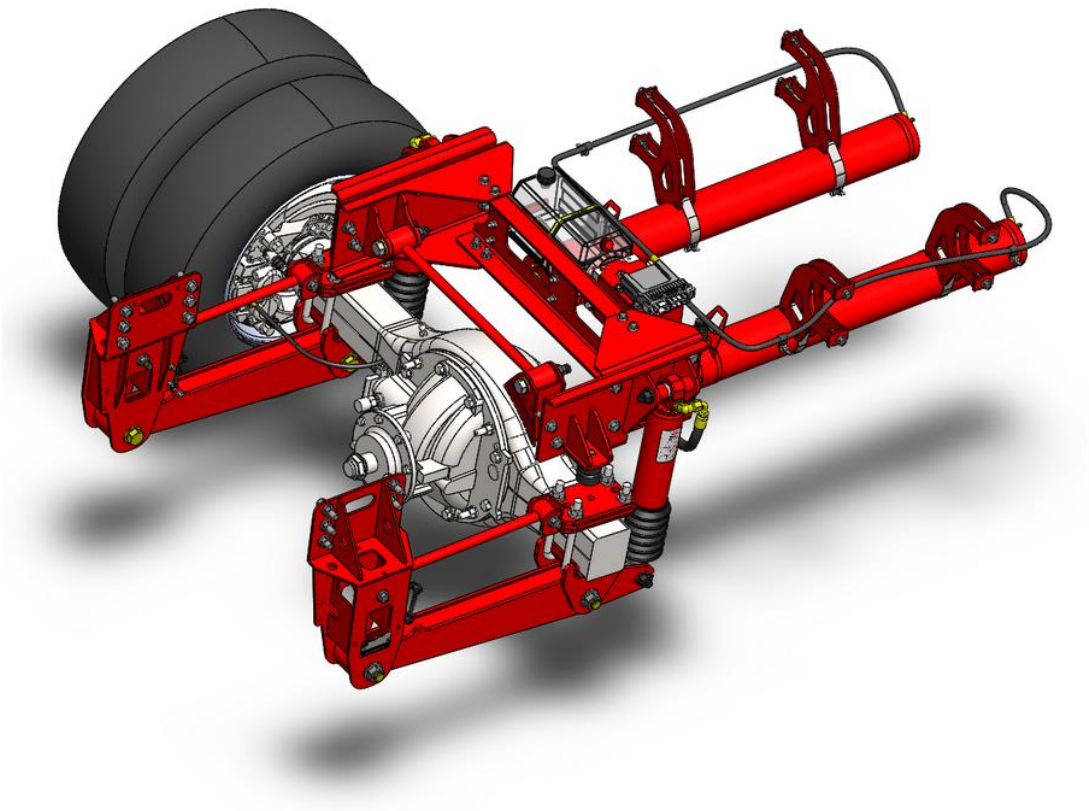
DS150FR

DS150FR-S

Drive Axle Rear Suspensions
for Freightliner M2 Chassis
with Leaf Springs



LIQUIDSPRING™ LLC

Installation / Maintenance Manual

D11205 Rev U 10/19

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Introduction

This manual provides installation information for the LiquidSpring **CLASS**® DS150FR series of rear axle suspension systems for the Freightliner M2 106, S2, and S2C series of 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 Application

LiquidSpring offers three (3) versions of the DS150FR line of suspensions:

Suspension	Application
DS150FR-S	Conversion of Leaf Spring version with under/behind cab mounted fuel tank.
DS150FR-SF	Conversion of Leaf Spring version with under/behind cab mounted fuel tank and shortened rear overhang.
DS150FR-SS / -SSA	Conversion of Leaf Spring version with under cab mounted fuel tank.

Suspension Rating

The LiquidSpring line of DS150FR suspensions can be used on the hydraulic brake versions of Freightliner M2 106 chassis. Suspension ratings are based on the OEM rear axle rating of each chassis:

Model	Freightliner M2 106, S2, S2C
DS150FR-S	15,000 lbs
DS150FR-SF	15,000 lbs
DS150FR-SS / -SSA	15,000 lbs

The rear axle GAWR with LiquidSpring DS150FR installed is the lessor of either the OEM original rear rating (as published) or the above suspension rating.

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

Serial Number Tag Information

The serial number is found on an aluminum tag (Figure 1) 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.

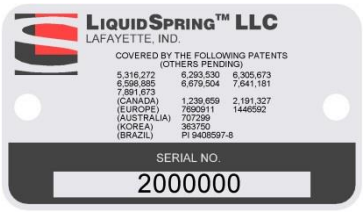


Figure 1. Serial Tag

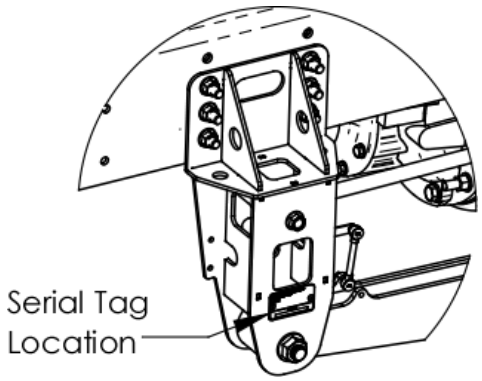


Figure 2. Serial Number Tag Location

Vehicle Towing and Jacking Information

Before attempting any type of towing procedures, the vehicle manufacturer 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. Appling 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
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
CHN	Castle Hex Nut
HTCN	Hex Thin Castle 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

Special Tools

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

Bleed Kit (Actron 7840 shown, others similar).

Gallon Hand Pump (Autotec 57429 shown, other similar)

Hydraulic Fitting Assembly

SAE O-Ring Adjustable Fittings

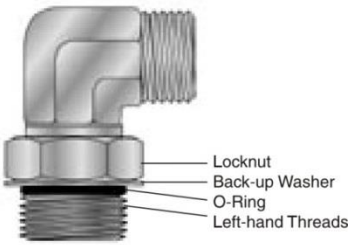


Figure 3. Adjustable SAE fitting

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.

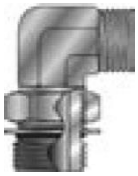


Figure 4. Locknut completely backed off.

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

Pre-Installation

1. Check the vehicle rear 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 rear tire-to-frame dimensions on each side prior to disassembly.

Frame Preparation

1. Chock the front tires.
2. Disconnect battery.
3. Jack up the rear frame of the vehicle to remove load from the rear suspension.
4. 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.

5. Remove the air leveling valves and air tanks.
6. Remove the OEM shock absorbers and mounts.
7. Remove the leaf springs and shackles, if present.
8. Remove any bump stop bolted on the outboard side of the frame, directly above the axle.
9. Remove the front spring hangers. Do not remove upper (2) bolts per side attaching the cross member to the frame. Do not remove cross members.
10. The rear shackle hanger or rear spring mounts can either be removed or left installed.
11. Remove any overload pads mounted outside the frame rail.
12. Locate the 10811-014 template.
13. Attach the frame as indicated in **Appendix A: Drill Locations, Page 57**.
14. Mark and drill (5) Ø21/32" holes as indicated.
15. Repeat with the passenger side.
16. Mark and drill (5) Ø21/32" hole as indicated.
17. See Secondary Volume Sections for additional frame drill locations.

Axle Preparation

Note: Freightliner M2 106's are equipped with either Meritor or Detroit rear axles. Mounts and templates for both axles are included in the kit and marked "Meritor" and "Detroit" for use with the respective axles.

1. Move any Parking Brake Cables and wiring from top of axle and position away from the the axle.
2. Remove the two axle differential bolts as shown in Figure 5.

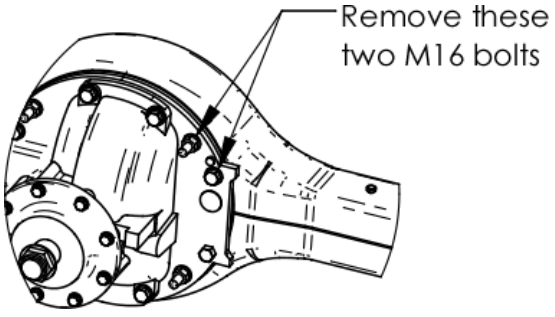


Figure 5. Removal of Axle Bolts.

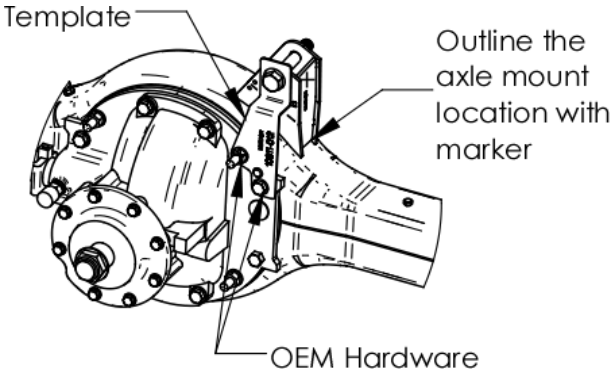


Figure 6, Position Axle Mount using Template

3. Temporarily attach the template to the axle using the two differential bolts. Using 5/8" hardware, fasten the Axle Mount to the template in the position shown in Figure 6.
4. Outline the axle mount with a visible paint marker.
5. Remove the axle mount from the axle and grind away the outlined area to bare metal.

Note: Make sure axle housing is free of paint 1/2" beyond the perimeter of the axle mount.

Note: Make sure the axle mount is free of powder coat 1/2" up from bottom edge around the perimeter.

6. Reattach the axle mount to the template after axle tube is clean and prepped for welding.
7. Tack weld all 4 sides of the axle mount to the axle housing as shown in Figure 7

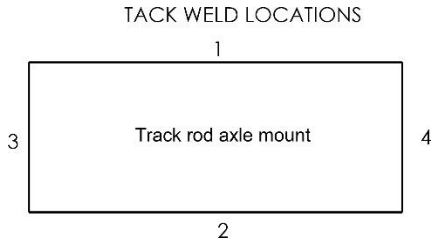


Figure 7. Tack Welding Axle Mount

8. Remove the template from the axle.
9. Position axle for a flat weld. The axle must be pivoted fore and aft for welding front and rear faces.

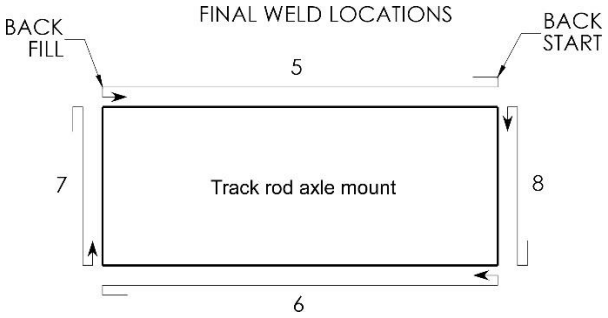


Figure 8. Final Welding on Axle Mount

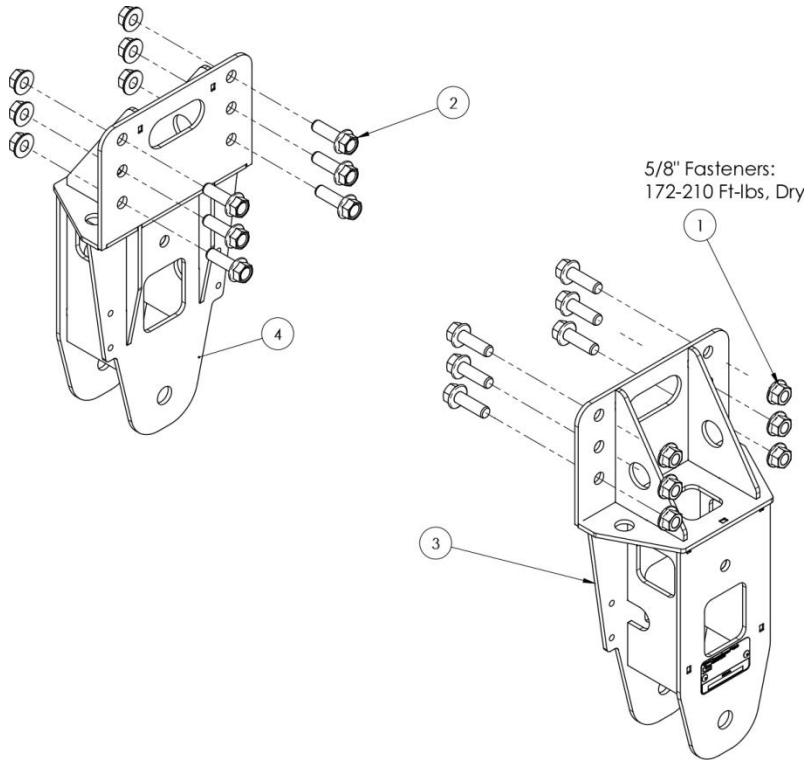
10. Beginning at the indicated location, back step the start of the weld from 0.315-0.512” to prevent a cold start.
11. Lay a full fillet in a single pass: Fillet size 0.375-0.50”.
12. Back fill the end of the weld 0.315-0.512” to eliminate craters.
13. Complete the welding on all sides of the bracket using Steps 9-12.
14. Once the axle has cooled, reinstall the two M16 differential bolts to the axle using sealant and torque to 140 ft/lbs.
15. Apply touch up paint to any bare metal showing on the axle mount and housing.

IMPORTANT: If welding equipment is not capable of welding a single pass as specified, multiple passes will be required.

Note: When welding multiple passes, the first pass should be centered over the fit-up line. The second pass should be placed slightly above the first. Blend the weld smoothly with the axle mount and the first pass. The third pass should penetrate the lower half of the second pass to the edge of the axle housing. When making the second and third passes the direction should be reversed. Refer to steps above for back start and back fill. Clean weld before each pass.

Installation

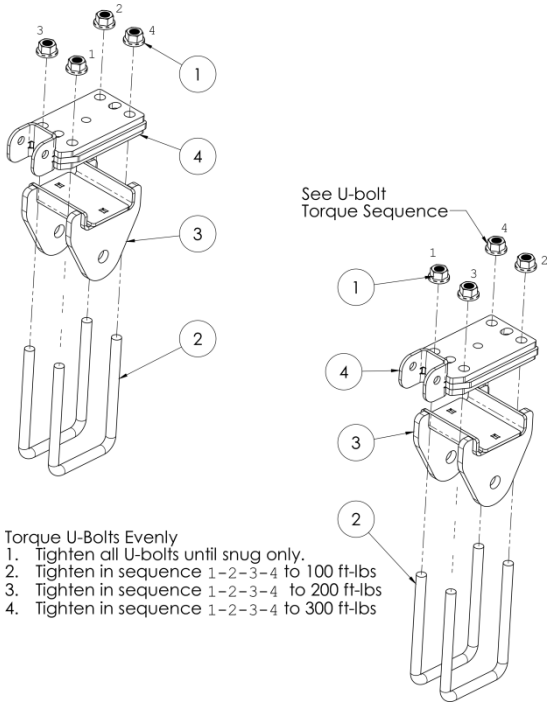
Front Hangers



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	12	10012-008	LFN 5/8-11 Gr G	3	1	11104-002	Left Hand Hanger
2	12	10874-200	HFB 5/8-11 x 2” Gr 8	4	1	11105-002	Right Hand Hanger

1. Install the Left Hand Hanger (with serial tag) to the driver side of the frame using the (6) 5/8”-11 x 2” Hex Flange Bolts and 5/8”-11 Locking Flange Nuts.
2. Verify that the hanger is level to the frame rail.
3. Torque to **172-210 ft-lbs**.
4. Repeat with Right Hand Hanger to the passenger side of the frame.

Axle Connection



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-012	LFN 3/4-16, Gr. G	3	2	10947-005	Lower Control Arm Mount
2	4	10064-005	U-Bolt 3/4-16 x 9.03 Tri-8	4	2	10949-003	Upper Control Arm Mount

1. Loosely install the Upper Control Arm Mount on to the axle with the UCA clevis forward. The mount should be flush with the top of the axle with the locating stud in the center hole. Refer to **Figure 9** for correct orientation.

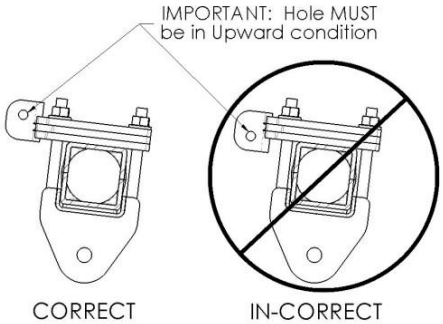


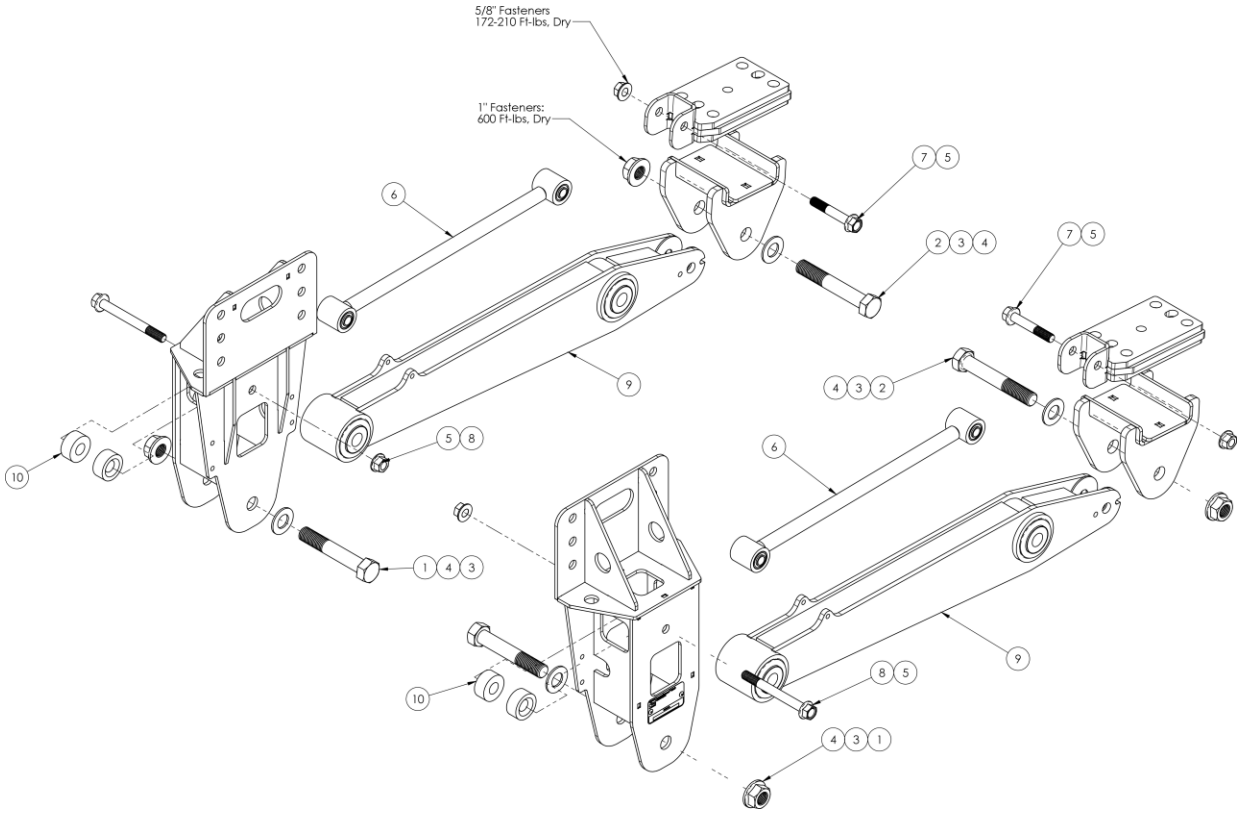
Figure 9. Control Arm Mount orientation.

2. Slip the Lower Control Arm Mount under the axle.
3. Slip the 3/4" U-Bolts under the LCA mount and secure using the 3/4" Locking Flange Nuts.
4. Snug down 3/4" Locking Flange Nuts.

   IMPORTANT: To aid control arm installation, do not torque until after control arms are installed.

