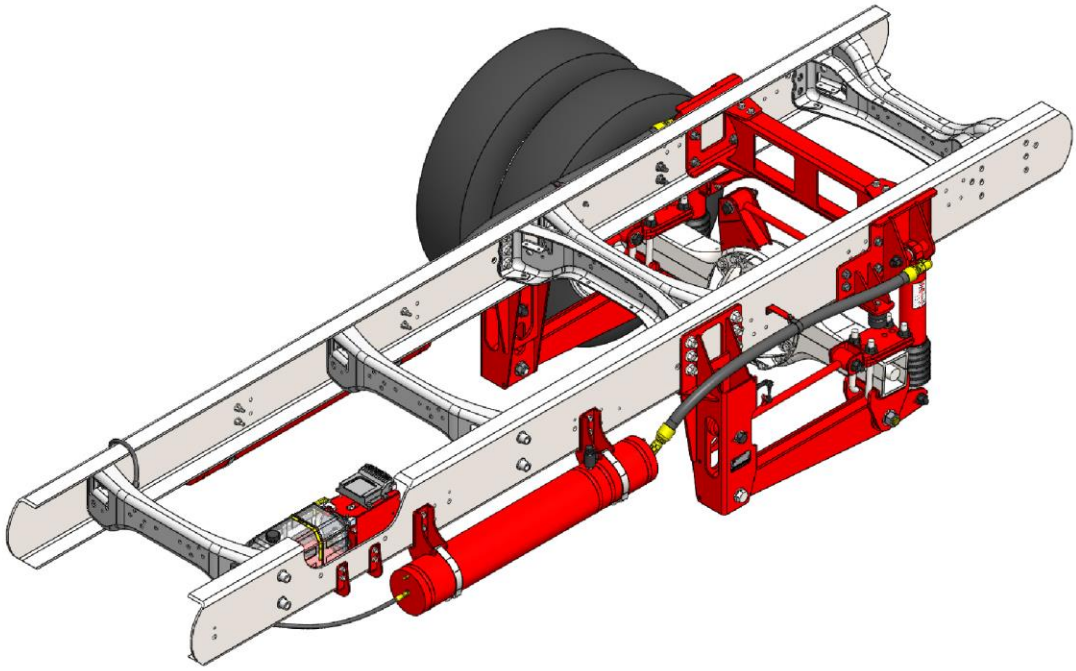
CLASS®

DS135F650SR
DS190F650SR

Drive Axle Rear Suspensions
Ford F650 Straight Rail
(10.13" Tall Frame, Hydraulic Brakes Only)



LIQUIDSPRING™ LLC

Installation / Operator Manual

D11374 Rev G 12/18

Contents

Introduction

This manual provides installation and operating information for the LiquidSpring **CLASS**® F650SR series of rear axle suspension systems for the 2016+ Ford F650 Straight Rail 10.13" Frame 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 the following versions for the F650SR:

Suspension	Application
DS190F650SR-SHB	Conversion of Straight Rail Chassis with OEM Leaf Spring Suspension and Hydraulic Brakes
DS135F650SR-SHF	Conversion of Straight Rail Chassis with OEM Leaf Spring Suspension and Hydraulic Brakes
DS135F650SR-SHR	Conversion of Straight Rail Chassis with OEM Leaf Spring Suspension and Hydraulic Brakes, 19.5" Wheels Only

Suspension Rating

Suspension ratings are based on the OEM rear axle rating of each chassis:

Model	Ford F650
DS190F650SR-SHB	19,000 lbs. GAWR
DS135F650SR-SHF	13,500 lbs. GAWR
DS135F650SR-SHR	13,500 lbs. GAWR

The rear axle GAWR with LiquidSpring F650SRs 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

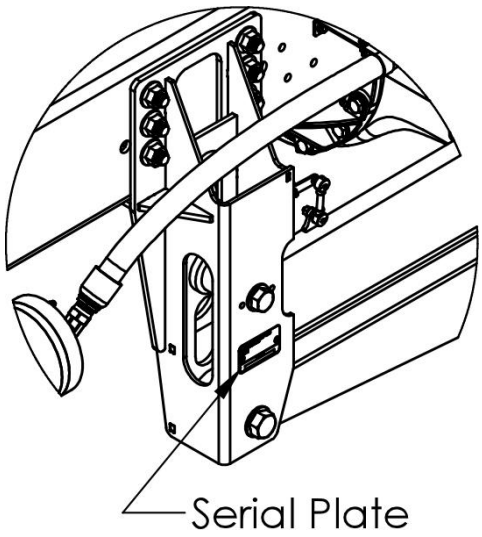


Figure 2. Serial Number Tag Location

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).

Hydraulic Fitting Assembly

SAE O-Ring Adjustable Fittings

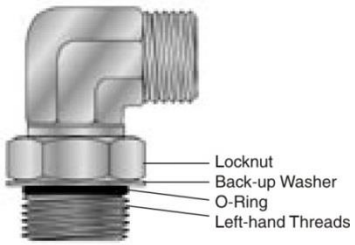


Figure 3. Adjustable SAE fitting

- Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material.
- 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.
- 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.

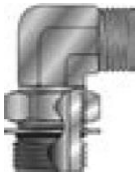


Figure 4. Locknut completely backed off.

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

- Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material.
- 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.
- 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.
- 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

- 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.
- Lubricate the threads and the entire surface of the cone with system fluid.
- Align mating components for hand connection and turn flare nut until sealing surfaces make full contact.
- 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 (3) Jounce stops bolted on the outboard side of the frame, directly above the leaf springs.
6. Remove the OEM U-bolts, shock absorbers, and mounts.
7. Unbolt rear leaf spring hanger.
8. Remove the front spring hangers. Do not remove cross members.

Note: Temporary removal of parking brake cable bracket may be helpful to gain access to front hanger bolts.

9. Remove the OEM leaf spring components from the axle.

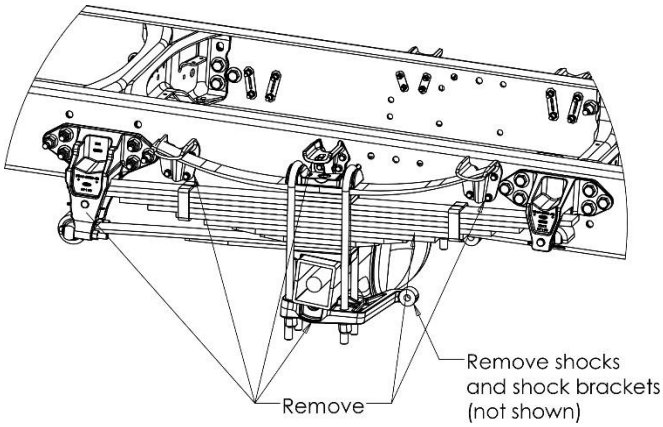


Figure 5. OEM Components to remove

10. Remove leaf springs from vehicle.

NOTE: Rear leaf hangers can be left bolted to springs if desired to aid removal of springs and suspension installation.

11. Locate the Frame Drilling Template for your kit:

    DS190F650SR-SHB – 10811-024

    DS135F650SR-SHF – 10811-024

    DS135F650SR-SHR – 10811-027

12. For a 10811-024, align the template with the two OEM shock mount holes. Ensure that the arrows are pointing up and towards the front of the vehicle, as shown in Figure 6.
13. For a 10811-027, align the template with the rear spring hanger holes. Ensure that the arrows are pointing up and towards the front of the vehicle, as shown in Figure 7**.**

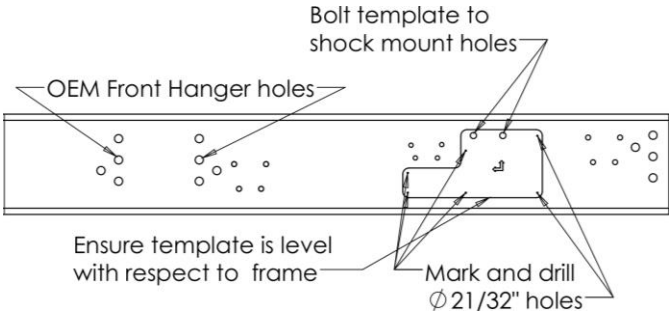


Figure 6. Template 10811-024 Location

14. Use the existing bolts to secure template to the frame. Check that the template is level with respect to the vehicle frame.
15. Mark and drill (6) Ø21/32” holes as indicated.
16. Repeat steps 12 thru 14 for passenger side of vehicle, again ensuring that the arrows point up and towards the front of the vehicle before drilling.

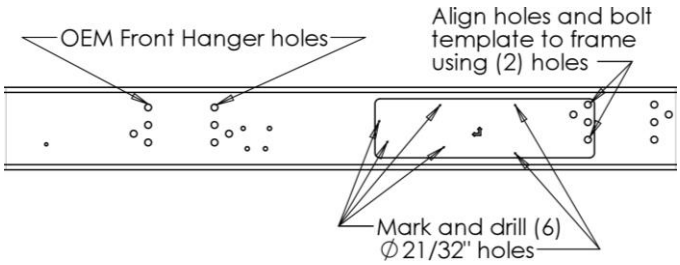


Figure 7. Template 10811-027 Location

17. See Secondary Volumes and Power Module sections for additional holes required to be drilled in frame.

Brake Line Mount Relocation

1. Follow this step ONLY if you have a **DS135F650SR-SHR** (Ambulance) Suspension Kit.

NOTE: Brake Line Relocation is not necessary for the DS190F650SR-SHB or the DS135F650SR-SHF.

2. This step allows the frame to lower close enough to the axle in order for the ambulance to kneel to the proper height.
3. Begin by unbolting both driver and passenger side brake line tabs from the axle. Move these lines up and out of the way for removal of mounts.

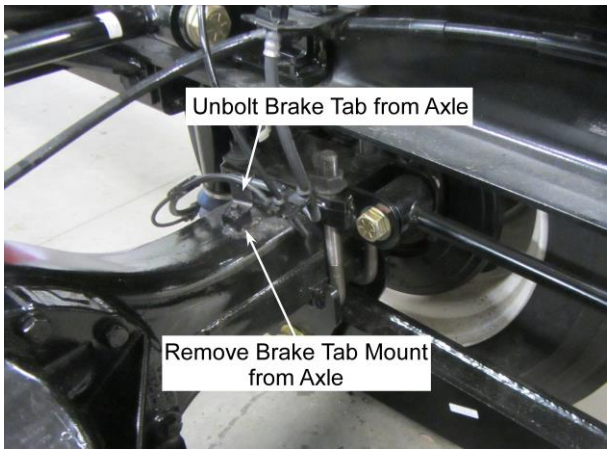


Figure 8. Brake Tab Mount Removal

4. Cut all welds holding both Brake Tab Mounts onto the Axle. Remove Brake Tab Mounts from axle.
5. Reposition the Brake Tab Mounts onto the axle, moving them toward the center of the axle in order to clear the frame rail. (Approximately 2-1/2")

NOTE: Using a straight edge on the frame to the axle will help locate the Mounts in the proper position.

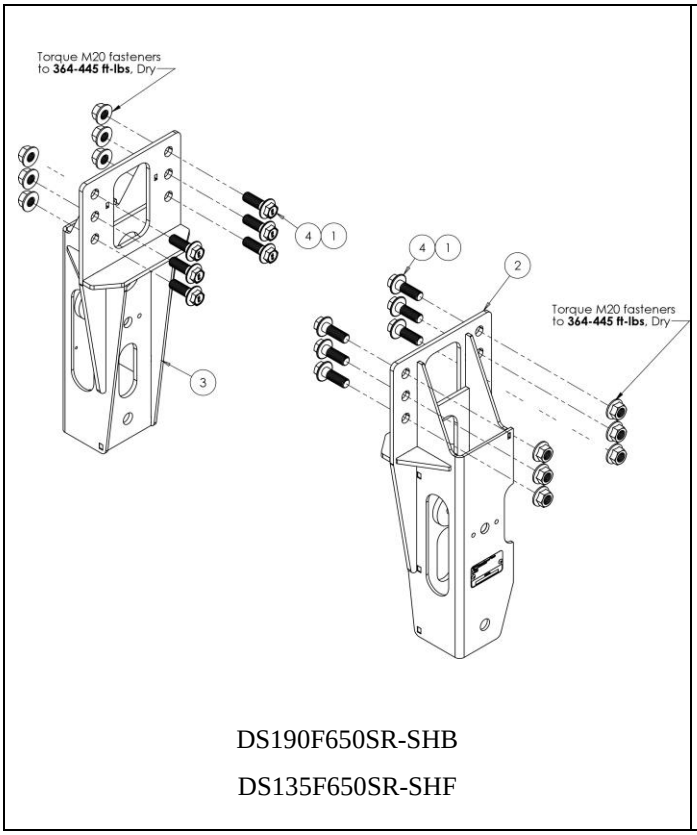
6. Outline the new mount locations on the axle using a visible paint marker.
7. Grind away the area marked down to bare metal to prepare for weld.
8. Place (4) heavy, solid weld tacks on each Mount, one on each side.

Figure 9. Brake Tab Mount Relocated

9. Allow mounts to cool, and then apply touch-up paint to any exposed bare metal.
10. Reattach the Brake Tabs to the Mounts on each side.

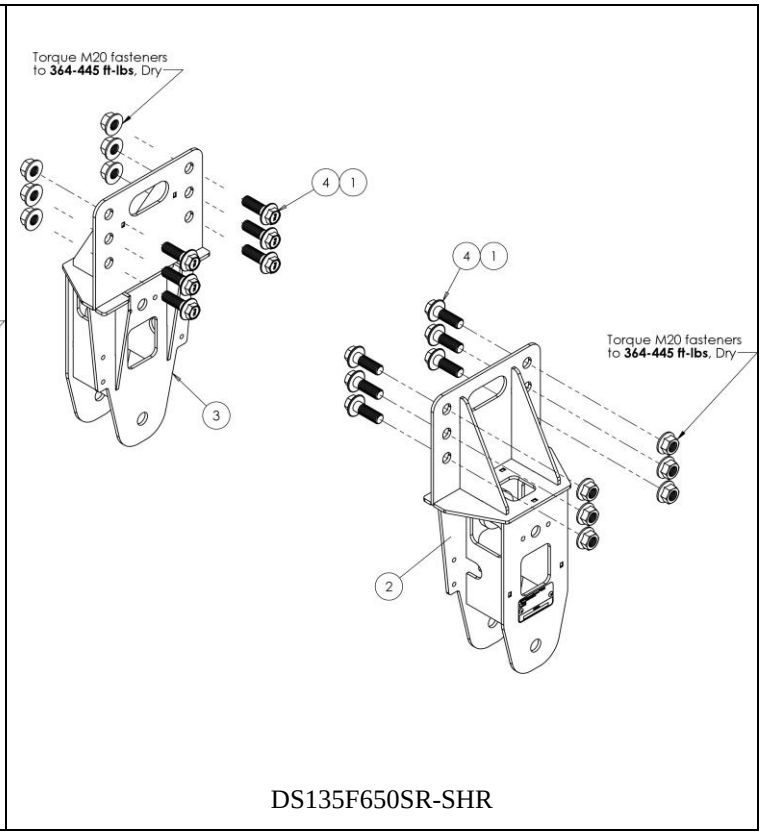
Installation

Front Hangers



DS190F650SR-SHB

DS135F650SR-SHF

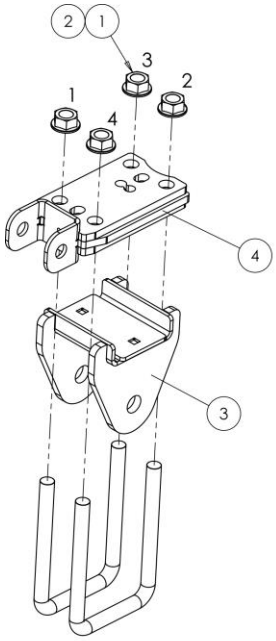


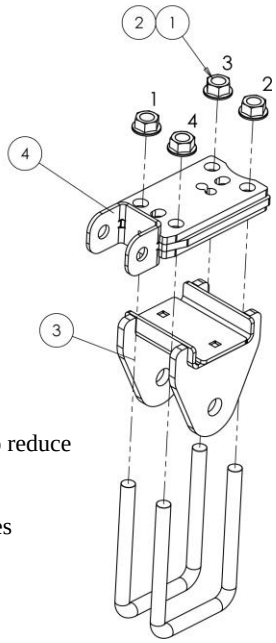
DS135F650SR-SHR

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	12	10873-005	LFN M20-2.5, CL 10.9 Z	3	1	11084-012	Hanger, RH
2	1	11083-006	Hanger, LH			11105-004	Hanger, RH **(DS135F650SR-SHR)**
		11104-004	Hanger, LH **(DS135F650SR-SHR)**	4	12	11366-060	HFB M20-2.5x60 CL 10.9

1. Install the Left-Hand Hanger (with serial tag) to the driver side of the frame using (6) M20-2.5 x 60mm Hex Flange Bolts and (6) M20-2.5 Locking Flange Nuts.
2. Verify that the hanger is level to the frame rail.
3. Torque to **364-445 ft-lbs**.
4. Repeat with Right-Hand Hanger to the passenger side of the frame.

Axle Connection





U-Bolts

1. Lubricate U-Bolts with oil or anti-seize compound to reduce nut friction.
2. Tighten all U-Bolts until they are snug only.
3. Tighten in the sequence shown in the following stages
    a. Stage 1 60 ft-lbs.
    b. Stage 2 200 ft-lbs
    c. Stage 3 325 ft-lbs
    d. Stage 4 450 ft-lbs

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-016	LFN 7/8-14, Gr. G	3	2	10947-014	Lower Axle Connection
2	4	10064-008	U-Bolt 7/8-14 x 8-15/16 Tri-8	4	2	10949-007	Upper Axle Connection

1. Loosely install the Upper Axle Connection on to the axle with the clevis forward.

IMPORTANT: The Upper Axle Seat should be flush to the top of the axle with the axle stud in the hole furthest from axle centerline. See Figure 10 for reference.

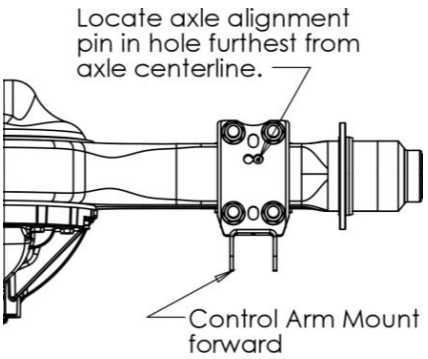


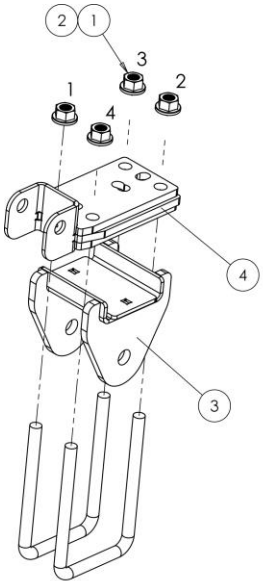
Figure 10. Aligning Axle Connection on Axle Stud

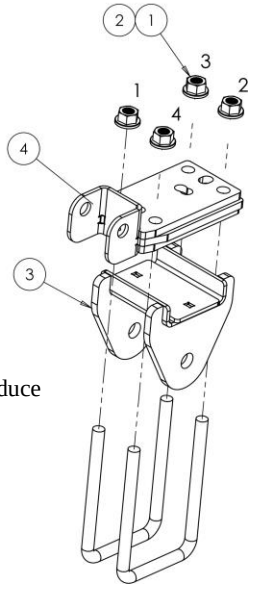
2. Slip the Lower Axle Connection under the axle.
3. Slip the 7/8" U-Bolts under the LCA mount and secure using the 7/8" Locking Flange Nuts.
4. Snug down 7/8" Locking Flange Nuts.

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

5. Repeat for other side.

Axle Connection – DS135F650SR-SHR





U-Bolts

4. Lubricate U-Bolts with oil or anti-seize compound to reduce nut friction.
5. Tighten all U-Bolts until they are snug only.
6. Tighten in the sequence shown in the following stages
    a. Stage 1 60 ft-lbs.
    b. Stage 2 100 ft-lbs
    c. Stage 3 200 ft-lbs
    d. Stage 4 300 ft-lbs

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 Axle Connection
2	4	10064-005	U-Bolt 3/4-16 x 9.03 Tri-8	4	2	10949-006	Upper Axle Connection

1. Loosely install the Upper Axle Connection on to the axle with the clevis forward. The mount should be flush with the top of the axle with the lcation stud in the furthest hole (from axle center line). See Figure 11 and Figure 12 for reference.

