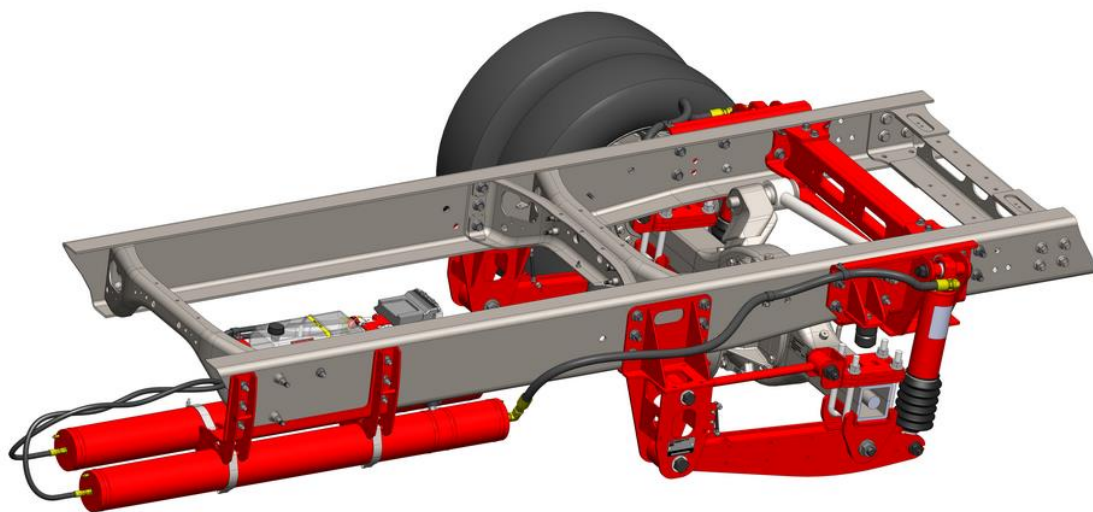


DS-NCV2

DS 1 35NCV2 **DS 1 55NCV2**

Rear Axle Suspension System
for Chevrolet 4500HD/5500HD/6500HD
and International CV 4x2



Installation / Operator Manual

D11673 Rev D
7/19

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Introduction

This manual provides installation information for the LiquidSpring CLASS® rear suspension systems for the Chevrolet Silverado 4500HD/5500HD/6500HD and International CV 4x2 Cab Chassis.

Before you begin installation of the suspension system:

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

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.

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 Application and Rating

Model	Model Years	OEM Suspension Type	Rear Axle GAWR	LiquidSpring Kit	LiquidSpring Suspension Max. Rating (lbs)	WARNING: Overloading suspension system may result in abnormal handling characteristics and premature wear of components.
Chevrolet Silverado 4500HD / 5500HD / 6500 HD International CV	2019 and later	Air Ride	10,000 – 13,500	DS135NCV2-A	13,500	
		Steel Leaf	10,000 – 13,500	DS135NCV2-S	13,500	
Chevrolet Silverado 5500HD / 6500 HD International CV		Air Ride	15,000 – 15,500	DS155NCV2-A	15,500	
		Steel Leaf	15,000 – 15,500	DS155NCV2-S	15,500	

Serial Number Tag Information

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

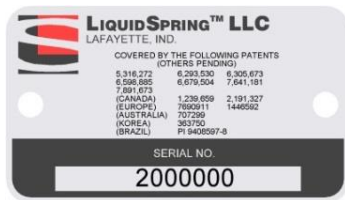


Figure 1: Suspension Identification

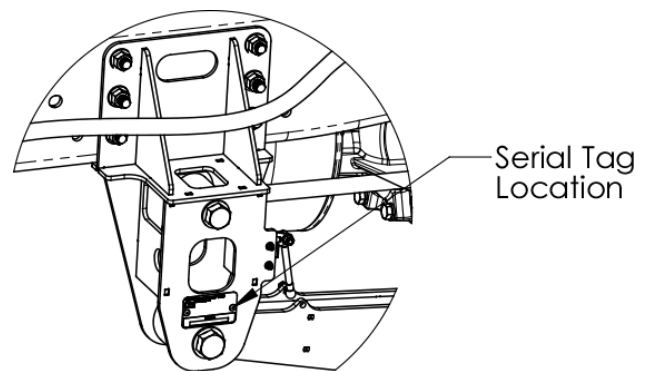


Figure 2: Serial Number Tag Location

Vehicle Towing and Jacking Information

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

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

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

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

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

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.

Abbreviations

The following abbreviations will be used throughout the manual.

HCS	Hex Cap Screw (also HB)
HFB	Hex Flange Bolt
SHCS	Socket Head Cap Screw
SFHS	Serrated Flange Hex Screw
STS	Self Tapping Screw
HN	Hex Nut, Non-locking
LHN	Locking Hex Nut
LFN	Locking Flange Nut

HFW	Hardened Flat Washer
SLW	Spring Lock Washer
FW	Flat Washer
SAE	SAE O-Ring Fitting
37°	SAE or JIC 37° Flare Fitting (F – Female)
LH	Left Handed Part
RH	Right Handed Part
UCA	Upper Control Arm
LCA	Lower Control Arm
USM	Upper Strut Mount
PM	Power Module

Hydraulic Fitting Assembly

SAE O-Ring Adjustable Fittings

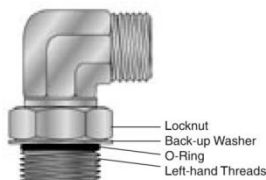


Figure 3: Adjustable SAE fitting

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.

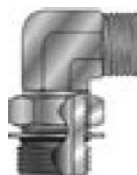


Figure 4: Locknut completely backed off.

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

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. Depressurize the air system using dump switch inside cab or by bleeding at the air tank on OEM Air ride vehicles.

5. Disconnect the negative vehicle battery cable.

NOTE: Do not remove track rod.

6. Remove the OEM shock absorbers and frame mounted shock brackets. See Figure 5.
7. Remove Air Bags and Height control valves.

IMPORTANT: Make sure all lines are free from axle clamp components before removing.

8. Remove the OEM Trailing arm and axle clamp components.
9. Remove the OEM Axle Stop Bumpers.
10. Remove the forward hanger brackets.

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	-10 fitting: 36-63 ft-lbs
-8 fitting: 27-39 ft-lbs	-12 fitting: 65-88 ft-lbs

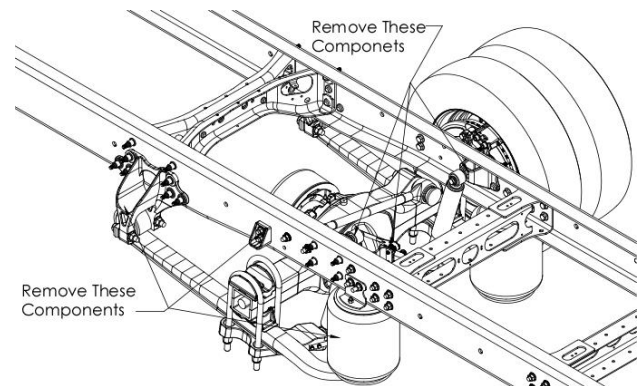


Figure 5: OEM Components to remove, Air Ride Vehicles

11. Remove air lines routing from the rear air tank to the height valves. Install a port plug into the tank where air hose was removed.
12. Locate the two upper strut mounts and place along the frame as shown below in Figure 6 and Appendix A: Frame Drilling Locations, Figure A 1, and Figure A 2, Figure A 3, Figure A 4.

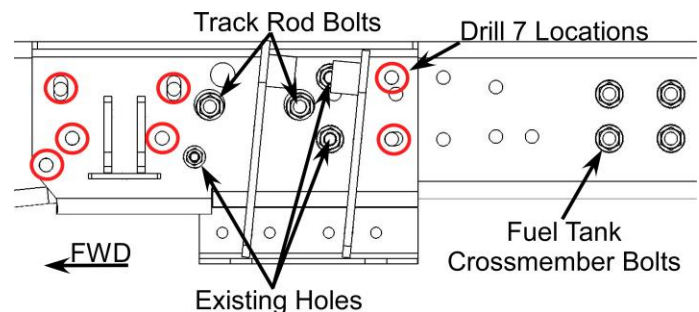


Figure 6: Drill Locations for Driver's Side USM

13. Drill holes as indicated.
14. Locate the parking brake line and mark the location of adjustment nut.
15. Disconnect the parking brake line at the adjuster.

-
16. Remove electrical harness bracket inside frame rail approximately 30"-32" down from front hanger. See Figure 7 below.



Figure 7: Locating Volume Mount to Frame

17. Locate volume mount and align holes as shown below in Figure 8 and Appendix A: Frame Drilling Locations, Figure A 5.

NOTE: OEM harness/ brake line brackets may need to be removed.

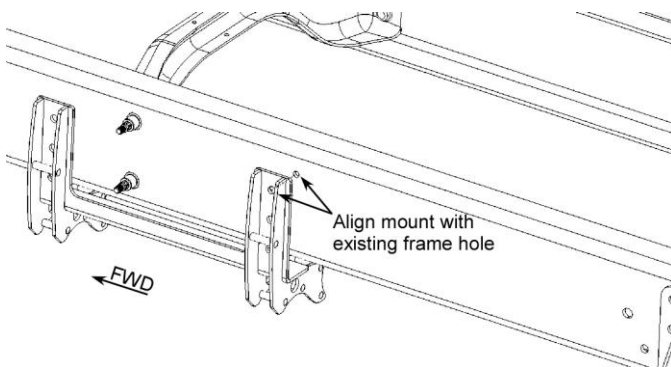
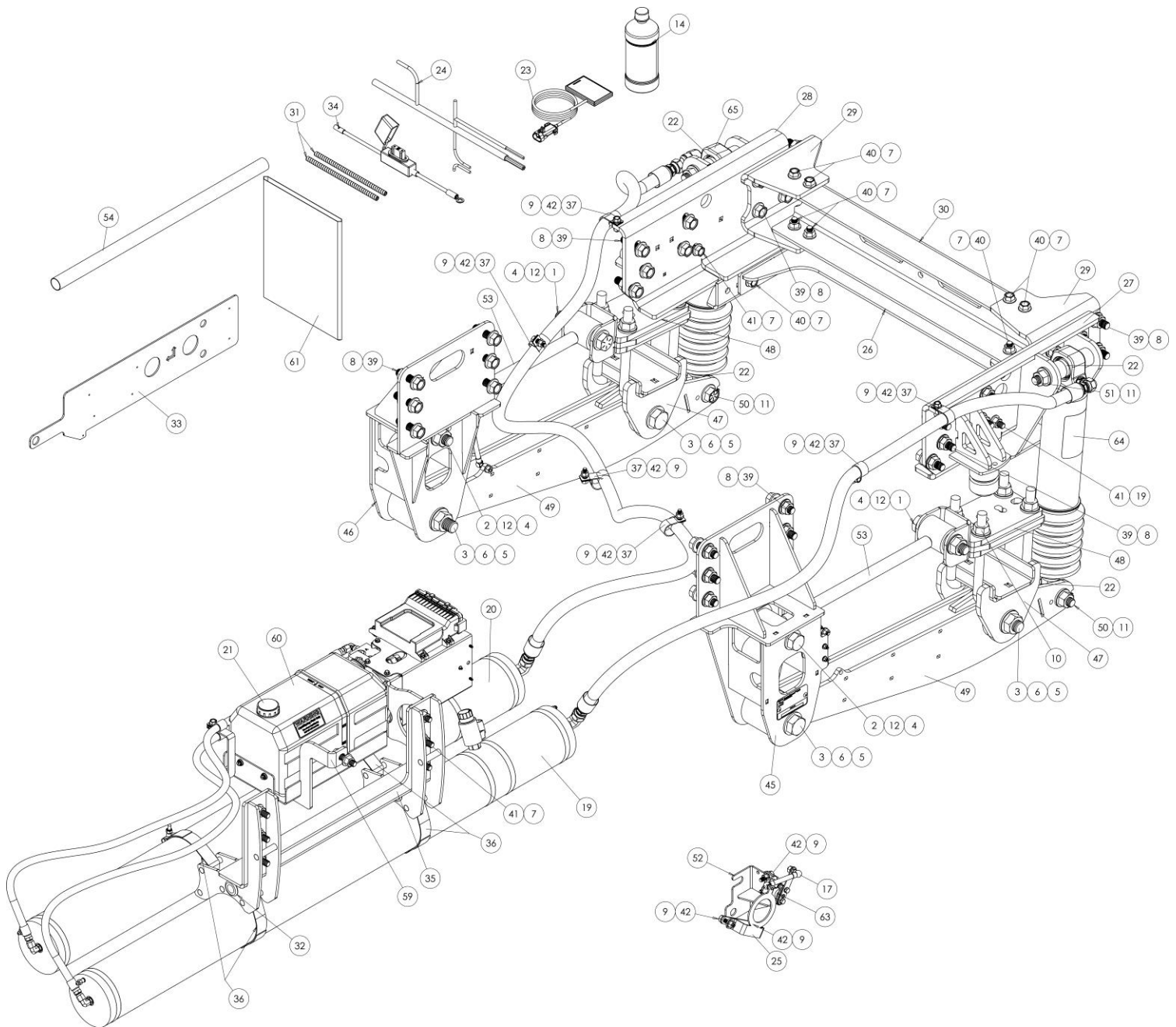


Figure 8: Locating Volume Mount to Frame for Drilling

18. Mark and drill the holes as indicated in Appendix A: Frame Drilling Locations.

Part Identification



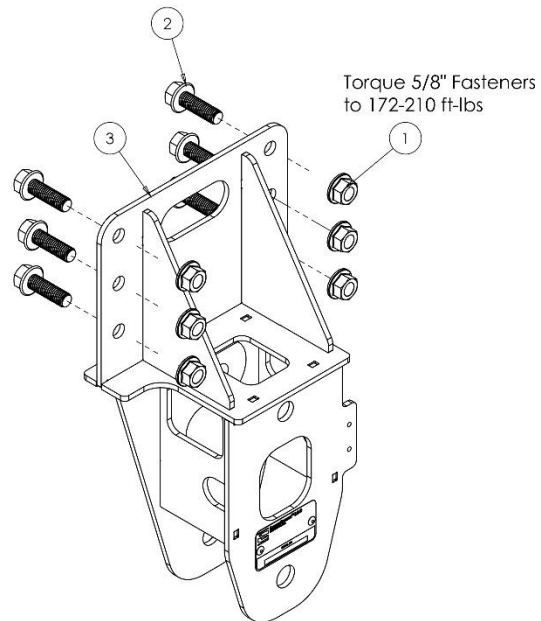
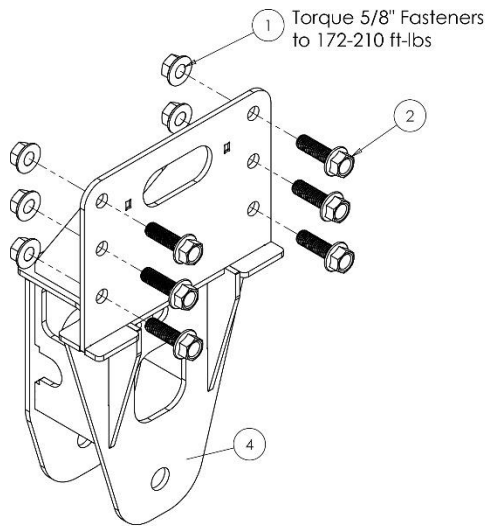
DS135-155NCV2-A BOM

