Contents

INTRODUCTION .......................................................................................... 3
  SUSPENSION APPLICATION AND RATING .................................... 3
  SERIAL NUMBER TAG INFORMATION ........................................... 3
  VEHICLE TOWING AND JACKING INFORMATION ......................... 4

ABBREVIATIONS ...................................................................................... 4

HYDRAULIC FITTING ASSEMBLY ......................................................... 4
  SAE O-Ring Adjustable Fittings ....................................................... 4
  SAE O-Ring Non-Adjustable Fitting ................................................ 4
  JIC 37° Fitting .................................................................................... 5

PRE-INSTALLATION ................................................................................ 5

CHASSIS PREPARATION .......................................................................... 5

FRAME DRILLING .................................................................................... 6

BRAKE LINES .......................................................................................... 7

PART IDENTIFICATION: .......................................................................... 8
  DS129FS3, DS147FS3, AND DS147FS3B ............................................ 8
  BOM: DS129FS3, DS147FS3/DS147FS3B ........................................ 9

INSTALLATION ......................................................................................... 10
  Front Hangers .................................................................................... 10
  Upper Strut Mounts .......................................................................... 11
  Bridge and Axle Clamp Hangers ...................................................... 12
  Control Arms ..................................................................................... 13
  Track Rod and Tie Bar ...................................................................... 14
  Strut Assembly Installation ............................................................ 15
  Height Sensors ................................................................................. 16
  Steering Sensor Installation ............................................................. 17
  Power Module Installation ............................................................... 18
  Secondary Volumes .......................................................................... 19
  Brake Cables .................................................................................... 20
  Hydraulic Hose Attachment and Routing ...................................... 21
  External Electrical Installation ....................................................... 22
  Dash Harness Installation ............................................................... 23
  Driver Interface Installation ........................................................... 24
  Optional Door Electrical Harness Installation ............................. 24
  Initial System Fill ............................................................................. 24
  Bleeding the System ....................................................................... 25
  Calibrating the System ................................................................... 25

SYSTEM OPERATION ............................................................................... 26
  System Start Up ................................................................................ 26
  ON/OFF Button .............................................................................. 26
  Warning Light .................................................................................. 26
  Ride Mode Adjustment .................................................................... 26
  Ride Height Adjustment .................................................................. 26
  Depressurizing the System .............................................................. 27
  Calibrating the Steering Sensor Only ............................................. 28
  Calibrating the System (Full) ........................................................ 28
  Checking Fluid Level ........................................................................ 28
  Checking Fittings for Leaks ............................................................. 29

SERVICE INTERVALS ............................................................................. 29
  Once Daily or Before Each Shift of Usage ..................................... 29

Initial 1,000 mile (1,600 km) Inspection .................. 29
Routine Maintenance 25,000 miles (40,000 km) or 6 month maximum Interval .......................... 29

TROUBLESHOOTING .......................................................................... 30
  Issues with Vehicle Raising/Pump ............................................... 30
  Issues with Vehicle Lowering/Dump Valve ................................. 30
  Issues with One Corner Not Leveling Properly .............................. 31
  Issues with Height Sensors ........................................................... 31
  Issues with Ride/Handling .............................................................. 31
  Issues with Steering Sensor ........................................................... 31
  Issues with Vehicle Speed Signal .................................................. 32
  Issues with Vehicle Brake Signal .................................................. 32
  Issues with Door Switch ................................................................. 32
  Issues with Vehicle Ignition Signal ............................................... 32
  Issues with Vehicle Park Signal ..................................................... 32
  Issues with Driver Interface .......................................................... 32
  Issues with Power Module ............................................................. 33
  Issues with Strut Assembly ............................................................ 33
  Issues with Secondary Volume Assembly ..................................... 34

APPENDIX A: ELECTRICAL SCHEMATICS ........................................ 35

WARRANTY CONDITIONS ..................................................................... 39

INSTALLATION CHECK LIST ................................................................. 41
Introduction

This manual provides installation information for the LiquidSpring CLASS® DS129FS3, DS147FS3, and DS147FS3B series of rear axle suspension systems for the Ford F450/F550 Cab Chassis.

Before you begin installation of the suspension system:

1. Read and understand all instructions and procedures prior to installation of components.
2. 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.
3. Follow your company’s maintenance and service, installation, and diagnostics guidelines.
4. Use proper tools when required to help avoid serious personal injury and damage to components.

Suspension Application and Rating

<table>
<thead>
<tr>
<th>Model</th>
<th>Model Years</th>
<th>Rear Axle GAWR</th>
<th>LiquidSpring Kit</th>
<th>LiquidSpring Suspension Rating (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F450</td>
<td>2017-Current</td>
<td>12,880</td>
<td>DS129FS3</td>
<td>12,880</td>
</tr>
<tr>
<td>F550</td>
<td>13,660-14,706</td>
<td>DS147FS3</td>
<td>DS147FS3B</td>
<td>14,706</td>
</tr>
</tbody>
</table>

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

Serial Number Tag Information

The serial number is found on an aluminum tag riveted to the Left Hand Suspension Hanger as shown in Figure 2. This information will aid you when contacting the chassis manufacturer or LiquidSpring LLC.

Figure 1. Suspension Identification

Figure 2. Serial Number Tag Location
**Vehicle Towing and Jacking Information**

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.

---

**Abbreviations**

The following abbreviations will be used throughout the manual.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCS</td>
<td>Hex Cap Screw (also HB)</td>
</tr>
<tr>
<td>HFB</td>
<td>Hex Flange Bolt</td>
</tr>
<tr>
<td>SHCS</td>
<td>Socket Head Cap Screw</td>
</tr>
<tr>
<td>SFHS</td>
<td>Serrated Flange Hex Screw</td>
</tr>
<tr>
<td>STS</td>
<td>Self Tapping Screw</td>
</tr>
<tr>
<td>HN</td>
<td>Hex Nut, Non-locking</td>
</tr>
<tr>
<td>LHN</td>
<td>Locking Hex Nut</td>
</tr>
<tr>
<td>LFN</td>
<td>Locking Flange Nut</td>
</tr>
<tr>
<td>HFW</td>
<td>Hardened Flat Washer</td>
</tr>
<tr>
<td>SLW</td>
<td>Spring Lock Washer</td>
</tr>
<tr>
<td>FW</td>
<td>Flat Washer</td>
</tr>
<tr>
<td>SAE</td>
<td>SAE O-Ring Fitting</td>
</tr>
<tr>
<td>37°</td>
<td>SAE or JIC 37° Flare Fitting (F – Female)</td>
</tr>
<tr>
<td>LH</td>
<td>Left Handed Part</td>
</tr>
<tr>
<td>RH</td>
<td>Right Handed Part</td>
</tr>
<tr>
<td>UCA</td>
<td>Upper Control Arm</td>
</tr>
<tr>
<td>LCA</td>
<td>Lower Control Arm</td>
</tr>
<tr>
<td>USM</td>
<td>Upper Strut Mount</td>
</tr>
<tr>
<td>PM</td>
<td>Power Module</td>
</tr>
</tbody>
</table>

---

**Hydraulic Fitting Assembly**

**SAE O-Ring Adjustable Fittings**

- **Figure 3. Adjustable SAE fitting**
  1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material.
  2. If O-ring or seal is not pre-installed to fitting male port end, install proper size O-ring or seal, taking care not to damage it.
  3. Lubricate O-ring with light coat of the system fluid or a compatible lubricant to help the O-ring slide smoothly into the port and avoid damage.

- **Figure 4. Locknut completely backed off.**

4. Back off lock nut as far as possible. Make sure back-up washer is not loose and is pushed up as far as possible.

5. Screw fitting into port until the back-up washer or the retaining ring contacts face of the port. Light wrenching may be necessary. Over tightening may damage washer.

6. To align the tube end of the fitting to accept incoming hose assembly, unscrew the fitting by the required amount, but not more than one full turn.

7. Using two wrenches, hold fitting in desired position and tighten locknut to the proper torque value: -4 fitting: **14-16 ft-lbs (168-192 in-lbs)** -12 fitting: **75-83 ft-lbs**.

8. Inspect to ensure that O-ring is not pinched and that washer is seated flat on face of port.

**SAE O-Ring Non-Adjustable Fitting**

- **Figure 4. Non-Adjustable SAE fitting**
  1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material.

2. If O-ring or seal is not pre-installed to fitting male port end, install proper size O-ring or seal, taking care not to damage it.
3. Lubricate O-ring with light coat of the system fluid or a compatible lubricant to help the O-ring slide smoothly into the port and avoid damage.

4. Screw fitting into port and tighten to proper torque:
   -4 fitting: 26-28 ft-lbs (310-341 in-lbs)
   -12 fitting: 75-83 ft-lbs.

**JIC 37° Fitting**

1. Inspect components to ensure that male and female threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material. Annular tool marks of 100µin with the thread are permissible.

2. Lubricate the threads and the entire surface of the cone with system fluid.

3. Align mating components for hand connection and turn flare nut until sealing surfaces make full contact.

4. Using two wrenches, hold fitting in desired position and tighten to the proper torque:

<table>
<thead>
<tr>
<th></th>
<th>-4 fitting</th>
<th>-10 fitting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9-12 ft-lbs</td>
<td>36-63 ft-lbs</td>
</tr>
<tr>
<td></td>
<td>27-39 ft-lbs</td>
<td>65-88 ft-lbs</td>
</tr>
</tbody>
</table>

**Pre-Installation**

1. Check the vehicle wheel alignment prior to installation to insure pre-existing conditions do not exist.

2. It is suggested, but not required, to remove the attached body to ease installation.

3. A chassis lift can be used in assistance of the installation of the suspension system.

4. Measure and record the wheelbase and tire-to-frame dimensions on each side prior to disassembly.

**Chassis Preparation**

1. Chock the front tires.

2. Jack up the rear frame of the vehicle to remove the load from the rear leaf springs.

3. Place jack stands under the frame and block the rear tires from moving.

   Note: Jack stands can be placed under the axle and the tires removed for ease of access. It is recommended to place an additional jack stand under the pinion to prevent the axle from rotating after leafs are removed.