5. Repeat for other side.

Control Arms



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10003-003	HCS 1-8 x 6.00 Gr 8	6	2	10570-006	Upper Control Arm
2	2	10003-004	HCS 1-8 x 6.50 Gr 8	7	2	10874-375	HFB 5/8-11 x 3.750 Gr 8
3	4	10006-004	HFW 1	8	2	10874-600	HFB 5/8-11 x 6" Gr. 8
4	4	10012-003	LFN 1-8 Gr G	9	2	10953-005	Lower Control Arm
5	4	10012-008	LFN 5/8-11 Gr G	10	4	11689-001	Spacer, Plastic, M2

1. Install Plastic Spacers in Front Hanger, refer to **Figure 10.**

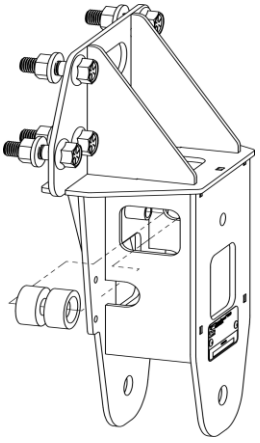


Figure 10: Insertion of Plastic Spacers in Front Hanger

2. Loosely install the Upper and Lower Control Arms as shown above.

   Note: Orientate Lower Control Arms with height sensor linkage tabs pointing upward.

   IMPORTANT: Fasteners inserted into the axle mount must be orientated towards the outboard as shown. Fasteners inserted into the front hanger can be orientated either direction.

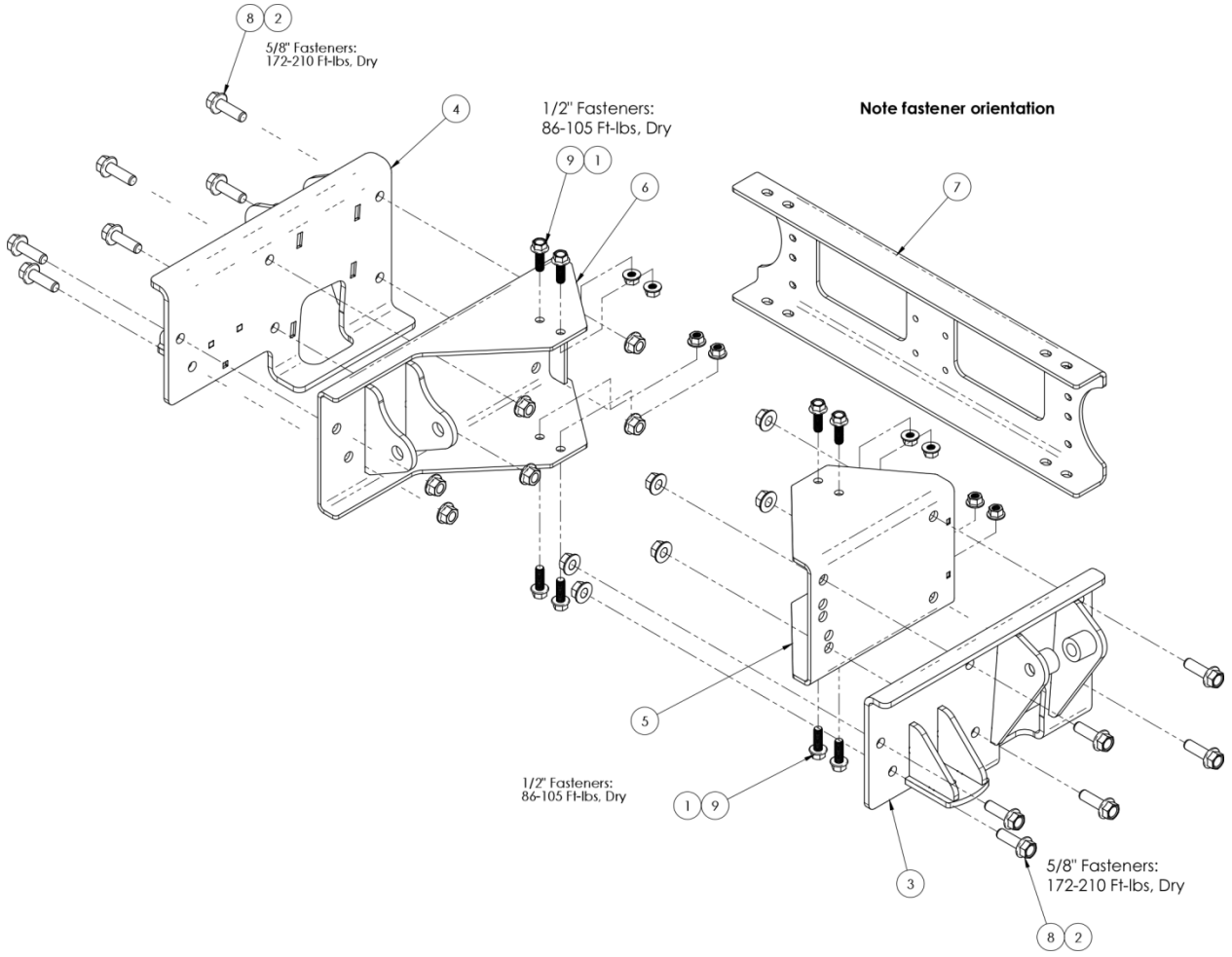
   IMPORTANT: Verify that the 1"-8 x 6-1/2" Hex Cap Screw is used to attach the Lower Control Arm to the LCA mount at the axle and that the 1"-8 x 6" Hex Cap Screw is used to attach the LCA to the Hanger.

3. Torque U-Bolts as specified in **Axle Connection** Section.

4. Do not tighten control arm fasteners until track rod is in place and axle is raised to ride height.

   Note: The axle must be held at ride height before applying the final torque to the control arm bolts to prevent preloading the bushings.

Upper Strut Mounts



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-007	LFN 1/2-13 Gr G	6	1	10795-011	Cross-member Mount, RH
2	12	10012-008	LFN 5/8-11 Gr G	7	1	10796-007	Cross-member Channel (-S, -SS, -SF, -SEP)
3	1	10790-020	Upper Strut Mount, LH			10796-014	Crossmember Channel (-SEPB Only)
4	1	10790-021	Upper Strut Mount, RH	8	12	10874-200	HFB 5/8-11 x 2” Gr 8
5	1	10795-008	Cross-member Mount, LH	9	8	10885-150	HFB 1/2-13 x 1-1/2” Gr 8

1. Loosely attach the Left Hand Upper Strut Mount and Left Hand Cross-member Mount to the frame located just behind and above the rear axle using (6) 5/8”-11 x 2” Hex Flange Bolts and (6) 5/8”-11 Locking Flange Nuts. Refer to **Figure 11**.
2. Loosely attach the Right Hand Upper Strut Mount and Right Hand Cross-member Mount to the frame using (6) 5/8”-11 x 2” Hex Flange Bolts and (6) 5/8”-11 Locking Flange Nuts. Refer to **Figure 12**.

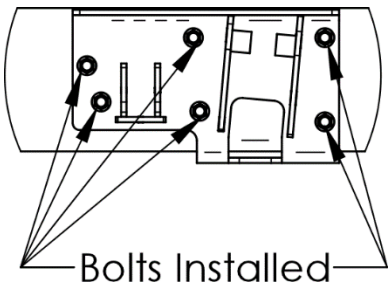


Figure 11. Driver Side (LH) Upper Strut Mount Installation.

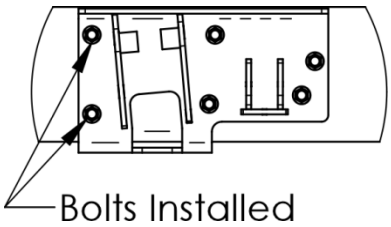
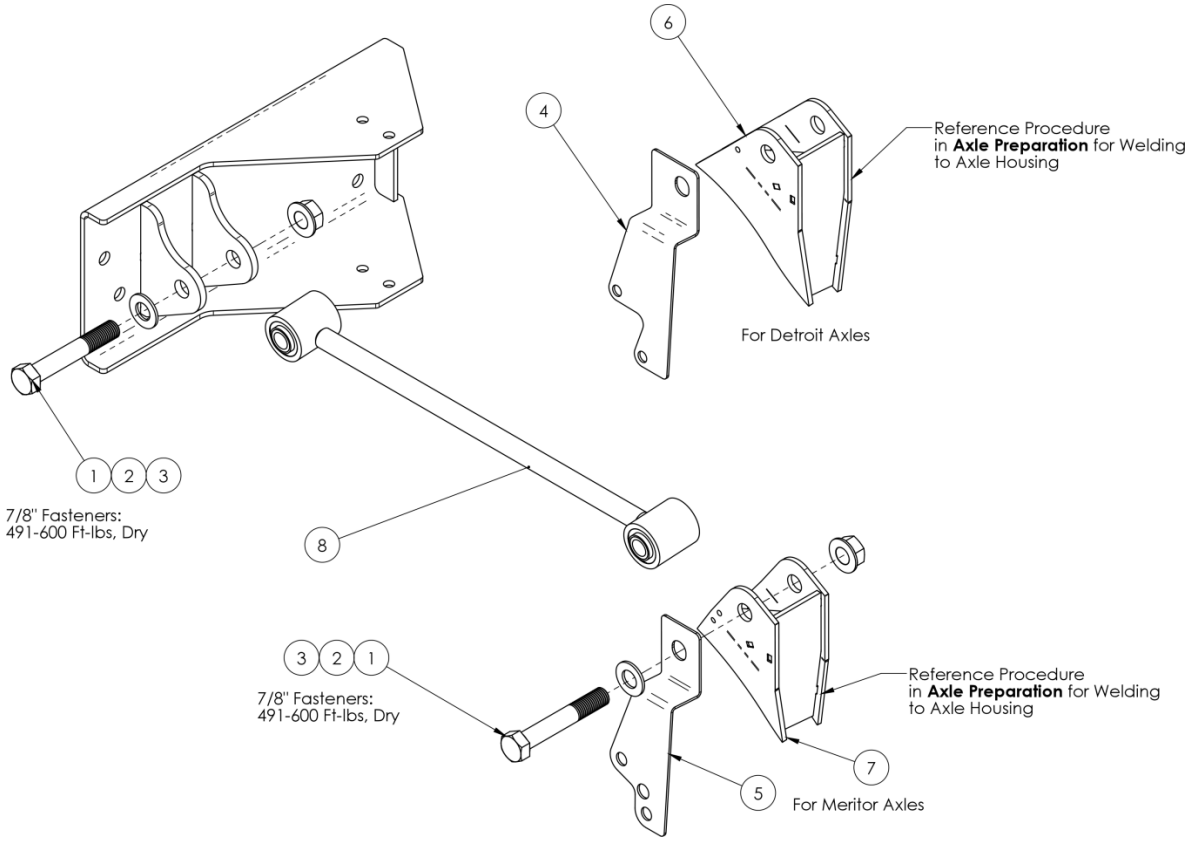


Figure 12. Passenger Side (RH) Upper Strut Mount Installation.

3. Install the Cross-member Channel inside of the mounts using the 1/2”-13 x 1-1/2” Hex Flange Bolts and 1/2”-13 Locking Flange Nuts.
4. Torque all 5/8” fasteners to **172-210 ft-lbs.**
5. Torque all 1/2” fasteners to **86-105 ft-lbs.**

Track Rod



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10002-550	HB 7/8”-9 x 5-1/2” Gr. 8	5	1	10811-012	Mount Template, Meritor
2	2	10006-003	HFW 7/8”	6	1	10951-004	Track Rod Mount, Detroit
3	2	10012-017	LFN 7/8”-9 Gr G	7	1	10951-005	Track Rod Mount, Meritor
4	1	10811-011	Mount Template, Detroit	8	1	11198-001	Track Rod Assembly

1. Loosely attach the Track Rod Assembly to the Track Rod Axle Mount and to the Frame Mount.
2. Jack each side of the axle until approximately design ride height position. See Error! Reference source not f ound..

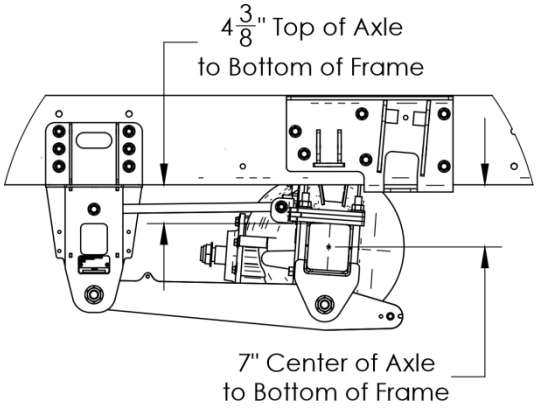
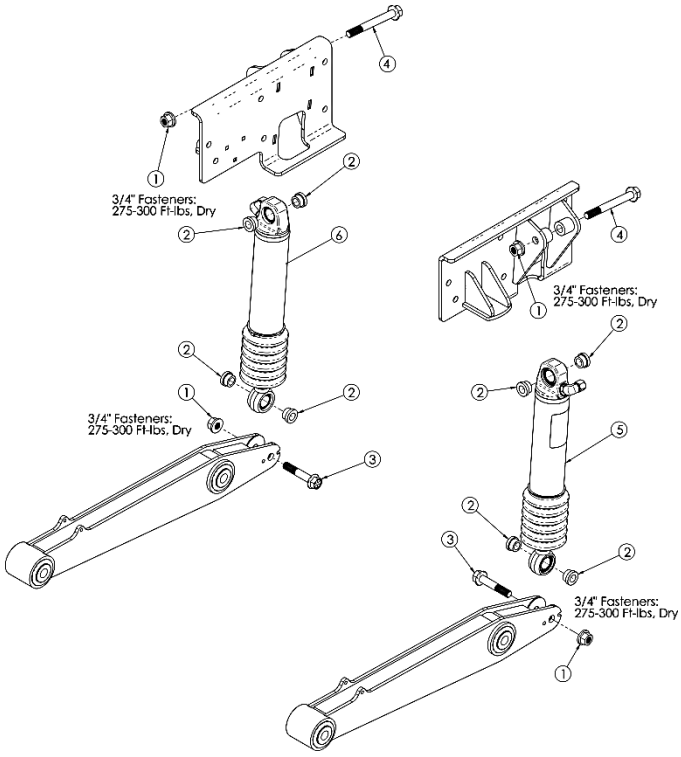


Figure 13. Lift to Design Ride Height.

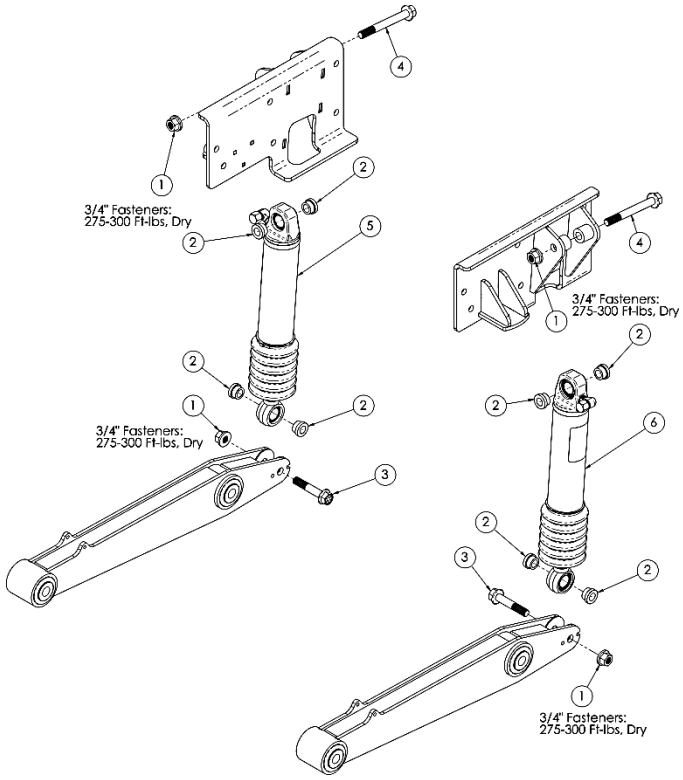
3. Torque the two (2) 7/8” Track Rod mounting bolts to **491-600 ft-lbs.**
4. Torque the eight (4) 1” Control Arm mounting bolts to **600 ft-lbs.**
5. Torque the four (4) 5/8” Control Arm mounting bolts to **172-210 ft-lbs.**

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

Struts



DS150FR-S Strut Installation



DS150FR-SF Strut Installation

DS150FR-SS / -SSA Strut Installation

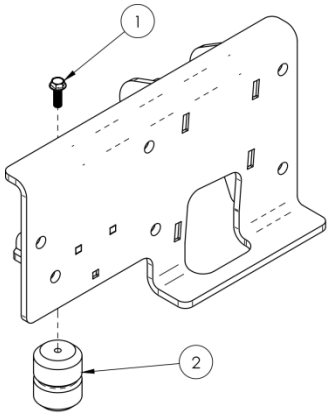
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-014	LFN 3/4-10 Gr G	4	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
2	8	10640-005	Bearing Spacer 1.24x.812x.318	5	1	11057-003	Asy, Strut (Port pointing right)
3	2	11102-400	HFB 3/4-10 x 4 Gr 8	6	1	11057-004	Asy, Strut (Port pointing left)

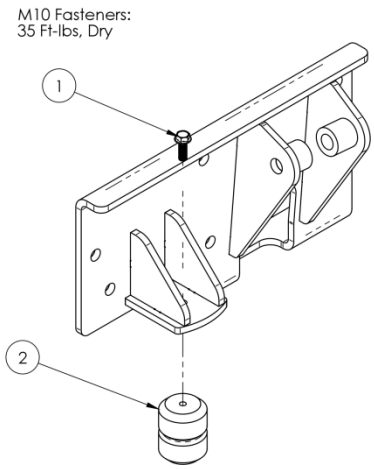
1. Install the Left Hand Strut assembly as shown making sure to install bearing spacers on both upper and lower mounts.

   Note: Verify Hydraulic port is pointed rearward on DS150FR-S and forward on the DS150FR-SF and DS150FR-SS.