ITEM	QTY.	PART NUMBER	DESCRIPTION	ITEM	QTY.	PART NUMBER	DESCRIPTION
1	2	10002-500	HCS 7/8-9x5" Gr 8	34	1	10815-001	Wiring Harness, Fused Battery Lead
2	2	10002-600	HCS 7/8-9x6", Gr. 8	35	1	10830-041	Volume Mount
3	4	10003-004	HB 1.000-8x6.5", Gr. 8	36	4	10843-003	T-Bolt Clamp
4	4	10006-003	HFW .875"	37	6	10855-002	Vinyl-Coated Loop Clamp, 1" ID
5	4	10006-004	HFW 1"	38	2	10867-003	Jounce Bumper
6	4	10012-003	LFN 1-8, Gr G	39	34	10874-200	HFB 5/8-11x2, Gr. 8
7	20	10012-007	LFN 1/2-13, Gr. G	40	12	10885-150	HFB 1/2-13x1.5, Gr. 8
8	34	10012-008	LFN 5/8-11 Gr G	41	8	10885-175	HFB 1/2-13 x 1.75, Gr 8
9	12	10012-010	LFN 5/16-18, Gr. G	42	11	10886-100	HFB 5/16-18 x 1, Gr. 8
10	8	10012-012	LFN 3/4-16, Gr. G	43	1	10904-046	Strap, Pitman Arm Mount
11	4	10012-014	LFN 3/4-10 Gr G	44	1	10904-047	Steering Sensor Mount Plate
12	4	10012-017	LFN 7/8-9, Gr. G	45	1	10943-003	Asy, Front Hanger, LH
13	4	10064-004	U-Bolt 3/4-16 x 8.25 Tri-8	46	1	10944-004	Front Hanger, RH
14	1	10474-001	Compressible Fluid, 16 oz. Bottle	47	2	10947-001	Lower Axle Clamp
15	2	10502-002	HFB M10-1.5x40 CL 10.9 Z	48	2	10949-012	Upper Axle Clamp
16	2	10587-009	Height Sensor Linkage	49	2	10953-020	Asy, Lower Control Arm
17	1	10587-011	Steering Sensor Linkage	50	2	11102-400	HFB 3/4-10 x 4 Gr 8
18	2	10591-003	Ball Stud 5/16-18 x .75L	51	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
19	1	10597-143	Volume Assembly, LH	52	1	11138-008	Steering Mount
20	1	10597-144	Volume Assembly, RH	53	2	11198-005	Asy, Control Arm
21	1	10614-001	Cap, Filler/Breather	54	1	11350-002	Reflective Thermashield, 1"IDx24" L
22	8	10640-005	Bearing Spacer	55	2	11639-040	HCS M5-0.8x40 18.8 SS
23	1	10680-001	Driver Interface	56	4	11639-050	HCS M5-0.8x50 18.8 SS
24	1	10704-003	Wiring Harness, Dash	57	6	11641-001	FW M5 10x5.3x1 316 Stainless
25	1	10733-011	Pitman Arm Brkt	58	6	11642-001	LFN M5-0.8 18-8 Stainless Nylon
26	1	10782-006	Crossmember Reinforcement	59	1	11649	Kit, Power Module Mounting
27	1	10790-057	USM, LH	60	1	11658-019	Asy, Power Supply, Side Mount
28	1	10790-058	USM, RH	61	1	11674	Kit, Document, DS135-155NCV
29	2	10795-005	Crossmember, End Channel	62	2	11675-001	Asy, Height Sensor, HW
30	1	10796-004	Crossmember Channel	63	1	11675-002	Asy, Steering Sensor, HW
31	2	10804-002	Spiral Cable Wrap	64	1	See Table 1	Asy, Strut
32	4	10805-001	Grommet, .75 ID x 1.38 OD x .56 T	65	1	See Table 1	Asy, Strut
33	1	10811-033	Template, Frame Drilling				

Table 1: Strut Assembly		
Unit	P/N of 63 and 64	Description of Items
DS135NCV2	10994-009/-010	Asy, Strut
DS155NCV2	11057-027/-028	Asy, Strut

Installation

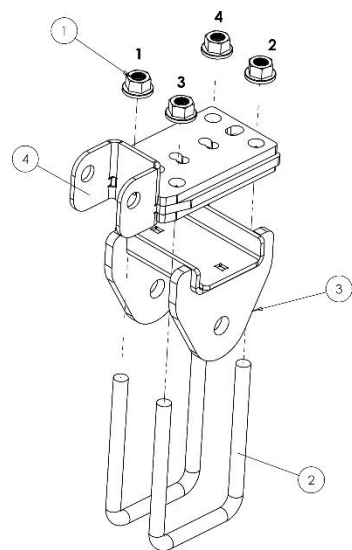
Front Hangers



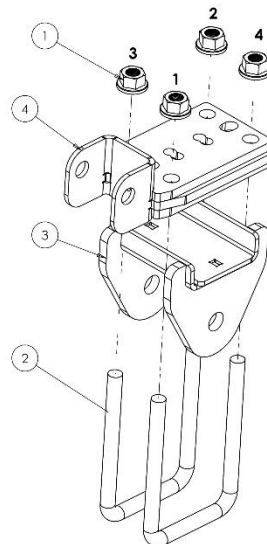
ITEM	QTY.	PART NUMBER	DESCRIPTION
1	12	10012-008	LFN 5/8-11 Gr. G
2	12	10874-200	HFB 5/8-11 x 2" Gr. 8
3	1	10943-003	Left Hand Front Hanger
4	1	10944-004	Right Hand Front Hanger

1. Install the Left-Hand Front Hanger (with the serial tag) on to the driver side of the frame.
2. Verify that the hanger is level to the frame rail.
3. Torque fasteners as specified above.
4. Repeat for the Right-Hand Front Hanger (without the serial tag) on to the passenger side of the frame.

Axle Clamp Group



- For the U-Bolts:
- Lubricate U-Bolt threads with oil or anti-seize compound to reduce friction.
 - Tighten all U-Bolts until they are snug only
 - Tighten in a criss-cross sequence in the stages listed below:
Stage 1: 75 ft-lbs
Stage 2: 150 ft-lbs
Stage 3: 225 ft-lbs
Stage 4: 250 ft-lbs



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-012	LFN ¾-16 , Gr. G	3	2	10947-001	Lower Axle Clamp
2	4	10064-004	U-Bolt ¾"-16 x 8.25	4	2	10949-012	Upper Axle Clamp

1. Locate the upper axle clamp on to the driver's side of axle. The upper axle clamp should be flush to the top of the axle with the axle stud in the slot closest to axle centerline. Reference Figure 9 and Figure 10 for correct orientation.

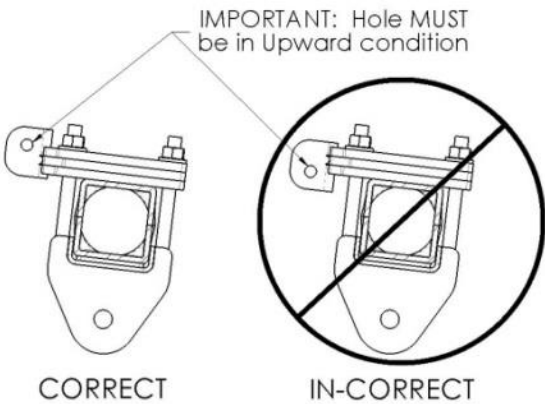
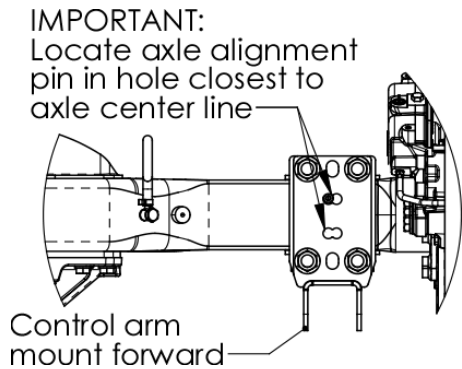


Figure 10: Upper Axle Clamp Orientation

Figure 9: Aligning Upper Axle Clamp with Axle Stud

2. Locate the lower axle clamp to the bottom of the axle and upper axle clamp with the U-bolts.

3. Rotate brake line fitting as shown below in Figure 11.

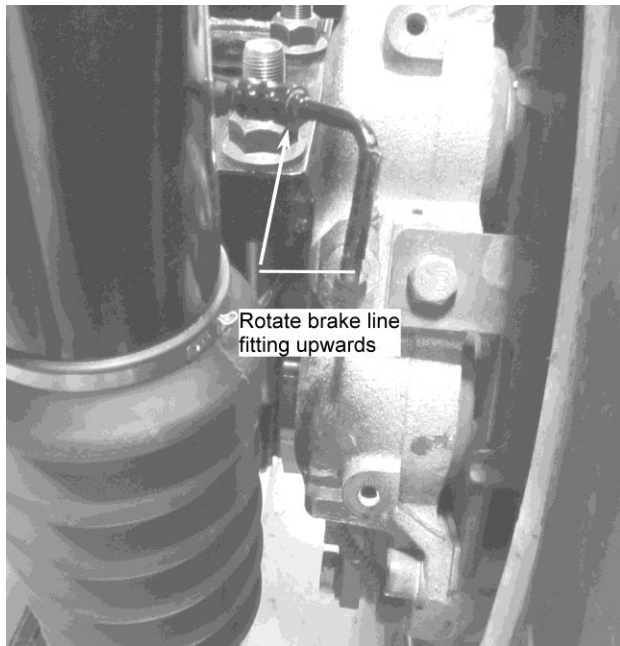


Figure 11: Rotate Brake Line Fitting Upwards

4. Reattach brake line and ABS line to U-bolts as shown below in Figure 12.

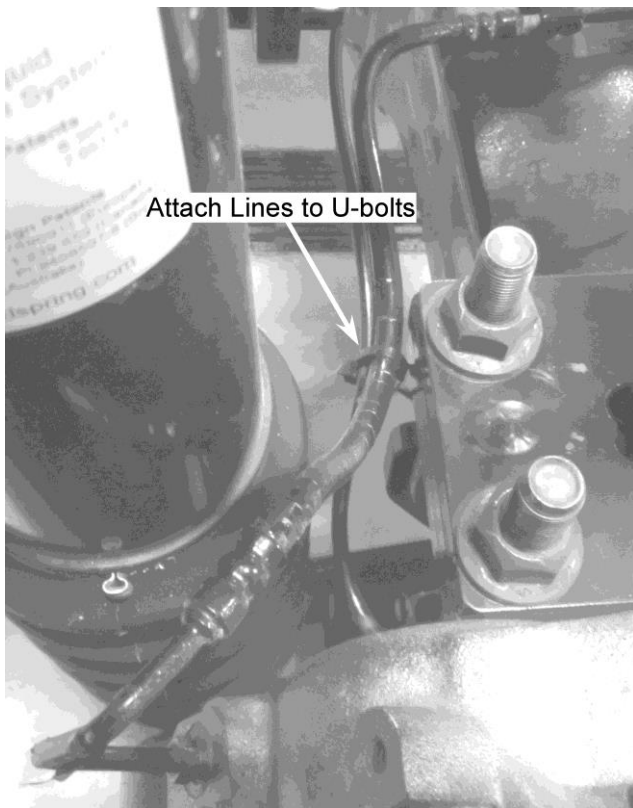


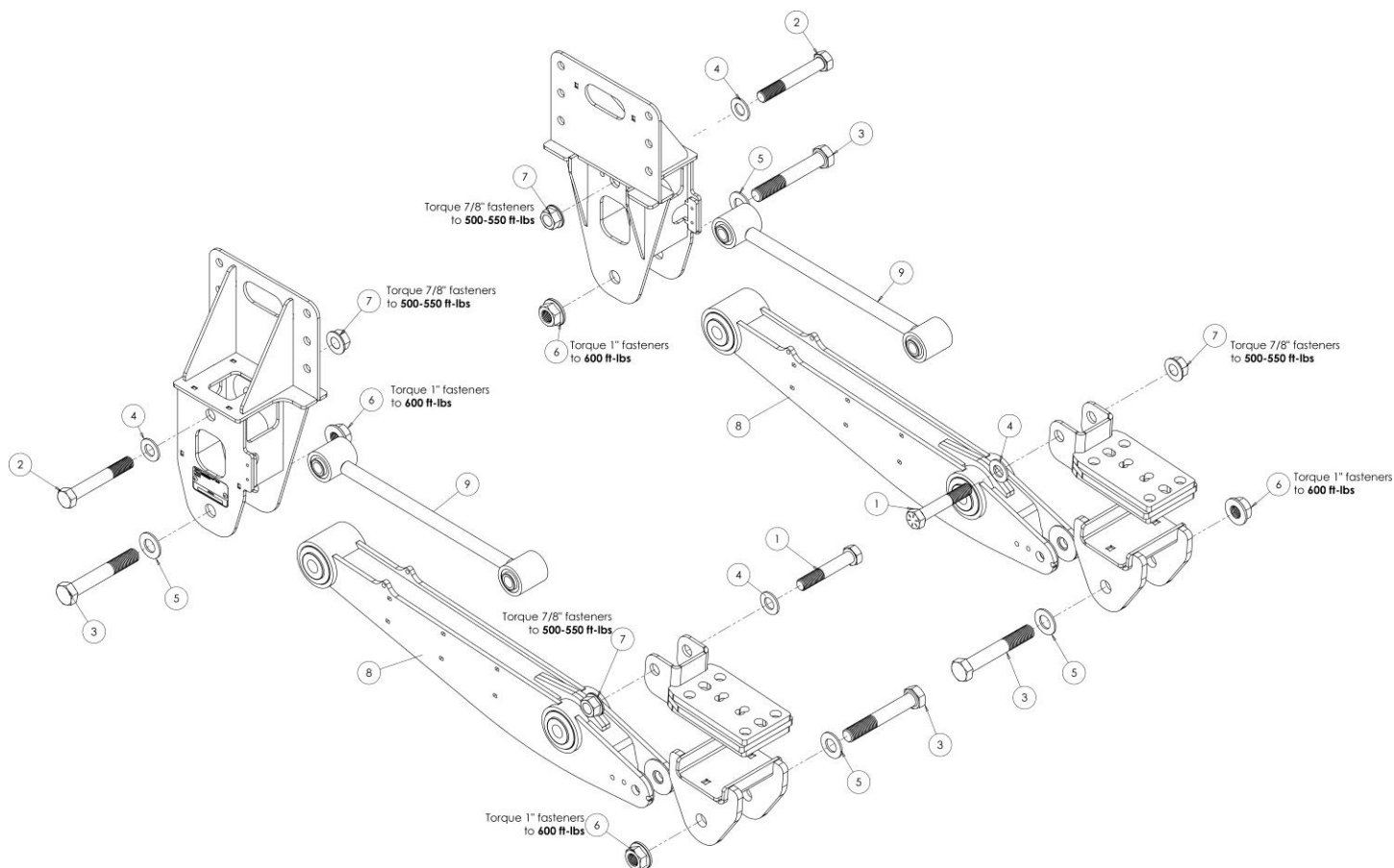
Figure 12: Attach Lines to U-Bolt

5. Add spiral wrap to lines as needed to prevent chafing.
6. Repeat for the right-hand upper clamp, lower clamp, U-bolts, and brake line.

NOTE: It is recommended that brakes are bled after rotating brake line fitting.

7. While U-Bolts are still loose, move on to the Control Arm Installation.

Control Arms



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10002-500	HCS 7/8-9x5" Gr 8	6	4	10012-003	LFN 1-8, Gr. G
2	2	10002-600	HCS 7/8-9x6" Gr 8	7	4	10012-017	LFN 7/8-9 Gr. G
3	4	10003-004	HB 1-8 x 6-1/2", Gr. 8	8	2	10953-020	Lower Control Arm
4	4	10006-003	HFW 7/8"	9	2	11198-005	Upper Control Arm
5	4	10006-004	HFW 1"				

1. Install the upper and lower control arms between the driver side front hanger and axle seat / axle hangers loosely with hardware shown above.