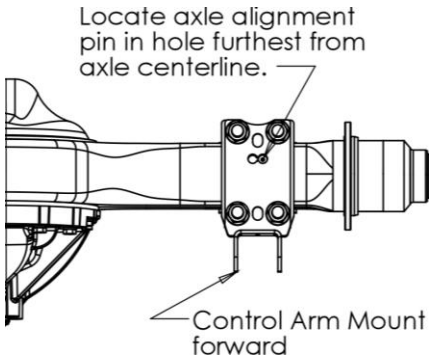


Figure 11. Aligning Axle Connection on Axle Stud

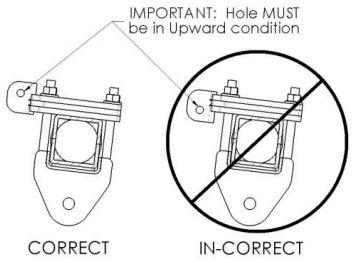


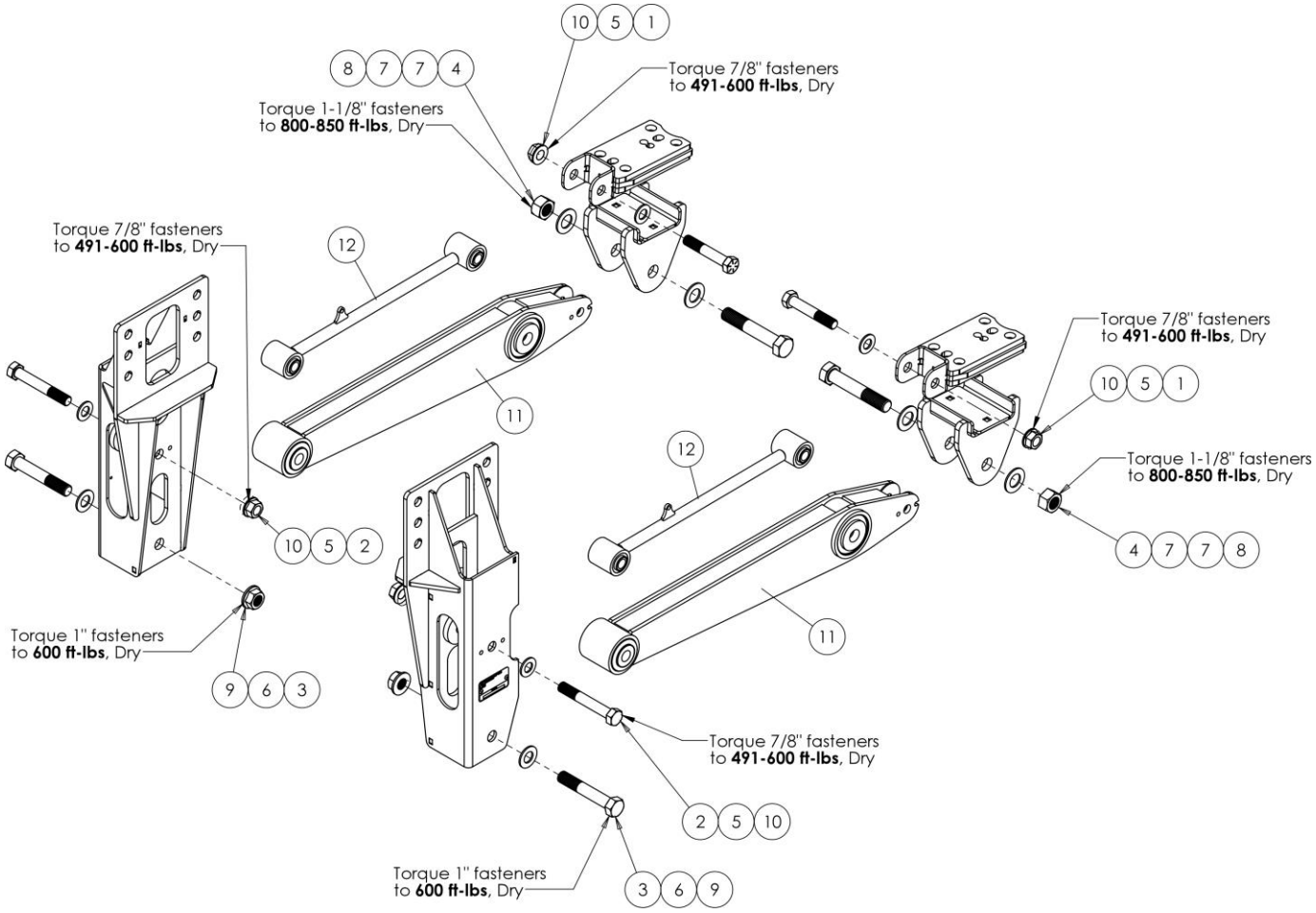
Figure 12. Control Arm Mount orientation.

2. Slip the Lower Axle Connection 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	10002-500	HCS 7/8”-9 x 5.0, Gr. 8	7	4	10006-005	HFW 1-1/8”
2	2	10002-600	HCS 7/8”-9 x 6.0, Gr. 8	8	2	10008-003	HCS 1-1/8”-7 x 6.5, Gr. 8
3	2	10003-003	HB 1”-8 x 6.0, Gr. 8	9	2	10012-003	LFN 1”-8, Gr. G
4	2	10004-014	LFN 1-1/8”-7, Gr. C	10	4	10012-017	LFN 7/8”-9, Gr. G
5	4	10006-003	HFW 7/8”	11	2	10953-009	Lower Control Arm
6	2	10006-004	HFW 1”	12	2	11198-007	Upper Control Arm

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

   Note: Orientate Upper 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.

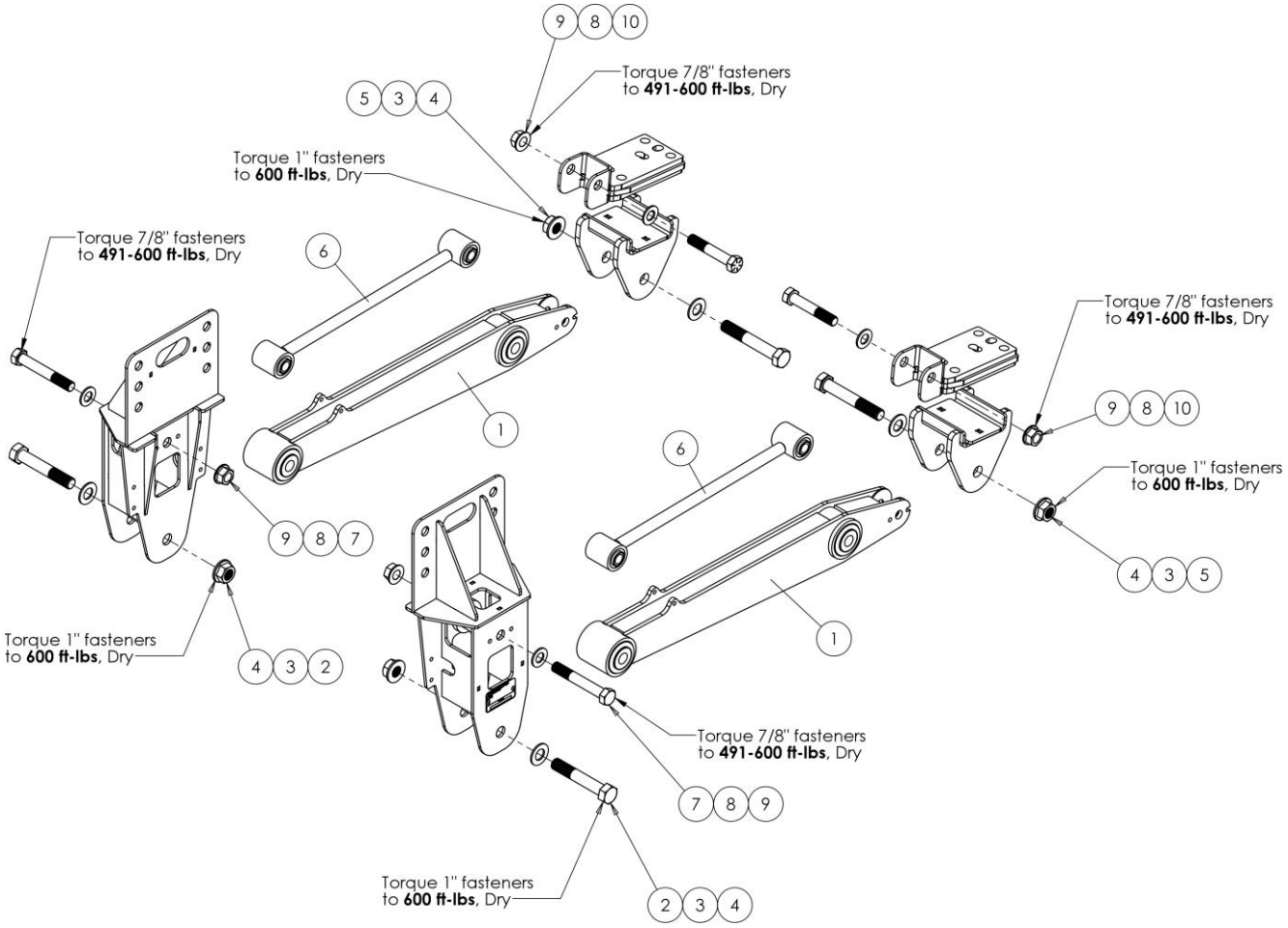
   IMPORTANT: Verify that the 1-1/8”-7 x 6-1/2” Hex Cap Screw is used to attach the Lower Control Arm to the LCA mount at the axle and that the 1”-8 x 6” Hex Cap Screw is used to attach the LCA to the Hanger.

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

3. 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.

Control Arms – DS135F650SR-SHR



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10002-500	HCS 7/8”-9 x 5.0, Gr. 8	6	4	10006-004	HFW 1”
2	2	10002-600	HCS 7/8”-9 x 6.0, Gr. 8	7	4	10012-003	LFN 1”-8, Gr. G
3	2	10003-003	HB 1”-8 x 6.0, Gr. 8	8	4	10012-017	LFN 7/8”-9, Gr. G
4	2	10003-004	HB 1”-8 x 6.5, Gr. 8	9	2	10953-011	Lower Control Arm
5	4	10006-003	HFW 7/8”	10	2	11198-008	Upper Control Arm

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

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

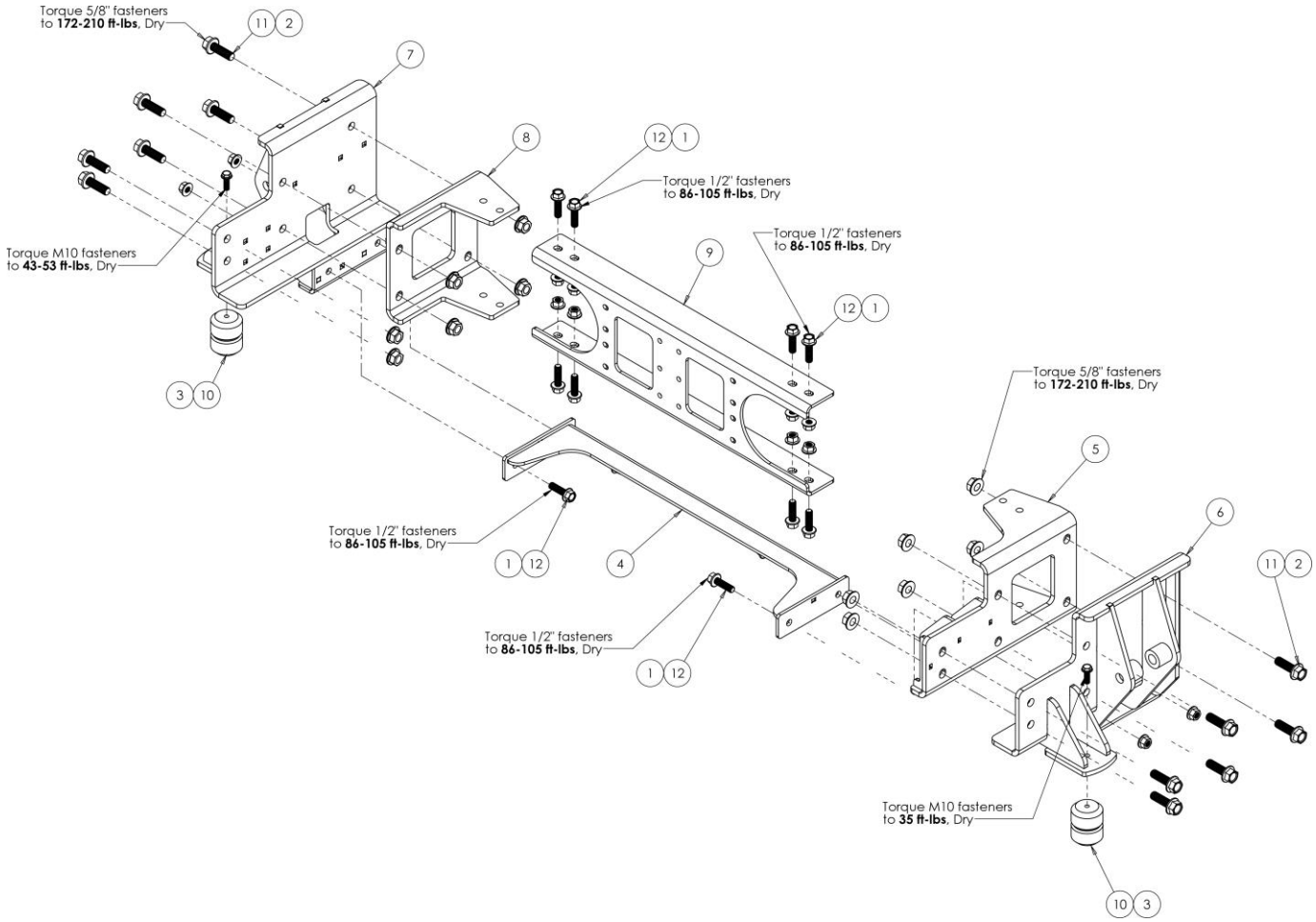
   IMPORTANT: Fasteners inserted into the axle mount must be orientated towards the outboard as shown. Fasteners inserted into the front hanger can be orientated either direction.

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

6. 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	12	10012-007	LFN ½”-13 Gr. G	7	1	10790-038	Upper Strut Mount, RH
2	12	10012-008	LFN 5/8”-11 Gr. G	8	1	10795-017	Crossmember End Channel
3	2	10502-001	HFB M10-1.5 x 30, CL 10.9	9	1	10796-016	Crossmember Channel
4	1	10782-006	Crossmember Reinforcement	10	2	10867-003	Jounce Bumper
5	1	10789-020	Track Rod Mount	11	12	10874-200	HFB 5/8”-11 x 2.0, Gr. 8
6	1	10790-037	Upper Strut Mount, LH	12	12	10885-175	HFB ½”-13 x 1.75, Gr. 8

1. Using the holes drilled in the *Frame Preparation* step, loosely attach the LH Upper Strut Mount and Track Rod 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 13. Note orientation of the Track Rod Mount as shown above.
2. Loosely attach the Right Hand Upper Strut Mount and Cross-Member End Channel to the frame using (6) 5/8”-11 x 2” Hex Flange Bolts and (6) 5/8”-11 Locking Flange Nuts. Refer to Figure 14. Note orientation of the End Channel as shown above.

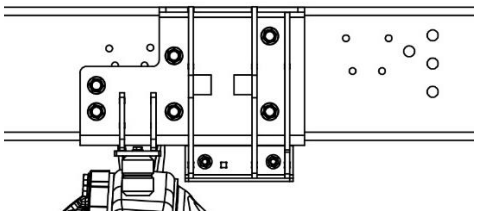


Figure 13. Driver Side (LH) Upper Strut Mount Installation.

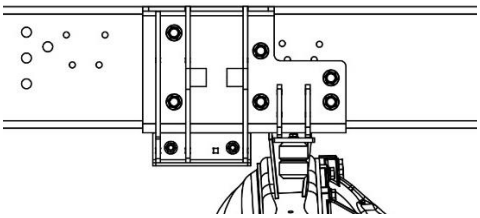


Figure 14. Passenger Side (RH) Upper Strut Mount Installation.

3. Install the Crossmember Channel inside of the mounts using the 1/2”-13 x 1-1/2” Hex Flange Bolts and 1/2”-13 Locking Flange Nuts. Note orientation of channel as shown above.
4. Make sure both Upper Strut Mounts are flush against the bottom of the frame.
5. Loosely attach the Crossmember Reinforcement between the Upper Strut Mounts, under the frame.
6. Torque all 5/8” fasteners, which attach the upper strut mounts and track rod to the frame, to **172-210 ft-lbs.**
7. Torque all 1/2” fasteners to **86-105 ft-lbs.**
8. Install Jounce bumpers using the M10 fasteners.
9. Torque M10 Fasteners to **35 ft-lbs.**

Note: Jounce bumpers may need to be removed to complete suspension calibration if vehicle has no payload. Jounce bumpers can be installed after the calibration is completed.

10. Jack each side of the axle until approximate design ride height position is reached. See Figure 15.
11. Torque the two (2) 1-1/8” Control Arm mounting bolts to **800-850 ft-lbs.**
12. Torque the two (2) 1” Control Arm mounting bolts to **600 ft-lbs.**
13. Torque the four (4) 7/8” Control Arm mounting bolts to **600 ft-lbs.**

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

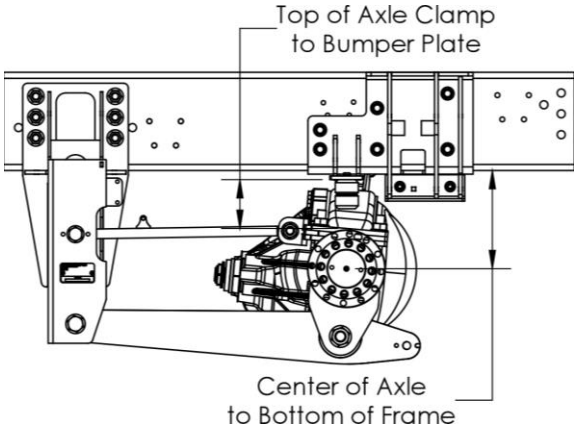
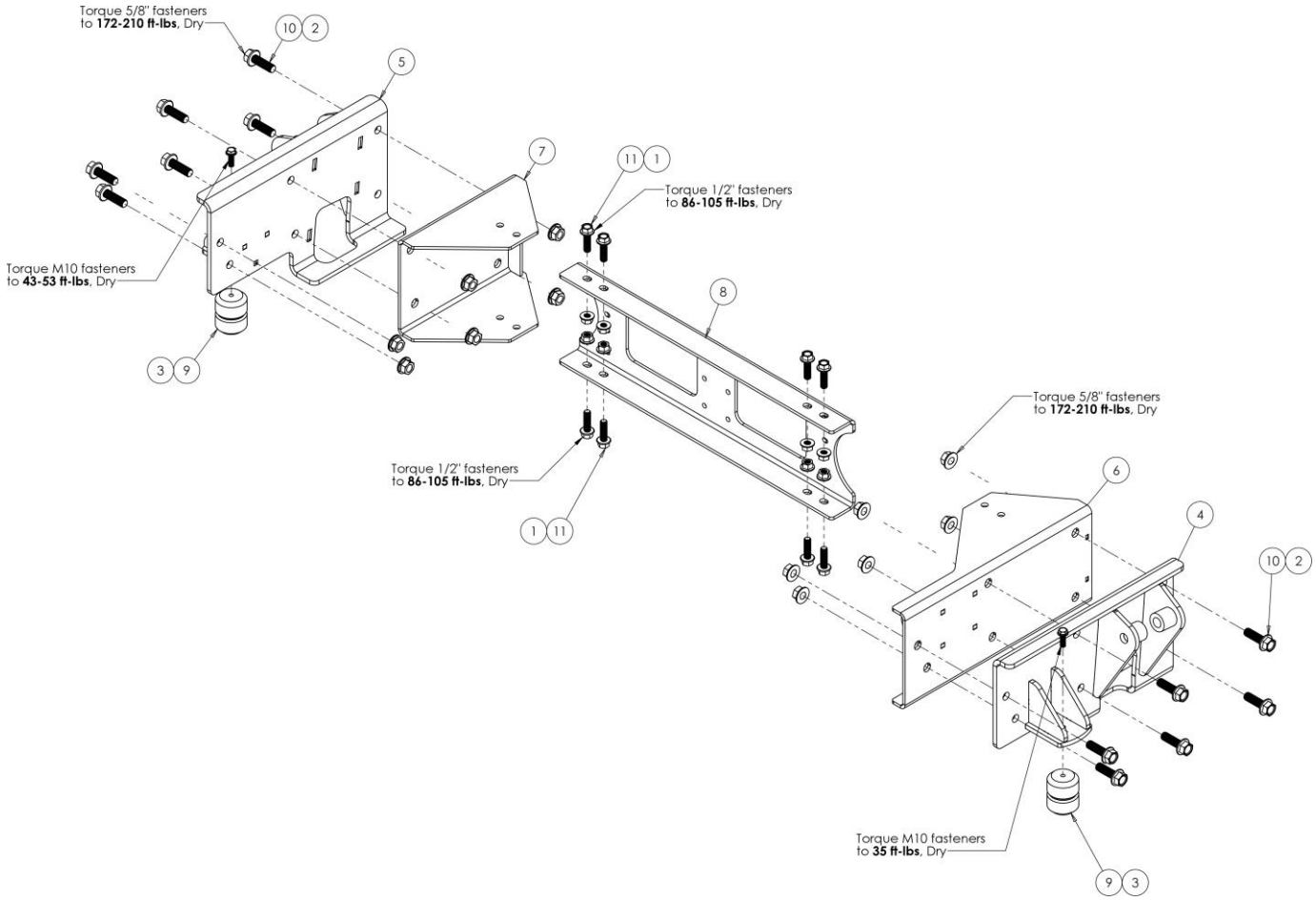


Figure 15. Design Ride Height.

