



# KDSS Bleeding Procedure

## Quick Training Guide – QT413A

This guide describes the Kinetic Dynamic Suspension System (KDSS) and how to use the High Pressure Oil Pump SST to properly bleed the system.



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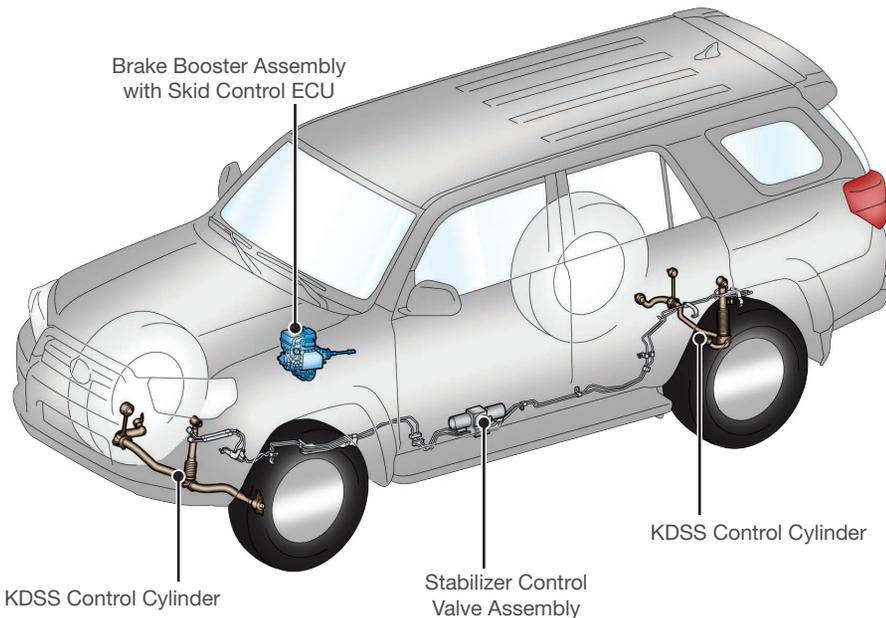
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### What is KDSS?

The Kinetic Dynamic Suspension System (KDSS) is an electronically-modulated suspension system designed to improve off-road handling. When operating, this system suppresses stabilizer bar operation to improve wheel articulation during off-road driving, and to smooth the ride on bumpy roads.

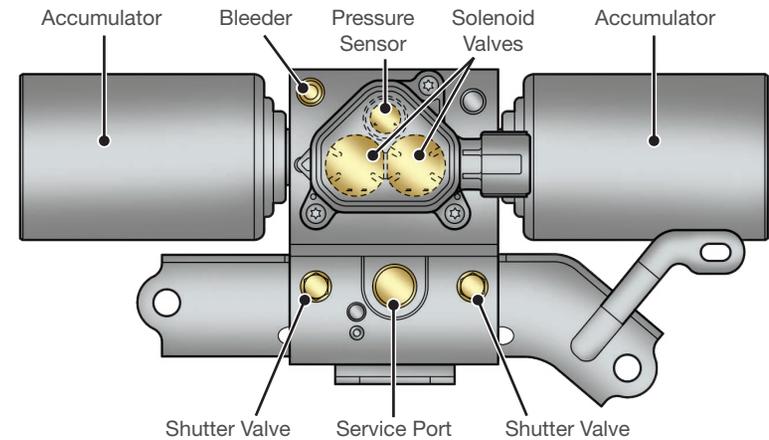
The major components of the system are:

- Stabilizer Control ECU
- Stabilizer Control Valve Assembly
- KDSS Control Cylinders for each stabilizer bar



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### Stabilizer Control Valve Assembly<sup>1</sup>



Description

Operation

Accumulator Pressure Sensor	<ul style="list-style-type: none"> <li>• Detects the hydraulic pressure and transmits its signal to the Stabilizer Control ECU</li> </ul>
Stabilizer Control Solenoid Valve	<ul style="list-style-type: none"> <li>• Opens and closes the piping between each stabilizer control cylinder chamber and its respective accumulator</li> </ul>
Accumulators	<ul style="list-style-type: none"> <li>• Absorb the pressure from the Front Stabilizer Control Cylinder and Rear Stabilizer Control Cylinder</li> </ul>
Shutter Valves	<ul style="list-style-type: none"> <li>• Open and close the passages to the service port</li> </ul>
Service Port	<ul style="list-style-type: none"> <li>• Allows for filling the system with hydraulic fluid</li> </ul>

<sup>1</sup>Components may vary by model. 4Runner shown.

