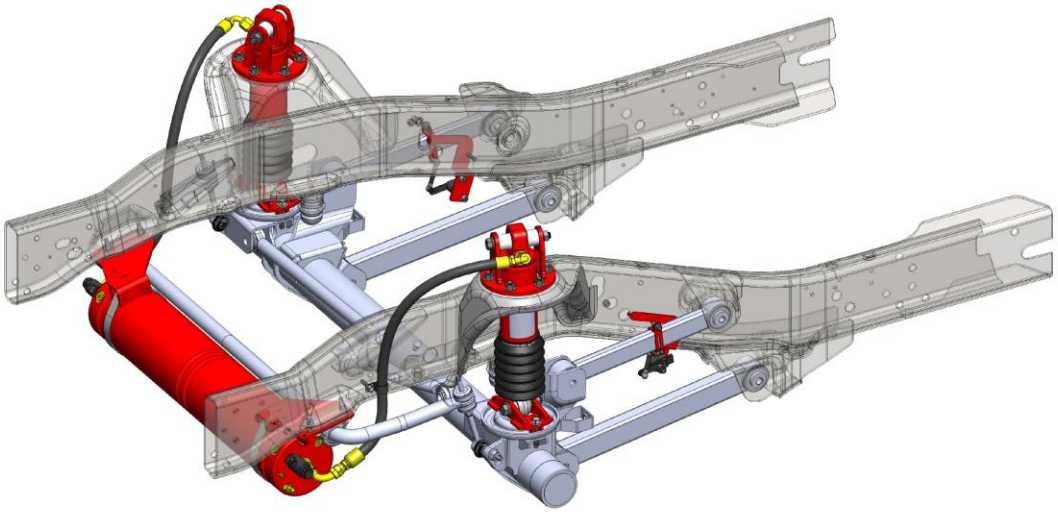
CLASS®

FS70R/FS73R

Steer Axle Front Suspensions
for 2014 and newer RAM
4500/5500 Cab Chassis, 4x2/4x4



LIQUIDSPRING™ LLC

Installation / Operator Manual

D11420 Rev K 12/2019

Contents

Introduction

This manual provides installation information for the LiquidSpring front axle suspension system for the RAM 4500/5500 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 special tools when required to help avoid serious personal injury and damage to components.

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.

These instructions cover the following models:

Model	Application
FS70RF/FS70RA	4500/5500 (2014 and Newer)
FS73R	4500/5500 (2014 and Newer)

LiquidSpring LLC reserves the right to modify the suspension and/or procedures and to change specifications at any time without notice and without incurring obligation.

WARNING: Attaching towing equipment to improper locations and failure to utilize OEM/Coach Builder 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.

Suspension Rating

Model	4500/5500
FS70RF/FS70RA	**Up to 7,000 lbs**
FS73R	**7,250 lbs**

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

Serial Number Tag Information

The suspension model, serial number, and maximum axle capacity are found on an aluminum tag that is riveted to the Power Module. This information will aid you when contacting the chassis manufacturer or LiquidSpring LLC.

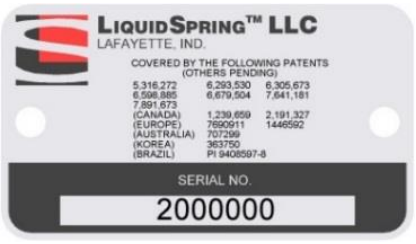


Figure 1. Suspension Identification

Vehicle Towing and Jacking Information

Before attempting any type of towing procedures, contact the OEM/Coach Builder 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.

Hydraulic Fitting Assembly

SAE O-Ring Adjustable Fittings

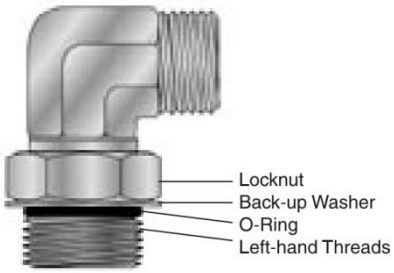


Figure 2. Adjustable SAE fitting

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.

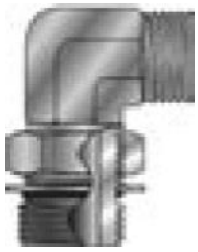


Figure 3. Locknut completely backed off.

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

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:
   -4 fitting: **9-12 ft-lbs**
   -8 fitting: **27-39 ft-lbs**
   -10 fitting: **36-63 ft-lbs**
   -12 fitting: **65-88 ft-lbs**.

Pre-Installation

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

Frame Preparation

1. Chock the rear tires.
2. If LiquidSpring rear suspension is already installed, press the Up arrow on the driver interface to raise the rear suspension. While the suspension is raised, place jack stands under the rear framerails. After jack stands are installed, press the down arrow to Low position, lowering the suspension onto the jack stands, also depressurizing the hydraulic system. Then turn OFF the LiquidSpring system.

Note: Pressing and holding the down arrow when in the low position will force the system to lower or depressurize. Holding the Ride Height down button for approximately 30 seconds after the system reaches the lowest height, then immediately turn off the system. This procedure will free most of the pressure from the system, and the hydraulic system can be bled of any remaining pressure by opening the bleed ports.

1. Disconnect the negative cable from the vehicle battery(ies).
2. Jack up the front frame of the vehicle to remove the load from the front coil springs.
3. Place jack stands under the frame
4. Place Jack stands under the front axle and remove the tires for ease of access.

Note: Removal of fender liner and flares will aid installation.

5. Remove the OEM coil springs and shock absorbers. Refer to OEM service manual for instructions.

Figure 4: Remove OEM Springs and Shocks

6. Using the Upper spring bucket hole as a guide, drill a 4-1/2” hole through the top of the factory spring bucket. A hole saw is recommended over a plasma torch, for speed and clean, accurate cutting.

Figure 5: Cut a 4-1/2" hole around the OEM shock hole using a hole saw.

Figure 6: View of clean cut using hole saw.

7. Using the reinforcement plate (found in USM Installation) as a template, align 3 of the existing holes, then mark and drill the 3 additional holes in the upper spring bucket to 17/32”. See Figure 7

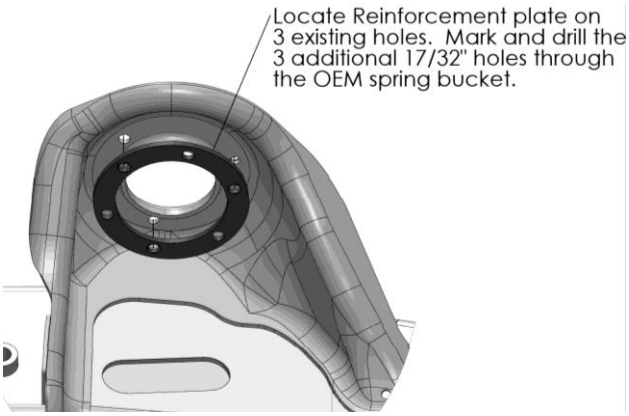


Figure 7: Use reinforcement plate as a template for drilling holes

8. Deburr any rough edges and paint over any bare metal surfaces.
9. Repeat process on passenger side.

Axle Preparation

IMPORTANT: MY 2019 Vehicles have different axles than prior models, requiring a different size hole to be drilled through the spring perch.

1. Locate two holes in the lower spring perch and enlarge to 15/32” for 1/2” Self-Tapping Bolt to be used in Lower Strut Mount installation steps on page 13.

IMPORTANT: Do NOT enlarge holes larger than 15/32”.

2. Repeat for passenger side.

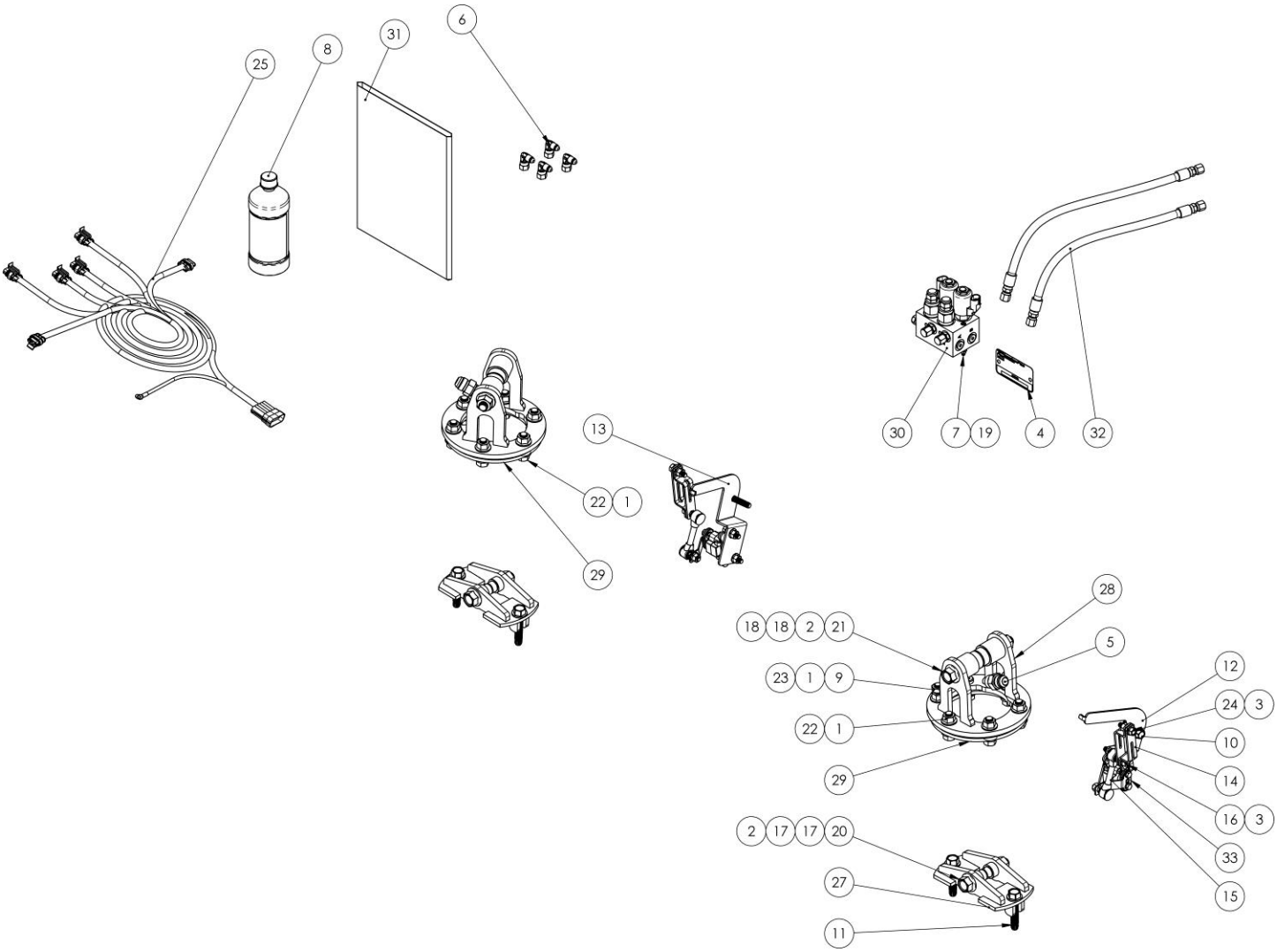
Parts List Information

Abbreviations

HCS	Hex Cap Screw
HFB	Hex Flange Bolt
SHCS	Socket Head Cap Screw
SFHS	Serrated Flange Hex Screw
HN	Hex Nut, Non-locking
LHN	Locking Hex Nut
LFN	Locking Flange Nut
CHN	Castle Hex Nut
HTCN	Hex Thin Castle Nut
HFW	Hardened Flat Washer
SLW	Spring Lock Washer
SAE	SAE O-Ring Fitting
37°	SAE or JIC 37° Flare Fitting
LH	Left Handed Part
RH	Right Handed Part

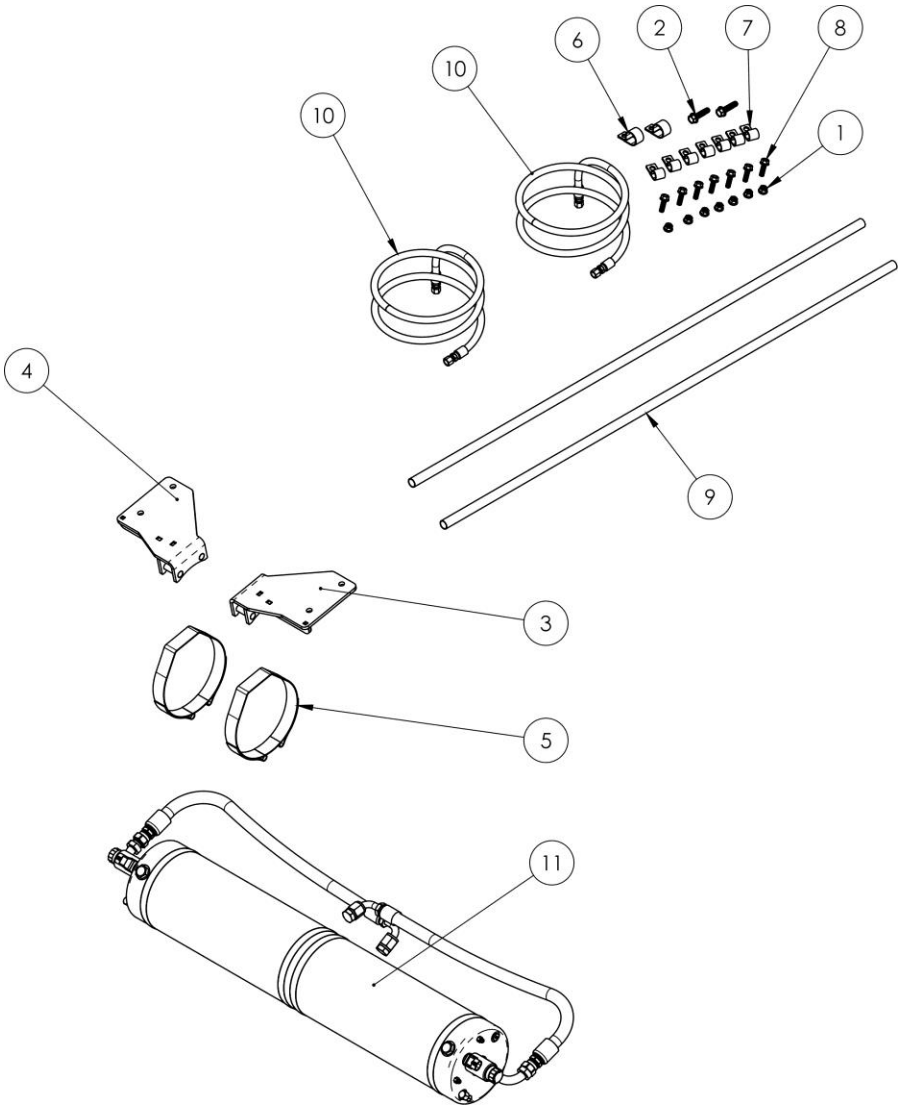
Part Identification:

FS70R/FS73R (Base Suspension Kit)



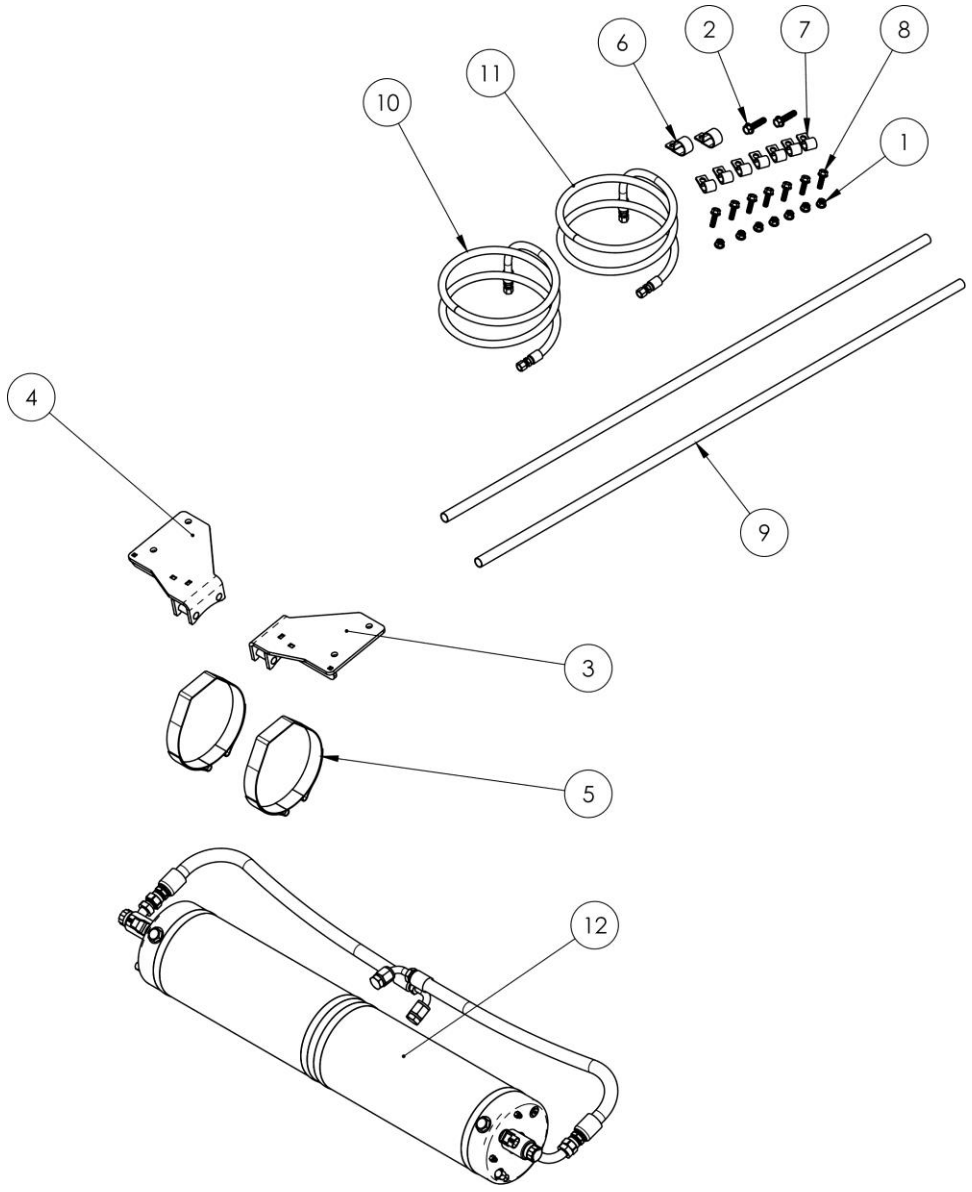
ITEM	QTY	PART NUMBER	DESCRIPTION
1	12	10012-007	LFN 1/2-13, Gr. G, Black Phos
2	4	10012-008	LFN 5/8-11 Gr G, Black Phos
3	8	10012-010	LFN 5/16-18, Gr. G, Black Phos
4	1	10261-002	Name Plate
5	2	10321-012	Hyd. Fit -10 SAE x -10 37
6	4	10322-021	Hyd Fit 90, -4 37 x -4 37 F
7	2	10463-004	SHCS M5-0.8x60 CL 12.9 BO
8	1	10474-001	Compressible Fluid, 16 oz. Bottle
9	2	10493-002	JN 1/2-13, Z
10	2	10510-006	STS 3/8-16 x 1.50, Z, Hex Head
11	4	10510-009	STS 1/2-13 x 2.50, Z, Hex Head
12	1	10656-008	Height Sensor Mount, LH
13	1	10545-009	Height Sensor Mount, RH
14	4	10563-007	Mount, Height Sensor Linkage
15	2	10587-004	Asy, Linkage, 2.762" OP
16	2	10591-003	Ball Stud 5/16-18 x .75L
17	4	10640-001	Bearing Spacer, 3/4 x 5/8 x 1/2
18	4	10640-011	Bearing Spacer, 1.24 x .627 x 1.366
19	2	10873-006	LFN M5-0.8, CL 8, Z, Nyon Insert
20	2	10874-350	HFB 5/8-11x3.500, Gr 8, BO
21	2	10874-550	HFB 5/8-11 x 5.50", Gr. 8, BO
22	9	10885-150	HFB 1/2-13x1.500, Gr. 8, BO
23	2	10885-200	HFB 1/2-13x2.000, Gr. 8, BO
24	6	10886-100	HFB 5/16-18 x 1.000, Gr. 8, BO
25	1	10911-017	Wiring Harness, Front Route
26	1	11039-004	LPSH 1/2-13 x 1.50, BO
27	2	11403-003	Wldmnt, Lower Strut Mnt, Front
28	2	11410-001	Wldmnt, Upper Strut Mnt, Front
29	2	11411-003	Upper Strut Mnt, Reinf. Ring
30	1	11414-001	Asy, Front Valve Block
31	1	11419	Kit, Document, FS70R
32	2	11459-020	Asy, Hose, -4 x 20"L
33	2	11752-001	Asy, Sensor

FS70RF (Volumes and Mounting Kit)



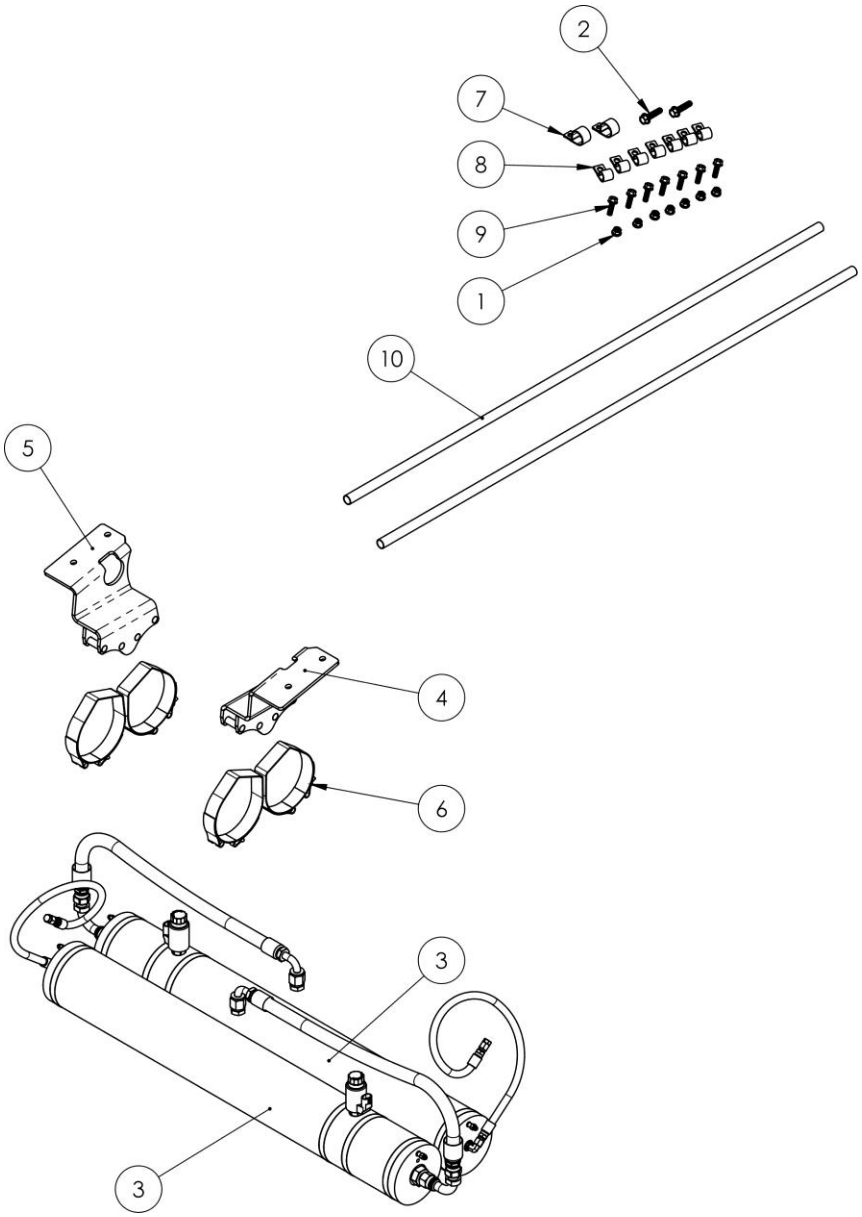
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	7	10012-010	LFN 5/16-18, Gr. G, Black Phos	7	7	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
2	2	10510-006	STS 3/8-16 x 1.50	8	7	10886-100	HFB 5/16-18 x 1.000, Gr. 8, BO
3	1	10830-035	Wldmnt, Volume Mount, LH	9	2	11333-001	Reflective Thermashield, 5/8"IDx48" L
4	1	10830-036	Wldmnt, Volume Mount, RH	10	2	11459-120	Asy, Hose, -4 x 120"L
5	2	10843-004	T-Bolt Clamp, Range 6.63-7.25	11	1	11495-002	Asy, Vol, 340 x 340, 5.5 ID
6	2	10855-002	Vinyl-Coated Loop Clamp, 1" ID				

FS70RA (Volumes and Mounting Kit)



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	7	10012-010	LFN 5/16-18, Gr. G, Black Phos	7	7	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
2	2	10510-006	STS 3/8-16 x 1.50	8	7	10886-100	HFB 5/16-18 x 1.000, Gr. 8, BO
3	1	10830-035	Wldmnt, Volume Mount, LH	9	2	11333-001	Reflective Thermashield, 5/8"IDx48" L
4	1	10830-036	Wldmnt, Volume Mount, RH	10	1	11459-120	Asy, Hose, -4 x 120” L
5	2	10843-004	T-Bolt Clamp, Range 6.63-7.25	11	1	11459-160	Asy, Hose, -4 x 160” L
6	2	10855-002	Vinyl-Coated Loop Clamp, 1" ID	12	1	11495-002	Asy, Vol, 340 x 340, 5.5 ID