SUSPENSION	CENTER AXLE TO BOTTOM FRAME	TOP AXLE CLAMP TO BUMPER PLATE
DS190F650SR-SHB	10-1/8”	5-1/16”
DS135F650SR-SHF	10-1/8”	5-1/16”
DS135F650SR-SHR	7-5/8”	5-1/2”

Upper Strut Mounts – DS135F650R-SHR



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	12	10012-007	LFN ½"-13 Gr. G	7	1	10795-019	Crossmember Mount, RH
2	12	10012-008	LFN 5/8"-11 Gr. G	8	1	10796-007	Crossmember Channel
3	2	10502-001	HFB M10-1.5 x 30, CL 10.9	9	2	10867-003	Jounce Bumper
4	1	10790-020	Upper Strut Mount, LH	10	12	10874-200	HFB 5/8"-11 x 2.0, Gr. 8
5	1	10790-021	Upper Strut Mount, RH	11	12	10885-175	HFB ½"-13 x 1.75, Gr. 8
6	1	10795-018	Crossmember Mount, LH				

1. Using the holes drilled in the *Frame Preparation* step, loosely attach the LH Upper Strut Mount and Track Rod 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 16. Note orientation of the Track Rod Mount as shown above.
2. Loosely attach the Right Hand Upper Strut Mount and Crossmember End Channel to the frame using (6) 5/8"-11 x 2" Hex Flange Bolts and (6) 5/8"-11 Locking Flange Nuts. Refer to Figure 17. Note orientation of the End Channel as shown above.

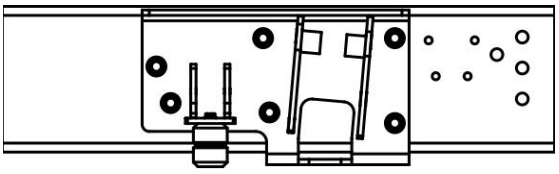


Figure 16. Driver Side (LH) Upper Strut Mount Installation.

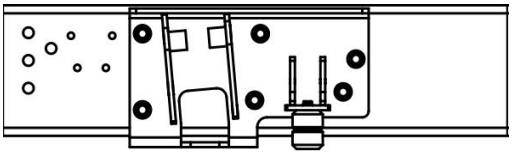


Figure 17. Passenger Side (RH) Upper Strut Mount Installation.

3. Install the Crossmember Channel inside of the mounts using the 1/2”-13 x 1-1/2” Hex Flange Bolts and 1/2”-13 Locking Flange Nuts. Note orientation of channel as shown above.
4. Make sure both Upper Strut Mounts are flush against the bottom of the frame.
5. Loosely attach the Crossmember Reinforcement between the Upper Strut Mounts, under the frame.
6. Torque all 5/8” fasteners, which attach the upper strut mounts and track rod to the frame, to **172-210 ft-lbs.**
7. Torque all 1/2” fasteners to **86-105 ft-lbs.**
8. Install Jounce bumpers using the M10 fasteners.
9. Torque M10 Fasteners to **35 ft-lbs.**

Note: Jounce bumpers may need to be removed to complete suspension calibration if vehicle has no payload. Jounce bumpers can be installed after the calibration is completed.

10. Jack each side of the axle until approximate design ride height position is reached. See Figure 18.
11. Torque the two (2) 1-1/8” Control Arm mounting bolts to **800-850 ft-lbs.**
12. Torque the two (2) 1” Control Arm mounting bolts to **600 ft-lbs.**
13. Torque the four (4) 7/8” Control Arm mounting bolts to **600 ft-lbs.**

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

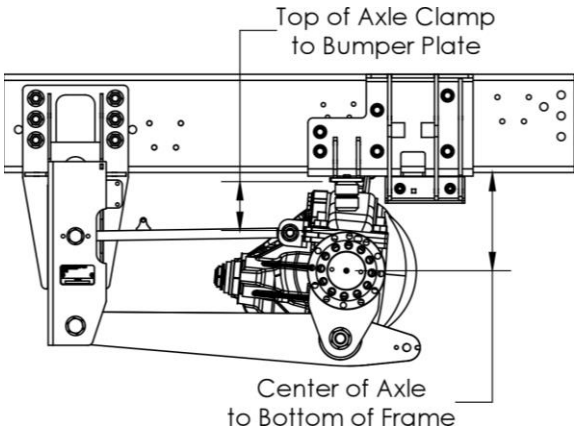
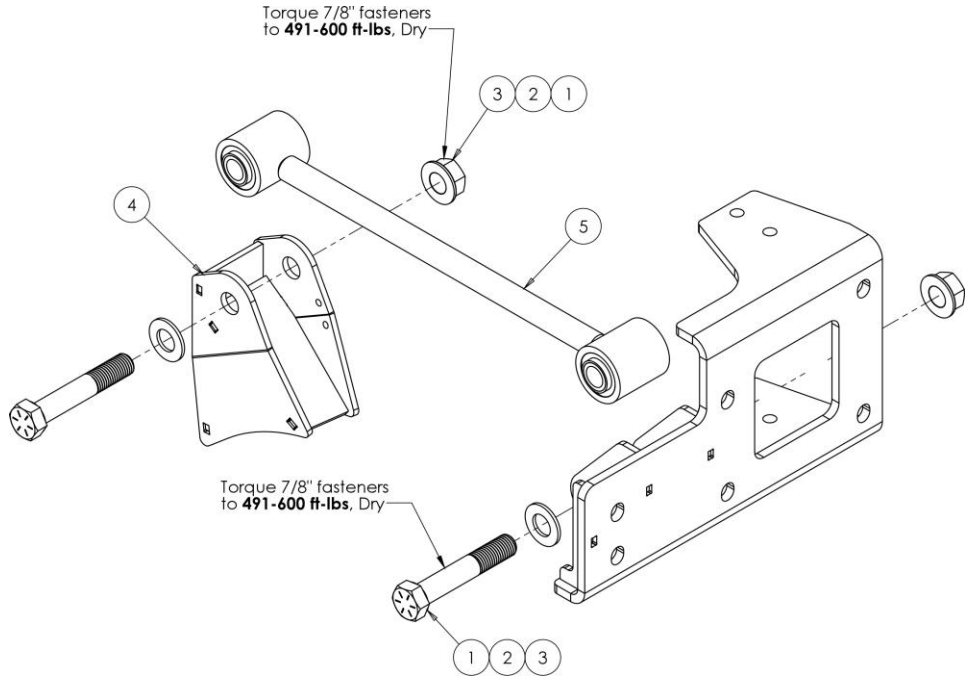


Figure 18. Design Ride Height.

SUSPENSION	CENTER AXLE TO BOTTOM FRAME	TOP AXLE CLAMP TO BUMPER PLATE
DS190F650SR-SHB	10-1/8”	5-1/16”
DS135F650SR-SHF	10-1/8”	5-1/16”
DS135F650SR-SHR	7-5/8”	5-1/2”

Track Rod



ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	10002-500	HCS 7/8”-9 x 5” Gr. 8
2	2	10006-003	HFW 7/8”
3	2	10012-017	LFN 7/8”-9, Gr. G
4	1	10951-009	Axle Mount
5	1	11198-005	Track Rod

1. Loosely attach the Track Rod Assembly to the Track Rod Axle Mount and to the Frame Mount using the 7/8” fasteners.
2. Ensure that vehicle is still sitting at ride height.
3. If not at ride height, jack each side of the axle or adjust frame height until approximate design ride height position is reached. See Figure 18.
4. Swing track rod up and out of the way to prepare for welding of axle mount. (Axle Mount should be attached to Track Rod at this time)

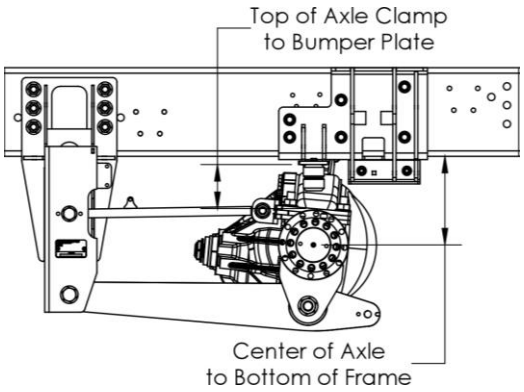


Figure 19. Ride Height for Track Rod Installation.

Track Rod Axle Mount

1. Move any Parking Brake Cables and wiring from top of axle and position away from the axle.

IMPORTANT: Hangers, Axle Clamps, Control Arms, Upper Strut Mounts, Crossmembers, and Track Rod components must be installed before proceeding with axle mount welding.

2. Lift axle to LiquidSpring Ride Height and ensure axle is centered in vehicle.

3. If axle is center is incorrect, adjust as necessary. Refer to Figure 20 for examples of axle centering, and Figure 19 for correct ride height measurements.

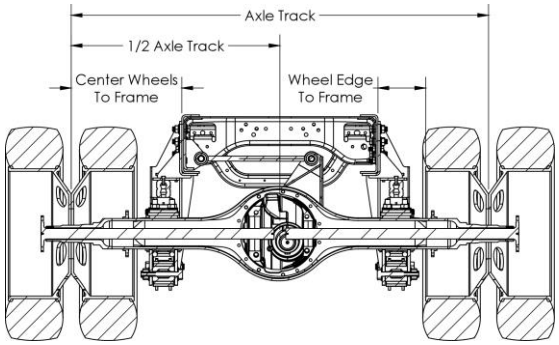


Figure 20. Checking Axle Center.

4. Temporarily place the mount onto the axle as shown in Figure 21. The template profile should approximately match the axle profile.

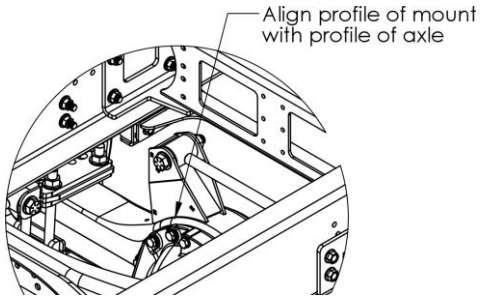


Figure 21. Position Axle Mount

5. Outline the axle mount with a visible paint marker.

6. Swing the axle mount and track rod out of the way and grind away the outlined area and ½" beyond to bare metal.

7. Swing the mount back down onto the axle, again aligning the profiles.

8. Tack weld all 4 sides of the axle mount to the axle housing as shown in Figure 22.

IMPORTANT: Before final weldment, ensure that vehicle is at ride height, axle is centered, and track rod is approximately level horizontally.

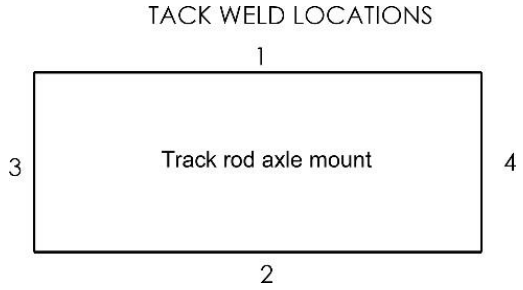


Figure 22. Tack Welding Axle Mount

9. Unbolt track rod from axle mount.

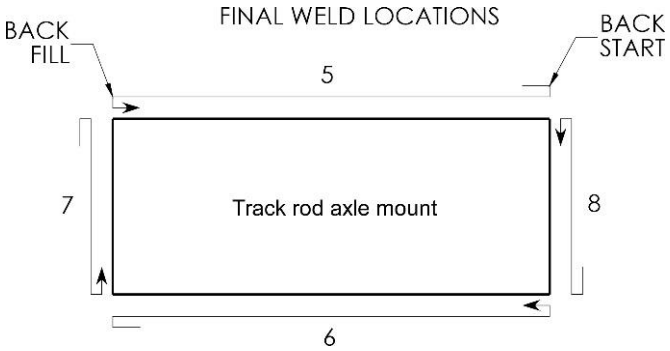


Figure 23. Final Welding on Axle Mount

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.

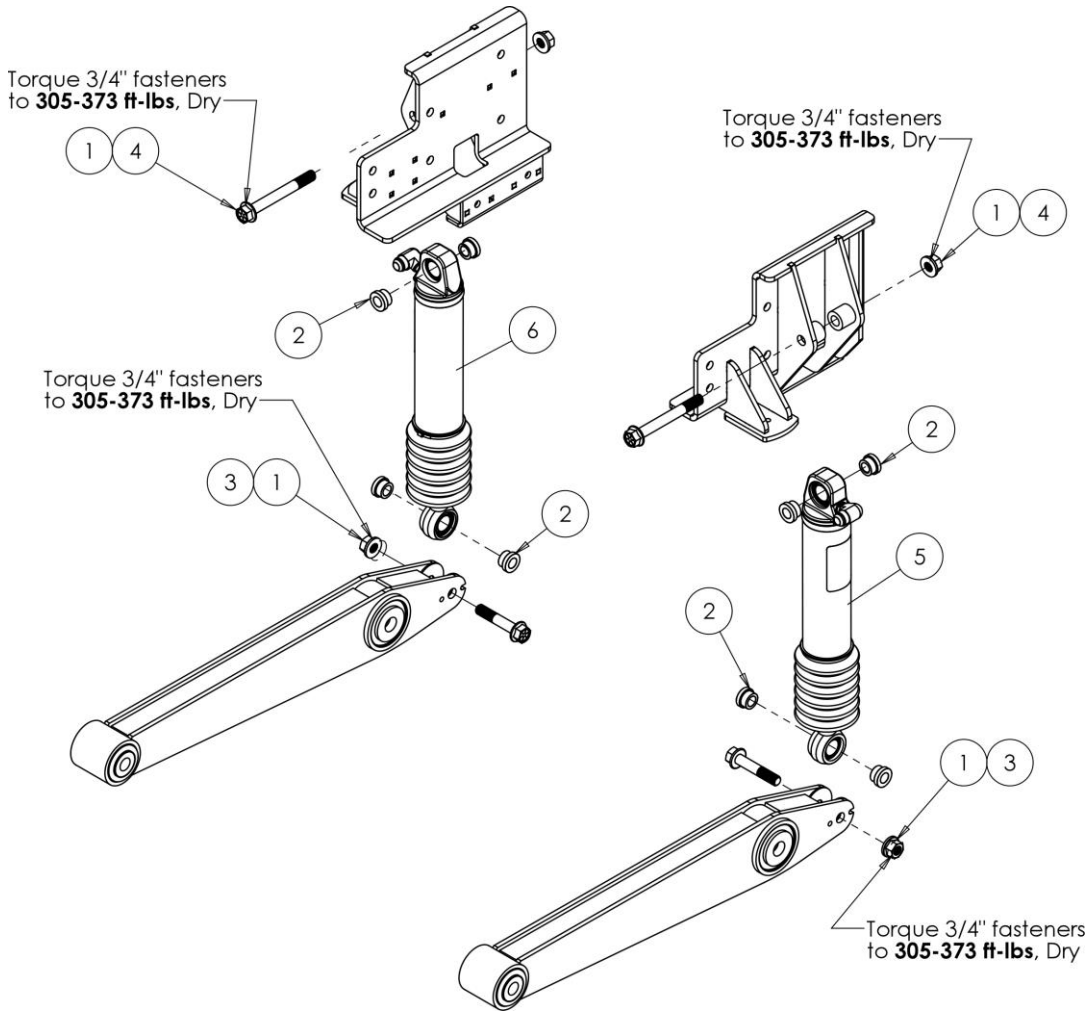
14. Once the axle has cooled, re-install the track rod, and torque the 7/8" fasteners to **491-600 ft-lbs**.

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 fill. Clean weld before each pass.

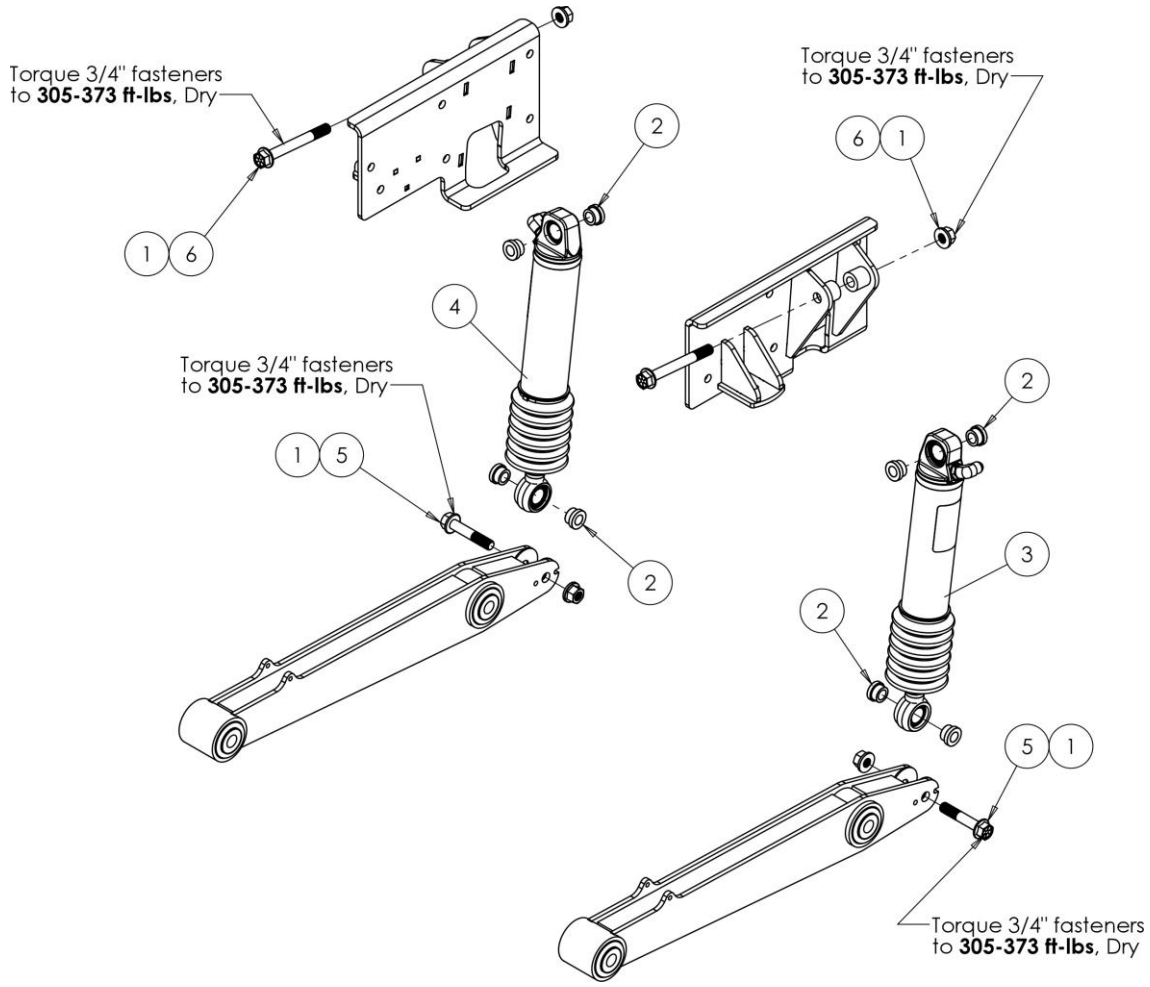
Struts



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-014	LFN 3/4-10, Gr. G	5	1	11177-007	Strut Assembly LH – **DS190**
2	8	10640-005	Bearing Spacer 1.24x.812x.318			11057-003	Strut Assembly LH – **DS135**
3	2	11102-400	HFB 3/4-10 x 4, Gr. 8	6	1	11177-008	Strut Assembly RH – **DS190**
4	2	11102-650	HFB 3/4-10 x 6-1/2, Gr. 8			11057-004	Strut Assembly RH – **DS135**

1. Install the Left Hand Strut assembly as shown making sure to install bearing spacers on both upper and lower mounts.
2. Repeat for installation of Right Hand Strut assembly.
3. Torque upper and lower strut mounts to **305-373 ft-lbs.**