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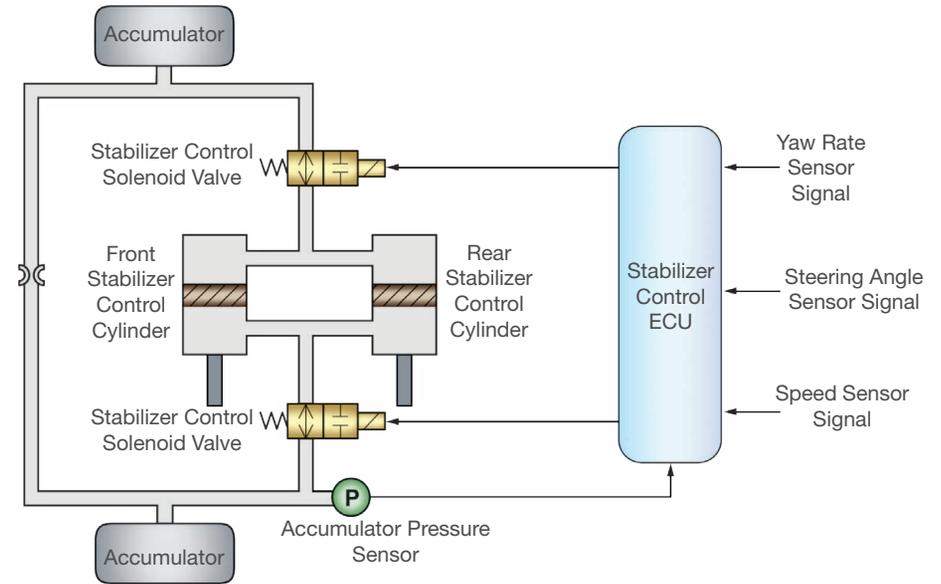
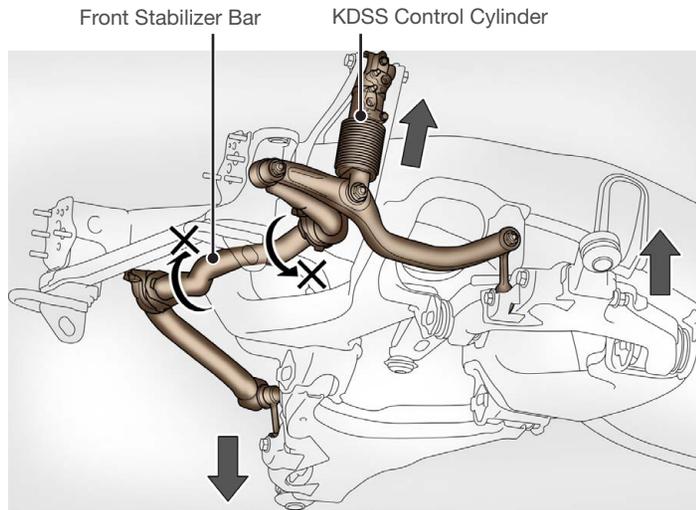
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### How KDSS Works

When the piston in the KDSS Control Cylinder is permitted to move, it effectively disconnects the stabilizer bar. This is illustrated in the figure below for the front stabilizer bar<sup>1</sup>.

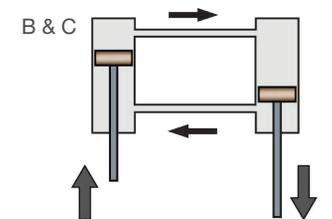
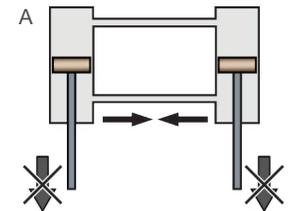
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The Stabilizer Control Solenoid Valves control the operation of the Control Cylinders. The valves always switch at the same time and in the same direction.

- When the valves are opened, chambers in the Control Cylinders are connected to the accumulators
- The accumulators absorb pressure changes allowing the pistons in the cylinders to move
- The solenoids are controlled by the Stabilizer Control ECU, based on inputs from the Skid Control ECU

- During on-road cornering, both Stabilizer Control Solenoid Valves are closed, preventing movement of the hydraulic cylinder pistons.
- When driving on bumpy roads, the Stabilizer Control Solenoid Valves open, allowing the hydraulic cylinder pistons to move somewhat, while the accumulators absorb the pressure.
- During off-road driving the Stabilizer Control Solenoid Valves open, allowing the fluid to freely flow between the front and rear chambers, effectively disconnecting the stabilizer bars.



<sup>1</sup>Land Cruiser shown.

