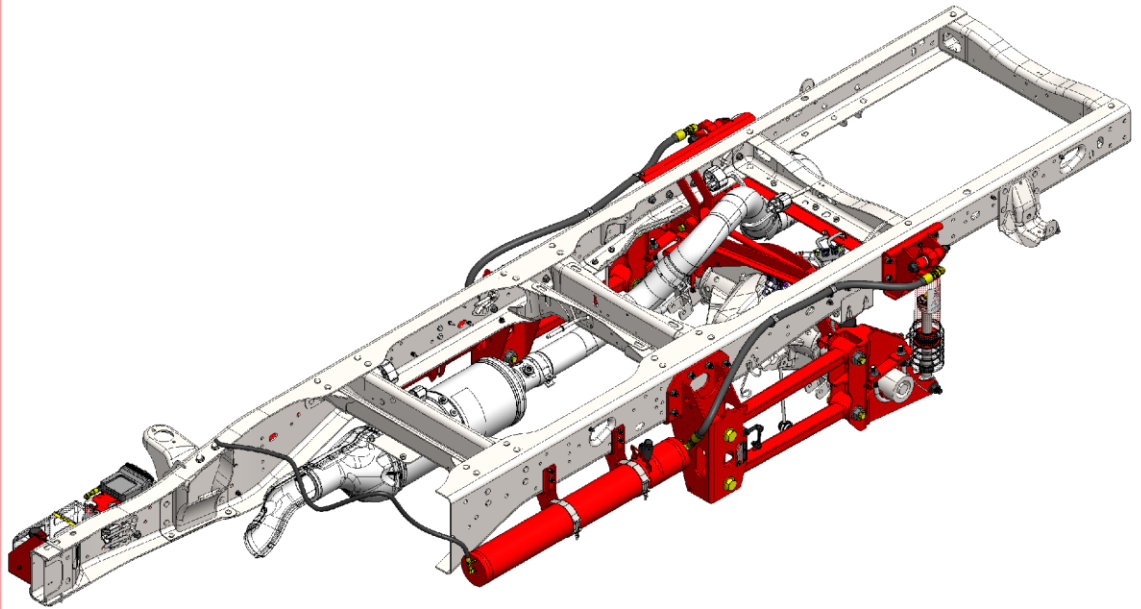


DS99R

DS99R

Drive Axle Rear Suspensions
for 84" CA Ram 3500 Cab Chassis



Installation / Maintenance Manual

D11187 Rev G 7/2019

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Introduction

This manual provides installation information for the LiquidSpring CLASS® DS99R series of rear axle suspension systems for the RAM 3500 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 preceded by the terms "NOTE", "IMPORTANT", "CAUTION", and "WARNING". 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.

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.

Suspension Rating

The LiquidSpring DS99R suspension is rated for **9,850 lbs.**

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

Serial Number Tag Information

The suspension model, serial number, and maximum axle capacity are found on an aluminum tag that is 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

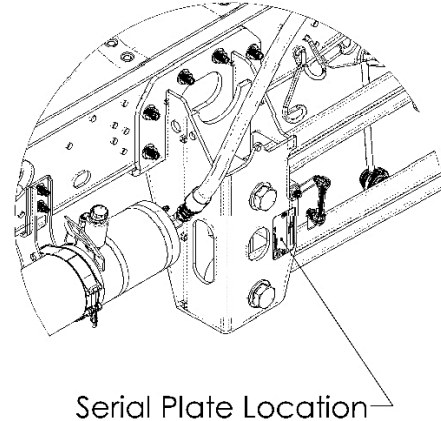


Figure 2. Serial Number Tag Location (view may not represent suspension in kit)

Vehicle Towing and Jacking Information

Before attempting any type of towing procedures, the OEM/Coach Builder must be referred to for the recommended towing methods.

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

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

WARNING: Attaching towing equipment to improper locations and failure to utilize 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.

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

Hydraulic Fitting Assembly

SAE O-Ring Adjustable Fittings

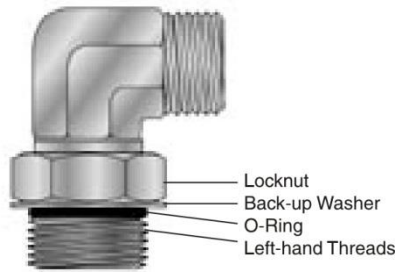


Figure 3. Adjustable SAE fitting

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.

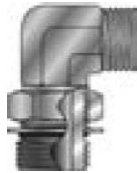


Figure 4. Locknut completely backed off.

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

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.
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.

Frame 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.

4. Disconnect the negative cable from the vehicle battery.
5. Remove the OEM shock absorbers.
6. Remove the OEM leaf springs and rear shackles.
7. If equipped with the midship fuel tank, dropping the tank may ease installation, but not necessary.
8. Remove the OEM Axle Stop Bumpers from under the frame. Retain Drive side hardware.
9. Remove the driver and passenger side Parking Brake Cables and wire form brackets and position the cable and conduit aside.
10. Remove the Front Hangers.
11. Remove the passenger side welded on jounce bumper mount. Use caution when removing as not to damage the frame.
12. Remove the leaf spring overload pads.

Note: Do not remove sway bar or sway bar mounting components.

13. Locate the drilling template and follow the instructions in Appendix A: Drill Locations, page 41, for drilling holes in the framerail.

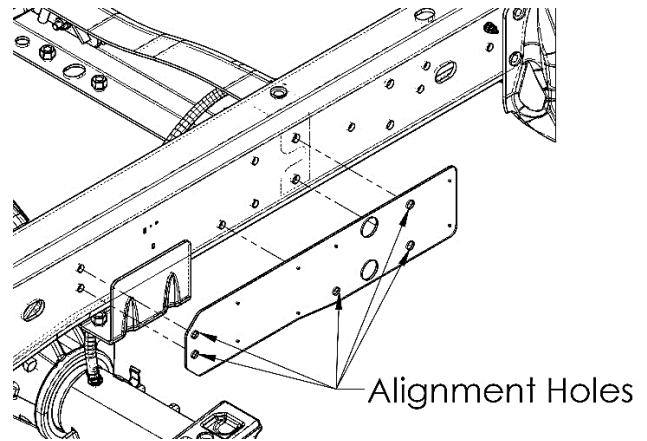


Figure 5. Location of Drilling Template on Driver Side Frame.

Note: See secondary volumes, page 20, for additional frame drill requirements.

Parts List Information

HCS	Hex Cap Screw
HFBS	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

Abbreviations

HTCN	Hex Thin Castle Nut
HFWS	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

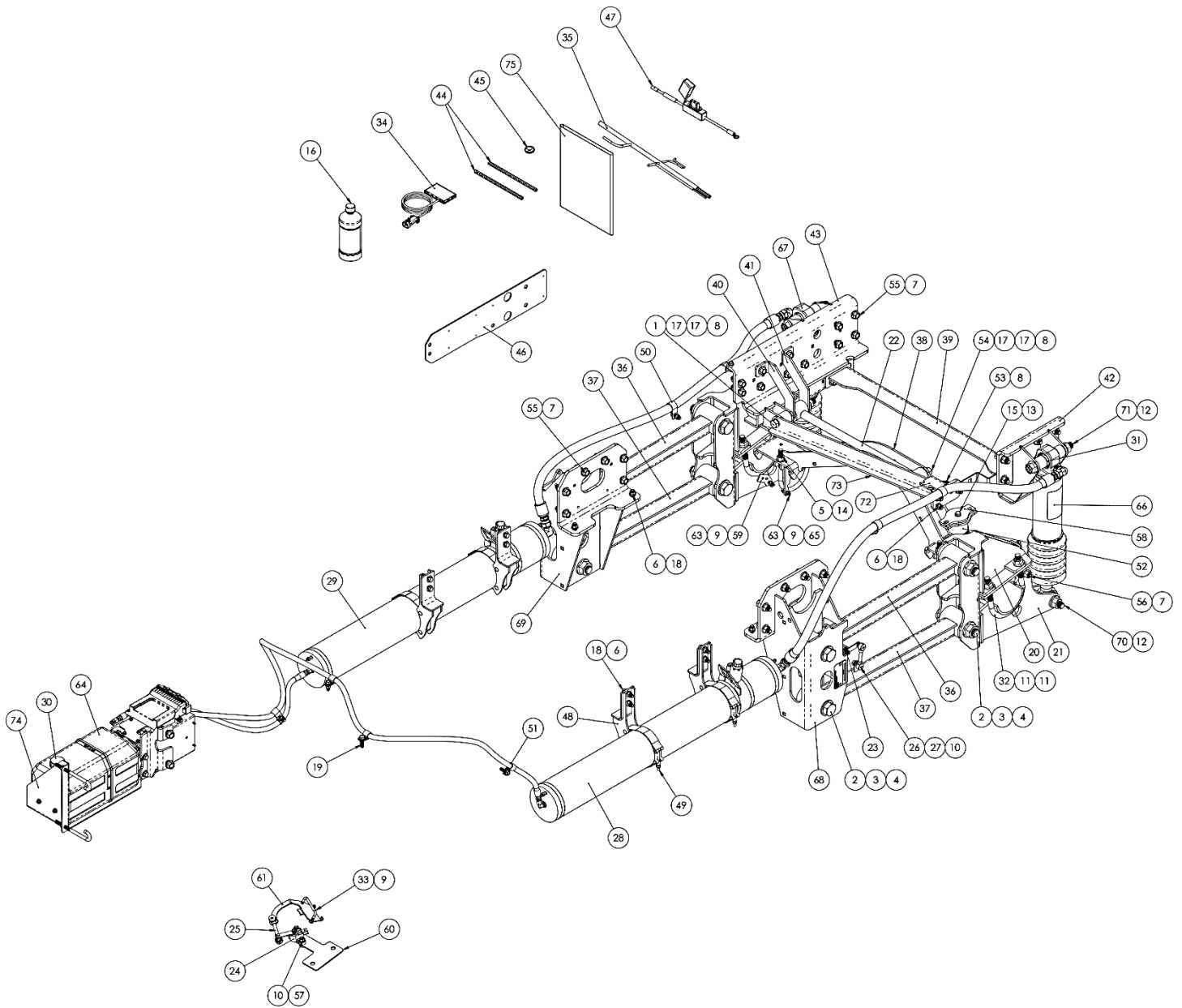
Special Tools

The following tools can assist in installation of the LiquidSpring system.



Bleed Kit (Actron 7840 shown, others similar).

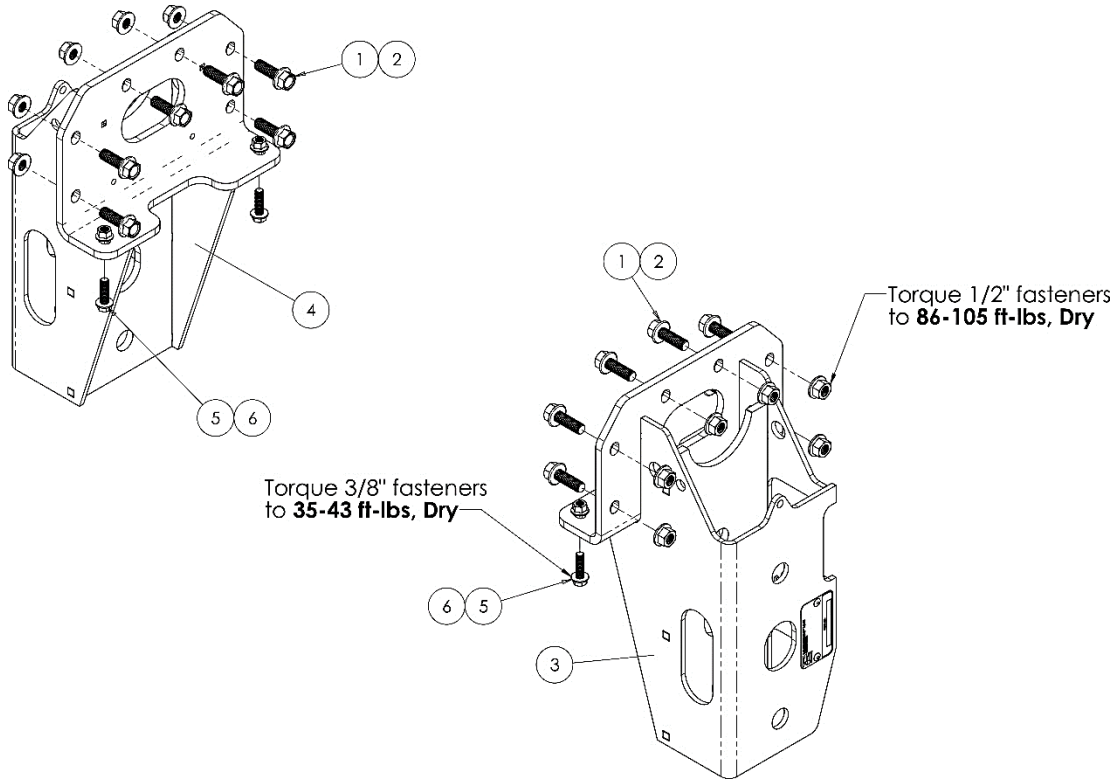
Part Identification:



DS99R BOM							
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10000-016	HB .625-11x6.500, Gr. 8	39	1	10782-009	Crossmember Reinforcement
2	8	10003-010	HCS 1-8x5.500, Gr. 8	40	1	10788-011	Track Rod Mnt, Front
3	8	10006-004	HFW 1.000	41	1	10788-012	Track Rod Mnt, Rear
4	8	10012-003	LFN 1-8, Gr G, Top Lock	42	1	10790-018	USM, LH
5	4	10012-004	LFN 1/2-20, Gr. G	43	1	10790-019	USM, RH
6	15	10012-005	LFN 3/8-16, Gr G	44	2	10804-002	Spiral Cable Wrap, .375 OD x 8" L
7	35	10012-007	LFN 1/2-13, Gr. G	45	1	10805-005	Grommet, .63 ID x 1.13 OD x .38 T
8	3	10012-008	LFN 5/8-11 Gr G	46	1	10811-009	Template, Frame Drilling
9	5	10012-009	LFN 1/4-20, Gr. G	47	1	10815-001	Fused Battery Lead
10	16	10012-010	LFN 5/16-18, Gr. G	48	4	10830-015	Volume Mount
11	8	10012-013	LFN 5/8-18, Gr. G	49	4	10843-003	T-Bolt Clamp, Range 4.88-5.5
12	4	10012-014	LFN 3/4-10 Gr G	50	4	10855-002	Vinyl-Coated Loop Clamp, 1" ID
13	2	10237-003	SLW 3/8	51	5	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
14	2	10383-002	U-Bolt 1/2-20 x 6.50 Gr 5	52	2	10867-002	Jounce Bumper
15	2	10461-004	HCS 3/8-16x1.250, Gr. 8	53	1	10874-175	HFB 5/8-11x1.750, Gr. 8
16	1	10474-001	Silicone Oil, 16 oz. Bottle	54	1	10874-400	HFB 5/8-11x4.00, Gr. 8
17	4	10494-001	Wedge Lock Washer, 5/8	55	35	10885-150	HFB 1/2-13x1.500, Gr. 8
18	15	10501-002	HFB 3/8-16 x 1.250, Gr 8	56	2	10885-325	HFB 1/2-13 x 3.25 Gr 8
19	1	10502-001	HFB M10-1.5 x 30 CL 10.9	57	14	10886-100	HFB 5/16-18 x 1.000, Gr. 8
20	2	10546-005	Axle Seat	58	1	10889-003	Jounce Bumper Plate
21	2	10552-003	Axle Cradle	59	1	10902-001	Parking Brake Relocating Bracket
22	1	10570-003	Track Rod	60	1	10904-018	Bracket, Steering Sensor
23	2	10586-001	Height Sensor	61	1	10904-020	Ball Stud Bracket
24	1	10586-002	Steering Sensor	62	1	10919-001	Brake line relocation bracket
25	1	10587-001	Linkage	63	3	10989-100	HFB 1/4-20x1.000, Gr. 8
26	2	10587-005	Linkage	64	1	11013-006	Asy, Power Supply DS99R
27	2	10591-001	Ball Stud, 10mm x 5/16-18	65	1	11048-002	Bracket, Bridge Orientation
28	1	10597-065	LH, Secondary Volume	66	1	11057-005	Asy, Strut, LH
29	1	10597-066	RH, Secondary Volume	67	1	11057-006	Asy, Strut, RH
30	1	10614-001	Cap, Filler/Breather	68	1	11083-002	Front Hanger, LH
31	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	69	1	11084-004	Front Hanger, RH
32	4	10642-001	U-Bolt 5/8-18 x 7.00 Gr 8	70	2	11102-400	HFB 3/4-10 x 4 Gr 8
33	1	10669-005	U-Bolt, 1/4-20 x 3.00 x 1.375 Gr 5	71	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
34	1	10680-001	Driver Interface	72	1	11114-002	Tie Plate Mount
35	1	10704-003	Dash Wire Harness	73	1	11115-005	Tie Plate
36	2	10720-007	Upper Control Arm	74	1	11167	Power Module Mounting Kit
37	2	10720-008	Lower Control Arm	75	1	11186	Kit, Documents, Ram 3500
38	1	10762-007	Bridge				

Installation

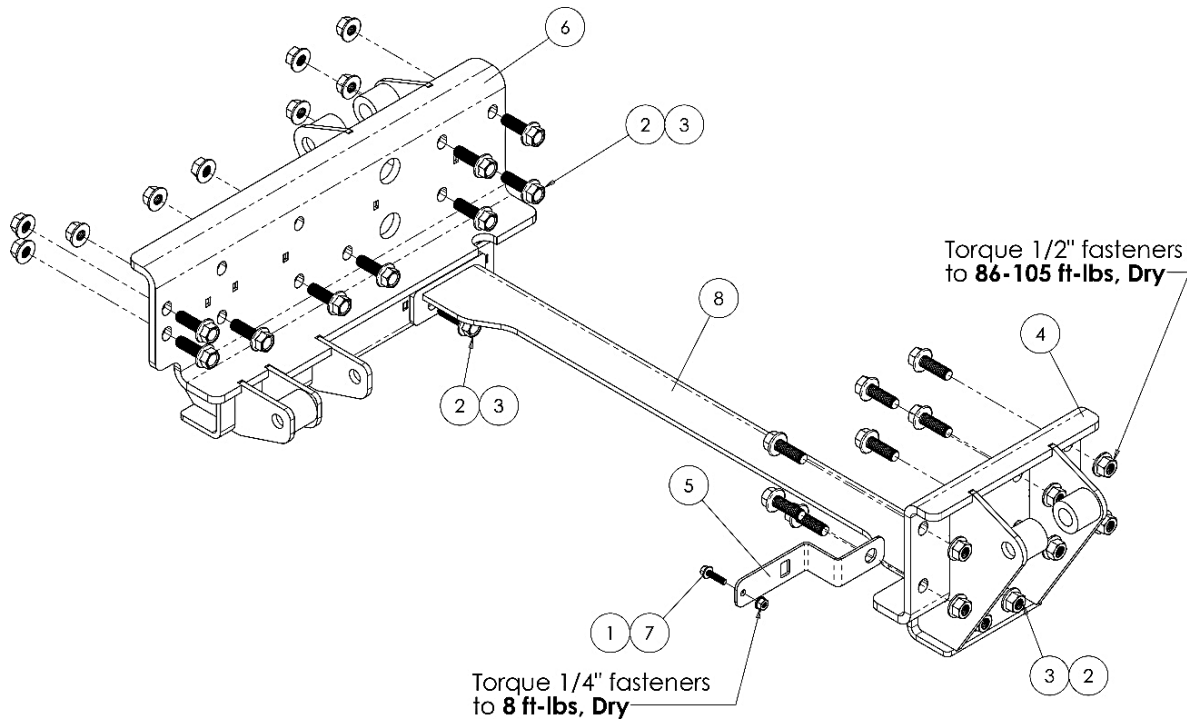
Front Hangers



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	12	10885-150	HFB 1/2-13x1.50, Gr. 8	4	1	11084-004	RH, Front Hanger
2	12	10012-007	LFN 1/2-13, Gr. G	5	4	10501-002	HFB 3/8-16 x 1.25, Gr. 8
3	1	11083-002	LH, Front Hanger	6	4	10012-005	LFN 3/8-16, Gr. G

1. Install hangers in OEM front hanger locations
2. Loosely tighten 3/8 fasteners on the lower flange to hold hanger up close to the frame.
3. Torque 1/2"-13 nuts to **86-105 ft-lbs.**
4. Torque 3/8"-16 nuts to **35-43 ft-lbs.**

Upper Strut Mounts



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10012-009	LFN 1/4-20, Gr. G	5	1	10919-001	Brake Line Relocation Bracket
2	19	10885-150	HFB 1/2-13 x 1.50", Gr. 8	6	1	10790-019	RH USM
3	19	10012-007	LFN 1/2-13, Gr. G	7	1	10989-100	HFB 1/4-20x1.00, Gr. 8
4	1	10790-018	LH USM	8	1	10782-009	Crossmember Reinforcement

1. Prior to installing components, a small portion of the exhaust heat shield will need to be trimmed away. Using tin snips trim away ≈1" material from the top of the shield where it would come in close contact with the reinforcement crossmember. See Figure 6 and Figure 7



Figure 6: Material to remove from Heat Shield



Figure 7: Approximate size of material removed

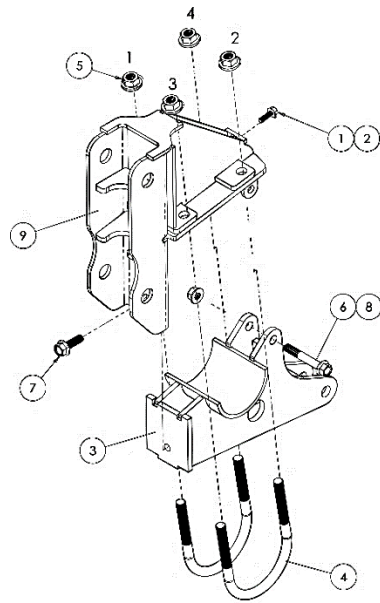
2. Loosely attach all components through previously drilled holes in frame.

IMPORTANT: Before tightening fasteners, verify the top of each upper strut mount is level with the top of the frame.

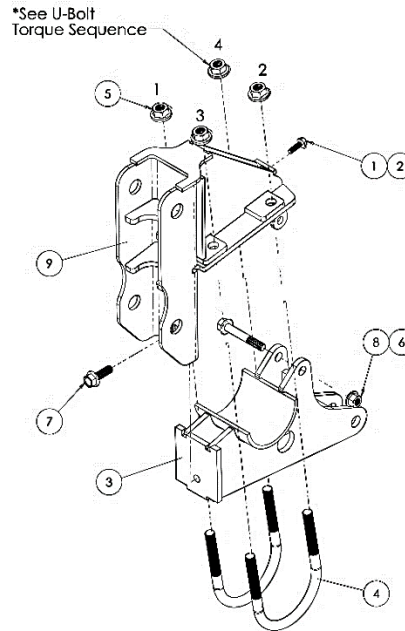
3. Torque all 1/2-13 nuts to **86-105 ft-lbs**.

Note: There will be two holes on the passenger side Upper strut mount left open at this time.

Axle Clamp Hangers



***Torque U-Bolts Evenly**
 1. Tighten all U-Bolts until snug only
 2. Tighten in sequence 1-2-3-4 to 75 ft-lbs
 3. Tighten in sequence 1-2-3-4 to 150 ft-lbs
 4. Tighten in sequence 1-2-3-4 to 175-200 ft-lbs



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10886-100	HFB 5/16-18 x 1.00, Gr. 8	6	2	10885-325	HFB 1/2-13 x 3.25, Gr. 8
2	2	10012-010	LFN 5/16-18, Gr. G	7	2	10885-150	HFB 1/2-13 x 1.50, Gr. 8
3	2	10552-003	Axle Cradle	8	2	10012-007	LFN 1/2-13, Gr. G
4	4	10642-001	U-Bolt 5/18-18, 7.00, Gr. 8	9	2	10546-005	Axle Seat
5	8	10012-013	LFN 5/8-18, Gr. G				

1. Detach the hydraulic brake line flexible hose brackets on both driver and passenger side OEM spring seats.
2. Place the LH Axle Seat on the axle spring seat.
3. Place the LH Axle Cradle under the axle and loosely attach to the Axle Seat using the 1/2"-13 bolts.
4. Slip the 5/8" U-bolts into position. Lightly tighten u-bolts. Repeat installation for RH side.
5. **Torque, the U-bolt nuts evenly in an X-type pattern in 4 stages:**
 - Stage 1: Tighten snug only.
 - Stage 2: Torque to 75 ft-lbs.
 - Stage 3: Torque to 150 ft-lbs.
 - Stage 4: Torque to 175-200 ft-lbs].

Note: U-Bolt Torques for Dry Fasteners. Reduce torques 20% for use with Anti-Sieze.

6. Torque the 1/2" Fasteners to **86-105 ft-lbs.**
7. Reinstall the brake flexible line mounting brackets to back of the Axle Seat Weldments using 5/16" hardware provided in kit. Adjust lines for clearance

around the strut and any moving parts. Bend wire form brackets upward for additional clearance.

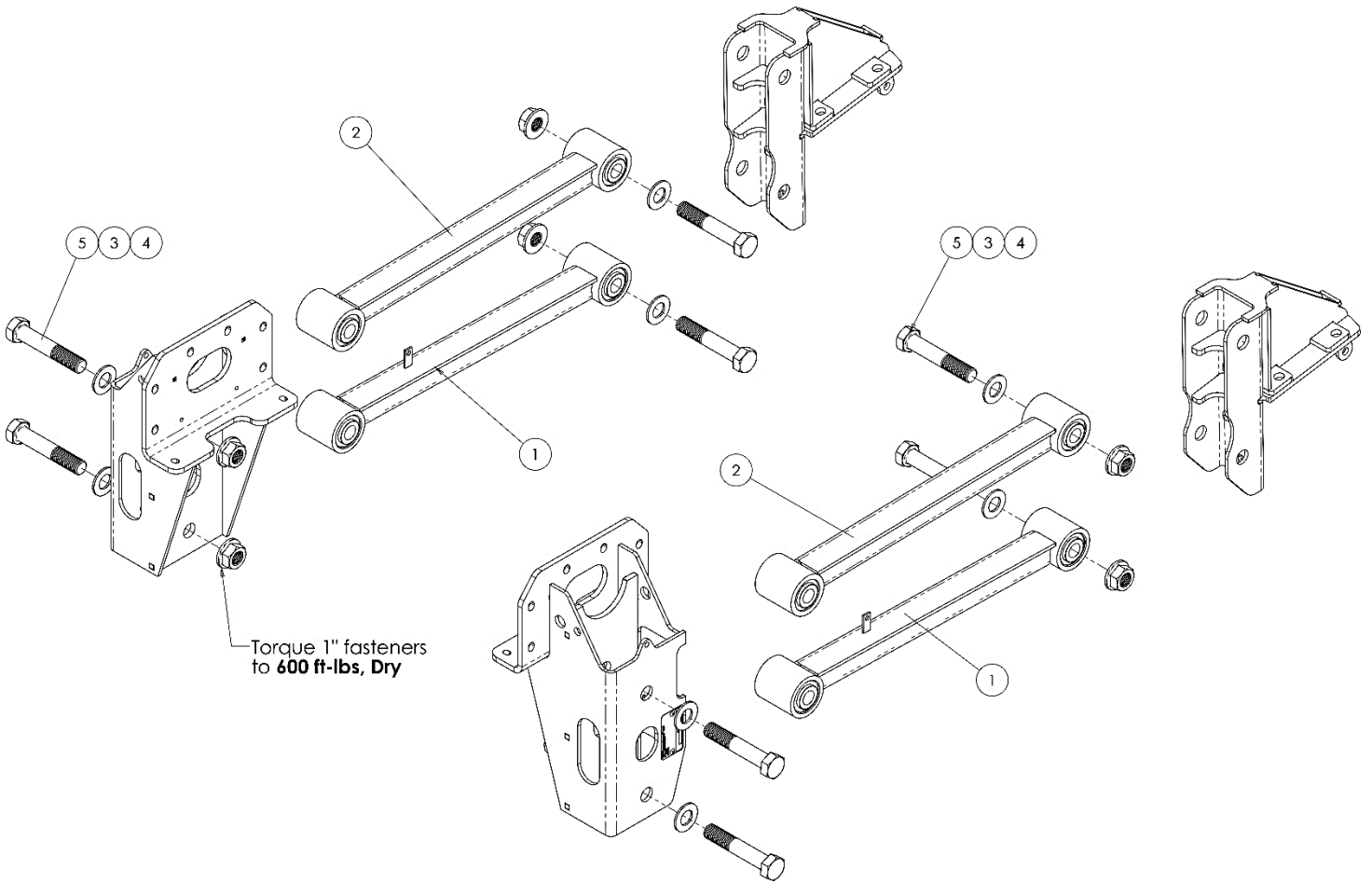


Figure 8. Attachment of driver side brake flexible line.