4. Disconnect the negative vehicle battery cable.

5. Remove the OEM shock absorbers. Note: Retain driver side upper shock mount nut, to be reused in Track Rod / Tie bar installation.

6. Remove the OEM leaf springs and rear shackles. Retain front spring hanger hardware where the hanger bolts through the lower flange

   Note: It’s not necessary to remove the rear shackle hanger from the frame.

7. Remove the OEM spring overload pads riveted to the frame.

8. If equipped with midship fuel tank, dropping the tank may ease installation, but is not necessary.

   Note: Do not remove OEM Jounce Bumpers. If they are removed, they will need re-installed prior to Upper strut mount / track rod mount installation.

9. Disconnect the parking brake cable and remove the driver side parking brake cable bracket mounted just in front of the front leaf hanger, See Figure 5.

10. Disconnect the axle mounted parking brake cable guide, located on the passenger side shock mount. This will need relocated to the control arm mount in later steps.
Frame Drilling

**WARNING:** Use caution when drilling, making sure fuel systems, brake lines, and electrical wiring are protected and do not get damaged.

Figure 6. Location of Drill Template on Dr. Side Frame

1. Center punch, mark holes, and drill as indicated in Figure 7 and Figure 8.

Figure 7: Driver side template location for upper strut mount frame drilling.

Upper Strut Mount Holes: Centerpunch and Drill to Ø21/32", 4 Places.

2. Locate the “knockout” template which is inside the template previously used for marking the upper strut mount holes. It must be broken out of the template prior to using. See Figure 9.

Figure 9: Location of Knockout

3. Insert the template inside the fuel tank crossmember as shown in Figure 10 and center punch, mark holes, and drill as indicated in Figure 11.

Figure 10: Locate template inside crossmember channel as shown behind the exhaust

Centerpunch and Drill to Ø7/16", 2 Places.

4. Locate the Volume Mounting Brackets and place along frame as shown in Secondary Volume Installation for additional drill locations.

Figure 11: Mark and drill holes as indicated.

Upper Strut Mount Holes: Centerpunch and Drill to Ø21/32", 6 Places.

Figure 8: Passenger side template location for upper strut mount and track rod frame mount frame drilling.
**Brake Lines**

NOTE: The following procedures should be used in conjunction with OEM Hydraulic Brake service instructions and procedures.

1. Locate the two hydraulic brake lines, and copper crush washers included in the kit.

   ![Figure 12: Brake Line Kit P/N: 11326](image)

2. On the rear axle, locate the OEM LH Rear brake outer flexible hose.

   NOTE: Removal of the wheel and tires may aid in the following steps, but not necessary.

   ![Figure 13: OEM Brake Line Removal](image)

3. Remove the banjo bolt and disconnect the brake hose from the LH caliper. Retain the banjo bolt.

4. Disconnect the brake tube fitting, remove the brake hose bracket bolt from the axle, and remove the hose.

   ![Figure 14: Replacement DR Side Brake components](image)

5. Loosely install the new brake hose bracket (10806-010) using the OEM M8 fastener.

   Insert the provided hydraulic line fitting through the brake hose bracket and secure using the bowed retainer clip. Refer to Figure 14.

6. Connect the OEM brake line into the tube fitting – torque to 159 in-lbs and install the banjo fitting with the banjo bolt and crush washers to the caliper – torque to 12-14 ft-lbs.

7. Follow the same procedure for the RH flexible brake hose.

8. Locate the OEM axle mounted inner brake hose bracket.

9. Detach the axle vent hose retainer clip, and the hydraulic brake tube retainer clips.

10. Disconnect the hydraulic brake tube fittings, and remove the axle vent hose fitting from the axle.

11. Replace the OEM bracket with the provided bracket which will raise the brake tube fittings higher off the axle.

12. Install the brake tube fittings through the bracket - torque to 159 in-lbs.

13. Install the OEM retainer clips, re-attach the vent hose clip, and re-install the wheel speed sensor harness retainers.

14. Install the vent hose fitting, torque both the vent hose fitting and brake hose bracket (10806-010 + 10806-011) to 159 in-lbs.

   ![Figure 15: Axle Mounted Brake line standoff](image)

15. Bleed the brake system. Refer to OEM service instructions (206-00 Brake System – General Information, General Procedures).

   NOTE: Follow OEM specified brake bleeding procedure. Use DOT 4 Low Viscosity High Performance Motor Vehicle Brake Fluid, such as Motorcraft PM-20.

   NOTE: A pressure bleed system may be used to simplify one-man operation. See Figure 14

   ![Figure 16: An example of pressure bleed system: Mityvac MV6840](image)
Part Identification:

*DS129FS3, DS147FS3, and DS147FS3B*
## BOM: DS129FS3, DS147FS3/DS147FS3B

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>10002-550</td>
<td>HB .875-9x5.500, Gr. 8</td>
<td>39</td>
<td>1</td>
<td>10806-011</td>
<td>Brake Line Axle Stand-Off</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>10002-850</td>
<td>HB .875-9x8.500, Gr. 8</td>
<td>40</td>
<td>1</td>
<td>10811-022</td>
<td>Drill Template</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>10003-004</td>
<td>HB 1.000-8x6.500, Gr. 8</td>
<td>41</td>
<td>1</td>
<td>10815-002</td>
<td>Fused Battery Lead</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>10006-003</td>
<td>HFW .875</td>
<td>42</td>
<td>4</td>
<td>10830-013</td>
<td>Volume Mount</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>10006-004</td>
<td>HFW 1.000</td>
<td>43</td>
<td>2</td>
<td>10839-003</td>
<td>Retaining Ring, Bowed</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>10012-003</td>
<td>LFN 1-8, Gr G</td>
<td>44</td>
<td>4</td>
<td>10843-003</td>
<td>T-Bolt Clamp</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>10012-005</td>
<td>LFN 3/8-16, Gr G</td>
<td>45</td>
<td>4</td>
<td>10855-002</td>
<td>Loop Clamp, 1&quot; ID</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>10012-007</td>
<td>LFN 1/2-13, Gr. G</td>
<td>46</td>
<td>7</td>
<td>10855-003</td>
<td>Loop Clamp, 5/8&quot; ID</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td>10012-008</td>
<td>LFN 5/8-11 Gr G</td>
<td>47</td>
<td>4</td>
<td>10855-004</td>
<td>Loop Clamp, 3/8&quot; ID</td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>10012-010</td>
<td>LFN 5/16-18, Gr. G</td>
<td>48</td>
<td>9</td>
<td>10874-175</td>
<td>HFB 5/8-11x1.75, Gr. 8</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>10012-012</td>
<td>LFN 3-4-16, Gr. G</td>
<td>49</td>
<td>4</td>
<td>10874-200</td>
<td>HFB 5/8-11x2.00, Gr. 8</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>10012-014</td>
<td>LFN 3-4-10 Gr G</td>
<td>50</td>
<td>1</td>
<td>10885-125</td>
<td>HFB 1/2-13x1.25, Gr. 8</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>10012-017</td>
<td>LFN 7/8-9, Gr. G</td>
<td>51</td>
<td>15</td>
<td>10885-150</td>
<td>HFB 1/2-13x1.50, Gr. 8</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>10064-007</td>
<td>U-Bolt, 3/4-16 x 8.00 Tri-8</td>
<td>52</td>
<td>14</td>
<td>10886-100</td>
<td>HFB 5/16-18 x 1.00, Gr. 8</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>10474-001</td>
<td>Silicone Oil, 16 oz. Bottle</td>
<td>53</td>
<td>4</td>
<td>10886-125</td>
<td>HFB 5/16-18 x 1.25, Gr. 8</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>10501-002</td>
<td>HFB 3/8-16 x 1.250, Gr. 8</td>
<td>54</td>
<td>1</td>
<td>10902-002</td>
<td>Park Brake Cable Mount</td>
</tr>
<tr>
<td>17</td>
<td>8</td>
<td>10501-150</td>
<td>HFB 3/8-16 x 1.500, Gr. 8</td>
<td>55</td>
<td>2</td>
<td>10910-005</td>
<td>Spacer Plate (84CA)</td>
</tr>
<tr>
<td>18</td>
<td>2</td>
<td>10586-004</td>
<td>Height Sensor</td>
<td>56</td>
<td>2</td>
<td>10947-011</td>
<td>Lower Axle Cradle</td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>10586-008</td>
<td>Linkage, 3.281&quot; OP</td>
<td>57</td>
<td>2</td>
<td>11003-016</td>
<td>HFB M8-1.25x16 CL 10.9, BO</td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>10591-001</td>
<td>Ball Stud, 10mm x 5/16-18</td>
<td>58</td>
<td>1</td>
<td>11057-007</td>
<td>LH Strut Asy DS129FS3</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>10597-087</td>
<td>Volume Assembly, LH</td>
<td>59</td>
<td>1</td>
<td>11185-007</td>
<td>LH Strut Asy DS147FS3/B</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>10597-088</td>
<td>Volume Assembly, RH</td>
<td>60</td>
<td>2</td>
<td>11102-400</td>
<td>HFB 3/4-10 x 4 Gr 8</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>10614-001</td>
<td>Cap, Filler/Breather</td>
<td>61</td>
<td>2</td>
<td>11122-650</td>
<td>HFB 3/4-10 x 6-1/2 Gr 8</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>10640-005</td>
<td>Bearing Spacer</td>
<td>62</td>
<td>1</td>
<td>11122-004</td>
<td>Upper Control Arm</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>10680-001</td>
<td>Driver Interface</td>
<td>63</td>
<td>1</td>
<td>11133-001</td>
<td>Reflective Terrain shield</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>10704-011</td>
<td>Dash Harness</td>
<td>64</td>
<td>1</td>
<td>11198-002</td>
<td>Track Rod</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>10729-014</td>
<td>Front Hanger, RH</td>
<td>65</td>
<td>1</td>
<td>11505-001</td>
<td>Asy, Power Supply</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>10730-008</td>
<td>Front Hanger, LH</td>
<td>66</td>
<td>2</td>
<td>11122-001</td>
<td>Lower Control Arm</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>10741-004</td>
<td>Steering Sensor</td>
<td>67</td>
<td>2</td>
<td>11122-001</td>
<td>Upper Control Arm</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
<td>10745-012</td>
<td>Upper Axle Seat</td>
<td>68</td>
<td>2</td>
<td>11122-001</td>
<td>Upper Control Arm</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>10762-011</td>
<td>Bridge</td>
<td>69</td>
<td>1</td>
<td>11133-001</td>
<td>Reflective Terrain shield</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>10782-013</td>
<td>Crossmember Reinf.</td>
<td>70</td>
<td>1</td>
<td>11535</td>
<td>Pwr Mod Mnt Kit</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>10782-014</td>
<td>OEM Crossmember Reinf.</td>
<td>71</td>
<td>1</td>
<td>11541</td>
<td>Document Kit</td>
</tr>
<tr>
<td>34</td>
<td>1</td>
<td>10789-019</td>
<td>Track Rod Mnt</td>
<td>72</td>
<td>1</td>
<td>11520</td>
<td>Kit, MY2017 Steering</td>
</tr>
<tr>
<td>35</td>
<td>1</td>
<td>10790-033</td>
<td>USM, LH</td>
<td>73</td>
<td>1</td>
<td>11521</td>
<td>Kit, MY2018 Steering</td>
</tr>
<tr>
<td>36</td>
<td>1</td>
<td>10790-034</td>
<td>USM, RH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Installation