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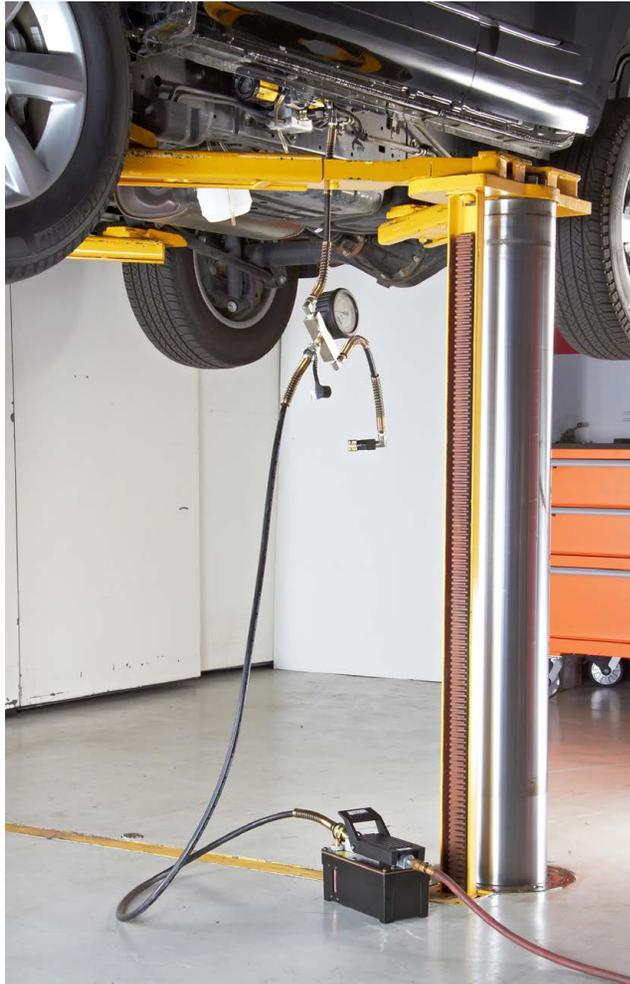
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High Pressure Oil Pump Connected to Vehicle

### Service Preparation

#### High Pressure Oil Pump (SST 09760-60020)

A High Pressure Oil Pump SST is required for adding fluid to the system and for air bleeding.

- Prior to the oil pump's first use, separate the fluid reservoir from the pump, and remove and discard the rubber priming cap from the pump inlet.



#### Suspension Fluid AHC (P/N 08886-01805)

When bleeding air, approximately 6 liters of Suspension Fluid AHC are needed to completely fill the system.



There is no substitute for Suspension Fluid AHC.

### Precautions

The KDSS hydraulic system is under high pressure (approximately 3 MPa or 435 psi).



- Before servicing the system, be sure to check the pipe connections and whether or not any hydraulic circuit parts are damaged
- If a fluid leak is discovered, **immediately** release the pressure and repair the fluid leak
- If hydraulic system components need to be disconnected or removed, always bleed pressure using the bleeder on the Stabilizer Control Valve Assembly

When components are disconnected, always keep them covered and protected to prevent the entry of dirt or other foreign matter into the system.

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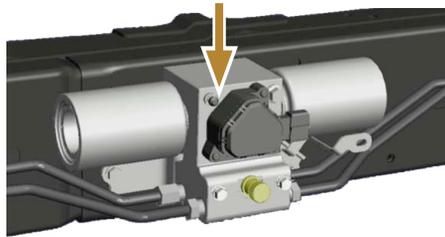
### Overview of Service Procedures

Below is a summary of the procedures for bleeding the KDSS suspension system. **Each of these procedures** is explained in detail on the following pages.

**Note** These are the procedures for the 4Runner. The procedures for the Land Cruiser, while similar in concept, **are not exactly the same**. Consult the Repair Manual whenever performing service on the KDSS system.