2. Repeat for installation of Right Hand Strut assembly.
3. Torque upper and lower strut mounts to **275-300 ft-lbs.**

Jounce Stops

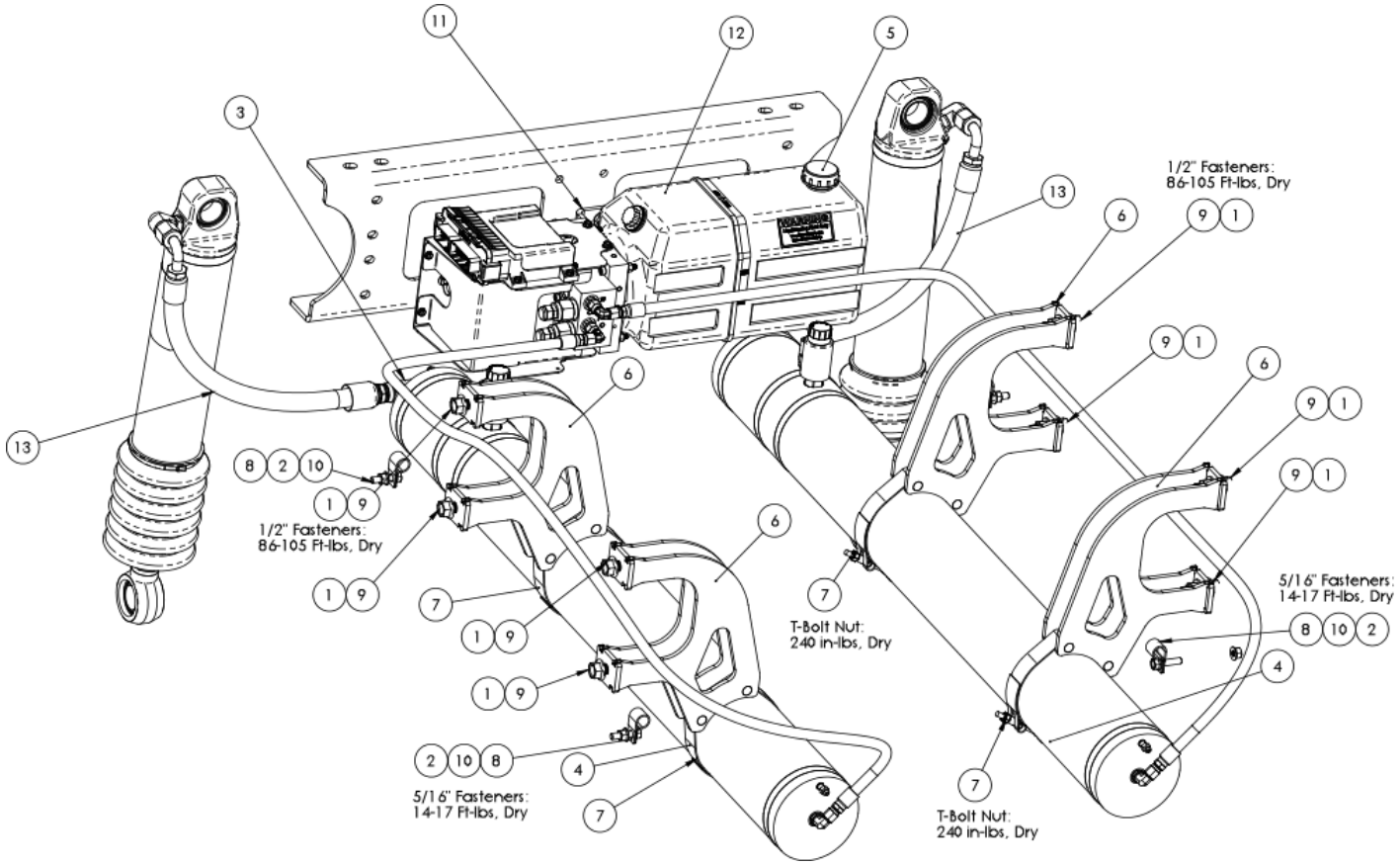




ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10502-001	HFB M10-1.5 x 30 CL 10.9	1	2	10867-003	Jounce Bumper 2.375" OD x 3.00" T

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

Secondary Volumes [DS150FR-S]



ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-007	LFN 1/2-13 Gr G
2	4	10012-010	LFN 5/16-18 Gr G
3	2	10322-010	Hyd. Fitting 90 -10 37 x -10 37 F
4	2	10597-047	Volume Asy
5	1	10614-001	Cap, Filler/Breather
6	4	10830-017	Volume Mount
7	4	10843-003	T-Bolt Clamp

ITEM	QTY	PART NUMBER	DESCRIPTION
8	4	10855-003	Vinyl Coated Loop 5/8" ID
9	8	10885-150	HFB 1/2"-13 x 1-1/2" Gr 8
10	4	10886-125	HFB 5/16"-18 x 1-1/4" Gr 8
11	1	11109	Kit, Power Module Mounting
12	1	11287-004	Asy, Power Module, M2
13	2	11458-019	Asy, Hose -10 x 19" L

1. Using the dimensions given in **Figure 57**, drill (4) Ø9/16" holes per side for the volume mounts.
2. Locate (2) Volume Mounts.
3. Attach Volume Mounts to the inside of the frame rails, behind the rear axle, using the 3/8"-16 x 1" Hex Flange Bolts and 3/8"-16 Locking Flange Nuts.

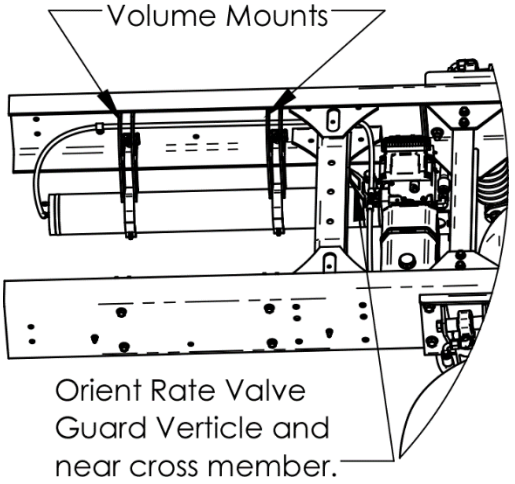


Figure 14. Installation of Volume Mounts.

4. Torque the 1/2”-13 fasteners to **85-105 ft-lbs**.
5. Locate (2) T-Bolt Clamps, open the mounts, and place them in the mounts, around the two pegs.

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.

6. Lift the tank into the tank mounts.

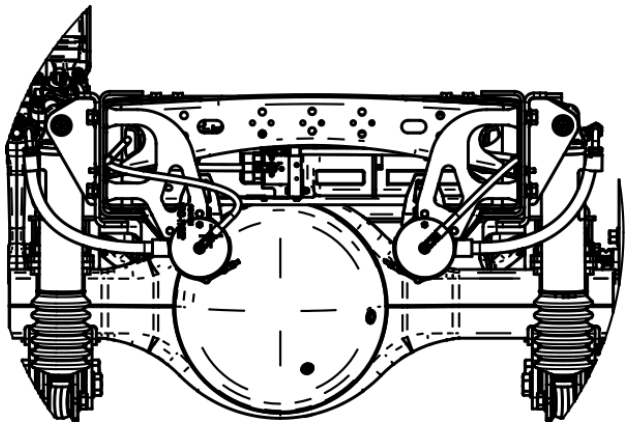
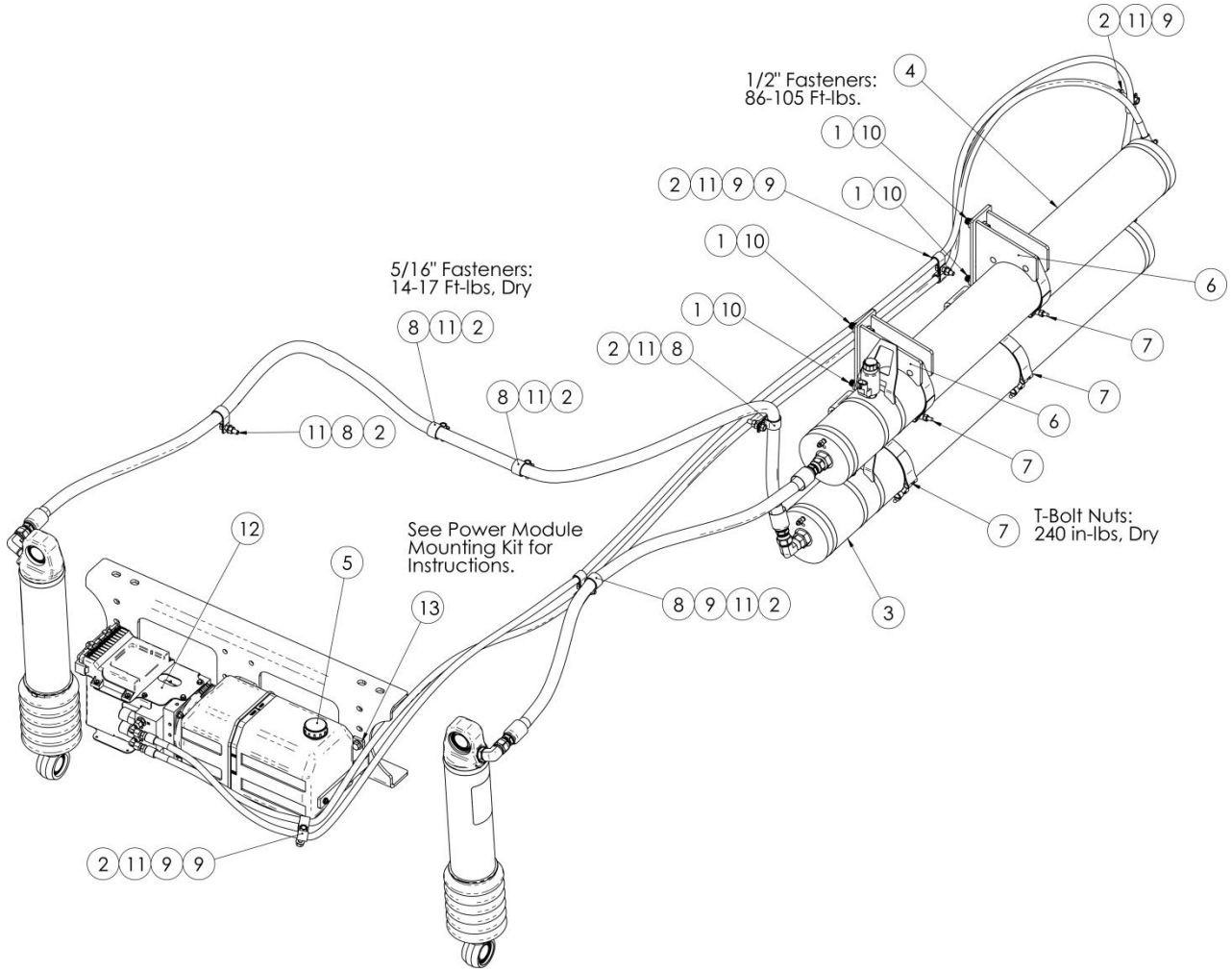


Figure 15. Rear view of volumes installed.

7. Secure both clamps around the volume and torque the T-Bolt nut to **240 in-lbs**.
8. Repeat with the other side.

Secondary Volumes [DS150FR-SF]



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-007	LFN 1/2”-13 Gr G	8	5	10855-002	Vinyl Coated Loop Clamp, 1” ID
2	8	10012-010	LFN 5/16”-18 Gr G	9	7	10855-003	Vinyl Coated Loop Clamp, 5/8” ID
3	1	10597-069	Volume Assembly, LH	10	4	10885-150	HFB 1/2”-13 x 1-1/2” Gr. 8
4	1	10597-070	Volume Assembly, RH	11	8	10886-125	HFB 5/16”-18 x 1-1/4” Gr 8
5	1	10614-001	Cap, Filler/Breather	12	1	11287-004	Power Module Asy M2
6	2	10830-019	Volume Mount	13	1	11109	Power Module Mount Kit
7	4	10843-003	T-Bolt Clamp				

1. Locate the (2) Volume Mounts.
2. Place the mounts against the driver side frame, forward of the front hanger. **Figure 58**, in **Appendix A: Drill Locations,** shows the suggested locations

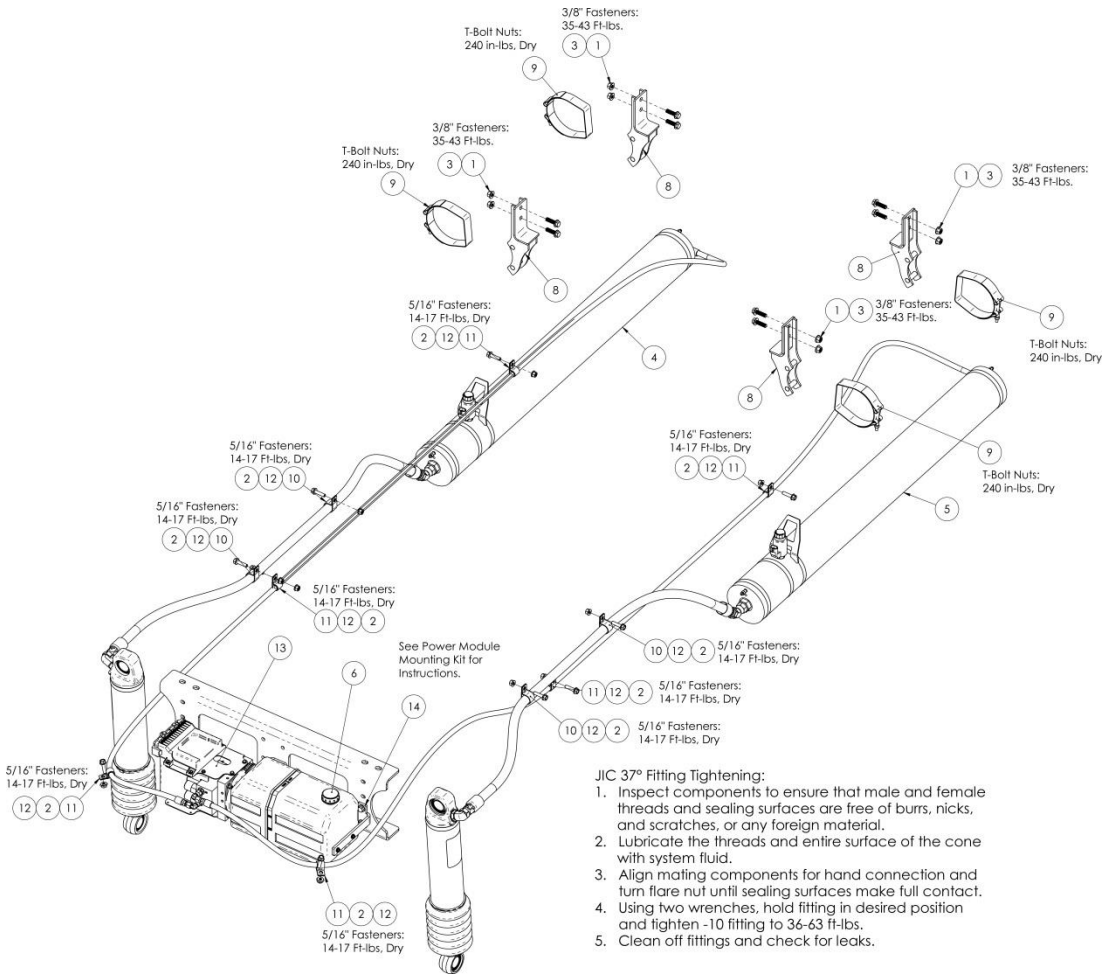
Important: Locate the mounts such that the distance between two mounts as wide as possible. Avoid partially drilling through existing frame holes and inside fuel line mounts.

3. 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) Ø9/16” holes per mount.
4. Attach the two mounts with 1/2” Flange Bolts and Nuts. Torque to **86-105 ft-lbs**.
5. Locate the Right Hand Volume Assembly, which includes the shorter -10 hydraulic hose attached.

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.

6. Raise the volume assembly until the volume contacts both mounts, in the top-most location. Rotate the volume assembly until the bleed screws are located to the top and as vertical as possible.
7. Locate (2) T-Bolt Clamps, open the clamps, and place them in the mounts around the two pegs.
8. Secure both clamps around the volume and torque the T-Bolt nut to **240 in-lbs**.
9. Locate the Left Hand Volume Assembly, which includes the longer -10 hydraulic hose.
10. Raise the volume assembly until the volume contacts both mounts. Rotate the volume until the bleed screws are located to the top and as vertical as possible.
11. Locate (2) T-Bolt Clamps, open the clamps, and place them in the mounts around the two pegs.
12. Secure both clamps around the volume and torque the T-Bolt nut to **240 in-lbs**.

Secondary Volumes [DS150FR-SS / -SSA]



ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-005	LFN 3/8"-16 Gr G, Z
2	10	10012-010	LFN 5/16"-18 Gr G
3	8	10501-002	HFB 3/8-16 x 1.250, Gr 8, BO
4	1	10597-071	Volume Assembly, LH
5	1	10597-072	Volume Assembly, RH
6	1	10614-001	Cap, Filler/Breather
7	1	10830-015	Wldmnt, Volume Mount (-SS)
		10830-013	Wldmnt, Volume Mount (-SSA)

ITEM	QTY	PART NUMBER	DESCRIPTION
8	4	10843-003	T-Bolt Clamp, Range 4.88-5.5
9	4	10855-002	Vinyl-Coated Loop Clamp, 1" ID
10	4	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
11	6	10886-125	HFB 5/16"-18 x 1-1/4" Gr 8
12	10	11287-004	Power Module Asy M2
13	1	11109	Power Module Mount Kit

1. Locate (4) Volume Mounts.
2. Place the mounts against the driver side frame, forward of the front hanger. **Figure 59**, in **Appendix A: Drill Locations,** shows the suggested locations

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

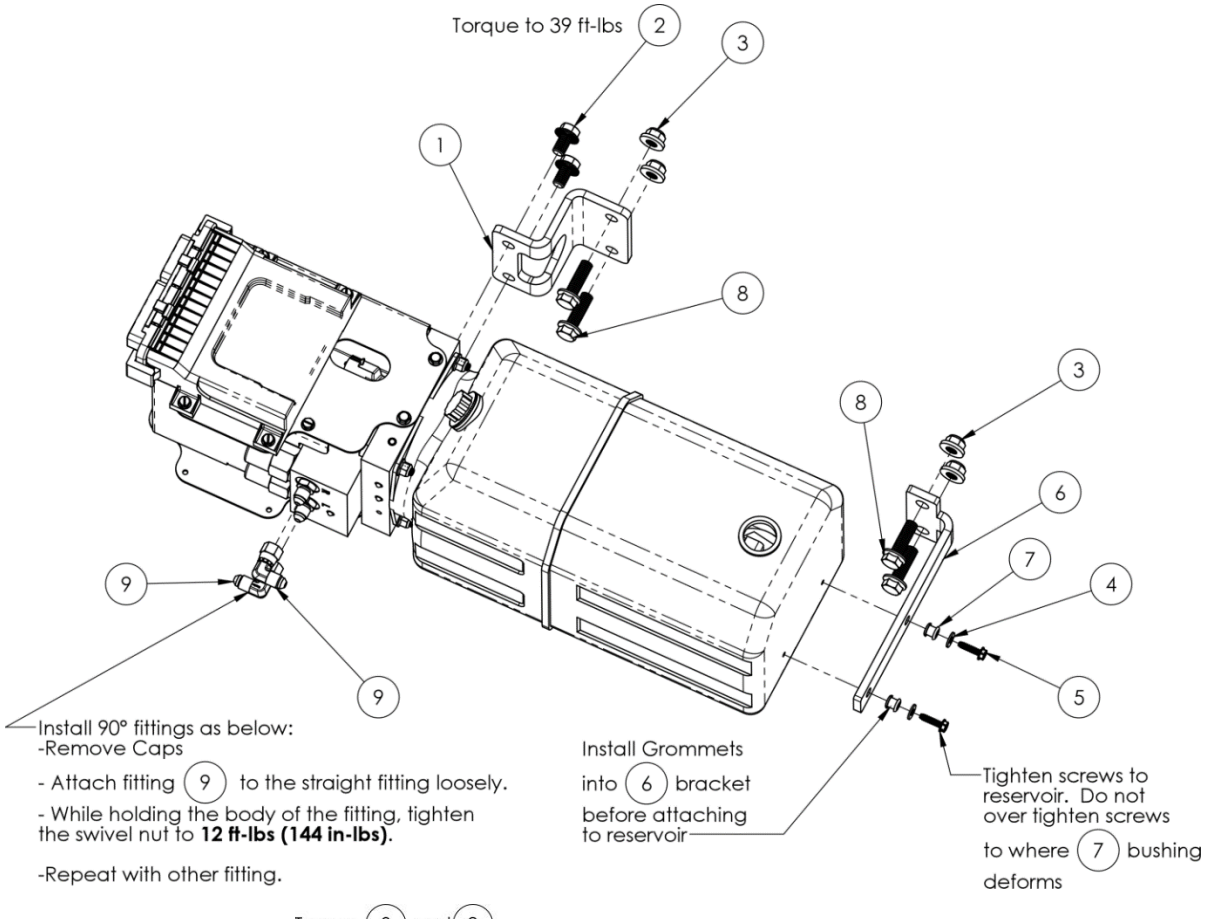
3. Verifying the mounts are held flush to the bottom of the frame and utilizing the mount hole pattern, mark the locations of the mounting holes and drill (2) Ø7/16" holes per mount.
4. Attach the two mounts with 3/8" Flange Bolts and Nuts. Torque to **35-43 ft-lbs**. Note: Orientate nuts outboard.
5. Repeat with Volume Mounts on the passenger side of the frame. **Figure 59,** in **Appendix A: Drill Locations**, shows the suggested locations.

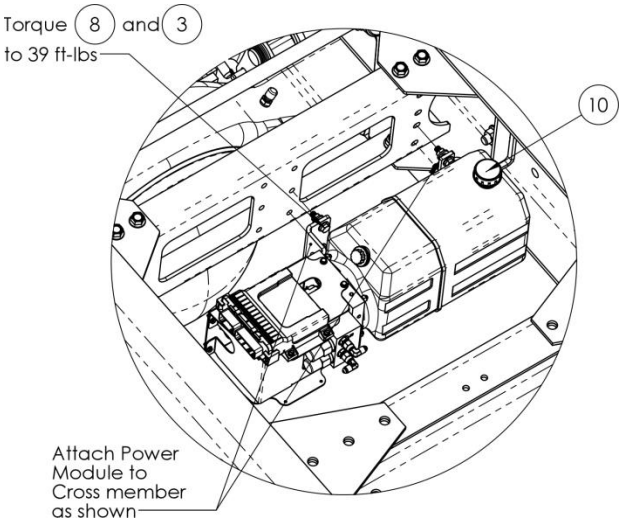
6. Locate the Left Hand Volume Assembly.

