LiquidSpring Owner's Documents, Touchscreen

LIQUIDSPRING®
SMART SUSPENSION

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Introduction

This manual provides safety, operation, and maintenance information for LiquidSpring® **Smart Suspension** systems equipped with a touchscreen.

LiquidSpring LLC reserves the right to make changes and improvements to its products and publications at any time. Contact LiquidSpring LLC Customer Service for information on the latest version of this manual at 765-474-7816 or email: service@liquidspring.com

Before beginning any maintenance or servicing of the suspension system:

- Read and understand all instructions and procedures.
- Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.
- Follow any company maintenance, service, installation, and diagnostics guidelines.
- Use proper tools when required to help avoid serious personal injury and damage to components.

IMPORTANT: Use only LiquidSpring components for servicing this suspension system. Use of improper components will void LiquidSpring Warranty.

Throughout this manual, important product information is indicated. These terms are defined as follows:

NOTE: Includes additional information to enable accurate and easy performance of procedures.

IMPORTANT: Includes additional information that if not followed could lead to hindered product performance and/or product failure.

CAUTION: A caution indicates procedures that must be followed exactly. Damage to equipment or suspension components and personal injury can occur if the procedure is not followed.

WARNING: A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.

Suspension Rating

LiquidSpring suspension ratings are based on the OEM axle ratings of each chassis. The GAWR with LiquidSpring installed is the lesser of either the OEM original rating (as published) or the LiquidSpring suspension rating.

The first two (2) letters of the suspension model number represent the type of suspension:

FS – Front Suspension
DS – Drive Axle Suspension (Rear Suspension)

The next two (2) or three (3) numbers represent the suspension's maximum capacity in 100s of lbs.

Example: DS200 – 20,000 lbs. Rating

WARNING: Overloading suspension system may result in abnormal handling characteristics and premature wear of components.

Serial Tag

The serial number is found on the aluminum tag as shown in Figure 1. This information is required when contacting the chassis manufacturer or LiquidSpring LLC.
Rear Suspension – Front Hanger (Figure 1)
Front Suspension – Power Module Bracket (Figure 2) or Front Hanger (Figure 3)

Figure 1. Serial tag

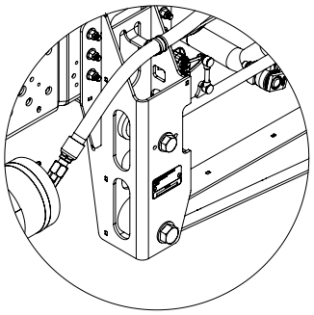


Figure 2. Serial Tag Location (Rear)

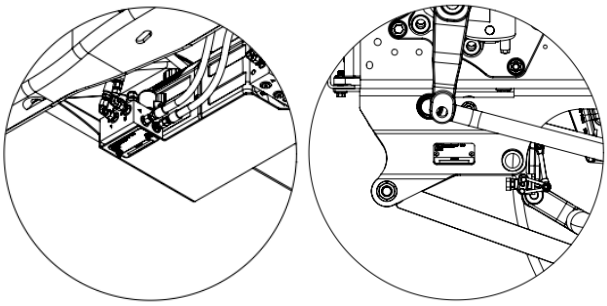


Figure 3. Serial Tag Locations (Front)

Important Safety Notices

Fluid

The LiquidSpring suspension system requires the use of a specific compressible fluid for proper operation. If additional fluid is needed, the fluid can be purchased directly from LiquidSpring LLC.

CAUTION: Adding any other fluid not obtained from LiquidSpring LLC to the system will result in incorrect operation of the system, and will likely damage critical components of the system, and will void the LiquidSpring Warranty.

WARNING: The system operates under high fluid pressure (up to 4000 psi). Follow proper procedures when installing LiquidSpring components. High pressure fluids can penetrate the skin and cause severe tissue damage.

Vehicle Towing

Before attempting any type of towing procedures, contact the Chassis OEM or Vehicle Manufacturer for instructions.

NOTE: Before towing vehicle, check with local authorities, such as Department of Transportation, for permissible towing methods. Some states do not permit towing vehicles by chains or towing straps.

Do not attach tow apparatus (hooks, chains, straps, etc.) to the suspension components.

WARNING: Attaching towing equipment to improper locations and failure to utilize Chassis OEM or Vehicle Manufacturer recommended towing methods could result in one or more of the following:

Damage to the suspension and/or vehicle,
Loss of vehicle control,
Possible disconnect from the vehicle.