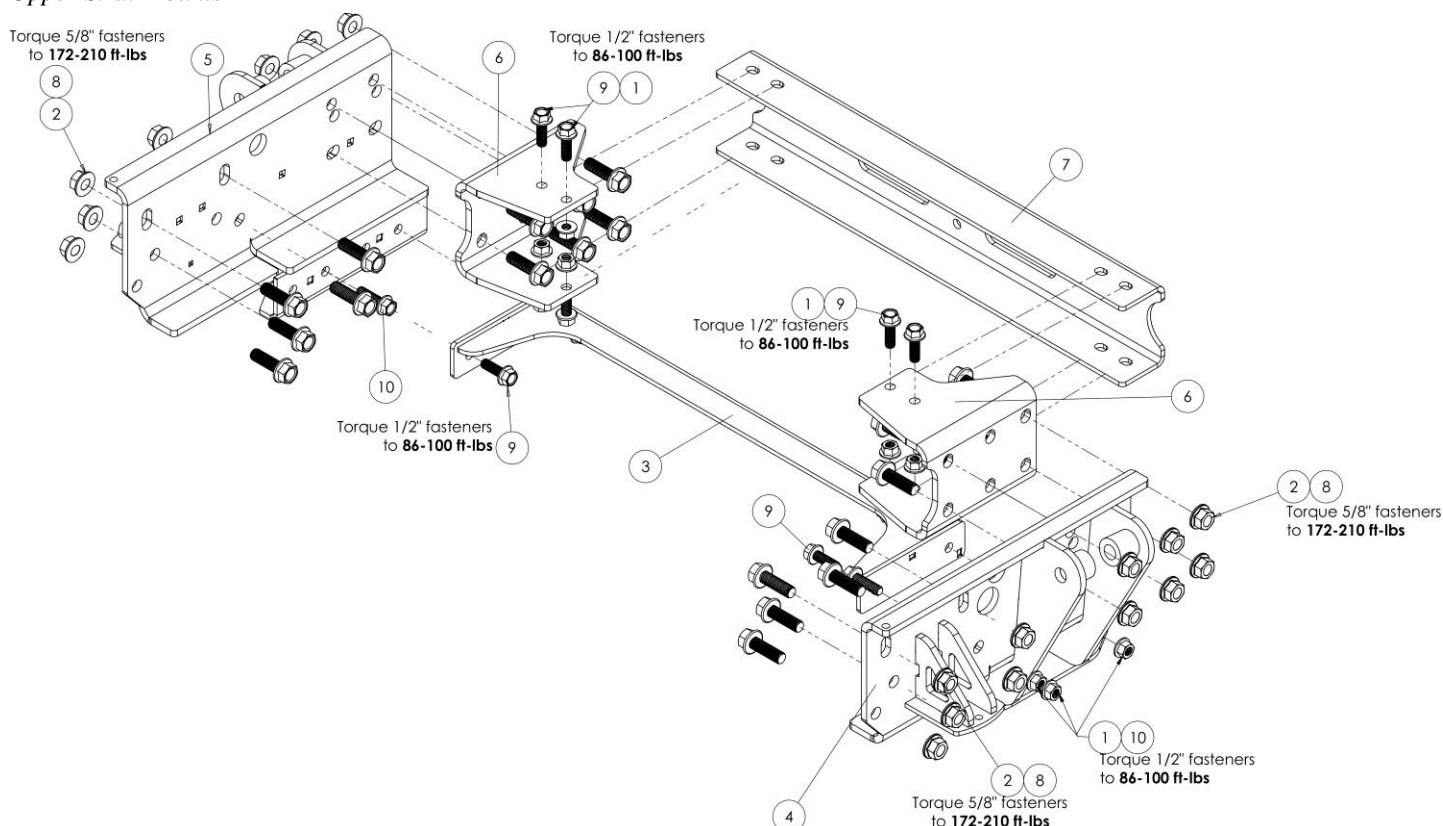
NOTE: Orientate the lower control arms with the height sensor linkage tabs pointing upward.

IMPORTANT: Bolts inserted at the axle seat must point outboard (towards tire). Orienting the bolts incorrectly may result in damage to the frame rail

2. Torque U-Bolts as specified in the Axle Clamp Group section.

NOTE: Axle must be held at ride height for tightening control arm bolts to prevent preloading the bushings.

Upper Strut Mounts



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	14	10012-007	LFN 1/2-13, Gr. G	6	2	10795-005	Cross-member End Channel
2	22	10012-008	LFN 5/8-11 Gr. G	7	1	10796-004	Cross-member Channel
3	1	10782-006	Cross-member Reinforcement	8	22	10874-200	HFB 5/8-11x2", Gr. 8
4	1	10790-057	LH Upper Strut Mount	9	12	10885-150	HFB 1/2-13x1-1/2", Gr. 8
5	1	10790-058	RH Upper Strut Mount	10	2	10885-175	HFB 1/2-13x2", Gr. 8

- Loosely attach the LH Upper Strut Mount and Cross-member End Channel to the frame located just behind the axle. The rearmost USM holes line up with the foremost two cross-member end channel holes.

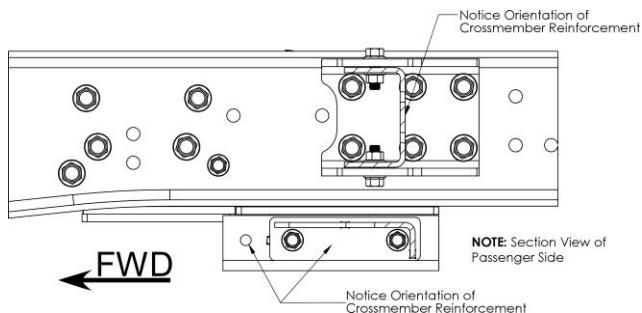


Figure 13: Crossmember Orientation

- Repeat with RH Upper Strut Mount and Cross-member End Channel.

- Install the Cross-member Channel inside the End Channels with 1/2"-13 hardware with nuts inside the channel as shown.

IMPORTANT: Bolts must be installed in directions as shown to provide clearance to the Struts and other Moving parts.

- Install Lower Cross-member Reinforcement using 1/2"-13 x 1-1/2" hardware with bolts facing outward.

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

- Torque all 5/8"-11 nuts to **172-210 ft-lbs**.
- Torque all 1/2"-13 nuts to **86-105 ft-lbs**.
- Jack each side of the axle until approximately design ride height position. See Figure 14.

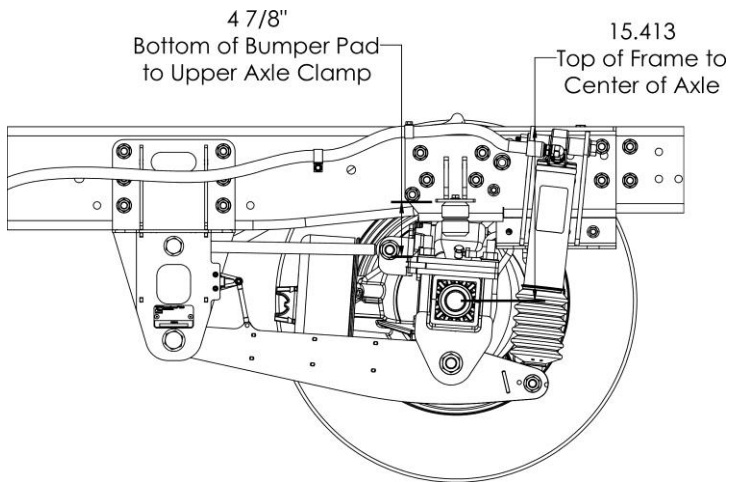
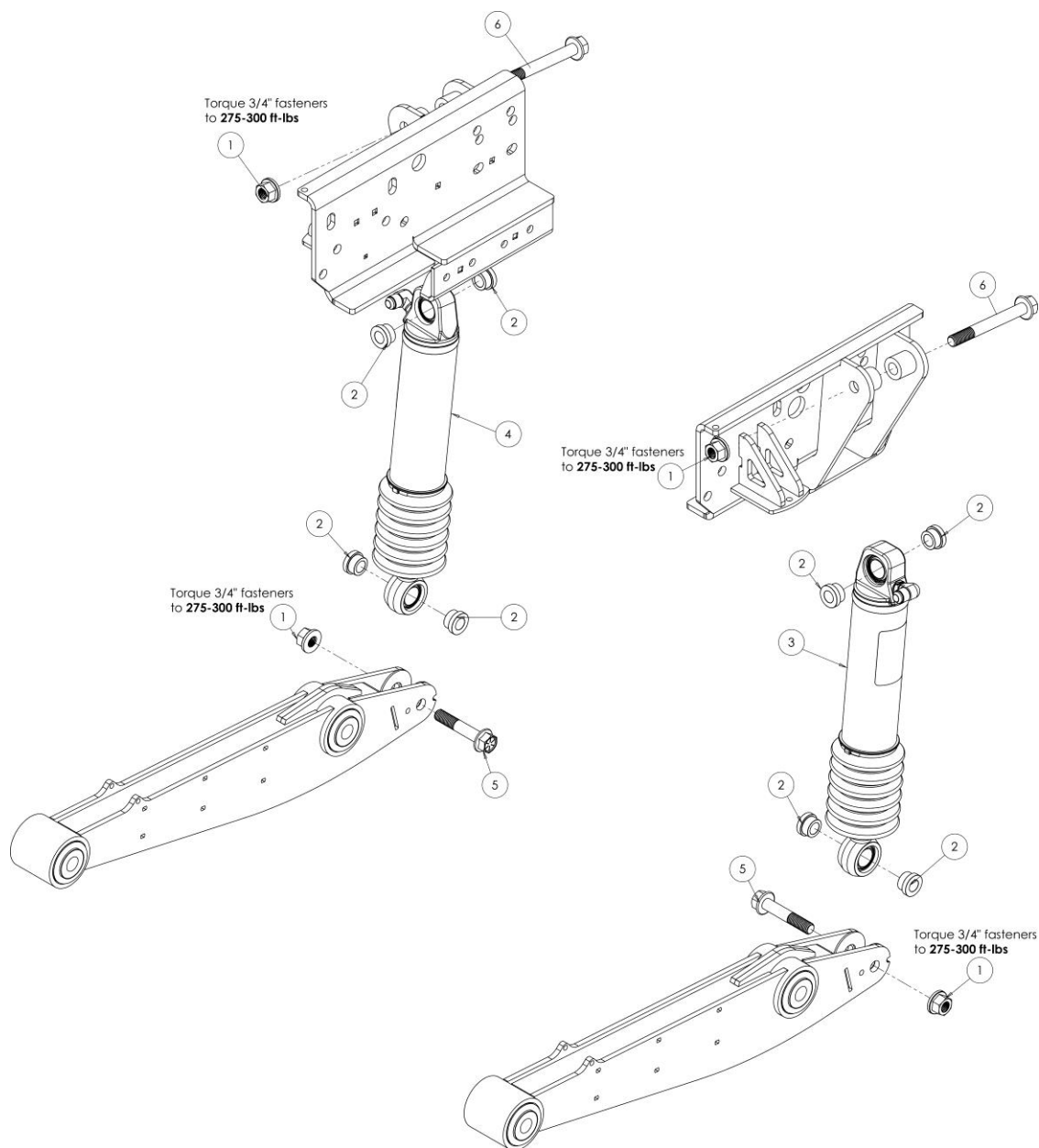


Figure 14: Lift Axle to Design Ride Height

8. Torque the four (4) 1" Lower Control Arm mounting bolts to **600 ft-lbs.**
9. Torque the four (4) 7/8" Upper Control Arm mounting bolts to **491-600 ft-lbs.**

IMPORTANT: Torque all control arm fasteners while axle is at approximate ride height.

Strut Assembly Installation



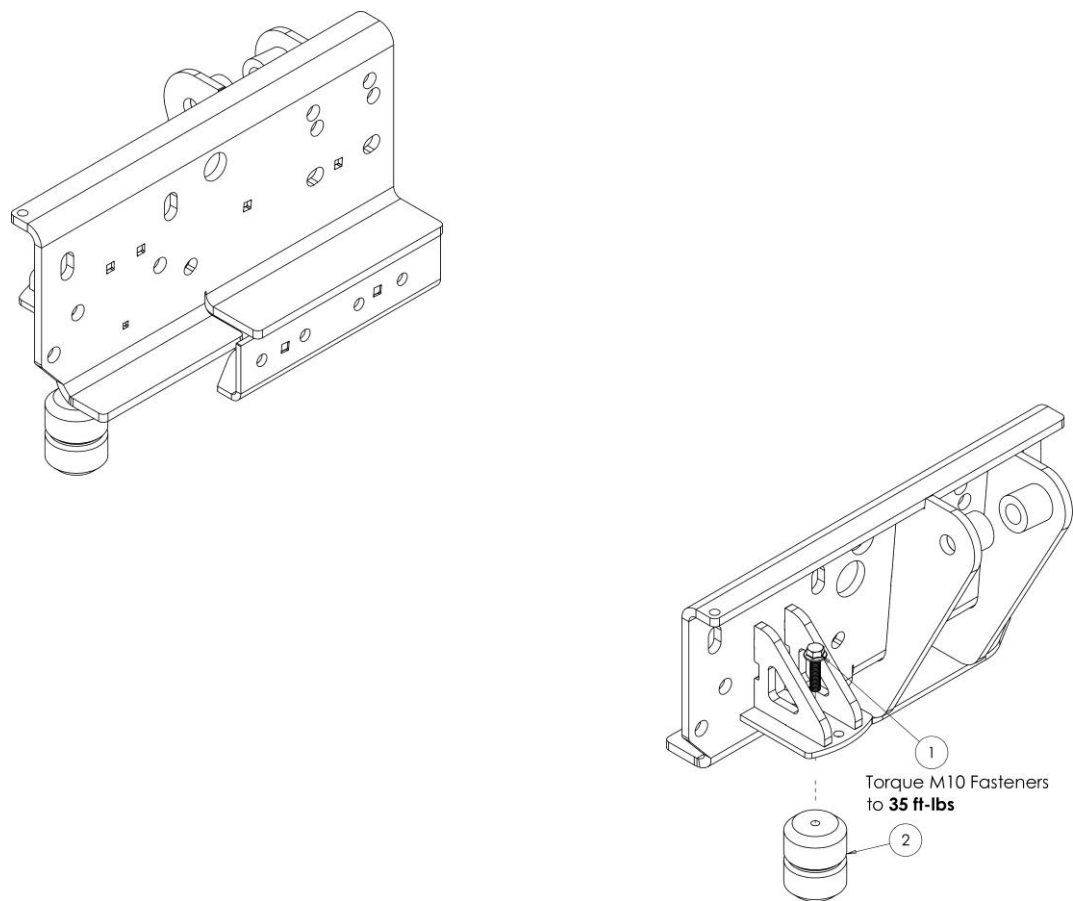
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-014	LFN 3/4-10 Gr G	4	1	See Table 1	Asy, Strut, RH
2	8	10640-005	Bearing Spacer	5	2	11102-400	HFB 3/4-10 x 4" Gr 8
3	1	See Table 1	Asy, Strut, LH	6	2	11102-650	HFB 3/4-10 x 6-1/2" Gr 8

1. Install the Left-Hand Strut Assembly as shown making sure to install bearing spacers.

NOTE: Point strut hydraulic port forward.