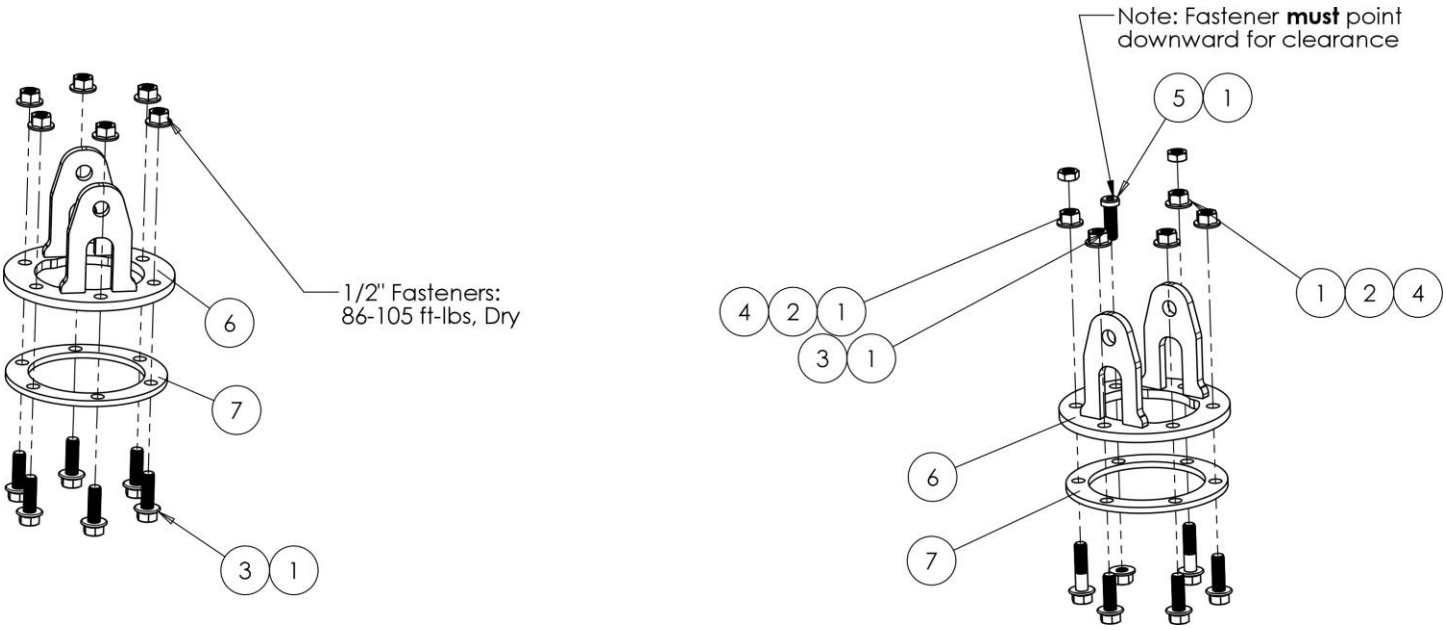
FS73R (Volumes and Mounting Kit)



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	7	10012-010	LFN 5/16-18, Gr. G, Black Phos	6	4	10843-003	T-Bolt Clamp, Range 4.88-5.5
2	2	10510-006	STS 3/8-16 x 1.50	7	2	10855-002	Vinyl-Coated Loop Clamp, 1" ID
3	2	10597-166	Asy, Vol, 50 x 339	8	7	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
4	1	10830-044	Wldmnt, Volume Mnt, Double LH	9	7	10886-100	HFB 5/16-18 x 1.000, Gr. 8, BO
5	1	10830-045	Wldmnt, Volume Mnt, Double RH	10	2	11333-001	Reflective Thermashield, 5/8"IDx48" L

Installation

Upper Strut Mounts



ITEM	QTY	PART NUMBER	DESCRIPTION
1	12	10012-007	LFN 1/2-13, Gr. G
2	2	10493-002	JN ½-13
3	9	10885-150	HFB ½-13x1.500, Gr. 8
4	2	10885-200	HFB ½-13x2.000, Gr. 8

ITEM	QTY	PART NUMBER	DESCRIPTION
5	1	11039-004	LPSH 1/2-13 x 1.50
6	2	11410-001	Upper Strut Mount Weldment
7	2	11411-003	Upper Strut Mnt. Reinforcement

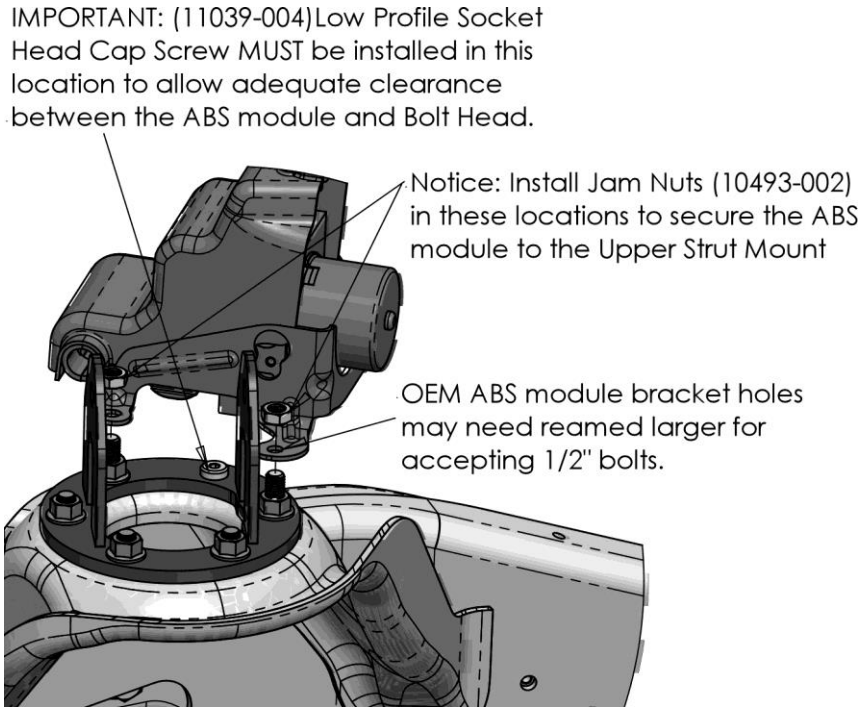


Figure 8: Dr Side Upper Strut Mount with ABS Module. NOTE: 2013-2018 ABS shown, 2019+ similar.

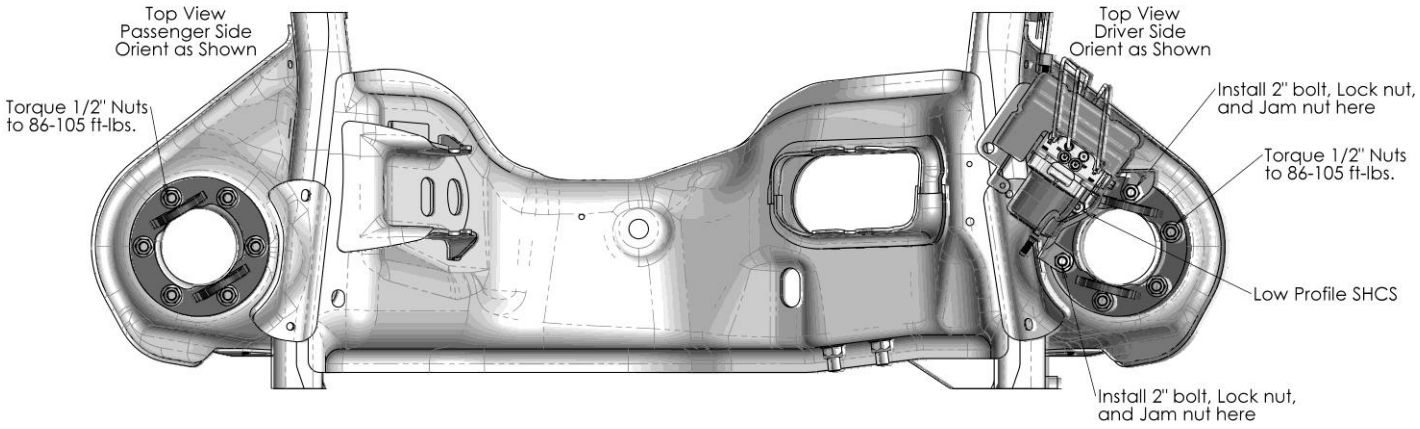


Figure 9: Top View showing orientation of upper strut mounts. NOTE: View shows 2019+ ABS Module

Note: The ABS Module installed on 2013 and newer vehicles will be re-attached in a similar manner as OEM using Jam nuts. The two mounting holes may need enlarged to 17/32".

Note: The driver side inner fender liner may need to be trimmed to ease installation of the Upper Strut Mount.

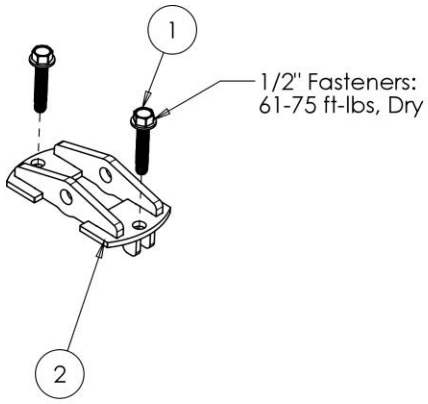
IMPORTANT: Install 11039-004 Low profile socket head cap screw pointing downward under ABS Module for clearance.

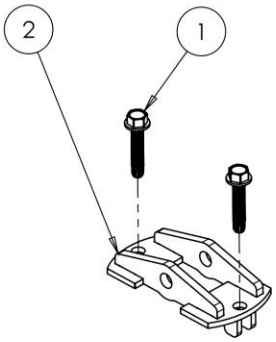
1. Install upper strut mounts and reinforcement ring to the upper spring bucket using 1/2" fasteners.

IMPORTANT: Make sure to install the reinforcement ring on the underside of the OEM spring bucket.

2. Torque 1/2"-13 nuts to **86-105 ft-lbs.**

Lower Strut Mount





ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10510-009	STS 1/2-13 x 2.50, Z, Hex Head	2	2	11403-003	Front Lower Strut Mount

IMPORTANT: Make sure NOT to enlarge mounting holes in the axle more than Ø15/32, for using self-tapping bolts.

1. Attach lower strut mounts through Ø15/32” pilot holes in the axle spring seats.

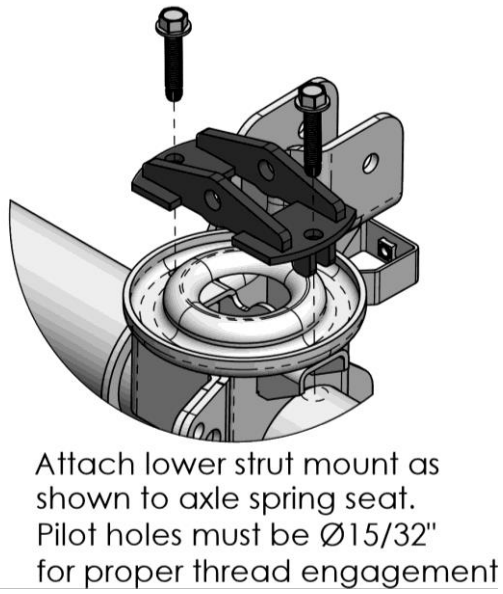
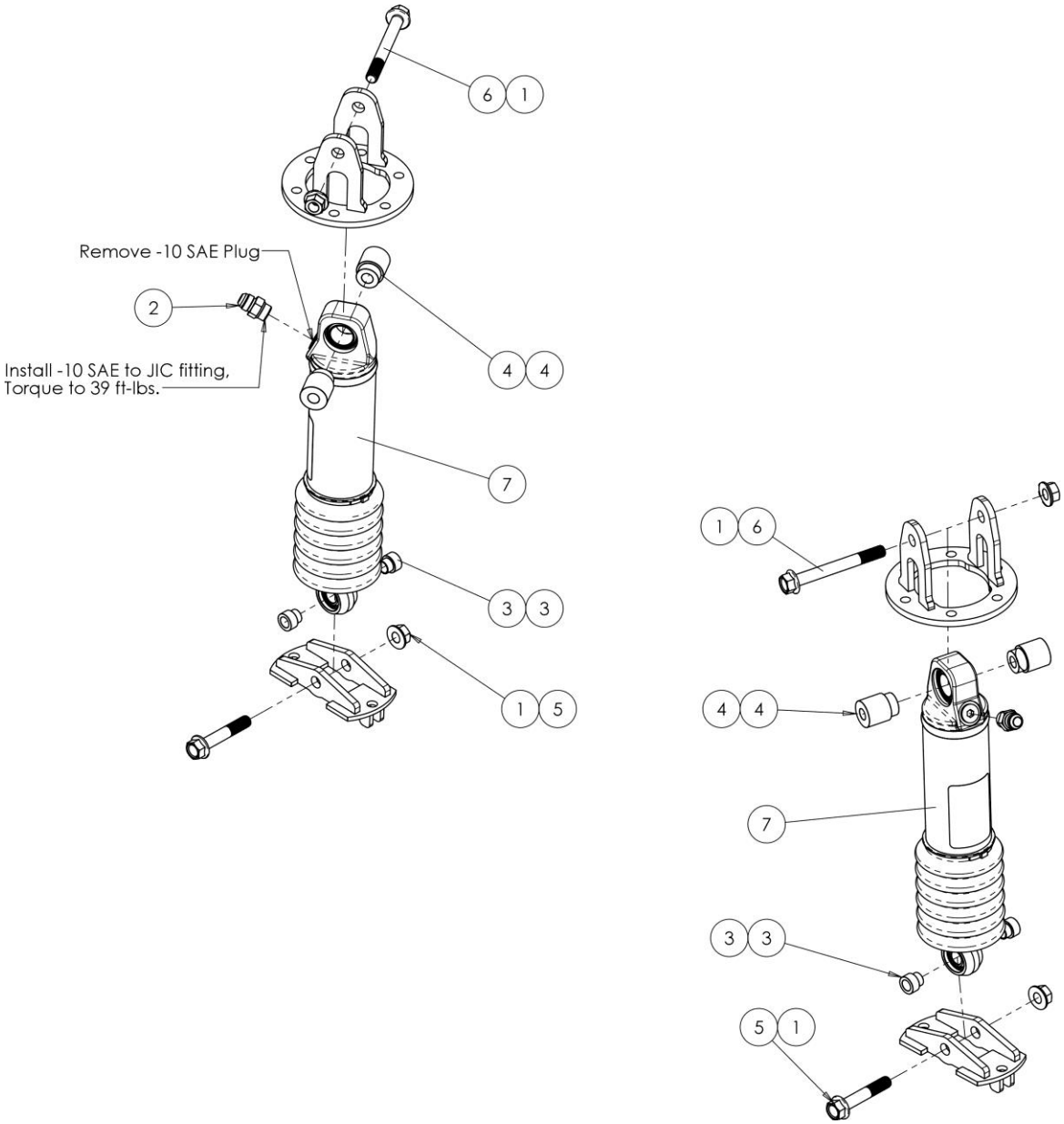