Front Hangers

1. Install the hangers as shown with supplied and OEM fasteners through OEM front hanger holes.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>10012-008</td>
<td>LFN 5/8-11 Gr. G</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>10729-014</td>
<td>RH Front Hanger</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>10730-008</td>
<td>LH Front Hanger</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>10874-175</td>
<td>HFB 5/8-11 x 1.75&quot; Gr. 8</td>
</tr>
</tbody>
</table>

Note: Snug OEM fasteners on frame flange prior to tightening 5/8” fasteners to ensure hanger is flush with bottom of frame rail.

2. Torque Fasteners to **172-210 ft-lbs.**
Upper Strut Mounts

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>10790-033</td>
<td>USM, LH</td>
<td>8</td>
<td>6</td>
<td>10885-150</td>
<td>HFB ½-13x1-1/2&quot;, Gr.8</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>10789-019</td>
<td>Track Rod Mount</td>
<td>9</td>
<td>7</td>
<td>10012-007</td>
<td>LFN ½-13 Gr. G</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>10790-034</td>
<td>USM, RH</td>
<td>10</td>
<td>5</td>
<td>10501-002</td>
<td>HFB 3/8-16x1-1/4&quot;, Gr.8</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>10782-013</td>
<td>Cross-member Reinforcement</td>
<td>11</td>
<td>5</td>
<td>10012-005</td>
<td>LFN 3/8-16, Gr. G</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>10874-175</td>
<td>HFB 5/8-11x1.75&quot;, Gr.8</td>
<td>12</td>
<td>1</td>
<td>10782-014</td>
<td>OEM Crossmember Reinf.</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>10874-200</td>
<td>HFB 5/8-11x2&quot;, Gr.8</td>
<td>13</td>
<td>6</td>
<td>10885-150</td>
<td>HFB 1/2-13x1-1/2&quot;, Gr.8</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>10012-008</td>
<td>LFN 5/8-11 Gr. G</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Loosely attach all components through previously drilled holes in the frame and crossmember.

Figure 17: OEM Crossmember Reinforcement installed

IMPORTANT: Bolts must be installed in directions as shown to provide clearance to the Struts and other Moving parts. No bolts should be pointed towards the fuel tank.

IMPORTANT: Before tightening fasteners, verify the top of each upper strut mount is level with the top of the frame. Placing a jack under the USM helps to ensure mounts are flush to the bottom frame flange.

2. Torque all fasteners as shown above.
1. Install the Bridge and axle clamp components onto the axle. Note: The LH side of the bridge has a socket head bolt acting as a pin, which locates to the LH spring seat hole.

2. Relocate the RH parking brake cable guide to the RH Lower axle clamp. The cable guide may be tight around the cable and need loosened to enable sliding the cable inside. See Figure 18, Figure 19, and the section Parking Brake Cables.

3. Install M8 Bolts through lower Axle Cradle to the axle spring seat, to properly align the bracket. Notice: Install M8 Bolt to orient lower axle cradle.

Noticing: Cable will interfere with Bridge if not relocated.

4. Once you verify the Axle seat is sitting flush to the Bridge and the Bridge is sitting flush to the axle, Torque the U-Bolts as indicated above.

---

**Figure 18: Loosen Cable Guide for Repositioning**

**Figure 19: Relocate OEM Brake line to Axle Clamp**
Control Arms

1. Locate control arms and install as shown.
   
   Note: Front Hanger Control Arm fasteners can be reversed (nut outboard, if required).
   
   Note: Height sensor tab is pointed up and located forward on Lower Control Arms.

2. Do Not Torque fasteners at this time. Torque after track rod is installed and axle is held at ride height.

   IMPORTANT: Axle must be held at ride height for tightening control arm bolts to prevent premature wear of bushings from excess twist in the rubber.
### Track Rod and Tie Bar

#### Note:
Prior to installing Tie Bar Mount, one hole will need drilled in the frame.

Caution: When drilling through the frame rail, use caution not to drill into fuel, electrical, or brake lines.

1. Using the tie plate mount as a template, install the tie plate onto the LH shock mount, hold level to the frame, and mark the frame for drilling a Ø17/32” hole to allow mounting with 1/2” hardware. See Figure 20.

2. Using the Tie bar mount, as a template, mark and drill a Ø17/32” hole. See Figure 20.

3. Install components as shown above.

4. Jack each side of the axle until approximately design ride height position. See Figure 21.

5. Torque the two (2) 7/8” Track Rod mounting bolts to 491-600 ft-lbs.

6. Torque the eight (8) 1” Control Arm mounting bolts to 600 ft-lbs.

**Figure 21:** Adjust frame or axle to ride height when tightening control arm and track rod fasteners.

**IMPORTANT:** Vehicle must be at ride height when tightening control arms and track rod, to prevent premature wear of bushings from excess twist in the rubber.
Strut Assembly Installation

1. Install the Left Hand Strut Assembly as shown with strut hydraulic ports forward.
2. Repeat for installation of Right Hand Strut Assembly, Bearing Spacers, and Hardware.
3. Torque upper and lower strut fasteners to **275-300 ft-lbs. Do not over torque.**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>10012-014</td>
<td>LFN 3/4-10 Gr G</td>
<td>4</td>
<td>1</td>
<td>11057-008</td>
<td>RH Strut DS129FS3</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>10640-005</td>
<td>Bearing Spacer</td>
<td></td>
<td></td>
<td>11185-008</td>
<td>RH Strut DS147FS3/147FS3B</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>11057-007</td>
<td>LH Strut DS129FS3</td>
<td>5</td>
<td>2</td>
<td>11102-400</td>
<td>HFB 3/4-10 x 4&quot; Gr 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11185-007</td>
<td>LH Strut DS147FS3/147FS3B</td>
<td>6</td>
<td>2</td>
<td>11102-650</td>
<td>HFB 3/4-10 x 6-1/2&quot; Gr 8</td>
</tr>
</tbody>
</table>
**Height Sensors**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>10012-010</td>
<td>LFN 5/16-18, Gr. G</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>10586-001</td>
<td>Height Sensor Assembly</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>10587-008</td>
<td>Linkage Assembly</td>
</tr>
</tbody>
</table>

**IMPORTANT:** Strut assemblies must be installed prior to the installation of the height sensors to prevent over-travel of sensors which could damage sensor components.

1. Install Height Sensor components and hardware as shown.
2. Torque all 5/16 hardware to **14-17 ft-lbs**.
3. Snap the Linkage Assemblies to the ball studs attached to the lower control arms and to the ball studs on the Height Sensor arms. **Install locking clips as shown in Figure 22.**

**Figure 22, Height Sensor Linkage Installation.**
1. Raise the front end of the vehicle, per OEM instructions.
2. Remove and retain the lower two of three nuts securing front track rod mount to cross member. See Figure 23.
3. Install bracket over two bolts and reinstall OEM nuts. Torque to 120 – 147 ft-lbs
4. Route the steering sensor branch containing the J35 steering sensor connector to the steering sensor.

**Important:** Verify the wiring harness does not contact heat source or moving components.
5. Connect the electrical connector to the steering sensor prior to installation of the Steering Sensor.
6. Install steering linkage mount to the pitman arm, ensuring it is pressed up against the flange/boss on pitman arm. 2017 vehicles, the bracket should be pressed up against the pitman arm nut.
7. Attach linkage to ball studs and install locking clips.

**Important:** Verify the steering sensor components do not bind or interfere during full travel of the steering

**Figure 23. Track rod mount bolts to temporarily remove**

*Items 1, 3, 4, and 5 are provided as a kit (P/N: 11520) for MY2017, and as kit (P/N: 11521) for MY2018. Part #’s provided for service*
Power Module Installation.

1. Locate the Power Module Assembly and Power Module Mounting Kit.
2. Assemble as instructed in the kit, and mount onto chassis under the cab on the driver side.

---

**Figure 24: Power module location on truck**
WARNING: Each Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to support the Volume Assembly during installation.

1. Locate and Place the mounts against the driver side frame, forward of the front hanger. See Figure 25

Important: Locate the mounts such that the distance between two mounts as wide as possible. Avoid partially drilling through existing frame holes and inside fuel line mounts. See Figure 25 for dimensions.

