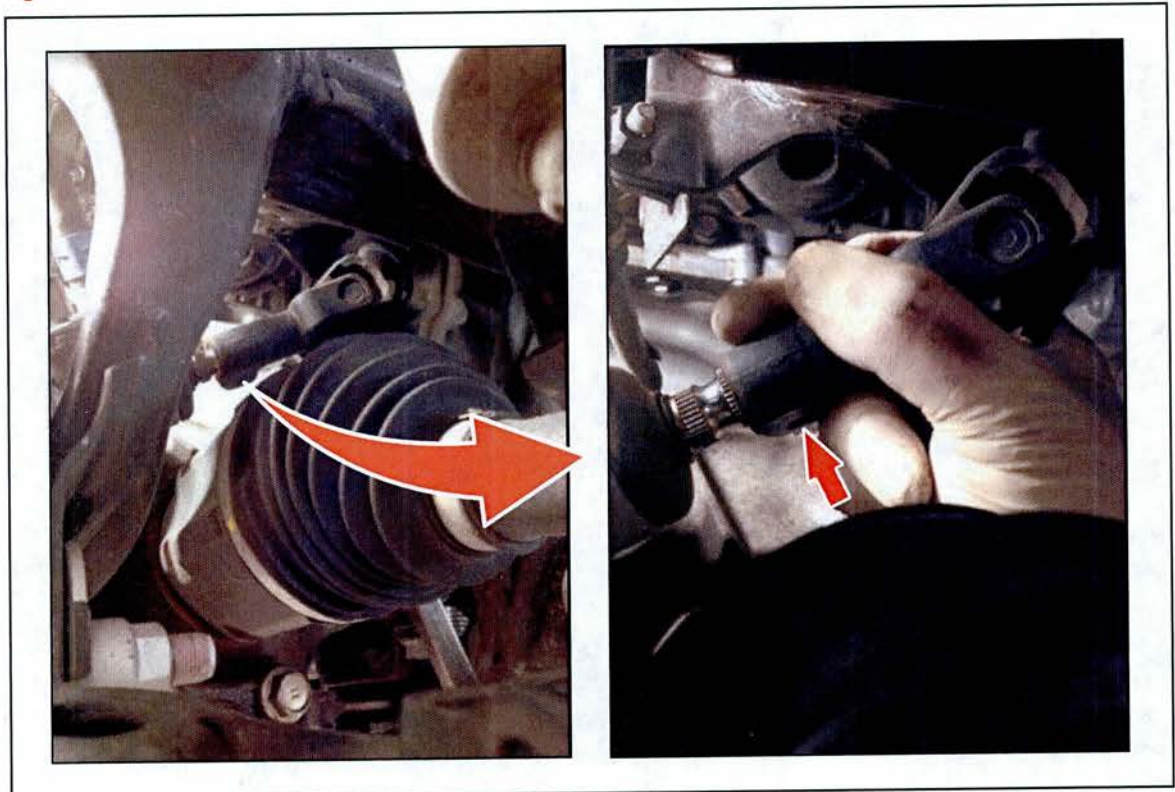
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

11. Remove the pinch bolt that attaches the intermediate shaft to the input shaft of the power steering rack.

Figure 8.