Figure 10: Strut mount exploded view on axle

2. Tighten and torque 1/2-13 fasteners to **61-75 ft-lbs**. Do **not** over-torque.

Strut Installation



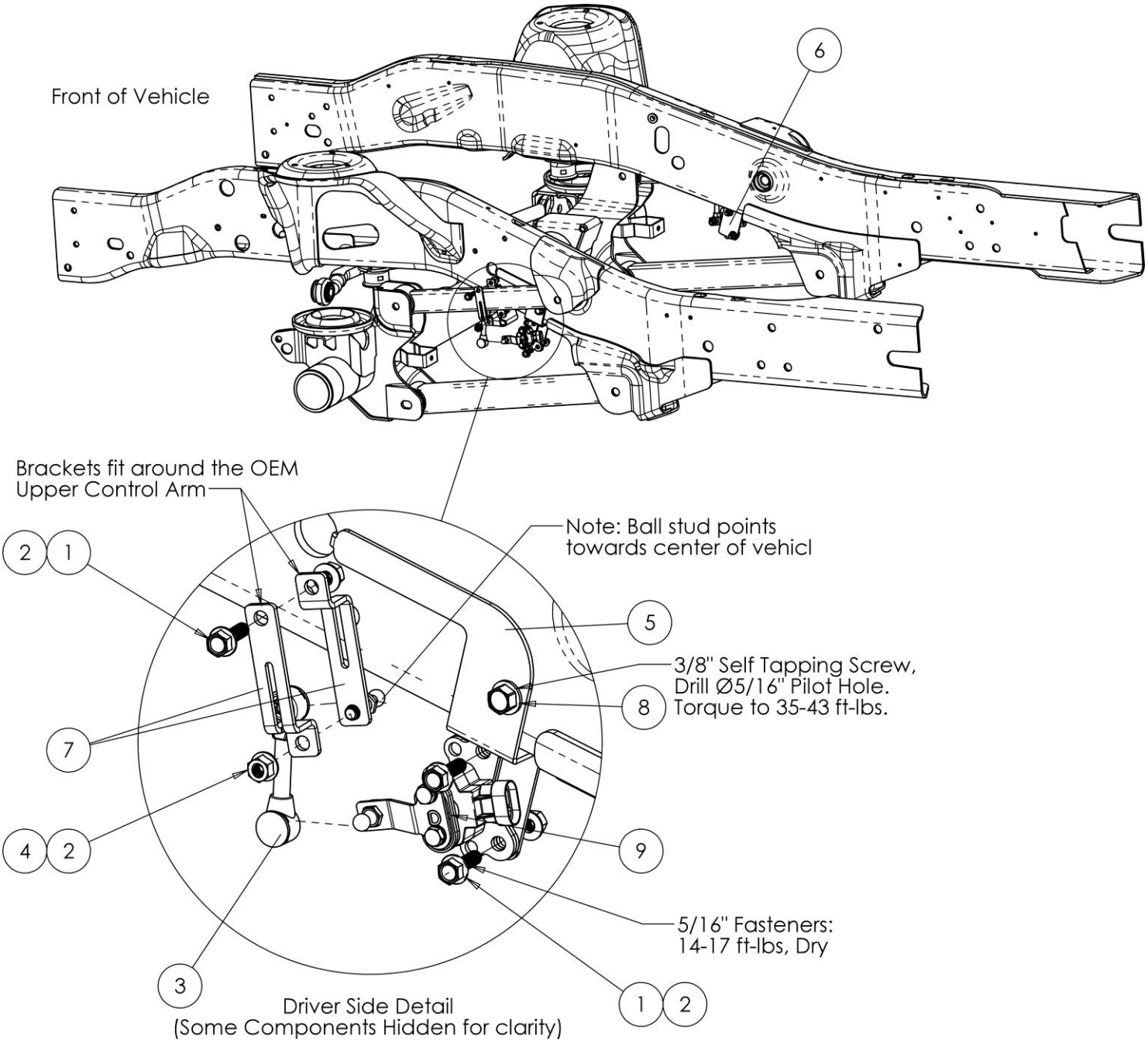
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-008	LFN 5/8-11, Gr. G	5	2	10874-350	HFB 5/8-11x3.500, Gr. 8
2	2	10321-012	Hyd. Fit -10 SAE x -10 37	6	2	10874-550	HFB 5/8-11x5.500, Gr. 8
3	4	10640-001	Bearing Spacer, 3/4 x 5/8 x 1/2	7	2	11433-004	Strut Assembly **(FS70R)**
4	4	10640-011	Bearing Spacer, 1.24 x .627 x 1.366			11737-001	Strut Assembly **(FS73R)**

Note: 5/8" bolts may be pointed in a different orientation, for clearance or ease of install.

Note: Struts MUST be installed with Plugs in place. Do not replace the plugs with the -10 SAE to JIC straight fitting until after the strut is installed in the bracketry.

1. Install strut assembly to upper strut mount using appropriate bearing spacers and hardware.
2. Extend the lower strut to the mounts and install using appropriate bearing spacers and hardware.
3. Torque 5/8" fasteners to **182-210 ft-lbs**.
4. Once installed, remove factory installed -10 SAE plugs from the struts and install the -10 SAE to JIC straight fittings to the struts, **Torque -10 fittings to 39 ft-lbs**.

Height Sensors



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10886-100	HFB 5/16-18 x 1.00, Gr. 8	6	1	10545-009	Height Sensor Mount, RH
2	8	10012-010	LFN 5/16-18, Gr. G	7	4	10563-007	Height Sensor Linkage Mount
3	2	10587-004	Linkage	8	2	10510-006	STS 3/8-16 x 1.50
4	2	10591-003	Ball Stud, 10mm x 5/16-18 x .75L	9	2	11752-001	Asy, Height Sensor
5	1	10545-008	Height Sensor Mount, LH				

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.

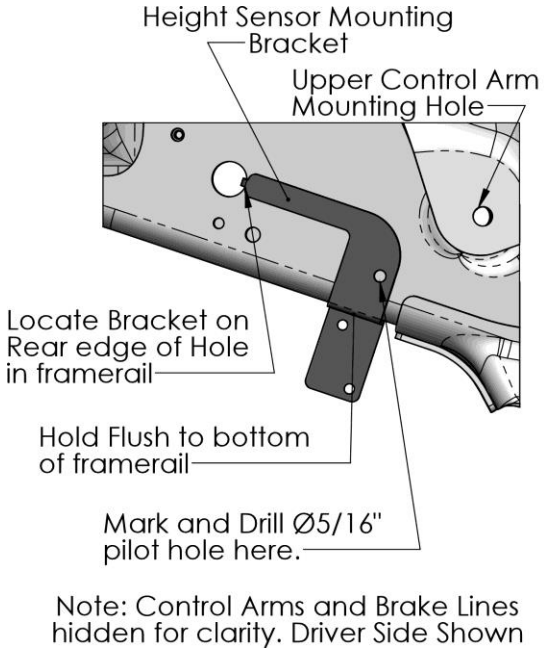


Figure 11: Locating Sensor Bracket to Frame

1. Align Height Sensor mounting bracket to framerail, drill 5/16" pilot hole for mounting.
2. Attach Bracket using 3/8-16 Self-Tapping Flange bolt to frame, Torque to 35-43 ft-lbs.
3. Install Height Sensors.
4. Measure and mark 7" from the centerline of the upper control arm bolt attached to the frame.

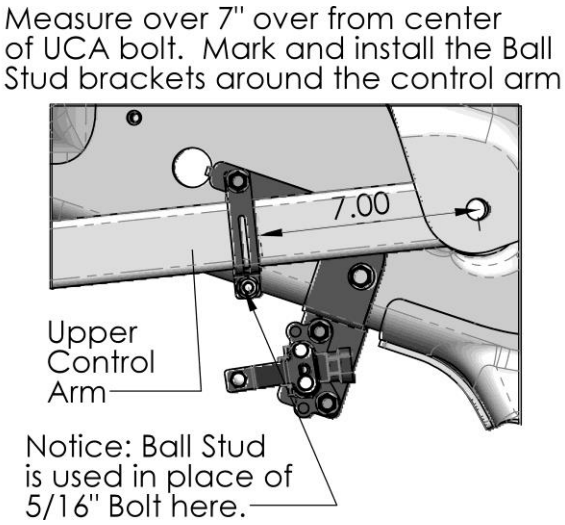


Figure 12: Locate ball stud mount around upper control arm as shown.

5. Align the ball stud brackets to this mark and fasten using the 5/16 hardware. Make sure to use the ball stud in the lower hole, pointing inward. Orient as shown in the exploded views.
6. Repeat with the Right Hand (Passenger Side).

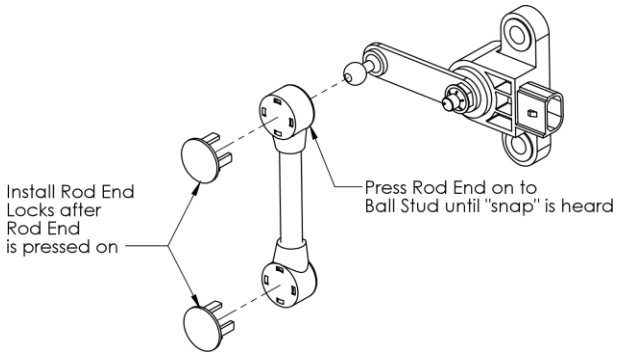


Figure 13. Height Sensor Plastic Linkage End Installation

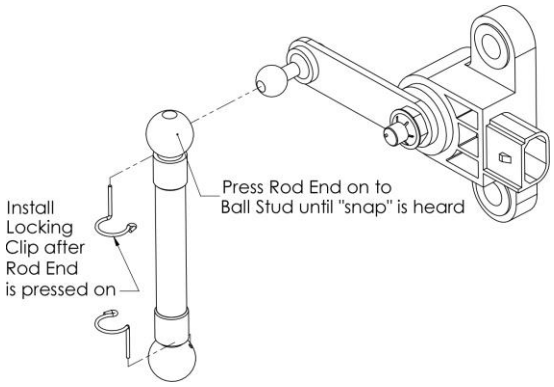
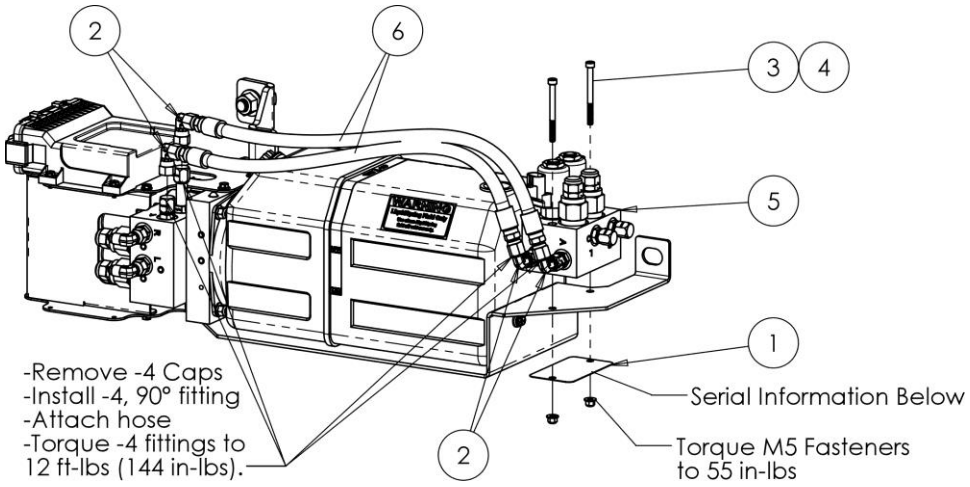


Figure 14. Height Sensor Metal Linkage End Installation.

Note: Linkage is NOT shown in the same orientation as installed on the vehicle.

Isolation Manifold Installation



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10261-002	Name Plate	4	2	10873-006	LFN M5-0.8, CL 8, Nylon Insert
2	4	10322-021	Hyd Fit 90, -4 37 x -4 37 F	5	1	11414-001	Front Valve Block Assembly
3	2	10463-004	SHCS M5-0.8x60 CL 12.9	6	2	11459-020	Asy, Hose, -4 x 20"L

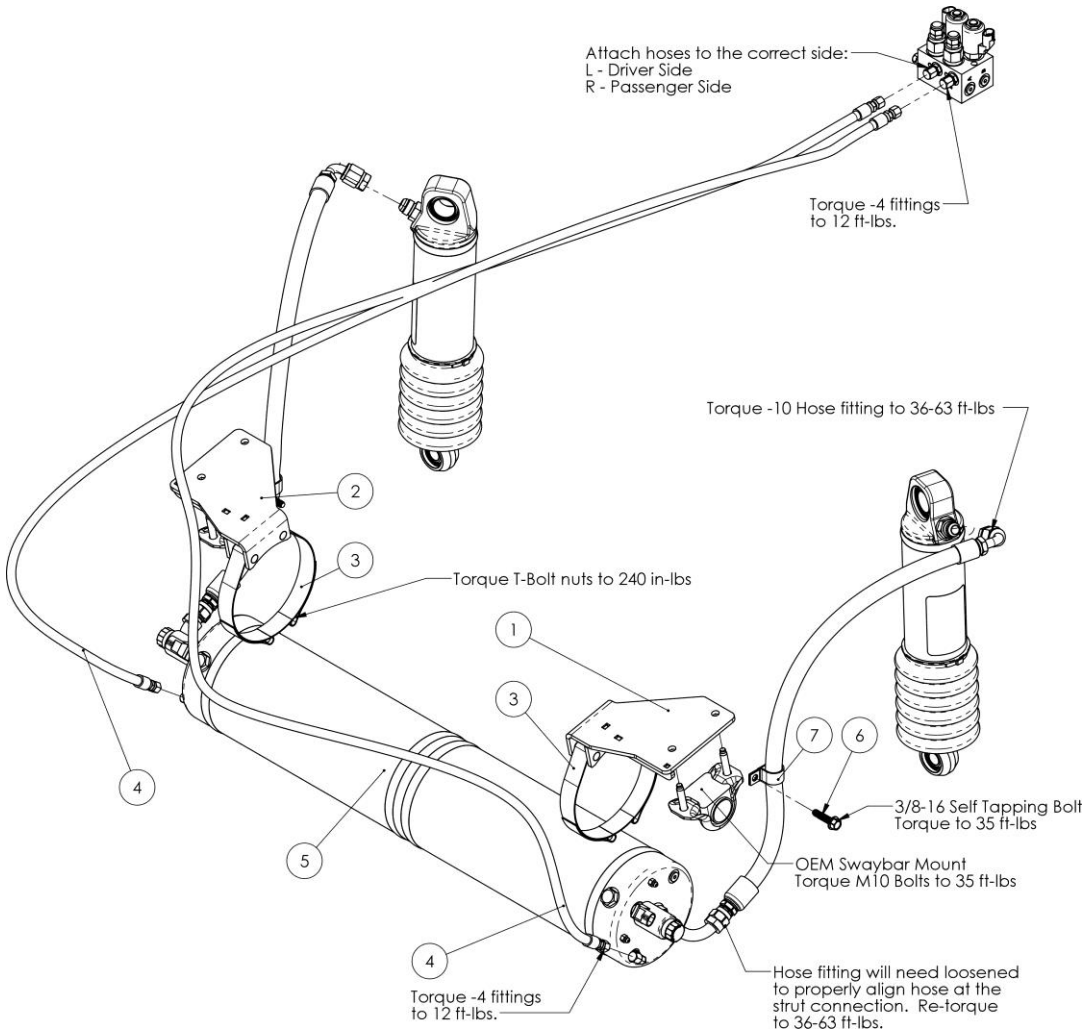
Note: FS70RF power module shown. FS70RA/FS73R is similar.