2. Verifying the mounts are held flush to the bottom of the frame and utilizing the mount hole pattern, mark the locations of the mounting holes and drill (2) Ø7/16” holes per mount.

3. Attach the two mounts with 3/8” Flange Bolts and Nuts. Torque to 35-43 ft-lbs. Note: Orientate nuts outboard.

4. Repeat with Volume Mounts on the passenger side of the frame.

5. Raise the volume assembly until the volume contacts both mounts. Rotate the volume assembly until the bleed screws are located to the top and as vertical as possible.

6. Locate (2) T-Bolt Clamps, open the clamps, and place them in the mounts around the two pegs. Torque the T-Bolt nut to 240 in-lbs.

7. Repeat with opposite side. Note, the 90° Elbows connected to the volume may have to be loosened and re-orientated as necessary.

Figure 25: Suggested Tank Mount Locations
### Brake Cables

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>10012-005</td>
<td>LFN 1/2-13, Gr. G</td>
<td>4</td>
<td>2</td>
<td>10886-100</td>
<td>HFB 5/16-18 x 1&quot; Gr 8</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>10012-010</td>
<td>LFN 5/16-18, Gr. G</td>
<td>5</td>
<td>1</td>
<td>10902-002</td>
<td>Parking Brake Cable Mount</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>10885-150</td>
<td>HFB 1/2-13 x 1.5, Gr 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Locate and install Parking Brake Cable Mount using 1/2” hardware, and torque to 86-105 ft-lbs, Dry.
2. Attach Drive Side Cable to the Cable mount.
3. Attach both OEM Cable Guides to the Cable Mount using 5/16” hardware, and torque to 14-17 ft-lbs, Dry.

![Figure 26: Parking Brakes Installed](image1)

4. Using 5/8” loop clamps and 5/16” hardware, secure the passenger parking brake cable to the Bridge mounting points as shown in Figure 27

![Figure 27: Attachment points for Passenger Parking brake cable.](image2)

5. Secure the Passenger hydraulic brake line behind the axle with a 3/8” loop clamp. See Figure 28

![Figure 28: Passenger hydraulic brake hose.](image3)
Hydraulic Hose Attachment and Routing

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>10012-010</td>
<td>LFN 5/16”-18 Gr G</td>
<td>3</td>
<td>5</td>
<td>10855-003</td>
<td>Vinyl Coated Loop Clamp, 5/8” ID</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>10855-002</td>
<td>Vinyl Coated Loop Clamp, 1”ID</td>
<td>4</td>
<td>6</td>
<td>10886-100</td>
<td>HFB 5/16-18 x 1” Grade 8</td>
</tr>
</tbody>
</table>

CAUTION: Attachment of the hydraulic hoses may result in some spillage of fluid. Use of oil absorbent mats is recommended.

CAUTION: Make sure hoses are not chafing or in contact with any sharp edges.

1. Locate -10 hose on Left Hand (driver side) Secondary Volume and route the hose to strut area, over front hanger and axle.

2. Locate 3/16” ID PVC Tubing (not included with kit). Note: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit can be used.

3. Attach the PVC tubing to the bleed screw on the -10 hose side of the Left Hand Secondary Volume Assembly and place the other end in a bucket.

4. Open the bleed screw slightly to relieve any residual pressure.

5. After pressure is relieved, close the bleed screw and torque to 13-18 ft-lbs.

6. Remove the cap from the strut port, and Remove the plug from the end of the hose.

7. Attach the hose end (-10 JIC fitting) to the strut port and torque to 36-63 ft-lbs.

8. Secure hose with clamp to front hanger and frame or Upper strut mount.

9. Repeat with the opposite side. Note, the -10 90° Elbow connected to the volume may have to be loosened and re-orientated as necessary.

10. Attach the PVC tubing to the bleed screw on the -4 hose side of the Left Hand Secondary Volume Assembly and place the other end in a bucket.

11. Open the bleed screw slightly to relieve any residual pressure and after pressure is relieved, close the bleed screw and torque to 13-18 ft-lbs.

12. Route the Left Hand (Driver side) -4 (1/4”) hydraulic hose to the Power Module. Use hose clamps to secure the hose from movement or chafing.

13. Attach the hose end to the fitting in the port marked “L”. Torque to 12 ft-lbs. Do not over tighten.

14. Repeat with the Pass side for the port marked “R”.

15. Clean up any fluid spillage.

Figure 29. Bleed screw locations.

Figure 30. -4 Hose Connections, Frame Hidden.
**External Electrical Installation:**

1. Locate the External Electrical Harness attached to the power module.

2. Unroll the wiring harness and using the External Electrical Harness wiring diagram, found in the electrical schematics section, and identify the connection ends.

3. Locate the trunk containing Height Sensor (J21 and J22) and the Rate Valve (J23 and J24) connections.

4. Route and make the following connections to the Height Sensors.

| J21 | Left Height Sensor |
| J22 | Right Height Sensor |

5. Route and make the following connections to the Rate Valves.

| J23 | Left Rate Valve |
| J24 | Right Rate Valve |

6. Secure harness to OEM harness. Use of plastic clips is recommended.

7. Install Reflective ThermaShield around wiring crossing over the exhaust piping. Supplied is a 4’ section which needs cut in half and installed on branches J22 and J24. See Figure 31 and Figure 32.

8. Locate the 8ga wire ground ring terminal, J30, branch near the power module.

9. Locate and drill Ø1/4” hole in frame. Remove frame coating(s) as needed to ensure metal-to-metal contact between the ring terminal and frame.

10. Attach the ground ring terminal, J30, to the chassis frame for grounding. Sealant may be applied after ring terminal is secured.

11. Route the remaining trunk (containing blunt wires and steering sensor connector) towards the firewall. Secure to OEM wiring harness.

12. Locate the existing firewall access hole under the dash, behind the parking brake pedal.

13. Route the wiring harness branch containing the (8) 18ga blunt wires through the firewall access hole.

14. Locate the 8ga battery connection branch.

15. Route branch to the battery positive terminal.

16. Locate the Battery Fuse Lead containing the 80 amp fuse.

17. Crimp the fuse lead to the 8ga battery connection branch blunt end.

18. Melt the heat shrink on the crimped connection to seal the splice.

19. Remove the 80 amp fuse and retain.

20. Connect to the positive terminal post per OEM Upfitter wiring instructions.

---

**Figure 31:** Install 2’ sections on each J22 and J24

**Figure 32:** Wiring routed through hanger.

**Figure 33:** 2016 pictured, 2017 similar
Dash Harness Installation

1. Locate the dash harness.

2. Locate and identify the following 18ga wires in the two external wiring harness branches passed through the firewall:
   - Red (Battery Power)
   - Yellow (Ignition)
   - Black (Ground)
   - White (CAN High)
   - White/Black (CAN Low)
   - Yellow/Black (Park)
   - Violet/White (Speed)
   - Pink/Black (Brake)

3. Crimp each wire to the corresponding blunt wire in the dash harness labeled “External Harness Connections”. Match wire colors, crimp using butt splices, and install heat shrink.

4. Locate the four (4) Yellow, Yellow/Black, Violet/White, and Pink/Black 18ga wires in the dash harness. Route the wires to the Customer Access Harness located inside the passenger kick panel.

5. Make the following connections with the Customer Access Harness: Crimp each wire using butt splices. Heat shrink sealing is recommended.

6. Locate the 48” Red 12ga wire in the dash harness. Route the wire through the firewall grommet to the additional customer access wires located under the fuse panel behind the Driver side battery.

Figure 34: Customer Access Harness

7. Make the following connection with the Underhood Customer Access – Upfitter Harness: Crimp the wire using sealed butt splices. Heat shrink sealing is recommended.

<table>
<thead>
<tr>
<th>Liquidspring Dash Harness</th>
<th>→</th>
<th>Ford Customer Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red 12ga (Battery)</td>
<td>→</td>
<td>Brown/Red – 20A B+</td>
</tr>
</tbody>
</table>

8. Attach the Ground ring terminal (J32) from the dash harness to a ground location under the steering wheel, near the OBD port.

9. Refit any sheathing and apply appropriate electrical tape and zip ties to secure excess wire.

10. Replace passenger side plastic kick panel.
**Driver Interface Installation:**

1. Locate the Driver Interface.
2. Mount the Driver Interface to the dash in an appropriate location.
3. Route the Driver Interface harness to the dash harness connector, J26, and connect.
4. Secure all wires under the dash.
5. Replace the 80 amp fuse at the battery.

**Optional Door Electrical Harness Installation:**

The optional door harness can be used to remotely activate the system “kneeling” feature in which the suspension automatically lowers to a point slightly less than maximum jounce travel. The door harness can be utilized in two actuation methods.

**IMPORTANT:** Do not connect positive (12VDC) signal to either the W98 Tan/Blk or W93 Brown wires. Applying positive (12VDC) to either of these wires can result in ECU failure.

**A. Single Wire - Ground Signal From Source**

Ground is provided to the door harness Brown (W93) wire from a grounding source (e.g., multiplex signal, switch, etc.). If a remote switch is used, it is recommended to use a normally closed (NC) door switch which remains open when the door is closed (or closed when the door is opened). One side of the switch must be connected to a ground source and the other side routed to the door harness. If multiple switches are used, they should be wired in a parallel arrangement with the door harness. Requires single wire routed from source to door harness.

**B. Dual Wire – Ground Signal From System**

Ground is provided by the suspension system when the Brown (W93) wire is connected to the Tan/Black (W98) wire of the door harness. This arrangement requires a remote switch that is a normally closed (NC) door switch which remains open when the door is closed (or closed when the door is opened). One side of the switch needs to be connected to the door harness Brown (W93) wire and the other side to the door harness Tan/Black (W98) wire. Requires two wires routed from switch to door harness.

1. Door harness wires are located on the main external wiring harness as a branch near the power module.
2. Unwrap the door harness wires.
3. Based on the selected actuation method above, strip the end(s) of the door harness blunt wire(s) and connect the end(s) to the signal source using a heat shrinkable butt-splice. Crimp the connection(s) accordingly and apply heat to the insulator to seal the connection(s).