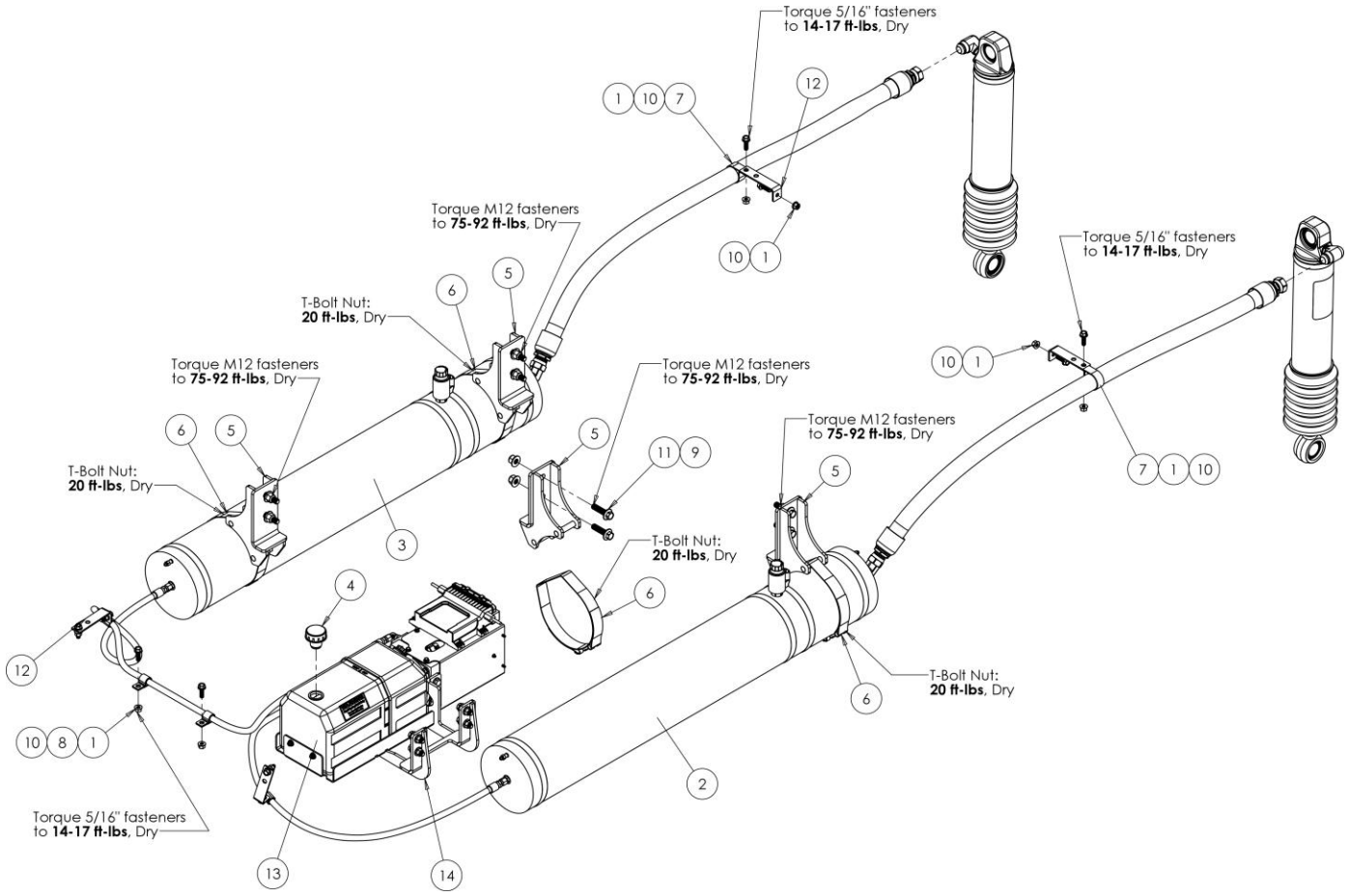
Struts – DS135F650SR-SHR



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-014	LFN 3/4-10, Gr. G	4	1	11057-004	Strut Assembly RH
2	8	10640-005	Bearing Spacer 1.24x.812x.318	5	2	11102-400	HFB 3/4-10 x 4, Gr. 8
3	1	11057-003	Strut Assembly LH	6	2	11102-650	HFB 3/4-10 x 6-1/2, Gr. 8

1. Install the Left Hand Strut assembly as shown making sure to install bearing spacers on both upper and lower mounts.
2. Repeat for installation of Right Hand Strut assembly.
3. Torque upper and lower strut mounts to **305-373 ft-lbs.**

Secondary Volumes – DS190F650SR-SHB



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	10	10012-005	LFN 5/16”-18 Gr. G	8	4	10855-003	Vinyl Coated Loop Clamp, 5/8” ID
2	1	10597-095	Volume Assembly, LH	9	8	10873-004	LFN M12-1.75, CL 10.9
3	1	10597-096	Volume Assembly, RH	10	10	10886-100	HFB 5/16”-18 x 1” Gr. 8
4	1	10614-001	Cap, Filler/Breather	11	8	11012-045	HFB M12-1.75 x 45 CL 10.9
5	4	10830-022	Volume Mount	12	4	11263-004	Hose Bracket
6	4	10843-004	T-Bolt Clamp	13	1	11287-003	Power Module Assembly
7	2	10855-001	Vinyl Coated Loop Clamp, 1.5” ID	14	1	11380	Power Module Mount Kit

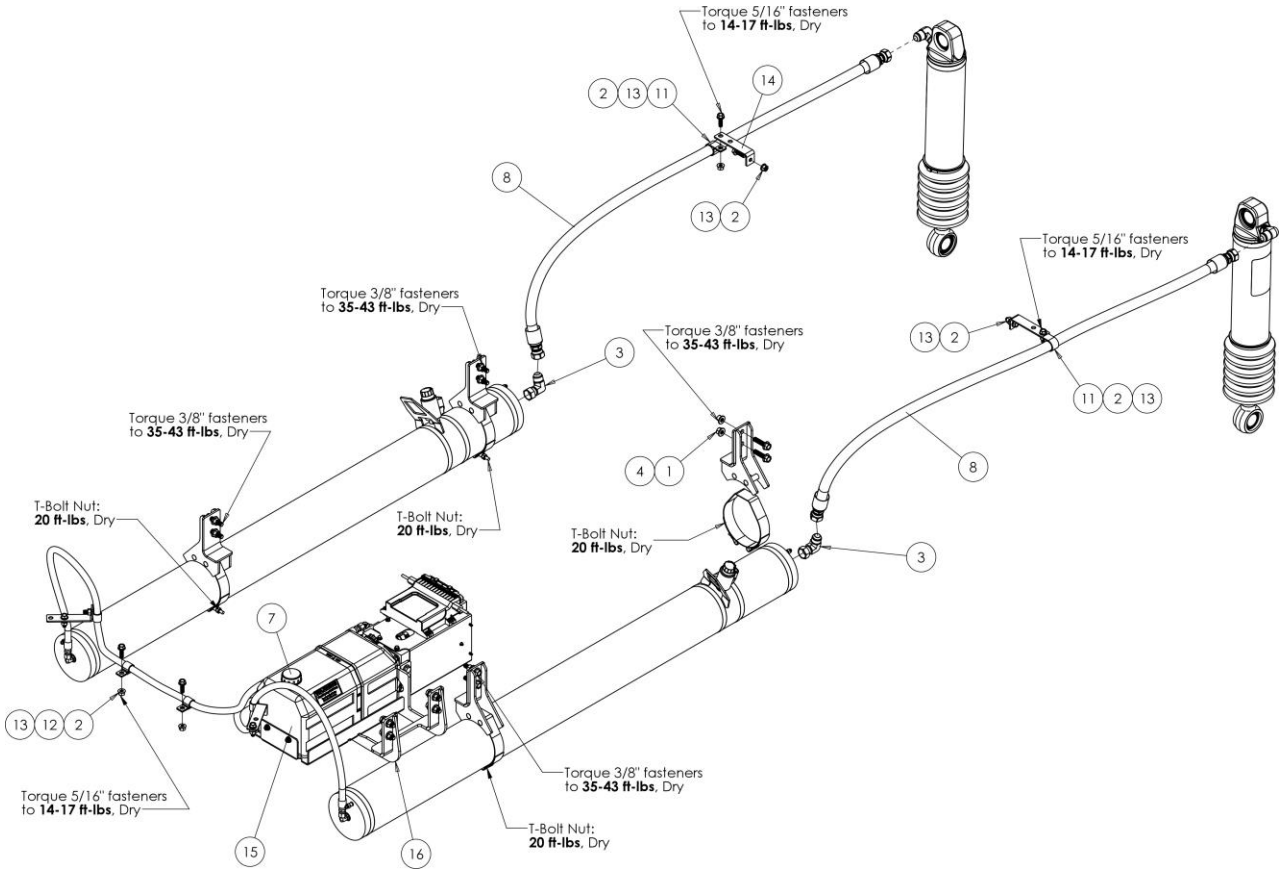
WARNING: Each Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to support the Volume Assembly during installation.

1. Locate (2) Volume Mounts.
2. Place Volume Mount onto outside of frame, verifying that the mount is held flush with the bottom of the frame.

Important: Avoid partially drilling through existing frame holes and inside fuel line mounts.

3. Using the Volume Mount as a guide, mark and drill (4) 17/32” holes as shown in Appendix C: Frame Drilling Locations.
4. Attach the two mounts with M12 Flange Bolts and Nuts. Torque to **75-92 ft-lbs**.
5. Repeat with Volume Mounts on the passenger side of the frame.
6. Locate the appropriate Volume Assembly.
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 **20 ft-lbs (240 in-lbs)**.
10. Repeat with opposite side.

Secondary Volumes – DS135F650SR-SHF



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-005	LFN 3/8”-16, Gr. G	9	4	10830-013	Volume Mount
2	10	10012-010	LFN 5/16”-18, Gr. G	10	4	10843-003	T-Bolt Clamp
3	2	10322-010	Hyd Fitting 90, -10 37 x -10 37 F	11	2	10855-002	Vinyl Coated Loop Clamp, 1” ID
4	8	10501-150	HFB 3/8”-16 x 1.5”, Gr. 8	12	4	10855-003	Vinyl Coated Loop Clamp, 5/8” ID
5	1	10597-103	Volume Assembly, LH	13	10	10886-100	HFB 5/16”-18 x 1” Gr. 8
6	1	10597-104	Volume Assembly, RH	14	4	11263-004	Hose Bracket
7	1	10614-001	Cap, Filler/Breather	15	1	11287-003	Power Module Assembly
8	2	10810-002	Hydraulic Hose, -10 x 55-5/8”L	16	1	11380	Power Module Mount Kit

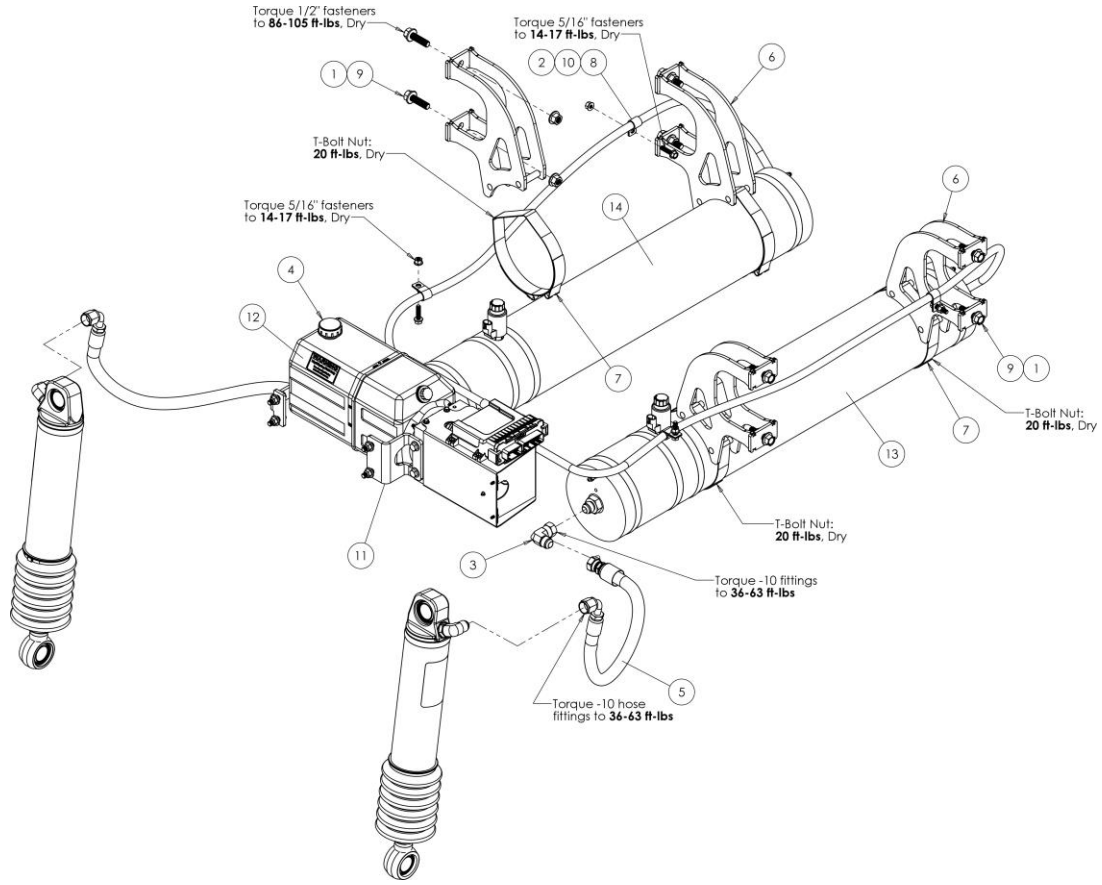
WARNING: Each Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to support the Volume Assembly during installation.

1. Locate (2) Volume Mounts.
2. Place Volume Mount onto outside of frame, verifying that the mount is held vertically.

Important: Avoid partially drilling through existing frame holes and inside fuel line mounts.

3. Using the Volume Mount as a guide, mark and drill (4) Ø7/16” holes as shown in Appendix C: Frame Drilling Locations.
4. Attach the two mounts with 3/8” Flange Bolts and Nuts. Torque to **35-43 ft-lbs**.
5. Repeat with Volume Mounts on the passenger side of the frame.
6. Locate the appropriate Volume Assembly.
7. Raise the volume assembly until the volume contacts both mounts. Rotate the volume assembly as necessary to avoid contact with frame cross members, keeping bleed screws 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 **20 ft-lbs (240 in-lbs)**.
10. Repeat with opposite side.

Secondary Volumes – DS135F650SR-SHR



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	10012-007	LFN 1/2”-13, Gr. G	8	4	10855-003	Vinyl Coated Loop Clamp, 5/8” ID
2	4	10012-010	LFN 5/16”-18, Gr. G	9	8	10885-175	HFB 1/2”-13 x 1.75” Gr. 8
3	2	10322-010	Hyd Fitting 90, -10 37 x -10 37 F	10	4	10886-125	HFB 5/16”-18 x 1.25” Gr. 8
4	1	10614-001	Cap, Filler/Breather	11	1	11109	Power Module Mount Kit
5	2	10810-007	Hydraulic Hose, -10 x 25-3/16”L	12	1	11287-003	Power Module Assembly
6	4	10830-027	Volume Mount	13	1	11462-001	Volume Assembly, LH
7	4	10843-004	T-Bolt Clamp	14	1	11462-002	Volume Assembly, RH

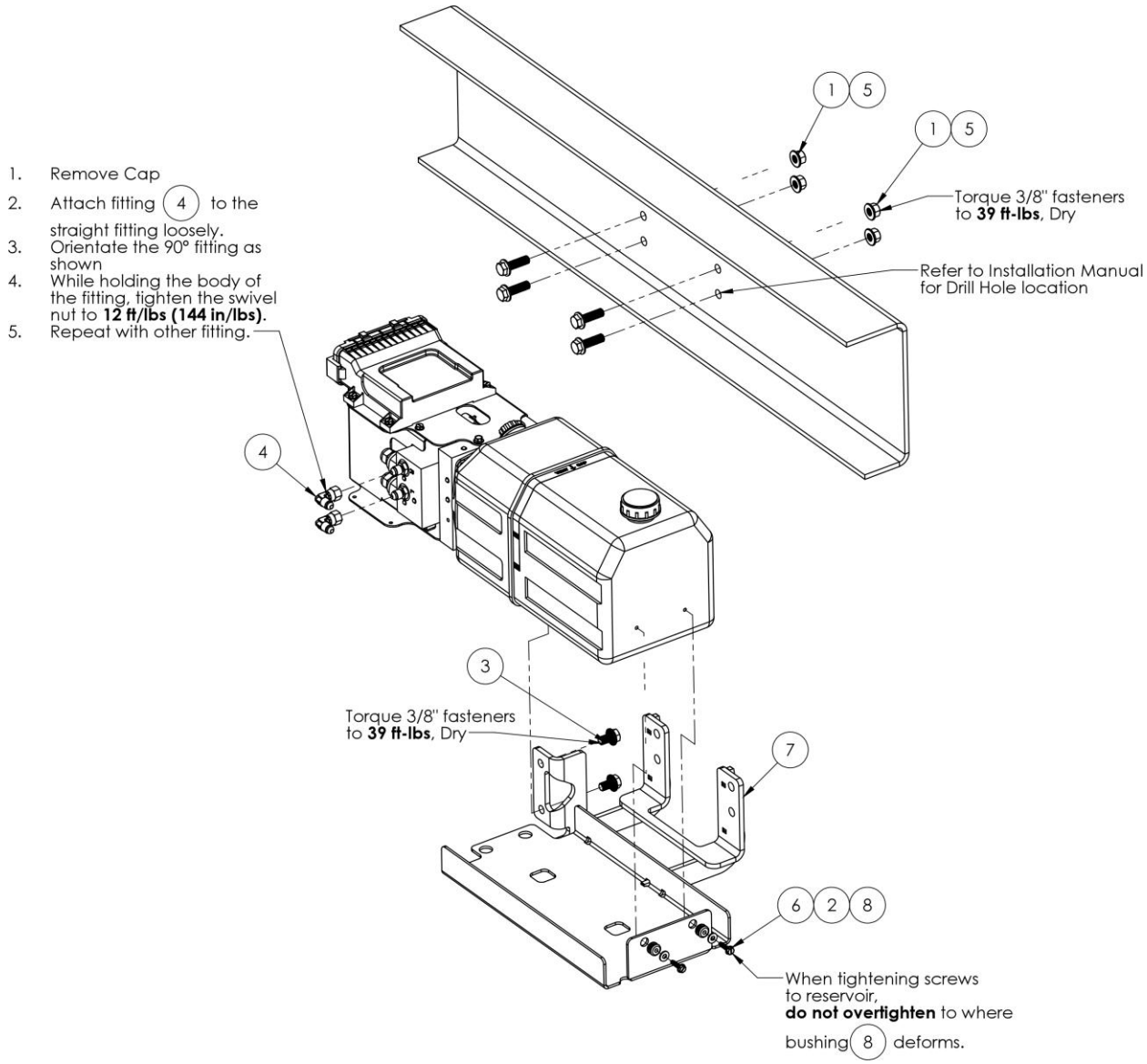
WARNING: Each Volume Assembly is heavy (in excess of 100 lbs). Use of a portable lift, crane, or suitable jack is recommended to support the Volume Assembly during installation.

1. Locate (2) Volume Mounts.
2. Place Volume Mount onto inside of frame, verifying that the mount is held vertically.

Important: Avoid partially drilling through existing frame holes and inside fuel line mounts.

3. Using the Volume Mount as a guide, mark and drill (4) Ø17/32” holes as shown in Appendix C: Frame Drilling Locations.
4. Attach the two mounts with 1/2” Flange Bolts and Nuts. Torque to **85-105 ft-lbs**.
5. Repeat with Volume Mounts on the passenger side of the frame.
6. Locate the appropriate Volume Assembly.
7. Raise the volume assembly until the volume contacts both mounts. Rotate the volume assembly as necessary to avoid contact with frame cross members, keeping bleed screws 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 **20 ft-lbs (240 in-lbs)**.
10. Repeat with opposite side.

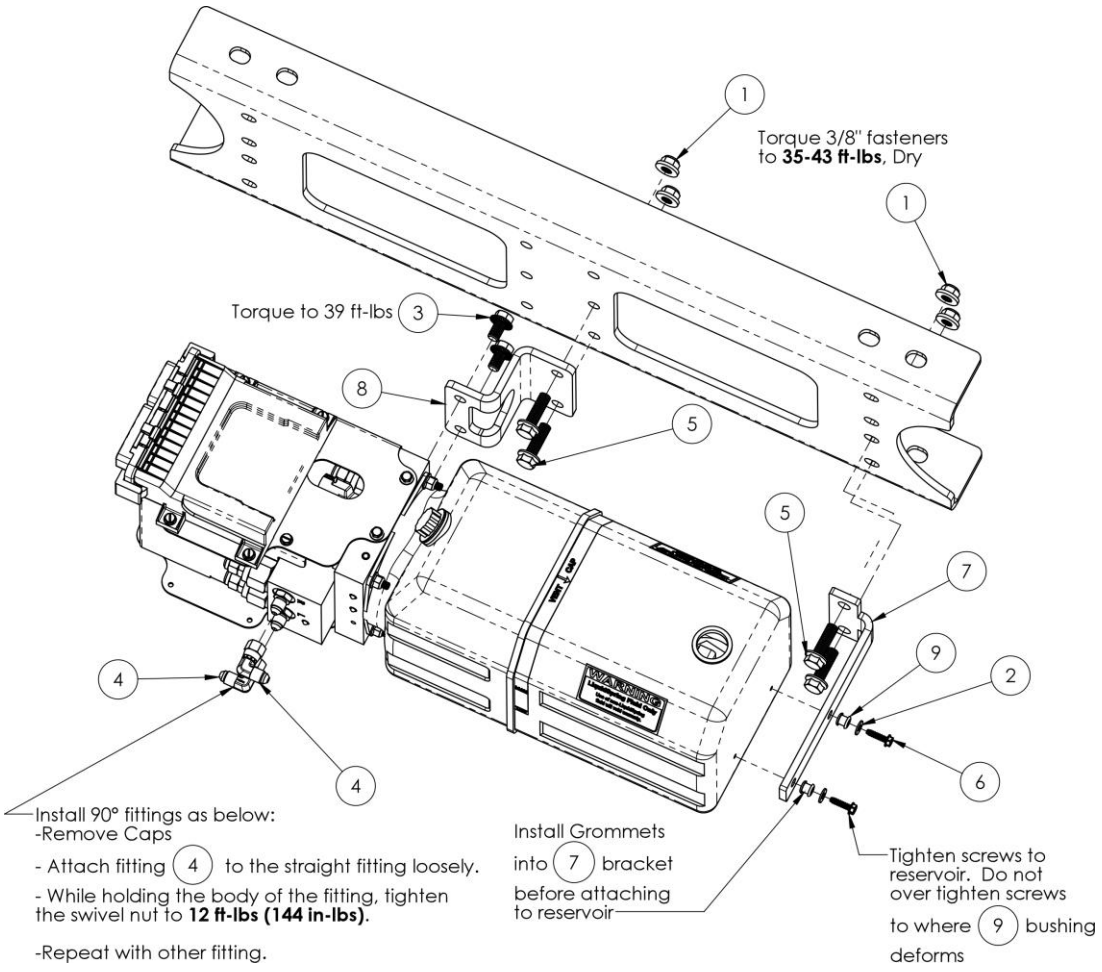
Power Module



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-005	LFN 3/8”-16, Gr. G	5	4	10501-002	HFB 3/8”-16 x 1.25” Gr. 8
2	2	10088-001	FW #10	6	2	10510-002	STS #10-16 x 0.75”
3	2	10252-003	SFHS 3/8”-16 x .625” Gr. 8	7	1	10798-030	Power Module Mount
4	2	10322-021	Hyd Fit, 90, -4 37 x -4 37 F	8	2	10805-004	Grommet

1. Locate the Power Module Assembly and Power Module Mounting Kit.
2. Using the Power Module Reservoir Mount, mark and drill holes shown in Appendix .
3. Verify that the mount is held flush to the bottom of the frame and utilizing the mount hole pattern. Mark the location of the mounting holes and drill (4) Ø7/16” holes.
4. Install the Power Module Mount using the 3/8” fasteners and Torque to **35-43 ft-lbs.**
5. Follow instruction supplied with the hardware for attaching Power Module to Mount.

