Fuel Tank and Fuel Gauge Diagnostic Tips

Service Category Vehicle Interior

Section Meter/Gauge/Display **Market** USA

Toyota Supports ASE Certification

Applicability

YEAR(S)	MODEL(S)	ADDITIONAL INFORMATION
2004 – 2008	Prius	

Introduction

This TSB explains the design and operational characteristics of the bladder tank and fuel gauge system. Diagnostic tips for the following customer concerns are also included.

- Fuel tank capacity and/or fuel gauge accuracy (Procedure A)
- Difficulty adding fuel (Procedure B)

Warranty Information

OP CODE	DESCRIPTION	TIME	OFP	T1	T2
N/A	Not Applicable to Warranty	–	–	–	–

System Description

Bladder Tank

The Prius features many systems designed to improve its environmental performance. One such system is the vapor reducing fuel tank, sometimes referred to as the “bladder tank”. When a vehicle is driven, refueled, or parked, fuel vapor is generated inside the fuel tank. This vapor is collected and contained in the evaporative charcoal canister. To reduce the amount of vapor generated, the Prius fuel tank utilizes a bladder. The bladder will expand and contract in accordance with the volume of fuel in the fuel storage area of the tank. By reducing the air space above the remaining fuel, less vapor will be generated, and the evaporative performance of the system is improved.

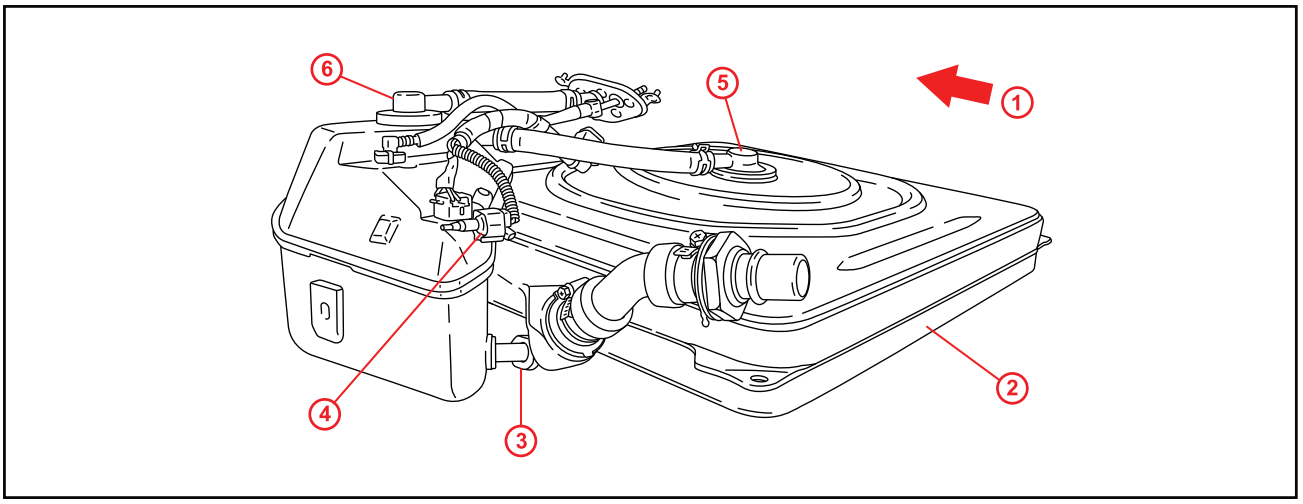
Tank Construction

The fuel tank consists of a steel outer structure that contains a semi-flexible rectangular resin bladder. Fuel is stored in the bladder and is transferred to a smaller rigid sub-tank assembly through a hose located at the bottom center of the bladder. The sub-tank contains the fuel pump, fuel filter, and the fuel level sender. A sensor is located inside the fuel tank to measure the air temperature outside of the bladder. Fuel vapor from the bladder tank vents through a rollover valve (ROV #1) into the sub-tank. A second ROV (ROV #2) vents the vapor out the sub-tank to the charcoal canister.

Fuel Tank and Fuel Gauge Diagnostic Tips

System Description (Continued)

Figure 1. Bladder Tank Construction



1	Front of Vehicle
2	Bladder
3	Fuel Hose from Bladder to Sub-tank

4	Temperature Sensor
5	ROV #1
6	ROV #2

Tank Capacity

Because the bladder is constructed of resin, temperature will affect its flexibility, and therefore, the tank capacity. When cold, the bladder will contract and become more rigid decreasing its volume. As it warms, it will become more flexible allowing it to expand and increase its volume. Because of this characteristic, it is considered normal for refuel capacity to vary with fuel temperature, fuel pump filling rate, and ambient temperature.