**Initial System Fill**

1. Install the wheels and tires. Torque wheel nuts to OEM specifications.
2. Reconnect the negative cable to the vehicle battery.
3. Verify that the front wheels are steered straight ahead.
4. Lower the vehicle to the ground and remove any jack stands from under the vehicle. The suspension should be in the kneeled position.
5. Locate the container of Compressible Fluid.
6. Remove the breather cap from the Power Module reservoir.
7. Fill the reservoir approximately 2/3 full.
8. Turn the ignition key to “Run” and ensure that the LiquidSpring driver display LEDs light up and that the red “Warning” LED is not lit. If the red “Warning” LED is lit, proceed to the Trouble Shooting Section.

**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.

9. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.
10. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.
11. The green ride height indicator LED should indicate “Low” and begin flashing as the pump/motor starts. If pump/motor does not start, check Trouble Shooting Electrical Section.
12. Monitor the fluid level in the reservoir. If the level drops below 1/4 of the tank, press and release the Red ON/OFF button to shut off the system, refill the reservoir, and turn the system back on by pressing the Red ON/OFF button.
13. If the suspension system does not begin to rise to a preset ride height after 3 minutes, stop the system and check the following first and then repeat this step:
   a. Check for any fluid leaks.
   b. Check that the hoses are properly connected.
c. Completely depressurize the system. See Depressurizing the System section, under System Operation.

14. After the suspension system stops leveling, check the fluid level in the reservoir. If low, fill to the indicated line.

![Figure 36. Final fill fluid level.](image)

**Bleeding the System**

1. Locate 3/16” ID PVC Tubing (not included with kit). Note: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit or Lisle 19200 Brake Bleeding Kit (found at Sears) can be used.

2. Attach the PVC tubing to one of the upper bleed screws on the Left Hand Secondary Volume Assembly and place the other end in a bucket.

![Figure 37. Bleed screw locations.](image)

3. Open the bleed screw slightly.

4. After air bubbles are no longer present, close the bleed screw and torque to **13-18 ft-lbs**.

5. Repeat with remaining three bleed screws.

**Calibrating the System**

**IMPORTANT**: Proper calibration of the system must be conducted with the vehicle loaded to the as delivered condition with body installed. For calibration on an empty chassis cab, LiquidSpring recommends weight be added to the frame approximately equal to the planned body to allow for proper bushing deflections.

Note: The LiquidSpring Calibration routine will automatically determine maximum and minimum suspension ride height. Based on those ride heights, the system will determine the correct normal design ride height. The calibration system will also calibrate the steering sensor.

![Diagram](image)

1. Verify that the front wheels are steered straight ahead.

2. Lower the vehicle to the ground and remove any jack stands and any other obstructions from under the vehicle.

3. To begin the calibration, turn the ignition key to “Run” and ensure that the LiquidSpring driver display lights up and that the red “Warning” LED is not lit or flashing.

**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.

4. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.

5. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.

6. Press and hold both Ride Height Adjustment Buttons simultaneously until the SPORT, COMFORT, HIGH, and LOW green LED’s begin to flash. The suspension system will begin to rise to the full high position, and then lower to the full lowered position.

7. After the system completes the calibration routine, the suspension will return to the original ride height.

8. Turn off the ignition for at least 3 minutes. Note: The suspension system will not use the calibrated ride height settings until power has been cycled.

Note: Pressing the red ON/OFF button on the driver display does not cycle power to the LiquidSpring suspension system, but only will enable/disable the system.

9. Turn the ignition back to Run.

10. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.

11. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.

12. Calibration is now completed.
System Start Up:

- In most instances, the suspension system can be left alone to operate automatically.
- After startup, all the indicator lights will flash on for 1-2 seconds, and then the Green Ride Height Indication LED and Green Ride Mode Indication LED will light to show the current Ride Mode and Ride Height.
- The four yellow LED’s will light up if the steering wheel is approximately 10°-20° each side of straight ahead, but will not light up when steering wheel exceeds 20° from center. If the vehicle is steered straight ahead and the four yellow LED’s are not lit (and the red warning LED is not lit) see Calibrating the Steering Sensor Only.
- When the steering wheel is turned more than 20° off center, the four Yellow Steering Centering Indication LED will not be lit.

ON/OFF Button:

Pressing the ON/OFF button will enable/disable the suspension. When the suspension is ON, relevant LED’s are lit up. When the suspension is OFF, none of the LED’s are lit. It is recommended to leave the suspension ON at all times unless the vehicle or suspension is being serviced.

IMPORTANT: After turning the vehicle ignition off, the suspension system will remain powered for 1 hour before shutting off.

Warning Light:

If the Red LED warning light is continuously illuminated along with one or more of the other indicator lights, please refer to the Troubleshooting Section on page 30.

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.

- **Comfort Mode** provides a smooth, soft ride. Use for normal city and highway driving.
- **Sport Mode** provides more “feel” or response to the road conditions. Use where road conditions or personal preference demand more control.
- **Normal Mode** is a balance between Comfort and Sport. Use where more control than Comfort is desired, but better ride than Sport.

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 road.

Ride Height Adjustment:

Press the UP/DOWN arrow buttons to change ride height from NORMAL to HIGH (body up) or LOW (body down).

- A solid green LED will indicate the selected height. A flashing green LED will indicate the current height and that height adjustment is
occurring. When a single solid green LED is lit, the selected height has been achieved.

- Two solid green LEDs will be lit if the current height is not the selected height and height adjustment is not occurring.
- If LOW or HIGH heights are selected while the vehicle is traveling at less than 10 mph or stopped, the suspension height is either lowered or raised.
- If LOW 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 10 mph within 2 minutes of selecting the height. In this instance, the NORMAL height green LED will flash and the selected height green LED 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 in NORMAL height indicated by only the NORMAL height green LED lit solid.
- If LOW height is selected and the ignition is turned off before LOW height is achieved, the system will continue to lower to LOW height. When LOW height is selected the system will monitor and maintain the kneeled position by only lowering as needed for 1 hour after the ignition is turned off.
- If HIGH height is selected and the ignition is turned off before HIGH height is achieved, the system will stop adjusting ride height. When HIGH height is selected the system will monitor and maintain the current position by only lowering as needed for 1 hour after the ignition is turned off.
- The door switch function (if equipped) is disabled when the driver display LOW or HIGH height is selected before the door is opened on vehicles equipped with a door switch for kneeling.

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

**Depressurizing the System**

1. Turn the ignition key to “Run” and ensure that the LiquidSpring driver display LEDs light up and that the red “Warning” LED is not lit. If the red “Warning” LED is lit, proceed to the Trouble Shooting Section.

**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.

1. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.
2. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.
3. Press and release the HEIGHT DOWN arrow button to lower the vehicle to the LOW height.
4. Press and hold the HEIGHT DOWN arrow button for approximately 2 minutes.
5. Release the HEIGHT DOWN arrow button.
6. Press and release the ON/OFF button to disable the system.
7. Turn off the vehicle ignition.

If any of the hydraulic connected components is to be removed and serviced, it is recommended to also follow the following steps:

8. Locate 3/16” ID PVC Tubing. Note: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit can be used.
9. Attach the PVC tubing to one of the upper bleed screws on the Left Hand Secondary Volume Assembly and place the other end in a bucket.
10. Open the bleed screw slightly to relieve any residual pressure.

![Bleed Screw Locations](image)
11. After pressure is relieved, close the bleed screw and torque to 13-18 ft-lbs.

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 non-hydraulic connected suspension 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.

**Calibrating the Steering Sensor Only**

Note: The yellow lights only light up when the steering sensor indicates the center location. They will not be lit outside of 10°-20° off center.

**IMPORTANT:** The LiquidSpring CLASS® system includes an automatic self-centering routine. In conditions such as driving on highway with significant side wind, the yellow lights may temporarily not be lit when the steering wheel is exactly centered. Rotate slowly from center to full steering stop, then repeat the opposite direction. If the yellow lights momentarily light up during the travel in one or the other direction, the system is operating normally and the steering sensor does not need to be manually re-centered.

Continue operating normally.

If the yellow lights do not light up at all during turning the steering wheel, following the instructions below.

1. Verify that the front wheels are steered straight ahead.
2. To begin the calibration, turn the ignition key to “Run” and ensure that the LiquidSpring display lights up and that the red “Warning” LED is not lit or flashing.

**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.

3. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.

4. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.

5. Press and hold both Ride Height Adjustment Buttons simultaneously until the SPORT, COMFORT, HIGH, and LOW green LED’s begin to flash.

6. As soon as the four green LED’s begin to flash, press the ON/OFF button to stop the process.

7. Verify that the four yellow arrow LED’s are lit.

8. Steering calibration is completed.

**Calibrating the System (Full)**

See Section Calibrating the System, on page 25

**Checking Fluid Level**

1. Turn the ignition key to “Run” and ensure that the LiquidSpring display LEDs light up and that the red “Warning” LED is not lit. If the red “Warning” LED is lit, proceed to the Trouble Shooting Section.

**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. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.

3. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.

4. After the suspension system stops leveling, check the fluid level in the reservoir. If low, fill to the indicated line.

5. To add fluid, remove filler/breather cap on reservoir.


7. Add fluid to the reservoir until the fluid level is within the band shown in Figure 39.

8. Replace filler/breather cap and retighten.

**Figure 39. Final fill fluid level.**
Checking Fittings for Leaks

**WARNING:** The system operates under high fluid pressure (up to 3500 psi). Do not attempt to locate leaks by feeling with hands or any part of the body. High pressure fluids can penetrate the skin and cause severe tissue damage.

1. While system is at ride height and pressurized, visually examine fittings and hose connections for any source of leaks. Do not use hands to search for leak. If the source of the leak is a fitting or other component, depressurize the system and repair or replace as needed.

2. Tighten hose nuts if the leak is coming from the connection between the hose nut and a fitting. Depressurize the system before tightening anything. Replace hose if the leak is coming from anywhere else on the hose.