Power Module – DS135F650SR-SHR

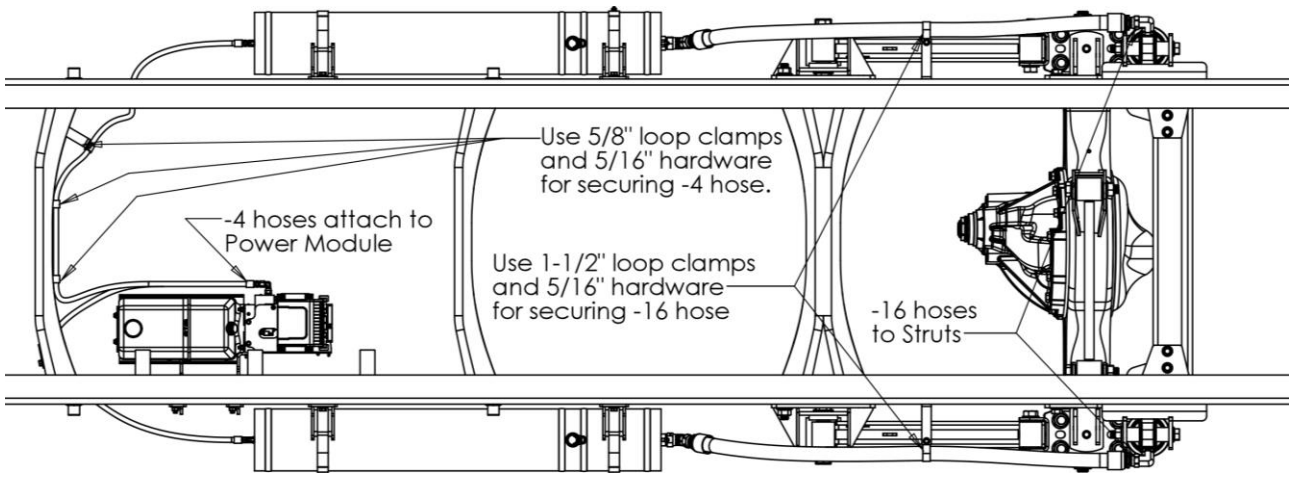


ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-011	LFN 3/8”-16, Gr. G
2	2	10088-001	FW #10
3	2	10252-003	SFHS 3/8”-16 x .625” Gr. 8
4	2	10322-021	Hyd Fit, 90, -4 37 x -4 37 F
5	4	10501-002	HFB 3/8”-16 x 1.25” Gr. 8

ITEM	QTY	PART NUMBER	DESCRIPTION
6	2	10510-002	STS #10-16 x 0.75”
7	1	10798-015	Power Module Reservoir Mount
8	1	10799-015	Power Module Manifold Mount
9	2	10805-007	Grommet

1. Locate the Power Module Assembly and 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 Crossmember 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 – DS190F650SR-SHB



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

1. Locate -16 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 -16 hose side of the Left Hand Secondary Volume Assembly and place the other end in a bucket.

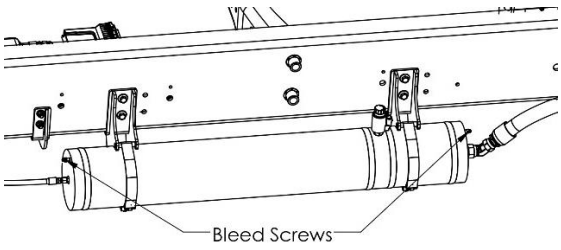


Figure 24. Bleed screw locations.

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 -16 (1”) 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 (-12 JIC fitting) to the strut port.
11. Torque to **75-83 ft-lbs.**
12. Secure hose with clamps and 5/16” hardware making sure to secure hoses from movement or chafing. as shown in Figure 25. Drill attaching Ø3/8” holes as necessary.
13. Repeat with the opposite side.

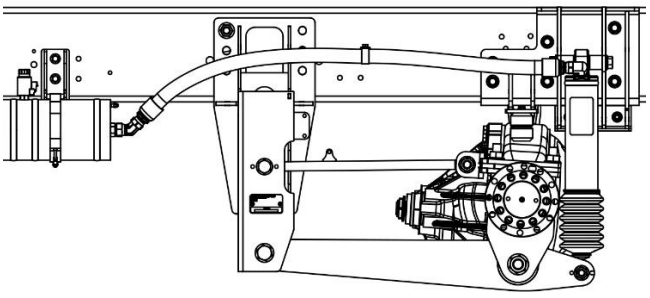


Figure 25. Driver side outboard hose routing.

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

14. Route the Left Hand (Driver side) -4 (1/4") hydraulic hose to the Power Module as shown in Figure 26. Use hose clamps and bracket to secure the hose from movement or chafing.

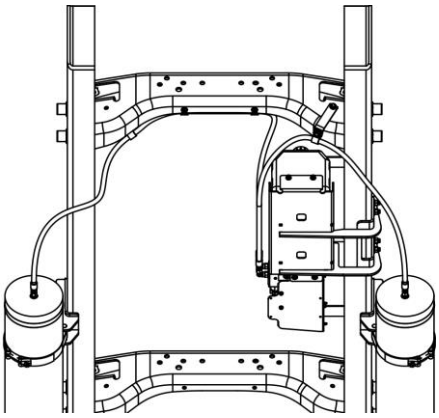


Figure 26. Driver side -4 Hose routing.

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 to the Power Module as shown in Figure 20. Use hose clamps and bracket to secure the hose from movement or chafing.

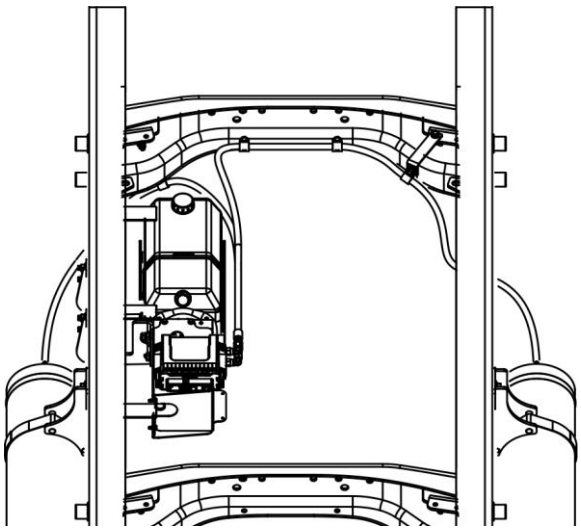
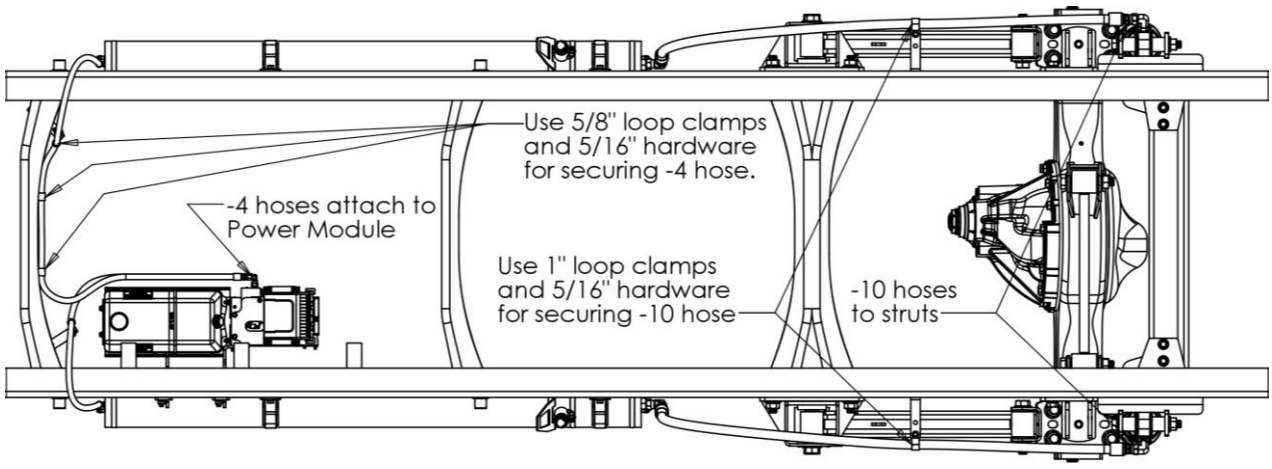


Figure 27. Passenger side -4 Hose routing.

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

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 – DS135F650SR-SHF



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.

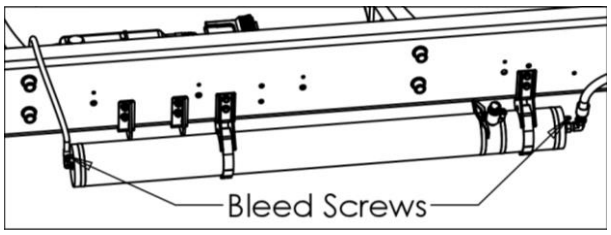


Figure 28. Bleed screw locations.

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 -10 hose end 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. Torque all -10 fittings to **36-63 ft-lbs.**
12. Secure -10 hose with clamps and 5/16" hardware making sure to secure hoses from movement or chafing. as shown in Figure 22. Drill attaching Ø3/8" holes as necessary.
13. Repeat with the opposite side.

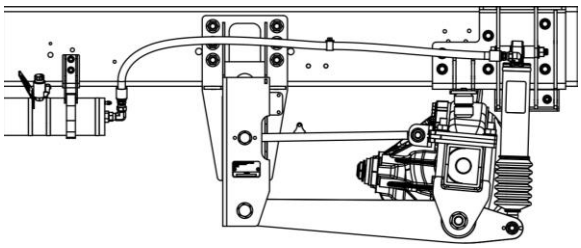


Figure 29. Driver side outboard hose routing.

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

14. Route the Left Hand (Driver side) -4 (1/4") hydraulic hose to the Power Module as shown in Figure 23. Use hose clamps and bracket to secure the hose from movement or chafing.

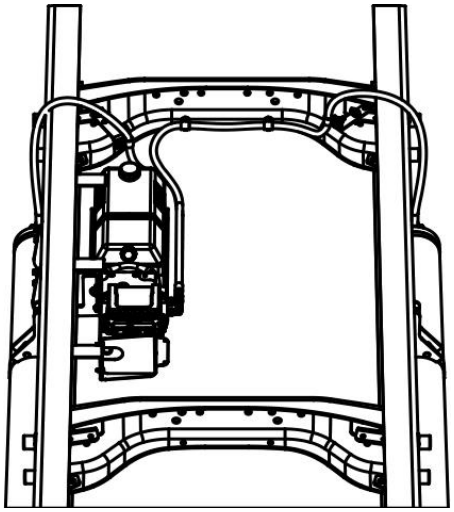


Figure 30. -4 Hose routing to PM

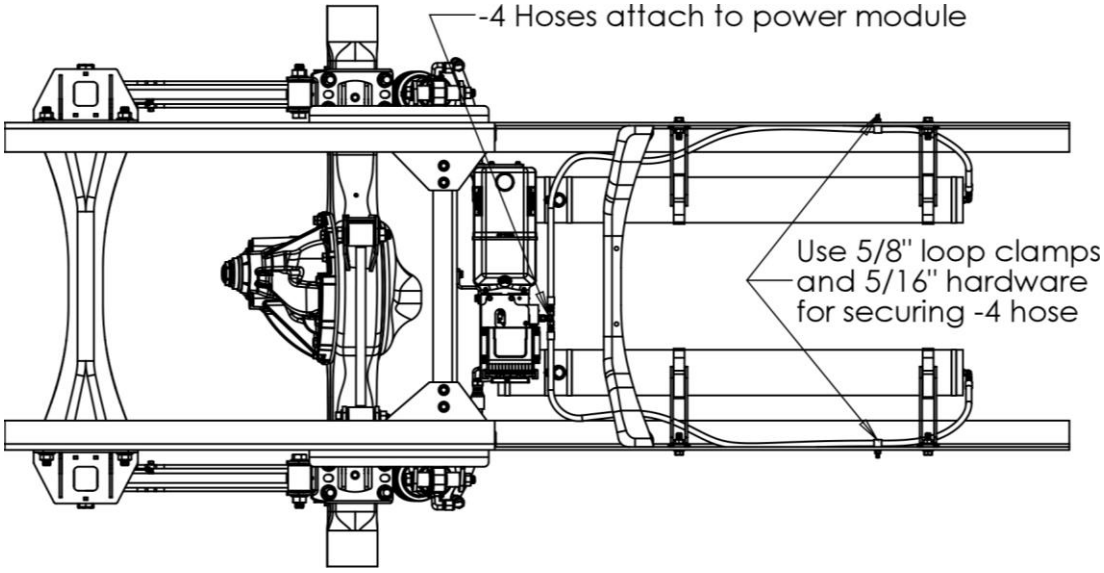
CAUTION: Make sure the hose is not chafing or in contact with any sharp edges.

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 to the Power Module as shown in Figure 23. Use hose clamps and bracket to secure the hose from movement or chafing.

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

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 – DS135F650SR-SHR



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.

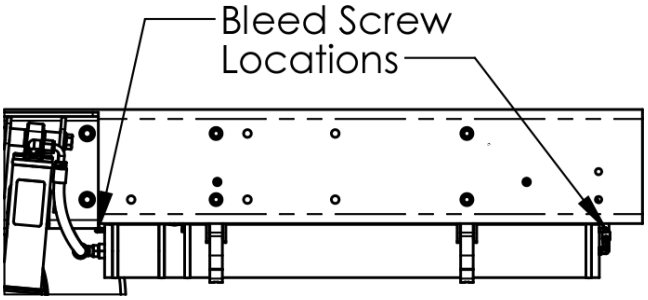


Figure 31. Bleed screw locations.

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 -10 hose end 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.

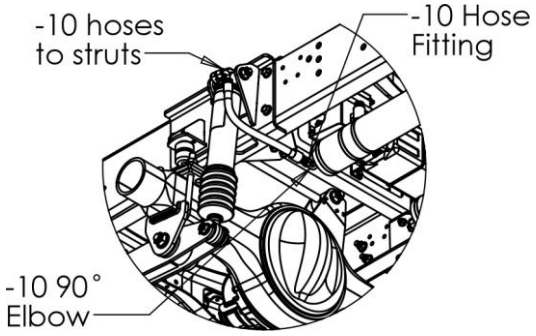


Figure 32. Driver side outboard hose routing.

11. Torque all -10 fittings to **36-63 ft-lbs.**
12. Repeat with the opposite side.

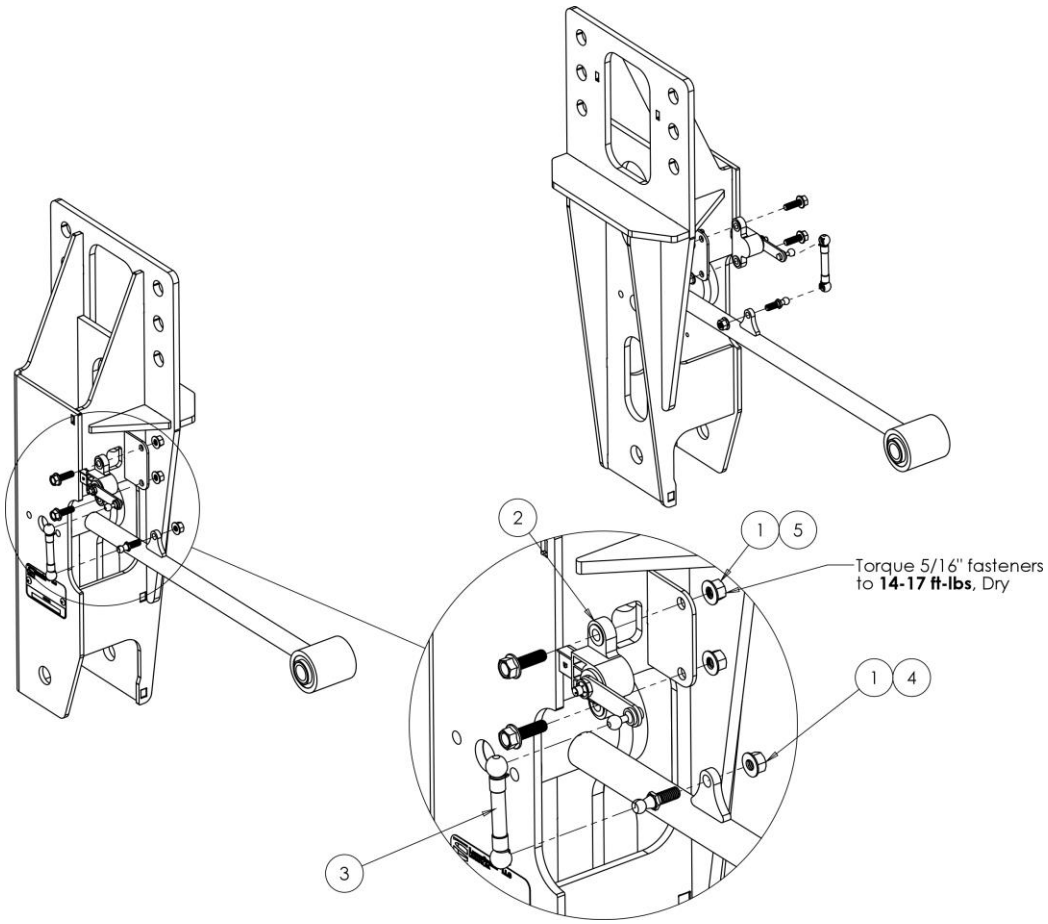
CAUTION: Make sure the hose is not chafing or in contact with any sharp edges.

7. 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.
8. Open the bleed screw slightly to relieve any residual pressure.
9. After pressure is relieved, close the bleed screw and torque to **13-18 ft-lbs.**
10. 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.

11. Remove the plug from the hose end.
12. Attach the hose end to the fitting in the port marked "L". Torque to **12 ft-lbs. Do not over tighten.**
13. Repeat with the opposite side.
14. Attach the hose end to the fitting in the port marked "R". Torque to **12 ft-lbs. Do not over tighten.**
15. 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	Height Sensor Assembly	5	4	10886-100	HFB 5/16-18 x 1" Gr 8
3	2	10587-006	Linkage Assembly, 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. **Install rod end clips as shown.**

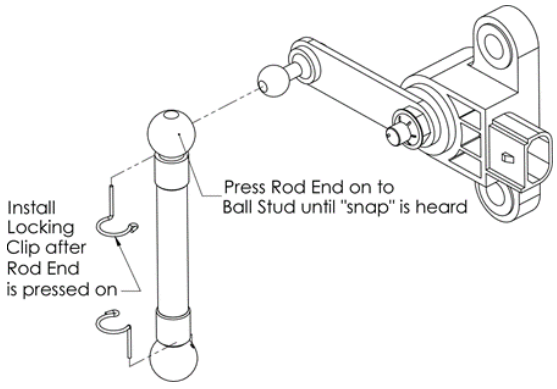
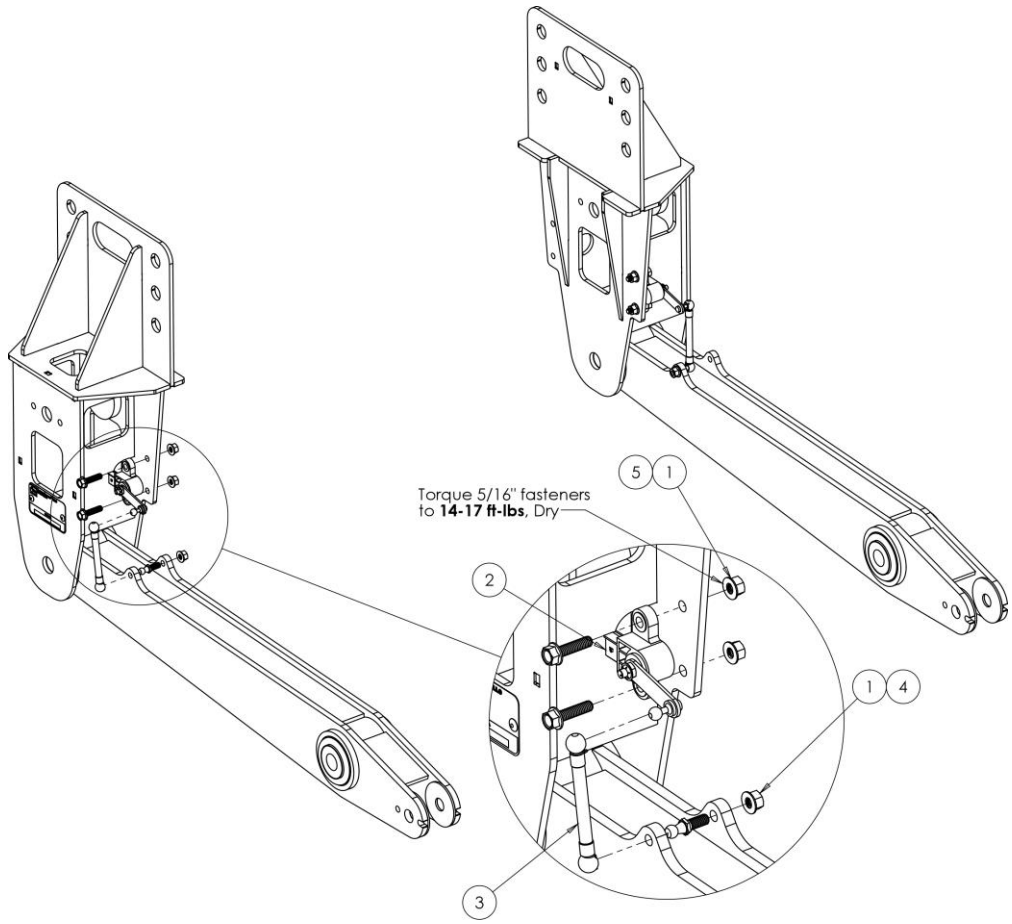


Figure 33. Height Sensor Linkage Installation.