2. Repeat for installation of Right-Hand Strut Assembly, Bearing Spacers, and Hardware.
3. Torque Upper and Lower strut fasteners to **275-300 ft-lbs**. *Do not over torque.*

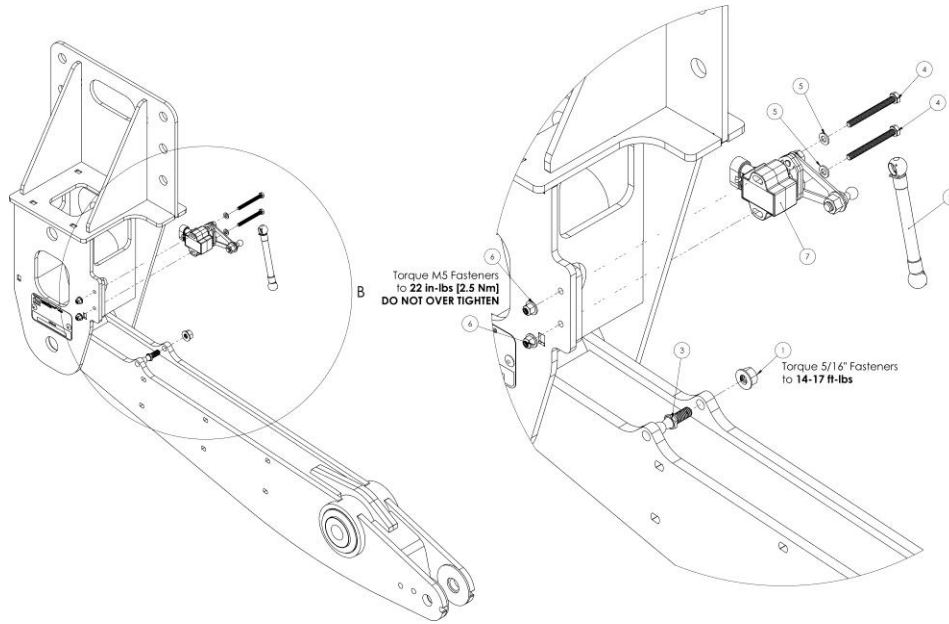
Jounce Bumpers



ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10502-002	HFB M10-1.5 x 40 CL 10.9
2	2	10867-003	Jounce Bumper

1. Install Jounce Bumpers as shown to Upper Strut Mounts.
2. Torque M10 fasteners to **35 ft-lbs**.

Height Sensors



(Driver Side Only Shown)

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10012-010	LFN 5/16-18, Gr. G	5	2	11641-001	FW M5
2	2	10587-009	Linkage Assembly	6	2	11642-001	LFN M5-.08
3	1	10591-003	Ball Stud 5/16-18 x .75L	7	1	11675-001	Asy, Height Sensor
4	2	11639-050	HCS M5-0.8 x 50				

IMPORTANT: Strut assemblies must be installed prior to the installation of the height sensors.

1. Install Height Sensor components and fasteners as shown. Be sure to attach the ball stud to the inboard hole on the control arms as shown above.

NOTE: Make sure sensor is pushed towards rear when tightening bolt in slot.

2. Torque all 5/16" fasteners to **14-17 ft-lbs.**
3. Torque M5 fasteners to **22 in-lbs.**
4. Snap the Linkage Assemblies to the ball studs attached to the lower control arms and to the ball studs on the Height Sensor arms. Refer to **Figure 15** or **Figure 16** for detail of linkage.

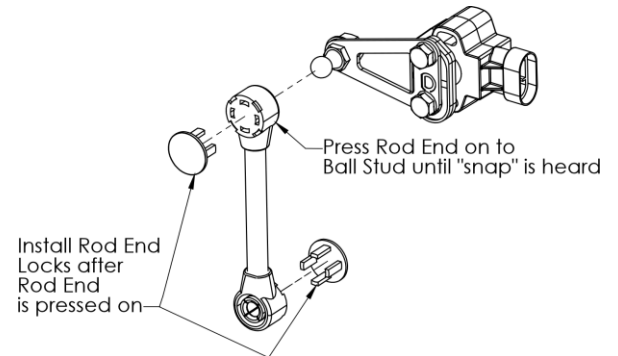


Figure 15: Height Sensor Plastic Linkage End Installation

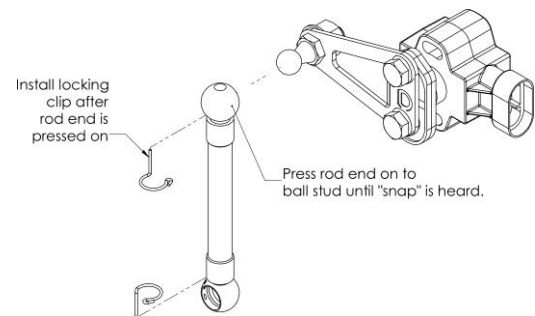
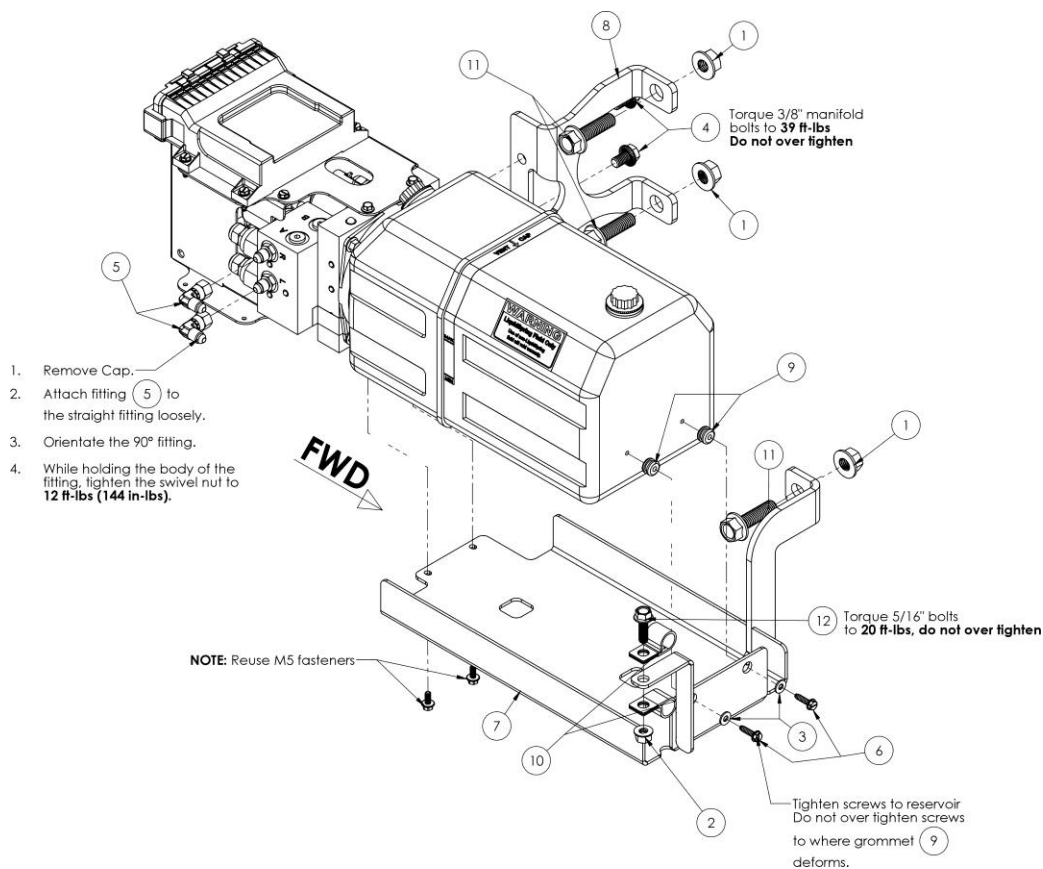


Figure 16: Height Sensor Metal Linkage End Installation

Power Module Installation.



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	3	10012-007	LFN 1/2-13 Gr G	7	1	10798-038	Power Reservoir Mnt
2	1	10012-010	LFN 5/16-18	8	1	10799-031	Power Mod Manifold Mnt
3	2	10088-001	FW #10	9	2	10805-004	Grommet
4	2	10252-003	SFHS 3/8-16 x .625	10	3	10855-003	Vinyl-Coated Loop Clamp, 5/8"
5	2	10322-021	Hyd Fit 90, -4 3/7 x -4 3/7 F	11	3	10885-175	HFB 1/2-13 x 1.75"
6	2	10510-002	STS #10-16 x .75	12	1	10886-100	HFB 5/16-18 x 1"

1. Locate the Power Module Assembly and Power Module Mounting Kit.
2. Attach the power module to the manifold and reservoir mounts as shown above.

IMPORTANT: Do not over tighten the self-tapping screws such that the rubber bushing deforms.

3. Attach the power module assembly with mounting kit to the rearward part of volume mount. See Figure 17 and *Secondary Volumes* section for installed view.

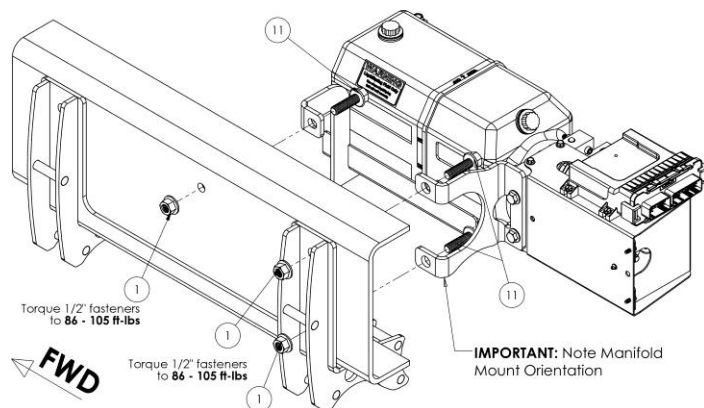
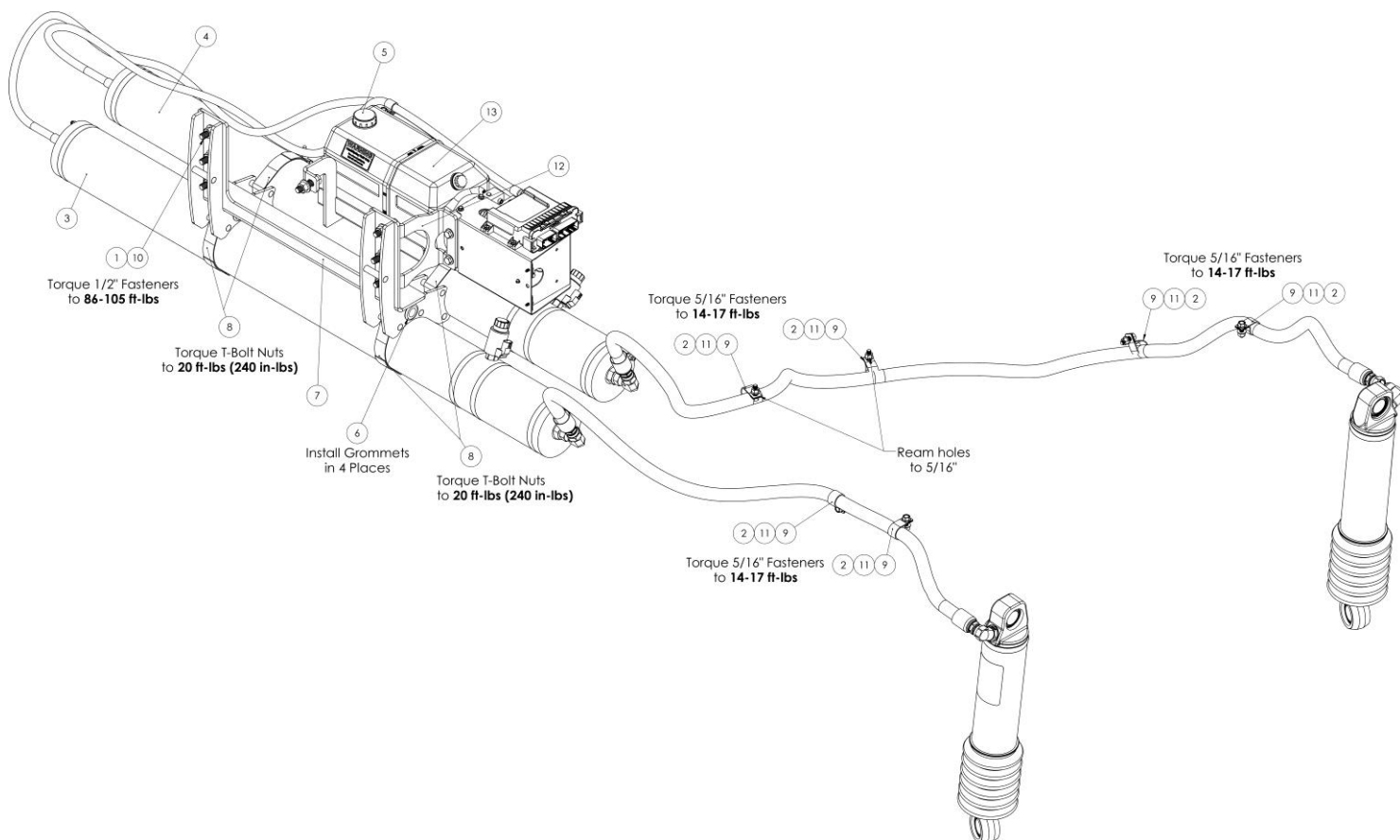


Figure 17: Power Module Mounting

4. Mark and drill a 1/2" hole at the location of the Reservoir Mount bolt hole on the frame.
5. Torque 1/2"-13 fasteners to **86-105 ft-lbs.**

Secondary Volumes



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10012-007	LFN 1/2-13, Gr. G	8	4	10843-003	T-Bolt Clamp
2	6	10012-010	LFN 5/16-18 Gr. G	9	6	10855-002	Vinyl Coated Loop Clamp 1"
3	1	10597-143	Volume Asy LH	10	6	10885-175	HFB 1/2-13 x 1.75"
4	1	10597-144	Volume Asy RH	11	6	10886-100	HFB 5/16-18 x 1" Gr 8
5	1	10614-001	Breather/Fill Cap	12	1	11649	Kit, Power Module Mounting
6	4	10805-001	Grommet	13	1	11658-019	Asy, Power Module
7	1	10830-041	Volume Mount				

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

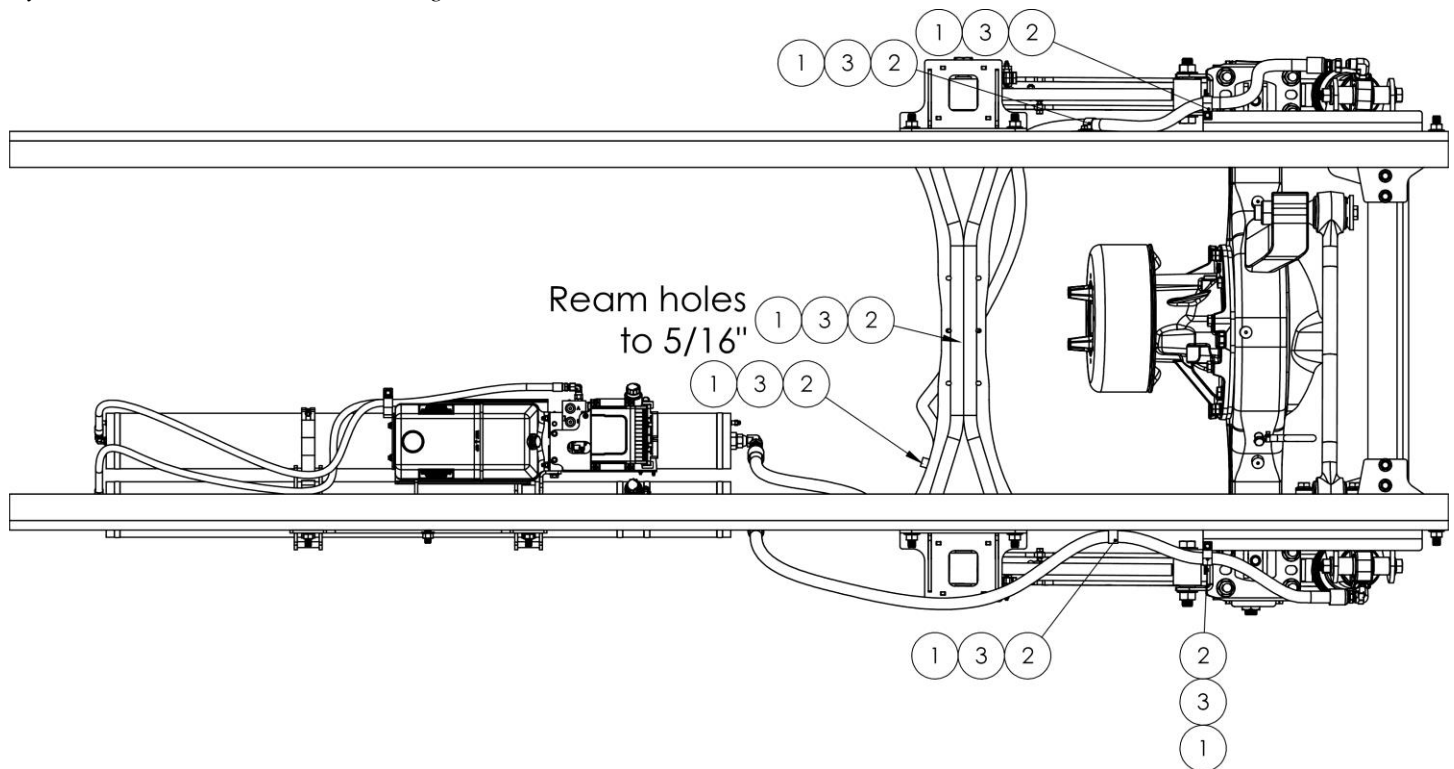
1. Locate the Volume Mount.
2. Place the mount against the driver side frame, forward of the front hanger, where holes were previously drilled during Frame Preparation.
3. Attach the mount with 1/2"-13 x 1.75 fasteners. Torque to **86-105 ft-lbs**.
4. Locate the RH Volume Assembly.
5. Raise the volume assembly until the volume contacts top mount. Rotate the volume assembly until the bleed screws are as vertical as possible with rate valves clear of interferences.