Vehicle Jacking

The LiquidSpring suspension system should be turned "OFF" (see *Operation* section) before jacking vehicle. Jacks should never be applied to suspension components.

WARNING: Do not apply jack to bottom of front hanger or other suspension components. Appling a jack to improper locations can result in damage to the suspension and/or vehicle and severe personal injury.

Vehicle Trailering

The fluid in the LiquidSpring suspension system will expand/contract with changes in temperature. This results in movement of the suspension even with the system off. The system needs to be lowered and completely depressurized (Refer to *Depressurizing the System* in the *Operation* section) before strapping or chaining the chassis frame to the trailer. If vehicle is to be secured via wheels, suspension should be left at NORMAL ride height.

WARNING: If correct procedures are not followed, tie-downs can loosen, and vehicle could dislodge from trailer and cause serious injury.

Higher Rollover Risk

WARNING: Lifted vehicles have a significantly higher rollover rate than other vehicles.

Vehicles with a higher center of gravity (lifted and four-wheel drive vehicles) handle differently than vehicles with a lower center of gravity.

Avoid sharp turns, excessive speed, and abrupt maneuvers in these vehicles.

Failure to drive cautiously increases the risk of losing control of your vehicle, vehicle rollover, personal injury, and death.

Do not modify your vehicle in any way that would excessively raise the center of gravity.

Take corners at slower speeds than you would in a vehicle with a lower center of gravity.

Always drive at a safe speed.

Post Installation Welding

Prior to any chassis welding, disconnect negative cable(s) from chassis batteries; also disconnect LiquidSpring ECU header connectors and Power Module chassis ground connection. See Figure 4. Follow all OEM requirements for chassis welding.

WARNING: Failure of ECU may occur if not properly disconnected.

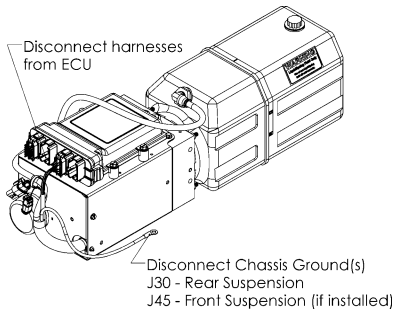
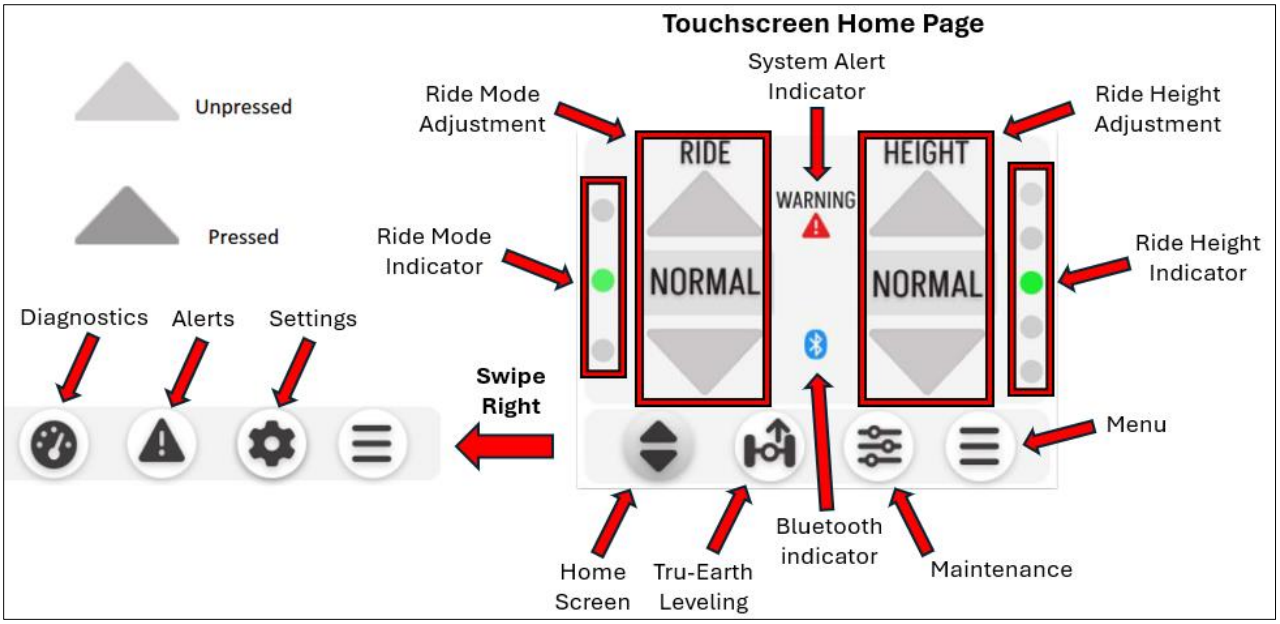