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

Height Sensors – DS135F650SR-SHR



ITEM	QTY	PART NUMBER	DESCRIPTION
1	6	10012-010	LFN 5/16-18 Gr G
2	2	10586-001	Height Sensor Assembly
3	2	10587-006	Linkage Assembly, 3.938" SS
4	2	10591-003	Ball Stud, 5/16-18 x .75L
5	4	10886-100	HFB 5/16-18 x 1" Gr 8

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

6. Locate the Height Sensor, Linkage Assembly, and Ball Stud.
7. 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.**
8. 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.**
9. Snap the Linkage Assembly to the ball stud attached to the lower control arm and to the ball stud on the Height Sensor arm. **Install rod end clips as shown.**

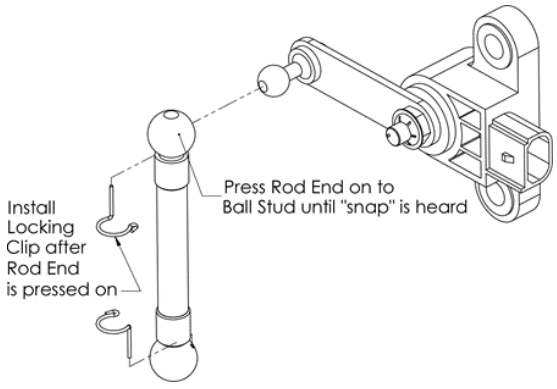
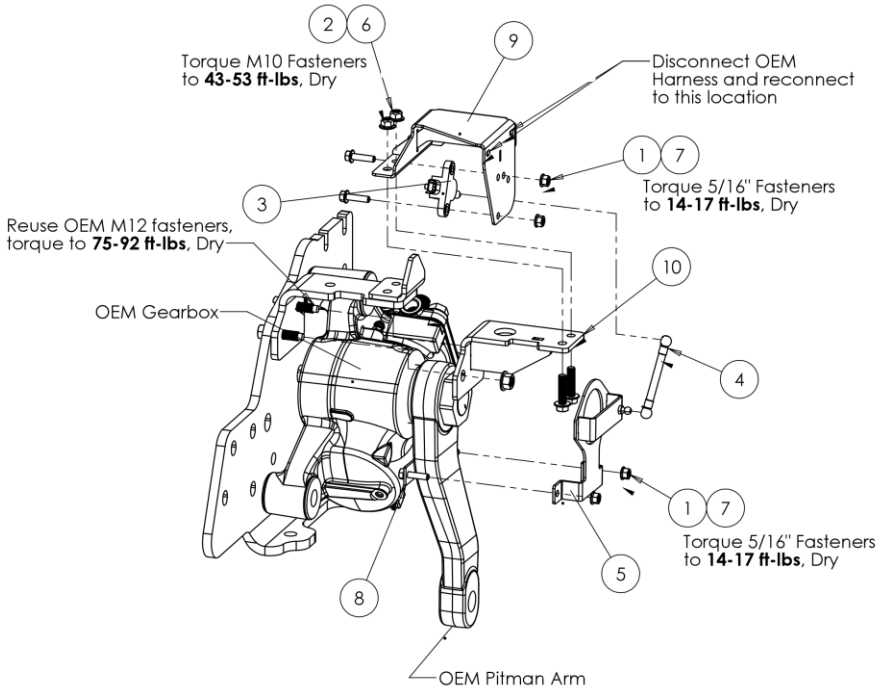


Figure 34. Height Sensor Linkage Installation.

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

Steering Sensor



ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10012-010	LFN 5/16-18 Gr G	6	2	10873-002	LFN M10-1.5 CL 10.9
2	2	10502-002	HFB M10-1.5 x 40 CL 10.9	7	4	10886-125	HFB 5/16-18 x 1-1/4" Gr 8
3	1	10586-002	Steering Sensor	8	1	10904-026	Pitman Arm Mount Strap
4	1	10587-006	Linkage, 3.938" SS	9	1	10904-034	Steering Sensor Mount
5	1	10733-005	Pitman Arm Bracket	10	1	11451-001	Frame Reinforcement Bracket

1. Raise vehicle hood and locate the steering gearbox.
2. Slip the Pitman Arm Bracket over the OEM pitman arm attachment nut. Secure the Bracket to the OEM pitman arm using the Pitman Arm Strap and 5/16-18 fasteners. Torque to **14-17 ft-lbs**.
3. Locate the OEM wire harness directly above the gearbox and beside the hood mount.
4. Disconnect the wire harness from the OEM bracket. See Figure 35.
5. Remove the two OEM nuts attaching the OEM harness bracket to the frame mount as shown in Figure 36. The hood strut can be disconnected if necessary. Remove the two captured OEM bolts, and the OEM harness bracket.
6. Remove the two M12 nuts holding the frame mount to the frame, but do not remove OEM frame mount or M12 bolts.
7. Slide Frame Reinforcement Bracket under the OEM frame mount, and re-install the M12 nuts.

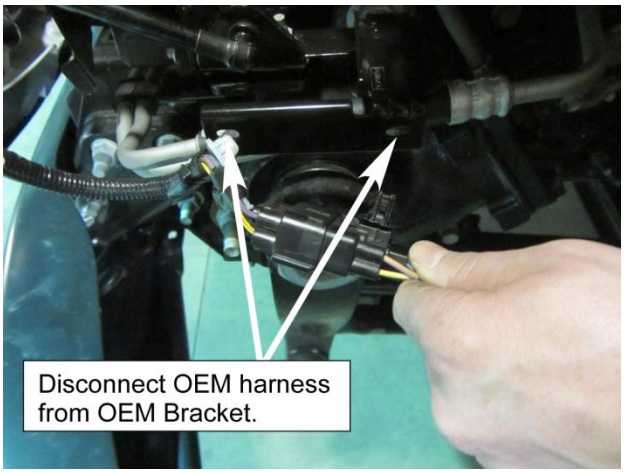


Figure 35. OEM Harness above Steering Gearbox.

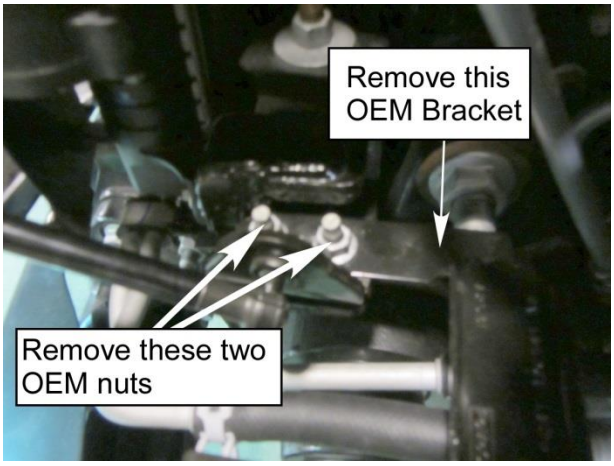


Figure 36. OEM Bracket to be removed.

8. Locate the Steering Sensor and Linkage. Attach the linkage to the steering sensor and install the lock to the end attached to the steering sensor arm.

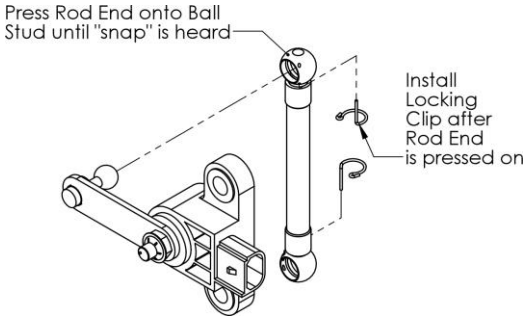


Figure 37. Steering sensor linkage attachment.

9. Locate the Steering Sensor Mount.
10. Attach the Steering Sensor to the Mount using the 5/16" fasteners. Use the center hole, see Figure 38 for reference. Torque to **14-17 ft-lbs.**
11. Attach the Steering Sensor Mount to the OEM chassis on top of the OEM hood strut mount using the M10 nuts provided. Torque to **58-71 Nm (43-53 ft-lbs).**
12. Torque the OEM frame bracket M12 fasteners to **102-125 N-m (75-92 ft-lbs).**
13. Attach the linkage to the pitman arm bracket.
14. Before installing the clip, check that the steering sensor arm is approximately 90° with respect to the steering sensor body. Use the adjustment holes as necessary to bring the sensor arm close to 90°. Refer to Figure 37 and Figure 38 for reference.
15. Reattach the OEM cable to the holes provided in the Steering Sensor Mount.

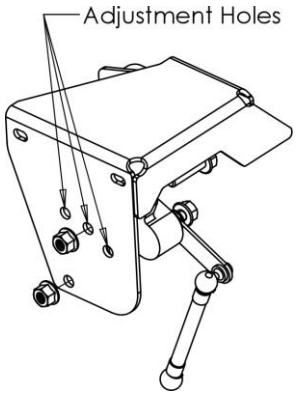


Figure 38. Steering sensor attachment.

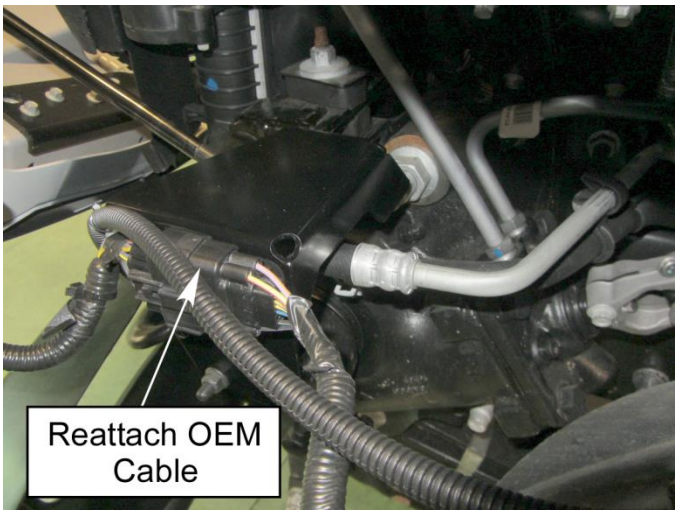


Figure 39. Reinstallation of OEM harness

Wiring

External Electrical Installation:

1. Locate the External Electrical Harness attached to the power module.
2. Unroll the wiring harness and using the External Electrical Harness wiring diagram, found in the electrical schematics section, and identify the connection ends.
3. Locate the trunk containing Height Sensor (J21 and J22) and the Rate Valve (J23 and J24) connections.
4. Route and make the following connections to the Height Sensors.

J21	→	Left Height Sensor
J22	→	Right Height Sensor

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

J23	→	Left Rate Valve
J24	→	Right Rate Valve

6. Secure harness to frame, cross-members, etc. as necessary. Use of the down clips or clamps is recommended.
7. Locate the 8ga wire ground ring terminal, J30, branch near the power module.
8. Locate and drill Ø1/4" hole in frame. Remove frame coating(s) as needed to ensure metal-to-metal contact between the ring terminal and frame.
9. Attach the ground ring terminal, J30, to the chassis frame for grounding. Sealant may be applied after ring terminal is secured.
10. Route the remaining trunk (containing blunt wires and steering sensor connector) towards the firewall. Secure to OEM wiring harness.
11. Locate the existing firewall access hole under the dash, behind the brake pedal and just above the OEM customer access upfitter wiring.
12. Route the wiring harness branch containing the (8) 18ga blunt wires inside the cab through the firewall access hole.

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

Figure 40. OEM Upfitter Driver Side Terminal Connection instruction.

Important: Do not connect to passenger side battery.

Dash Electrical Harness Installation:

1. Locate the dash harness.
2. Locate and identify the following 18ga wires in the external wiring harness branch passed through the firewall:
   Red (Battery Power)
   Yellow (Ignition)
   Black (Ground)
   White (CAN High)
   White/Black (CAN Low)
   Violet/White (Speed)
   Pink/Black (Brake)
   Yellow/Black (Park)
3. Connect each wire to the corresponding wire in the dash harness using appropriate butt splices. Match wire colors. Heat shrink sealing is optional.

Figure 41. Accessing inside of side kick panel.

4. Remove outboard side kick panel.
5. Locate dash harness.
6. (Ground) Attach ring terminal J32 to ground screw.

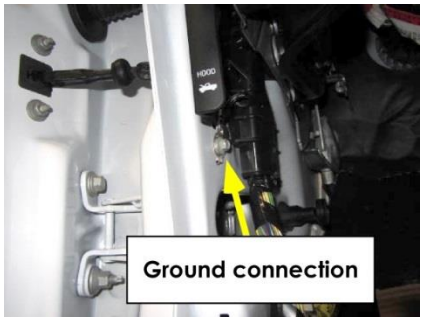


Figure 42. Location of ground connection.

7. Locate the OEM customer access upfitter wiring, under the dash, behind the brake pedal. See Figure 43.

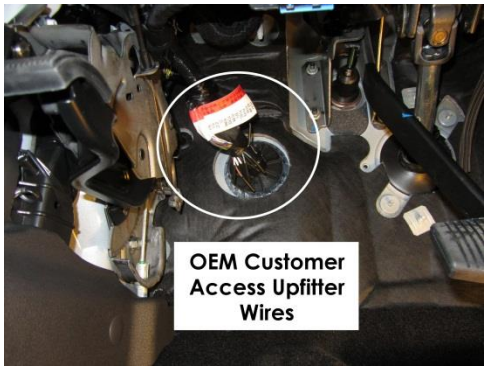


Figure 43. Customer Access wires.

8. Remove some of the electrical tape to reveal the blunt-cut wires, if necessary.
9. For each of the following connections, strip the end and use the appropriate butt splice to crimp the LiquidSpring dash harness to OEM Upfitter wires.

LiquidSpring Dash Wire	→	**OEM Upfitter Wire**
Speed Violet/White	→	*VS-OUT* Violet/Orange
Ignition Yellow	→	*RUN/ACC* Yellow/Grey
*Park** Yellow/Black	→	*Ground**
Brake Pink/Black	→	*BRAKE* Blue/Orange
Battery Power Red	→	*Trailer Brake Power* Brown/Red

*Park (Yellow/Black) wire must be connected to ground.

10. Replace the driver side plastic kick panel.

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 Compressible 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.

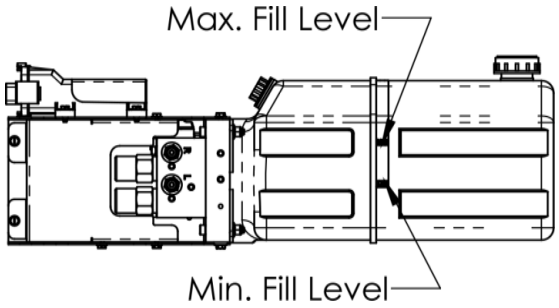


Figure 44. Final fill fluid level.

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.

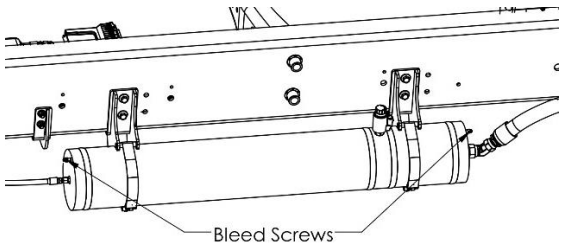


Figure 45. Bleed screw locations.

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).

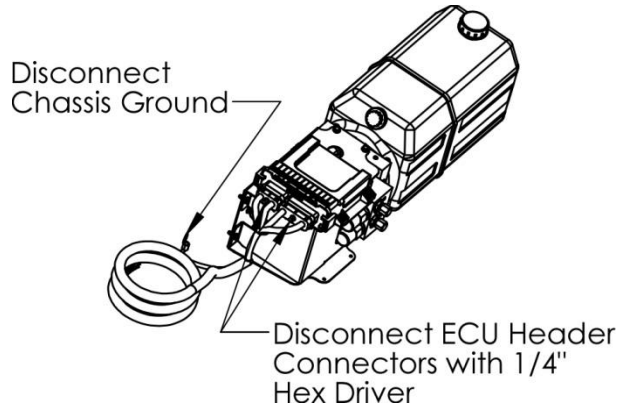
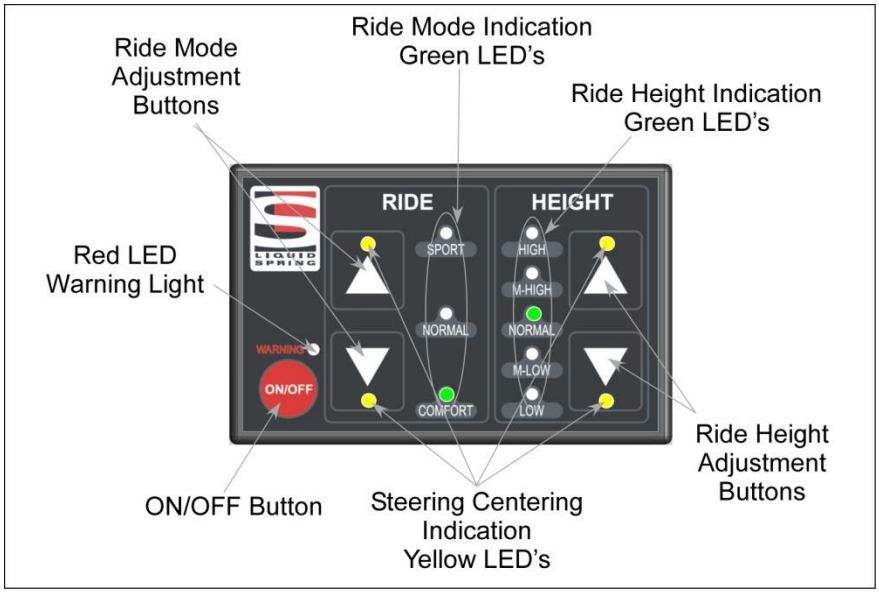


Figure 46. ECU disconnects prior to welding on chassis.

System Operation



System Start Up:

1. In most instances, the suspension system can be left alone to operate automatically.
2. 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.
3. 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.
4. 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 60 minutes 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 45.

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.

1. **Comfort Mode** provides a smooth, soft ride. Use for normal city and highway driving.
2. **Sport Mode** provides more "feel" or response to the road conditions. Use where road conditions or personal preference demand more control.
3. **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).

1. 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.

2. Two solid green LEDs will be lit if the current height is not the selected height and height adjustment is not occurring.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.

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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.

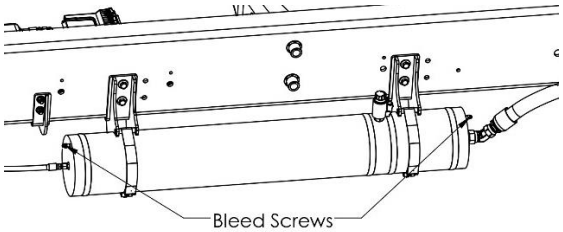

Figure 47. Bleed screw locations.

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.

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3. Press and release the Red ON/OFF button on the driver display. All LEDs on the driver display should go out.
4. Press and release the Red ON/OFF button again. The LEDs on the driver display should all flash and then only the four yellow arrow LEDs, one green ride mode indicator LED, and one green ride height indicator LED should remain lit.
5. Press and hold both Ride Height Adjustment Buttons simultaneously until the SPORT, COMFORT, HIGH, and LOW green LED's begin to flash.
6. As soon as the four green LED's begin to flash, press the ON/OFF button to stop the process.
7. Verify that the four yellow arrow LED's are lit.
8. Steering calibration is completed.