6. Locate (2) T-Bolt Clamps, open the clamps, and place them in the mounts around the two pegs.
7. Secure both clamps around the volume and torque the T-Bolt nut to **240 in-lbs**.

8. Repeat with the LH Volume Assembly.

NOTE: The -10 90° Elbow connected to the volume may have to be loosened and re-orientated as necessary.

9. Install Grommets in the Volume Mount pass through holes as shown above.
10. Route and re-attach parking brake line through the Volume Mount pass through holes.



ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10012-010	LFN 5/16"-18, Gr G
2	6	10855-002	Vinyl-Coated Loop Clamp, 1" ID
3	6	10886-100	HFB 5/16-18 x 1", Gr 8

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

1. Locate -10 hose on Left-Hand (driver side) Secondary Volume.
2. Route hose to strut area, over front hanger and axle.
3. Locate 3/16" ID PVC Tubing (not included with kit). Note: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit can be used.
4. Attach the PVC tubing to the bleed screw on the -10 hose side of the Left Hand Secondary Volume Assembly and place the other end in a bucket.

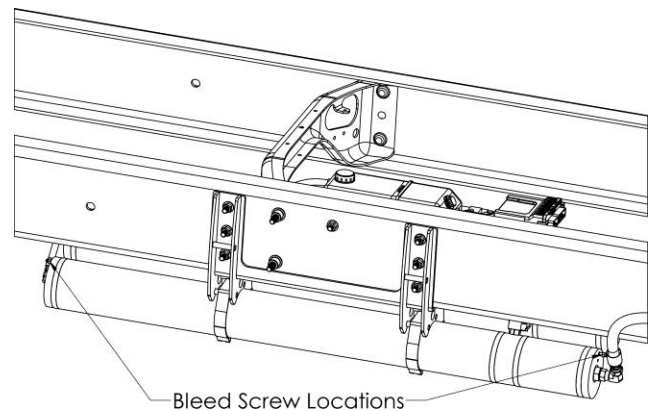


Figure 18: Bleed screw locations.

5. Open the bleed screw slightly to relieve any residual pressure.
6. After pressure is relieved, close the bleed screw and torque to **13-18 ft-lbs.**
7. Remove the cap from the strut port.
8. Raise the end of the -10 (5/8") hose, attached to the volume assembly, above the secondary volume to prevent fluid loss.

9. Remove the plug from the end of the hose.
10. Attach the hose end (-10 JIC fitting) to the strut port.
11. Torque to **36-63 ft-lbs.**
12. Secure hose with clamps as shown below in Figure 19.

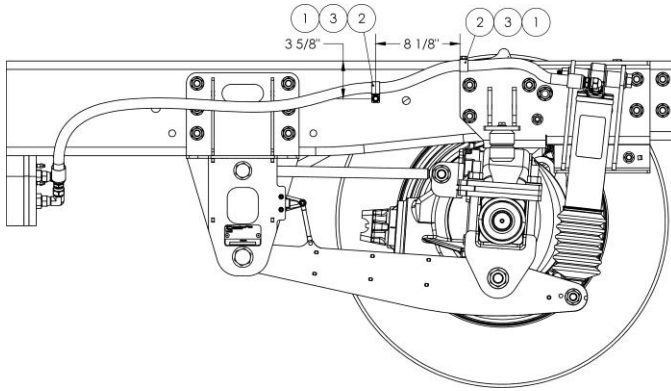


Figure 19: Driver Side Hose Routing

13. Repeat with the opposite side. Note, the -10 90° Elbow connected to the volume may have to be loosened and re-orientated as necessary.
14. Use hose clamps to secure hoses from movement and chafing.

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

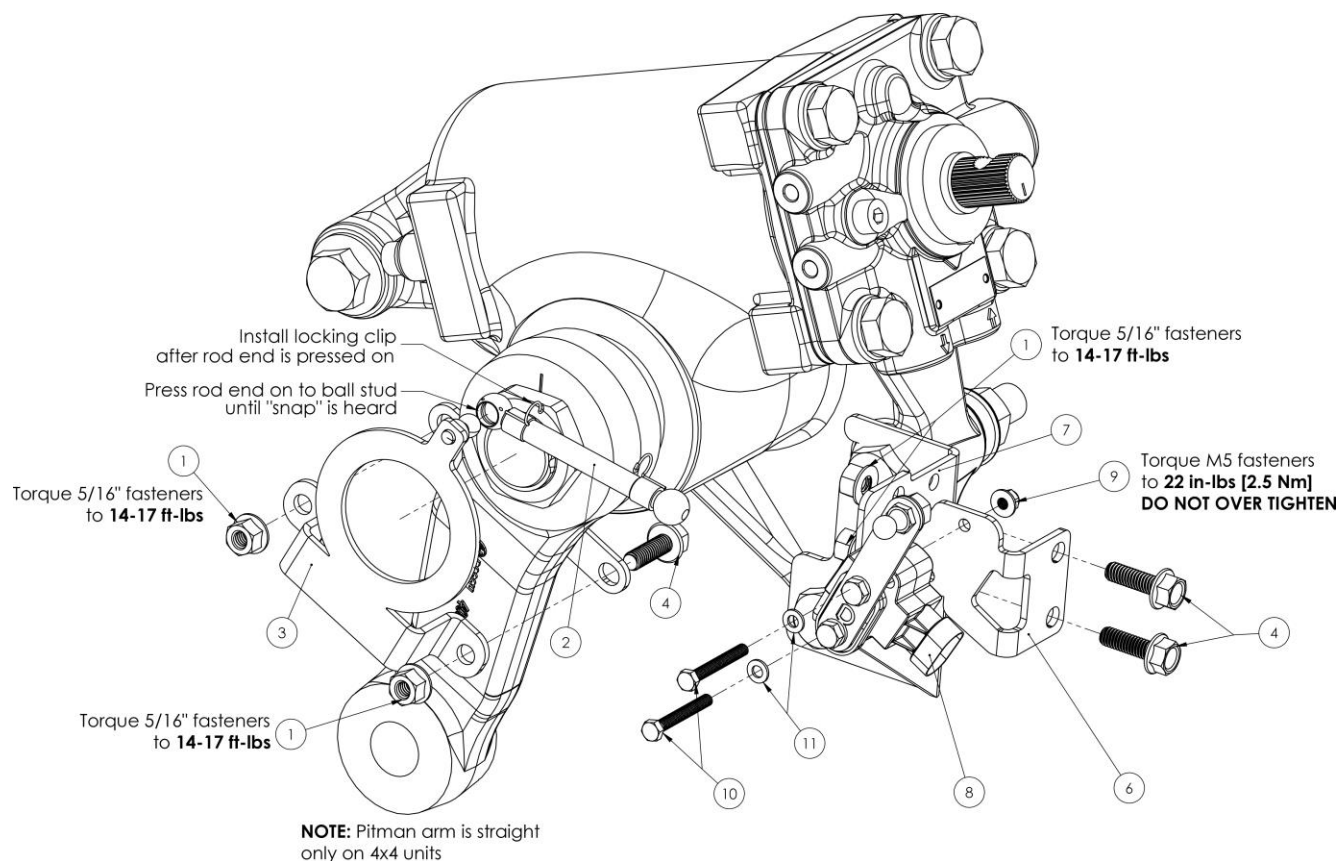
15. Attach the PVC tubing to the bleed screw on the -4 hose side of the Left Hand Secondary Volume Assembly and place the other end in a bucket.
16. Open the bleed screw slightly to relieve any residual pressure.
17. After pressure is relieved, close the bleed screw and torque to **13-18 ft-lbs.**
18. Locate the -4 90° Elbow and -4 hose.
19. Loosely attach one end of the hose to the elbow.
20. Remove the -4 Cap from the -4 fitting on the forward end of the Left-Hand volume.
21. Attach the elbow to the fitting. Tighten fittings as per Hydraulic Fitting Assembly, JIC 37° Fitting on Page 5.
22. Route the lower mounted volume -4 (1/4") hydraulic hose to the Power Module as shown in previous page. Use hose clamps to secure the hose from movement or chafing.

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

23. Attach the hose end to the fitting in the port marked "L". Torque to **12 ft-lbs. Do not over tighten.**

24. Repeat the volume mounted more inboard.
25. Attach the hose end to the fitting in the port marked "R". Torque to **12 ft-lbs. Do not over tighten.**
26. Clean up any fluid spillage.

Steering Bracket Installation



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-010	LFN 5/16-18, Gr. G, Black Phos	7	1	11138-008	Steering Mnt
2	1	10587-011	Asy, Linkage 3.58" OP	8	1	11675-002	Asy, Steering Sensor
3	1	10733-011	Pitman Arm Bracket	9	2	11642-001	LFN M5-0.8 Nylon
4	4	10886-100	HFB 5/16-18	10	2	11639-040	HCS M5-0.8
5	1	10904-046	Pitman Arm Strap	11	2	11641-001	FW M5 10x5.3x1
6	1	10904-047	Steering Sensor Mnt Plate				

1. Install the Pitman Arm Bracket and Pitman Arm Strap to the pitman arm. **Torque to 14-17 ft-lbs.**
2. Remove the lower bolt attaching the steering gear box to the frame. Retain bolt for reuse. Back the upper bolt out 1/4". See Figure 20.
3. Place Steering Mount in place as shown above and in Figure 20. Reattach OEM M16 bolts to secure Steering Mount to the steering gear box. **Torque to 245 ft-lbs.**

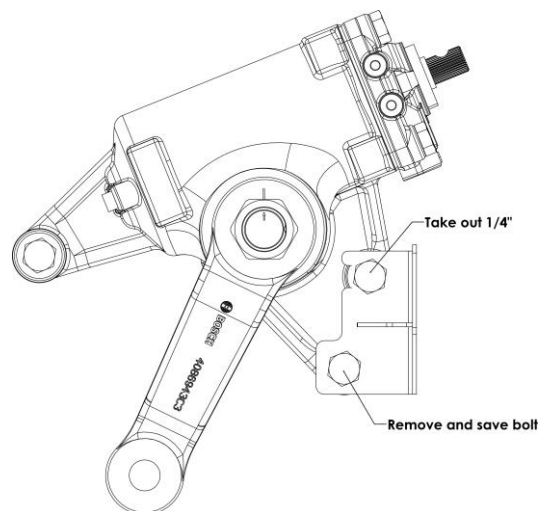


Figure 20: Install Steering Mount

-
4. Attach the Steering Sensor Assembly to the Steering Sensor Mount Plate as shown below in Figure 21.

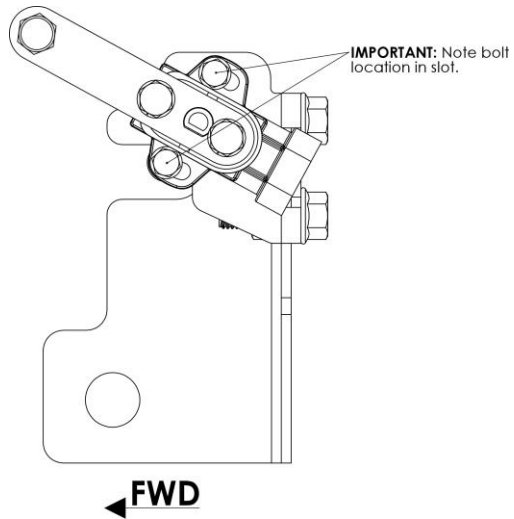


Figure 21: Sensor Installed on Mount Plate

5. Attach the Steering Sensor Mount Plate to the Steering Mount using 5/16"-18 fasteners. **Torque to 14-17 ft-lbs.**
6. Snap the Linkage Assembly to the Pitman Arm Bracket and to the ball stud on the sensor arm. See Figure 22 for complete assembly.

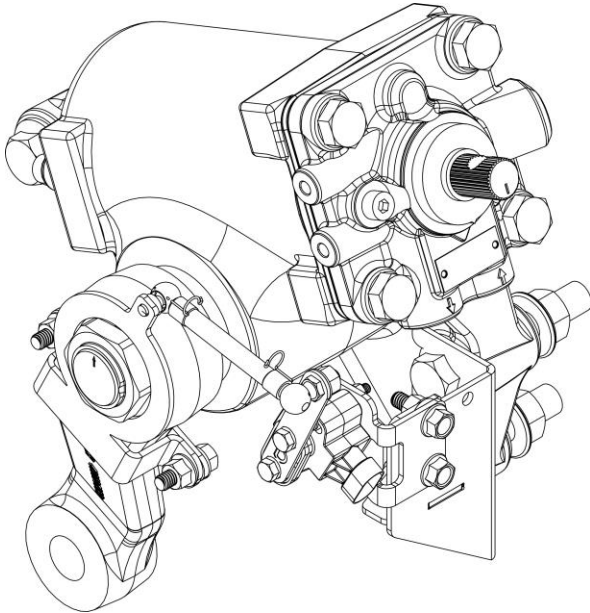


Figure 22: Assembled Steering Sensor

External Electrical Installation:

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

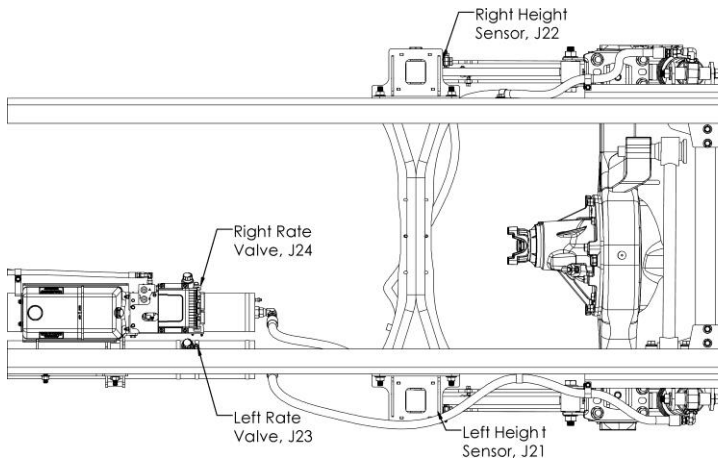


Figure 23: Rate valve and height sensor electrical connections

5. Connect height sensor and rate valve connections, See Figure 23.
- NOTE: Connection after routing the harness and prior to installing the height sensor may aid in electrical connection.
6. Secure harness to OEM harness on driver side. Use of plastic clips is recommended.
 7. Locate the 8ga wire ground ring terminal, J30, branch near the power module.
 8. Locate and drill Ø1/4" hole in frame. Remove frame coating(s) as needed to ensure metal-to-metal contact between the ring terminal and frame.
 9. Attach the ground ring terminal, J30, to the chassis frame for grounding. Sealant may be applied after ring terminal is secured.
 10. Route the remaining trunk (containing blunt wires and steering sensor connector) towards the firewall. Secure to OEM wiring harness.
 11. Route the wiring harness branch containing the (7) 18ga blunt wires through the firewall in Figure 24.