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.

7. Raise the volume assembly until the volume contacts both mounts. Rotate the volume assembly until the bleed screws are located to the top and as vertical as possible.
8. Locate (2) T-Bolt Clamps, open the clamps, and place them in the mounts around the two pegs.
9. Secure both clamps around the volume and torque the T-Bolt nut to **240 in-lbs**.
10. Locate the Right Hand Volume Assembly.
11. Raise the volume assembly until the volume contacts both mounts. Rotate the volume until the bleed screws are located to the top and as vertical as possible.
12. Locate (2) T-Bolt Clamps, open the clamps, and place them in the mounts around the two pegs.
13. Secure both clamps around the volume and torque the T-Bolt nut to **240 in-lbs**.

Power Module





ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10799-015	Power Module Manifold Mount	6	1	10798-015	Power Module Reservoir Mount
2	2	10252-003	SFHS 3/8”-16 x 5/8” Gr 8	7	2	10805-007	Grommet
3	4	10012-011	LFN 3/8”-16 Gr G	8	4	10501-002	HFB 3/8”-16 x 1-1/4” Gr 8
4	2	10088-001	FW #10	9	2	10322-021	Hyd. Fit. 90, -4 37 x -4 37 F
5	2	10510-002	STS #10-16 x 3/4” Hex Head	10*	1	10614-001	Cap, Filler/Breather

*P/N 10614-001 is included in the main kit.

1. Locate the Power Module Assembly and the Power Module Mounting Kit.
2. Attach the Manifold Mount to the Power Module as shown above using the 3/8”-16 x 5/8” Serrated Flange Hex Screws. Torque to **39 ft-lbs**.
3. Insert the grommets into the Reservoir Mount and attach it to the back of the plastic reservoir as shown above using the #10 Flat Washers and #10-16 x 3/4” Self Tapping Screws. **Do not over tighten to where the grommets deform.**
4. Attach the Power Module to the Cross-member Channel as shown above using 3/8”-16 x 1-1/4” Hex Flange Bolts and 3/8”-16 Locking Flange Nuts. Torque to **39 ft-lbs.**
5. Remove the red plug from the top of the reservoir and install the Filler/Breather Cap.

Hose Attachment & Routing [DS150FR-S]

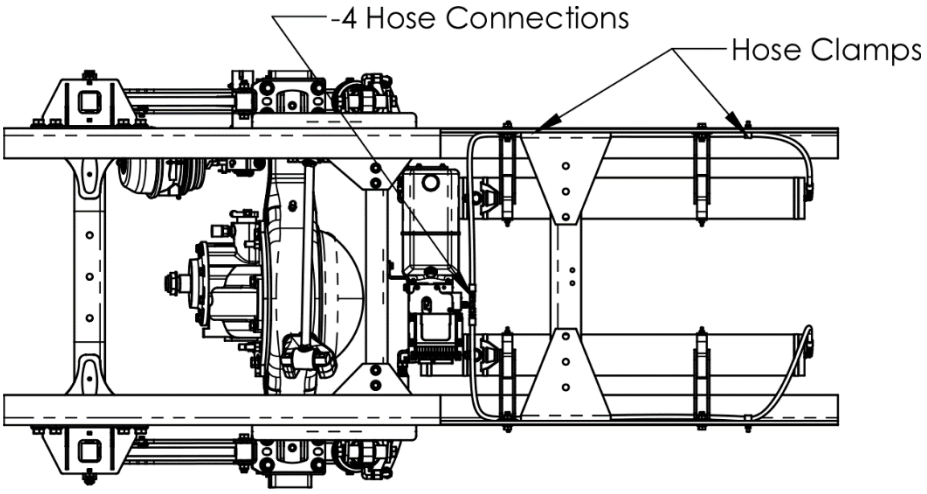


Figure 16. DS150FR-A -4 Hose Routing (Top View)

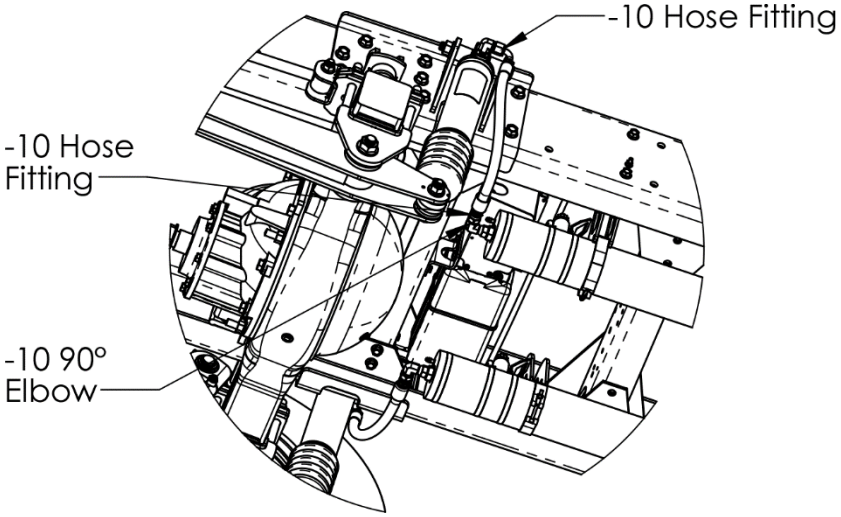


Figure 17. DS150FR-A -10 Hose Routing (Bottom View)

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

1. 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.
2. 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.

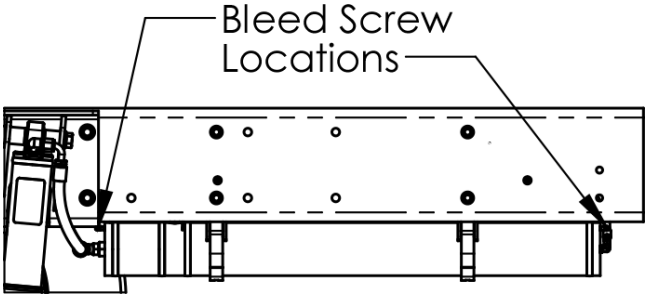


Figure 18. Bleed screw locations.

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

4. After pressure is relieved, close the bleed screw and torque to **13-18 ft-lbs.**
5. Locate -10 hose and -10 JIC 90° Elbow Hydraulic Fitting.
6. Remove the cap from the elbow fitting on the strut.
7. Loosely attach the elbow hose end (90° -10 JIC fitting) to the strut port.
8. Loosely attach the 90° elbow fitting to the opposite end of the hose (with the straight -10 JIC fitting).
9. Place a bucket or oil absorbent mat under the capped end of the secondary volume.
10. Remove the -10 cap from the volume and attach the -10 elbow.
11. Tighten all the -10 fittings to **36-63 ft-lbs**.
12. Repeat with the opposite side.

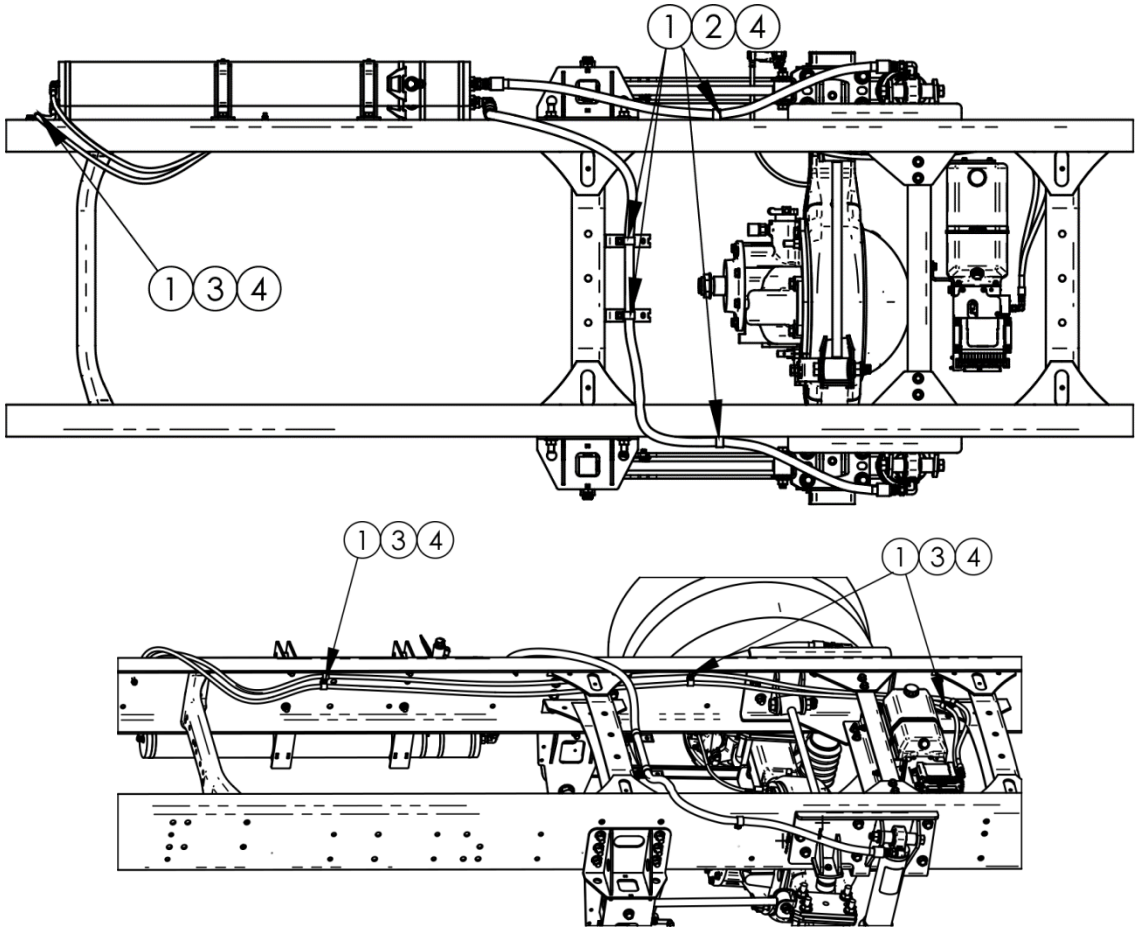
CAUTION: Make sure the hose is not chafing or in contact with any sharp edges.

13. 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.
14. Open the bleed screw slightly to relieve any residual pressure.
15. After pressure is relieved, close the bleed screw and torque to **13-18 ft-lbs.**
16. 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.

17. Remove the plug from the hose end.
18. Attach the hose end to the fitting in the port marked "L". Torque to **12 ft-lbs. Do not over tighten.**
19. Repeat with the opposite side.
20. Attach the hose end to the fitting in the port marked "R". Torque to **12 ft-lbs. Do not over tighten.**
21. Clean up any fluid spillage.

Hose Attachment & Routing [DS150FR-SF]



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10012-010	LFN 5/16”-18 Gr G	3	3	10855-003	Vinyl Coated Loop Clamp, 5/8” ID
2	4	10855-002	Vinyl Coated Loop Clamp, 1”ID	4	2	10886-100	HFB 5/16-18 x 1.000” Grade 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 Left Hand strut area, as shown above.
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.

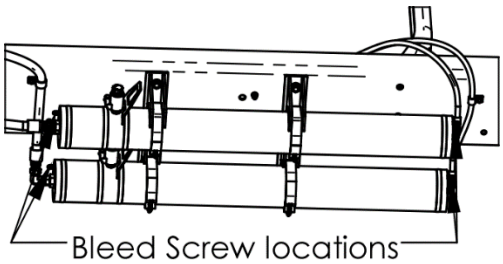


Figure 19. Bleed screw locations.

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 above. Drill attaching Ø3/8" holes as necessary.
13. Repeat with the opposite side.

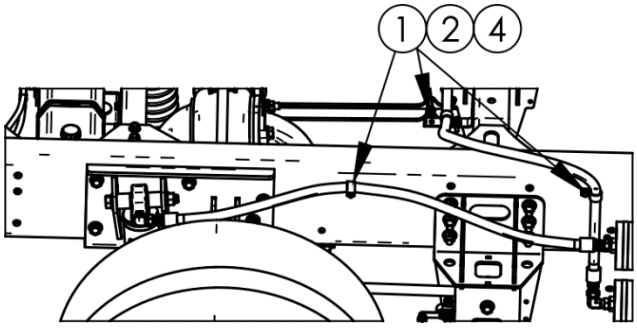


Figure 20. Passenger Side -10 hose routing.

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. 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.

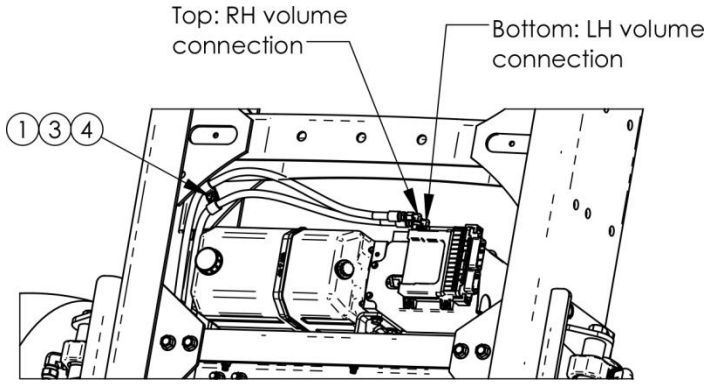
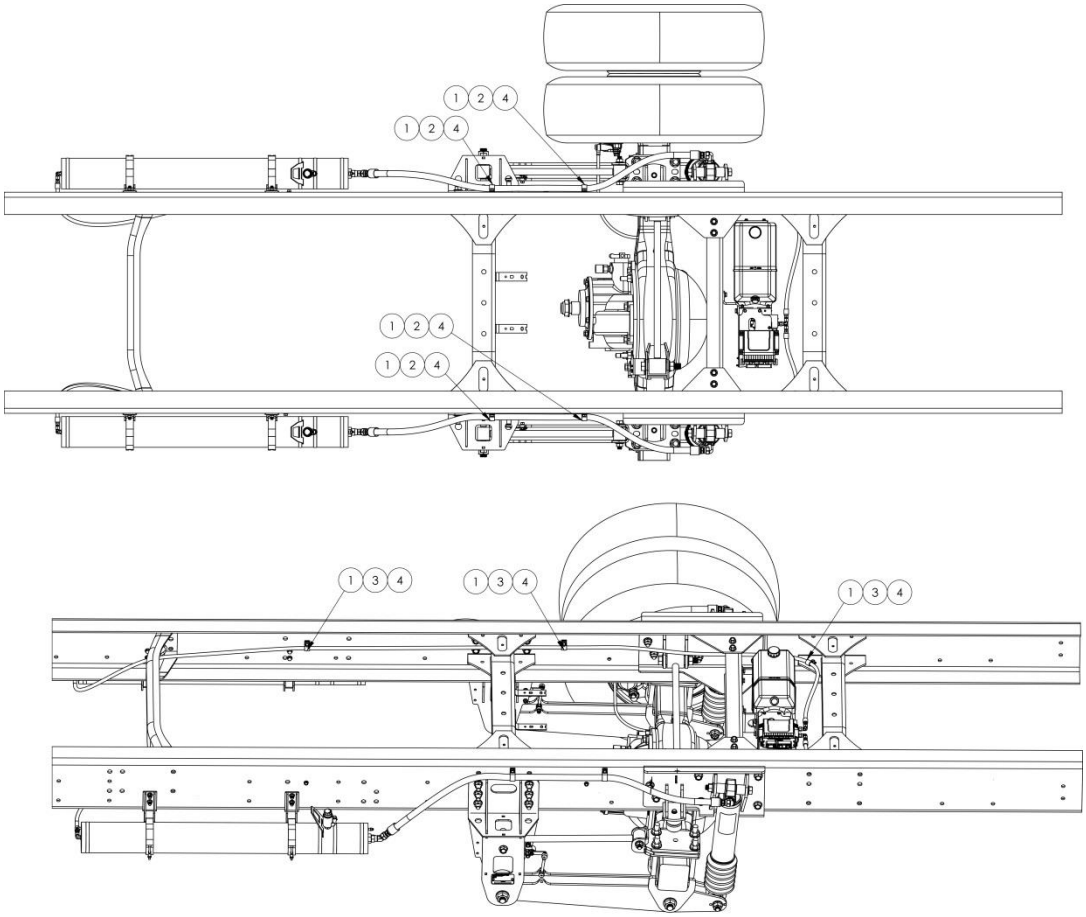


Figure 21. Driver side and Passenger side -4 Hose routing.

19. Remove the plug from the hose end.
20. Attach the hose end to the fitting in the port marked "L". Torque to **12 ft-lbs. Do not over tighten.**
21. Repeat with the opposite side.
22. Attach the hose end to the fitting in the port marked "R". Torque to **12 ft-lbs. Do not over tighten.**
23. Clean up any fluid spillage.

Hose Attachment & Routing [DS150FR-SS / -SSA]



* Driver Side has same hose routing as Passenger side

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	10	10012-010	LFN 5/16”-18 Gr G	3	6	10855-003	Vinyl Coated Loop Clamp, 5/8” ID
2	4	10855-002	Vinyl Coated Loop Clamp, 1”ID	4	10	10886-100	HFB 5/16-18 x 1.000” Grade 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.

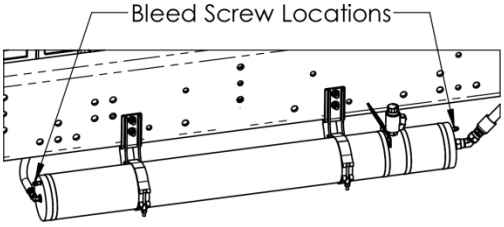


Figure 22. Bleed screw locations

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. Drill attaching Ø3/8" holes as necessary.
13. Repeat with the opposite side.

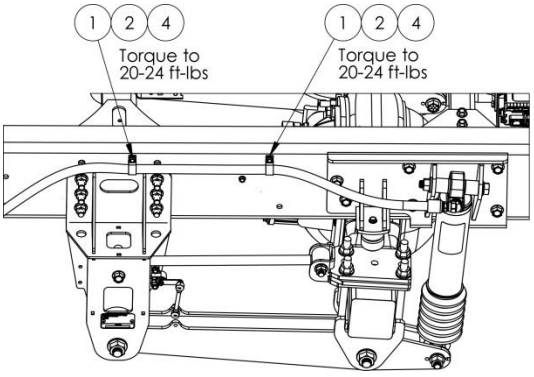


Figure 23. Driver Side -10 hose routing.

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. 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.

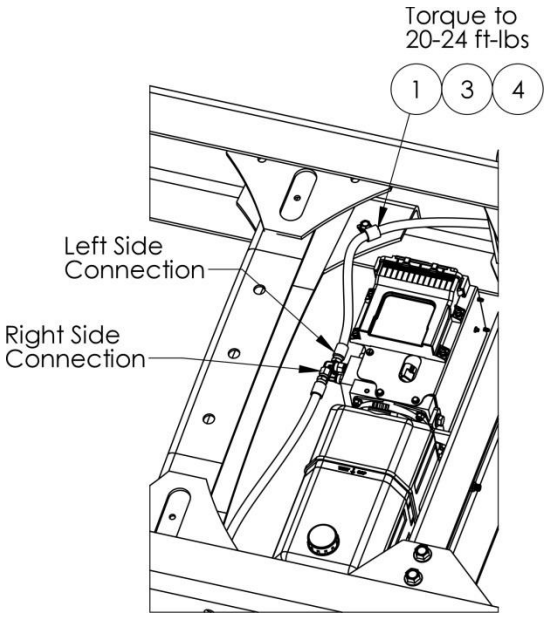
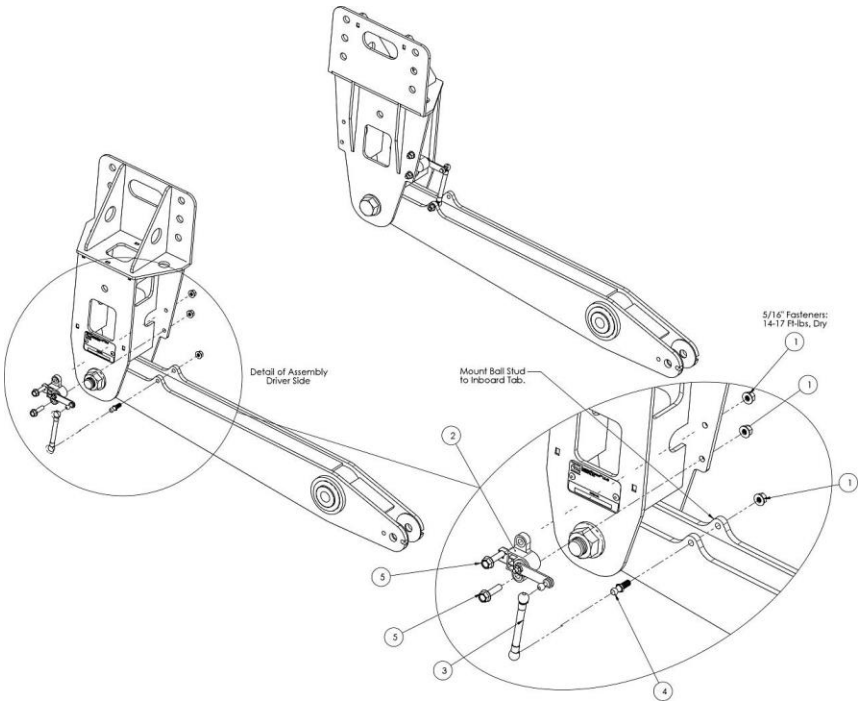


Figure 24. Driver side and Passenger side -4 Hose routing.