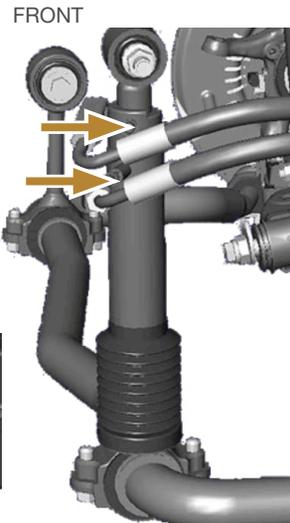
#### Procedure #1: Leak Check

1. Connect the SST.
2. Pressurize the system.
3. Check for leaks.

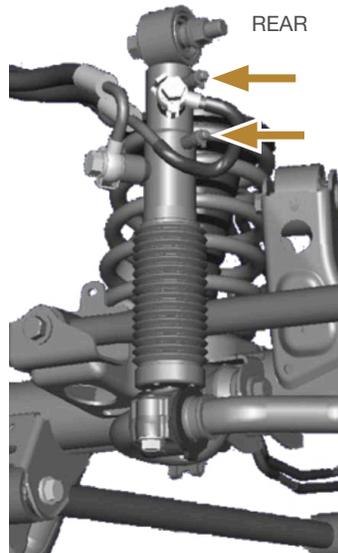


#### Procedure #2: Fill and Bleed the System (5 MPa)

1. Add fluid to the Stabilizer Control Valve Assembly.
2. Add fluid to the lower chamber of the Front Stabilizer Control Cylinder.
3. Add fluid to the upper chamber of the Front Stabilizer Control Cylinder.
4. Add fluid to the lower chamber of the Rear Stabilizer Control Cylinder.
5. Add fluid to the upper chamber of the Rear Stabilizer Control Cylinder.
6. Repeat steps 1 through 5 until no more air comes out of the bleeder plugs.



→ **Bleeder Plugs**



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#### Procedure #3: Bleed the Upper Half of the System (7 MPa)

1. Bleed the Stabilizer Control Valve Assembly.
2. Bleed the upper half of the Front Stabilizer Control Cylinder.
3. Bleed the upper half of the Rear Stabilizer Control Cylinder.

#### Procedure #4: Bleed the Lower Half of the System (7 MPa)

1. Disconnect the Front Stabilizer Control Cylinder.
2. Disconnect the Rear Stabilizer Control Cylinder.
3. Bleed the lower half of the Front Stabilizer Control Cylinder.
4. Bleed the lower half of the Rear Stabilizer Control Cylinder.

#### Procedure #5: Adjust the Hydraulic Pressure

1. Reconnect the Front and Rear Stabilizer Control Cylinders.
2. Adjust the hydraulic pressure. (2.6 to 3 MPa (377 – 435 psi @ 68°F))

#### Procedure #6: Check/Adjust Vehicle Ride Height

1. Check the vehicle ride height and adjust if needed.
2. Disconnect the SST.

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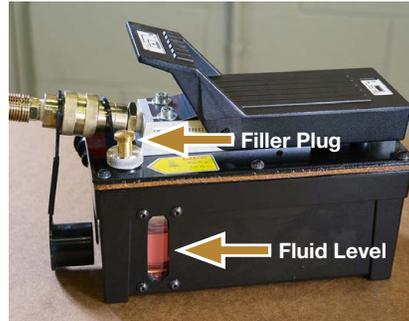
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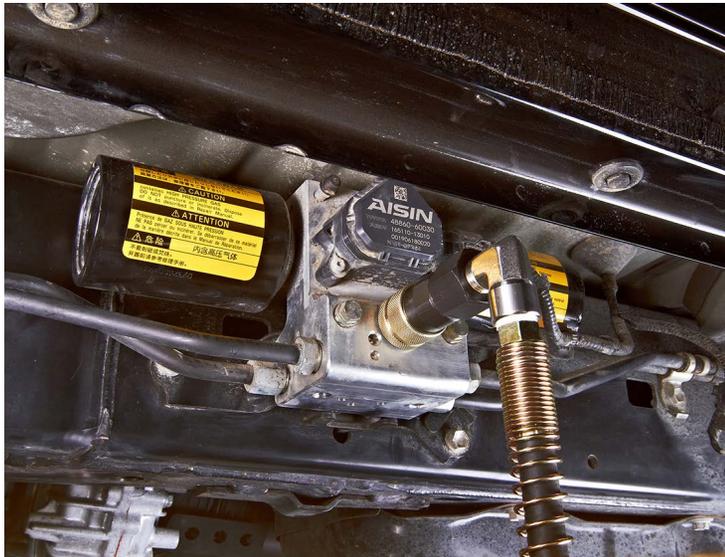
### Procedure #1: Leak Check

#### Step 1. Connect the SST

- Add new fluid to the SST.
- Remove the Stabilizer Control Valve Assembly protector cover.
- Remove the cap from the service port on the Stabilizer Control Valve Assembly and connect the SST.
  - Connect either one of the hoses to the service port<sup>1</sup>
  - Fluid will not be expelled from the unconnected hose