1. Locate the Isolation Manifold Block, Hoses, Fittings, Serial Tag, and Hardware.
2. Install the Isolation Manifold as shown to the reservoir bracket, torque M5 fasteners to **55 in-lbs.**.

IMPORTANT: Attach Serial Tag to the underside of the reservoir pan as shown.

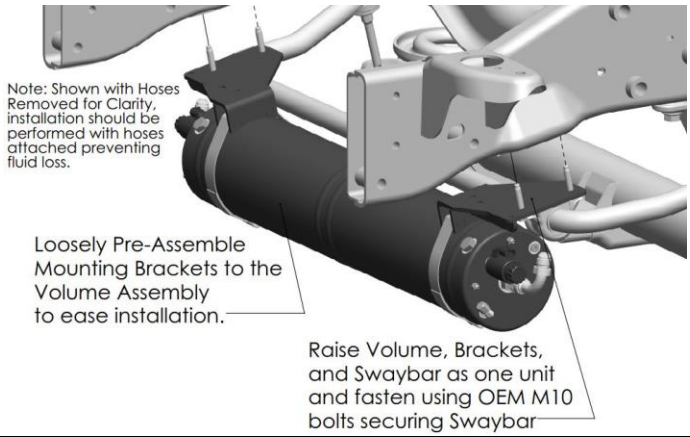
3. Attach -4 fittings and hoses as shown, connecting the ports labeled A to A and B to B. Torque -4 fittings to **12 ft-lbs (144 in-lbs.)**

Secondary Volume – FS70RF



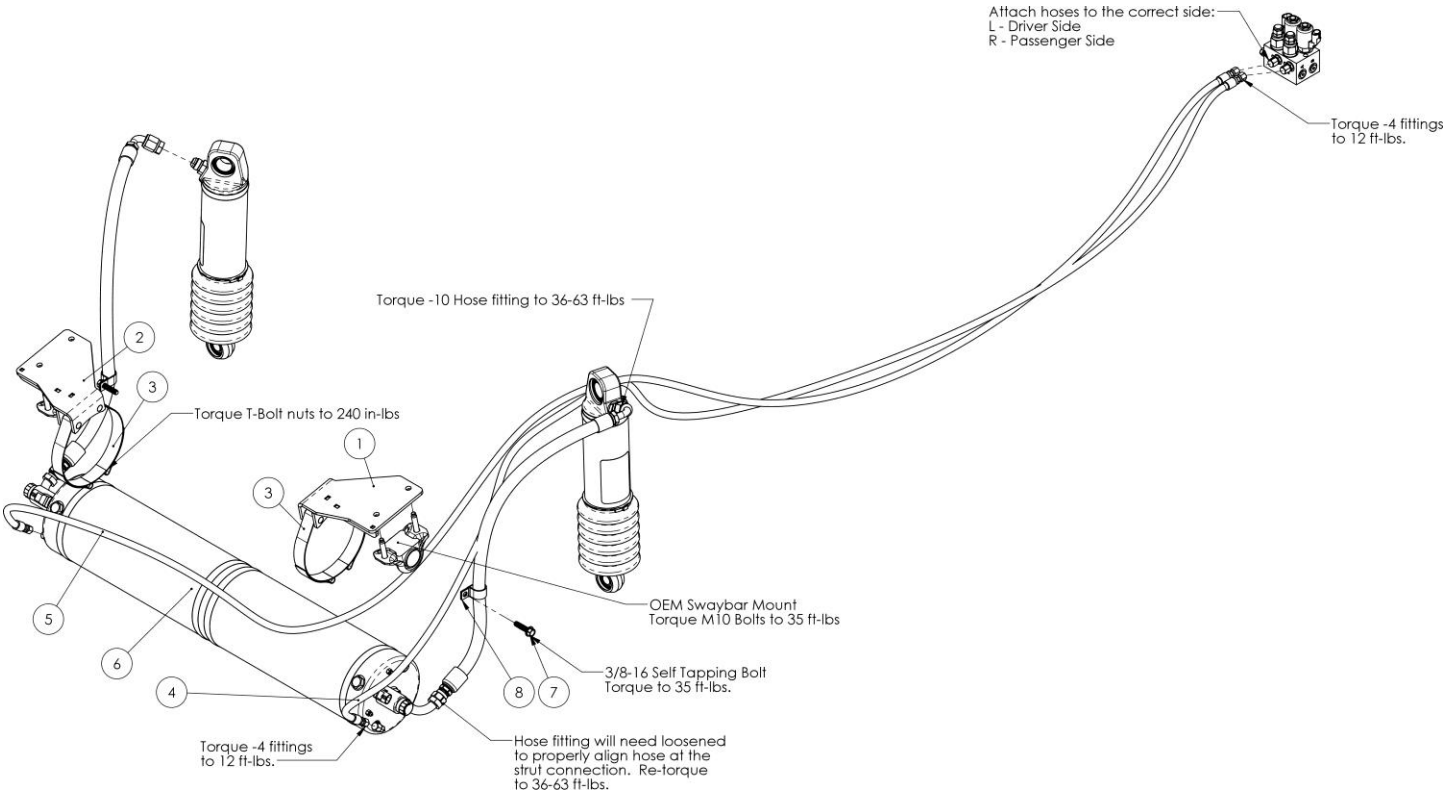
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10830-035	Volume Mount, LH	5	1	11495-002	Volume Assembly
2	1	10830-036	Volume Mount, RH	6	2	10510-006	STS 3/8-16 x 1.50
3	2	10843-004	T-Bolt Clamp, Range 6.63-7.25	7	2	10855-002	Vinyl-Coated Loop Clamp, 1” ID
4	2	11459-120	Asy, Hose, -4 x 120”				

WARNING: The Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to assist the Volume installation.



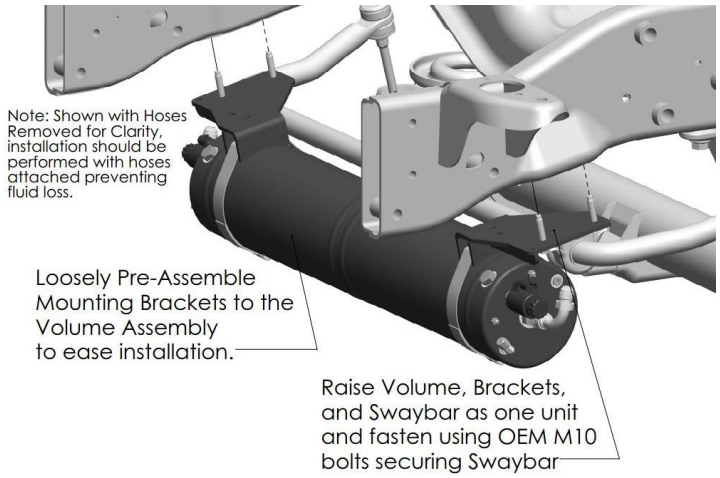
1. Loosely Assemble the Volume Mount Brackets to the volume assembly.
2. Lower the OEM swaybar and align the swaybar clamp bolts through the volume bracket holes.
3. Raise the volume assembly and swaybar in place, using a jack or appropriate lifting device and fasten the OEM bolts, torque to 35 ft-lbs.
4. Orient the volume as shown in Figure 15, to provide best clearance for hoses, and torque T-Bolt clamps to 240 in-lbs.
5. Route hoses using loop clamps to secure away from moving parts, sharp edges, and/or heat sources.
6. Use 1” loop clamps and 3/8 Self-tapping bolts to secure -10 hose to framerail. Note: Use 5/16” pilot hole for 3/8” Self-tapping bolts. Torque to 35 ft-lbs.

Secondary Volume – FS70RA



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10830-035	Volume Mount, LH	5	1	11459-160	Asy, Hose, -4 x 160”
2	1	10830-036	Volume Mount, RH	6	1	11495-002	Volume Assembly
3	2	10843-004	T-Bolt Clamp, Range 6.63-7.25	7	2	10510-006	STS 3/8-16 x 1.50
4	1	11459-120	Asy, Hose, -4 x 120”	8	2	10855-002	Vinyl-Coated Loop Clamp, 1” ID

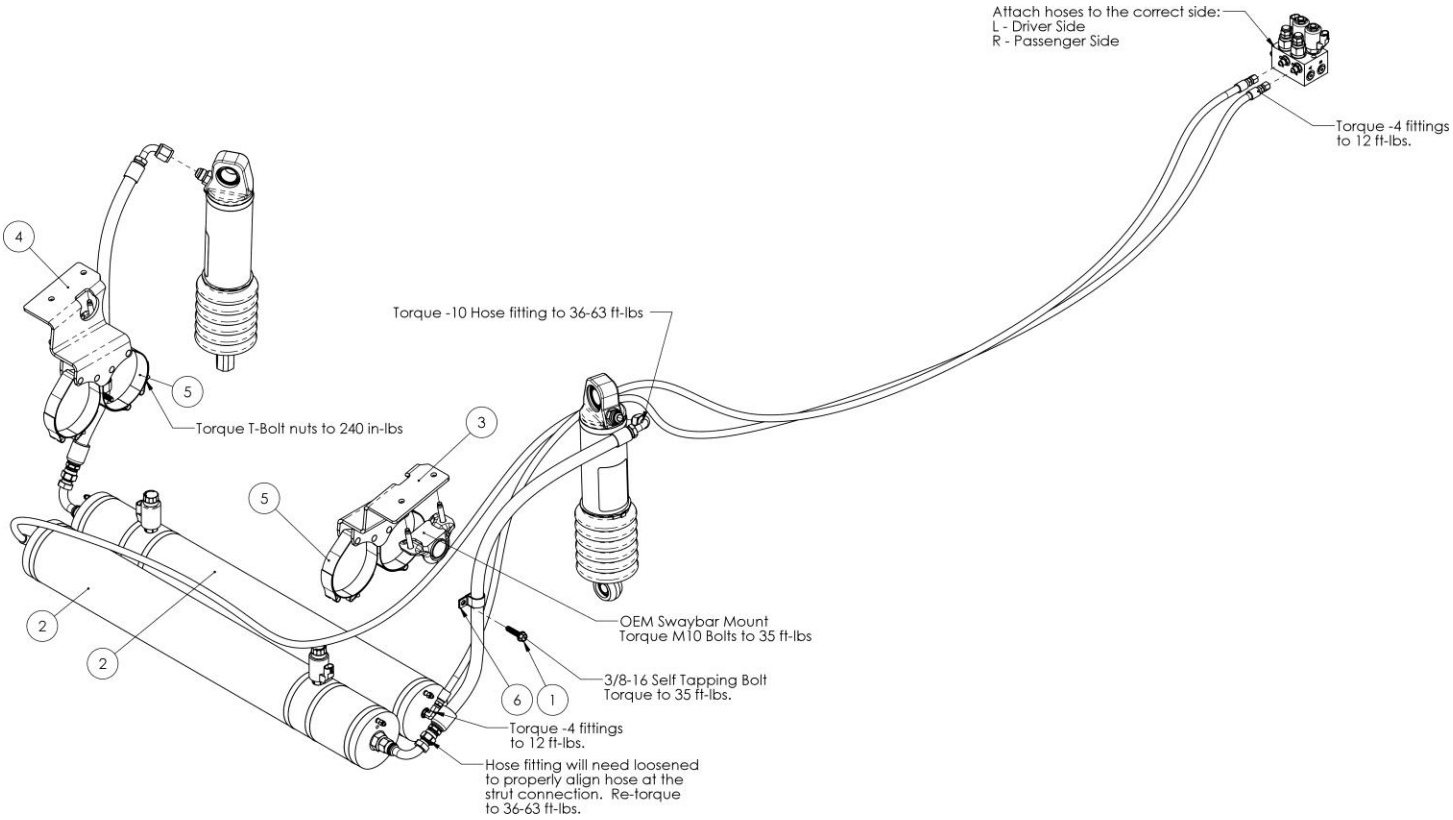
WARNING: The Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to assist the Volume installation.