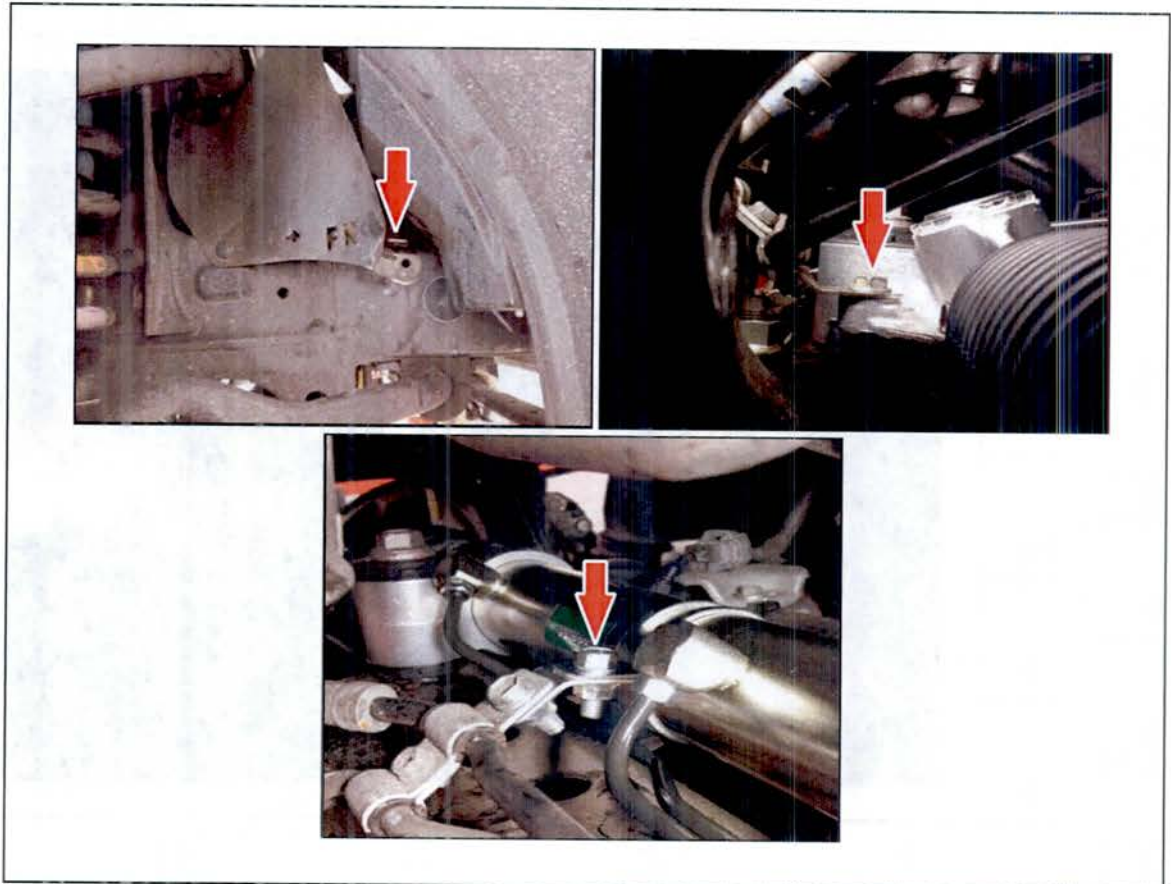
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

12. Remove three bolts securing pressure feed tubes on the steering rack linkage.

Figure 9.



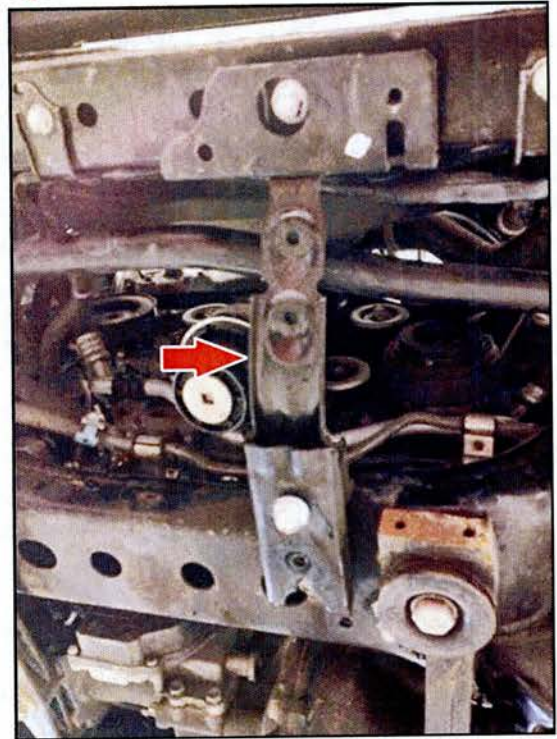
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

13. Remove the engine under cover sub-assembly mounting brackets.

Figure 10.