**Note** It may be necessary to remove the Step Side Assembly in order to attach the SST.

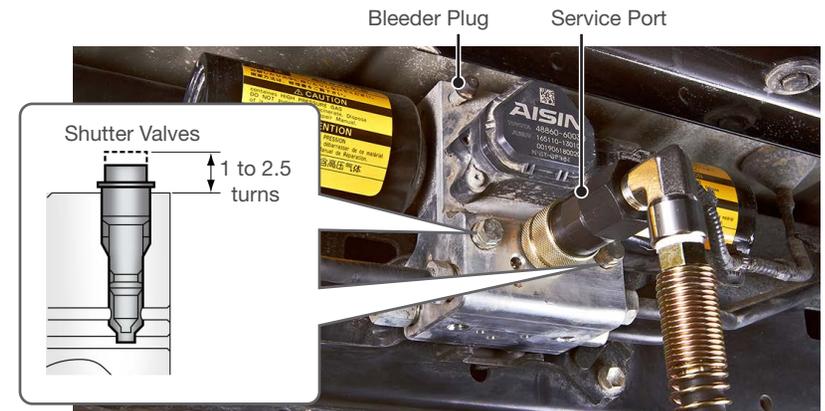


<sup>1</sup>14Runner shown. The Land Cruiser has 2 service ports.

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#### Step 2. Pressurize the System

- Loosen the 2 shutter valves on the Stabilizer Control Valve Assembly.
  - Do not loosen the shutter valves more than 1 to 2.5 turns. Excessive loosening or removing the shutter valves will allow fluid to spray out and air to enter the system.



**Tip** The Land Cruiser Repair Manual also lists the amount that the shutter valve should protrude.

- Open the vent valve on the SST pump filler plug.

Adjust pressure to 5 MPa

- Apply pressure with the SST until the pressure reaches 5 MPa (725 psi).
  - Do not allow the pressure to reach 8 MPa (1160 psi) as this could damage the accumulators



725 psi

#### Step 3. Check for Leaks

If a fluid leak is discovered, immediately release the pressure and repair the leak.

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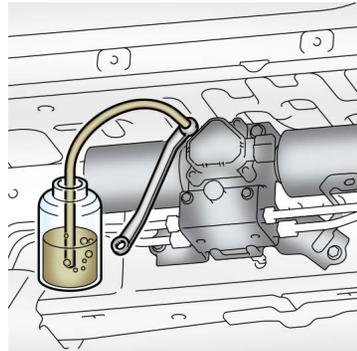
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### Procedure #2<sup>1</sup>: Fill and Bleed the System (5 MPa)

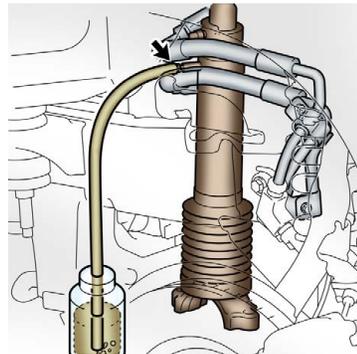
#### Step 1. Add Fluid to the Stabilizer Control Valve Assembly

- Loosen the bleeder plug on the Stabilizer Control Valve Assembly.
- Pump the SST and maintain a pressure of 5 MPa (725 psi) **until air stops coming out.**
- Tighten the bleeder plug.



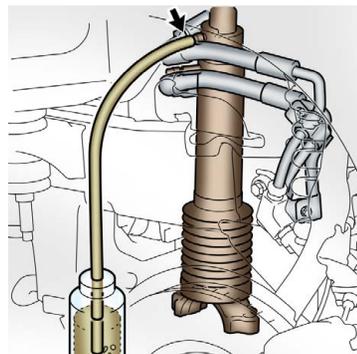
#### Step 2. Add Fluid to the Lower Chamber of the Front Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 5 MPa (725 psi).
- Loosen the lower chamber bleeder plug on the Front Stabilizer Control Cylinder.
- Pump the SST and maintain a pressure of 5 MPa (725 psi) **until air stops coming out.**
- Tighten the bleeder plug.



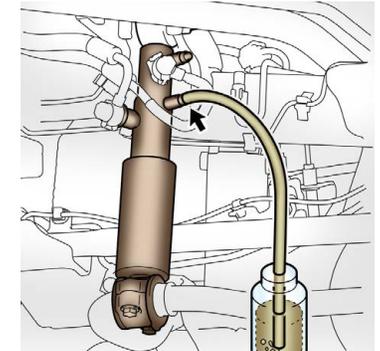
#### Step 3. Add Fluid to the Upper Chamber of the Front Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 5 MPa (725 psi).
- Loosen the upper chamber bleeder plug on the Front Stabilizer Control Cylinder.
- Pump the SST and maintain a pressure of 5 MPa (725 psi) **until air stops coming out.**
- Tighten the bleeder plug.