Calibrating the System (Full)

See Section *Calibrating the System*, on page 29

Checking Fluid Level

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

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

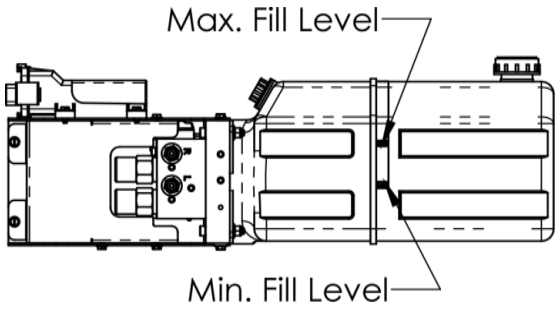


Figure 48. Final fill fluid level.

5. To add fluid, remove filler/breather cap on reservoir.
6. Locate a container of Compressible Fluid.
7. Add fluid to the reservoir until the fluid level is within the band shown in Figure 48.
8. Replace filler/breather cap and retighten.

Checking Fittings for Leaks

WARNING: The system operates under high fluid pressure (up to 4000 psi). Do not attempt to locate leaks by feeling with hands or any part of the body. High pressure fluids can penetrate the skin and cause severe tissue damage.

1. While system is at ride height and pressurized, visually examine fittings and hose connections for any source of leaks. Do not use hands to search for leak. If the source of the leak is a fitting or other component, depressurize the system and repair or replace as needed.
2. Tighten hose nuts if the leak is coming from the connection between the hose nut and a fitting. Depressurize the system before tightening anything. Replace hose if the leak is coming from anywhere else on the hose.

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

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

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

Service Intervals

Once Daily or Before Each Shift of Usage

- Check the suspension system to be sure it is fully operational.
    - After starting vehicle, verify all LED's on the driver display flash briefly, then the Green Ride Height and Ride Mode LED's are lit and the Red Warning LED does not stay on or flash.
    - Verify the four Yellow LED's are lit when the steering wheel is centered.
    - Verify that they system is at NORMAL ride height, with a steady green LED.
        - If the Driver Display indicates a blinking ride height LED, allow the system to complete leveling as indicated by a steady green LED.
        - If LOW or HIGH height is shown with a solid green LED, use the arrow buttons to raise or lower the suspension to NORMAL height.
- Visually inspect struts, hoses, and fittings for signs of leakage.
    - For leakage resulting in fluid pooled on the floor greater than 1" in diameter, it is recommended to service the system immediately.
    - For signs of leakage or weeping that results in wetness on components or a single drop, it is recommended to monitor the leak and schedule repair service accordingly.

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

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

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

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

Troubleshooting

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

Driver Interface Lights	Condition	Cause	Correction
Warning + RIDE: SPORT	Battery Voltage in excess of 16VDC	Vehicle charging system providing incorrect voltage.	Inspect and replace as necessary.
		LiquidSpring system not connected to 12VDC electrical system	Inspect and replace as necessary
Warning + RIDE: NORMAL	Pump Motor runs in excess of 3 minutes	See *Issues with Vehicle Raising/Pump Section*	See *Issues with Vehicle Raising/Pump Section*
Warning + RIDE: COMFORT	Battery Voltage below 9 VDC	Vehicle charging system providing incorrect voltage	Inspect and replace as necessary
		80A fuse blown / Loss of battery voltage on circuit W25	Inspect / Repair Replace as necessary
Warning + HEIGHT: HIGH	Issue with Right 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

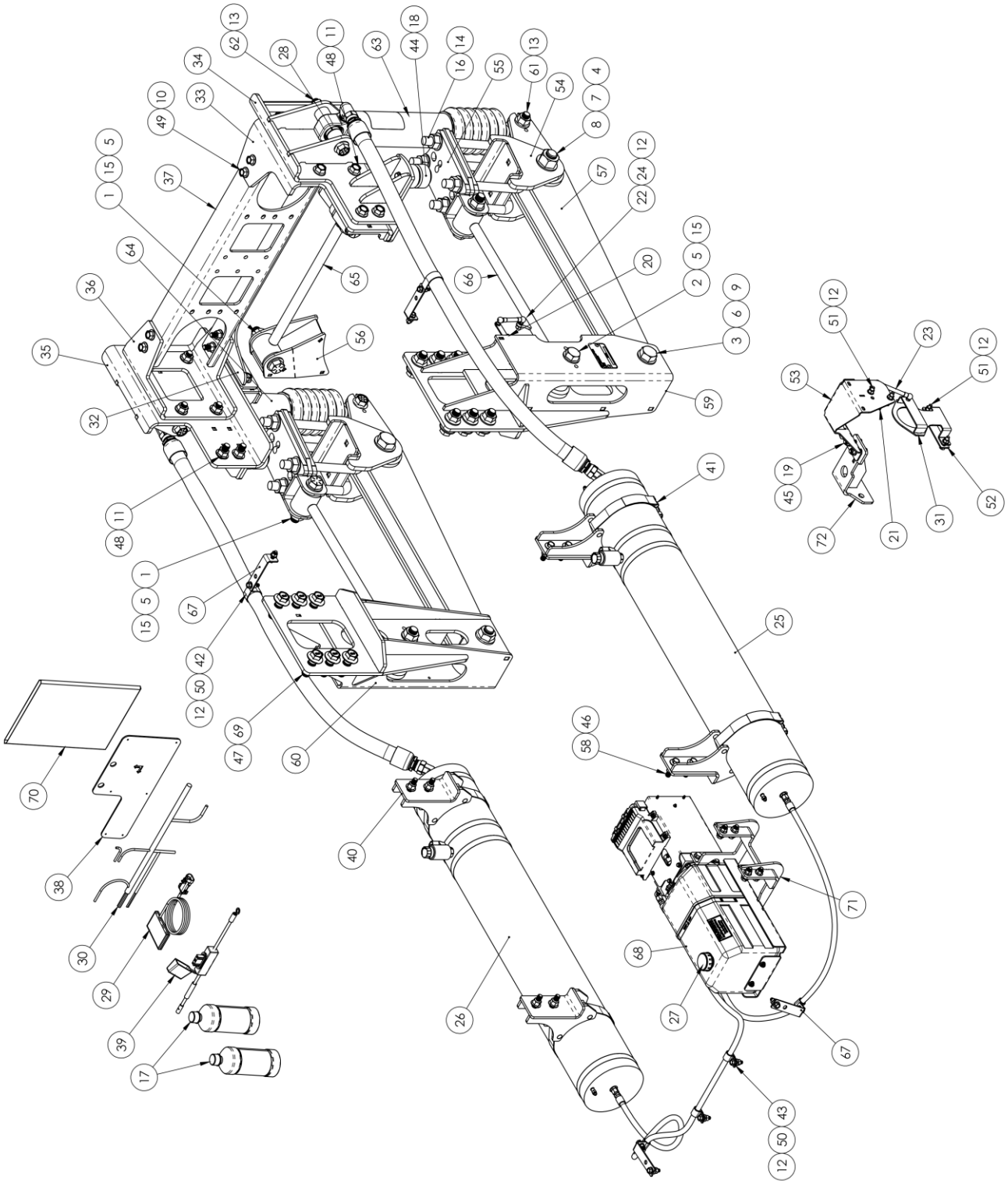
Condition	Cause	Correction
Hydraulic Leak	Weld failure between cylinder and end	Replace strut
	Cylinder fracture	Replace strut
	Threads stripped between cylinder and gland	Replace strut
	Seals worn out	Replace strut
	Rod severely scratched or dented	Replace strut
	Fitting loose	Tighten or replace fittings
	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

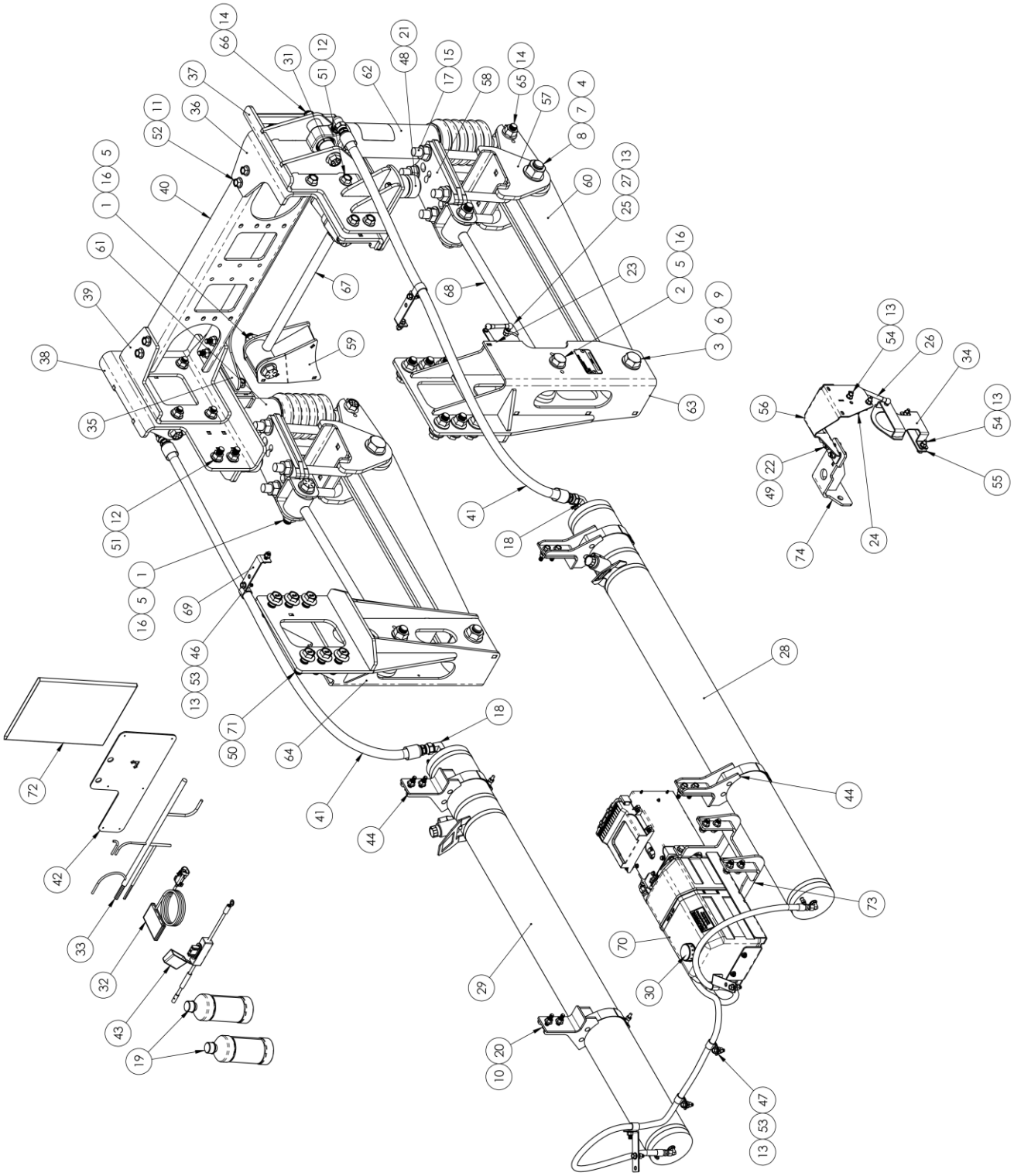
Appendix A: Part Identification:

DS190F650SR-SHB



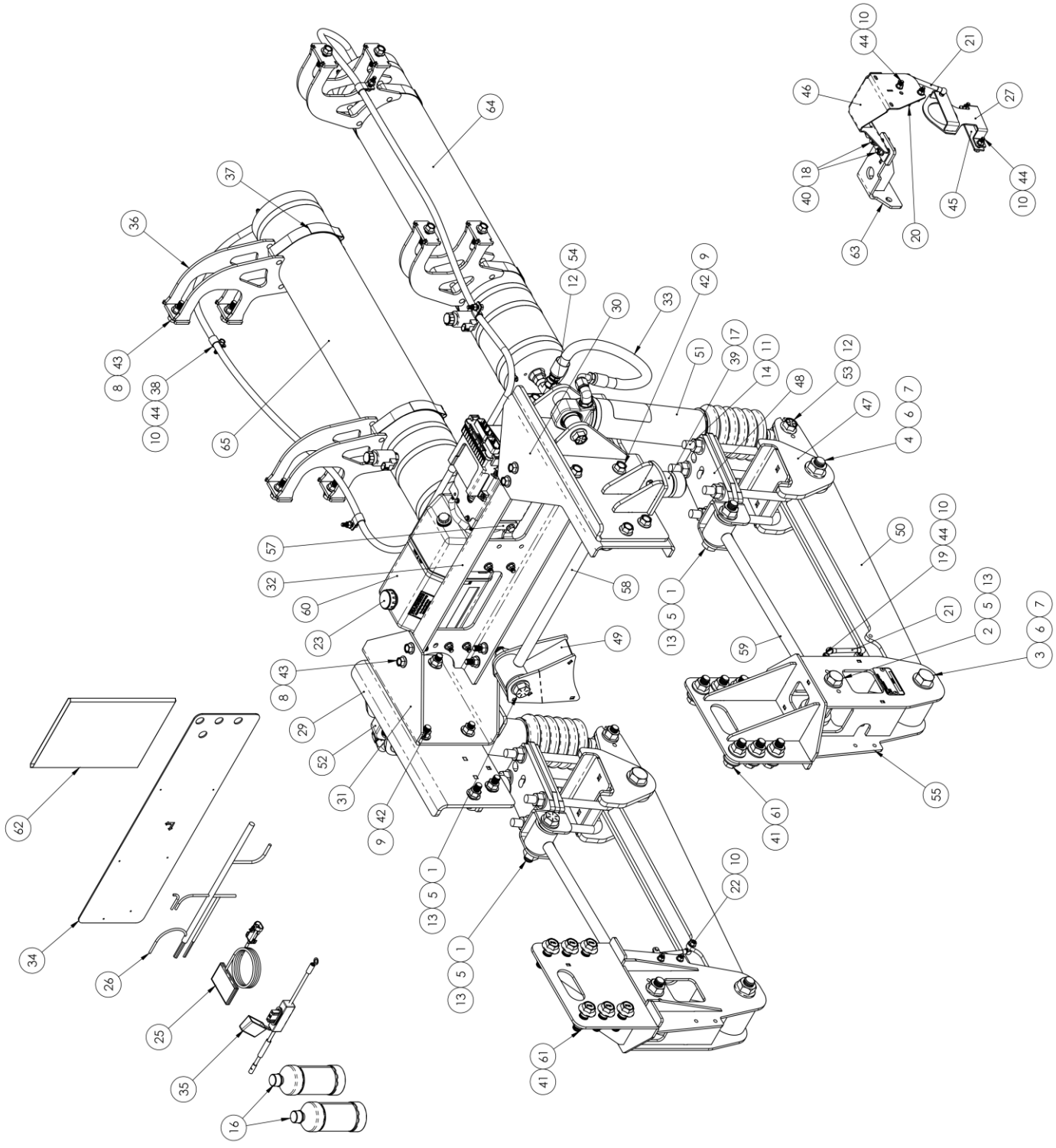
DS190F650SR-SHB							
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10002-500	HCS 7/8”-9 x 5” Gr. 8	37	1	10796-016	Crossmember Channel
2	2	10002-600	HCS 7/8”-9 x 6” Gr. 8	38	1	10811-024	Frame Drilling Template
3	2	10003-003	HB 1”-8 x 6” Gr. 8	39	1	10815-001	Wiring Harness, Fused Battery Lead
4	2	10004-014	LHN 1-1/8”-7 Gr. C	40	4	10830-022	Volume Mount
5	6	10006-003	HFW 7/8”	41	4	10843-004	T-Bolt Clamp
6	2	10006-004	HFW 1”	42	2	10855-001	Vinyl-Coated Loop Clamp, 1.5" ID
7	4	10006-005	HFW 1-1/8”	43	4	10867-003	Vinyl-Coated Loop Clamp, 5/8" ID
8	2	10008-003	HCS 1-1/8”-7 x 6-1/2” Gr. 8	44	2	10873-002	Jounce Bumper
9	2	10012-003	LFN 1”-8, Gr. G	45	2	10873-004	LFN M10-1.5, CL 10.9
10	12	10012-007	LFN ½”-13, Gr. G	46	8	10874-200	LFN M12-1.75, CL 10.9
11	12	10012-008	LFN 5/8”-11 Gr G	47	12	10873-005	LFN M20-2.5, CL 10.9
12	20	10012-010	LFN 5/16”-18, Gr. G	48	12	10874-200	HFB 5/8”-11 x 2" Gr 8
13	4	10012-014	LFN ¾”-16, Gr. G	49	12	10885-175	HFB ½”-13 x 1-1/2, Gr. 8
14	8	10012-016	LFN 7/8”-14, Gr. G	50	14	10886-100	HFB 5/16”-18 x 1”, Gr. 8
15	6	10012-017	LFN 7/8”-9, Gr. G	51	4	10886-125	HFB 5/16”-18 x 1-1/4 Grade 8
16	4	10064-008	U-Bolt 7/8-14 x 8-15/16 Tri-8	52	1	10904-026	Pitman Arm Mount Strap
17	2	10474-001	Compressible Fluid, 16 oz. Bottle	53	1	10904-034	Steering Sensor Mount
18	2	10502-001	HFB M10-1.5 x 30 CL 10.9	54	2	10947-014	Lower Axle Connection
19	2	10502-002	HFB M10-1.5 x 40 CL 10.9	55	2	10949-007	Upper Axle Connection
20	2	10586-001	Height Sensor	56	1	10951-009	Axle Mount
21	1	10586-002	Steering Sensor	57	2	10953-009	Lower Control Arm
22	2	10587-005	Linkage	58	8	11012-045	HFB M12-1.75x45 CL 10.9
23	1	10587-006	Linkage, 3.938" SS	59	1	11083-006	Hanger, LH
24	2	10591-003	Ball Stud 5/16-18 x 3/4” L	60	1	11084-012	Hanger, RH
25	1	10597-095	Volume Assembly, LH	61	2	11102-400	HFB 3/4-10 x 4 Gr 8
26	1	10597-096	Volume Assembly, RH	62	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
27	1	10614-001	Cap, Filler/Breather	63	1	11177-007	Strut Assembly, RH
28	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	64	1	11177-008	Strut Assembly, LH
29	1	10680-001	Driver Interface	65	1	11198-005	Track Rod
30	1	10704-003	Wiring Harness, Dash	66	2	11198-007	Upper Control Arm
31	1	10733-005	Pitman Arm Bracket	67	4	11263-004	Hose Bracket
32	1	10782-006	Crossmember Reinforcement	68	1	11287-003	Power Module Assembly
33	1	10789-020	Track Rod Mount	69	12	11366-060	HFB M20-2.5x60 CL 10.9
34	1	10790-037	Upper Strut Mount LH	70	1	11373	Kit, Documents, F650SR-SHB
35	1	10790-038	Upper Strut Mount RH	71	1	11380	Kit, Power Module Mount
36	1	10795-017	Crossmember, End Channel	72	1	11451-001	Frame Reinforcement Bracket