8. Torque 5/16" hardware to **24 ft-lbs.**

IMPORTANT: Install 3/8" spiral wrap, around the flexible brake lines where they route near the struts to prevent wear to the rubber brake lines.

Control Arms



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10720-008	LCA	4	8	10012-003	LFN 1-8, Gr G
2	2	10720-007	UCA	5	8	10003-010	HB 1.00-8 x 5.50, Gr. 8
3	6	10006-004	HFW 1.00				

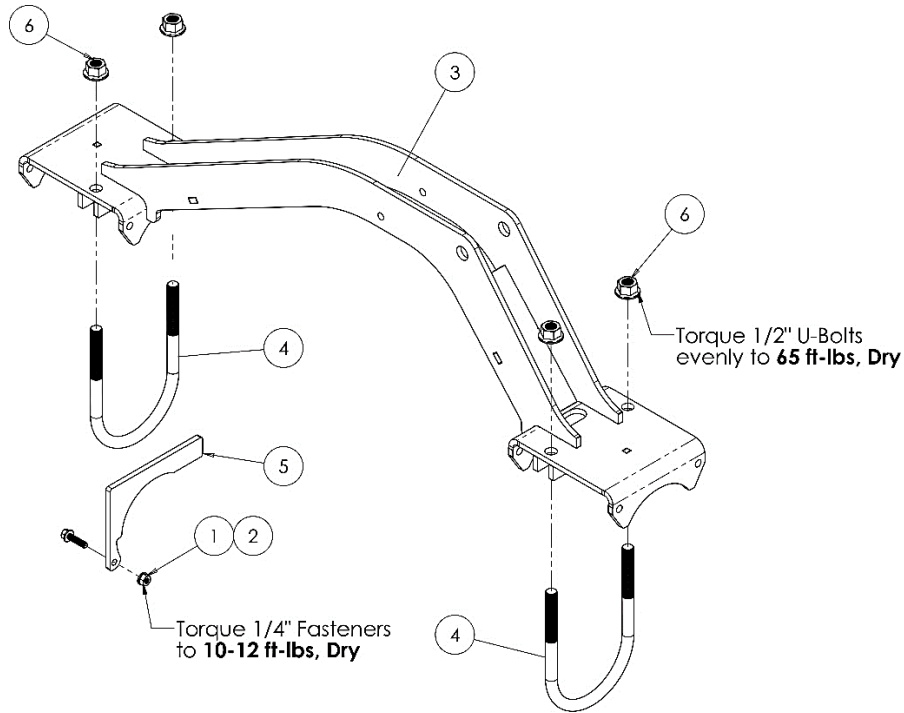
1. Locate control arms and install as shown.

Note: Height sensor tab is on top and forward on Lower Control Arm.

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

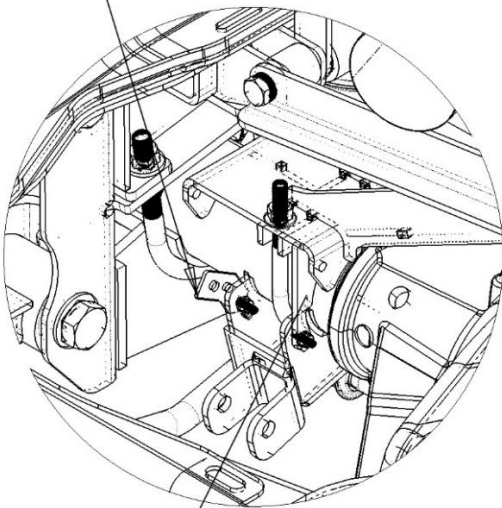
IMPORTANT: Vehicle must be at ride height when tightening control arms, to prevent premature wear of bushings from excess twist in the rubber.

Bridge



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10012-009	LFN 1/4-20, Gr. G	4	2	10383-002	U-Bolt 1/2-20 x 6.50, Gr 5
2	1	10989-100	HFB 1/4-20 x 1.00 Gr. 8	5	1	11048-002	Bridge Orientation Bracket
3	1	10762-007	Bridge	6	4	10012-004	LFN 1/2-20, Gr. G

Install Parking brake relocation bracket to extend parking brake away from axle



Install Bridge orientation bracket to OEM shock mount

1. Install Bridge orientation bracket onto axle prior to installing Bridge. Fasten to passenger side OEM shock mount using supplied 1/4" hardware.

Note: The Bridge should be sitting approximately 90° to the frame at ride height.

IMPORTANT: Make sure brake lines are clear when installing the bridge components.

2. Torque 5/8" U-Bolts evenly to **65 ft-lbs**.
3. Torque 1/4" hardware to **10-12 ft-lbs**.

Figure 9: Bridge installed with Orientation Bracket

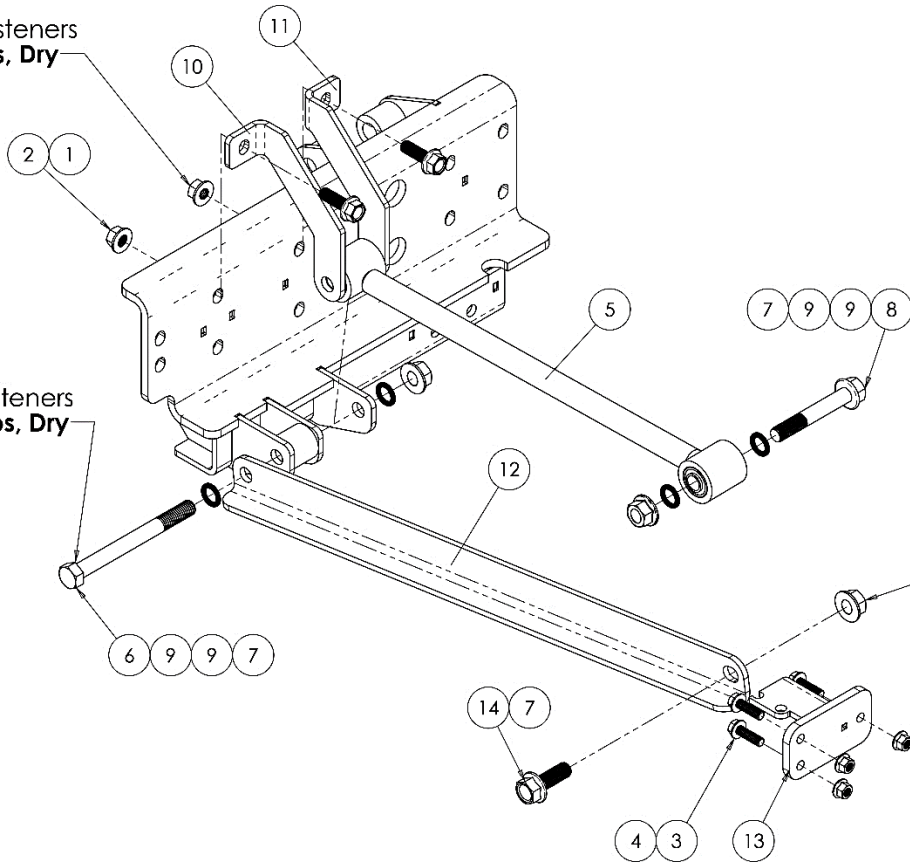
Track Rod and Tie Plate

Torque 1/2" fasteners to **86-105 ft-lbs, Dry**

Torque 7/8" fasteners to **491-600 ft-lbs, Dry**

Torque 5/8" fasteners to **172-210 ft-lbs, Dry**

Torque 3/8" fasteners to **35-43 ft-lbs, Dry**



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10885-150	HFB 1/2-13 x 1.50, Gr. 8	8	1	10874-400	HFB 5/8-11 x 4.00, Gr. 8
2	2	10012-007	LFN 1/2-13, Gr. G	9	4	10494-001	Wedge Lock Washer, 5/8"
3	3	10501-002	HFB 3/8-16 x 1.25, Gr. 8	10	1	10788-011	Track Rod Mnt, Front
4	3	10012-005	LFN 3/8-16, Gr. G	11	1	10788-012	Track Rod Mnt, Rear
5	1	10570-003	Track Rod	12	1	11115-005	Tie Plate
6	1	10000-016	HB 5/8-11x6.50, Gr. 8	13	1	11114-002	Tie Plate Mount
7	3	10012-008	LFN 5/8-11, Gr. G	14	1	10874-175	HFB 5/8-11 x 1.75, Gr. 8

1. Prior to installing components, one hole will need drilled in the frame, and excess threads removed from stud on the axle.
2. Remove excess threads from stud protruding out of the axle as shown in Figure 10
3. Detach fuel and brake line brackets from the frame in the area above the axle.
4. Using the tie plate mount as a template, mark the third mounting hole in the frame and drill to Ø13/32 to allow mounting with 3/8" hardware. See



Figure 10: Trim Stud to allow clearance in full Jounce

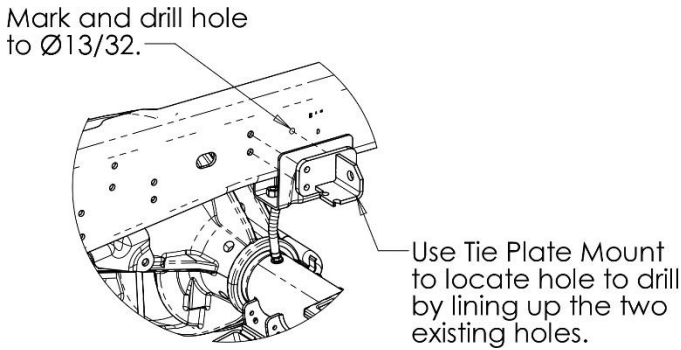


Figure 11: Placing mount upside down - outside the frame, mark hole and drill from the outside.

5. Install the Tie Plate Mount inside the frame and attach the OEM fuel and brake lines on top of the bracket.

Note: Use caution when drilling in areas with fuel and brake lines, as not to damage them.



Figure 12: Tie Plate Bracket installed with fuel and brake lines reattached

6. Raise or Lower Axle until Design Ride height is achieved. Ride Height is approximately when the track rod is horizontal, or when the CL of axle to bottom of frame is 10-1/2".

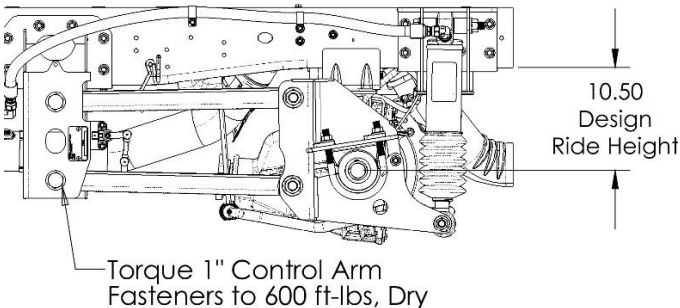


Figure 13: Adjust frame or axle to ride height when tightening control arm fastners.