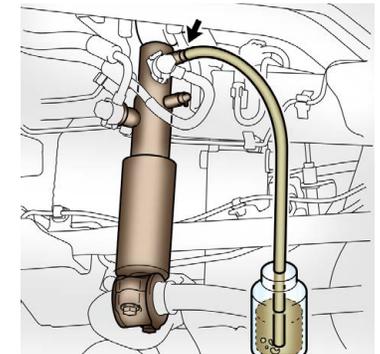
#### Step 4. Add Fluid to the Lower Chamber of the Rear Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 5 MPa (725 psi).
- Loosen the lower chamber bleeder plug on the Rear Stabilizer Control Cylinder.
- Pump the SST and maintain a pressure of 5 MPa (725 psi) **until air stops coming out.**
- Tighten the bleeder plug.



#### Step 5. Add Fluid to the Upper Chamber of the Rear Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 5 MPa (725 psi).
- Loosen the upper chamber bleeder plug on the Rear Stabilizer Control Cylinder.
- Pump the SST and maintain a pressure of 5 MPa (725 psi) **until air stops coming out.**
- Tighten the bleeder plug.



#### Step 6. Repeat Steps 1 through 5

- Repeat steps 1 through 5 until no more air comes out.



Frequently check the pump SST fluid level window for proper fluid level.

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<sup>1</sup>Runner shown.

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### Procedure #3<sup>1</sup>: Bleed the Upper Half of the System (7 MPa)

#### Step 1. Bleed the Stabilizer Control Valve Assembly

- Pump the SST until the pressure reaches 7 MPa (1015 psi).
- Loosen the bleeder plug on the Stabilizer Control Valve Assembly to bleed the air.
- When the air stops coming out tighten the bleeder plug so pressure can be reapplied.
- Repeat steps a through c** until air stops coming out.
- Tighten the bleeder plug.

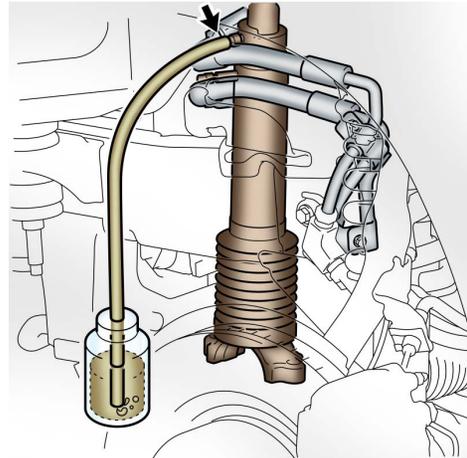
Adjust pressure to 7 MPa



1015 psi

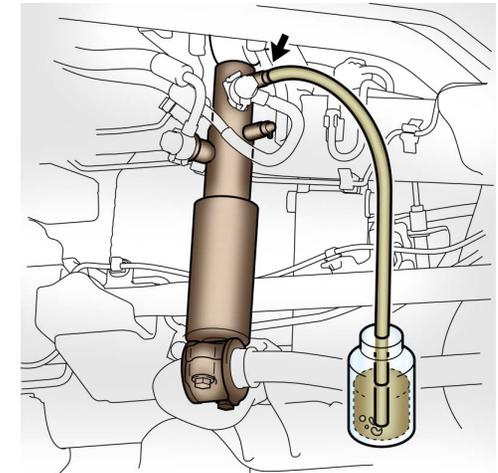
#### Step 2. Bleed the Upper Chamber of the Front Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 7 MPa (1015 psi).
- Loosen the upper chamber bleeder plug on the Front Stabilizer Control Cylinder to bleed the air.
- When the air stops coming out tighten the bleeder plug so pressure can be reapplied.
- Repeat steps a through c** until air stops coming out.
- Tighten the bleeder plug.

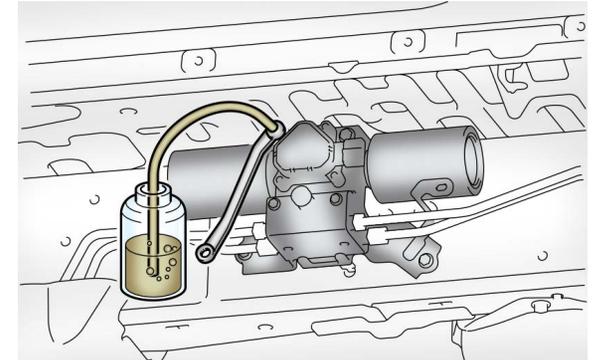


#### Step 3. Bleed the Upper Chamber of the Rear Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 7 MPa (1015 psi).
- Loosen the upper chamber bleeder plug on the Rear Stabilizer Control Cylinder to bleed the air.
- When the air stops coming out tighten the bleeder plug so pressure can be reapplied.
- Repeat steps a through c** until air stops coming out.
- Tighten the bleeder plug.