19. Remove the plug from the hose end.
20. Attach the hose end to the fitting in the port marked "L". Torque to **12 ft-lbs. Do not over tighten.**
21. Repeat with the opposite side.
22. Attach the hose end to the fitting in the port marked "R". Torque to **12 ft-lbs. Do not over tighten.**
23. Clean up any fluid spillage.

Height Sensors



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10012-010	LFN 5/16-18 Gr G	4	2	10591-003	Ball Stud, 5/16-18 x .75L
2	2	10586-001	Asy, Height Sensor	5	4	10886-125	HFB 5/16-18 x 1.25 Gr 8
3	2	10587-006	Asy, Linkage, 3.938" SS				

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

1. Locate the Height Sensor, Linkage Assembly, and Ball Stud.
2. Attach the Ball Stud to the Left Hand (Driver Side) Upper Control Arm, orientated with the ball pointing inboard, using the 5/16"-18 Locking Flange Nut. Torque to **14-17 ft-lbs.**
3. Attach the Height Sensor to the Left Hand (Driver Side) Hanger using the 5/16"-18 x 1" Hex Flange Bolt and 5/16"-18 Locking Flange Nut. Torque to **14-17 ft-lbs. Do not over torque.**
4. Snap the Linkage Assembly to the ball stud attached to the lower control arm and to the ball stud on the Height Sensor arm. Refer to **Figure 25 or Figure 26** for detail of linkage.

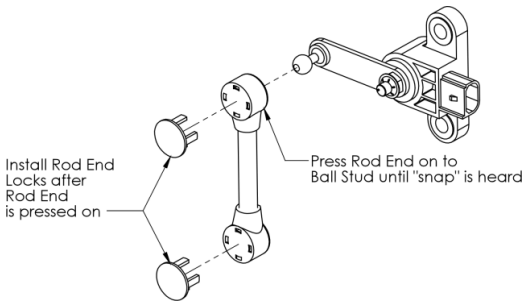


Figure 25. Height Sensor Plastic Linkage End Installation

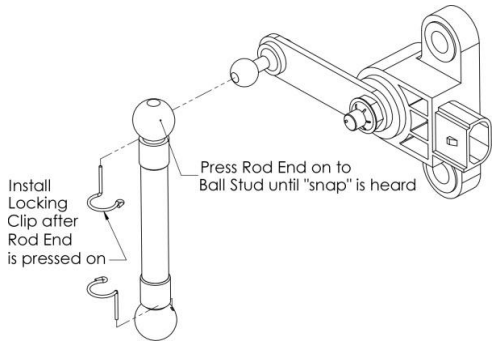
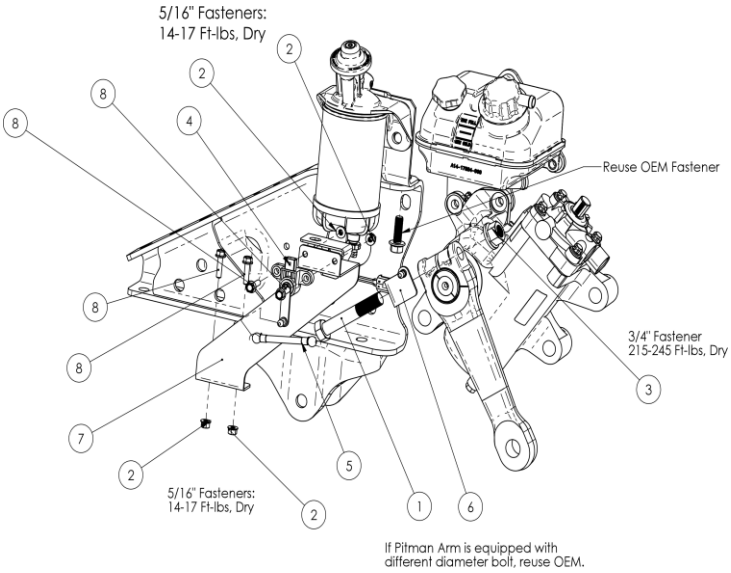
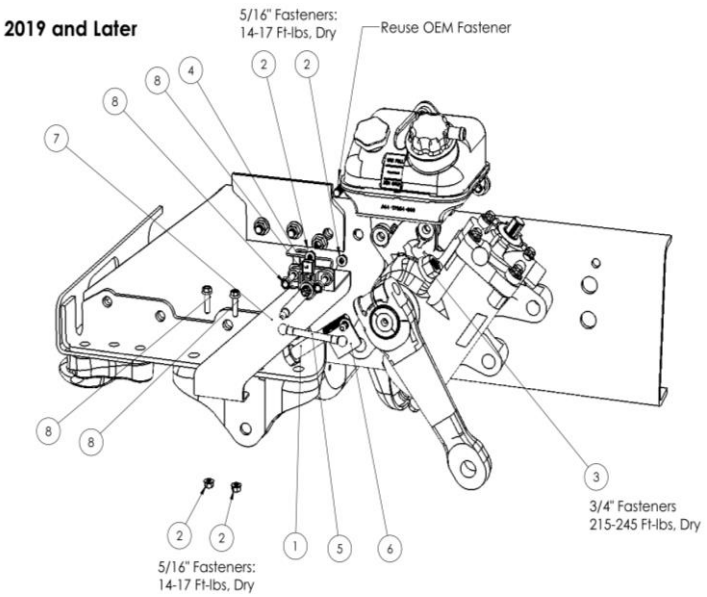


Figure 26. Height Sensor Metal Linkage End Installation.

5. Repeat with the Right Hand (Passenger Side).

Steering Sensors





ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10001-005	HB 3/4”-16x4-1/2” Gr 8	5	1	10587-006	Asy, Linkage 3.938” SS
2	4	10012-010	LFN 5/16”-18 Gr G	6	1	10733-004	Steering Linkage Mount
3	1	10012-012	LFN 3/4”-16 Gr G	7	1	10741-005	Steering Sensor Mount
4	1	10586-001	Height /Steering Sensor	8	4	10886-125	HFB 5/16”-18 x 1-1/4” Gr8

Note: Steering sensor and height sensors are the same part number.

1. Remove the hex bolt, lock nut, and washer from the pitman arm.
2. Install the Steering Linkage Mount using the provided 3/4”-16 x 4-1/2” Hex Bolt and Locking Flange Nut. Torque to **215-245 ft-lbs**. **Note: If OEM bolt is 7/8”, reuse bolt and nut in place of provided 3/4” bolt and nut.**

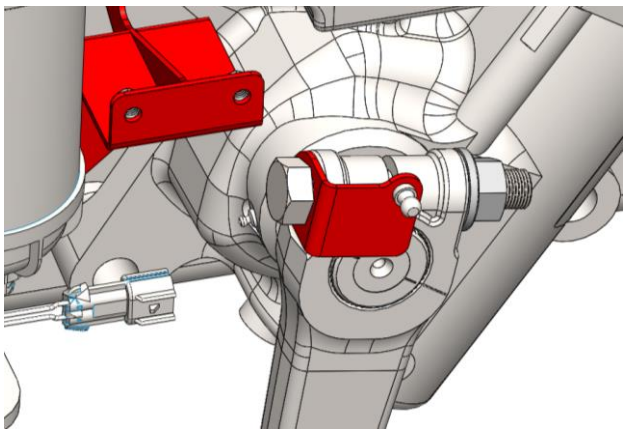


Figure 27. Steering Linkage Mount installation.

3. Remove the bolt attaching the filter mount to the frame, as shown in **Figure 28.** Retain bolt and nut for reuse.

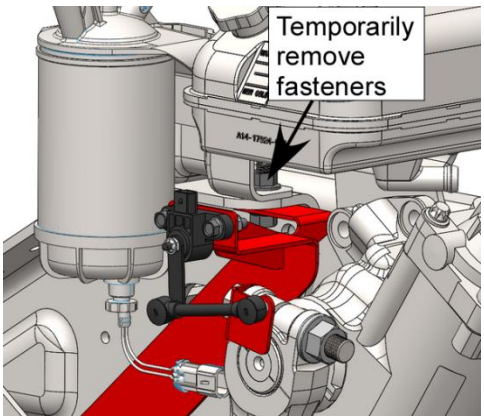


Figure 28. Steering Sensor Mount Installation.

4. Install the Steering Sensor Bracket reusing the OEM fasteners and the 5/16”-18 fasteners as shown in **Figure 28.**
5. Torque the OEM fastener to 90 ft-lbs.
6. Torque the 5/16”-18 fasteners to **14-17 ft-lbs**.

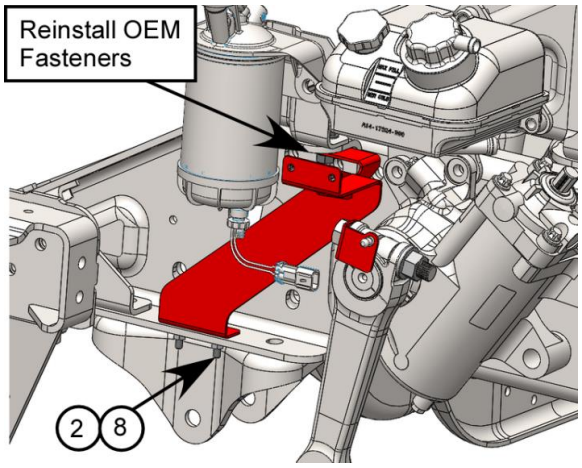


Figure 29. Installation of Steering Sensor Mount.

7. Install the Steering Sensor as shown in **Figure 31** using the 5/16” fasteners.
8. Torque to **14-17 ft-lbs**.

NOTE: If you have a MY 2019 or later vehicle, follow steps 9-14 for correct installation.

9. Remove one bolt attaching the fuel dryer mount to the frame, as shown in **Figure 30.** Retain bolt and nut for reuse.
10. Install the Steering Sensor Bracket reusing the OEM fasteners and the 5/16”-18 fasteners.

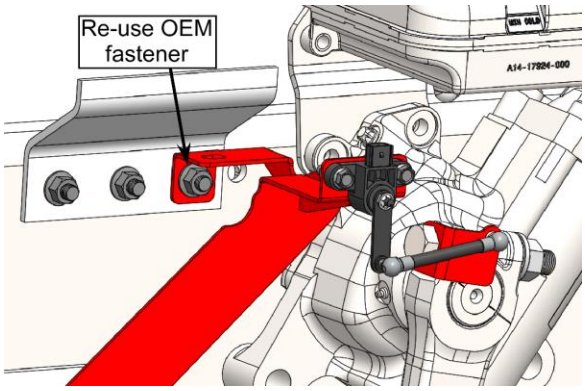


Figure 30. Steering Sensor Mount – MY2019+.

11. Torque the OEM fastener to **90 ft-lbs.**
12. Torque the 5/16”-18 fasteners to **14-17 ft-lbs**.
13. Install the Steering Sensor as shown in **Figure 31** using the 5/16” fasteners.
14. Torque to **14-17 ft-lbs**.

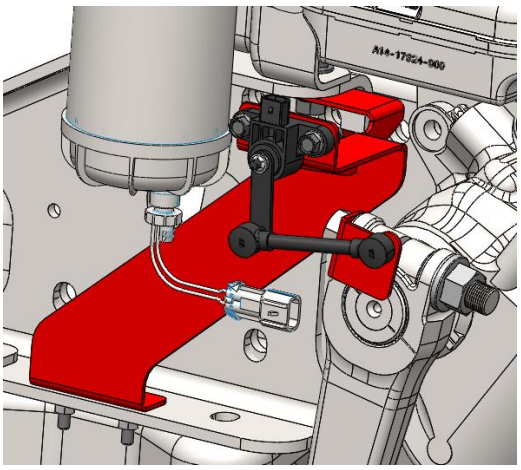


Figure 31. Steering Sensor Installation.

15. Snap the Linkage Assembly to the ball stud attached to the lower control arm and to the ball stud on the Sensor arm. Refer to **Figure 32 or Figure 33** for detail of linkage.

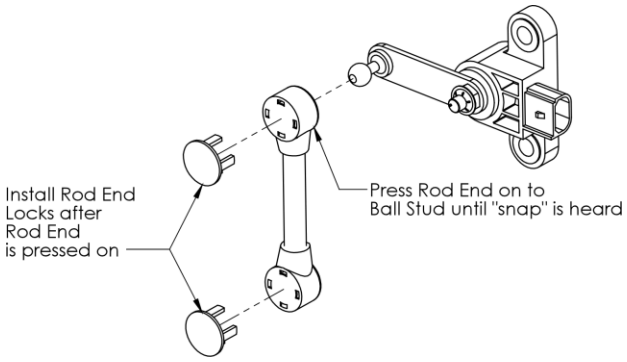


Figure 32. Sensor Plastic Linkage End Installation

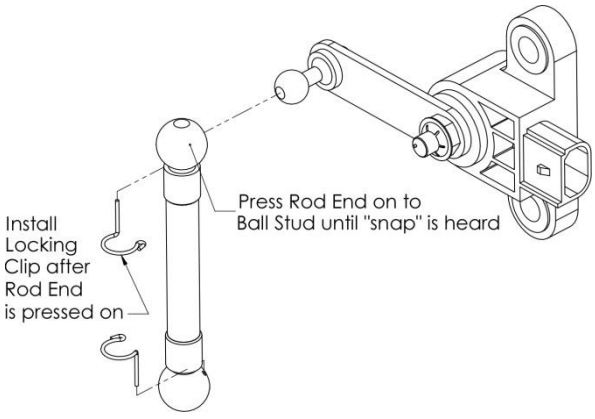


Figure 33. Sensor Metal Linkage End Installation.

Wiring

1. Locate the External Electrical Harness attached to the power module.
2. Unroll the wiring harness and use the Electrical Schematics wiring diagram to identify the connection ends.
3. Locate the trunk containing the Height Sensor (J21 and J22) and the Rate Valve (J23 and J24) connections.
4. Route the trunk towards the height sensors and rate valves. Note: The power module is mounted behind the axle, but ahead of the volumes, therefore the trunk may need to be routed first towards the height sensors, and then back towards the rate valves.

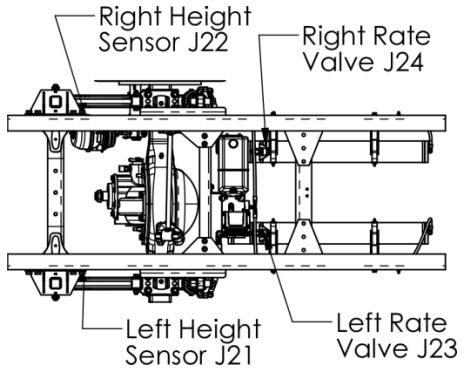


Figure 34. DS150FR-S Sensor connections.

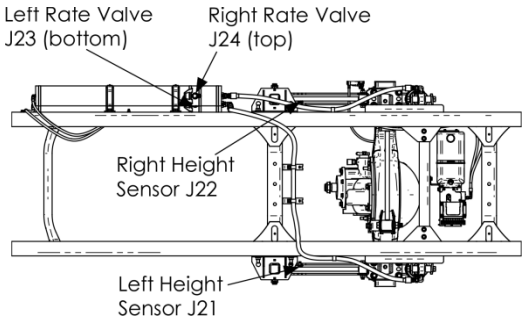


Figure 35. DS150FR-SF Sensor connections.

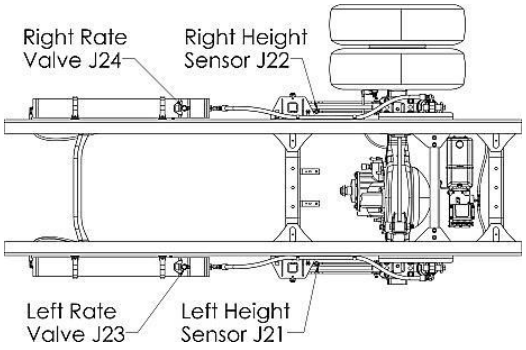


Figure 36. DS150FR-SS Sensor connections

5. Connect the height sensor and rate valve connections.
6. Secure the harness to OEM harness on the driver side. Use of plastic clips is recommended.
7. Locate the Black 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 should be applied after ring terminal is secured.
10. Route the remaining trunk (containing the blunt wires and steering sensor blunt wires) towards the cab. Secure to OEM wiring harness.
11. Locate the Dash Harness.
12. Inside the cab, under the dash, locate the firewall rubber pass through grommets.

Figure 37. Firewall pass through.

13. Punch out two holes for the two dash harness branches.
14. Push the dash harness branch labeled “Vehicle Connections” and the branch labeled “External Harness” through the firewall pass through.
15. Attach the Ground Ring Terminal, J32, from the dash harness to the firewall ground post.

Figure 38. Under dash ground connections.

16. Secure the dash harness.

TABLE 1 The following wire connections to the vehicle are required.

Name	Harness	Color-Size	Required Signal	Recommended Location
Battery	Dash	Red-18ga	12 VDC Hot all the time	Power Net Distribution Box
Ignition	Dash	Yellow-18ga	12 VDC with ignition ON 0 VDC with ignition OFF	Transmission Interface Connector (Pin 1)
Speed	External	Violet/White-18ga	Frequency based signal (11.3Hz/mph): Freightliner Circuit - 497k Allison Trans Circuit - 125	Transmission Interface Connector (Pin 5) Or From TCM on transmission (Allison Circuit 125)
			-SEPB units: Frequency based signal (2.2Hz/mph):	Provided by Body Builder. See Body Builder for location.
Brake	External	Pink/Black-18ga	12 VDC with brake ON 0 VDC with brake OFF	Body Builder Lighting Interface (Pin 4)
Ground	Dash	Black With Ring Terminal	Chassis Ground	Chassis ground in cab
Battery	Fused Battery Lead	Red-8ga	12 VDC hot all the time (up to 80 Amps)	Chassis battery
Ground	External	Black-8ga	Chassis Ground (up to 80 Amps)	Chassis ground

Note: Recommended locations are based on Freightliner M2 106. (See table 2 for list of codes). Other suitable signal location may be used on other chasses configurations. Instruction steps 17-45 refer to M2 106. Other vehicles may require different sources.

17. Locate the following Vehicle Electrical Modules/Connectors *(refer to Freightliner Body Builder Reference Guide OBD 2013/GHG 14 Electrical):*

TABLE 2	
Connector:	Location:
PNDB (Power Net Distribution Box)	Under hood, on firewall, driver side.
TIC (Transmission Interface Connector)	Multiple possible locations: *Under hood, on firewall, driver side (34C-001), *Under Cab (34C-002), or *End of Frame (34C-003)
BBLI (Body Builder Lighting Interface)	Multiple possible locations: *Back of cab (353-022) *End of frame (353-023) *Back of cab w/PDM (353-026) *End of frame w/PDM (353-027) Maybe under cab on crew cab versions.