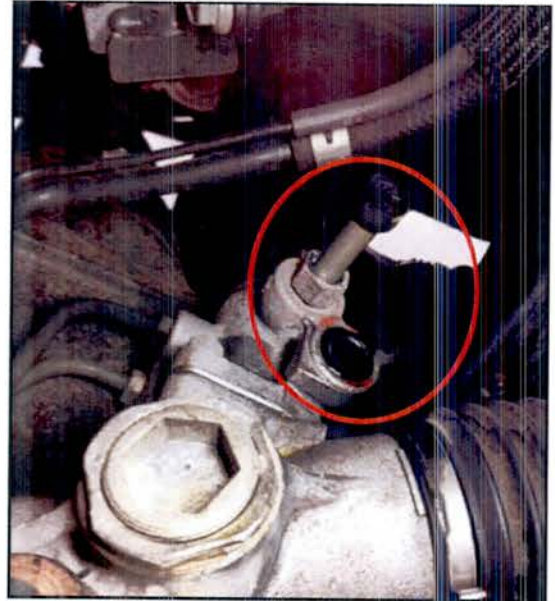
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

14. Remove pressure feed tubes on the steering rack linkage and drain fluid.

Figure 11.



15. Remove tie rod ends from steering knuckles.

Figure 12.



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Repair Procedure

Power Steering Rack Removal (Continued)

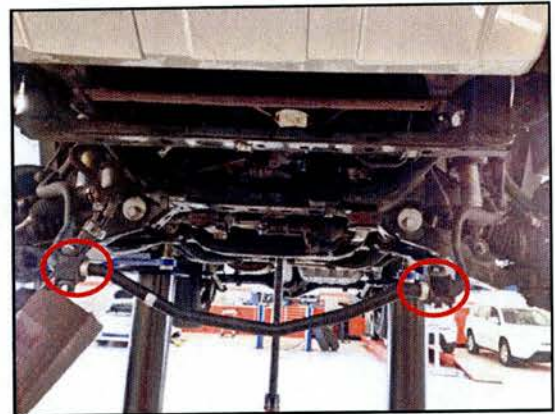
16. Drain the engine oil and remove the oil filter.

Refer to the Technical Information System (TIS), applicable model and model year Repair Manual:

- [2010 / 2011 / 2012 / 2013 FJ Cruiser](#):
Engine/Hybrid System – Lubrication – “1GR-FE Lubrication: Oil and Oil Filter: Replacement”

17. Remove front sway bar mounts.

Figure 13.



18. Remove passenger side sway bar link, then swing sway bar to driver's side.

Figure 14.



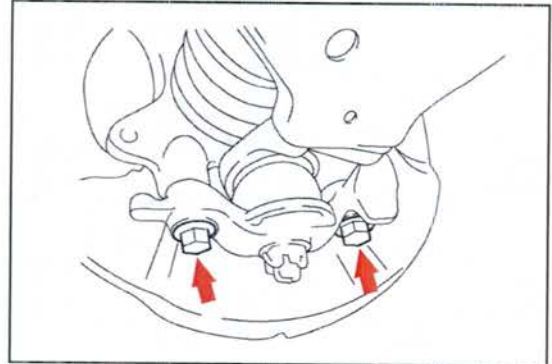
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Power Steering Rack Removal (Continued)

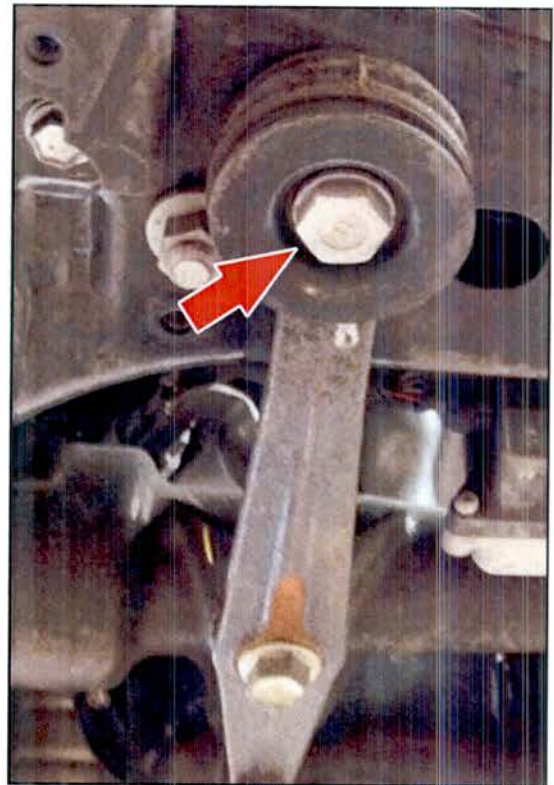
19. Remove passenger side lower control arm bolts.