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<sup>1</sup>4Runner shown.

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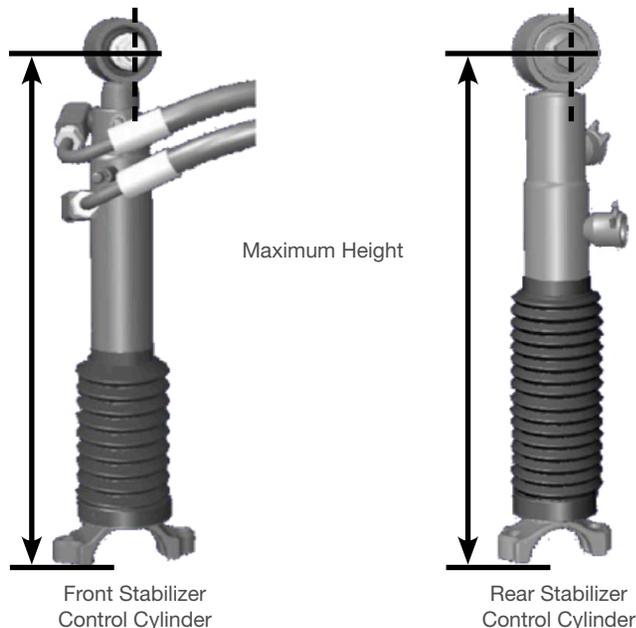
### Procedure #4<sup>1</sup>: Bleed the Lower Half of the System (7 MPa)

#### Step 1. Disconnect the Front Stabilizer Control Cylinder

- Disconnect the front stabilizer control arm and the front stabilizer link.
- Set the Front Stabilizer Control Cylinder to the maximum length to completely bleed the air.
  - 4Runner: 16.2 to 16.4 inches
  - Land Cruiser: 13.4 to 13.6 inches

#### Step 2. Disconnect the Rear Stabilizer Control Cylinder

- Disconnect the rear stabilizer control arm and the rear stabilizer link.
- Set the Rear Stabilizer Control Cylinder to the maximum length to completely bleed the air.
  - 4Runner: 15.2 to 15.4 inches
  - Land Cruiser: 13.1 to 13.3 inches

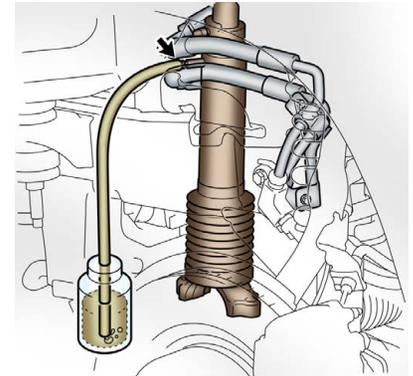


<sup>1</sup>4Runner shown.

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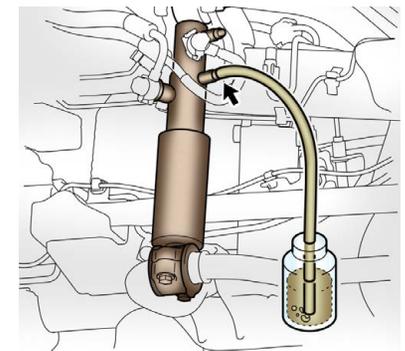
#### Step 3. Bleed the Lower Chamber of the Front Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 7 MPa (1015 psi).
- Loosen the lower chamber bleeder plug on the Front Stabilizer Control Cylinder to bleed the air.
- When the air stops coming out tighten the bleeder plug so pressure can be reapplied.
- Repeat steps a through c** until air stops coming out.
- Tighten the bleeder plug.



#### Step 4. Bleed the Lower Chamber of the Rear Stabilizer Control Cylinder

- Pump the SST until the pressure reaches 7 MPa (1015 psi).
- Loosen the lower chamber bleeder plug on the Rear Stabilizer Control Cylinder to bleed the air.
- When the air stops coming out tighten the bleeder plug so pressure can be reapplied.
- Repeat steps a through c** until air stops coming out.
- Tighten the bleeder plug.



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### Procedure #5: Adjust the Hydraulic Pressure (approx. 3 MPa)

#### Step 1. Reconnect the Stabilizers

- Reconnect the front stabilizer control arm and the front stabilizer link.
- Reconnect the rear stabilizer control arm and the rear stabilizer link.

#### Step 2. Adjust the Hydraulic Pressure

- With all the wheels on the ground, adjust the hydraulic pressure as specified in the Repair Manual.
- Maintain this pressure for 2 to 3 minutes to allow the pressure to stabilize.