3. Clean all fluid from hose and fittings to visually identify any leaks.

**IMPORTANT:** Over-tightening hoses and fittings can damage components and lead to leaks.

---

Service Intervals

**Once Daily or Before Each Shift of Usage**

- Check the suspension system to be sure it is fully operational.
  - After starting vehicle, verify all LED’s on the driver display flash briefly, then the Green Ride Height and Ride Mode LED’s are lit and the Red Warning LED does not stay on or flash.
  - Verify the four Yellow LED’s are lit when the steering wheel is centered.
  - Verify that they system is at NORMAL ride height, with a steady green LED.
    - If the Driver Display indicates a blinking ride height LED, allow the system to complete leveling as indicated by a steady green LED.
    - If LOW or HIGH height is shown with a solid green LED, use the arrow buttons to raise or lower the suspension to NORMAL height.
- 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.

**Initial 1,000 mile (1,600 km) Inspection**

- Inspect bolts and nuts at the control arm pivots to assure they are properly torqued.
- Inspect u-bolts to assure they are properly torqued.
- Thoroughly inspect all hydraulic connections for signs of leakage.
- Inspect reservoir fluid level.

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

- Check all suspension components for any signs of damaged/broken components, looseness, or wear.
- Inspect bolts and nuts at the control arm pivots to assure they are properly torqued.
- Inspect bolts and nuts at both the frame and axle mount ends of the track rod to assure they are properly torqued.
- Inspect u-bolts to assure they are properly torqued.
- Thoroughly inspect all hydraulic connections for signs of leakage.
- Inspect reservoir fluid level.
Troubleshooting

The LiquidSpring CLASS® system includes on-board diagnostics to assist in pin-pointing potential issues. When a fault in the system occurs, the red warning light on the Drivers Interface will light along with one or more of the other lights on the interface.

<table>
<thead>
<tr>
<th>Driver Interface Lights</th>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning + RIDE: SPORT</td>
<td>Battery Voltage in excess of 16VDC</td>
<td>Vehicle charging system providing incorrect voltage.</td>
<td>Inspect and replace as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LiquidSpring system not connected to 12VDC electrical system</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td>Warning + RIDE: NORMAL</td>
<td>Pump Motor runs in excess of 3 minutes</td>
<td>See Issues with Vehicle Raising/Pump Section</td>
<td>See Issues with Vehicle Raising/Pump Section</td>
</tr>
<tr>
<td>Warning + RIDE: COMFORT</td>
<td>Battery Voltage below 9 VDC</td>
<td>Vehicle charging system providing incorrect voltage</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td>Warning + HEIGHT: HIGH</td>
<td>Issue with Right Hand Height Sensor</td>
<td>See Issues with Height Sensors Section</td>
<td>See Issues with Height Sensors Section</td>
</tr>
<tr>
<td>Warning + HEIGHT: NORMAL</td>
<td>System kneels in excess of 3 minutes without suspension movement</td>
<td>See Issues with Vehicle Lowering/Dump Valve Section</td>
<td>See Issues with Vehicle Lowering/Dump Valve Section</td>
</tr>
<tr>
<td>Warning + HEIGHT: LOW</td>
<td>Issue with Left Hand Height Sensor</td>
<td>See Issues with Height Sensors Section</td>
<td>See Issues with Height Sensors Section</td>
</tr>
<tr>
<td>Slow or Fast Blinking Warning Light</td>
<td>Driver Interface can not communicate with ECU.</td>
<td>See Issues with Driver Interface</td>
<td>See Issues with Driver Interface</td>
</tr>
</tbody>
</table>

Issues with Vehicle Raising/Pump

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Leveled, Pump continues to run</td>
<td>Pump motor shorted out.</td>
<td>Contact LiquidSpring for further instructions.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump runs</td>
<td>Software issue</td>
<td>Turn off ignition, wait 30 seconds, restart vehicle.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Excessive noise in height sensor</td>
<td>See Issues with Height Sensors</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Reservoir fluid level low</td>
<td>Fill reservoir to specified level.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Hydraulic leak in system</td>
<td>Check for fluid leaks and repair or replace.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Vehicle overloaded</td>
<td>Check vehicle loading and correct.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Air in pump</td>
<td>Check fluid level in reservoir and fill accordingly. Fully depressurize system and restart leveling.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Internal leak in power module</td>
<td>Replace power module.</td>
</tr>
<tr>
<td>Vehicle Not Leveled (or Raised), Pump does not run</td>
<td>Height sensor error</td>
<td>See Issues with Height Sensors</td>
</tr>
<tr>
<td>Pump runs for short time then stops</td>
<td>System not turned on.</td>
<td>Turn system on.</td>
</tr>
<tr>
<td>Pump runs for short time then stops</td>
<td>Blown fuse</td>
<td>Check system fuses</td>
</tr>
<tr>
<td>Pump runs for short time then stops</td>
<td>Loss of electrical power</td>
<td>Check wiring between power module and battery.</td>
</tr>
<tr>
<td>Pump runs intermittently</td>
<td>Motor controller over temperature</td>
<td>Contact LiquidSpring for further instructions.</td>
</tr>
<tr>
<td>Pump runs intermittently</td>
<td>Loose connector or wiring</td>
<td>Check wiring harness connections and battery connections. Repair as necessary.</td>
</tr>
</tbody>
</table>

Issues with Vehicle Lowering/Dump Valve

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>System not turned on</td>
<td>Turn system on</td>
</tr>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>Blown fuse</td>
<td>Check system fuses and replace as necessary</td>
</tr>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>Obstacle under vehicle frame</td>
<td>Remove obstacle</td>
</tr>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>Wiring harness disconnected</td>
<td>Check wiring harness connections and reconnect</td>
</tr>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>Loss of electrical power</td>
<td>Check wiring between power module and battery</td>
</tr>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>Power module filters plugged</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
<tr>
<td>Vehicle does not lower (kneel).</td>
<td>Internal power module blockage</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
<tr>
<td>Vehicle slow lowering (kneeling)</td>
<td>Partial internal power module blockage</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
</tbody>
</table>
### Issues with One Corner Not Leveling Properly

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>One side will not raise or lower</td>
<td>Internal power module blockage</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
<tr>
<td></td>
<td>Low voltage</td>
<td>Check battery voltage.</td>
</tr>
<tr>
<td></td>
<td>Wiring harness disconnected</td>
<td>Check wiring harness connections and reconnect</td>
</tr>
<tr>
<td></td>
<td>Obstacle under vehicle frame</td>
<td>Remove obstacle</td>
</tr>
<tr>
<td></td>
<td>Power module filters plugged</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
<tr>
<td></td>
<td>Height sensor error</td>
<td>See Issues with Height Sensors</td>
</tr>
<tr>
<td>One corner raises and lowers slower than other corners</td>
<td>Internal power module blockage</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
<tr>
<td></td>
<td>Filter partially clogged</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
</tbody>
</table>

### Issues with Height Sensors

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle or corner stops leveling at incorrect height</td>
<td>Damaged height sensor and/or linkage</td>
<td>Inspect height sensor components. Replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Incorrect calibration</td>
<td>Recalibrate vehicle – see System Operation section.</td>
</tr>
<tr>
<td></td>
<td>Incorrect height sensor installation</td>
<td>Inspect height sensor components and correct.</td>
</tr>
<tr>
<td>Corner height where leveling stops is inconsistent</td>
<td>Sensor or Linkage loose</td>
<td>Inspect installation of height sensor and linkages and tighten if necessary</td>
</tr>
<tr>
<td></td>
<td>Loose connector / wire</td>
<td>Inspect wiring between sensor and power module for loose connection</td>
</tr>
<tr>
<td>Vehicle will not level - no height sensor signal</td>
<td>Height Sensor wiring shorted, broken, or disconnected</td>
<td>Inspect wiring between sensor and power module.</td>
</tr>
<tr>
<td></td>
<td>Malfunction in Sensor</td>
<td>Replace sensor.</td>
</tr>
<tr>
<td>No Height Sensor Signal change while driving</td>
<td>Linkage broken/disconnected</td>
<td>Inspect installation of height sensor and linkages. Correct and/or replace.</td>
</tr>
</tbody>
</table>

### Issues with Ride/Handling

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle rolls side to side excessively</td>
<td>System inactive (Drivers interface dark)</td>
<td>Turn system on (press On/Off button)</td>
</tr>
<tr>
<td></td>
<td>No electrical power to system</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td></td>
<td>Strut bushings worn</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td></td>
<td>Control arm bushings worn</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td></td>
<td>Sway bar bushings worn</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td></td>
<td>Strut mounting loose</td>
<td>Inspect and replace as necessary</td>
</tr>
<tr>
<td></td>
<td>Rate Valve wiring shorted, broken, or disconnected</td>
<td>Inspect wiring and correct/replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Voltage to Rate Valve solenoid too low</td>
<td>Check battery voltage.</td>
</tr>
<tr>
<td></td>
<td>Rate Valve Poppet Jammed open</td>
<td>Contact LiquidSpring for further instructions</td>
</tr>
<tr>
<td>Excessive stiffness when on flat, straight road</td>
<td>No vehicle speed signal</td>
<td>See Issues with Vehicle Speed Signal section.</td>
</tr>
<tr>
<td></td>
<td>Short to Rate Valve</td>
<td>Check wiring between rate valve (on secondary volume) and power module for signs of shorts. Replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Wiring to Rate Valve incorrect</td>
<td>Inspect wiring and correct as necessary.</td>
</tr>
</tbody>
</table>