Depending on the location of these connectors and the configuration of the vehicle, extra length of wire may need to be spliced in.

Also see **Appendix B: Electrical Terminals**.

18. At the PNBD, disconnect the ATC Fuse Output connector.

Figure 39. ATC Fuse Output connector.

19. Pull out, but do not remove the TPA.

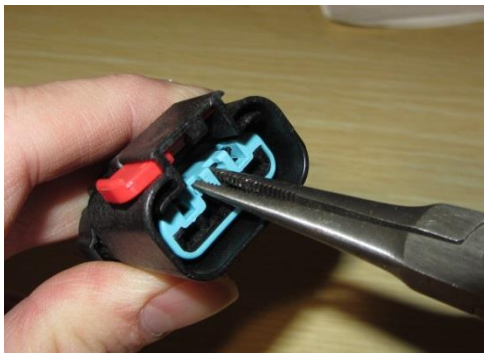


Figure 40. Resetting the TPA.

20. Locate the red “BAT” wire from the dash harness in the bundle labeled “Vehicle Connections”.
21. Attach an APEX 2.8mm Female terminal to the wire. See Appendix B: Electrical Terminals
22. .Remove the plug from the “D” or pin 4 location.

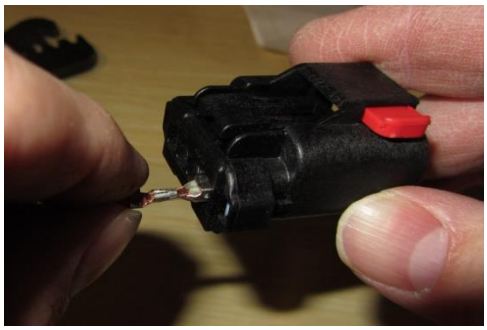


Figure 41. Inserting the BAT power wire.

23. Insert the wire into the “D” or pin 4 position of the connector.

Figure 42. TPA in lock position.

24. Press the TPA back into the lock position.
25. Reconnect the connector to the PNBD.
26. Locate the Transmission Interface Connector.

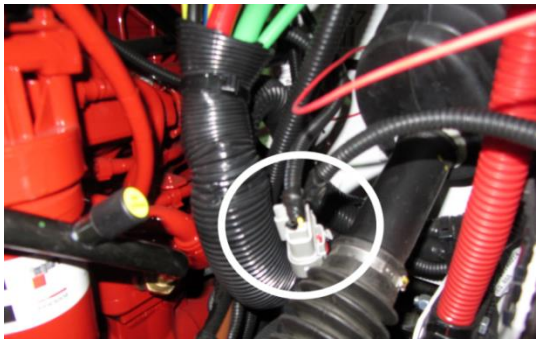


Figure 43. Transmission Interface Connector when located under hood.

27. Unplug the connector.
28. Pull out, but do not remove the white TPA.

Figure 44. Unlocking the connector.

29. Attach an APEX 1.5mm male terminal to both the Yellow (Ignition) wire from the dash harness (located in the branch labeled “Vehicle Connections”) and the Violet/White (Speed) wire from the main electrical harness. Splice additional wire to either wire if necessary to reach the Transmission Interface Connector.

30. Remove plugs from pin 1 and pin 5.
31. Insert the Violet/White wire into Pin 5 of the connector.

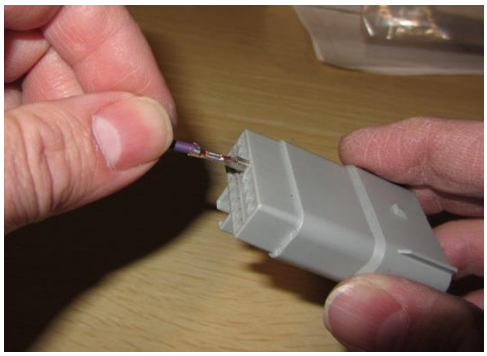


Figure 45. Inserting Violet/White wire.

32. Insert the Yellow wire into Pin 1 of the connector.
33. Push and lock the TPA.

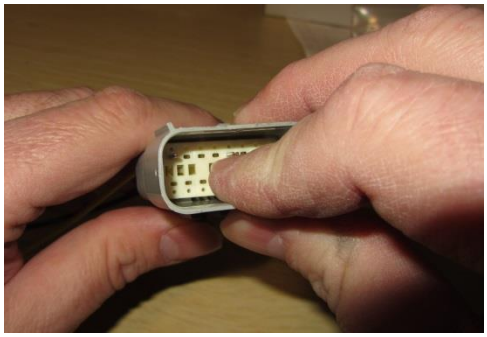


Figure 46. Locking the TPA.

34. Reconnect the connector.
35. Secure the wires.
36. Locate the Body Builder Lightning Interface. The connector should have an orange ribbon tape within 2” for identification.
37. Inside the main suspension harness, locate the Pink/Black wire. Pull wire from loom and rewrap junction with electrical tape.
38. Disconnect the connector.
39. Pull out, but do not remove the red TPA.

Figure 47. Unlocking the connector.

40. Attach an APEX 2.8mm male terminal to the Pink/Black (Brake) wire.
41. Remove the plug from pin 4.
42. Insert the Pink/Black wire into Pin 4.

Figure 48. Inserting Pink/Black wire.

43. Press and lock the TPA.

Figure 49. Body Builder Lighting Interface connector with TPA locked in position.

44. Reconnect the Body Builder Lighting Interface connector.
45. Secure all wiring.

Note: The rest of the wiring section refers to all vehicles.

46. Locate the remaining Dash harness wires labeled "External Harness":
    Red (Battery Power)
    Yellow (Ignition)
    White (CAN-H)
    White/Black (CAN-L)
    Black (Ground)
    Yellow/Black (Park)
47. Crimp each wire to the corresponding blunt wire in the External Harness. Match wire colors, crimp using butt splices, and install heat shrink.
48. Secure all wires.
49. Locate the branch containing connector J35.
50. Route branch to the steering sensor and connect. If necessary splice additional length to the three wires. Make sure the correct connections are made.

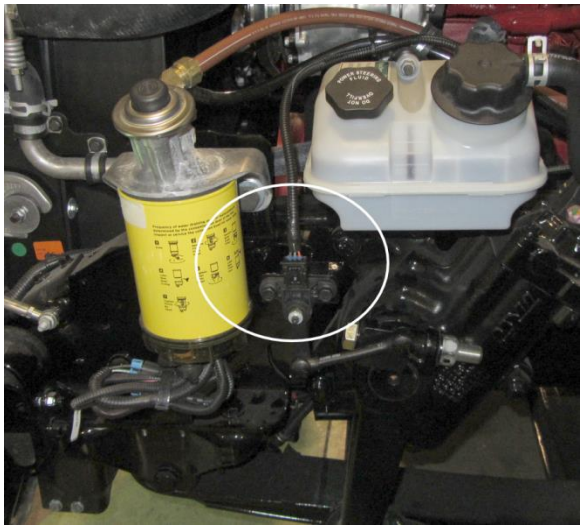


Figure 50. Steering Sensor electrical connection.

51. Secure the harness.
52. Locate the Red 8ga battery connection branch.
53. Route branch to the auxiliary battery positive terminal.
54. Locate the Battery Fuse Lead containing the 80 amp fuse.
55. Remove the 80 amp fuse.
56. Crimp the fuse lead to the 8ga battery connection branch blunt end.
57. Melt the heat shrink on the crimped connection to seal the splice.
58. Connect to the positive terminal post.
59. Replace the 80 amp fuse.

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. Verify that the front wheels are steered straight ahead.
3. Lower the vehicle to the ground and remove any jack stands from under the vehicle. The suspension should be in the kneeled position.
4. Locate the container of Silicone Fluid.
5. Remove the breather cap from the Power Module reservoir.
6. Fill the reservoir approximately 2/3 full.
7. 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.

8. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.
9. 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.
10. 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.
11. 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.
12. 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
13. After the suspension system stops leveling, check the fluid level in the reservoir. If low, fill to the indicated line.

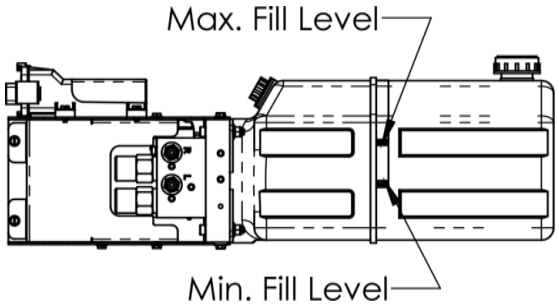


Figure 51. Final fill fluid level.

Bleeding the System

1. Verify system is turned OFF by either pressing the ON/OFF button on the driver interface until the lights are turned off or turning the ignition off.
2. Locate 3/16" ID PVC Tubing (not included with kit). Note: Alternatively, a bleed kit similar to the Actron 7840 Bleed Kit can be used.
3. Attach the PVC tubing to one of the upper bleed screws on the Left Hand Secondary Volume Assembly and place the other end in a bucket.

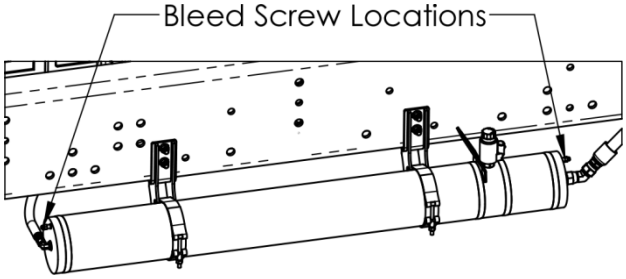


Figure 52. Bleed screw locations.

4. Open the bleed screw slightly.
5. After air bubbles are no longer present, close the bleed screw and torque to **13-18 ft-lbs.**
6. Repeat with remaining bleed screws. Note: the system may need to powered on and allowed to re-pressurize .
7. Repeat with other side.

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 Error light is not blinking.

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 lights on the driver display should go out.
5. Press and release the Red ON/OFF button a second time. The lights on the driver display should all flash then only show the four yellow arrow lights, one green ride mode indicator, and one green ride height indicator.
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, then press the Red ON/OFF button twice and verify the suspension system moves to the new and correct ride height.
10. 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).

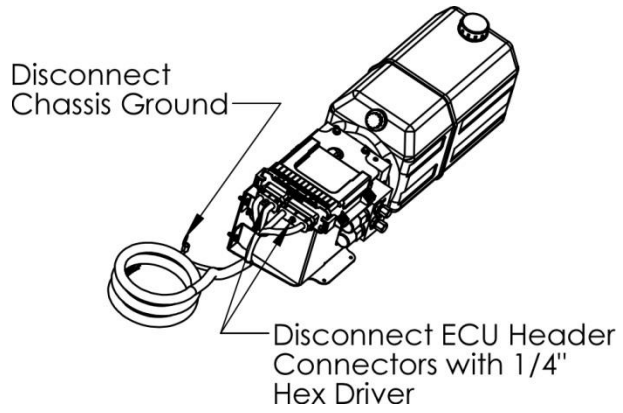
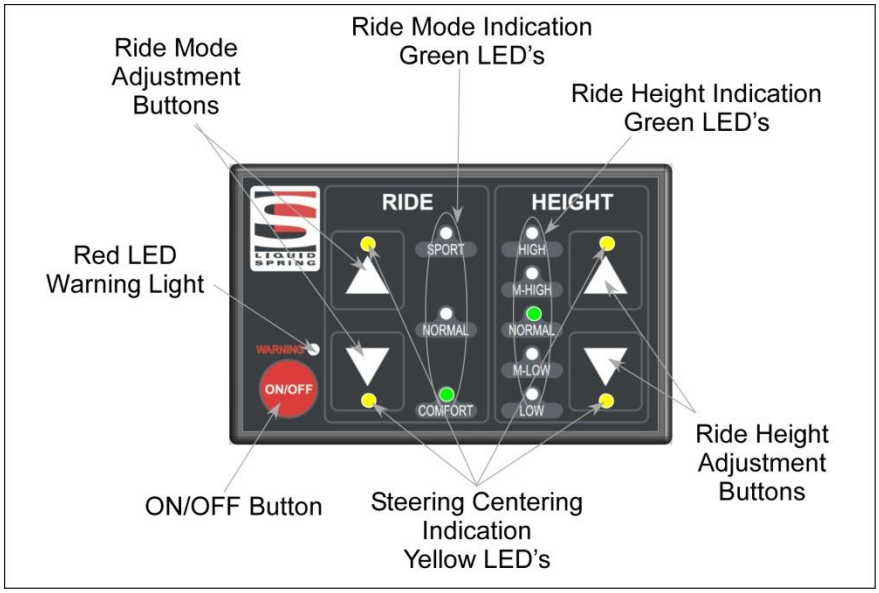


Figure 53. ECU disconnects prior to welding on chassis.

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 43.

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.

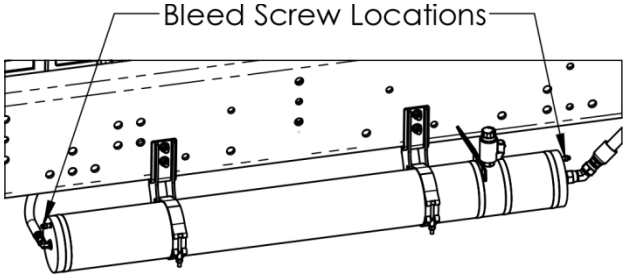


Figure 54. Bleed screw locations.

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 *Issues with Vehicle Raising/Pump Section*	See *Issues with Vehicle Raising/Pump Section*
Warning + RIDE: COMFORT	Battery Voltage below 9 VDC	Vehicle charging system providing incorrect voltage	Inspect and replace as necessary
		80A fuse blown / Loss of battery voltage on circuit W25	Inspect / Repair Replace as necessary
Warning + HEIGHT: HIGH	Issue with Right Hand Height Sensor	See *Issues with Height Sensors Section*	See *Issues with Height Sensors Section*
Warning + HEIGHT: NORMAL	System kneels in excess of 3 minutes without suspension movement	See *Issues with Vehicle Lowering/Dump Valve Section*	See *Issues with Vehicle Lowering/Dump Valve Section*
Warning + HEIGHT: LOW	Issue with Left Hand Height Sensor	See *Issues with Height Sensors Section*	See *Issues with Height Sensors Section*
Slow or Fast Blinking Warning Light	Driver Interface cannot communicate with ECU.	See *Issues with Driver Interface*	See *Issues with Driver Interface*

Issues with Vehicle Raising/Pump

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

Issues with Vehicle Lowering/Dump Valve

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

Issues with One Corner Not Leveling Properly

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

Issues with Height Sensors

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

Issues with Ride/Handling

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

Issues with Steering Sensor

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

Issues with Vehicle Speed Signal

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

Issues with Vehicle Brake Signal

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

Issues with Door Switch

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

Issues with Vehicle Ignition Signal

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

Issues with Vehicle Park Signal

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

Issues with Driver Interface

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

Issues with Power Module

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

Issues with Strut Assembly

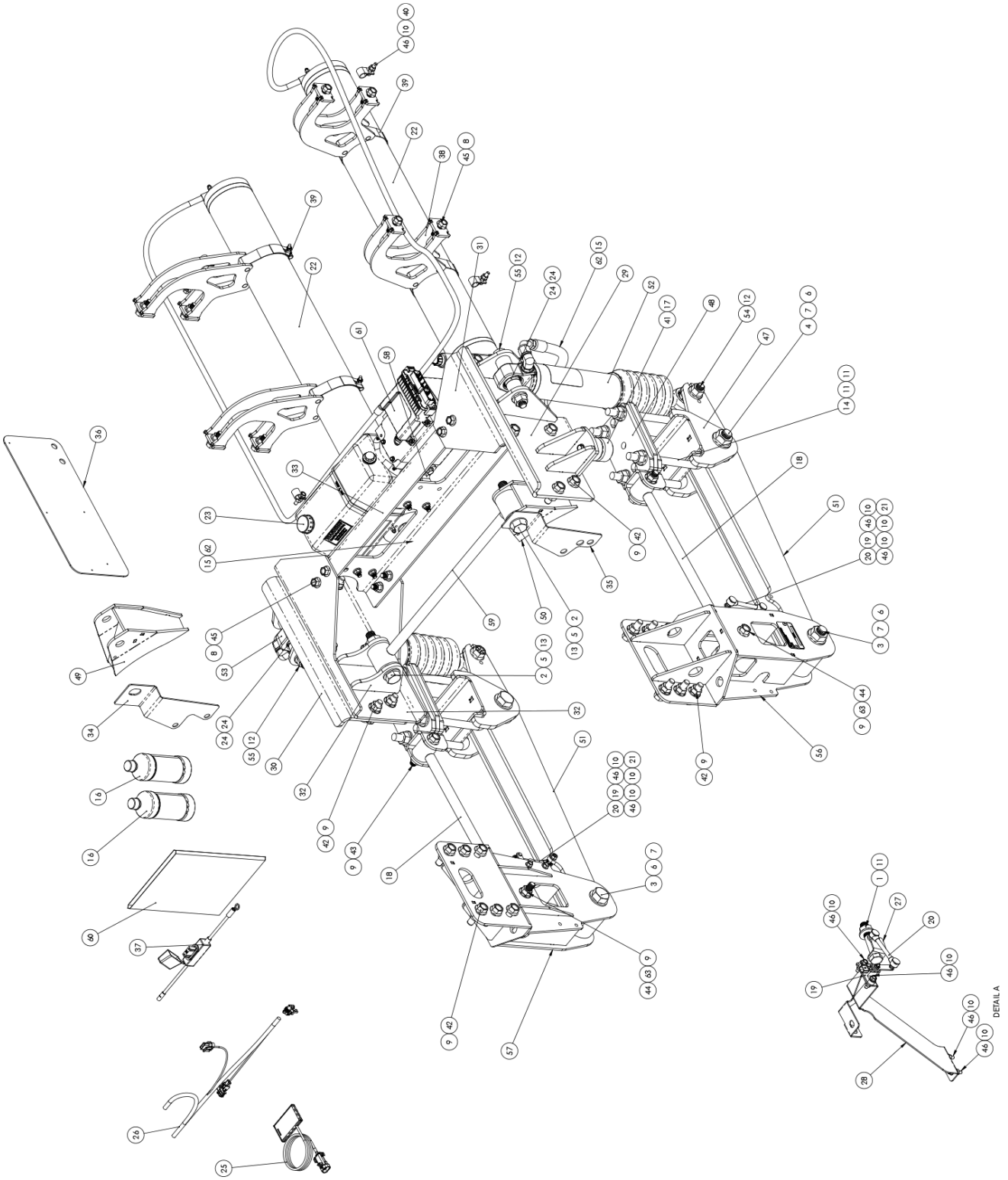
Condition	Cause	Correction
Hydraulic Leak	Weld failure between cylinder and end	Replace strut
	Cylinder fracture	Replace strut
	Threads stripped between cylinder and gland	Replace strut
	Seals worn out	Replace strut
	Rod severely scratched or dented	Replace strut
	Fitting loose	Tighten or replace fittings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