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Adjust pressure to approx. 2.6-3.0 MPa\*



\* The specific pressure varies depending on the fluid temperature. Refer to the specifications in the Repair Manual.

Approx. 377 - 435 psi

### KDSS System Pressure Specifications

4Runner <sup>1</sup>		
Fluid Temperature	Pressure	
(°F)	MPa	psi
32	2.46 – 2.50	357 – 363
41	2.53 – 2.59	367 – 376
50	2.60 – 2.67	377 – 387
59	2.67 – 2.76	387 – 400
68	2.75 – 2.85	399 – 413
77	2.82 – 2.95	409 – 428
86	2.90 – 3.05	421 – 442
95	2.98 – 3.16	432 – 458
104	3.06 – 3.27	444 – 474
113	3.14 – 3.38	455 – 490

Land Cruiser <sup>1</sup>		
Fluid Temperature	Pressure	
(°F)	MPa	psi
32 to 43	2.4 – 2.6	348 – 377
44 to 45	2.6	377
46 to 59	2.6 – 2.8	377 – 406
59 to 63	2.6 – 3.0	377 – 435
63 to 72	2.8 – 3.0	406 – 435
72 to 81	2.8 – 3.2	406 – 464
81 to 82	3.0 – 3.2	435 – 464
82 to 91	3.0 – 3.4	435 – 493
91 to 97	3.0 – 3.6	435 – 522
97 to 100	3.2 – 3.6	464 – 522
100 to 108	3.2 - 3.8	464 - 551
108 to 113	3.2 - 4.0	464 – 580

<sup>1</sup>The pressure/temperature chart is at the end of the bleeding instructions.

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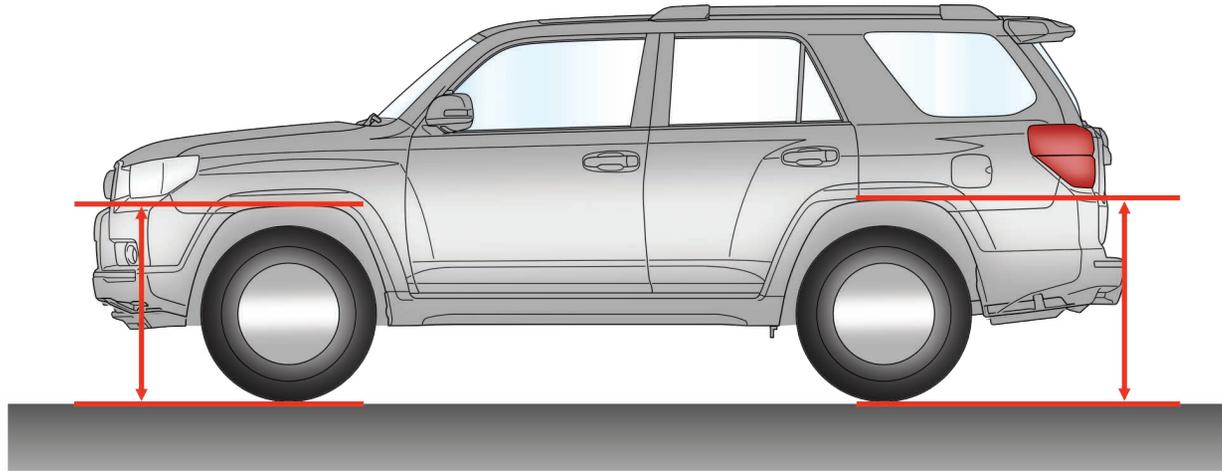
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### Procedure #6: Check/Adjust Vehicle Ride Height

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Verify that the difference in vehicle height between the right and left sides is within 20mm (0.76 in.).

#### Step 1. Check Vehicle Ride Height and Adjust If Needed

- a. Perform the inspection with:
  - Vehicle empty
  - Fuel tank full
  - Tires at correct pressure, facing straight ahead, on a flat surface
  - Vehicle load completely on the suspension
- b. Bounce the vehicle to stabilize the suspension.
- c. Measure the distance from the ground to the top of the wheel well arch and calculate the difference in height between the left and the right.
- d. Perform this procedure for both the front and rear wheel wells and verify that the difference in vehicle height between the right and left sides is within 20mm (0.76 in.).

- e. If the vehicle height is uneven:
  - Verify both shutter valves have been loosened 1 to 2.5 turns
  - Bounce the vehicle to equalize the pressure between the upper and lower chambers
  - Recheck the vehicle height

#### Step 2. Disconnect the SST

- a. Tighten the shutter valves, then disconnect the SST.
- b. Install the service valve cap.
- c. Inspect for fluid leaks.
- d. Install the Stabilizer Control Valve Assembly protector cover.