1. Loosely Assemble the Volume Mount Brackets to the volume assembly.
2. Lower the OEM swaybar and align the swaybar clamp bolts through the volume bracket holes.
3. Raise the volume assembly and swaybar in place, using a jack or appropriate lifting device and fasten the OEM bolts, torque to 35 ft-lbs.
4. Orient the volume as shown, to provide best clearance for hoses, and torque T-Bolt clamps to 240 in-lbs.
5. Route hoses using loop clamps to secure away from moving parts, sharp edges, and/or heat sources
6. Use 1” loop clamps and 3/8 Self-tapping bolts to secure -10 hose to framerail. Note: Use 5/16” pilot hole for 3/8” Self-tapping bolts. Torque to 35 ft-lbs.

Figure 15: Hose routing from volume to strut

Secondary Volume – FS73R



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10510-006	STS 3/8-16 x 1.50	4	1	10830-045	Volume Mount, Double, RH
2	2	10597-166	Volume Assembly	5	4	10843-003	T-Bolt Clamp, Range 4.88-5.5
3	1	10830-044	Volume Mount, Double, LH	6	2	10855-002	Vinyl-Coated Loop Clamp, 1" ID

WARNING: The Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to assist the Volume installation.

1. Remove the factory swaybar mounting bolts from the frame and remove the swaybar link from the swaybar at one end.

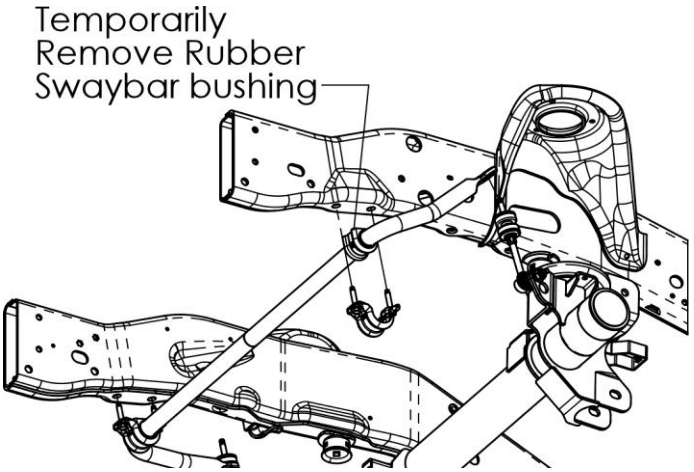


Figure 16: Temporarily remove swaybar attachment

2. Slide off the factory rubber swaybar bushing as shown in Figure 16 from one side.

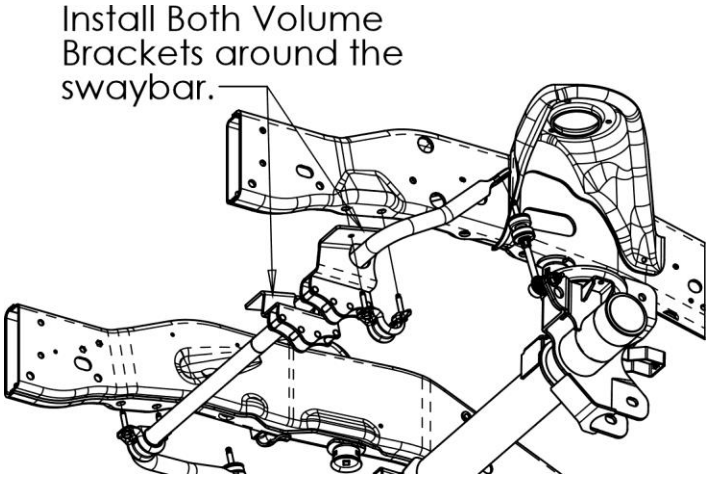


Figure 17: Slide both Brackets onto Swaybar

3. Install both volume brackets as shown in Figure 17 and Figure 18.

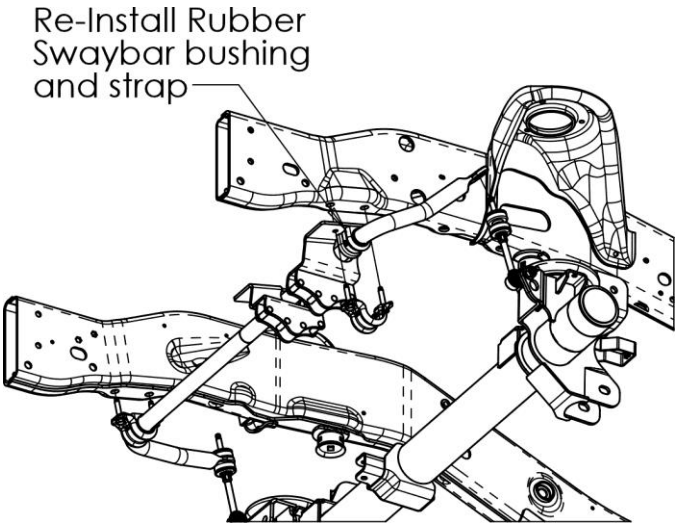


Figure 18: Re-Install the swaybar bushing

4. Re-Attach the swaybar link per OEM Specifications.

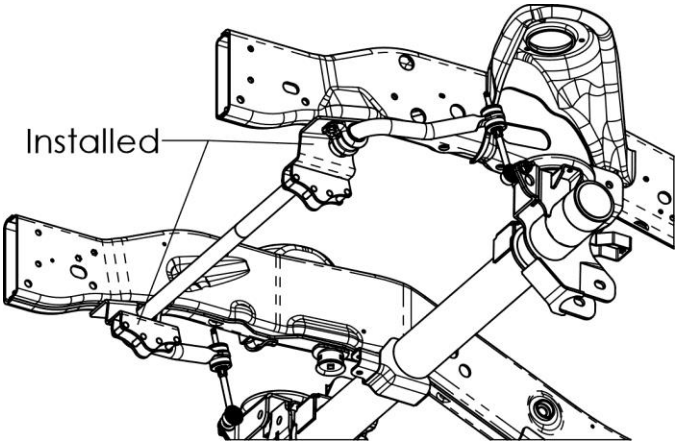
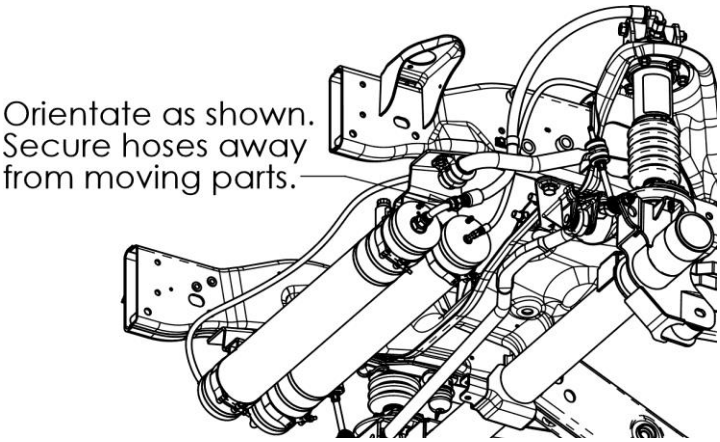


Figure 19: Finished Installation of volume brackets

5. Fasten the OEM Swaybar strap bolts, torque to 35 ft-lbs.
6. Raise the volume assemblies in place, using a jack or appropriate lifting device. Loosly install the T-bolt clamps until volumes are centered under the framerail and oriented correctly.



7. Orient the volumes as shown, to provide best clearance for hoses, and torque T-Bolt clamps to 240 in-lbs.
8. Route hoses using loop clamps to secure away from moving parts, sharp edges, and/or heat sources.
9. Use 1" loop clamps and 3/8 Self-tapping bolts to secure -10 hose to framerail. Note: Use 5/16" pilot hole for 3/8" Self-tapping bolts. Torque to 35 ft-lbs.

Figure 20: Hose routing from volume to strut. Note: FS70R configuration shown, FS73 similar.

Hydraulic Hose Attachment

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

CAUTION: During shipping, the fluid inside of the volume may have heated up causing increased pressure. Always open the bleed screw to relieve pressure prior to removing plugs in the hoses.

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.
3. Open the bleed screw slightly to relieve any residual pressure.
4. After pressure is relieved, close the bleed screw and torque to **13-18 ft-lbs.**
5. Locate the -10 hose assembly, with 90° fitting on one end.
6. Remove the cap from the strut port if installed.
7. Attach the 90° fitting to the strut port. Hand tighten only, at this time. Loosening the lower connection at the volume may be necessary for aligning the fitting to the strut.
8. Torque both ends to **36-63 ft-lbs.**

CAUTION: Make sure the hose is not chafing or in contact with any sharp edges.

9. Repeat with the opposite side.

CAUTION: Make sure the hose adequately clears the exhaust to prevent any contact.

10. Attach the -4 x 120"L hoses to each end of the volume.
11. Route the Left Hand (Driver side) -4 (1/4") hydraulic hose, attached to the volume assembly, to the Front Valve Block assembly.

Note: Use of hose clamps is recommended to secure the hose from movement or chafing.

12. Remove the cap from the -4 JIC fitting mounted on the Front Valve Block Assembly, marked "L".
13. Attach the hose end to the fitting marked "L". Torque the hose fitting and elbow to **12 ft-lbs. Do not over tighten.**
14. Repeat hose routing for the Right Hand (Passenger side) -4 (1/4") hydraulic hose routing to the -4 JIC fitting on the Front Valve Block Assembly marked "R"

Note: Use of hose clamps is recommended to secure the hose from movement or chafing.

CAUTION: Make sure that the hose is not chafing or in contact with any sharp edges or with the exhaust system.

15. Torque hose fittings to **12 ft-lbs. Do not over tighten.**
16. Clean up any fluid spillage.
17. Verify the -10 hose fittings to the secondary volume assemblies are torqued to **36-63 ft-lbs** on the JIC connections
18. Verify the -12 SAE fitting to the secondary volume assemblies are **75-83 ft-lbs**.
19. Verify the -4 SAE jam nut to the secondary volume assemblies are torqued to **14-16 ft-lbs**.
20. Verify the -4 hose fitting to the 90° fitting at the secondary volume assemblies are **12 ft-lbs**.

Electrical Installation – FS70RF and FS70RA

1. Locate the Front Route Wiring Harness, P/N: 10911-005.
2. Attach J38, 10-pin connector to mating connector (J37) on the wiring harness at the Power Module Assembly. Mating connector should be easily identifiable with yellow tape approximately 12” away from the ECU connection.
3. Unroll the wiring harness and using the Front Route Electrical Harness wiring diagram, found in the Electrical Schematics section, identify the connection ends.
4. Connect ISO valves, Height sensors, and Rate Valves.

Note: Connection after routing the harness and prior to installing the height sensor may aid in electrical connection.

5. Attach the ground ring terminal, J45, to the chassis frame for grounding. Sealant may be applied after ring terminal is secured.

IMPORTANT: When routing wiring, make sure there is adequate clearance to heat sources or moving parts. Be sure to secure excess wiring.