7. Install the track rod and the two track rod mount plates inside the clevis on the passenger Upper strut mount.

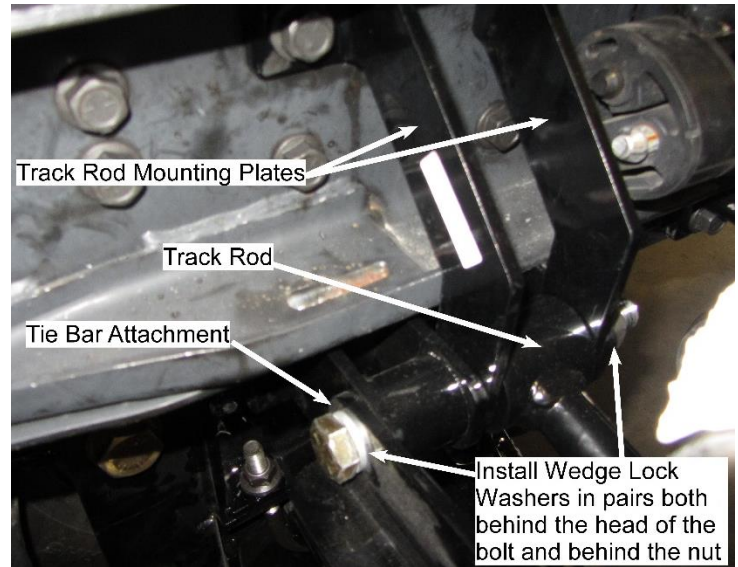


Figure 14: Detail of Track Rod Mounting inside frame

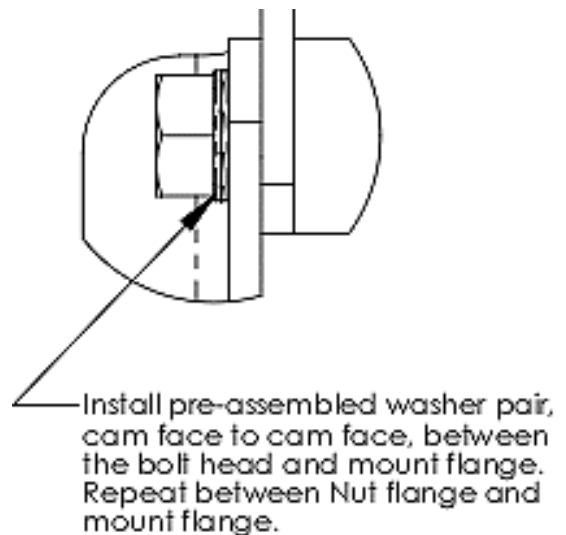


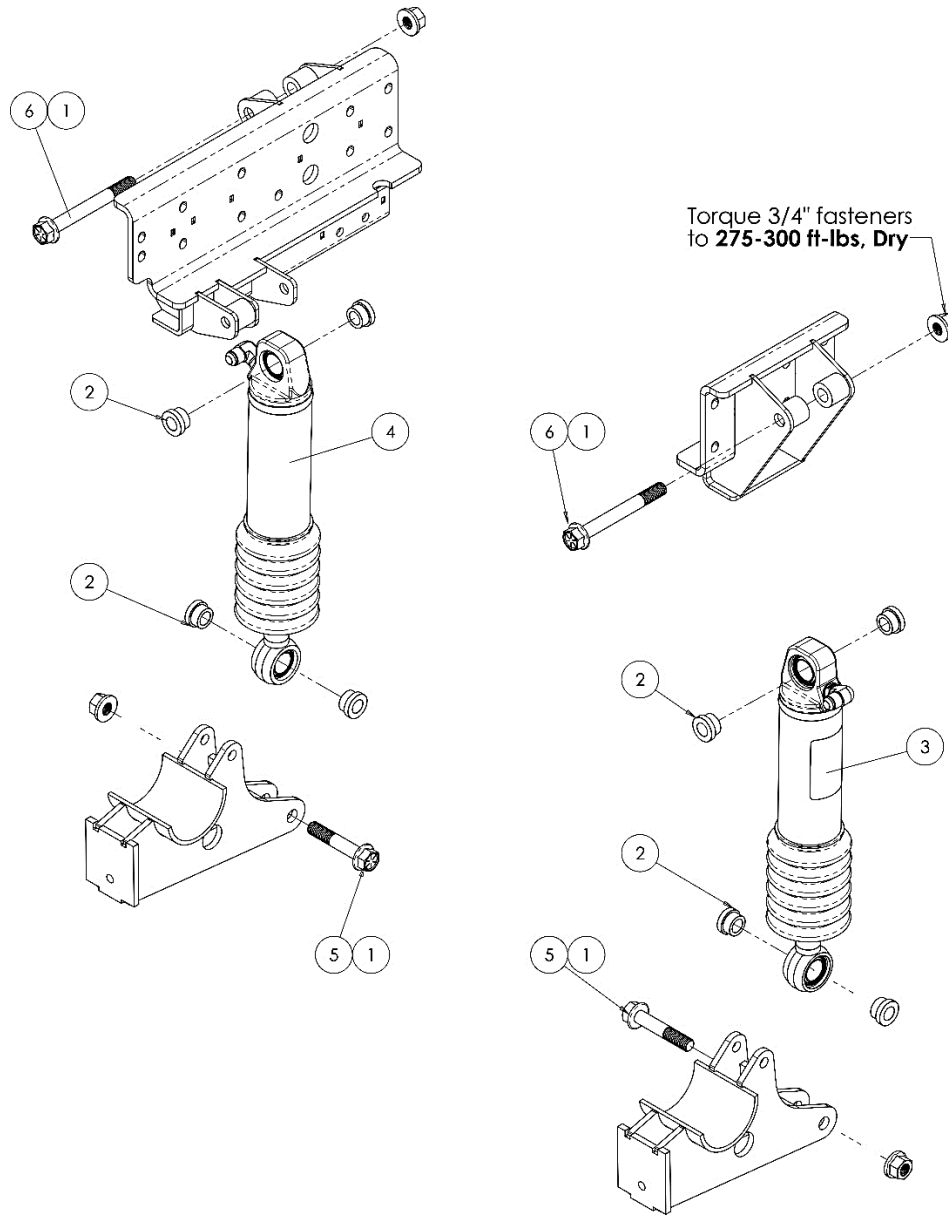
Figure 15: WLW Installation

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

IMPORTANT: Make sure each pair of wedge lock washers are installed under the bolt and nut faces.

9. Torque the (3) 3/8" Tie Plate Mount bolts to **35-43 ft-lbs.**
10. Torque the 5/8" Tie Plate fastener to **172-210 ft-lbs.**
11. Torque the (8) 1" Control Arm Bolts to **600 ft-lbs.**

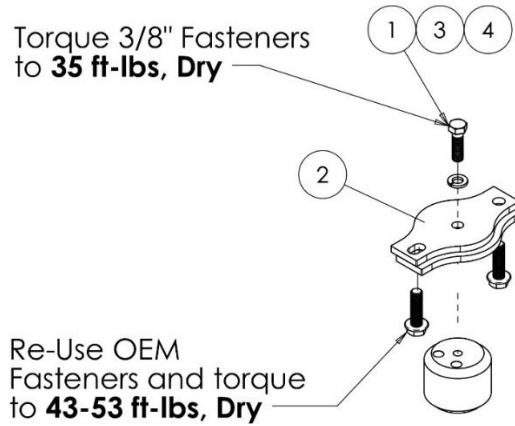
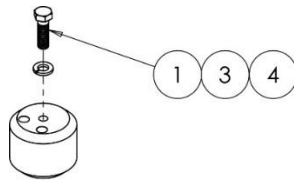
Strut Assembly Installation



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-014	LFN 3/4-10 Gr. G	4	1	11057-006	RH Strut Assembly
2	8	10640-005	Bearing Spacer, 1024 x .812 x .318	5	2	11102-400	HFB 3/4-10 x 4 Gr. 8
3	1	11057-005	LH Strut Assembly	6	2	11102-650	HFB 3/4-10 x 6.50 Gr. 8

1. Install Struts as shown above with -10 ports pointing forward.
2. Torque 3/4-10 fasteners to **275-300 ft-lbs, Dry**.

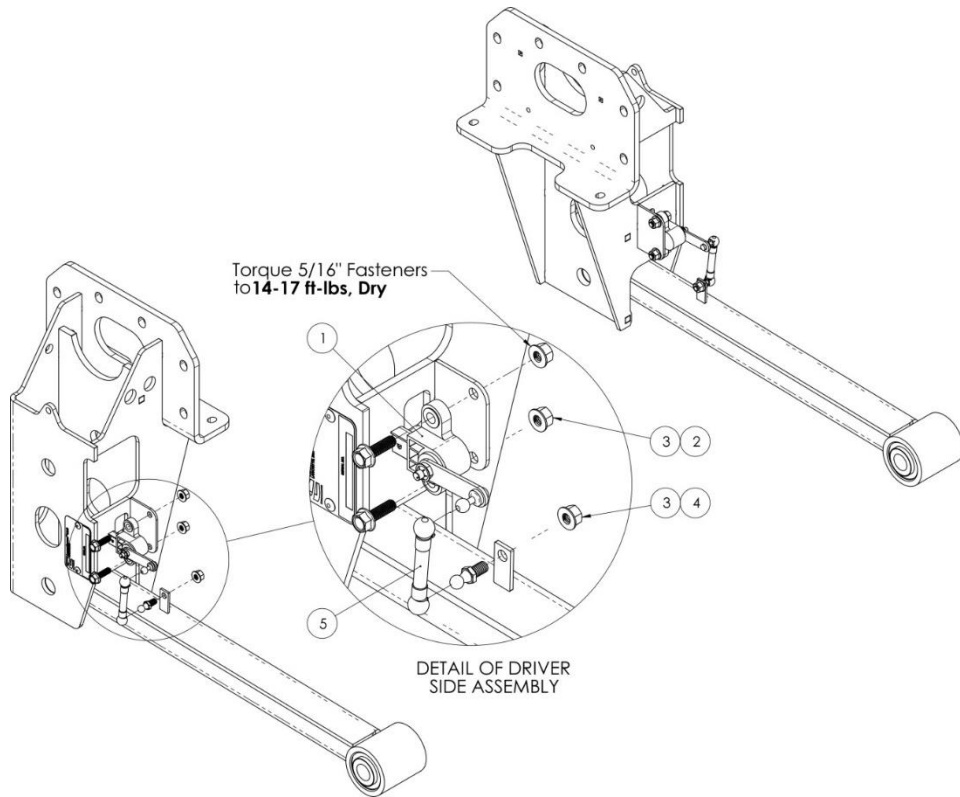
Jounce Bumpers



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10461-004	HCS 3/8-16x1.25, Gr. 8	3	2	10237-003	SLW 3/8
2	1	10889-003	Jounce Bumper Plate	4	2	10867-002	Jounce Bumper, 2.31" Dia x 1.88 T

1. Locate two jounce bumpers, two 3/8-16 Cap Screws, and two split lock washers from the kit.
2. Install the driver side bumper to the bumper plate and torque bumper to **35 ft-lbs**, then attach with OEM hardware to the original location and torque OEM fasteners to **43-53 ft-lbs**.
3. Attach the passenger side bumper through the bottom of the passenger upper strut mount and torque bumper to **35 ft-lbs**.

Height Sensors



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10586-001	Height Sensor	4	2	10591-001	Ball Stud, 10mm x 5/16-18
2	4	10886-100	HFB 5/16-18 x 1.00, Gr. 8	5	2	10587-005	Linkage
3	6	10012-010	LFN 5/16-18, Gr. G				

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 Sensors as shown above. Refer to **Figure 16** or **Figure 17** for detail of linkage.
2. Repeat with the Right Hand (Passenger Side).

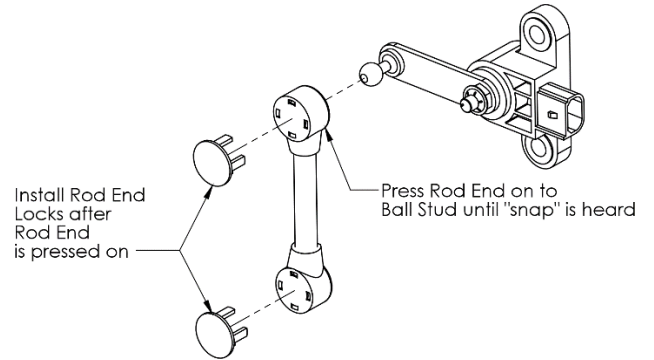


Figure 16. Height Sensor Plastic Linkage End Installation

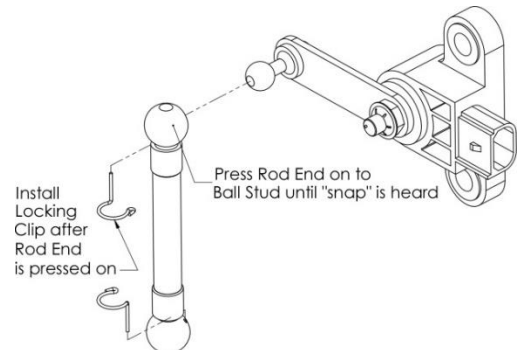
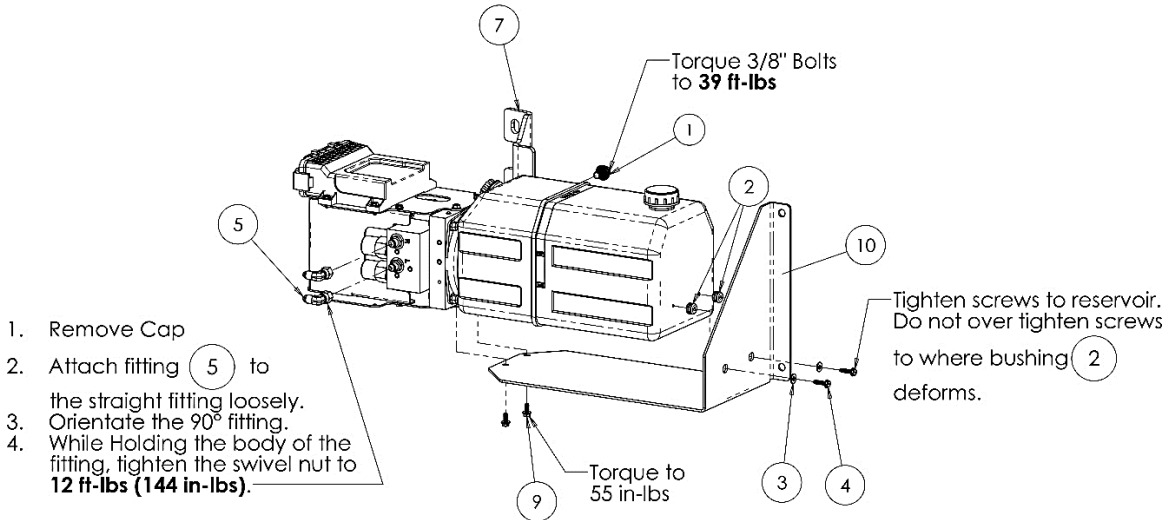


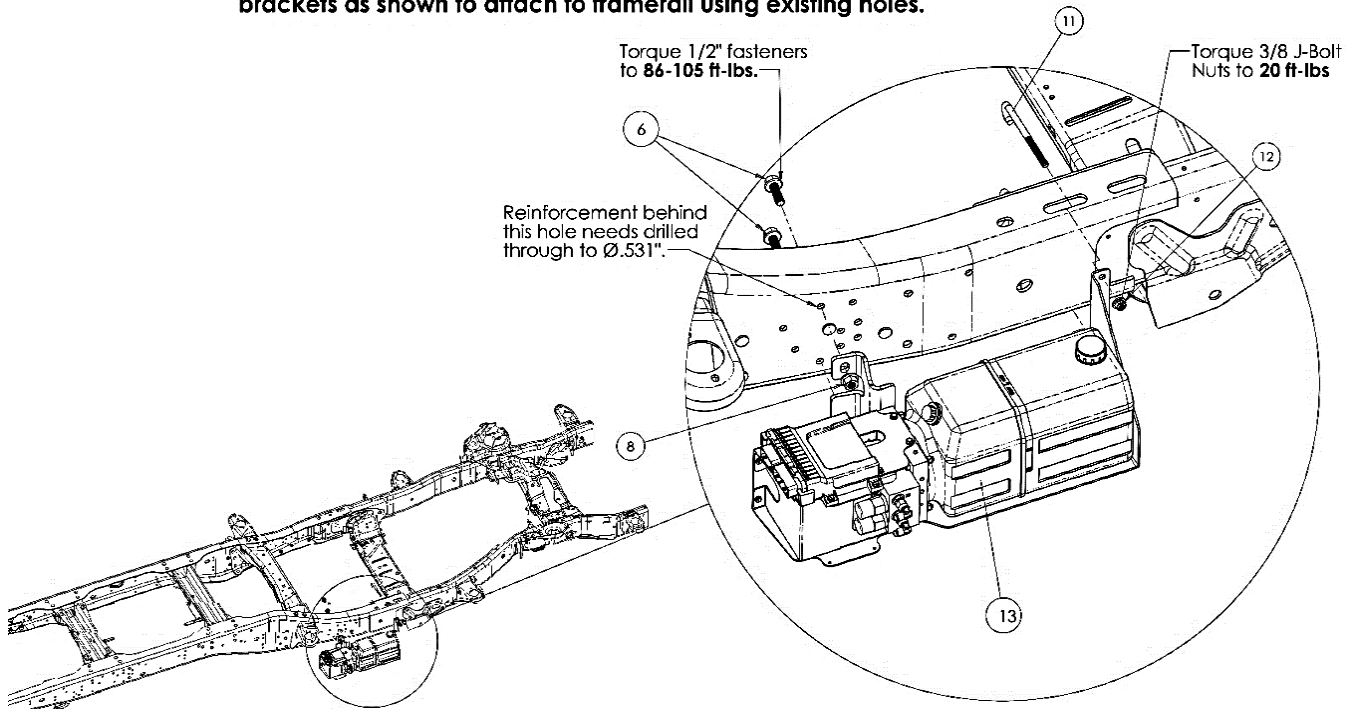
Figure 17. Height Sensor Metal Linkage End Installation.