Figure 24: Wire Harness Pass-thru

12. Locate the branch containing the J35 steering sensor connector.
13. 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.

14. Connect the harness to the steering sensor.
15. Locate the 8ga battery connection branch.
16. Route branch to the driver side battery positive terminal.
17. Locate the Battery Fuse Lead containing the 80 amp fuse.
18. Crimp the fuse lead to the 8ga battery connection branch blunt end.
19. Melt the heat shrink on the crimped connection to seal the splice.
20. Remove the 80 amp fuse and retain.
21. Connect to the positive terminal post per OEM Upfitter wiring instructions.

Dash Harness Installation

IMPORTANT: The following OEM P/N's must be purchased to complete wiring installation. Refer to Appendix B: Wiring.

P/N:	Qty:	Description:
19328970	1	Service Connector (X7)
13575832	2	Terminal (10-12ga)
13578892	1	Terminal (16-18ga)

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)

NOTE: The Yellow/Black wire in Dash Harness isn't used. It can be pulled from Dash Harness.

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. Find the X7 service connector and 3 terminals or wire leads in Appendix B: Wiring.
5. Place one 10ga wire into service connector pin 11, as shown in Figure 25, until you hear a click. Repeat with the other 10ga wire into pin 7.

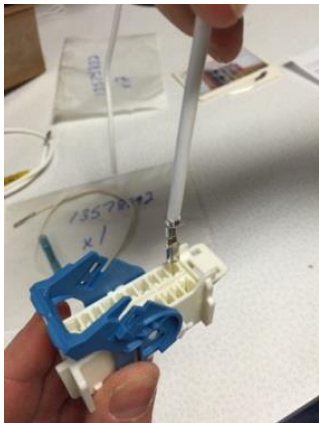


Figure 25: Installation of Wire

6. Mark that pin 11 wire is Ignition and pin 7 is Battery.
7. Place the 16ga wire into pin 19 and mark as Speed.
8. Service connector should look like Figure 26



Figure 26: Three wires installed into service connector.

9. Push down blue lock lever to secure wires to service connector as shown in Figure 27.

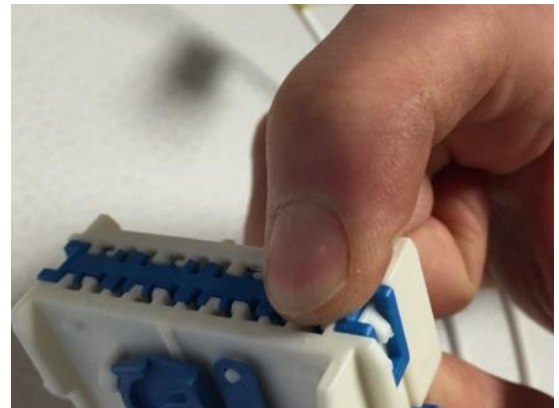


Figure 27: Blue lock lever in lock position

10. Locate the OEM IECM module (X61A Junction Block), located in the LH foot well, near or below the parking brake mechanism shown in Figure 28, and remove cover.



Figure 28: IECM Cover Location

11. Locate X7 in the junction box and install service connector into junction box. See Figure 29

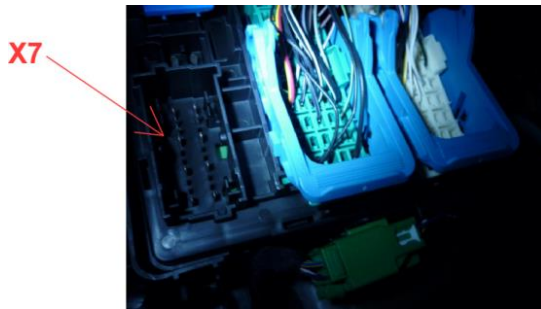


Figure 29: X7 Location in junction box

12. Make the following wiring butt splices:

LiquidSpring		→	Service Connector
Wire Color	Harness		Wire Color
Violet/White (Speed)	Dash	→	16ga White (Pin 19)
Yellow (Ignition)	Dash	→	10ga White (Pin 11)
Red (Battery)	Dash	→	10ga White (Pin 7)

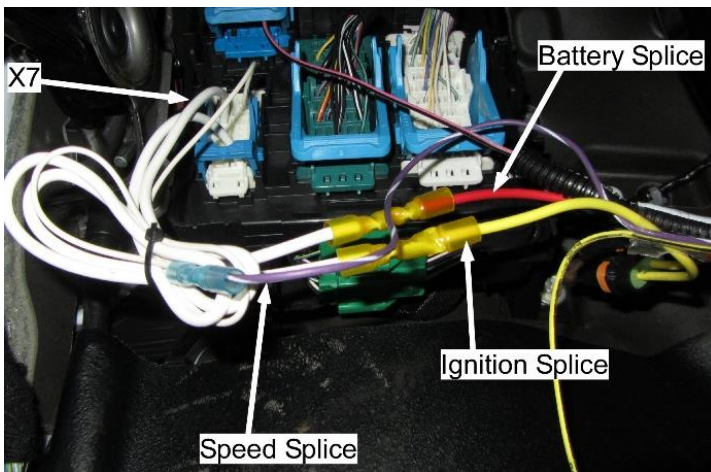


Figure 30: X7 Connector Installed and Spliced to Dash Harness

13. Locate and remove the X3 connector. See Figure 31.

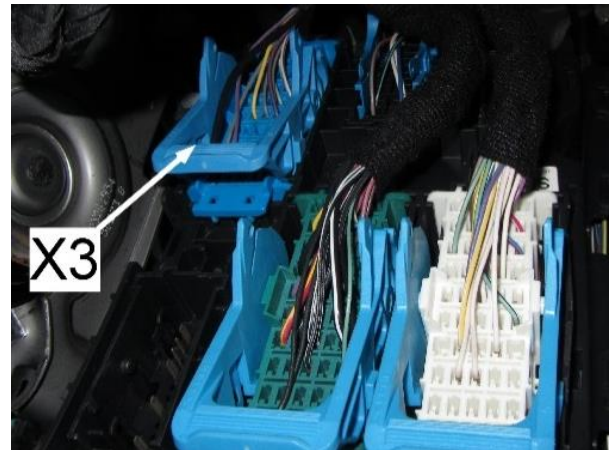


Figure 31: X3 Connector

14. Locate the Violet /Gray wire in pin 35 of the X3 connector and remove sheathing from the harness, to gain more access to the wire for splicing.
15. Cut the Violet/Gray wire a couple inches from the connector and install a butt splice onto one end of the wire.

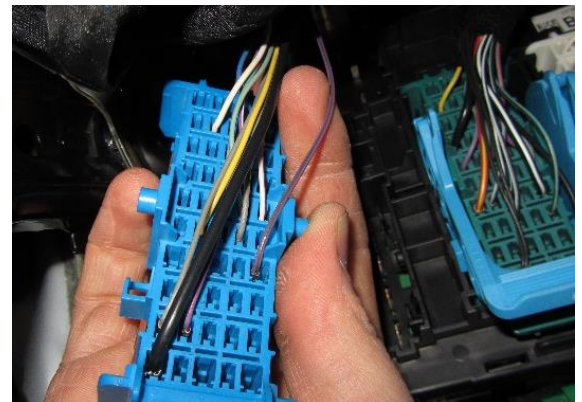


Figure 32: Violet/Gray - Pin 35 on X3 connector

16. Locate the Pink/Black wire in the dash harness. Tie the cut end of the Violet/Gray wire and the Pink/Black (Brake) wire together and insert into the other end of the butt splice and crimp. See Figure 33.

NOTE: The Pink/Black wire in the dash harness may be excessively long with corrugated loom and may be shortened as needed.

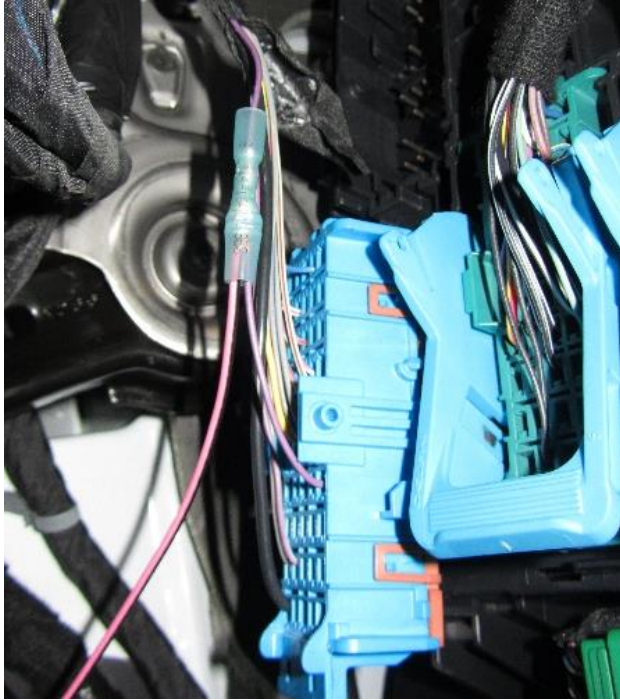


Figure 33: Pink/Black (Brake) Spliced to Violet/Gray wire

17. Re-install the X3 connector into the X61A junction block.
18. Route the Black J32 (Ground) wire with ring terminal, to a ground stud located near the fuse block. See Figure 34 below.

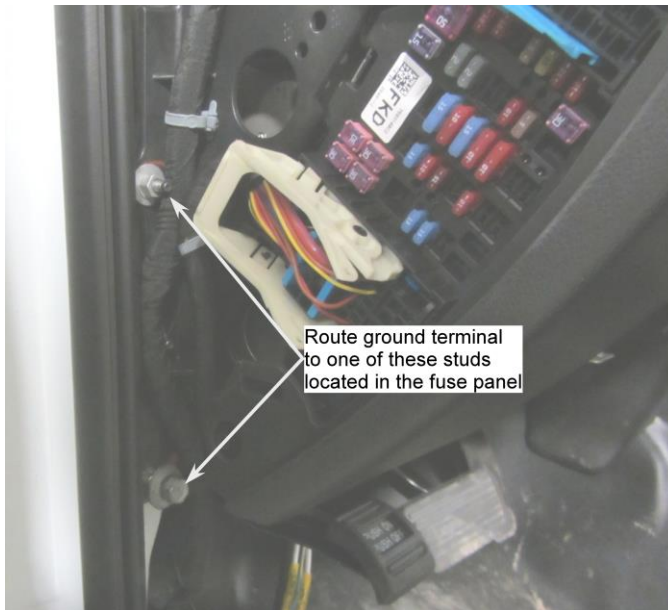


Figure 34: Ground Routed to Stud Near Fuse Block

19. Secure all wires under the dash using zip ties keeping away from moving parts. Make sure all connector latches are locked and reinstall the IECM and fuse panel cover.

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, J12, and connect.
4. Secure all wires under the dash.
5. Replace the 80 amp fuse at the battery.

Optional Door Electrical Harness Installation:

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

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

A. Single Wire - Ground Signal From Source

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

B: Dual Wire – Ground Signal From System

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

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

accordingly and apply heat to the insulator to seal the connection(s).

Initial System Fill

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

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

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

- c. Completely depressurize the system. See Depressurizing the System section, under System Operation

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

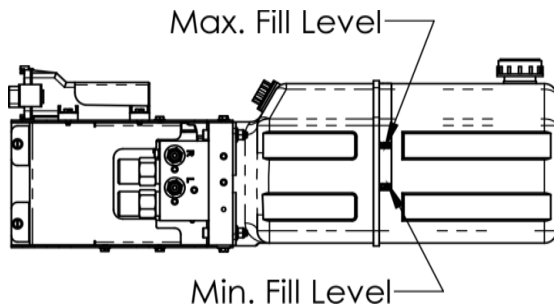


Figure 35. Final fill fluid level.

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.

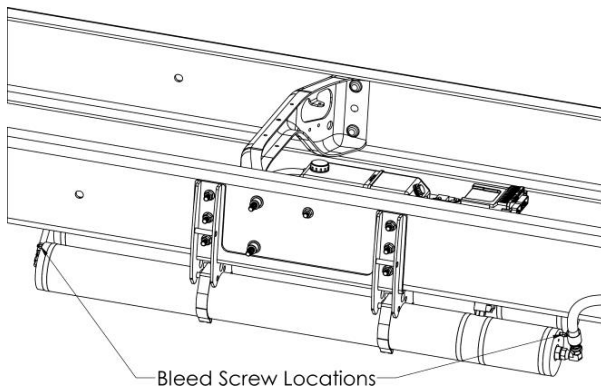


Figure 36. Bleed screw locations.

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.

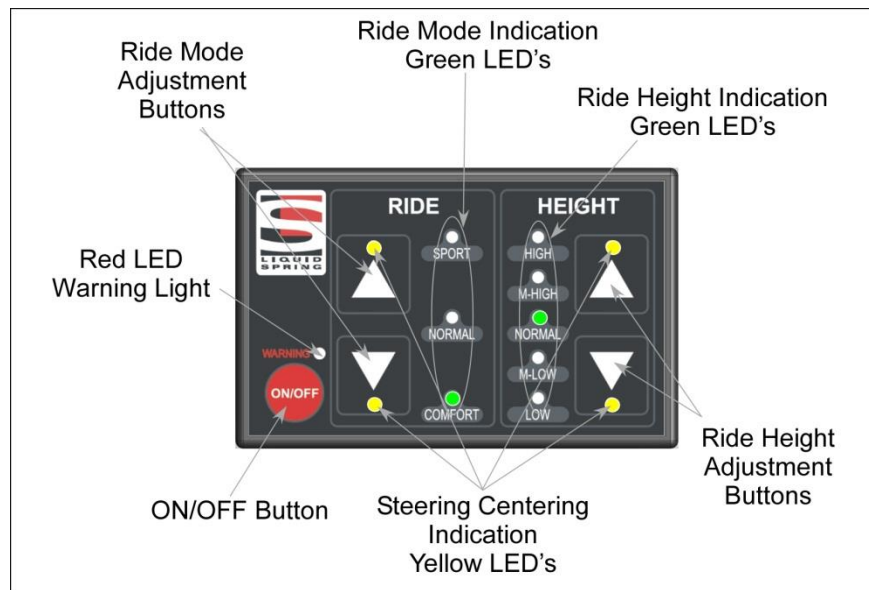
WARNING: Do not run vehicle in an enclosed building without adequate ventilation or without ducting exhaust fumes outside. Operation of a vehicle inside an enclosed building can lead to serious injury or death.

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.

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**

Ride Mode Adjustment:

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

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

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

Ride Height Adjustment:

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

- A solid green LED will indicate the selected height. A flashing green LED will indicate the current height and that height adjustment is

occurring. When a single solid green LED is lit, the selected height has been achieved.