6. Reinstall tires and wheels per OEM instructions.

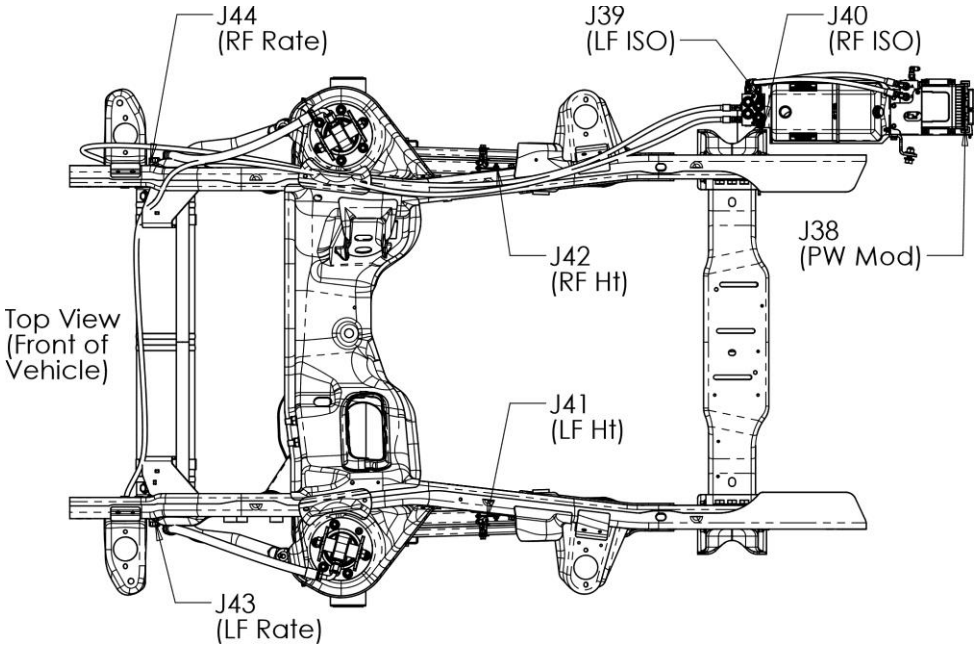


Figure 21: FS70RF Approximate wiring connection locations

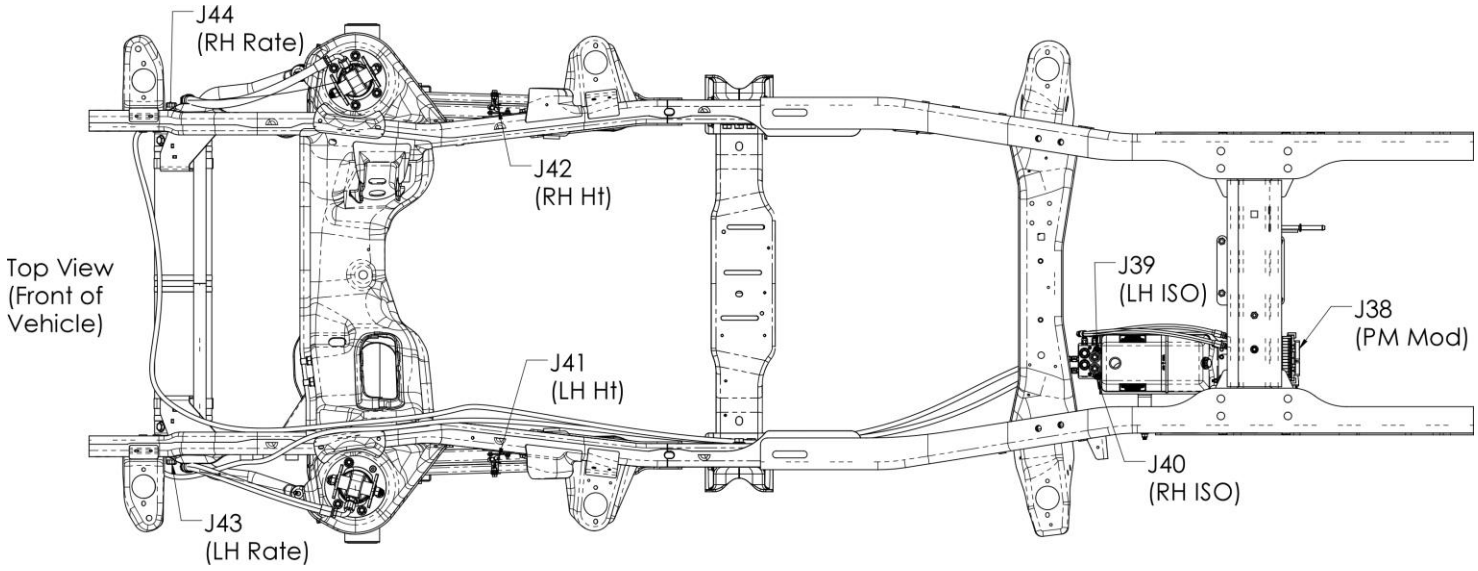


Figure 22: FS70RA Approximate wiring connection locations

Optional Door Electrical Harness Installation:

The LiquidSpring CLASS® Front Suspension system is equipped with two optional kneeling triggers.

- A rear only kneel, typically connected to the rear door switch to aid in loading at the rear.
- A full four corner kneel, typically connected to a side entrance door to aid in loading at side entrances.

When triggered, the suspension will lower to a pre-set ride height, above minimum axle travel.

Both triggers are activated by closing a ground signal. To utilize the optional kneeling triggers, follow the following steps.

IMPORTANT: Do not connect positive (12VDC) signal to either the W98 Blk, W99 Brown, or W113 White/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 White/Brown (W113) and 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 White/Brown (W113) or Brown (W93) wire is connected to the Black(or Tan/Black) (W98) wire of the door harness. This arrangement requires a remote switch that is a normally closed (NC) door witch 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 White/Brown (W113) or Brown (W93) wire and the other side to the door harness Black (or Tan/Black) (W98) wire. Requires two wires routed from switch to door harness.

Door Harness Wiring		
Pin Location	**Wire Color**	**Function**
Pin A	Brown	Rear Kneel when Grounded
Pin B	Black or Tan/Blk	Ground
Pin C	White/Brown	Front/Rear Kneel when Grounded

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).

System Preparation

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. Remove any jack stands from under the vehicle and lower the vehicle to the ground. The suspension should be at the full lowered position.
5. Verify that the Power Module reservoir fluid level is at least 2/3 full. If not add Compressible Fluid as necessary.

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.

Important: To utilize the front suspension, the system must be configured to recognize the front suspension. By default, the system is configured as a rear only, two corner leveling system. The CLASS software has the ability to automatically recognize front suspension connection and configure the system appropriately.

To activate the front suspension:

a. Verify that the Power Module ECU base part number is 11422 and that the revision is Rev B or greater. If the ECU base part number is 10870 or if the 11422 revision is "A", then contact LiquidSpring LLC for further instructions.
b. Verify that the front height sensors are electrically connected.
c. Turn the ignition key to "Run" and ensure that the LiquidSpring driver display LED's are lit and that the red "Warning" light is not lit. If the red "Warning" light is lit, refer to the Trouble Shooting Section.
d. Press and hold both the UP and DOWN arrows for the Ride Height selection (far right buttons) until the outer four green LED's begin flashing.
e. Release the buttons. The Driver Interface will flash, then reset and turned off.

6. Turn the Driver Interface back on and select NORMAL ride height, if not previously selected. The green ride height indicator LED should begin flashing as the pump/motor starts. If the pump/motor does not start, check Trouble Shooting Electrical Section.
7. Monitor the fluid level in the reservoir. If the level drops below ¼ of the tank, press and release the Red ON/OFF button to stop the system, refill the reservoir, and turn the system back on by pressing the Red ON/OFF button.
8. 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 filling:
   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.
9. After the suspension stop leveling, check the fluid level in the reservoir. If low, fill to the indicated line.

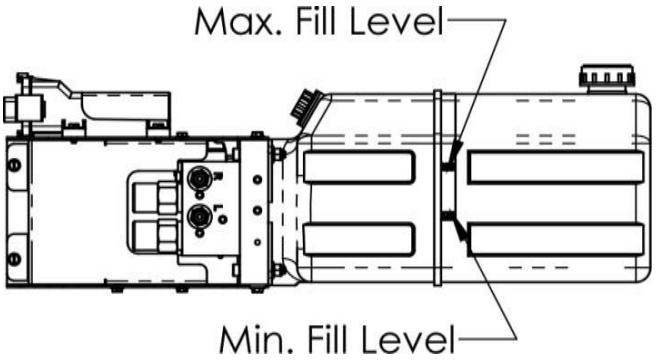


Figure 23. Final fill fluid level.

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.
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 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.

1. Verify that the front wheels are steered straight ahead.
2. Verify that the vehicle is on the ground. Remove any jack stands and/or 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 lower to the full lowered position, and then rise to the full high position.

   NOTE: Keep vehicle movement to a minimum during calibration.
7. After the system completes the calibration routine, the suspension will power cycle. The LEDs on the driver display should all flash then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit. Then the suspension system will then adjust to the new calibrated height.
8. Calibration is now completed.

Disabling/Enabling High Height

Note: The suspension has the ability to disable or enable high height functionality.

To Disable High Height:

1. While the system is calibrating, refer to step 6 in *calibrating the system*, press ride mode **DOWN** and allow calibration to finish.

To Enable High Height:

1. While the system is calibrating, refer to step 6 in *calibrating the system*, press ride mode **UP** and allow calibration to finish.

NOTE: Pressing and releasing the ride mode up or down can be executed any time during system calibration.

Post Installation Welding

WARNING: Prior to any chassis welding conducted after the installation of the LiquidSpring suspension system, disconnect cables from battery, disconnect ECU Header connectors (see below), and Power Module ground connection (see below).

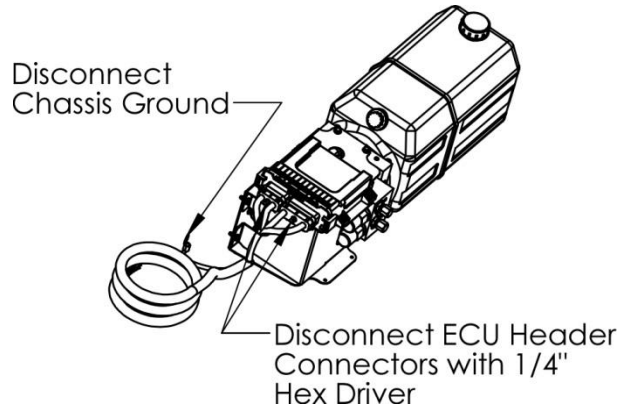
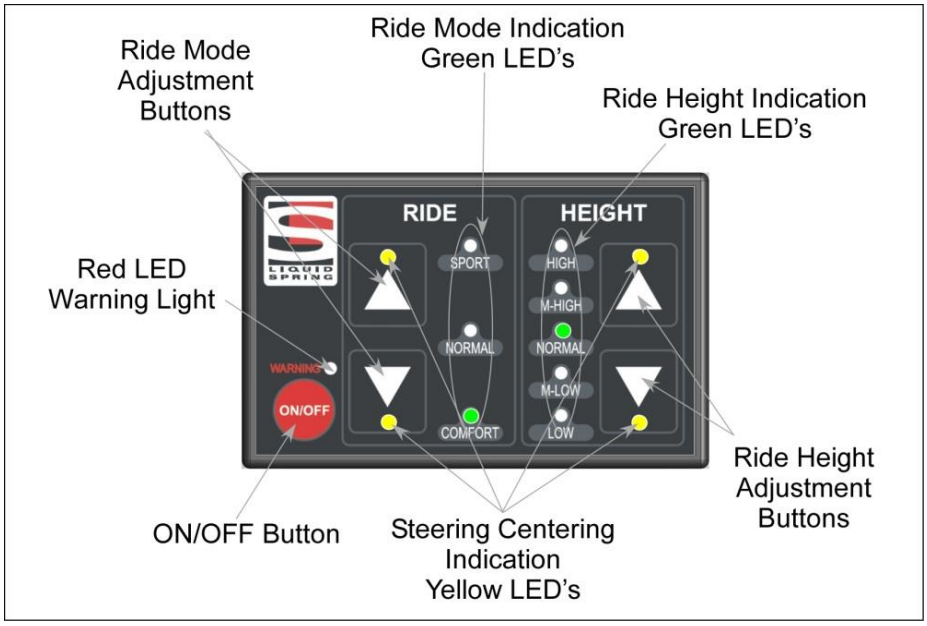


Figure 24. ECU disconnects prior to welding on chassis.

System Operation



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.
- The yellow lights will go off when the steering wheel is turned approximately 10-20° off center in either direction.

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

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.

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.

The following table shows the selection and indication of available ride heights:

Ride Height Description	Driver Interface Operation	Front Ride Height	Rear Ride Height	Ride Height LED (2 Corner Mode)	Ride Height LED (4 Corner Mode)
All Up (AU)	From RH, P&R UP 2 times. From RU, P&R UP 1 time.	HIGH	HIGH	n/a	● HIGH ○ M. HIGH ○ NORMAL ○ M. LOW ○ LOW
Rear Up (RU)	From RH, P&R UP 1 time	NORMAL	HIGH	● HIGH ○ M. HIGH ○ NORMAL ○ M. LOW ○ LOW	○ HIGH ● M. HIGH ○ NORMAL ○ M. LOW ○ LOW
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 > 15 MPH	NORMAL	NORMAL	○ HIGH ○ M. HIGH ● NORMAL ○ M. LOW ○ LOW	○ HIGH ○ M. HIGH ● NORMAL ○ M. LOW ○ LOW
Rear Down (RD)	From RH, P&R DOWN 1 time Rear Door Trigger	NORMAL	LOW	○ HIGH ○ M. HIGH ○ NORMAL ○ M. LOW ● LOW	○ HIGH ○ M. HIGH ○ NORMAL ● M. LOW ○ LOW
All Down (AD)	From RH, P&R DOWN 2 times. From RD, P&R DOWN 1 time. Side Door Trigger	LOW	LOW	n/a	○ HIGH ○ M. HIGH ○ NORMAL ○ M. LOW ● LOW
Depressurize	(2 Corner Mode): From RD, P&H DOWN (4 Corner Mode): From AD, P&H DOWN	FULL LOW	FULL LOW	○ HIGH ○ M. HIGH ○ NORMAL ○ M. LOW ● LOW	○ HIGH ○ M. HIGH ○ NORMAL ○ M. LOW ● LOW

P&R = Press and Release

P&H = Press and Hold

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. From NORMAL Ride Height, press and release the HEIGHT DOWN arrow button to lower the rear to the LOW height. For four corner systems, press and release HEIGHT DOWN arrow button a second time to lower the front.
4. Press and hold the HEIGHT DOWN arrow button for approximately 2 minutes.
5. While holding the HEIGHT DOWN arrow button, press and release the ON/OFF button to disable the system. Release the HEIGHT DOWN arrow button
6. 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:

7. Locate 3/16" ID PVC Tubing. Note: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit can be used.
8. 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.
9. Open the bleed screw slightly to relieve any residual pressure.
10. 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 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.

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.

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 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 the 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.