Power Module Installation

Step 1: Attach Brackets to Powermodule as shown.



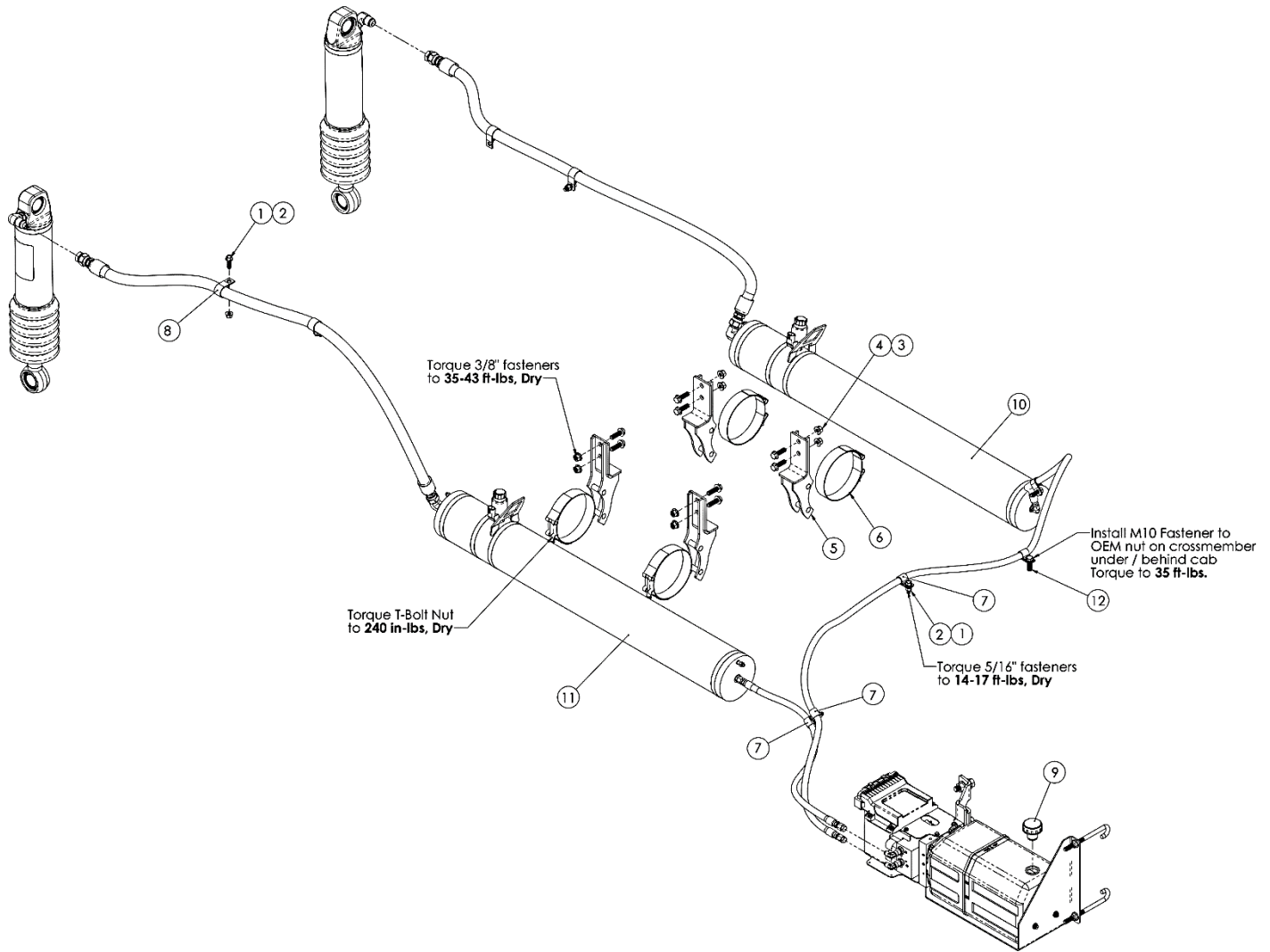
Step 2: Install Power Module under Cab on Passenger side. Use brackets as shown to attach to framerail using existing holes.



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10252-003	SFHS 3/8-16 x .625, Gr 8	8	2	10012-007	LFN 1/2-13, Gr. G
2	2	10805-004	Grommet, .19 ID x .56 OD x .375 T	9	2	10502-005	HFB M5-0.8 x 12 CL 10.9
3	2	10088-001	FW #10	10	1	10798-018	Reservoir Mount
4	2	10510-002	STS #10-16 x .75, Hex Head	11	2	10865-004	J-Bolt, 3/8-16 x 6" L
5	2	10322-021	Hyd Fit 90, -4 37 x -4 37 F	12	2	10012-011	LFN 3/8-16, Gr. G, Nylon Top
6	2	10885-150	HFB 1/2-13 x 1.50, Gr. 8	13	1	11013-006	Power Module, DS99R
7	1	10799-012	Manifold Mount				

1. Locate the Power Module Assembly and Power Module Mounting Kit.
2. Follow instructions supplied with the hardware for attaching brackets to the power module, and attaching power module to frame.

Secondary Volumes



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10886-100	HFB 5/16"-18 x 1.00" Gr 8	7	5	10855-003	Vinyl Coated Loop Clamp, 5/8" ID
2	6	11012-010	LFN 5/16-18, Gr. G	8	4	10855-002	Vinyl Coated Loop Clamp, 1" ID
3	8	10501-002	HFB 3/8-16 x 1.25, Gr. 8	9	1	10614-001	Breather Cap
4	8	10012-005	LFN 3/8-16, Gr. G	10	1	10579-065	Asy, 2 nd Volume, LH
5	4	10830-015	Volume Mount	11	1	10579-066	Asy, 2 nd Volume, RH
6	4	10843-003	T-Bolt Clamp, Range 4.88-5.5	12	1	10502-001	HFB M10-1.5x30 CL 10.9

- Place the mounts against the driver side frame, forward of the front hanger in locations shown in Figure 18.
- 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.
- Repeat with (2) more Volume Mount Weldments on the passenger side of the frame.
- Install volume mounting brackets, and volume assemblies using t-bolt band clamps with bleed ports pointing upward.
- Route hoses using loop clamps to secure away from moving parts, sharp edges, and/or heat sources.

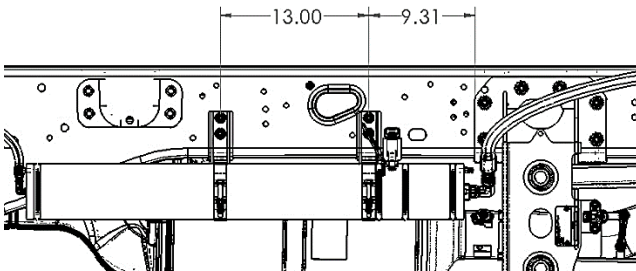
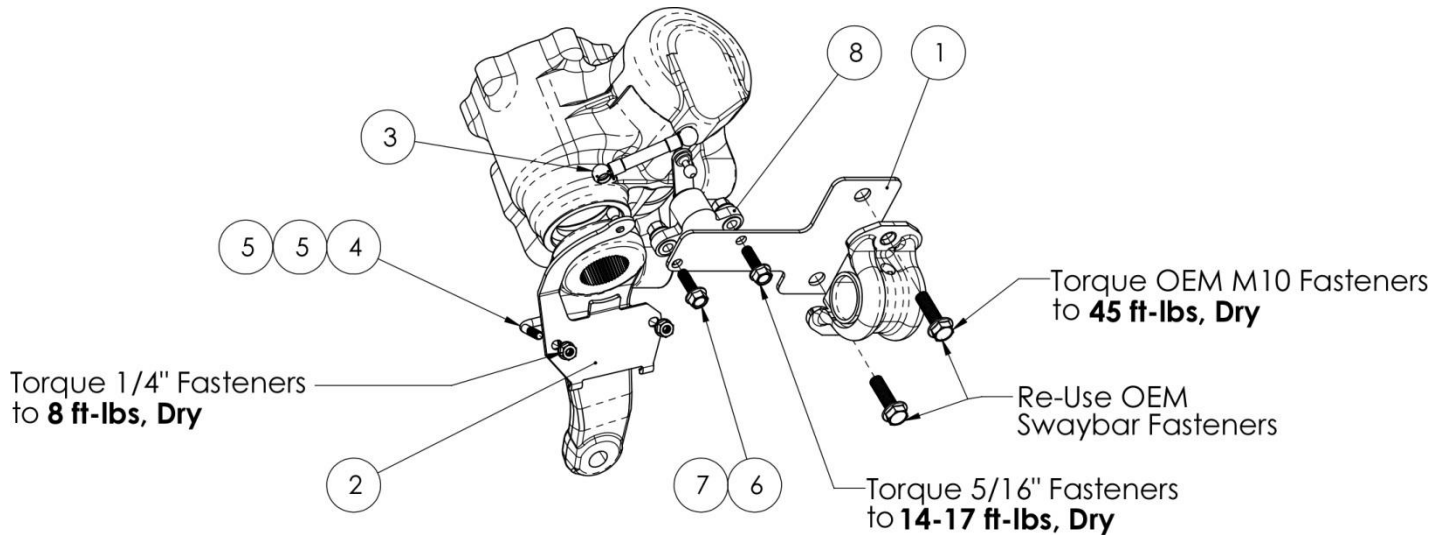


Figure 18: Location of Volume Brackets

Steering Sensor Installation



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10904-018	Steering Sensor Bracket	5	2	10012-009	LFN 1/4-20, Gr. G
2	1	10904-020	Ball Stud Bracket	6	2	10886-100	HFB 5/16-18 x 1.00, Gr. 8
3	1	10587-001	Asy, Linkage	7	2	10012-010	LFN 5/16-18, Gr. G
4	1	10669-005	U-Bolt, 1/4-20 x 3.00 x 1.375, Gr 5	8	1	10586-002	Steering Sensor

1. Remove Driver side swaybar mounting strap.
2. Install Sensor mount as shown and reinstall swaybar mounting strap. Torque OEM bolts to 45 ft-lbs.
3. Connect ball stud bracket to pitman arm with 1/4" U-bolt.
4. Connect Linkage and install locks.



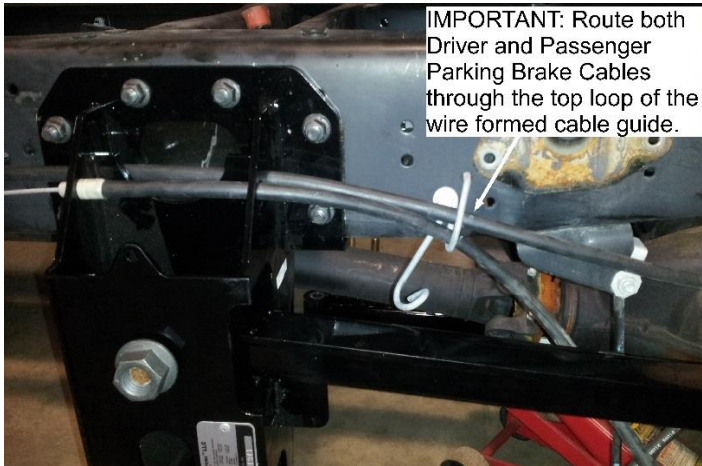
Figure 19. Sensor mount installs above the swaybar.

5. Route the steering sensor branch containing the J35 steering sensor connector to the steering sensor.
6. Turn steering wheel to full lock in either direction to check for any interference.

Parking Brake Cable

1. Route both the driver and passenger parking brake cables through the upper loop in the OEM wire formed cable guide.
2. The cables will route between the upper and lower control arms near the attachment at the axle.

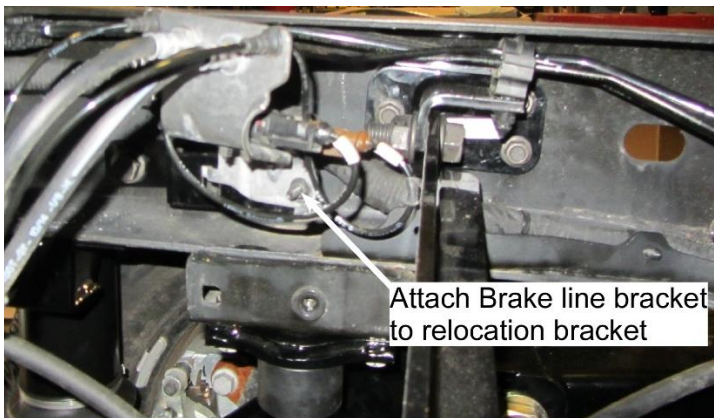
IMPORTANT: Routing cables in any other manner may cause binding or chafing of the cables as suspension travels.