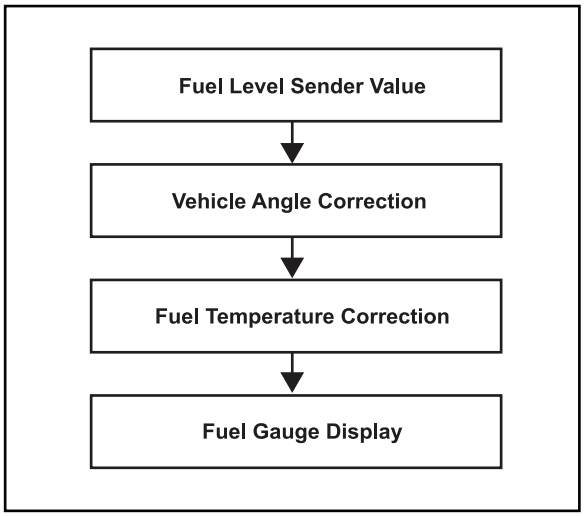
The specified fuel tank capacity is the maximum potential quantity of fuel when it is completely empty to when the bladder is fully expanded. When the fuel level is very low, some fuel may remain in the system that cannot be extracted by the fuel pump because the pickup must be submerged to scavenge fuel. Because of this and varying bladder shape due to temperature conditions, the refuel quantity after the fuel gauge indicates “empty” can be less than the specified tank capacity.

Fuel Tank and Fuel Gauge Diagnostic Tips

System Description (Continued)

Fuel Gauge

The fuel level is calculated by the combination meter ECU using information from the fuel level sender, fuel temperature sensor, and vehicle inclination sensor (located in the combination meter assembly.) The fuel level sensor provides the primary information regarding the approximate fuel level in the bladder by the measuring quantity in the sub-tank. A fuel temperature correction is applied to this value to compensate for the effect of temperature on the bladder. The inclination sensor information is used to compensate for the fuel level changes in the sub-tank caused by the vehicle's stance, front to back and side to side.



When the ignition is ON, the combination meter ECU continuously takes an average of this corrected value over a short period of time and then updates the fuel gauge. These compensations combined with combination meter ECU logic help prevent fuel sender variations due to bladder and vehicle conditions from affecting the fuel gauge display when the fuel quantity has not changed.

NOTE

It is recommended to add a minimum of 3 gallons when refueling. The fuel sender value must increase a sufficient amount for the combination meter ECU to recognize a refuel has occurred. If less than 3 gallons is added, the fuel gauge may NOT change after refueling. See precaution in the Owner's Manual.

Fuel Tank and Fuel Gauge Diagnostic Tips

Diagnostic Tips

BEFORE attempting any repair you **MUST** understand the customer's specific complaint. This will help determine the correct direction of diagnosis or if the vehicle is operating as designed. The following customer information may be very helpful for diagnosis.

- What did the fuel gauge indicate BEFORE refueling?
- How many gallons were able to be added before the pump clicked off?
- What did the fuel gauge indicate AFTER refueling?
- Does the customer fill the tank until full at every refuel or only add partial refuel amounts?

NOTE

If the vehicle is a 2004 model year, confirm TSB No. EL010-04, *"Fuel Gauge Inaccuracy",* was performed CORRECTLY before proceeding with this TSB. Review the diagrams of the check valve and inlet seal installations. Repair any problems found and reevaluate the condition. If this does NOT correct the condition, continue with this TSB diagnosis.

During refuel, does the vehicle accept several gallons before the fuel nozzle shuts off?

YES — The issue is possibly related to fuel gauge accuracy. Continue with Procedure A.

NO — The issue is possibly related to the Fuel Tank or EVAP system operation. Continue with Procedure B.

Procedure A: Fuel Gauge Accuracy

Confirm the current fuel tank level and fuel gauge value.

1. Park the vehicle on a level surface.
2. Record the current fuel gauge value on the combination meter.
3. Access the F14 connector on the top of the fuel tank

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

   2004 or 2005 Prius, *Vehicle Interior – Meter/Gauge/Display – "Combination Meter: Malfunction in Fuel Receiver Gauge"*

   2006 / 2007 / 2008 Prius, *Vehicle Interior – Meter/Gauge/Display – "Meter: Meter/Gauge System: Fuel Receiver Gauge Malfunction"*