Figure 4. ECU Disconnection

Operation



System Startup

- In most instances, the suspension system can be left alone to operate automatically.
- After startup, a splash screen will be displayed for 2 seconds before transitioning to the home page.
- If the system was shut down while in Tru-Earth Leveling mode, the Tru-Earth Leveling screen will be displayed.

NOTE: Vehicles capable of Tru-Earth Leveling are equipped with normally closed rate valves. When the ignition is first applied or the touch screen is turned on, the system will pulse the rate valves to equalize pressures for up to 20 seconds. It is normal to experience vibration, noises, and vehicle movement during the rate valve pulsing.

NOTE: If the system was shut down while in Tru-Earth Leveling, the rate valve pulsing will occur when exiting.

On/Off Button

Pressing the **Maintenance** button will reveal the maintenance screen as shown in **Figure 5**.

Figure 5. Maintenance Screen

A quick press and release of the **On/Off** button will turn the system and display off. To wake the system, tap anywhere on the screen and press the red **On/Off** button. The system will remember the last commanded state.

It is recommended to leave the suspension ON at all times unless the vehicle or suspension is being serviced.

System Alert Indicator

If the System Alert Indicator is illuminated, refer to the LiquidSpring *Troubleshooting Guide – Touchscreen* document for assistance.

Ride Mode Adjustment

Press the UP/DOWN arrow buttons to change the ride mode between SPORT, NORMAL, and COMFORT. The green indicator light will show the set mode.

- **Sport**: More responsive to external conditions / driver input. Good for windy conditions and twisty roads.
- **Normal**: Balance of Sport and Comfort.
- **Comfort**: Less responsive to external conditions / driver input. More plush and relaxed ride.

The system will react aggressively to evasive maneuvers regardless of ride setting.

The setting can be changed at any time. Based on road conditions, steering wheel angle, and the vehicle speed, the system automatically adjusts to provide the best handling while providing a smooth ride. All three settings will feel similar on a smooth and straight road.

Ride Height Adjustment

Press the UP/DOWN arrow buttons to change ride height from NORMAL, to M-HIGH (rear up), to HIGH (all up) or M-LOW (rear down), to LOW (all down).

- A solid green light will indicate the selected height. A flashing green light will indicate the current height and that height adjustment is occurring. When a single solid green light is lit, the selected height has been achieved.
- Two solid green lights will be lit if the current height is not the selected height and height adjustment is not occurring.
- If LOW, M-LOW, M-HIGH, or HIGH heights are selected while the vehicle is traveling at less than 10mph or stopped, the suspension height is either lowered or raised.
- If LOW, M-LOW, M-HIGH, or HIGH heights are selected while the vehicle is traveling at greater than 10 mph, the suspension will ignore the selected height and remain in NORMAL height unless the vehicle speed goes below 10mph within 2 minutes of selecting the height. In this instance, the NORMAL height green light will flash, and the selected height green light will be lit solid until the speed goes below 10 mph within 2 minutes of selecting the height.

  If the vehicle speed doesn't go below 10mph within the 2-minute period, the suspension will remain at NORMAL height indicated by only the NORMAL height green light lit solid.

NOTE: As a safety feature, if height is set to anything other than NORMAL, and then vehicle is driven over 15 mph, the suspension will automatically return to NORMAL height.

- If the ignition is turned off before the selected ride height is achieved, the system will stop adjusting ride height.
- The door switch kneeling function (if equipped) is disabled if any ride height other than NORMAL is selected before the door is opened on vehicles equipped with a door switch.

NOTE: The door switch trigger is only available from the NORMAL ride height position. The Touchscreen will take precedence/override the door trigger.