IMPORTANT: Route both Driver and Passenger Parking Brake Cables through the top loop of the wire formed cable guide.

Figure 20. Reinstallation of the formed wire brackets.

3. Reconnect splice along driver side framerail per OEM guidelines.
4. Re-attach OEM hydraulic brake line splitter previously attached to jounce bumpers, to the relocation bracket inside the framerail See Figure 21.



Attach Brake line bracket to relocation bracket

Figure 21: Re-install brake line bracket to previously installed bracket in the kit

5. Install parking brake relocation bracket on passenger side of axle using OEM hardware, then re-attach parking brake cable using supplied 1/4" hardware.

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.

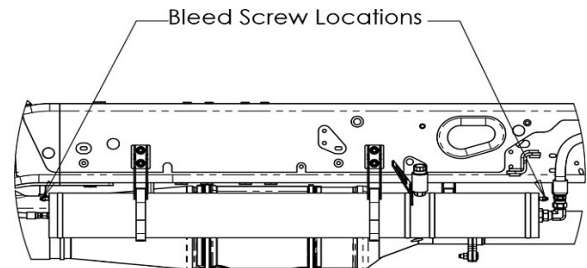


Figure 22. Bleed screw locations.

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.**

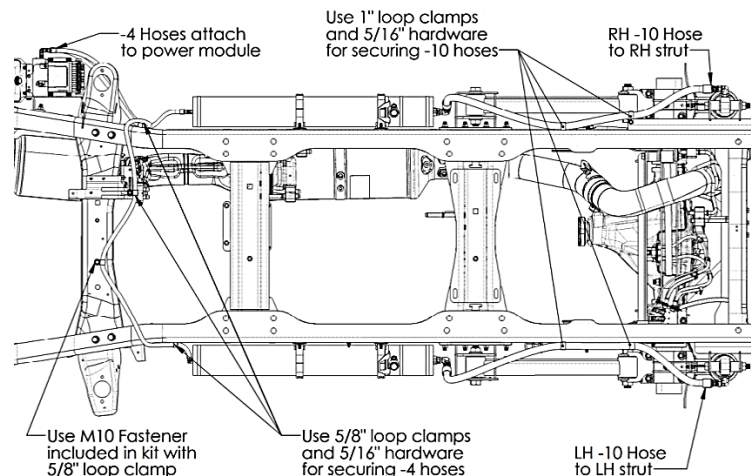


Figure 23: Location of loop clamps and hose routing

5. Remove the cap from the strut port.
6. Raise the end of the -10 (5/8") hose, attached to the volume assembly, above the secondary volume to prevent fluid loss.

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

7. Remove the plug from the end of the hose.
8. Attach the hose end (-10 JIC fitting) to the strut port.
9. Torque to **36-63 ft-lbs.**
10. Repeat with the opposite side.
11. Route the Left Hand (Driver side) -4 (1/4") hydraulic hose, attached to the volume assembly, to the Power Module. Use of hose clamps is recommended to secure the hose from movement or chafing.

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

12. Remove the cap from the LH -4 JIC fitting mounted on the side of the power module assembly.
13. Remove the plug from the hose end.
14. Attach the hose end to the LH fitting. Torque to **12 ft-lbs. Do not over tighten.**
15. Route the Right Hand (Passenger side) -4 (1/4") hydraulic hose, over the frame, to the power module assembly. 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.

16. Remove the cap from the RH -4 JIC fitting on the power module.
17. Remove the plug from the hose end.
18. Attach the hose end to the RH -4 JIC fitting. **Torque to 12 ft-lbs. Do not over tighten.**
19. Clean up any fluid spillage.
20. Re-install tires and wheels as per OEM instructions

External Electrical Installation

Locate the External Electrical Harness attached to the power module.

1. Unroll the wiring harness and using the External Electrical Harness wiring diagram, found in the Electrical Schematics section, identify the connection ends.
2. Locate the trunk containing Height Sensor (J21 and J22) and the Rate Valve (J23 and J24) connections.
3. Route the trunk towards the height sensors and rate valves.

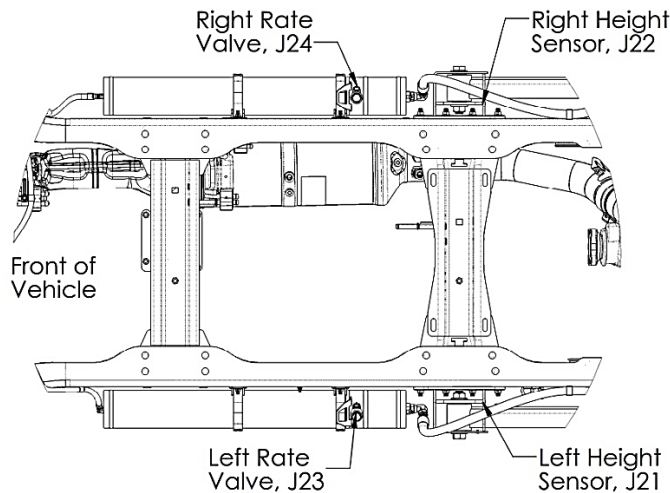


Figure 24. Rate valve and height sensor electrical connections.

4. Connect height sensor and rate valve connections. Note: Connection after routing the harness and prior to installing the height sensor may aid in electrical connection.
5. Route and secure harness to OEM harness on driver side. Use of plastic clips is recommended.
6. Locate the 8ga wire ground ring terminal, J30, branch near the power module.
7. Locate and drill $\text{Ø}1/4$ " hole in frame. Remove frame coating(s) as needed to ensure metal-to-metal contact between the ring terminal and frame.
8. Attach the ground ring terminal, J30, to the chassis frame for grounding. Sealant may be applied after ring terminal is secured.
9. Route the remaining trunk (containing blunt wires and steering sensor connector) towards the firewall. Secure to OEM wiring harness.
10. Drill $\text{Ø}7/8$ " hole in cover plate shown in Figure 25 and Figure 26. Nuts are located inside the passenger cabin on the firewall, left of the steering column for removing to ease drilling the hole.



Figure 25: Cover plate to route harness through

11. Locate the $5/8$ " ID x $1-1/8$ " OD x $3/8$ " Thick grommet.
12. Install the grommet in the $\text{Ø}7/8$ " hole just drilled.



Figure 26. Modified Clutch Linkage Cover Plate (Removed from vehicle)

13. Route the wiring harness branch containing the (8) 18ga blunt wires through the grommet provided in the kit.
14. Locate the branch containing the J35 steering sensor connector.
15. Route the steering connector branch down to the steering sensor. Secure the wiring harness. **Important: Verify the wiring harness does not contact heat source or moving components.**
16. Connect the harness to the steering sensor.
17. Locate the 8ga battery connection branch.
18. Route branch to the driver side battery positive terminal.
19. Locate the Battery Fuse Lead containing the 80 amp fuse.
20. Crimp the fuse lead to the 8ga battery connection branch blunt end.
21. Melt the heat shrink on the crimped connection to seal the splice.
22. Remove the 80 amp fuse and retain.

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



Figure 27. OEM Upfitter Driver Side Terminal Connection instruction.

Important: Do not connect to passenger side battery.

Dash Harness Installation

1. Locate the dash harness.
2. Locate and identify the following 18ga wires in the external wiring harness branch passed through the firewall:
 - Red (Battery Power)
 - Yellow (Ignition)
 - Black (Ground)
 - White (CAN High)
 - White/Black (CAN Low)
 - Violet/White (Speed)
 - Pink/Black (Brake)
 - Yellow/Black (Park)
3. Connect each wire to the corresponding wire in the dash harness using appropriate butt splices. Match wire colors. Heat shrink sealing is optional.
4. Locate the OEM V-Sim module, under the driver side dash, left of the steering column, and behind the parking brake mechanism.
5. In the OEM vehicle dunnage, locate the V-Sim harnesses, one containing a grey 24-cavity connector and the other containing a black 16-cavity connector. Refer to the Ram Chassis Cab V-Sim Usage Instructions as needed.
6. Make the following wiring butt splices:

LiquidSpring		→	V-Sim	
Wire Color	Harness		Wire Color	Harness Connector
Violet/White (Speed)	Dash	→	Brown/Yellow (Pin 16)	Black 16 Cavity
Pink/Black (Brake)	Dash	→	Dark Green/Orange (Pin 11)	Black 16 Cavity
Yellow/Black (Park)	Dash	→	Yellow/Dark Blue (Pin 7)	Grey 24 Cavity

7. Locate in the OEM dunnage the Port Upfitter 6-pin grey connector (p/n 7282-3740-40).
8. Cut the red wire, which is looped between pins 3 and 4.
9. Locate the 10 ga red or 12 ga red/white wire on the LiquidSpring Dash harness.
10. Splice the red/white wire to the red wire connected to pin 3 only. Do not splice to pin 4.
11. Cut the Pink/Yellow (or Pink/Orange) wire, which is looped between pins 1 and 6.
12. Locate the 18ga Yellow or Pink/Yellow wire on the LiquidSpring Dash Harness.
13. Splice the Yellow or Pink/Yellow wire to the Pink/Yellow or Pink/Orange wire connected to pin 1 only. Do not splice to pin 6.
14. Locate the 18ga black wire with ring terminal on the LiquidSpring Dash harness.
15. Route the ground wire behind the parking brake mechanism and attach to the A pillar as shown in Figure 28.

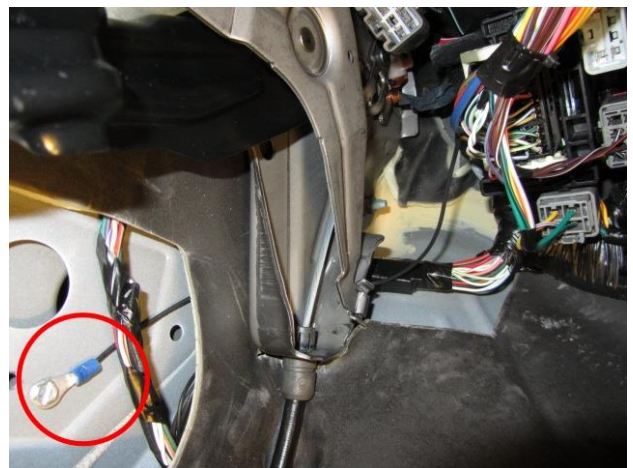


Figure 28. Dash harness ground to vehicle location (circled).

16. Connect the two V-Sim harnesses to the V-Sim.
17. Locate the Upfitter Port -2, found near the parking brake mechanism, left of the V-Sim.

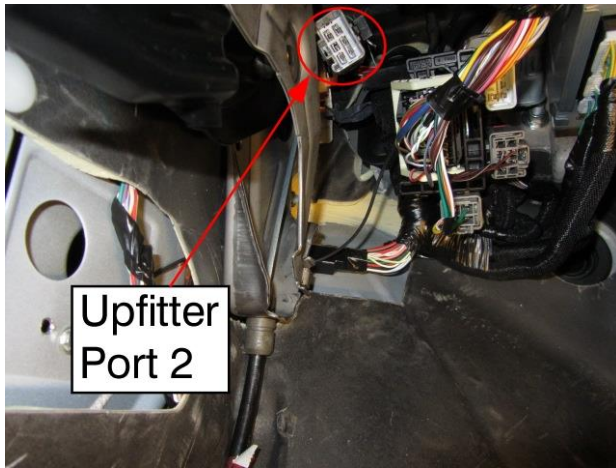


Figure 29. Upfitter Port 2. (2012 Model shown, 2013 in similar location).

18. Connect the Upfitter connector to Port 2.

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).

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. 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 Silicone 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.

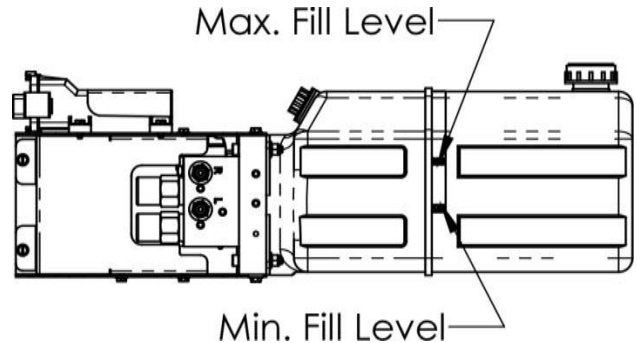


Figure 30. Final fill fluid level.

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.

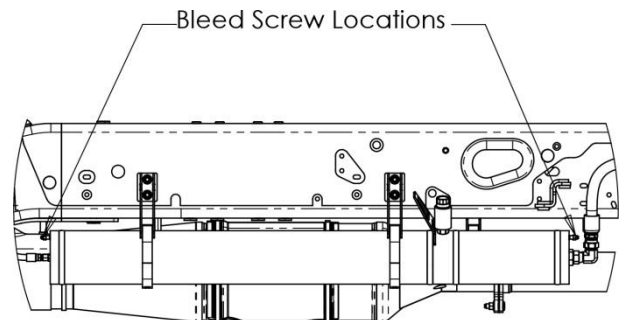


Figure 31. Bleed screw locations.

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.

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.

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).