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

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

Depressurizing the System

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

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

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

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

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

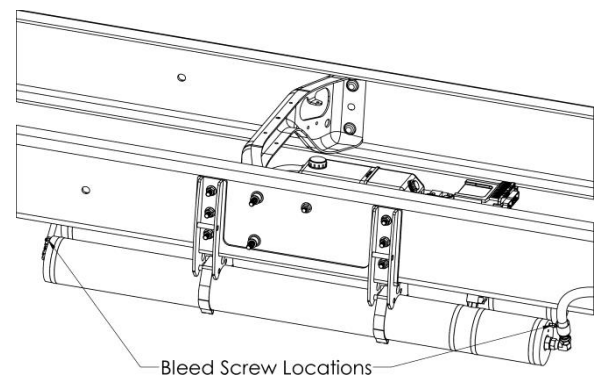


Figure 37. Bleed screw locations.

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.

Calibrating the System (Full)

See Section *Calibrating the System*, on page 29

Checking Fluid Level

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.

2. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.
3. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.
4. After the suspension system stops leveling, check the fluid level in the reservoir. If low, fill to the indicated line.

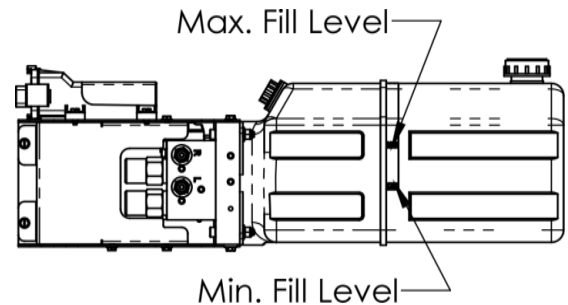


Figure 38. Final fill fluid level.

5. To add fluid, remove filler/breather cap on reservoir.
6. Locate a container of Compressible Fluid.
7. Add fluid to the reservoir until the fluid level is within the band shown in Figure 38.
8. Replace filler/breather cap and retighten.

Checking Fittings for Leaks

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

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

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

WARNING: Never tighten a hydraulic fitting or hose under pressure. Always depressurize the system before adjusting fittings and hoses.

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

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

Service Intervals

Once Daily or Before Each Shift of Usage

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

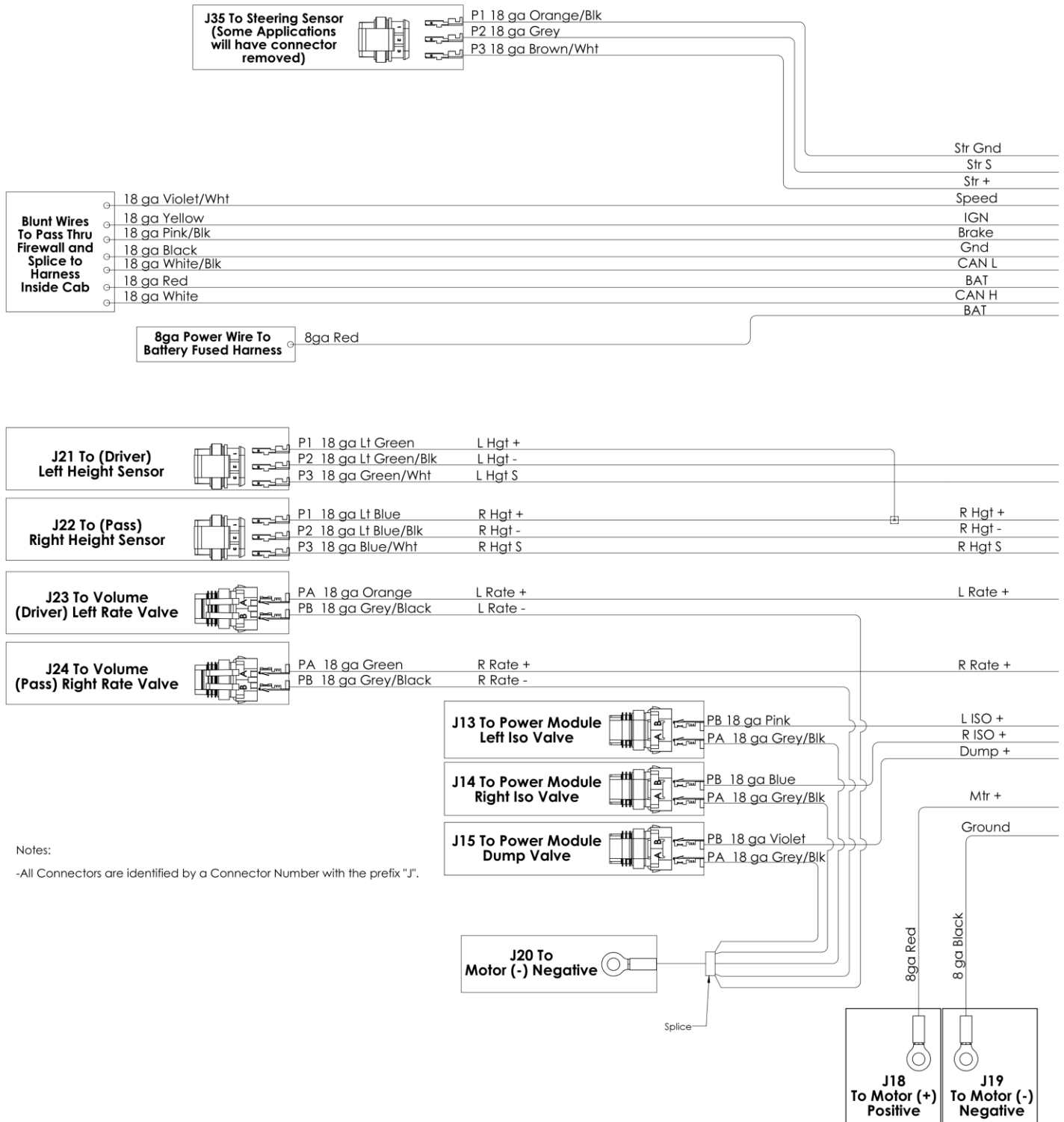
Issues with Strut Assembly

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

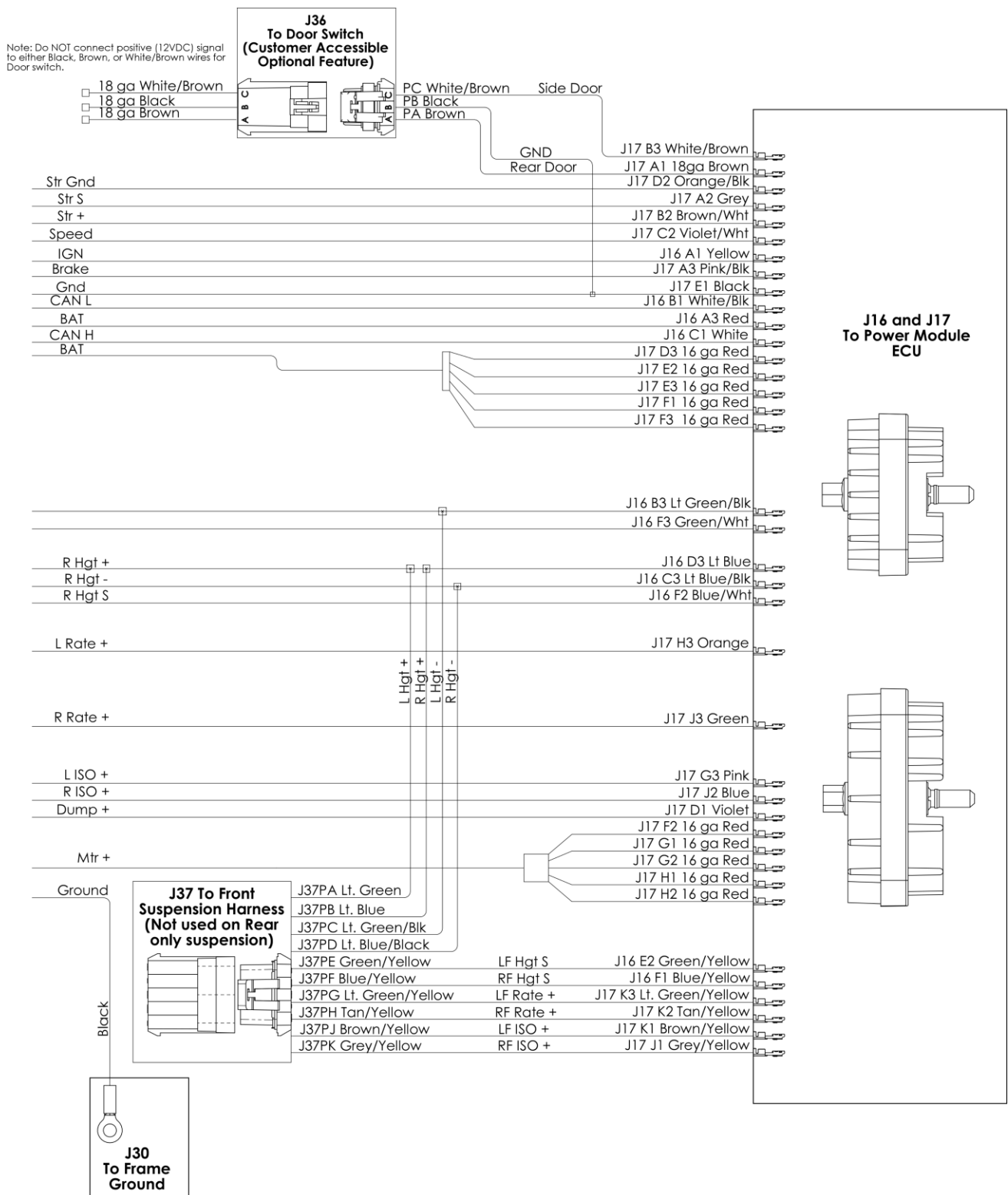
Issues with Secondary Volume Assembly

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

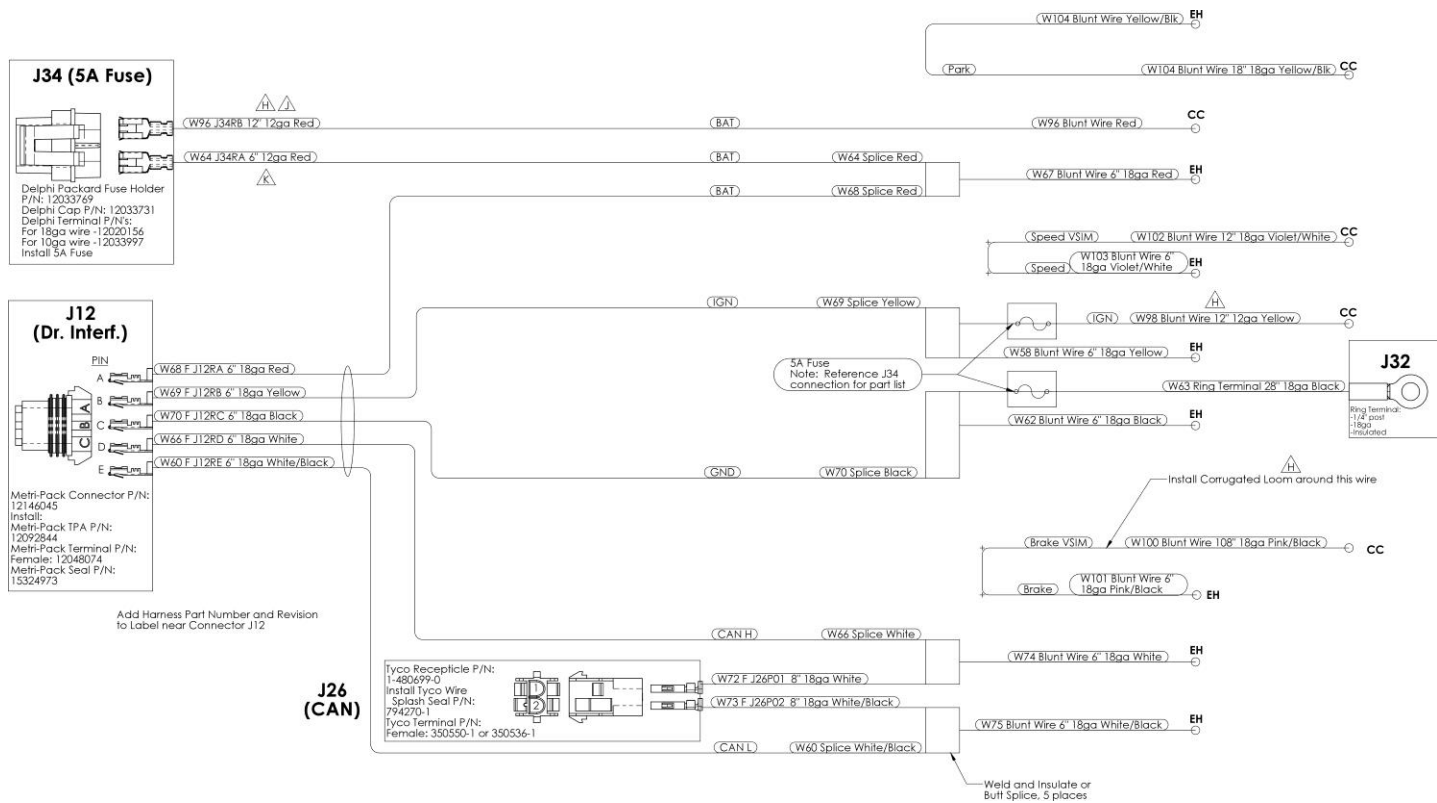
Electrical Schematics



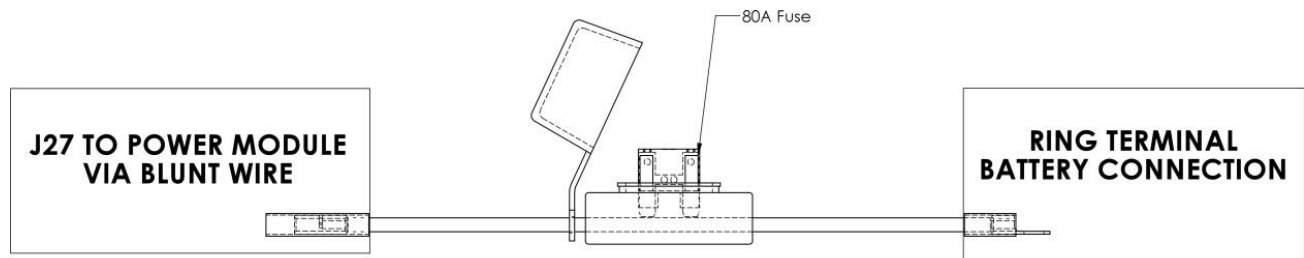
Schematic, External Wiring Harness – Part 1