NOTE: The LiquidSpring suspension ride heights (Normal, Low, M-Low, M-High, & High) are pre-determined by LiquidSpring Engineering and are not adjustable.

Ride Height Commands:

Ride Height Description	Driver Interface Operation	Front Ride Height	Rear Ride Height	Ride Height Display
All Up (AU)	From RH: P&R UP 2 times. From RU: P&R UP 1 time.	HIGH	HIGH	
Rear Up (RU)	From RH: P&R UP 1 time.	NORMAL	HIGH	
Ride Height (RH)	From AU: P&R DOWN 1 time. From RU: P&R DOWN 1 time. From RD: P&R UP 1 time. From AD: P&R UP 1 time. Auto Select: Speed > 15mph	NORMAL	NORMAL	
Rear Down (RD)	From RH: P&R DOWN 1 time. Rear Door Trigger	NORMAL	LOW	
All Down (AD)	From RH: P&R DOWN 2 times. From RD: P&R DOWN 1 time. Side Door Trigger	LOW	LOW	
Depressurize	Refer to **Depressurizing System** Section	FULL LOW	FULL LOW	
P&R: Press and Release		**P&H: Press and Hold**		

Tru-Earth Leveling™

1. Pressing the **Tru-Earth Leveling** button will reveal the Tru-Earth Leveling screen as shown in **Figure 6**.

Figure 6. Tru-Earth Leveling Screen

2. The vehicle must be stationary and in park to initiate Tru-Earth Leveling.

NOTE: Vehicles equipped with generators must shut them off before starting the calibration process.

NOTE: It is advised to steer the wheels straight ahead and avoid touching the steering wheel while the system is leveling.

WARNING: When exiting Tru-Earth Leveling, the system will return to NORMAL RIDE HEIGHT. Verify vehicle has adequate clearances before initiating or exiting Tru-Earth Leveling.

WARNING: Disconnect anything trailered prior to initiating Tru-Earth Leveling. The vehicle will raise and lower to achieve a level state, which can cause damage to anything trailered.

3. Selecting **Auto** will initiate Tru-Earth Leveling, it may take up to 90 seconds for the system to achieve its final state.
4. The Roll and Pitch icons will change color depending on the systems confidence in achieving a level state:
5. **Green:** Indicates the vehicle is level.
6. **Yellow**: Indicates the system will attempt to achieve a level state.
7. **Red**: Indicates at least one of the Roll/Pitch angles are too large for the system to attempt to level the vehicle.

NOTE: Once Tru-Earth Leveling has been achieved, vehicles with generators may resume operation.

8. Selecting **Manual** will reveal the Manual Leveling screen as shown in **Figure 7**.

NOTE: Manual Leveling will be available in the future through a software update, as it is still under development.

Figure 7. Manual Leveling Screen

Exiting Tru-Earth Leveling

The system will automatically exit Tru-Earth Leveling if the vehicle is driven above 2 mph. It is advised not to exceed speeds of 15 mph while the system is equalizing pressure.

Pressing the **Exit** button will manually take the system out of Tru-Earth Leveling. It will take up to 20 seconds for the system to equalize pressure and return to ride height.

NOTE: In some instances, after exiting Tru-Earth Leveling the vehicle may raise and lower excessively while returning to normal ride height. It is advised to move the vehicle to more level ground to allow it to achieve normal ride height in these instances.

Depressurizing the System

NOTE: In order for the system to be depressurized, the system must be out of Tru-Earth Leveling mode. Refer to the *Exiting Tru-Earth Leveling* section for instructions.

1. Turn the ignition key to "Run" and ensure that the LiquidSpring Touchscreen lights up and that the System Alert Indicator is not lit. If the System Alert Indicator is lit, refer to the *Troubleshooting Guide*.

WARNING: Do not run vehicle in an enclosed building without adequate ventilation or without ducting exhaust fumes outside. Operation of a vehicle inside an enclosed building can lead to serious injury or death.

2. The Touchscreen should light up with only one green ride mode indicator and one green ride height indicator lit.
3. From NORMAL Ride Height, press and release HEIGHT DOWN arrow button twice to lower the front and rear.