Figure 15.



20. Remove passenger side third member bolt.

Figure 16.



21. Remove steering rack bolts.
22. Move steering rack over to passenger side, then bring the driver side through the front of the vehicle and pull out rack.

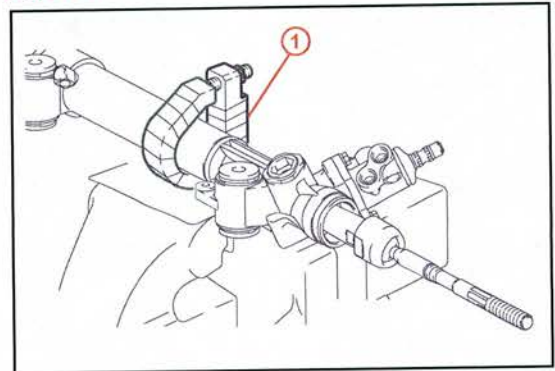
Steering Wheel Flutter at Highway Speeds

Repair Procedure (Continued)

Preload Spring Installation

1. Secure the power steering rack using the SST Rack & Pinion Holding Tool.

Figure 17.



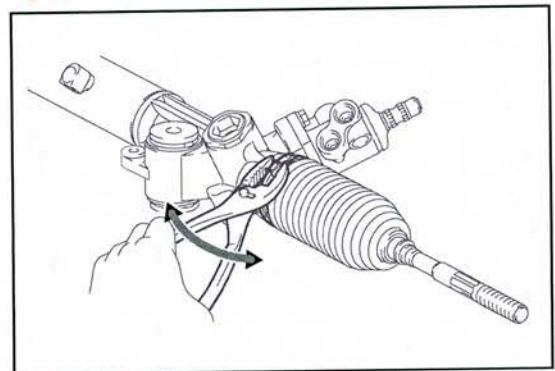
1	Rack & Pinion Holding Tool
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2. Remove the power steering clamp and clip and remove the boot. Repeat for the other side.

NOTE

Boot must be removed to get the most consistent steering rack turning force measurement.

Figure 18.



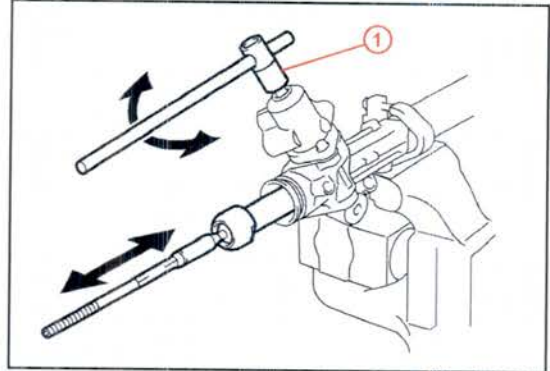
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preload Spring Installation (Continued)

- Remove any remaining power steering fluid by turning the input shaft right and left 10 times.

Figure 19.



1	Steering Worm Gear Adjusting Socket
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- Put matchmarks on the rack guide spring cap and gear box to aid in reinstallation.

Figure 20.



1	Rack Guide Spring Cap
2	Matchmark
3	Gear Box Housing

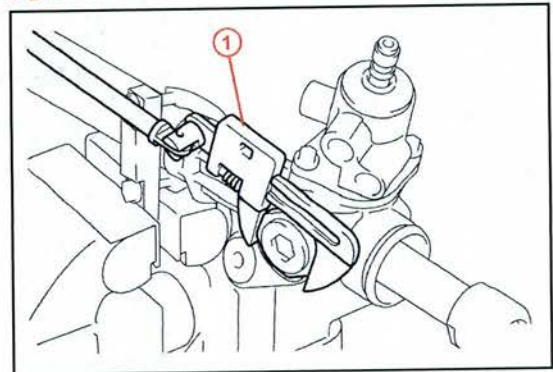
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preload Spring Installation (Continued)

5. Using the SST Variable Open Wrench, remove the lock nut.

Figure 21.