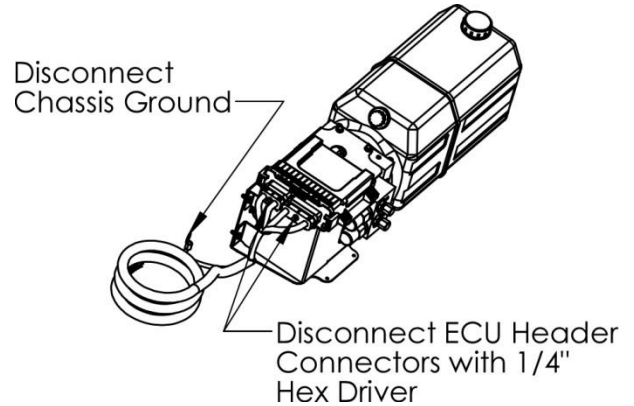
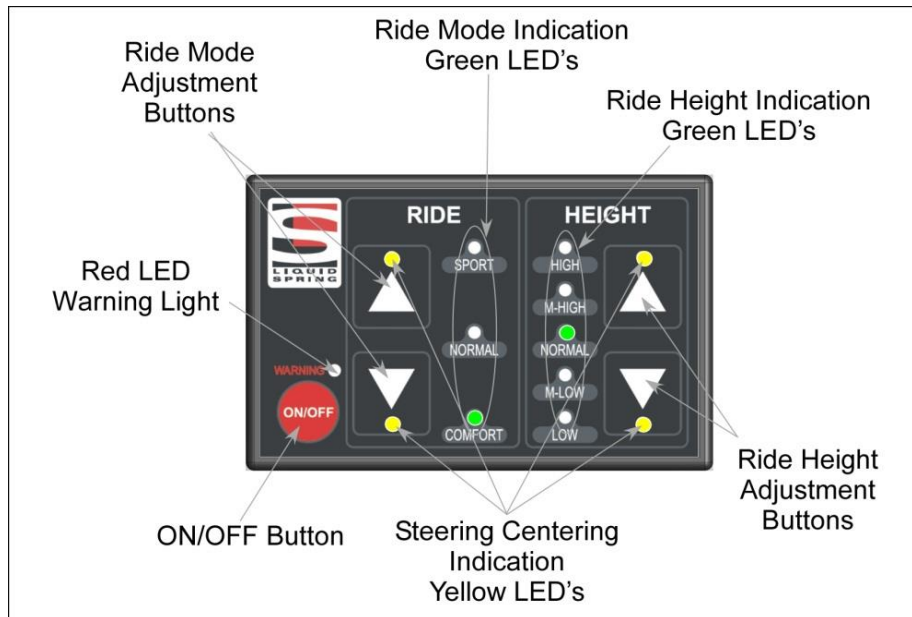


Figure 32. ECU disconnects prior to welding on chassis.

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.
- 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 32

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 1hour 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.

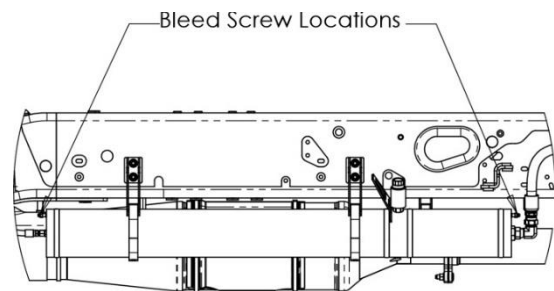


Figure 71. Bleed screw locations.

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

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 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.

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 <i>Issues with Vehicle Raising/Pump Section</i>	See <i>Issues with Vehicle Raising/Pump Section</i>
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 Hand Height Sensor	See <i>Issues with Height Sensors Section</i>	See <i>Issues with Height Sensors Section</i>
Warning + HEIGHT: NORMAL	System kneels in excess of 3 minutes without suspension movement	See <i>Issues with Vehicle Lowering/Dump Valve Section</i>	See <i>Issues with Vehicle Lowering/Dump Valve Section</i>
Warning + HEIGHT: LOW	Issue with Left Hand Height Sensor	See <i>Issues with Height Sensors Section</i>	See <i>Issues with Height Sensors Section</i>
Slow or Fast Blinking Warning Light	Driver Interface cannot communicate with ECU.	See <i>Issues with Driver Interface</i>	See <i>Issues with Driver Interface</i>

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 <i>Issues with Height Sensors</i>
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 <i>Issues with Height Sensors</i>
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 <i>Issues with Height Sensors</i>
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 <i>Issues with Vehicle Speed Signal</i> 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 <i>Calibrating the Steering Sensor Only</i> .
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

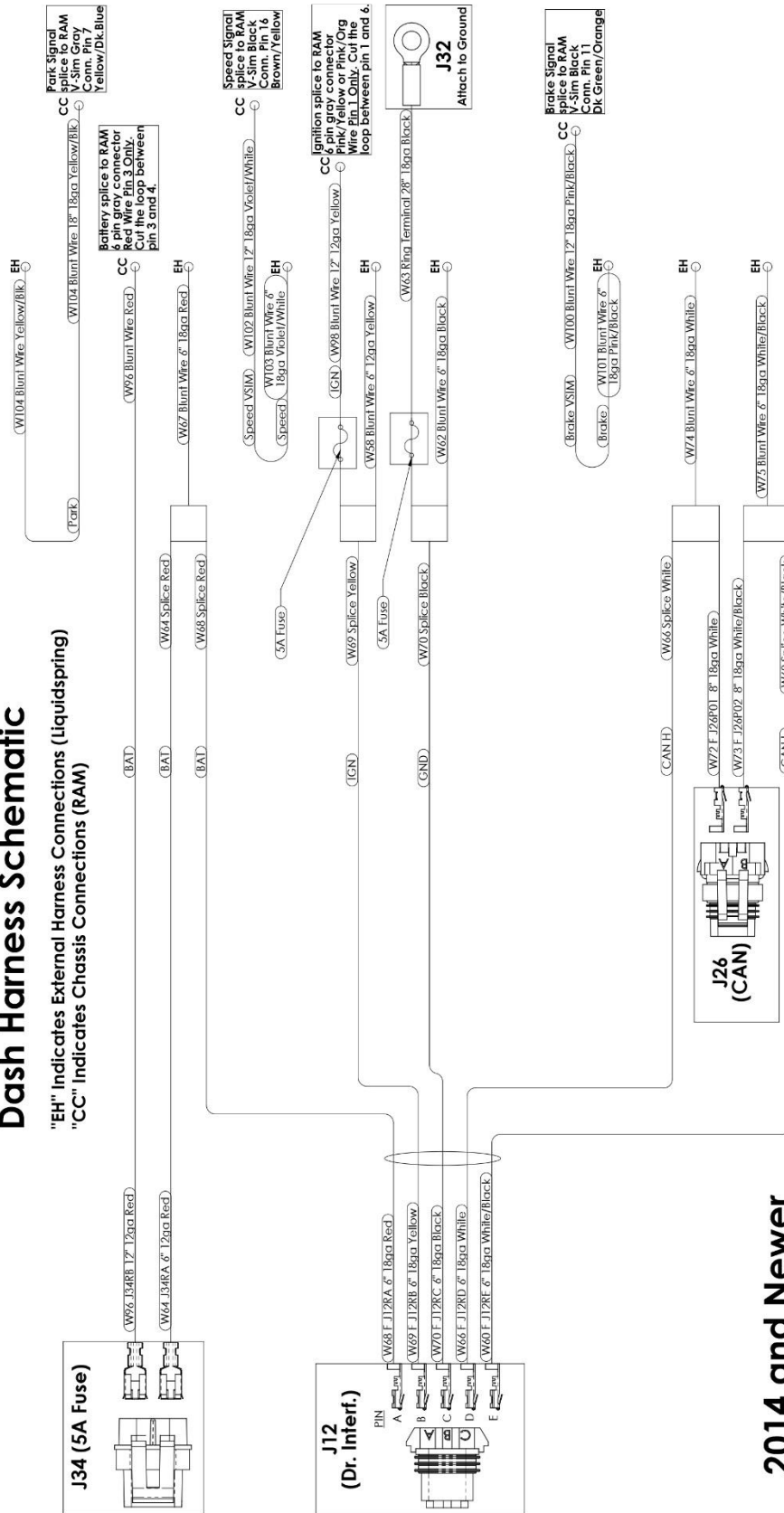
Issues with Secondary Volume Assembly

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

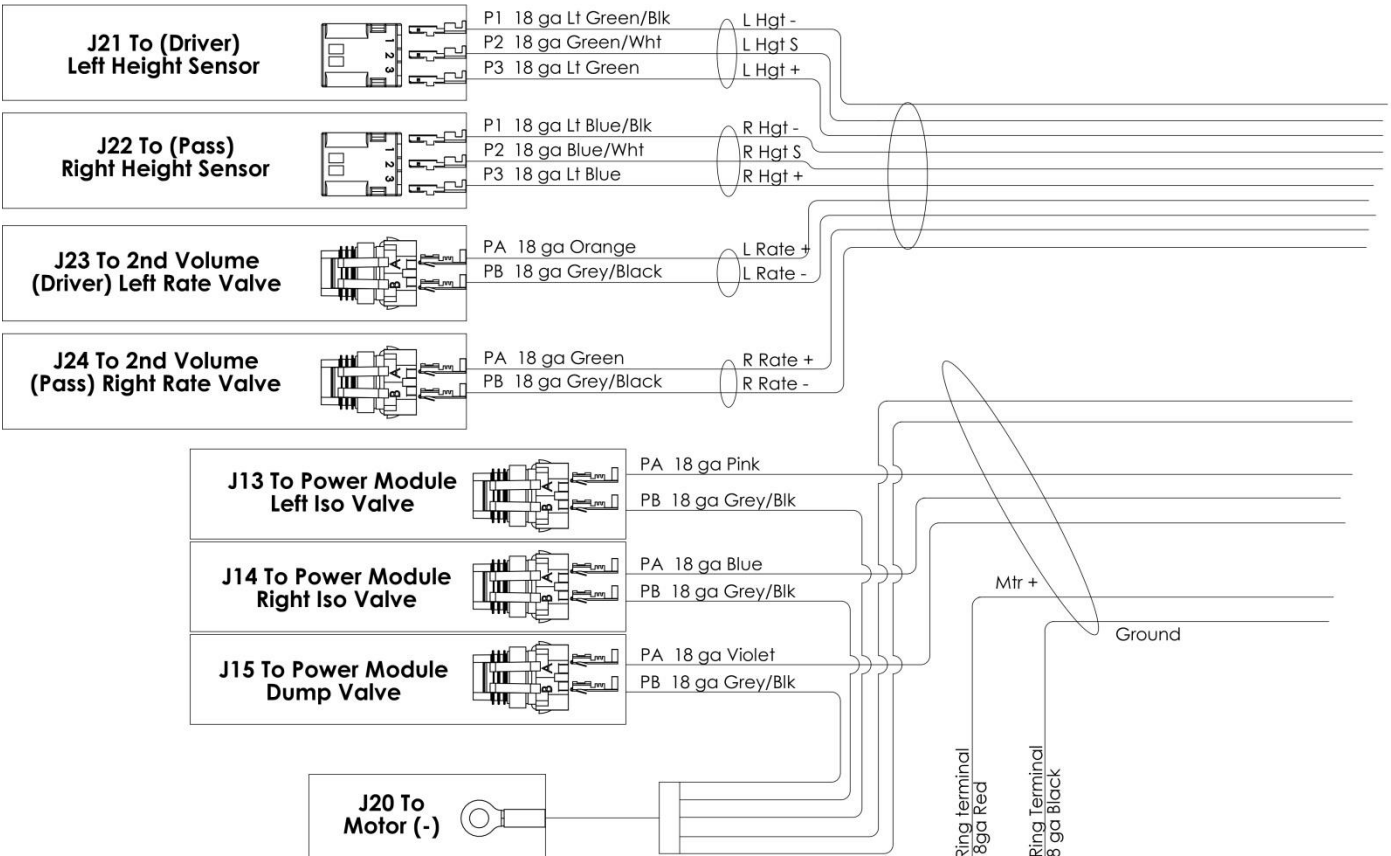
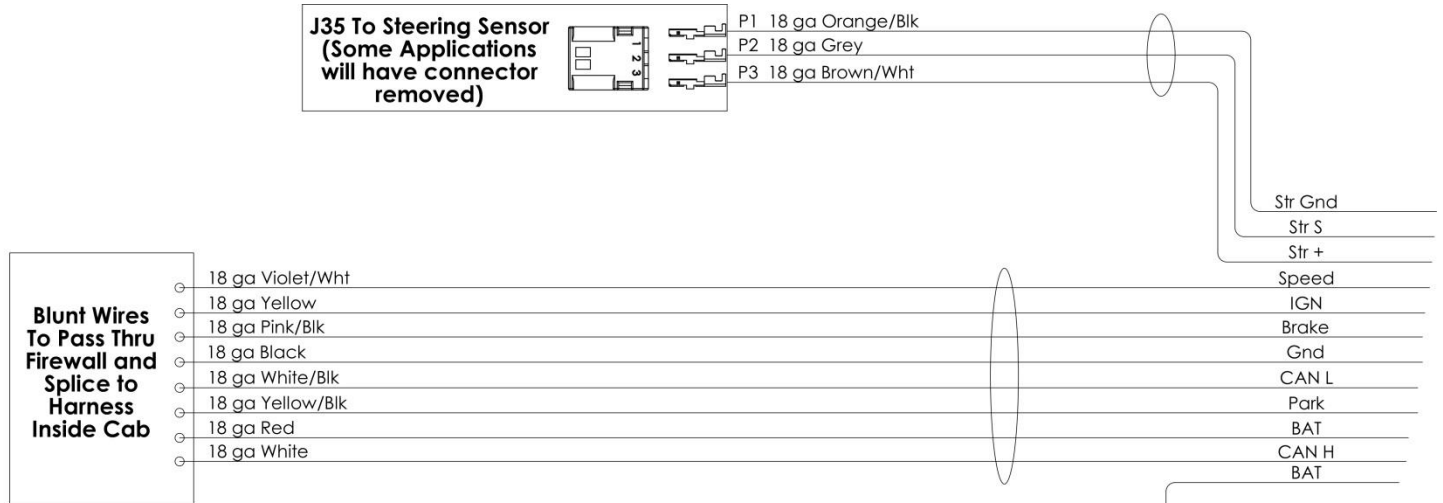
Electrical Schematics

Dash Harness Schematic

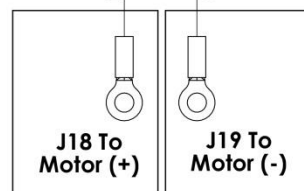
"EH" Indicates External Harness Connections (Liquidspring)
 "CC" Indicates Chassis Connections (RAM)