Issues with Secondary Volume Assembly

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

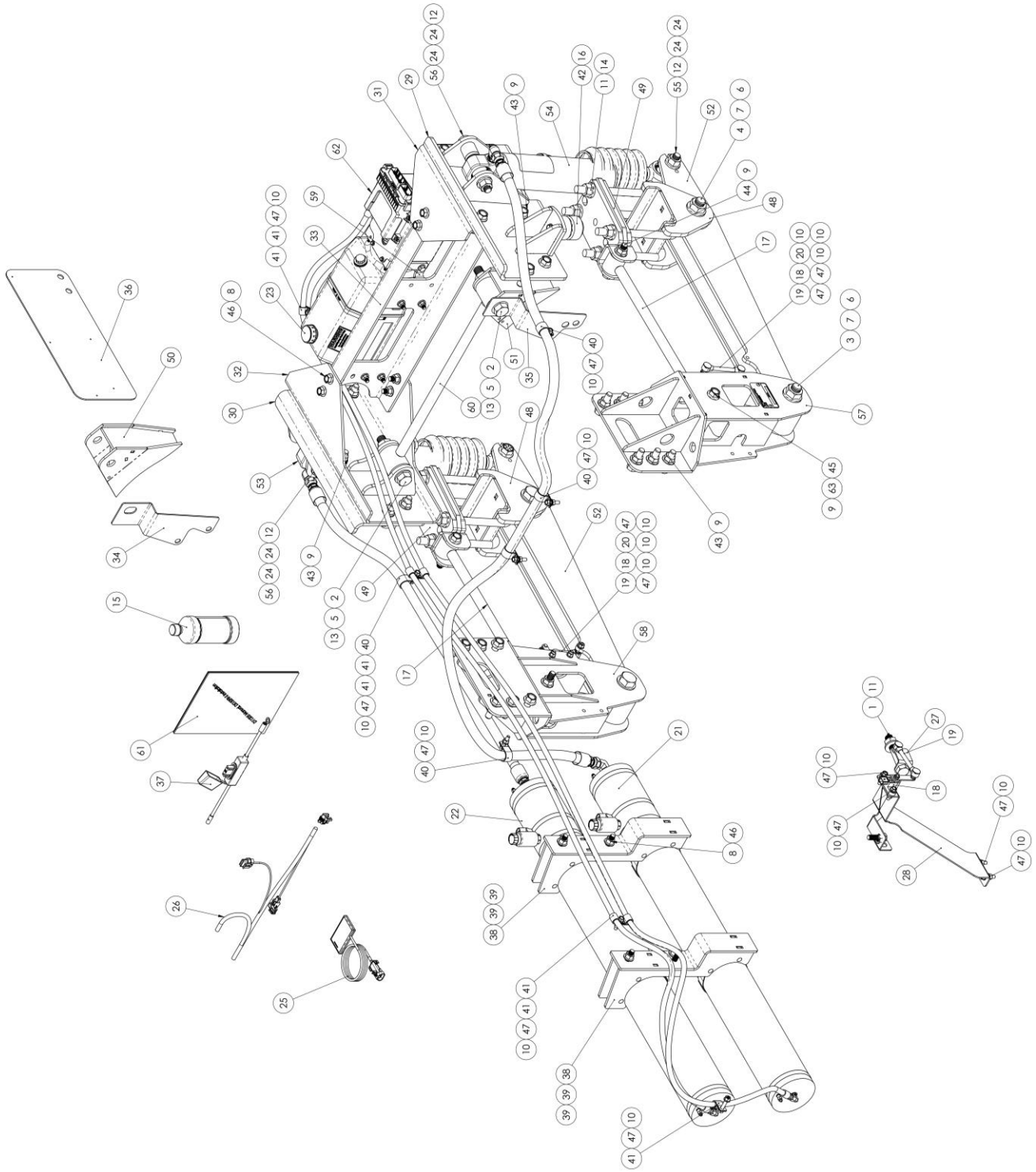
Part Identification:

DS150FR-S



DS150FR-S							
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10001-005	HCS 3/4-16 x 4-1/2 Gr 8	33	1	10796-007	Cross member Channel
2	2	10002-550	HCS 7/8”-9 x 5-1/2” Gr 8	34	1	10811-011	Mount Template, Detroit Axle
3	2	10003-003	HCS 1”-8 x 6”, Gr. 8	35	1	10811-012	Mount Template, Meritor Axle
4	2	10003-004	HCS 1”-8 x 6-1/2” Gr. 8	36	1	10811-014	Frame Drilling Template
5	2	10006-003	HFW 7/8”	37	1	10815-001	Fused Battery Lead
6	4	10006-004	HFW 1”	38	4	10830-017	Volume Mount
7	4	10012-003	LFN 1”-8, Gr G Top Lock	39	4	10843-003	T-Bolt Clamp, Range 4.88-5.5
8	16	10012-007	LFN 1/2”-13, Gr. G	40	4	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
9	28	10012-008	LFN 5/8”-11 Gr G	41	2	10867-003	Jounce Bumper, 2.375"Dia x 3.00"T
10	14	10012-010	LFN 5/16”-18, Gr. G	42	24	10874-200	HFB 5/8-11x2.000, Gr. 8
11	9	10012-012	LFN 3/4”-16, Gr. G	43	2	10874-375	HFB 5/8-11x3.750, Gr. 8
12	4	10012-014	LFN 3/4”-10 Gr G	44	2	10874-600	HFB 5/8-11 x 6", Gr. 8
13	2	10012-017	LFN 7/8”-9, Gr G	45	16	10885-150	HFB 1/2-13x1.500, Gr. 8
14	4	10064-005	U-Bolt 3/4-16 x 9.03 Tri-8	46	12	10886-125	HFB 5/16-18 x 1.25, Gr. 8
15	2	10322-010	Hyd Fit 90, -10 37 x -10 37 F	47	2	10947-005	Lower Axle Clamp
16	2	10474-001	Silicone Oil, 16 oz. Bottle	48	2	10949-003	Upper Axle Clamp
17	2	10502-001	HFB M10-1.5 x 30 CL 10.9	49	1	10951-004	Track Rod Axle Mount, Detroit
18	2	10570-006	UCA (21.080”)	50	1	10951-005	Track Rod Axle Mount, Meritor
19	3	10586-001	Sensor	51	2	10953-005	Asy, Lower Control Arm
20	3	10587-006	Linkage, 3.938" SS	52	1	11057-003	Asy, Strut, 2.75ID x 1.375 Rod
21	2	10591-003	Ball Stud 5/16”-18 x 3/4” L	53	1	11057-004	Asy, Strut, 2.75ID x 1.375 Rod
22	2	10597-047	2nd Vol 50 x 450, LH	54	2	11102-400	HFB 3/4-10 x 4 Gr 8 BO
23	1	10614-001	Cap, Filler/Breather	55	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8 BO
24	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	56	1	11104-002	Asy, Hanger, LH M2-S
25	1	10680-001	Driver Interface	57	1	11105-002	Wldmnt, Hanger M2-S
26	1	10704-009	Wiring Harness, Dash, M2	58	1	11109	Kit, Power Module Mounting
27	1	10733-004	Steering Linkage Mnt	59	1	11198-001	Track Rod
28	1	10741-005	Steering Sensor Mnt	60	1	11204	Kit, Drawing, Freightliner M2-S
29	1	10790-020	Upper Strut Mount, LH	61	1	11287-004	Asy, Power Supply, Side Mount
30	1	10790-021	Upper Strut Mount, RH	62	2	11458-019	Asy, Hose -10 x 19” L
31	1	10795-008	Mount, Cross member, LH	63	4	11689-001	Spacer, Plastic, M2
32	1	10795-011	Mount, Cross member, RH				

DS150FR-SF



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3	2	10003-003	HCS 1”-8 x 6”, Gr. 8	35	1	10811-012	Mount Template, Meritor Axle
4	2	10003-004	HCS 1”-8 x 6-1/2” Gr. 8	36	1	10811-014	Frame Drilling Template
5	2	10006-003	HFW 7/8”	37	1	10815-001	Fused Battery Lead
6	4	10006-004	HFW 1”	38	2	10830-019	Volume Mount, Double Tank
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9	28	10012-008	LFN 5/8”-11 Gr G	41	7	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
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20	2	10591-003	Ball Stud 5/16”-18 x 3/4” L	52	2	10953-005	Lower Control Arm
21	1	10597-069	2nd Vol 50 x 450, LH	53	1	11057-003	Strut, Port Right
22	1	10597-070	2nd Vol 50 x 450, RH	54	1	11057-004	Strut, Port Left
23	1	10614-001	Cap, Filler/Breather	55	2	11102-400	HFB 3/4-10 x 4 Gr 8 BO
24	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	56	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8 BO
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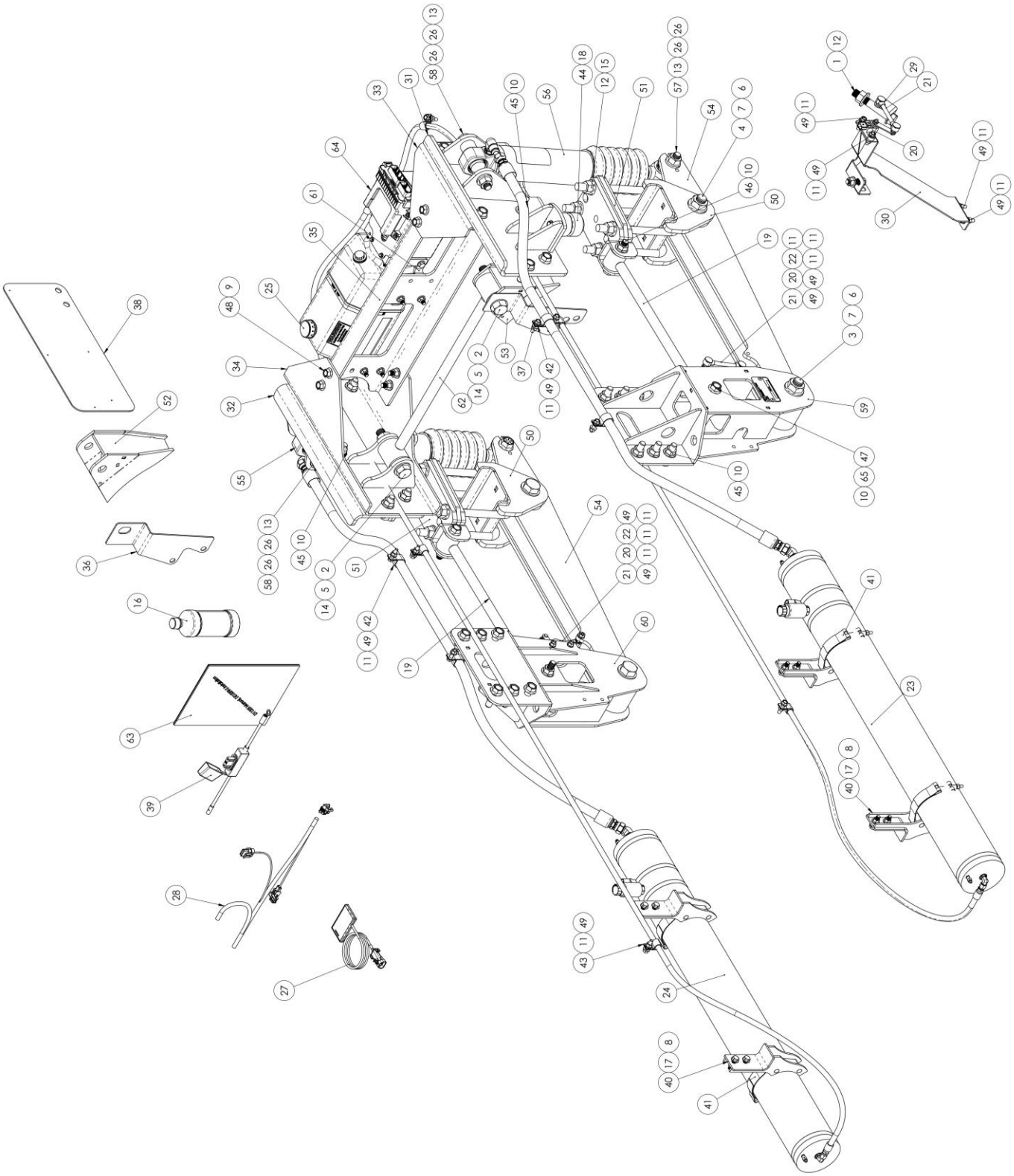
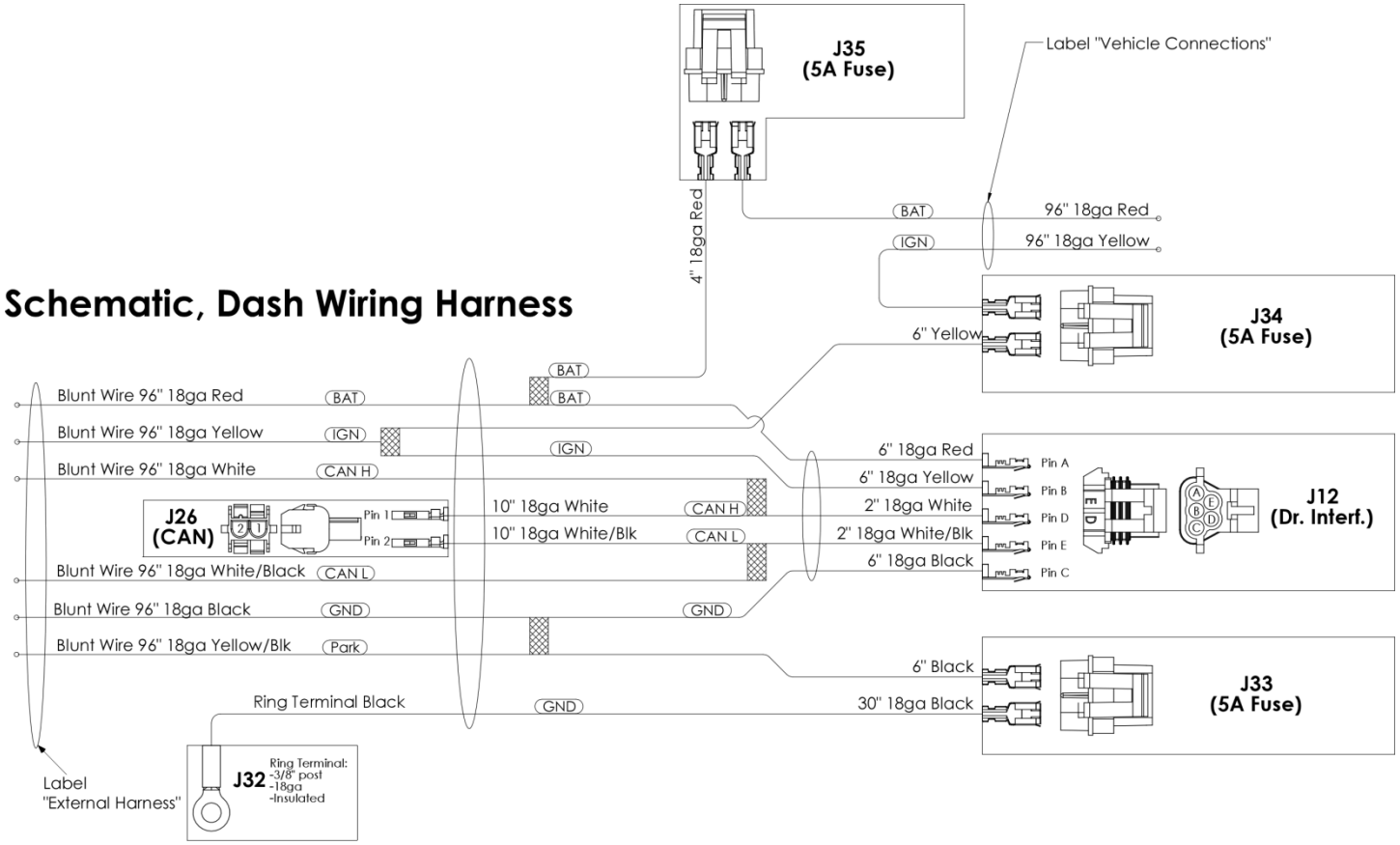
32	1	10795-011	Mount, Cross member, RH				

DS150FR-SS / -SSA

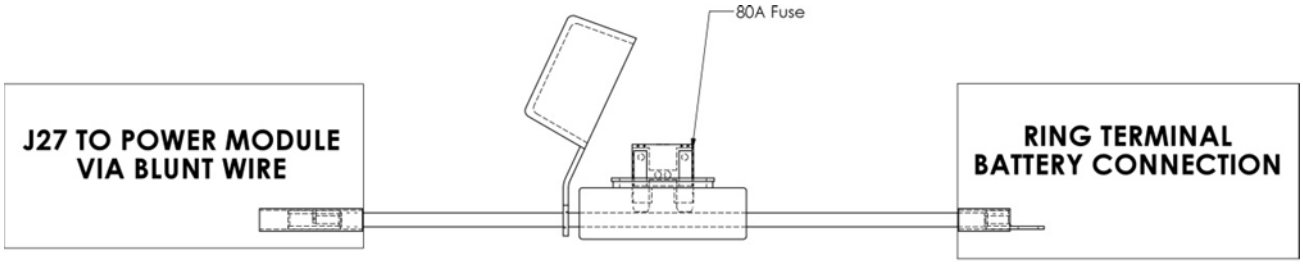


DS150FR-SS / -SSA							
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10001-005	HCS 3/4-16 x 4-1/2 Gr 8	34	1	10795-011	Mount, Cross member, RH
2	2	10002-550	HCS 7/8”-9 x 5-1/2” Gr 8	35	1	10796-007	Cross member Channel
3	2	10003-003	HCS 1”-8 x 6”, Gr. 8	36	1	10811-011	Mount Template, Detroit Axle
4	2	10003-004	HCS 1”-8 x 6-1/2” Gr. 8	37	1	10811-012	Mount Template, Meritor Axle
5	2	10006-003	HFW 7/8”	38	1	10811-014	Frame Drilling Template
6	4	10006-004	HFW 1”	39	1	10815-001	Fused Battery Lead
7	4	10012-003	LFN 1”-8, Gr G Top Lock	40	4	10830-015	Volume Mount (-SS)
8	8	10012-005	LFN 3/8-16, Gr G, Z			10830-013	Volume Mount (-SSA)
9	8	10012-007	LFN 1/2”-13, Gr. G	41	4	10843-003	T-Bolt Clamp, Range 4.88-5.5
10	28	10012-008	LFN 5/8”-11 Gr G	42	4	10855-002	Vinyl-Coated Loop Clamp, 1” ID
11	20	10012-010	LFN 5/16”-18, Gr. G	43	6	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
12	9	10012-012	LFN 3/4”-16, Gr. G	44	2	10867-003	Jounce Bumper, 2.375"Dia x 3.00"T
13	4	10012-014	LFN 3/4”-10 Gr G	45	24	10874-200	HFB 5/8-11x2.000, Gr. 8
14	2	10012-017	LFN 7/8”-9, Gr G	46	2	10874-375	HFB 5/8-11x3.750, Gr. 8
15	4	10064-005	U-Bolt 3/4-16 x 9.03 Tri-8	47	2	10874-600	HFB 5/8-11 x 6", Gr. 8
16	1	10474-001	Silicone Oil, 16 oz. Bottle	48	8	10885-150	HFB 1/2-13x1.500, Gr. 8
17	8	10501-002	HFB 3/8-16 x 1.250, Gr 8, BO	49	18	10886-125	HFB 5/16-18 x 1.25, Gr. 8
18	2	10502-001	HFB M10-1.5 x 30 CL 10.9	50	2	10947-005	Lower Axle Clamp
19	2	10570-006	UCA (21.080”)	51	2	10949-003	Upper Axle Clamp
20	3	10586-001	Sensor	52	1	10951-004	Track Rod Axle Mount, Detroit
21	3	10587-006	Linkage, 3.938" SS	53	1	10951-005	Track Rod Axle Mount, Meritor
22	2	10591-003	Ball Stud 5/16”-18 x 3/4” L	54	2	10953-005	Lower Control Arm
23	1	10597-071	2nd Vol 50 x 450, LH	55	1	11057-003	Strut, Port Right
24	1	10597-072	2nd Vol 50 x 450, RH	56	1	11057-004	Strut, Port Left
25	1	10614-001	Cap, Filler/Breather	57	2	11102-400	HFB 3/4-10 x 4 Gr 8
26	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	58	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
27	1	10680-001	Driver Interface	59	1	11104-002	LH Front Hanger
28	1	10704-009	Wiring Harness, Dash, M2	60	1	11105-002	RH Front Hanger
29	1	10733-004	Steering Linkage Mnt	61	1	11109	Kit, Power Module Mounting
30	1	10741-005	Steering Sensor Mnt	62	1	11198-001	Track Rod
31	1	10790-020	Upper Strut Mount, LH	63	1	11204	Kit, Drawing, Freightliner M2-S
32	1	10790-021	Upper Strut Mount, RH	64	1	11287-004	Asy, Power Supply, Side Mount
33	1	10795-008	Mount, Cross member, LH	65	4	11689-001	Spacer, Plastic, M2