### Issues with Steering Sensor

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>No steering signal ( reduced roll control when cornering)</td>
<td>Steering sensor wiring broke or incorrect.</td>
<td>Inspect wiring to steering sensor and correct as necessary.</td>
</tr>
<tr>
<td></td>
<td>Steering sensor malfunction</td>
<td>Replace sensor</td>
</tr>
<tr>
<td></td>
<td>Steering sensor not installed correctly</td>
<td>Inspect installation and correct as necessary</td>
</tr>
<tr>
<td>Yellow lights on driver display not lit when steered straight ahead</td>
<td>Zero point of steering sensor incorrect.</td>
<td>See Calibrating the Steering Sensor Only.</td>
</tr>
<tr>
<td>Intermittent steering sensor signal</td>
<td>Loose connector / wire</td>
<td>Check wiring between Steering sensor and Power module for loose connection.</td>
</tr>
</tbody>
</table>
### Issues with Vehicle Speed Signal

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>System leveling excessively while driving.</td>
<td>Speed Sensor wiring shorted, broken, or disconnected</td>
<td>Inspect wiring and repair/replace as necessary</td>
</tr>
<tr>
<td>Speed signal malfunction</td>
<td></td>
<td>Replace OEM speed sensor. See OEM service manual.</td>
</tr>
<tr>
<td>Intermittent speed sensor signal</td>
<td>Loose connector / wire</td>
<td>Check wiring between Speed sensor and Power module for loose connection.</td>
</tr>
</tbody>
</table>

### Issues with Vehicle Brake Signal

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle will not level</td>
<td>Brake signal wire not correctly tapped.</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Brake switch malfunction</td>
<td></td>
<td>Replace OEM speed sensor. See OEM service manual.</td>
</tr>
<tr>
<td>Intermittent leveling</td>
<td>Loose connector / wire</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
</tbody>
</table>

### Issues with Door Switch

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle will not kneel when rear door opened</td>
<td>Short or break in wiring between door switch and power module.</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Door switch malfunction</td>
<td></td>
<td>Inspect door switch and repair/replace as necessary</td>
</tr>
<tr>
<td>Vehicle kneels whenever speed below 5mph</td>
<td>Short or break in wiring between door switch and power module.</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Door Switch out of adjustment</td>
<td></td>
<td>Check installation of door switch and adjust as necessary</td>
</tr>
<tr>
<td>Door switch malfunction</td>
<td></td>
<td>Inspect and replace per body builder instructions.</td>
</tr>
<tr>
<td>Intermittent door switch signal</td>
<td>Loose connector / wire</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
</tbody>
</table>

### Issues with Vehicle Ignition Signal

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>System does not turn on (no leveling or stiffness control)</td>
<td>No ignition signal to controller or driver interface</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Ignition &quot;sensor&quot; malfunction</td>
<td></td>
<td>Inspect and replace per OEM service manual.</td>
</tr>
<tr>
<td>System does not turn off once ignition switched off</td>
<td>Signal side short to battery</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Ignition &quot;sensor&quot; malfunction</td>
<td></td>
<td>Inspect and replace per OEM service manual.</td>
</tr>
<tr>
<td>System intermittently works</td>
<td>Loose connector / wire</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
</tbody>
</table>

### Issues with Vehicle Park Signal

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>System will start up but won't level when parked</td>
<td>No park signal to controller</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Park sensor malfunction</td>
<td></td>
<td>Inspect and replace per OEM service manual.</td>
</tr>
<tr>
<td>System levels when stopped and not in park</td>
<td>Park signal always on</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Park sensor malfunction</td>
<td></td>
<td>Inspect and replace per OEM service manual.</td>
</tr>
<tr>
<td>Intermittent leveling when stopped in or out of park</td>
<td>Loose connector / wire</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
</tbody>
</table>

### Issues with Driver Interface

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning light blinks, system appears to level.</td>
<td>CAN wires crossed or not connected.</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>Malfunctioning Driver Interface</td>
<td></td>
<td>Inspect and replace as necessary.</td>
</tr>
<tr>
<td>Warning light blinks, system does not appear to operate (level)</td>
<td>No power to ECU (5A 18ga Red Wire)</td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>No ignition signal to ECU (Yellow Wire)</td>
<td></td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
<tr>
<td>CAN wires crossed or not connected.</td>
<td></td>
<td>Inspect wiring and repair/replace as necessary.</td>
</tr>
</tbody>
</table>
### Issues with Power Module

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump exhibits high pitch whine immediately after pump stops or when vehicle lowering</td>
<td>The Check Valve is stuck open</td>
<td>Replace Power Module</td>
</tr>
<tr>
<td>Pump running under heavy load and leveling slow</td>
<td>The Check Valve is only partially open</td>
<td>Replace Power Module</td>
</tr>
<tr>
<td>Pump running under heavy load and no leveling</td>
<td>The Check valve is stuck closed</td>
<td>Replace Power Module</td>
</tr>
<tr>
<td>Hydraulic fluid leaking from Power Module</td>
<td>O-ring failure</td>
<td>Replace O-ring</td>
</tr>
<tr>
<td></td>
<td>Manifold cracked</td>
<td>Replace Power Module</td>
</tr>
<tr>
<td></td>
<td>Fitting loose</td>
<td>Tighten fittings</td>
</tr>
<tr>
<td></td>
<td>Valve loose</td>
<td>Tighten valves to correct torque</td>
</tr>
<tr>
<td></td>
<td>Bolts between manifolds loose/broken</td>
<td>Replace and/or tighten bolts to correct torque</td>
</tr>
<tr>
<td></td>
<td>Hydraulic line loose</td>
<td>Tighten hydraulic line correctly</td>
</tr>
<tr>
<td></td>
<td>Bolts between reservoir and manifold loose/broken</td>
<td>Replace and/or tighten bolts to required torque</td>
</tr>
<tr>
<td></td>
<td>Broken / cracked reservoir</td>
<td>Replace reservoir</td>
</tr>
</tbody>
</table>

### Issues with Strut Assembly

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Leak</td>
<td>Weld failure between cylinder and end</td>
<td>Replace strut</td>
</tr>
<tr>
<td></td>
<td>Cylinder fracture</td>
<td>Replace strut</td>
</tr>
<tr>
<td></td>
<td>Threads stripped between cylinder and gland</td>
<td>Replace strut</td>
</tr>
<tr>
<td></td>
<td>Seals worn out</td>
<td>Replace strut</td>
</tr>
<tr>
<td></td>
<td>Rod severely scratched or dented</td>
<td>Replace strut</td>
</tr>
<tr>
<td></td>
<td>Fitting loose</td>
<td>Tighten or replace fittings</td>
</tr>
<tr>
<td></td>
<td>Hose failure</td>
<td>Replace failed hose</td>
</tr>
<tr>
<td></td>
<td>Hose cut</td>
<td>Replace failed hose</td>
</tr>
<tr>
<td>Rod broken at bushing housing</td>
<td>Weld failure</td>
<td>Replace strut</td>
</tr>
<tr>
<td>Rod doesn't move freely in/out cylinder</td>
<td>Piston jammed in cylinder</td>
<td>Replace strut</td>
</tr>
<tr>
<td>Rod moves very easily in/out cylinder</td>
<td>Piston broken therefore no damping</td>
<td>Replace strut</td>
</tr>
<tr>
<td>Reduced damping level</td>
<td>Damping components broken/worn out</td>
<td>Replace strut</td>
</tr>
<tr>
<td>Strut upper mount not securely attached to frame or Strut</td>
<td>Bolts attaching bracket to frame broken / came out</td>
<td>Replace bolts and tighten to required torque</td>
</tr>
<tr>
<td></td>
<td>Bolt attaching strut to bracket broke / came out</td>
<td>Replace bolts and tighten to required torque</td>
</tr>
<tr>
<td></td>
<td>Weld Failure</td>
<td>Replace strut upper mount</td>
</tr>
<tr>
<td></td>
<td>Structural failure</td>
<td>Replace strut upper mount</td>
</tr>
<tr>
<td>Strut lower mount not securely attached to axle or strut</td>
<td>Bolts attaching bracket to axle broken / came out</td>
<td>Replace bolts and tighten to required torque</td>
</tr>
<tr>
<td></td>
<td>Bolt attaching strut to bracket broke / came out</td>
<td>Replace bolts and tighten to required torque</td>
</tr>
<tr>
<td></td>
<td>Weld Failure</td>
<td>Replace strut lower mount</td>
</tr>
<tr>
<td></td>
<td>Structural failure</td>
<td>Replace strut lower mount</td>
</tr>
</tbody>
</table>
## Issues with Secondary Volume Assembly

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Leak</td>
<td>Weld failure between tube and end</td>
<td>Replace secondary volume welded assembly</td>
</tr>
<tr>
<td></td>
<td>Weld failure between tube and manifold</td>
<td>Replace secondary volume welded assembly</td>
</tr>
<tr>
<td></td>
<td>Cylinder fracture</td>
<td>Replace secondary volume welded assembly</td>
</tr>
<tr>
<td></td>
<td>Bleed screw loose</td>
<td>Tighten bleed screws to appropriate torque</td>
</tr>
<tr>
<td></td>
<td>Fitting loose</td>
<td>Tighten all fittings</td>
</tr>
<tr>
<td></td>
<td>Hose failure</td>
<td>Replace failed hose</td>
</tr>
<tr>
<td></td>
<td>Hose cut</td>
<td>Replace failed hose</td>
</tr>
<tr>
<td>loose or no longer attached</td>
<td>Bolts attaching bracket to frame broken / came out</td>
<td>Replace bolts and tighten to required torque</td>
</tr>
<tr>
<td></td>
<td>Bolt attaching volumes to bracket broke / came out</td>
<td>Replace bolts and tighten to required torque</td>
</tr>
<tr>
<td></td>
<td>Weld Failure</td>
<td>Replace brackets</td>
</tr>
<tr>
<td></td>
<td>Structural failure</td>
<td>Replace brackets</td>
</tr>
</tbody>
</table>
Appendix A: Electrical Schematics

Schematic, External Wiring Harness
Part 1
Note: Do not connect positive (12VDC) signal to either Tan/Blk or Brown wires.
Warranty Conditions

LiquidSpring LLC warrants that all CLASS® products shall be free of defects in material and workmanship provided the product has been properly assembled, installed by a designated/qualified installer, properly maintained, serviced, and used normally for the given application and within the rated capacities. The end user is responsible for operating, inspecting, and maintaining the product according to applicable product and vehicle owner’s manuals and for instructing all operators and maintenance personnel on proper use and maintenance.