Schematic, External Wiring Harness – Part 2



Dash Harness



Schematic, Battery Fuse Lead

Appendix A: Frame Drilling Locations

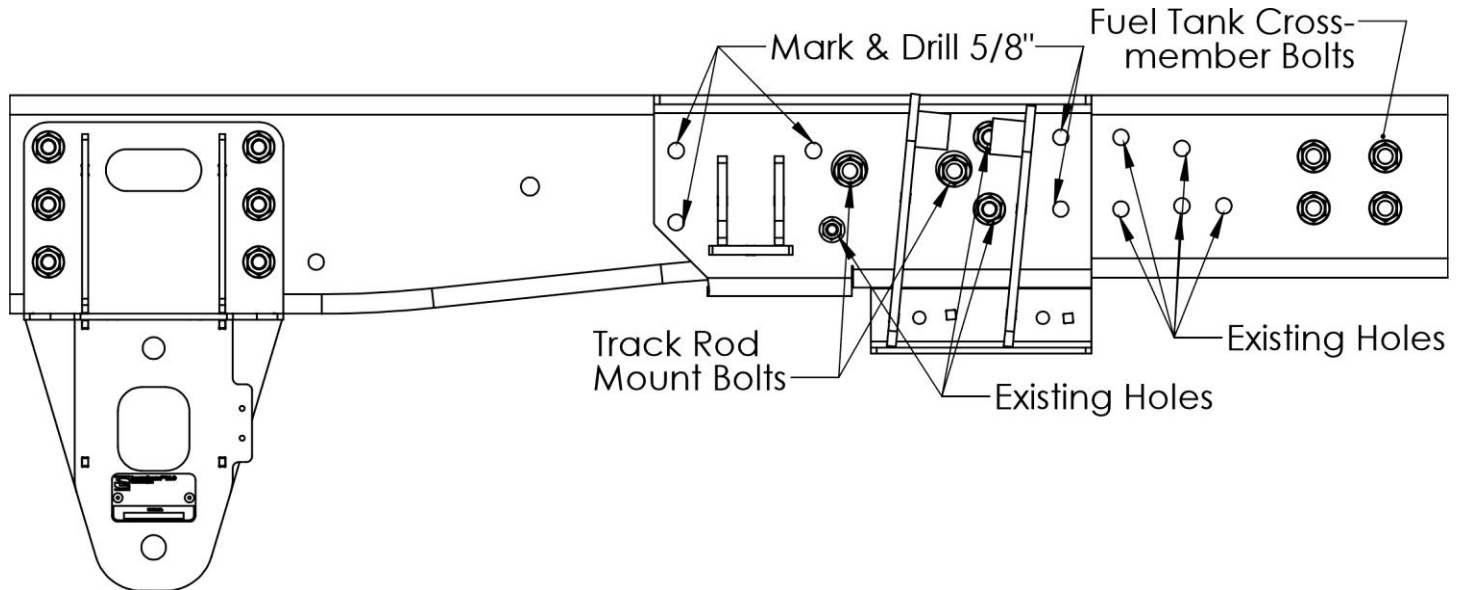


Figure A 1: Driver Side Upper Strut Mount Drilling

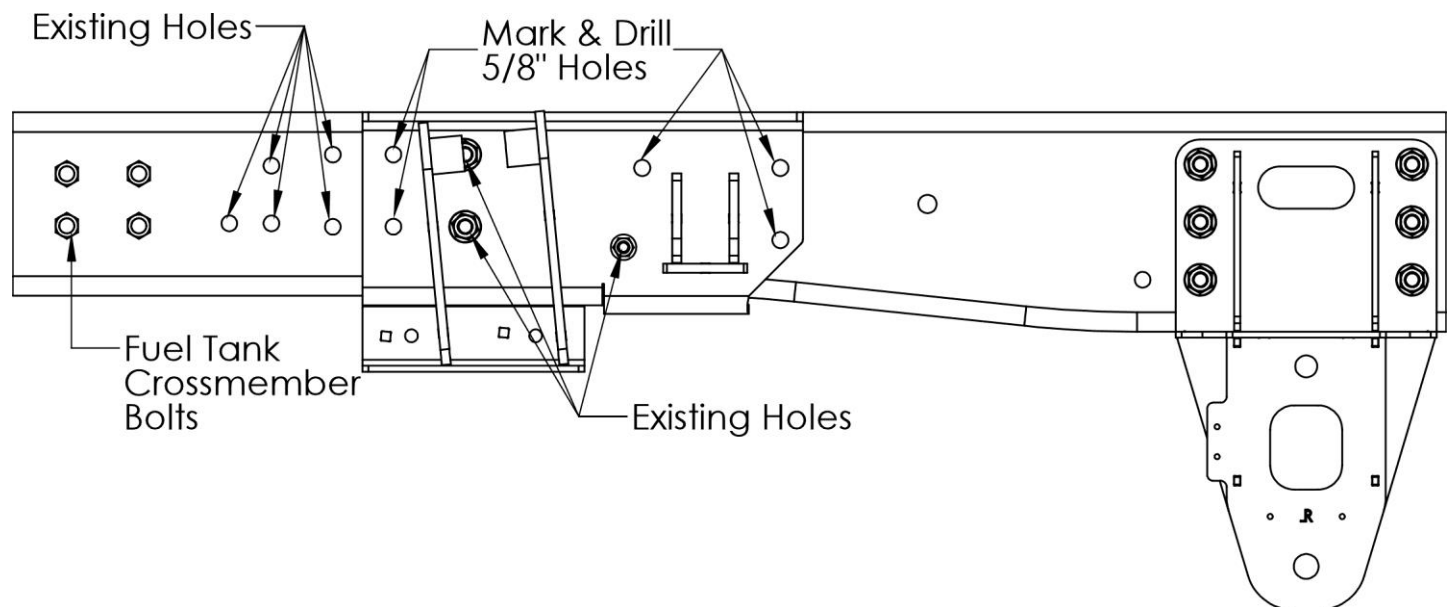


Figure A 2: Passenger Side Upper Strut Mount Drilling

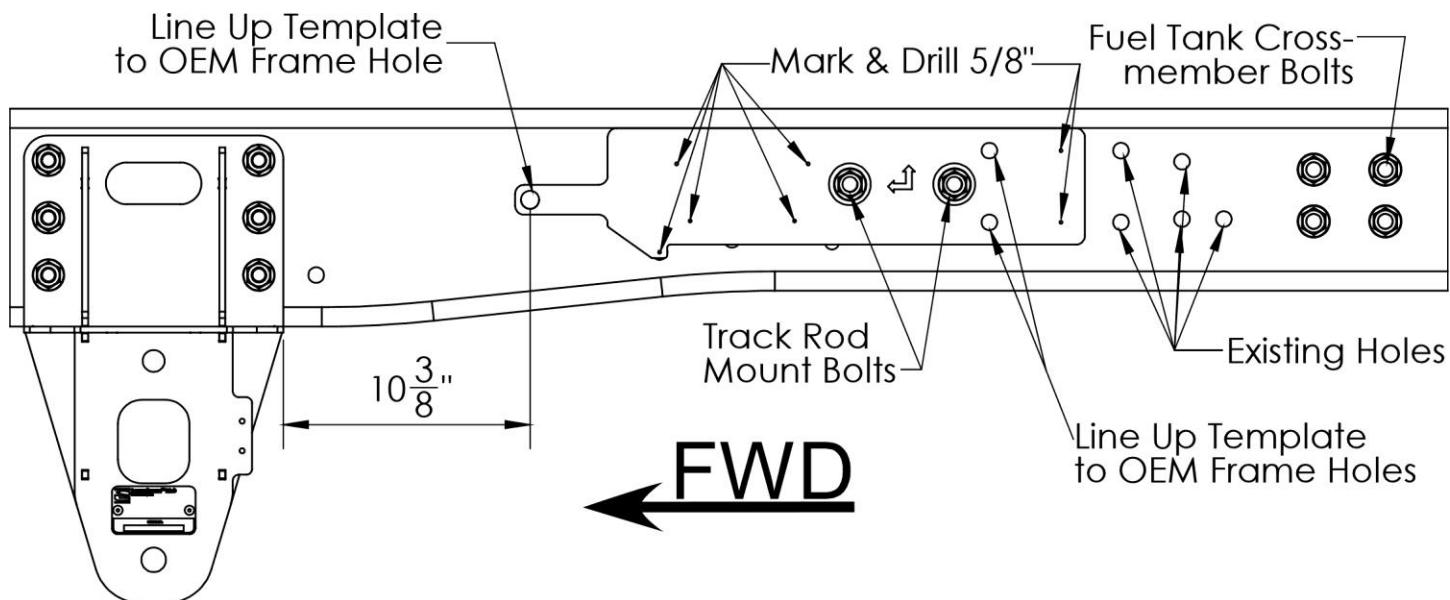


Figure A 3: Driver Side Upper Strut Mount Template Drilling

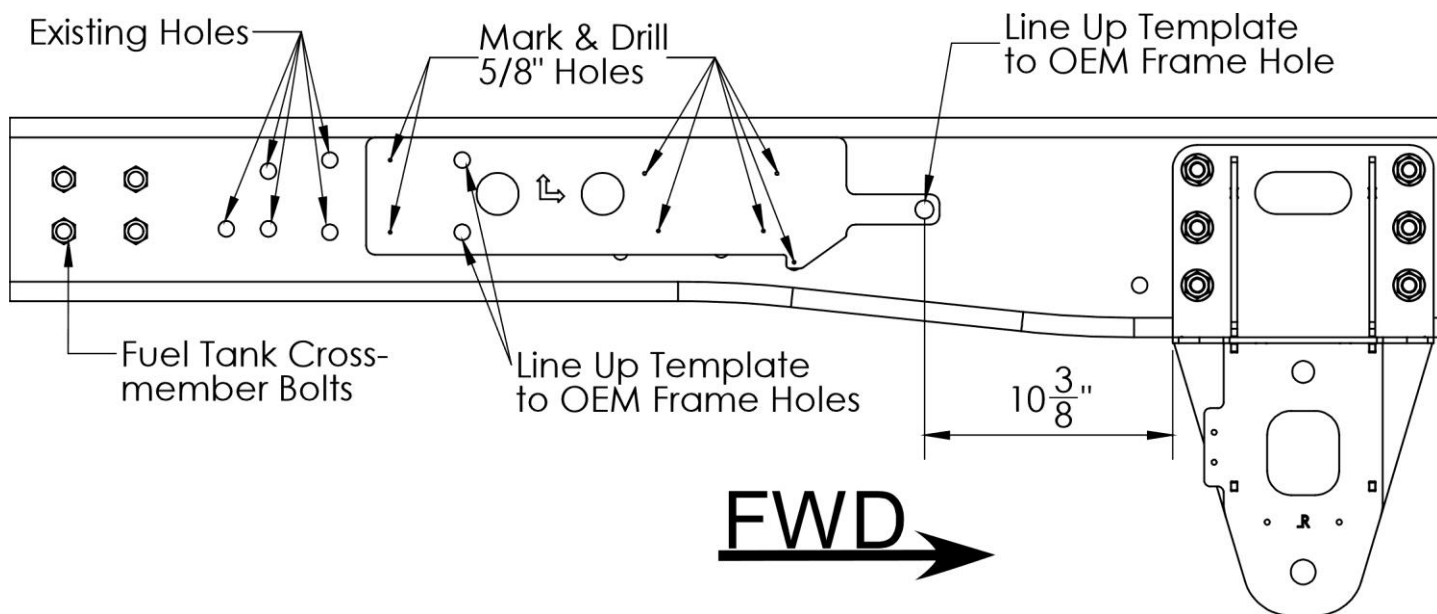


Figure A 4: Passenger Side Upper Strut Mount Template Drilling

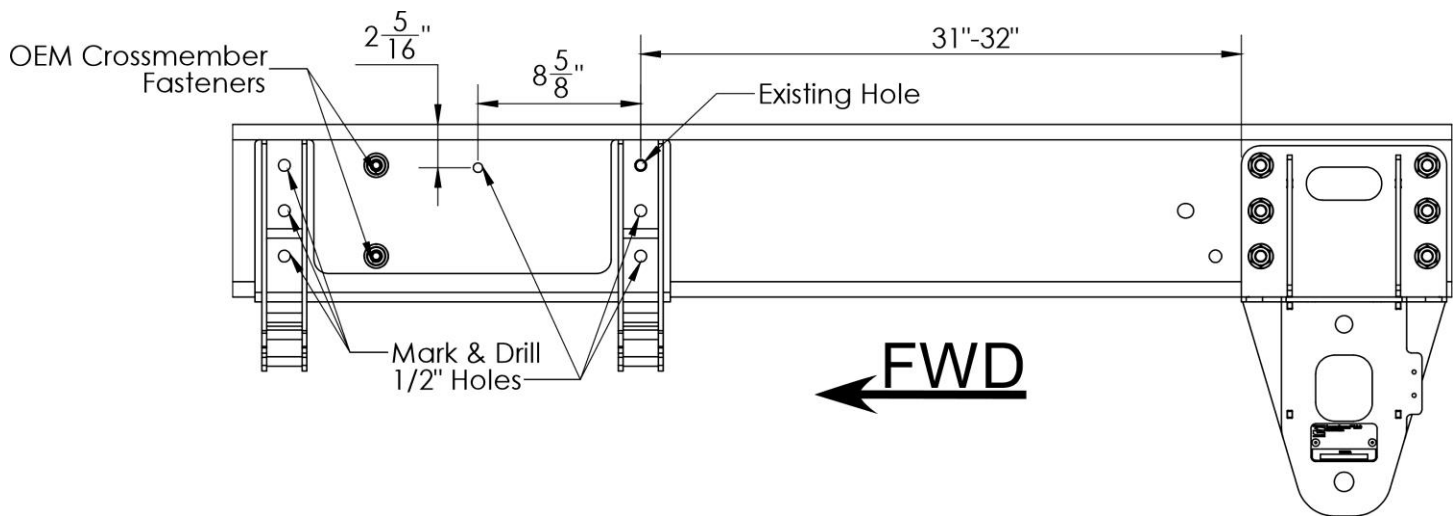


Figure A 5: Volume Mount Drilling

Appendix B: Wiring

The following accessories will need to be obtained for proper wiring. Parts can be found in the GM Upfitter UI Bulletin #115C.

Qty.	Description	Part Number
1	Service Connector	19328970
2	10ga Terminal	13575832
1	16ga Terminal	13578892



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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
- ☐ Upper Strut Mount and Secondary Volume Assy holes drilled.

FRONT HANGER INSTALLATION:

- ☐ Front Hangers are level with framerail.
- ☐ 5/8"-11 Nuts torqued to **172-210 ft-lbs.**

UPPER STRUT MOUNT/UPPER AND LOWER CROSSMEMBER:

- ☐ Upper Strut Mounts level with top of frame.
- ☐ Upper Cross member orientated correctly.
- ☐ Cross member Reinforcement orientated correctly.
- ☐ Bolts oriented per Installation Manual Views.
- ☐ 5/8"-11 Nuts torqued to **172-210 ft-lbs.**
- ☐ 1/2"-13 Nuts torqued to **86-105 ft-lbs.**

AXLE CLAMP INSTALLATION:

- ☐ 3/4"-16 U-Bolts torqued in stages up to **295 ft-lbs.**

CONTROL ARMS INSTALLATION:

- ☐ Lower Control Arms correctly orientated.
- ☐ 1"-8 Nuts torqued to **600 ft-lbs**, at ride height.
- ☐ 7/8"-9 Nuts torqued to **491-600 ft-lbs.** at ride height.

STRUT INSTALLATION:

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

JOUNCE BUMPER INSTALLATION:

- ☐ M10-1.5 Bolts torqued to **35 ft-lbs.**

HEIGHT SENSOR INSTALLATION:

- ☐ Sensor slid towards rear with bolt in front slot.
- ☐ M5 Fasteners torqued to **22 in-lbs. [2.5 Nm]**
- ☐ 5/16"-18 Fasteners torqued to **14-17 ft-lbs.**
- ☐ Locking Clips installed.

POWER MODULE/SECONDARY VOLUME INSTALLATION:

- ☐ 1/2"-13 Nuts torqued to **86-105 ft-lbs.**
- ☐ 3/8"-16 Screws torqued to **39 ft-lbs.**
- ☐ Reservoir Mount Self Tapping Screws tightened to **snug only.**
- ☐ 5/16"-24 Clamp Fasteners torqued to **240 in-lbs.**
- ☐ Parking brake line routed and re-connected.

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.

STEERING BRACKET & SENSOR INSTALLATION:

- ☐ M16 OEM bolt torqued to **245 ft-lbs. [335 Nm]**.
- ☐ 5/16"-18 Fasteners torqued to **14-17 ft-lbs.**
- ☐ Sensor positioned with M5 bolts in front slot (Slid towards rear).
- ☐ M5 Fasteners torqued to **22 in-lbs. [2.5 Nm]**
- ☐ Locking Clips installed.
- ☐ Steering clearances checked full left and right.

WIRING HARNESS INSTALLATION:

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

INITIAL FILL/CALIBRATION:

- ☐ Battery connected.
- ☐ Suspension rose to ride height.
- ☐ Reservoir at proper level.
- ☐ Calibration completed.