4. Press the **Maintenance** button to reveal the maintenance screen as shown in **Figure 8**.

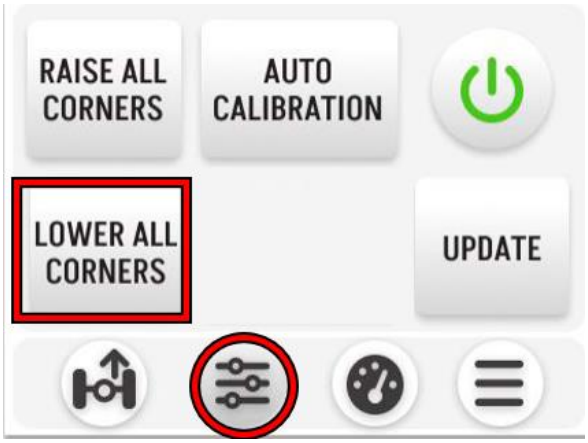


Figure 8. Maintenance Screen

5. After LOW height has been achieved, press and hold **Lower All Corners** for approximately 2 minutes. Loud "clicking" should be heard indicating the system has been depressurized.
6. Press and release the **On/Off** button to shut off the system and Touchscreen.
7. Turn off the vehicle ignition.

If any of the hydraulic components are to be removed for service, you **MUST** follow these steps:

1. Locate 3/16" ID PVC Tubing.

NOTE: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit can be used.

2. Attach the PVC tubing to one of the upper bleed screws on the Volume Assembly and place the other end in a catch bucket or tray.
3. Open the bleed screw slightly to relieve any residual pressure.
4. After pressure is relieved, close the bleed screw and repeat for bleed screw on the other side of the Volume Assembly. Torque to **13-18 ft-lbs**.

WARNING: Pressure MUST be relieved from both Bleed Screws on a Volume Assembly before any work is performed. Failure to relieve pressure can lead to serious injury or death.

WARNING: An increase in fluid temperature can lead to the system repressurizing. If the system is left depressurized for an extended period of time it will need to be depressurized again. This also applies when moving from one corner to the next.

Notes:

- Jacking up the chassis of a lowered, depressurized chassis will cause a slight vacuum in the system and minimize fluid loss while disconnecting hoses.
- For service of hydraulic connected suspension components (and certain non-hydraulic components), the suspension system can be first raised to the HIGH height, appropriate jack stands placed under the chassis, then depressurized as listed above lowering the chassis onto the jack stands.

Repressurizing the System

1. Turn the ignition key to "Run" and ensure that the LiquidSpring driver display lights up and that the System Alert Indicator is not lit. If the System Alert Indicator is lit, refer to the *Troubleshooting Guide*.
2. The driver display should light up with only one green ride mode indicator and one green ride height indicator lit.
3. If jack stands were placed under the frame prior to depressurizing, press and release the HEIGHT UP arrow to raise the vehicle to HIGH height.
4. Remove jack stands.
5. Press and release the HEIGHT DOWN arrow to lower the vehicle to NORMAL height.

If any of the hydraulic components were removed for service, a system bleed should be conducted to remove air trapped in the system:

1. Locate 3/16" ID PVC Tubing.
2. Attach the PVC tubing to one of the upper bleed screws on the Volume Assembly and place the other end in a catch bucket or tray.
3. Open the bleed screw slightly to release trapped air.
4. After large air bubbles are no longer present, close the bleed screw and torque to **13-18 ft-lbs**.

NOTE: Suspension may move when bleeding the system.

Temperature Changes

The **Smart Suspension** utilizes a compressible liquid for its spring and damping, which expands and contracts with temperature changes.

While parked for an extended time with the vehicle and/or suspension system turned off, suspension ride height will change with temperature change. Increases in ambient temperature or parking in direct sunlight can cause the suspension ride height to increase. Decreases in temperature can cause the suspension ride height to decrease.

When system is turned on again, the suspension will automatically return to the selected ride height.

While the suspension system can be used immediately upon start-up, it is recommended to allow the suspension system to automatically adjust the ride height for a brief period (less than 30 seconds) before driving away. Some ride harshness may be noticed until NORMAL ride height is achieved.

NOTE: Vehicles capable of Tru-Earth Leveling are equipped with normally closed rate valves. When the ignition is first applied or the touch screen is turned on, the system will pulse the rate valves to equalize pressures for up to 20 seconds. It is normal to experience vibration, noises, and vehicle movement during the rate valve pulsing.

NOTE: If the system was shut down while in Tru-Earth Leveling, the rate valve pulsing will occur when exiting.