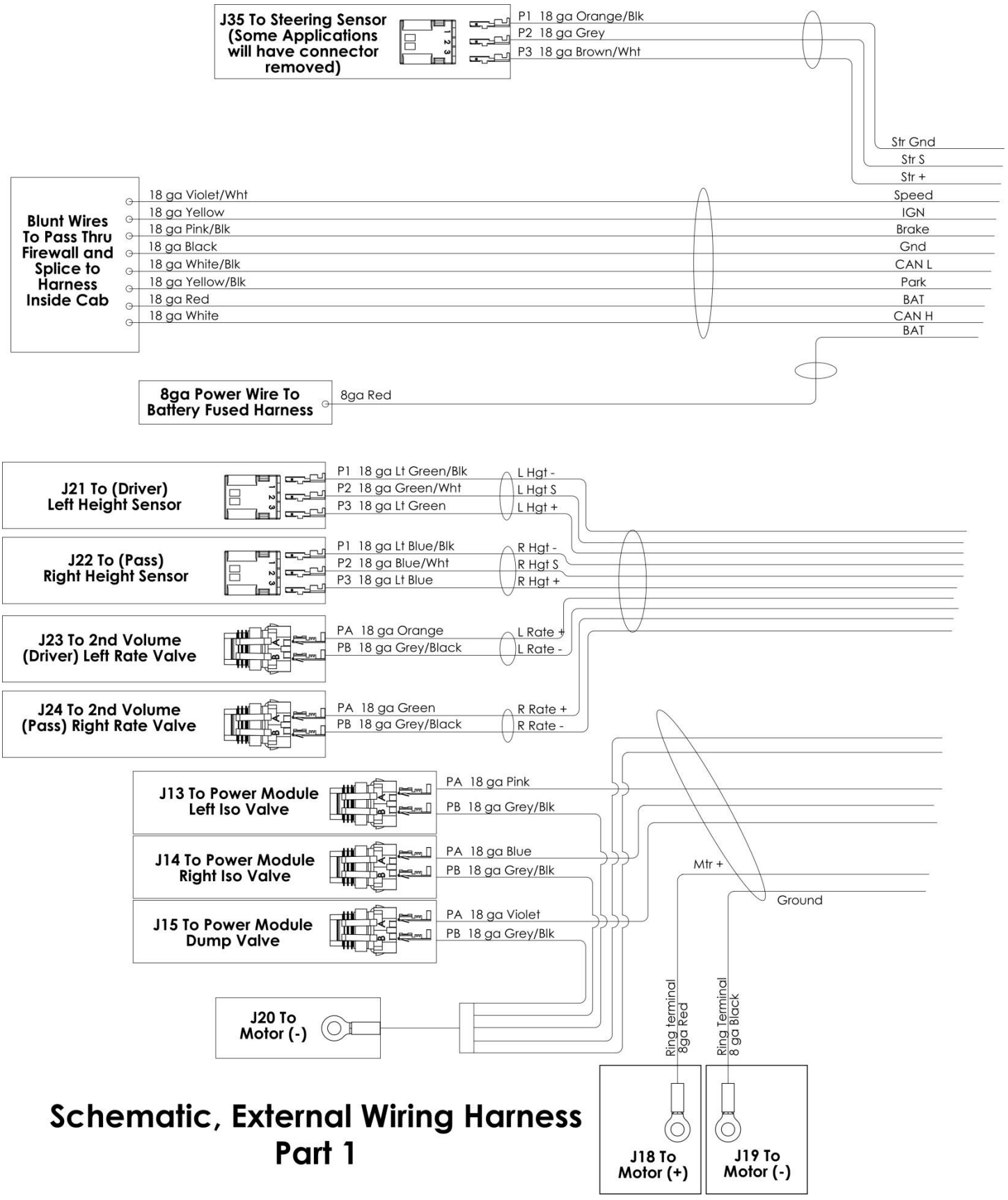
Electrical Schematics



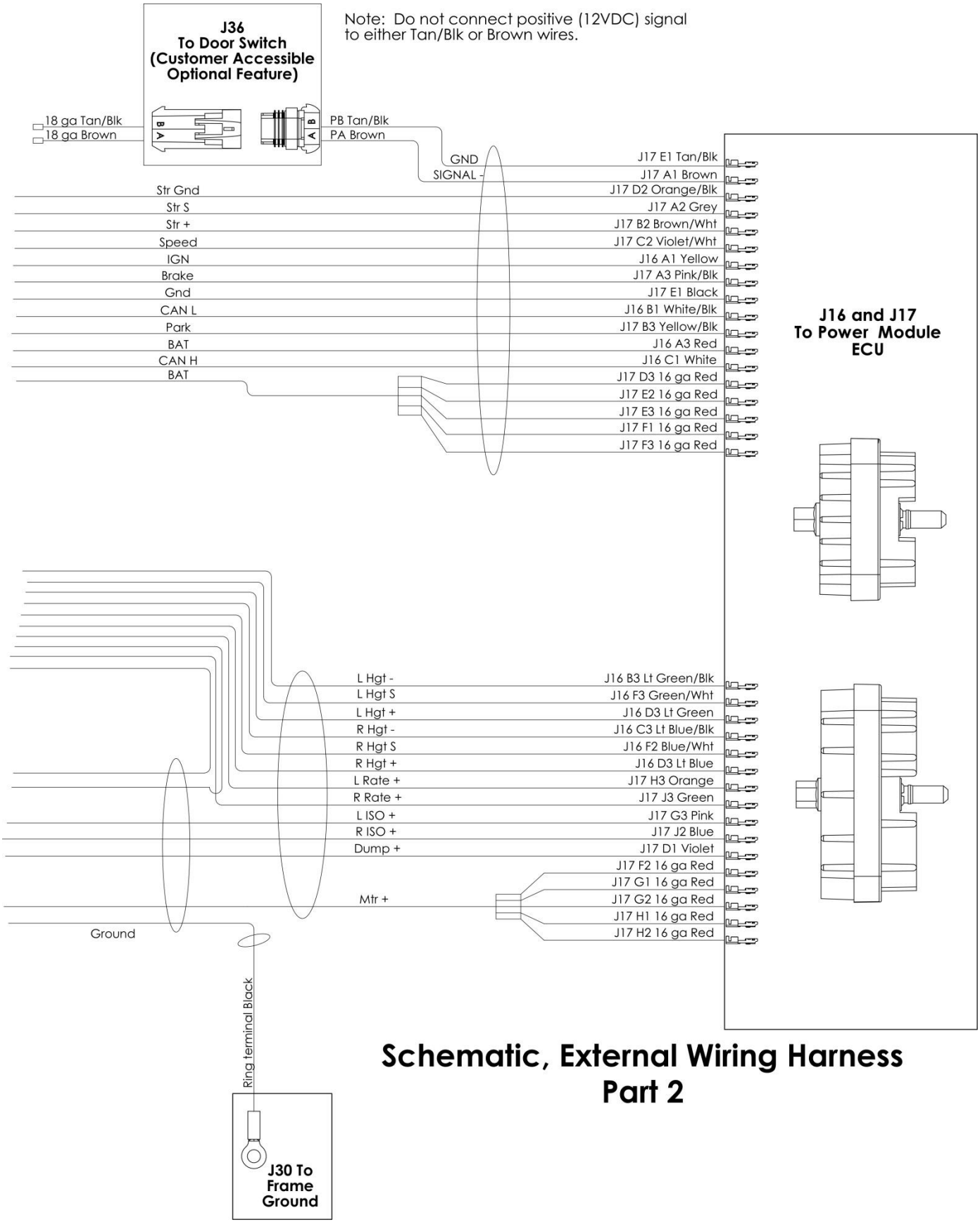
Schematic, Dash Wiring Harness



Schematic, Battery Fuse Lead



Schematic, External Wiring Harness Part 1



Schematic, External Wiring Harness Part 2

Appendix A: Drill Locations

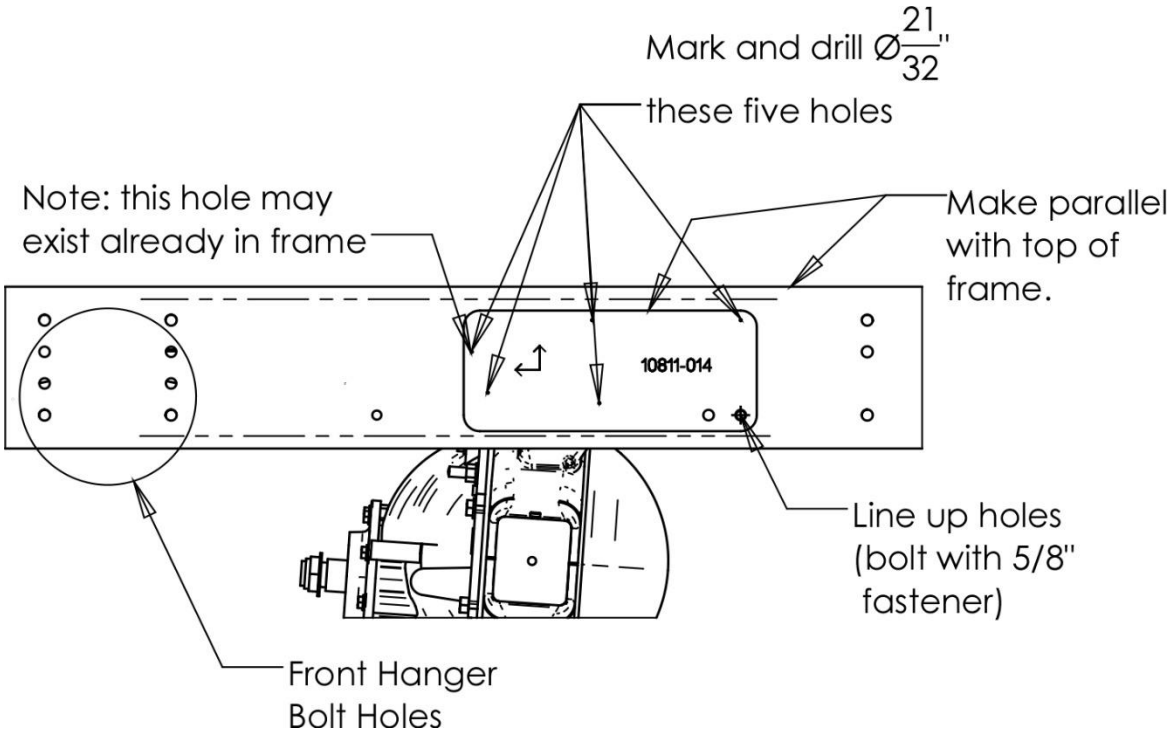


Figure 55. Driver Side Upper Strut Mount Frame Drilling

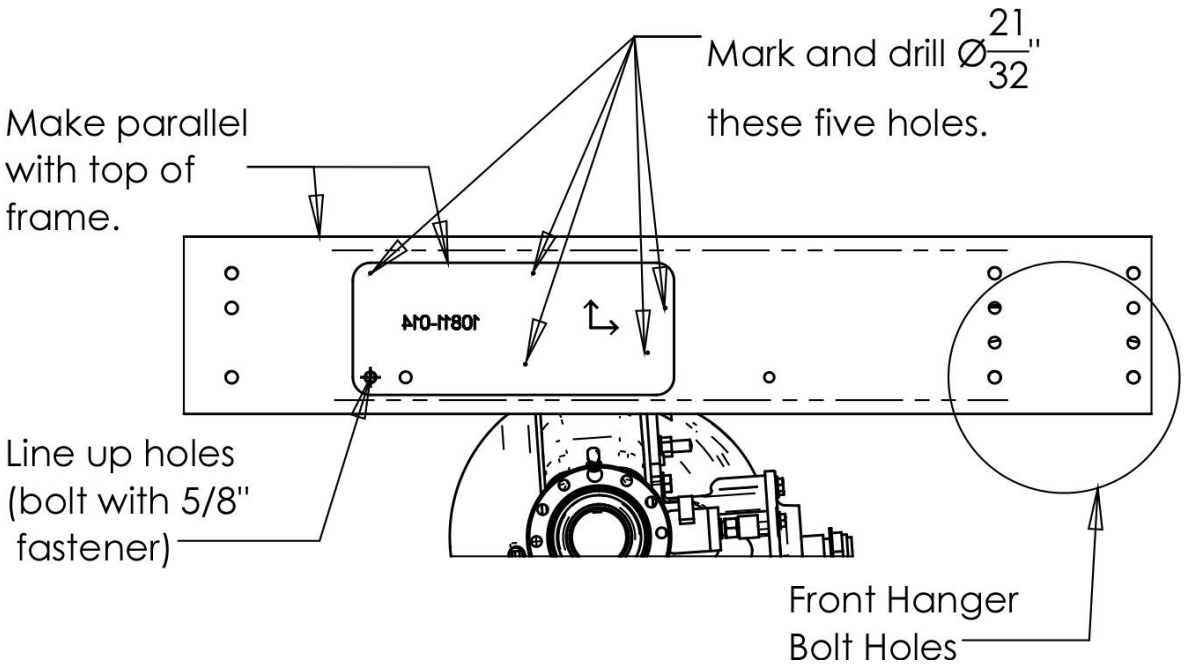


Figure 56. Passenger Side Upper Strut Mount Frame Drilling

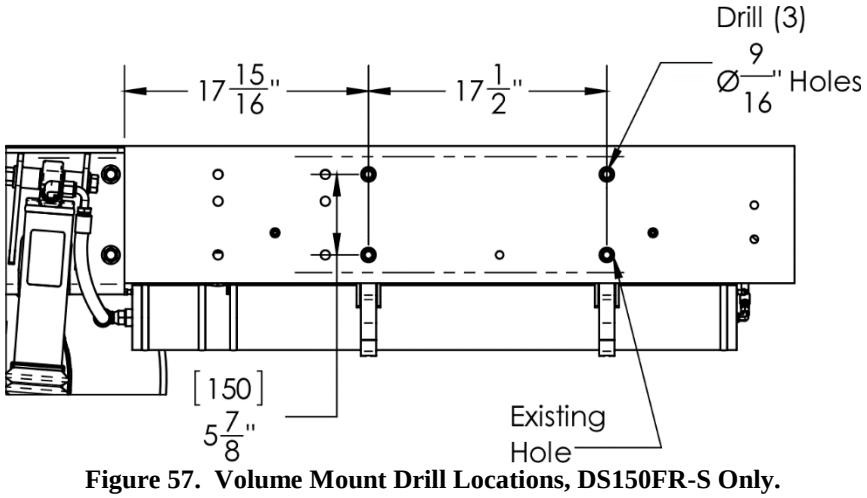


Figure 57. Volume Mount Drill Locations, DS150FR-S Only.

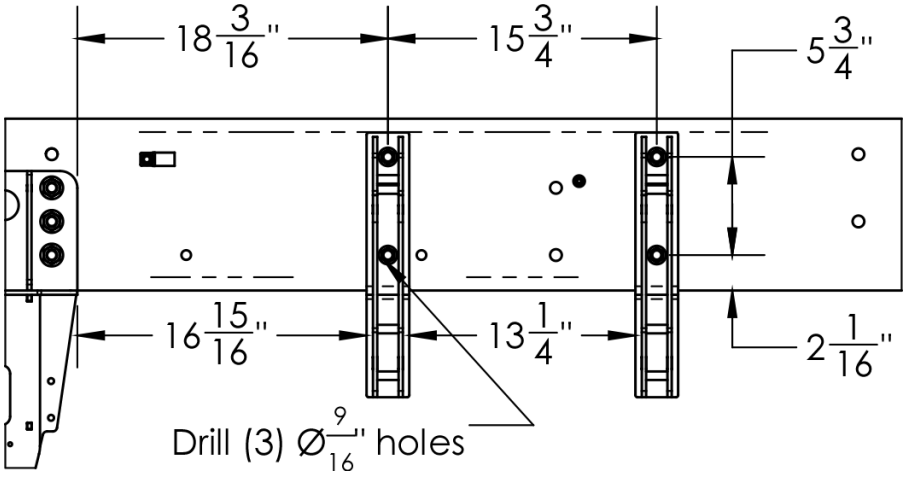


Figure 58. Volume Mount Drilling Location, DS150FR-SF Passenger Side.

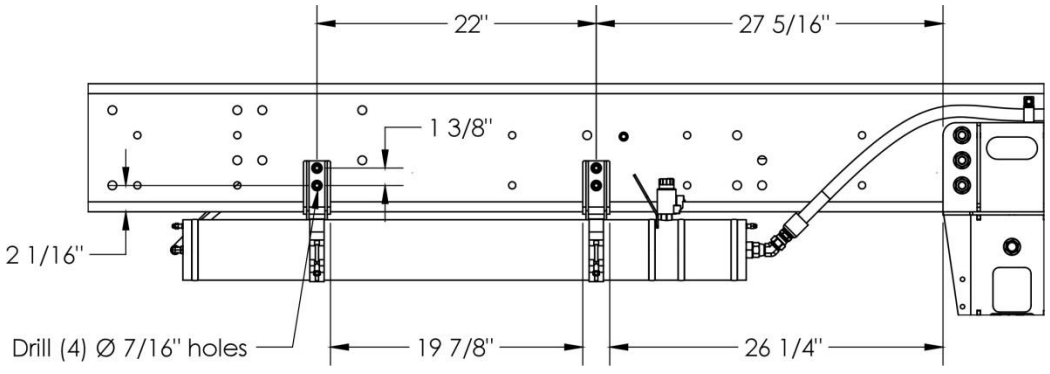


Figure 59. Volume Mount Drilling Location, DS150FR-SS Passenger and Driver Side.

Appendix B: Electrical Terminals

Signal	OEM Connector	Body Builder Reference Guide Page	Pin	Terminal P/N	LiquidSpring Harness	LiquidSpring Wire Color
Power	Power Net Distribution Box (PNDB)	6	D or 4	APEX 2.8mm Female FTL: 23-13211-000 (to -004) Delphi/FCI: 10810375	Dash	Red (in "Vehicle Connections" bundle)
Ignition	Transmission Interface Connector	32	1	APEX 1.5mm Male FTL: 23-13211-031 Delphi: 54001626 or 13630404	Dash	Yellow (in "Vehicle Connections" bundle)
Speed	Transmission Interface Connector	32	5	APEX 1.5mm Male FTL: 23-13211-031 Delphi: 54001626 or 13630404	External Harness	Violet/White
Brake	Body Builder Lighting Interface	23	4	APEX 2.8mm Male FTL: 23-13211-010 Delphi: 54001801RWC, 54001801, or 10762775	External Harness	Pink/Black

FTL: Freightliner service part number

LIQUIDSPRING™ LLC

LiquidSpring™ LLC
4899 E 400 S
Lafayette, IN 47905

Phone: 765-474-7816
Fax: 765-474-7826
Web: www.liquidspring.com

INSTALLATION CHECK LIST

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

FRAME PREPARATION:
☐Battery Disconnected
☐Upper Strut Mount, and Secondary Volume Asy holes drilled.

AXLE PREPARATION:
☐Weld Track Rod Mount to Axle
☐OEM M16 bolts reinstalled and torqued to **140 ft-lbs**.

FRONT HANGER INSTALLATION:
☐Front Hangers are level with framerail.
☐5/8”-11 Nuts torqued to **172-210 ft-lbs**.

UPPER STRUT MOUNT/UPPER CROSSMEMBER/CROSS MEMBER REINFORCEMENT*:*
☐Upper Strut Mounts level with top of frame.
☐Upper Cross member 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 **300 ft-lbs**.

CONTROL ARMS INSTALLATION:
☐Lower Control Arms correctly orientated.
☐1”-8 Nuts torqued to **600 ft-lbs**, at ride height.
☐5/8”-11 Nuts torqued to **172-210 ft-lbs** at ride height.

TRACK ROD INSTALLATION:
☐7/8”-14 Nuts torqued in stages up to **491-600 ft-lbs**.

STRUT INSTALLATION:
☐Struts ports orientated correctly.
☐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:
☐5/16”-18 Nuts 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 T-Clamp Fasteners torqued to **240 in-lbs**.
☐Replaced Top Plug with Breather Cap.

HOSE INSTALLATION:

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

STEERING SENSOR INSTALLATION:

☐3/4”-16 Nut torqued to **215-245 ft-lbs**.
☐OEM Nut torqued to **90 ft-lbs**.
☐5/16”-18 screws tightened to **14-17 in-lbs**.
☐Locking Clip installed.

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.
☐Brake signal from external harness inserted into pin 4 of the Body Builder Lighting Interface.
☐Speed signal from external harness inserted into pin 5 of Transmission Interface Connector.
☐Ignition signal from dash harness inserted into pin 1 of Transmission Interface Connector.
☐Power from dash harness inserted into pin 4 of the Power Net Distribution Box ATC Fuse Output Connector.
☐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..

INTIAL FILL/CALIBRATION:

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