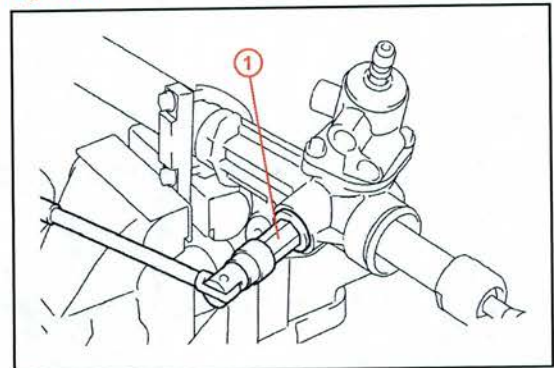


1	Variable Open Wrench
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6. Using a Hex Wrench, remove the rack guide spring cap.

NOTE
Do NOT remove the guide.

Figure 22.



1	Hex Wrench
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7. Remove the original rack guide spring.

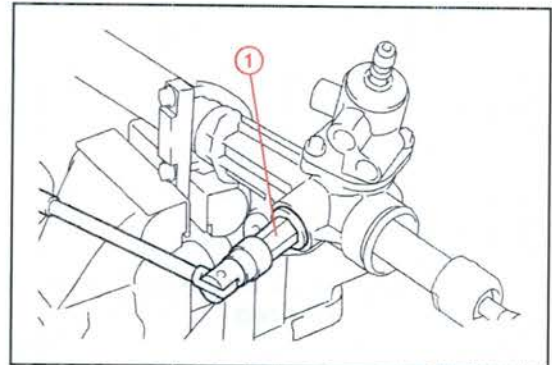
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preload Spring Installation (Continued)

8. Install the updated spring.
9. Apply sealant to 2 – 3 threads of the rack guide spring cap, using the Toyota Genuine Adhesive 1344, Three Bond 1344, Loctite® 242, or equivalent.
10. Apply grease to the spring side of the cap.
11. Temporarily install the cap.

Figure 23.



1	Hexagon Wrench
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12. Turn the power steering gear input shaft right and left 1 – 2 times.
13. Using the Hexagon Wrench, tighten the rack guide spring cap until the matchmarks line up.
14. Apply sealant to 2 – 3 threads of the lock nut, using the Toyota Genuine Adhesive 1344, Three Bond 1344, Loctite® 242, or equivalent.

Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preload Spring Installation (Continued)

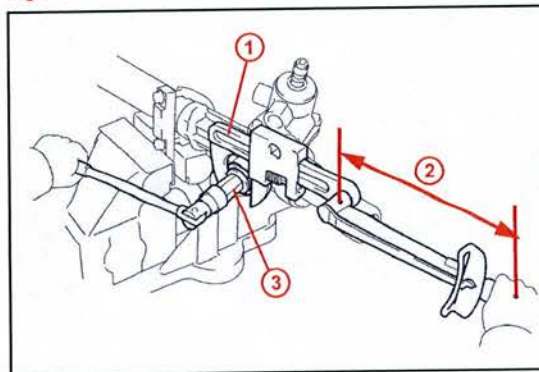
15. Using the Hexagon Wrench, hold the rack guide spring cap and tighten the lock nut.

Torque: 69 N*m (700 kgf*cm, 51 ft*lbf)

NOTE

The matchmarks on the lock nut **DO NOT** necessarily have to line up.

Figure 24.



1	Variable Open Wrench
2	Fulcrum Length
3	Hexagon Wrench

Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preload Spring Installation (Continued)

- Inspect the preload. Using the SSTs Steering Adapter and the Beam Torque Wrench, turn the input shaft.

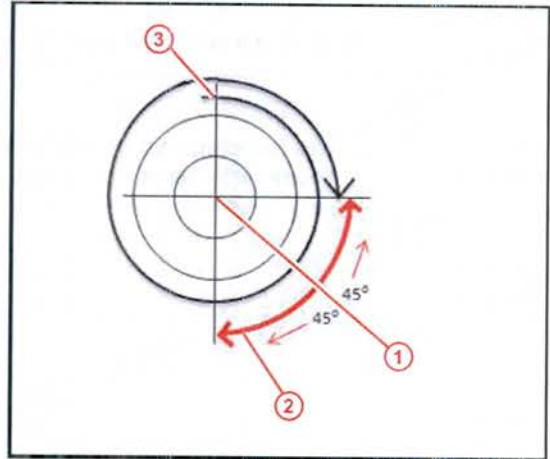
NOTE

- Measure the preload at the same steering rack center point.
- Make sure that the oil ports are not plugged with caps. A plugged oil port will affect the preload torque measurement.