The suspension system functions normally within a temperature range of -40°F to 140°F (-40°C to 60°C).

Door Switch Trigger

The door trigger is an optional function that allows the suspension to be automatically kneeled when the rear door is opened. A side door trigger is also available to kneel all four corners.

- Opening the rear door will set the suspension to Rear Down (RD) and the rear suspension will lower to a kneeled position.
- Opening the side door will set the suspension to All Down (AD) and the front and rear suspension will lower to a kneeled position.
- If the side door is closed, and the rear door is open, the front suspension will return to NORMAL and the rear suspension will remain kneeled.
- If the rear door is closed, and the side door is open, the front and rear suspension will remain kneeled.

Notes:

- Door trigger function is only active if the Driver Display is set to NORMAL height with the system and ignition turned ON.
- The door switch can be over-ridden by the Touchscreen height selections.
- If the system and ignition are OFF and a door is closed, lowering will cease, but the suspension will not raise to NORMAL. Suspension will raise when ignition and system are turned ON.
- If the system and ignition are ON and the door is re-opened, the suspension will resume lowering to the kneeled position.
- If the system and ignition are OFF and the door is reopened, the suspension will not lower.

Calibration

- LiquidSpring suspensions are recommended to be calibrated by the up fitter during installation. Calibrations may also be required after certain service or repairs. Routine calibrations are not required or recommended.
- The steering sensor will auto-calibrate (auto-center) during routine driving conditions. The sensor does not require routine calibration.

NOTE: If you are experiencing issues with your suspension, contact LiquidSpring Customer Service.

Preventative Maintenance

Service Intervals

Once Daily or Before Each Shift

1. Check the suspension system to be sure it is fully operational:
   - Start vehicle.
   - Steer straight ahead.
   - Verify the System Alert Indicator is not lit.
   - Verify only one green Ride Height and one green Ride Mode indicator remain lit (if at target ride height).
   - Verify that the system is at NORMAL ride height, with a steady green light.
     - If the Touchscreen indicates a blinking Ride Height indicator, allow the system to complete leveling as indicated by a steady green light.
     - If LOW or HIGH height is shown with a solid green light, use the arrow buttons to raise or lower the suspension to NORMAL height.
2. Visually inspect struts, hoses, and fittings for signs of leakage.
   - For leakage resulting in fluid pooled on the floor greater than 1" in diameter, it is recommended to service the system immediately.
   - For signs of leakage or weeping that results in wetness on components or a single drop, it is recommended to monitor the leak and schedule repair service accordingly.
3. Visually inspect Power Module Breather.
   - If the desiccant beads in the Desiccant Power Breather are bright pink, it is recommended to replace the breather. See Figure 9 & 10.
   - Contact LiquidSpring for replacement. P/N: 11789-001

Initial 1,000 Miles (1,600 km) Inspection

1. Inspect bolts and nuts at the control arm pivots to assure they are properly torqued.
2. Inspect U-bolts to assure they are properly torqued.

NOTE: Torque values can be found in the Installation Manuals specific to each suspension.

3. Thoroughly inspect all hydraulic connections for signs of leakage.
4. Inspect reservoir fluid level.

Routine Maintenance 25,000 miles (40,000 km) or 6-month maximum Interval

1. Check all suspension components for any signs of damaged/broken components, looseness, or wear.
2. Inspect bolts and nuts at the control arm pivots to assure they are properly torqued.

NOTE: Torque values can be found in the Installation Manuals specific to each suspension.

3. Inspect bolts and nuts at both the frame and axle mount ends of the track rod to assure they are properly torqued.
4. Inspect U-bolts to assure they are properly torqued.
5. Thoroughly inspect all hydraulic connections for signs of leakage.
6. Inspect reservoir fluid level.

Figure 9. New Breather (Blue)

Figure 10. Used Breather (Pink)

Maintenance Record

Model of Vehicle	Vehicle Identification Number (VIN)
Date of Purchase	Name and Address of Dealer
Suspension Model Number	Suspension Serial Number

Date	Mileage	Service Performed

Customer Service

If your LiquidSpring **Smart Suspension** is exhibiting any errors or erratic behavior, please contact LiquidSpring LLC Customer Service for instructions regarding diagnosis and/or replacement of any component. Suspension literature, including manuals, applications guides, and brochures can be found on the LiquidSpring website: https://liquidspring.com/literature/

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