Driver Interface Lights	Condition	Cause	Correction
Warning + RIDE: SPORT	Battery Voltage in excess of 16VDC	Vehicle charging system providing incorrect voltage.	Inspect and replace as necessary.
		LiquidSpring system not connected to 12VDC electrical system	Inspect and replace as necessary
Warning + RIDE: NORMAL	Pump Motor runs in excess of 3 minutes	See *Issues with Vehicle Raising/Pump Section*	See *Issues with Vehicle Raising/Pump Section*
Warning + RIDE: COMFORT	Battery Voltage below 9 VDC	Vehicle charging system providing incorrect voltage	Inspect and replace as necessary
		80A fuse blown / Loss of battery voltage on circuit W25	Inspect / Repair Replace as necessary
Warning + HEIGHT: HIGH	Issue with Right Rear Height Sensor	See *Issues with Height Sensors Section*	See *Issues with Height Sensors Section*
Warning + HEIGHT: NORMAL	System kneels in excess of 3 minutes without suspension movement	See *Issues with Vehicle Lowering/Dump Valve Section*	See *Issues with Vehicle Lowering/Dump Valve Section*
Warning + HEIGHT: LOW	Issue with Left Rear Height Sensor	See *Issues with Height Sensors Section*	See *Issues with Height Sensors Section*

Warning + HEIGHT: FLASHING HIGH	Issue with Right Front Height Sensor	See *Issues with Height Sensors Section*	See *Issues with Height Sensors Section*
Warning + HEIGHT: FLASHING LOW	Issue with Left Front Height Sensor	See *Issues with Height Sensors Section*	See *Issues with Height Sensors Section*
Warning + HEIGHT: M-HIGH	Issue with Accelerometer	Damaged ECU	Replace ECU
Slow or Fast Blinking Warning Light	Driver Interface cannot communicate with ECU.	See *Issues with Driver Interface*	See *Issues with Driver Interface*

Issues with Vehicle Raising/Pump

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

Issues with Vehicle Lowering/Dump Valve

Condition	Cause	Correction
Vehicle does not lower (kneel).	System not turned on	Turn system on
	Blown fuse	Check system fuses and replace as necessary
	Obstacle under vehicle frame	Remove obstacle
	Wiring harness disconnected	Check wiring harness connections and reconnect
	Loss of electrical power	Check wiring between power module and battery
	Power module filters plugged	Contact LiquidSpring for further instructions
	Internal power module blockage	Contact LiquidSpring for further instructions
Vehicle slow lowering (kneeling)	Partial internal power module blockage	Contact LiquidSpring for further instructions

Issues with One Corner Not Leveling Properly

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

Issues with Height Sensors

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

Issues with Ride/Handling

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

Issues with Steering Sensor

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

Issues with Vehicle Speed Signal

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

Issues with Vehicle Brake Signal

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

Issues with Door Switch

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

Issues with Vehicle Ignition Signal

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

Issues with Vehicle Park Signal

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

Issues with Driver Interface

Condition	Cause	Correction
Warning light blinks, system appears to level.	CAN wires crossed or not connected.	Inspect wiring and repair/replace as necessary.
	Malfunctioning Driver Interface	Inspect and replace as necessary.
Warning light blinks, system does not appear to operate (level)	No power to ECU (5A 18ga Red Wire)	Inspect wiring and repair/replace as necessary.
	No ignition signal to ECU (Yellow Wire)	Inspect wiring and repair/replace as necessary.
	CAN wires crossed or not connected.	Inspect wiring and repair/replace as necessary.

Issues with Power Module

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

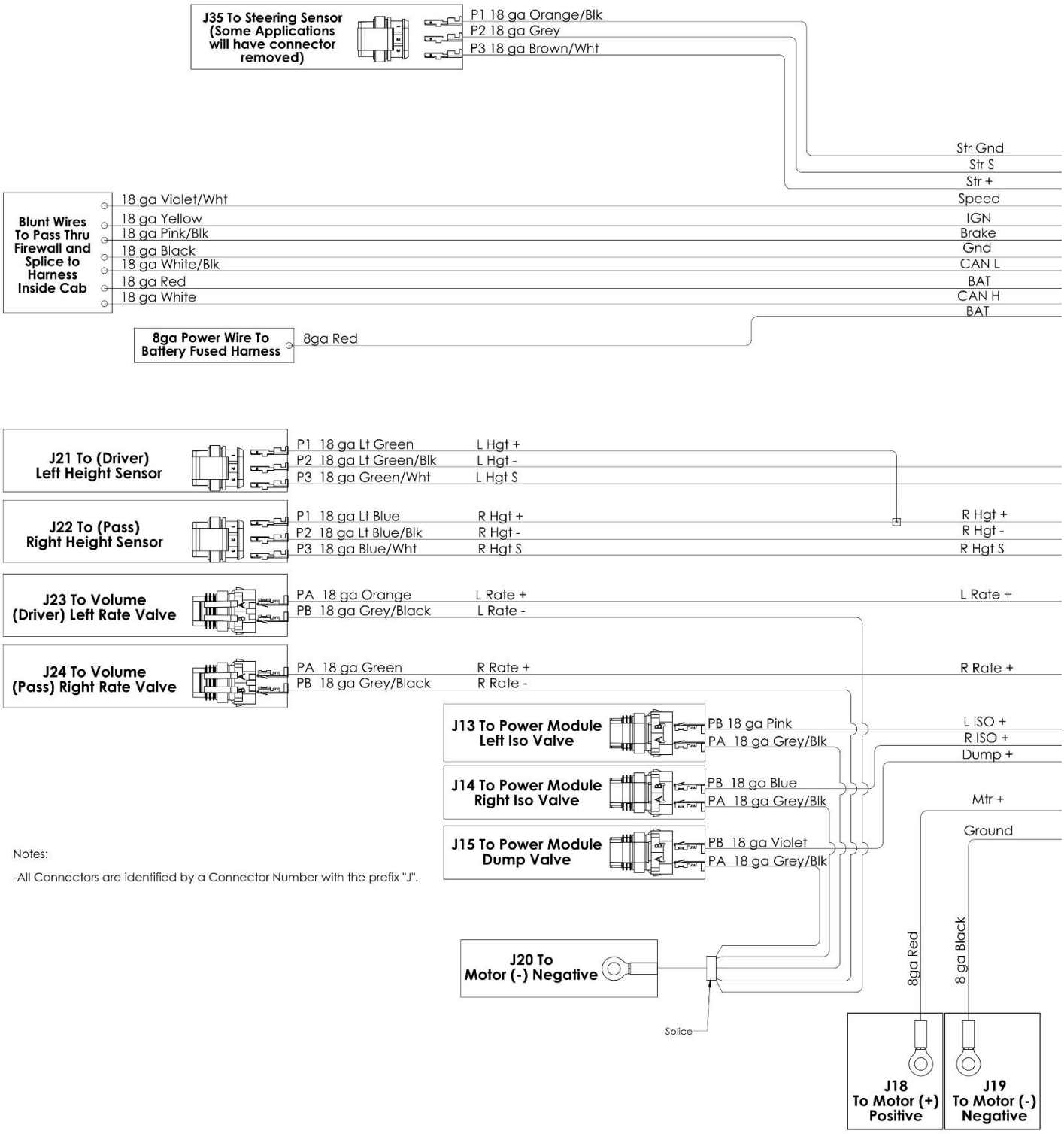
Issues with Strut Assembly

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

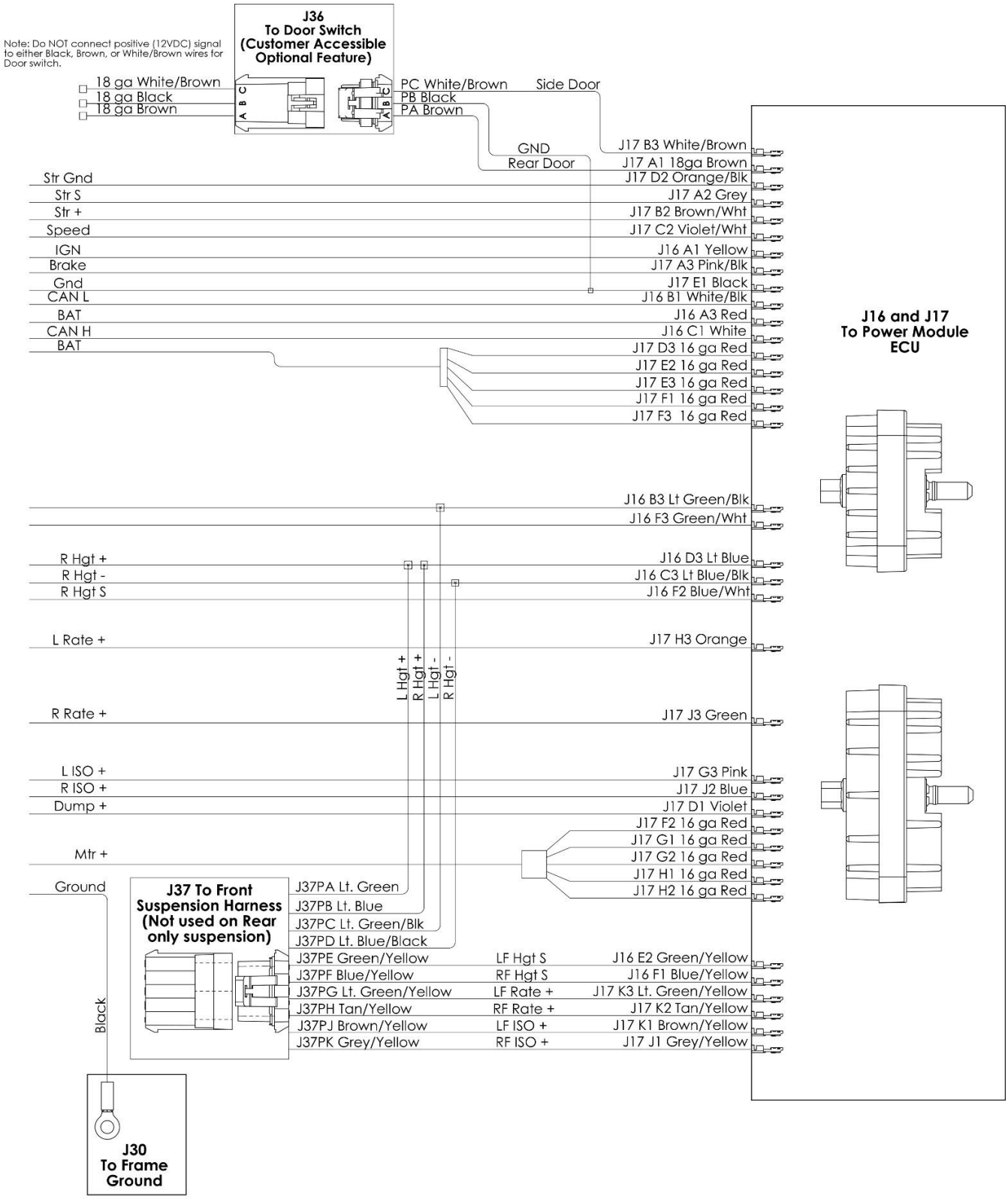
Issues with Secondary Volume Assembly

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

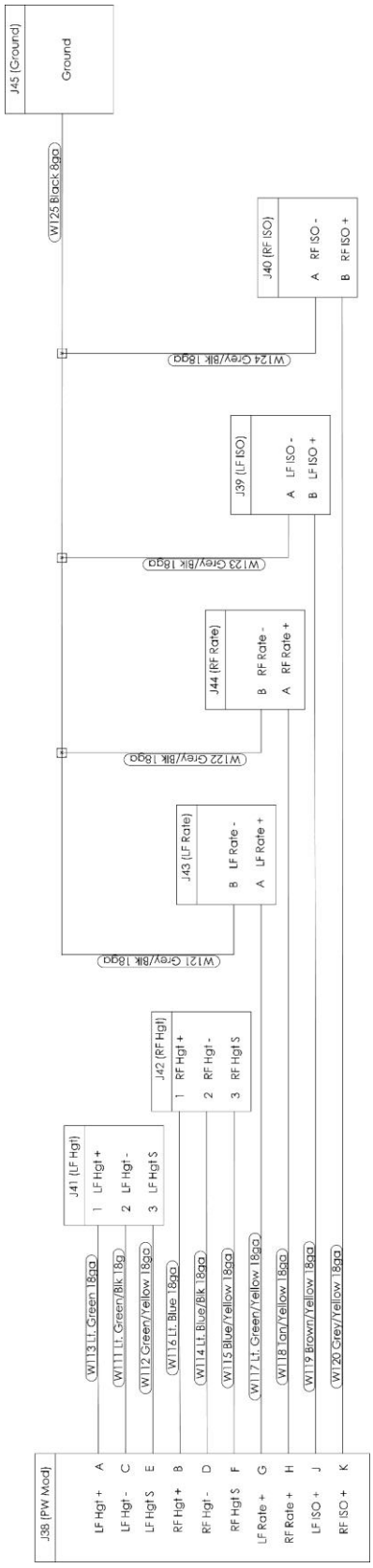
Electrical Schematics



Schematic, External Wiring Harness – Part 1



Schematic, External Wiring Harness – Part 2



Schematic, Front Route Wiring Harness

Installation Check List

Installer:	Installation Date:
Inspector:	Inspection Date:
Suspension S/N:	VIN:

FRAME and AXLE PREPARATION:
☐Battery Disconnected
☐Removed OEM Springs and shocks.
☐Enlarged lower spring perch holes to 15/32” on axle.
☐Upper Strut Mount hole enlarged to 4-1/2” and additional mounting holes drilled.

UPPER STRUT MOUNT INSTALLATION:
☐Upper strut mounts oriented properly.
☐Reinforcement ring installed under the spring buckets.
☐ABS module is re-attached to the upper strut mount fasteners with Low Profile SHCS installed under the ABS module.
☐1/2”-13 Nuts torqued to **86-105 ft-lbs**.

LOWER STRUT MOUNT:
☐Attach lower strut mounts to the axle spring perch and torqued the 1/2” Self-Tapping Bolts to **61-75 ft-lbs**.

STRUT INSTALLATION:
☐5/8”-11 Upper Nuts torqued to **182-210 ft-lbs**.
☐Replaced -10 port plugs with -10 SAE to JIC, torqued to **39 ft-lbs**

HEIGHT SENSOR INSTALLATION:
☐5/16”-18 Nuts torqued to **14-17 ft-lbs**.
☐3/8”-16 Self tapping screws torqued to **35 ft-lbs**.
☐Locking Clips installed.

SECONDARY VOLUME INSTALLATION
☐OEM Swaybar mounting bolts torqued to **35 ft-lbs.**
☐T-Bolt Clamp fasteners torqued to **240 in-lbs.**

ISOLATION BLOCK INSTALLATION:
☐M5 Fasteners torqued to **240 in-lbs**.
☐-4 Hoses torqued to **12 ft-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**.

WIRING HARNESS INSTALLATION:
☐Front Electrical harness routed, all connections made, and grounded.
☐Door harness installed (if equipped with rear or side door switch).
☐All harnesses properly secured from chaffing, heat, and located away from moving parts.

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

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