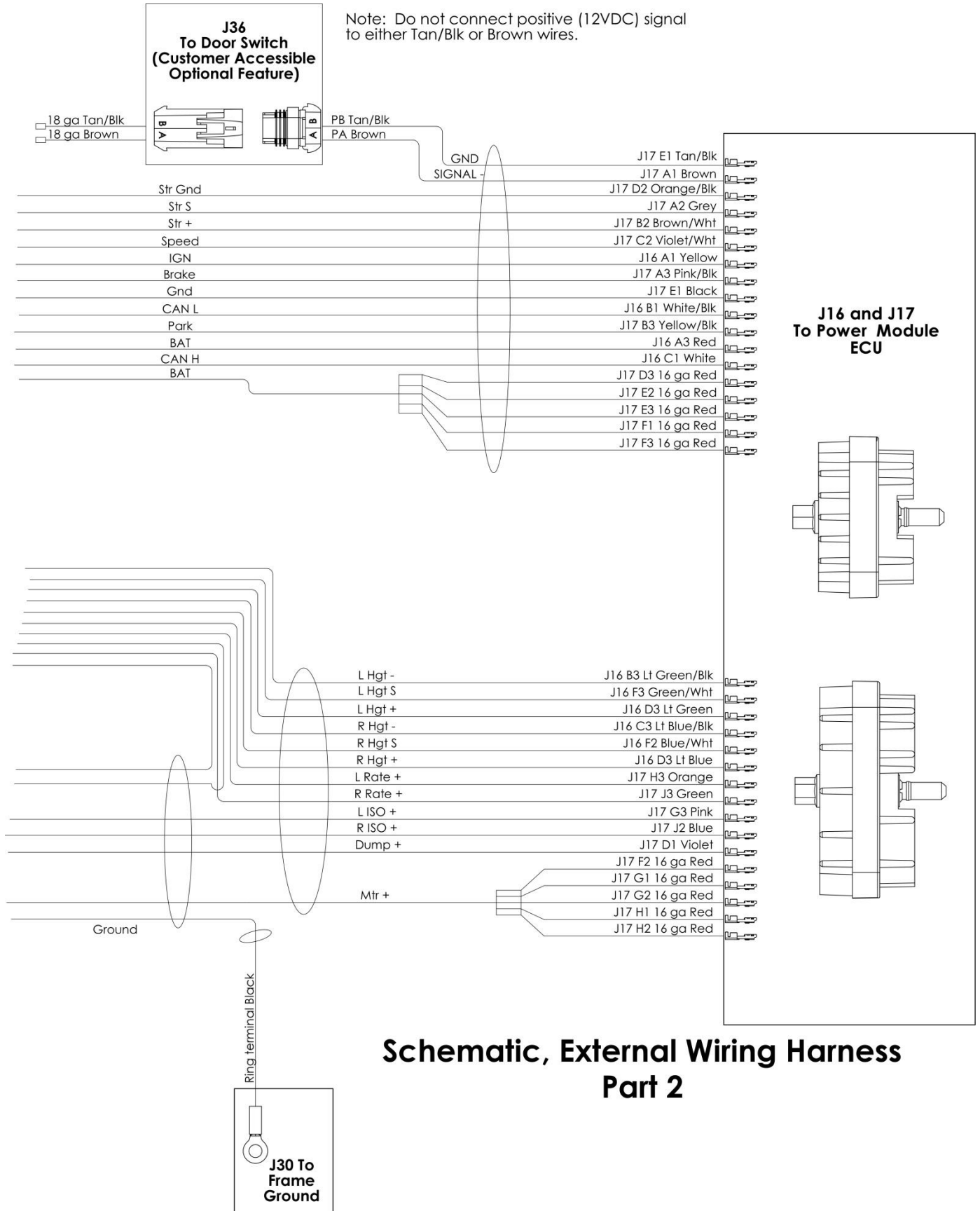


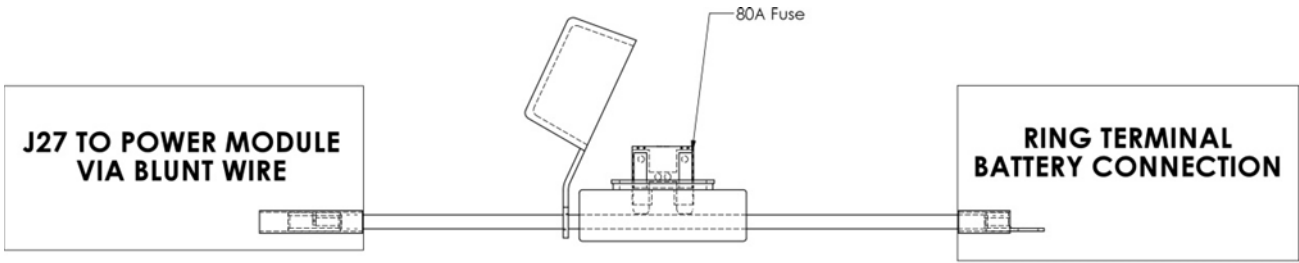
2014 and Newer



Schematic, External Wiring Harness Part 1







Schematic, Battery Fuse Lead

Appendix A: Drill Locations

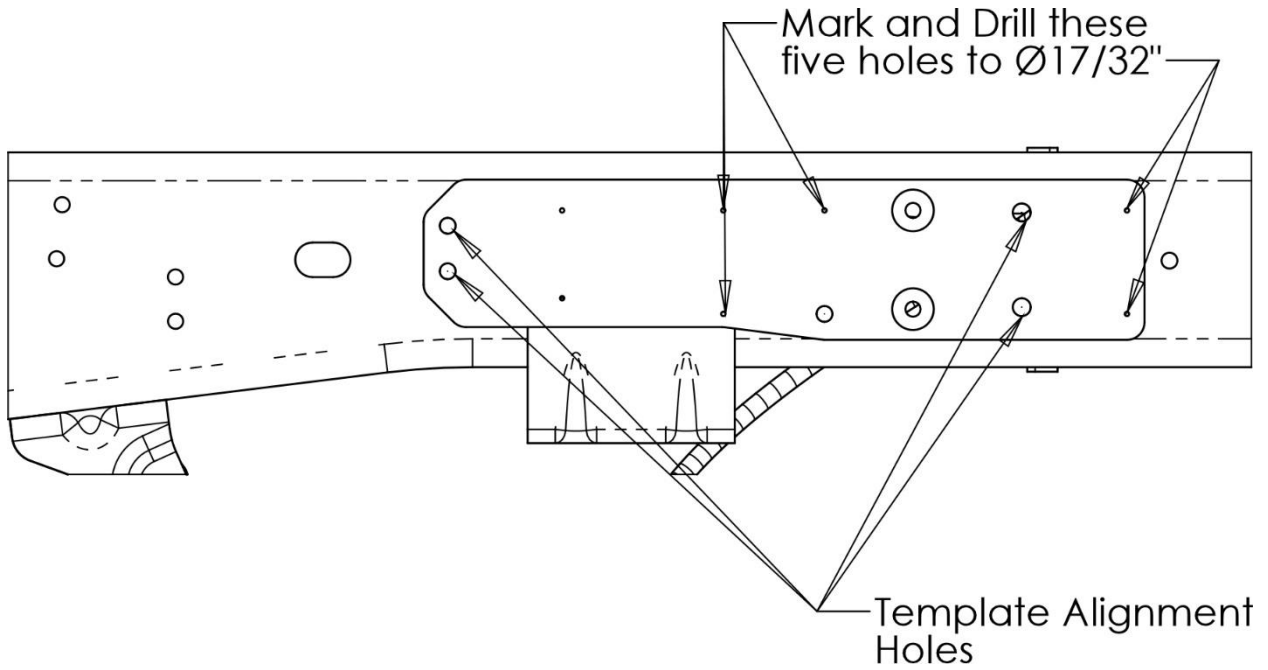


Figure 33. Driver Side Upper Strut Mount Frame Drilling

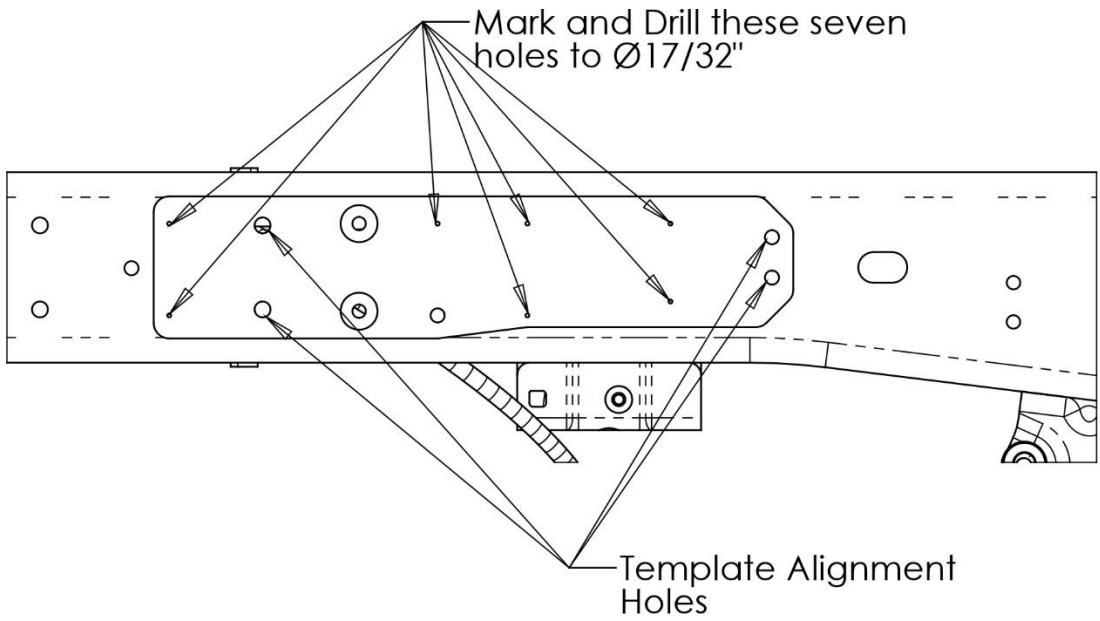


Figure 34. Passenger Side Upper Strut Mount Frame Drilling



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Information contained in this publication is subject to change without notice or liability. LiquidSpring LLC reserves the right to revise the information presented or discontinue the production of parts described at any time.

INSTALLATION CHECK LIST

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

FRAME PREPARATION:

- Battery Disconnected
- Removed OEM Leaf springs, overload pads, front hangers
- Remove OEM Jounce Bumpers, and cut off RH jounce pad off frame.
- Upper Strut Mount, Front Hanger, Tie Plate Mount, and Secondary Volume Assy holes drilled.

FRONT HANGER INSTALLATION:

- 1/2"-13 Nuts torqued to **86-105 ft-lbs.**
- 3/8"-16 Nuts torqued to **35-43 ft-lbs.**

UPPER STRUT MOUNT/TRACK ROD MOUNT/CROSS MEMBER REINFORCEMENT:

- Upper Strut Mounts level with frame.
- Cross member Reinforcement orientated correctly.
- Bolts oriented per Installation Manual Views.
- 1/2"-13 Nuts torqued to **86-105 ft-lbs.**

AXLE CLAMP INSTALLATION:

- 5/8"-18 U-Bolts torqued in stages up to **175-200 ft-lbs.**
- 1/2"-13 Nuts torqued to **86-105 ft-lbs.**

BRAKE LINE RELOCATION PLATE INSTALLATION:

- Installed 3/8 nylon spiral wrap around caliper whip hoses
- Driver and Passenger Brake caliper whip hoses attached to axle clamps with 5/16" hardware.

CONTROL ARMS INSTALLATION:

- Control Arms correctly orientated.
- 1"-8 Nuts torqued to **600 ft-lbs**, at ride height.

BRIDGE INSTALLATION:

- Bridge orientation bracket installed and 1/4" hardware torqued to **10-12 ft-lbs.**
- 1/2"-20 U-Bolts evenly torqued to **65 ft-lb.**

TRACK ROD INSTALLATION:

- 5/8"-11 Nuts torqued to **172-210 ft-lbs** at ride height.
- (4) Pairs of 5/8" Wedge Lock Washers installed under both bolt heads and behind both nuts.

TIE BAR INSTALLATION:

- 5/8"-11 Nut torqued to **172-210 ft-lbs** at ride height.
- OEM Brake and fuel lines secured to Tie plate mount.
- 3/8"-16 Nuts torqued to **35-43 ft-lbs.**

STRUT INSTALLATION:

- 3/4"-10 Nuts torqued to **275-300 ft-lbs.**

JOUNCE BUMPER INSTALLATION:

- 3/8"-16 Bolts torqued to **35-43 ft-lbs.**
- OEM M10 Bolts torqued to **43-53 ft-lbs.**

HEIGHT SENSOR INSTALLATION:

- 5/16"-18 Nuts torqued to **14-17 ft-lbs.**
- Locking Clips installed.

PARKING BRAKE CABLE INSTALLATION:

- Parking brake cable rerouted through and attached to front Driver side hanger.
- Wire formed brackets reattached
- Both Driver and Passenger cables route through upper OEM loop behind front hanger
- Passenger side parking cable relocated using bracket on axle.

POWER MODULE/SECONDARY VOLUME INSTALLATION:

- 3/8"-16 Manifold Bolts torqued to **39 ft-lbs.**
- 3/8"-16 J-Bolt Nuts torqued to **20 ft-lbs.**
- 1/2"-13 Nuts torqued to **86-105 ft-lbs.**
- Reservoir Mount Self Tapping Screws tightened to **snug only.**
- 5/16"-24 Clamp Fasteners torqued to **240 in-lbs.**
- 3/8"-16 Nuts Torqued to **35-43 ft-lbs.**

HOSE INSTALLATION:

- 4 Hose fittings torqued to **14 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 and 5/16"-18 hardware.

STEERING SENSOR INSTALLATION:

- OEM Swaybar bolts torqued to **45 ft-lbs.**
- 5/16"-18 fasteners torqued to **14-17 ft-lbs.**
- 1/4"-20 U-bolt 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.
- OEM Connector plugged into Upfitter Port 2.
- Driver Interface installed and connected to Dash Harness.
- External harness routed and secured.
- External harness connected to Rate Valves, Height Sensors, and Steering Sensor.
- 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.
- Calibration completed.