To find the rack center point: the rack must have a preload measurement of 45° in either side of the center point for accurate reading. The center point of the rack is 495° from right or left lock. To reach the starting point of measurement, turn the rack to either left or right lock, then turn rack 1 and 1/4 revolutions. Measure preload for the following 90°.

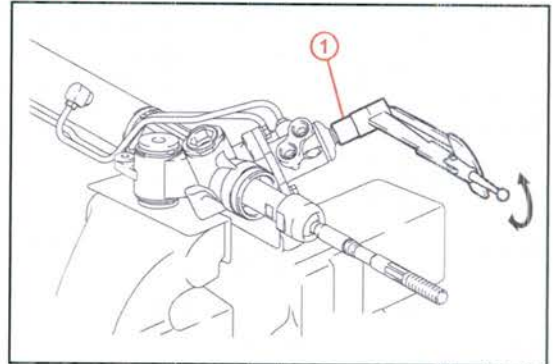
Torque: 2.6 +/- 0.3 N*m (26 kgf*cm, 23 in*lbf)

Figure 25.



1	Center Location of Steering Rack
2	Area of Preload Measurement
3	Start at Steering Lock (Either Side)

Figure 26.



1	Steering Worm Bearing Adjusting Socket
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- Reinstall the steering rack boot.

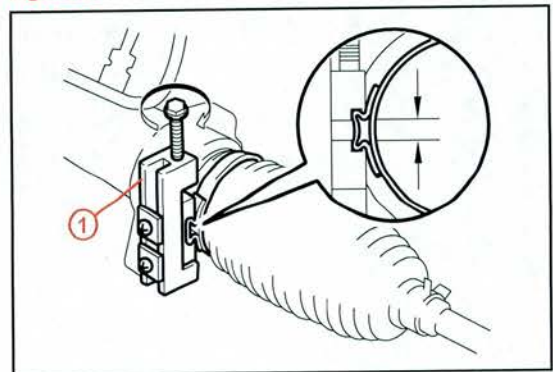
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Preload Spring Installation (Continued)

18. Using SST Drive Shaft Boot Clamping Tool or equivalent, install the NEW boot clamp.

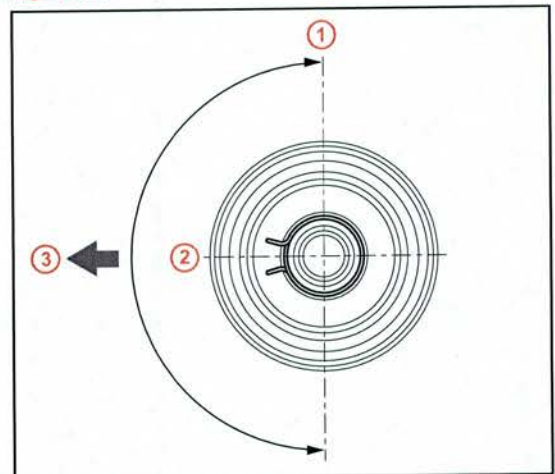
Figure 27.



1	Drive Shaft Boot Clamping Tool (or equivalent)
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19. Using the pliers, install the boot clips with proper orientation.

Figure 28.



1	Upward
2	180°
3	Front of Vehicle

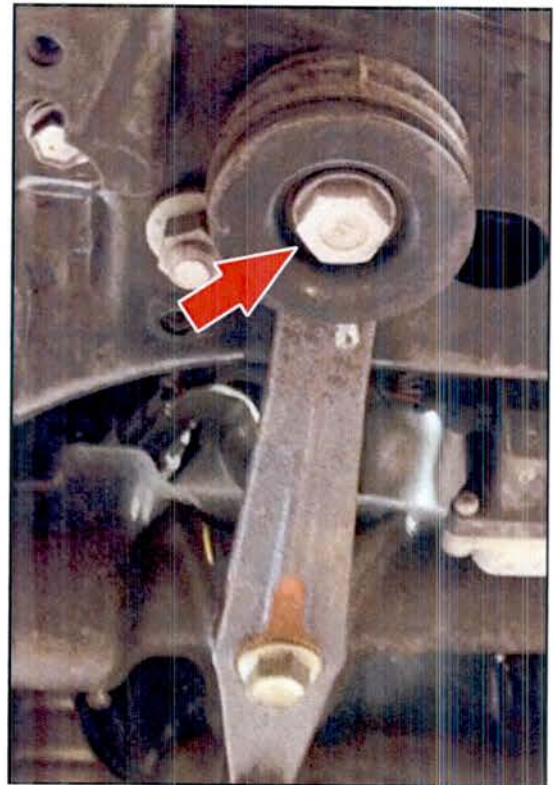
Steering Wheel Flutter at Highway Speeds