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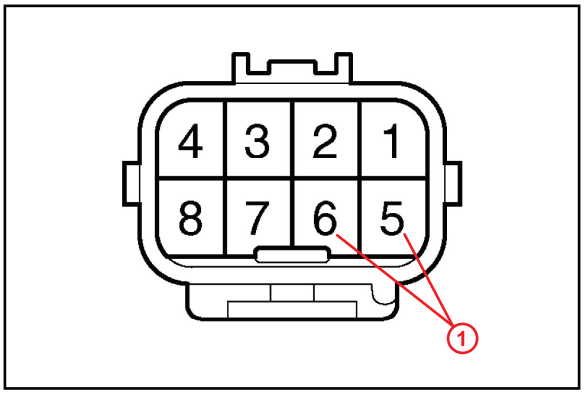
Procedure A: Fuel Gauge Accuracy (Continued)

4. With the Ignition OFF, disconnect connector F14 and measure the fuel sender resistance on the fuel tank side of the connector (terminals 5 & 6).

Figure 2. Fuel Tank Side of Connector



1	Resistance (Ω)

5. Does the sender resistance match the fuel gauge display per the resistance table?

FUEL GAUGE DISPLAYED VALUE (BARS)	APPROXIMATE SENDER RESISTANCE (Ω)
10	4 – 36
9	36 – 45
8	45 – 52
7	52 – 58
6	58 – 65
5	65 – 72
4	72 – 78
3	78 – 85
2	85 – 91
1	91 – 110

YES — The system is operating as designed and NO repair should be attempted. Explain system operation to the customer.

NO — Reset the fuel gauge and re-evaluate.

To reset the fuel gauge, follow the steps below.

A. With the ignition OFF, remove the DOME fuse for 10 seconds.

B. Replace the fuse, then turn the ignition ON.

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Procedure A: Fuel Gauge Accuracy (Continued)

C. Does the sender resistance match the fuel gauge display per the resistance table?

NOTE

Due to temperature and vehicle angle it may be normal for the fuel gauge display to change approximately one bar higher or lower after resetting.

YES — The fuel gauge displayed value may have been affected by insufficient refuel quantity. Review the minimum refuel quantity with the customer as outlined in the Owner's Manual and also mentioned in this bulletin, in the Note in the *"Fuel Gauge"* section under *"Description: Bladder Tank & Fuel Gauge System"*. NO further repair is necessary.

NO — Continue with diagnosis of the fuel gauge system. Refer to the Repair Manual as necessary.

Fuel Gauge Hints

- The inclination sensor reset procedure found in the Repair Manual should ONLY be done if the combination meter was removed from the vehicle during service or if it was previously done incorrectly (for example: the inclination sensor reset was performed on an unconfirmed surface).

IMPORTANT

- **The Inclination Sensor reset procedure establishes a reference for what the vehicle considers a level surface. It does NOT cause the fuel gauge to fully recalculate the fuel gauge value the same as the DOME fuse removal procedure.**
- **Resetting the inclination sensor must be done on a very level surface (+/- 0.3° front to back, side to side). Perform the reset on an alignment rack if possible. A service bay floor should NOT be considered a perfectly level surface unless verified.**

- If the customer complains that after refueling the fuel gauge stays full for an abnormally long time then drops suddenly, check for correct rollover valve installation as shown in TSB No. EL010-04, *"Fuel Gauge Inaccuracy"*.

NOTE

Incorrect rollover valve installation should ONLY need to be considered if the fuel filler pipe was replaced per TSB instructions (2004 model year) or if the rollover valve was removed in past diagnosis or service (all model years).

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Procedure B: Refueling Issues

Follow this procedure if the customer complains of a difficult-to-fill condition NOT related to fuel gauge operation. With a fuel system refueling concern, the customer may also state the vehicle will only accept fuel if pumped very slowly.

HINT

- **Have the customer bring the vehicle in for inspection when it is low on fuel, to verify the refueling complaint.**
- **DO NOT suggest refueling using the lowest setting on the fuel nozzle. This can cause overfilling and possible damage to the EVAP system.**

1. Review the customer complaint.

   Does the difficult-to-fill condition occur at every refuel or at any fuel station?

   YES — Diagnose a possible restriction or blockage in the fuel or EVAP system.

   NO — The concern may be related to incorrect refueling procedures. Confirm the customer's refueling methods before attempting any further diagnosis.

Diagnosis and Refueling Tips

- Inspect the filler neck including all the pipes and hoses of the system for blockage or restrictions.
- Inspect the correct orientation of the rollover valve and the inlet seal w/retainer installation in the filler neck opening per TSB No. EL010-04, *"Fuel Gauge Inaccuracy".*
- If having difficulty getting the vehicle to accept fuel, starting the pump nozzle on a lower flow setting then increase the pump speed to its maximum. Allow the fuel tank to fill until the fuel nozzle shuts off by itself. Do NOT "top off" the fuel tank.