Coverage

The starting date for warranty coverage will be the earlier date of the date purchased by the first end user or when the vehicle is put into service and ends when the time period is reached in the warranty coverage period below. Proof of such date is the responsibility of the first end user. If the starting date cannot be satisfactorily determined, then the date of product manufacture based on the product serial number shall be used as the effective starting date.

Main Structural Components – 48 Months or 100,000 miles whichever occurs first.

Major structural components are defined as frame hangers, control arms, axle clamp group, transverse torque arm, axle and frame mounts, and secondary volumes. All wear items such as bushings and strut seals are excluded.

Other Components – 36 Months or 50,000 miles whichever occurs first.

Other components include all power module components, electrical components, wire harnesses, valves, hydraulic lines, and wear items such as bushings and strut seals.

Labor – 12 Months

Estimated labor time and cost must be pre-approved prior to conducting warranty repair work for reimbursement consideration.

Claims

1. Review warranty conditions and coverage to determine if component is warrantable.
2. Locate product serial number, warranty starting date (see Coverage above), vehicle manufacturer, mileage, and VIN.
3. Contact LiquidSpring LLC to address claim.

Components must be returned to LiquidSpring LLC Prepaid and identified with a LiquidSpring LLC issued Returned Goods Authorization Number (RGA#) in order to qualify for reimbursement by LiquidSpring LLC. LiquidSpring LLC must authorize all warranty repairs at a cost determined and approved by LiquidSpring LLC before any repairs are started.

Warranty Contact: (765) 474-7816 (Option #1) Service@liquidspring.com

Limitations and Exclusions

The liability of LiquidSpring LLC under this limited warranty is solely limited to the repair or replacement of defective material and workmanship by an authorized party. LiquidSpring LLC shall not be liable for use of non-LiquidSpring LLC components or for repairs performed by unauthorized parties. This warranty does not include any expense of or related to transportation of parts outside the Continental United States or compensation for inconvenience or loss of use while the product is being repaired. LiquidSpring LLC shall not be liable for any expense, loss, or damage (direct, incidental, consequential or exemplary – including, but not limited to towing expenses, travel expenses, vehicle rental, downtime expenses, incidental charges or any other losses arising in connection with the sale, use or inability to use the product) resulting from the warranty-covered component found to be defective.

No expressed warranty is given by LiquidSpring LLC with respect to its product except at specifically set forth herein. Any warranty implied by law, including any warranty of merchantability or fitness for particular purpose, is limited to the expressed warranty term provided in the warranty coverage. The expressed warranty does not apply in the event of: use of non-LiquidSpring LLC replacement components; improper installation, maintenance or repair; misuse, negligence, or abuse including but not limited to overloading, unauthorized alterations or modifications.
# Warranty Labor Coverage

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ALLOWABLE LABOR HOURS (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strut (each)</td>
<td>0.75</td>
</tr>
<tr>
<td>Wiring Harness (Rear Main)</td>
<td>3.00</td>
</tr>
<tr>
<td>Power module</td>
<td>1.00</td>
</tr>
<tr>
<td>Pressure Relief Valve/ Isolation Valve</td>
<td>0.50**</td>
</tr>
<tr>
<td>ECU (External)</td>
<td>0.50</td>
</tr>
<tr>
<td>Hose Replacement (each)</td>
<td>0.75</td>
</tr>
<tr>
<td>Height Sensor</td>
<td>0.50</td>
</tr>
<tr>
<td>Steering Sensor</td>
<td>0.75</td>
</tr>
<tr>
<td>Rate Valve</td>
<td>0.50</td>
</tr>
<tr>
<td>Track Rod</td>
<td>1.50</td>
</tr>
<tr>
<td>One Control Arm</td>
<td>1.50</td>
</tr>
<tr>
<td>Pair of Control Arms</td>
<td>2.00</td>
</tr>
<tr>
<td>12V Motor</td>
<td>1.00</td>
</tr>
<tr>
<td>General Diagnostics</td>
<td>Contact Customer Service</td>
</tr>
</tbody>
</table>

(For any component(s) not listed above, the allowable labor hours must be approved by LiquidSpring LLC. Prior to the work being performed.)

*Labor hours based on $85.00 per hour.

*Labor for diagnosis will not be covered without prior consent from LiquidSpring LLC.

*0.50hr. for first valve removal 0.25hr. for each additional.

## Obtaining Warranty Parts

1. Obtain LiquidSpring LLC suspension serial number
   (Located on driver’s side front hanger see Operator’s Manual for details)
2. Obtain mileage of suspension
3. Obtain In-service date of suspension
4. Give a detailed description of the problem

## Contact LiquidSpring LLC

Customer Service Dept. - Phone: 765-474-7816  Email: Service@liquidspring.com
Installation Check List

<table>
<thead>
<tr>
<th>Installer:</th>
<th>Installation Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspector:</td>
<td>Inspection Date:</td>
</tr>
<tr>
<td>Suspension S/N:</td>
<td>VIN:</td>
</tr>
</tbody>
</table>

**FRAME PREPARATION:**
- ☐ Battery Disconnected
- ☐ Removed OEM Leaf springs, overload pads, and Driver side shock mount.
- ☐ Upper Strut Mount, and Secondary Volume Assy holes drilled.

**BRAKE LINES.**
- ☐ Replaced OEM flexible brake lines, and axle standoff bracket with provided parts.
- ☐ Torqued Brake line tube fittings to 159 in-lbs.
- ☐ Torqued Brake line banjo bolts to 12-14 ft-lbs.
- ☐ Brake system bled and bleed screws torqued to 133 in-lbs.

**FRONT HANGER INSTALLATION:**
- ☐ Front Hangers are flush to bottom of frame and OEM M14 Flange bolts torqued to 120-145 ft-lbs.
- ☐ 5/8”-11 Nuts torqued to -172-210 ft-lbs.

**UPPER STRUT MOUNT/TRACK ROD MOUNT / CROSS MEMBER REINFORCEMENT:**
- ☐ Upper Strut Mounts level with frame.
- ☐ Cross member Reinforcement orientated correctly.
- ☐ Bolts point outboard, away from fuel tank.
- ☐ 5/8”-11 Nuts torqued to -172-210 ft-lbs.
- ☐ 1/2”-13 Nuts torqued to 86-105 ft-lbs.

**AXLE CLAMP / BRIDGE INSTALLATION:**
- ☐ Install M8 Bolts to locate lower axle cradle on axle. Torque to 18 ft-lbs.
- ☐ 3/4”-16 U-Bolts torqued in stages up to 250 ft-lbs.

**CONTROL ARMS INSTALLATION:**
- ☐ 1”-8 Nuts torqued to 600 ft-lbs, at ride height.

**TRACK ROD INSTALLATION:**
- ☐ 7/8”-9 Nuts Torqued to 491-600 ft-lbs.

**STRUT INSTALLATION:**
- ☐ 3/4”-10 Upper Nuts torqued to 275-300 ft-lbs.
- ☐ 3/4”-10 Lower Nuts torqued to 275-300 ft-lbs.

**HEIGHT SENSOR INSTALLATION:**
- ☐ 5/16”-18 Nuts torqued to 14-17 ft-lbs.
- ☐ Locking Clips installed.

**POWER MODULE/SECONDARY VOLUME INSTALLATION:**
- ☐ 3/8”-16 Screws torqued to 39 ft-lbs.
- ☐ Reservoir Mount Self Tapping Screws tightened to snug only.
- ☐ 5/16”-24 T-Bolt Band Clamp Fasteners torqued to 240 in-lbs.

**HOSE INSTALLATION:**
- ☐ -4 Hose Fittings torqued to 12 ft-lbs.
- ☐ -10 Hose Fittings torqued to 36-63 ft-lbs.
- ☐ Bleed Screws closed and torqued to 13-18 ft-lbs.
- ☐ Hoses secured with loop clamps.
☐ 5/16 Nuts torqued to 14-17 ft-lbs.

**PARKING BRAKE CABLE INSTALLATION:**
☐ Parking Brake Cable Mount installed, and 1/2” Fasteners torqued to 86-105 ft-lbs.
☐ Passenger side Cable secured to bridge standoffs.
☐ Driver and Pass OEM cable guides attached to Parking Brake Cable Mount and 5/16” fasteners torqued to 14-17 ft-lbs.

**STEERING SENSOR INSTALLATION:**
☐ OEM Nuts torqued to 120-147 ft-lbs.
☐ 5/16”-18 fasteners torqued to 14-17 ft-lbs.
☐ (2017 Chassis) 1/4”-20 U-bolt nuts torqued to 60-85 in-lbs.
☐ (2018+ Chassis) Verify 1/4”-20 Bolts are pointing UP.
☐ (2018+ Chassis) 1/4”-20 locking flange nuts torqued to 60-85 in-lbs.
☐ Locking Clips installed.
☐ Steering sensor harness attached and routed.
☐ Steering wheel turned full left and full right and checked for clearance around sensor and linkage.

**WIRING HARNESS INSTALLATION:**
☐ Dash harness installed
☐ All appropriate wiring splices made.
☐ Driver Interface installed and connected to Dash Harness.
☐ External harness routed and secured.
☐ External harness connected to Rate Valves, Height Sensors.
☐ Battery harness installed with Fuse Lead and connected to Battery and Power Module.
☐ Door harness installed (if equipped with rear door switch).
☐ All connections sealed.
☐ All harnesses properly secured from chaffing, heat, and located away from moving parts.

**INITIAL FILL/CALIBRATION:**
☐ Battery connected.
☐ Suspension rose to ride height.
☐ Reservoir at proper level.
☐ System Bled and Bleed Screws closed and torqued to 13-18 ft-lbs
☐ Calibration completed.