Repair Procedure (Continued)

Reinstallation of Steering Rack

1. Reinstall steering rack into vehicle.
2. Reinstall the 2 nuts and bolts that attach the steering rack to the sub-frame.
Torque: 120 N*m (1,224 kgf*cm, 89 ft*lbf)
3. Reinstall passenger side third member bolt.
Torque: 137 N*m (1,400 kgf*cm, 101 ft*lbf)

Figure 29.



4. Reinstall passenger side lower control arm bolts.
Torque: 160 N*m (1,632 kgf*cm, 118 ft*lbf)
5. Reinstall passenger side sway bar end links.
Torque: 70 N*m (714 kgf*cm, 52 ft*lbf)
6. Install the engine oil filter and add engine oil.

Refer to TIS, applicable model and model year Repair Manual:

- [2010](#) / [2011](#) / [2012](#) / [2013](#) FJ Cruiser:
Engine/Hybrid System – Lubrication – “1GR-FE Lubrication: Oil and Oil Filter: Replacement”

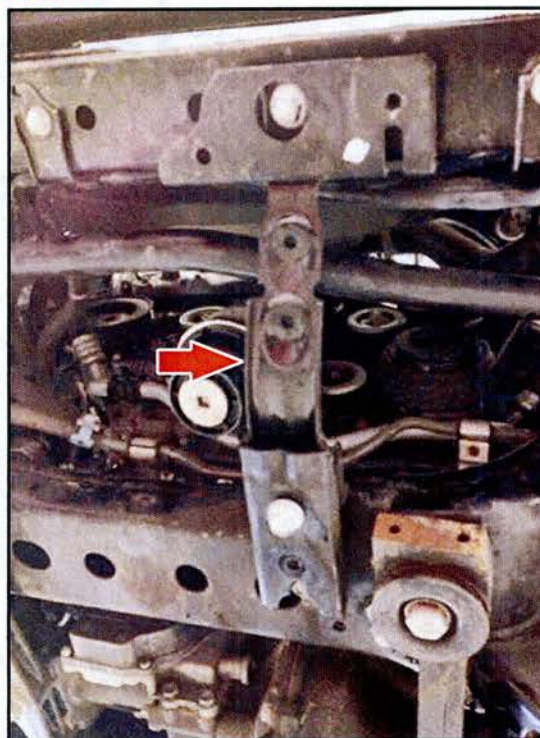
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Reinstallation of Steering Rack (Continued)

7. Reinstall tie rod ends to steering knuckle.
Torque: 91 N*m (928 kgf*cm, 67 ft*lbf)
8. Reconnect the pressure feed tubes on the steering rack linkage.
9. Reinstall the engine undercover mounting brackets.

Figure 30.



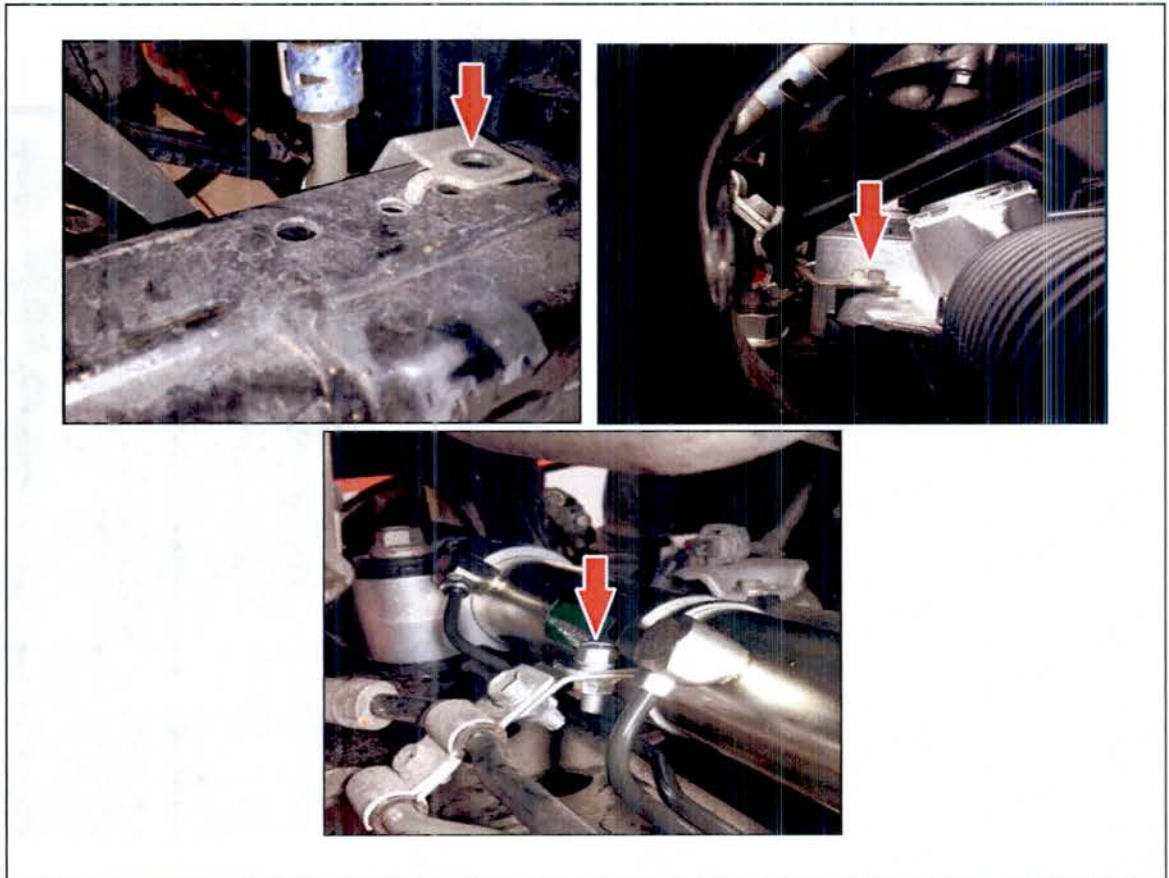
Steering Wheel Flutter at Highway Speeds

Repair Procedure

Reinstallation of Steering Rack (Continued)

10. Reinstall the three bolts securing the pressure feed tubes.

Figure 31.



11. Align the matchmarks on the No. 2 intermediate shaft and power steering rack, and install the bolt.

Torque: 36 N*m (367 kgf*cm, 27 ft*lbf)

Steering Wheel Flutter at Highway Speeds

Repair Procedure

Reinstallation of Steering Rack (Continued)

12. Lower the engine and reinstall the engine mount bolts.
Torque: 57 N*m (581 kgf*cm, 42 ft*lbf)
13. Reinstall the wiring harness ground bolt and wire harness mount.

Figure 32.



14. Reinstall fan shroud bolts.
15. Reinstall the front wheels.
Torque: 112 N*m (1,137 kgf*cm, 82 ft*lbf)
16. Reinstall the engine under cover sub-assembly.
17. Refill the power steering rack oil and bleed as necessary, using the Power Steering Oil, Dexron II, III, or equivalent.

Steering Wheel Flutter at Highway Speeds

Repair Procedure

Reinstallation of Steering Rack (Continued)

18. Perform power steering bleed procedure.
 - A. Check the steering rack fluid level.
 - B. Make sure that the front tires are off the ground.
 - C. With the engine OFF, turn the steering wheel from lock to lock several times.
 - D. Lower the vehicle.
 - E. Start the engine and let it idle for a few minutes.
 - F. Turn the steering wheel from lock to lock holding it at the lock position for 2 – 3 seconds each time.
 - G. Stop the engine and verify that there are no air bubbles in the power steering fluid reservoir.
19. Perform alignment.
20. Test drive vehicle to confirm that the flutter condition has been reduced.