DS135F650SR-SHF



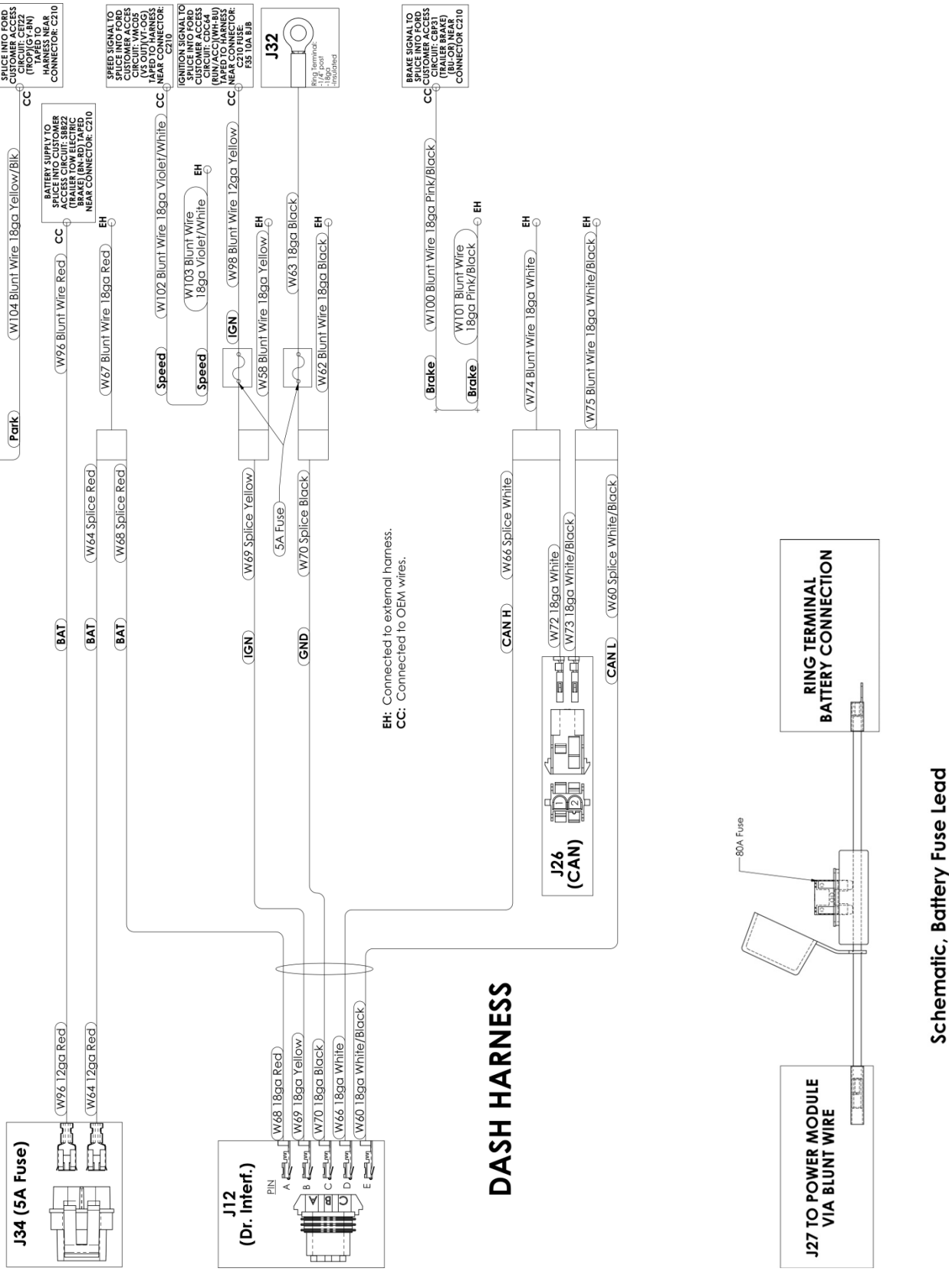
DS135F650SR-SHF							
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10002-500	HCS 7/8”-9 x 5” Gr. 8	38	1	10790-038	Upper Strut Mount RH
2	2	10002-600	HCS 7/8”-9 x 6” Gr. 8	39	1	10795-017	Crossmember, End Channel
3	2	10003-003	HB 1”-8 x 6” Gr. 8	40	1	10796-016	Crossmember Channel
4	2	10004-014	LHN 1-1/8”-7 Gr. C	41	2	10810-002	Hydraulic Hose, -10 x 55-5/8”
5	6	10006-003	HFW 7/8”	42	1	10811-024	Frame Drilling Template
6	2	10006-004	HFW 1”	43	1	10815-001	Wiring Harness, Fused Battery Lead
7	4	10006-005	HFW 1-1/8”	44	4	10830-013	Volume Mount
8	2	10008-003	HCS 1-1/8”-7 x 6-1/2” Gr. 8	45	4	10843-003	T-Bolt Clamp
9	2	10012-003	LFN 1”-8, Gr. G	46	2	10855-002	Vinyl-Coated Loop Clamp, 1” ID
10	8	10012-005	LFN 3/8”-16, Gr. G	47	4	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
11	12	10012-007	LFN ½”-13, Gr. G	48	2	10867-003	Jounce Bumper
12	12	10012-008	LFN 5/8”-11 Gr G	49	2	10873-002	LFN M10-1.5, CL 10.9
13	20	10012-010	LFN 5/16”-18, Gr. G	50	12	10873-005	LFN M20-2.5, CL 10.9
14	4	10012-014	LFN ¾”-16, Gr. G	51	12	10874-200	HFB 5/8”-11 x 2" Gr 8
15	8	10012-016	LFN 7/8”-14, Gr. G	52	12	10885-175	HFB ½”-13 x 1-3/4, Gr. 8
16	6	10012-017	LFN 7/8”-9, Gr. G	53	14	10886-100	HFB 5/16”-18 x 1”, Gr. 8
17	4	10064-008	U-Bolt 7/8-14 x 8-15/16 Tri-8	54	4	10886-125	HFB 5/16”-18 x 1-1/4” Gr. 8
18	2	10322-010	Hyd. Fitting 90, -10 37 x -10 37 F	55	1	10904-026	Pitman Arm Mount Strap
19	2	10474-001	Compressible Fluid, 16 oz. Bottle	56	1	10904-034	Steering Sensor Mount
20	8	10501-150	HFB 3/8”-16 x 1.5”, Gr. 8	57	2	10947-014	Lower Axle Connection
21	2	10502-001	HFB M10-1.5 x 30 CL 10.9	58	2	10949-007	Upper Axle Connection
22	2	10502-002	HFB M10-1.5 x 40 CL 10.9	59	1	10951-009	Axle Mount
23	2	10586-001	Height Sensor	60	2	10953-009	Lower Control Arm
24	1	10586-002	Steering Sensor	61	1	11057-003	Strut Assembly, RH
25	2	10587-005	Linkage	62	1	11057-004	Strut Assembly, LH
26	1	10587-006	Linkage, 3.938" SS	63	1	11083-006	Front Hanger, LH
27	2	10591-003	Ball Stud 5/16-18 x 3/4” L	64	1	11084-012	Front Hanger, RH
28	1	10597-095	Volume Assembly, LH	65	2	11102-400	HFB 3/4-10 x 4 Gr 8
29	1	10597-096	Volume Assembly, RH	66	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
30	1	10614-001	Cap, Filler/Breather	67	1	11198-005	Track Rod
31	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	68	2	11198-007	Upper Control Arm
32	1	10680-001	Driver Interface	69	4	11263-004	Hose Bracket
33	1	10704-003	Wiring Harness, Dash	70	1	11287-003	Power Module Assembly
34	1	10733-005	Pitman Arm Bracket	71	12	11366-060	HFB M20-2.5x60 CL 10.9
35	1	10782-006	Crossmember Reinforcement	72	1	11373	Kit, Documents, F650SR
36	1	10789-020	Track Rod Mount	73	1	11380	Kit, Power Module Mount
37	1	10790-037	Upper Strut Mount LH	74	1	11451-001	Frame Reinforcement Bracket

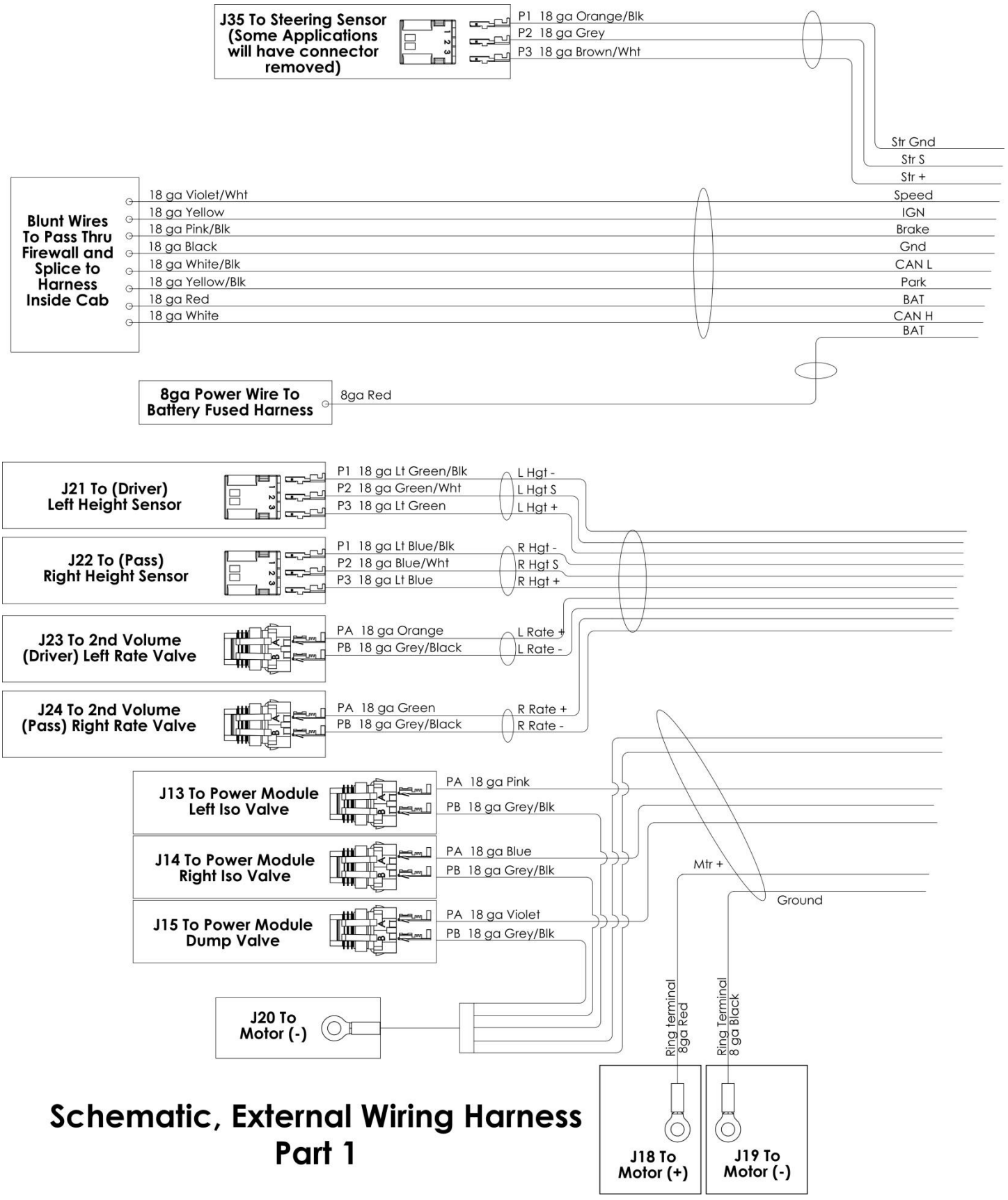
DS135F650SR-SHR



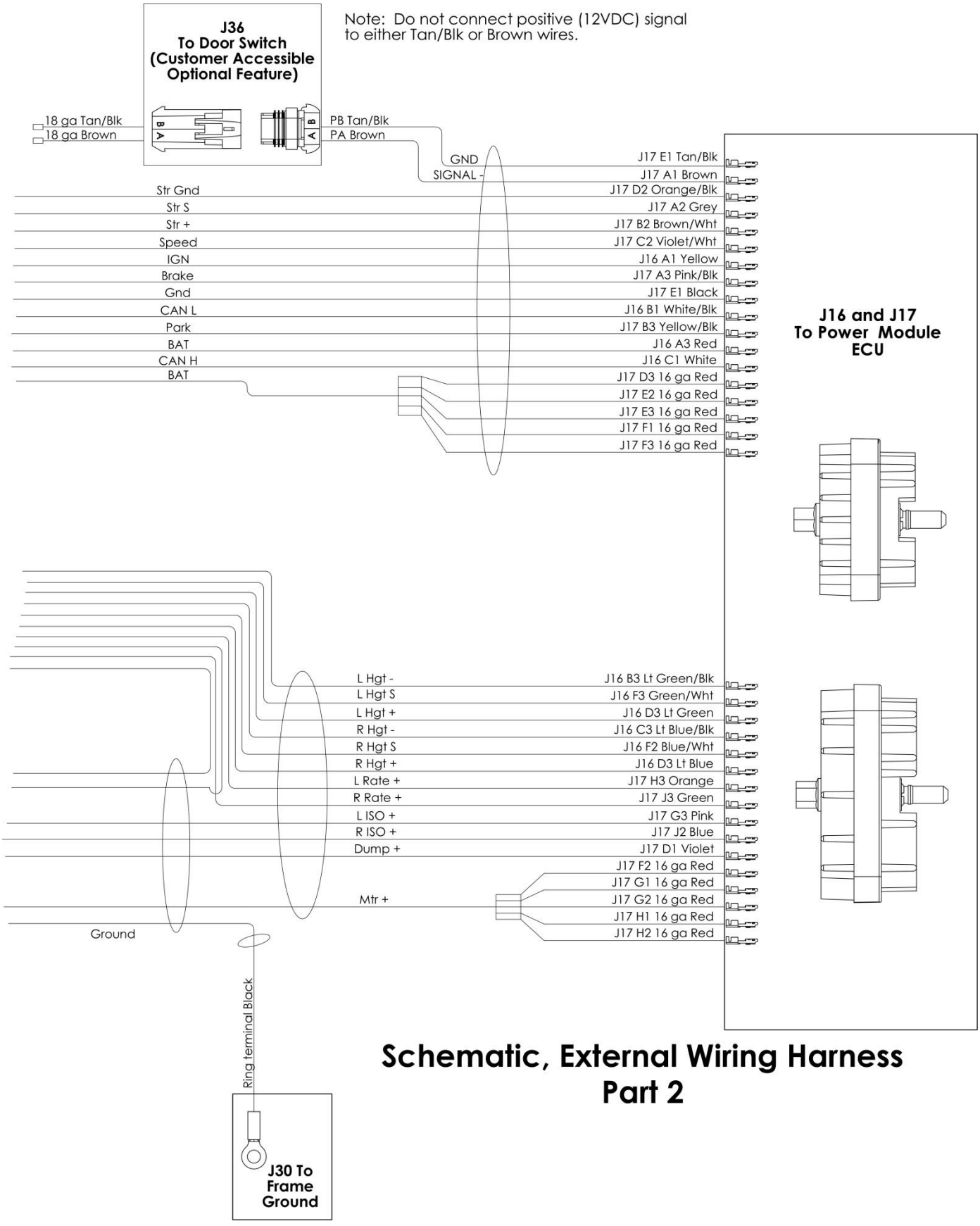
DS135F650SR-SHR							
ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	10002-500	HCS 7/8”-9 x 5” Gr. 8	34	1	10811-027	Frame Drilling Template
2	2	10002-600	HCS 7/8”-9 x 6” Gr. 8	35	1	10815-001	Wiring Harness, Fused Battery Lead
3	2	10003-003	HCS 1”-8 x 6” Gr. 8	36	4	10830-027	Volume Mount
4	2	10003-004	HB 1”-8 x 6.5” Gr. 8	37	4	10843-004	T-Bolt Clamp
5	6	10006-003	HFW 7/8”	38	4	10855-003	Vinyl-Coated Loop Clamp, 5/8" ID
6	4	10006-004	HFW 1”	39	2	10867-003	Jounce Bumper
7	4	10012-003	LFN 1”-8, Gr. G	40	2	10873-002	LFN M10-1.5, CL 10.9
8	16	10012-007	LFN ½”-13, Gr. G	41	12	10873-005	LFN M20-2.5, CL 10.9
9	12	10012-008	LFN 5/8”-11 Gr G	42	12	10874-200	HFB 5/8”-11 x 2" Gr 8
10	14	10012-010	LFN 5/16”-18, Gr. G	43	16	10885-175	HFB ½”-13 x 1-3/4, Gr. 8
11	8	10012-012	LFN ¾”-16, Gr. G	44	12	10886-125	HFB 5/16”-18 x 1-1/4” Gr. 8
12	4	10012-014	LFN ¾”-10, Gr. G	45	1	10904-026	Pitman Arm Mount Strap
13	6	10012-017	LFN 7/8”-9, Gr. G	46	1	10904-034	Steering Sensor Mount
14	4	10064-008	U-Bolt 3/4-16 x 9.03 Tri-8	47	2	10947-005	Lower Axle Connection
15	2	10322-010	Hyd. Fitting 90, -10 37 x -10 37 F	48	2	10949-006	Upper Axle Connection
16	1	10474-001	Compressible Fluid, 16 oz. Bottle	49	1	10951-009	Axle Mount
17	2	10502-001	HFB M10-1.5 x 30 CL 10.9	50	2	10953-011	Lower Control Arm
18	2	10502-002	HFB M10-1.5 x 40 CL 10.9	51	1	11057-003	Strut Assembly, RH
19	2	10586-001	Height Sensor	52	1	11057-004	Strut Assembly, LH
20	1	10586-002	Steering Sensor	53	2	11102-400	HFB 3/4-10 x 4 Gr 8
21	3	10587-006	Linkage, 3.938" SS	54	2	11102-650	HFB 3/4-10 x 6-1/2 Gr 8
22	2	10591-003	Ball Stud 5/16-18 x 3/4” L	55	1	11004-004	Front Hanger, LH
23	1	10614-001	Cap, Filler/Breather	56	1	11105-004	Front Hanger, RH
24	8	10640-005	Bearing Spacer, 1.24 x .812 x .318	57	1	11109	Kit, Power Module Mount
25	1	10680-001	Driver Interface	58	1	11198-005	Track Rod
26	1	10704-003	Wiring Harness, Dash	59	2	11198-008	Upper Control Arm
27	1	10733-005	Pitman Arm Bracket	60	1	11287-003	Power Module Assembly
28	1	10790-020	Upper Strut Mount, LH	61	12	11366-060	HFB M20-2.5x60 CL 10.9
29	1	10790-021	Upper Strut Mount, RH	62	1	11373	Kit, Documents, F650SR
30	1	10795-018	Crossmember Mount, RH	63	1	11451-001	Frame Reinforcement Bracket
31	1	10795-019	Crossmember Mount, LH	64	1	11462-001	Volume Assembly, LH
32	1	10796-007	Crossmember Channel	65	1	11462-002	Volume Assembly, RH
33	2	10810-007	Hydraulic Hose, -10 x 25-3/16”				

Appendix B: Electrical Schematics





Schematic, External Wiring Harness Part 1



Schematic, External Wiring Harness Part 2

Appendix C: Frame Drilling Locations

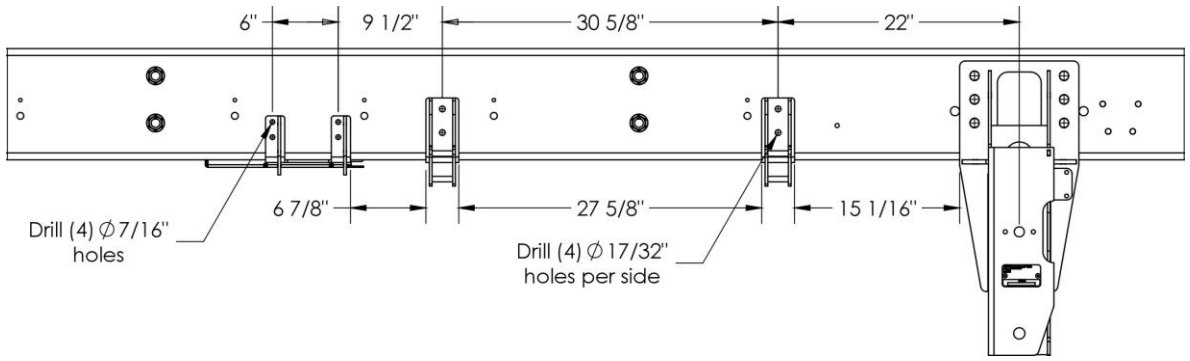


Figure 49. DS190F650SR-SHB Recommended Volume and PM Frame Drilling Locations (Driver Side)

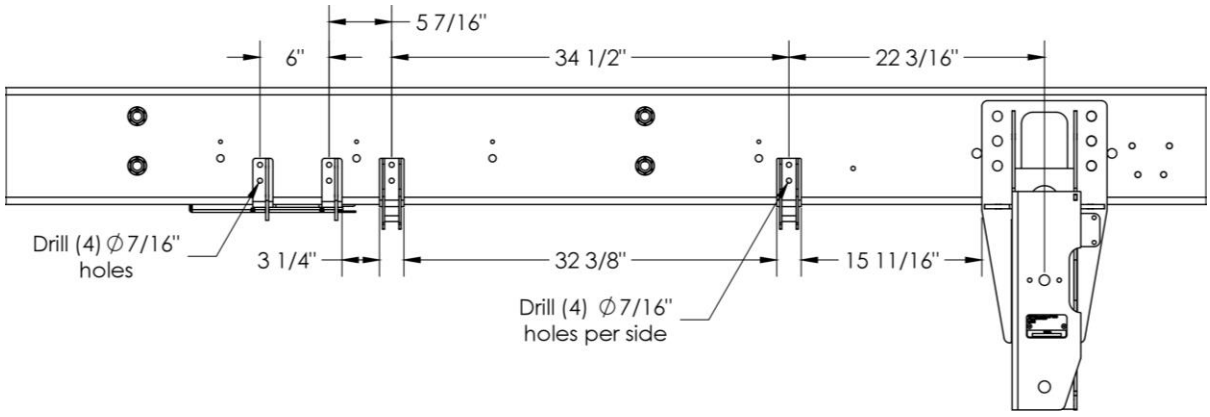


Figure 50. DS135F650SR-SHF Recommended Volume and PM Frame Drilling Locations (Driver Side)

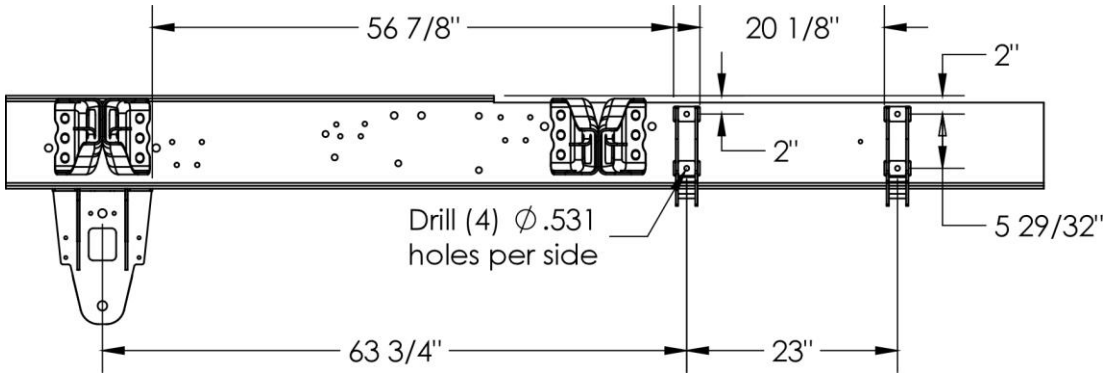


Figure 51. DS135F650SR-SHR Recommended Volume and PM Frame Drilling Locations (Pass Side Inside Frame)

LiquidSpring™ LLC
3416 Rascal Drive
Lafayette, IN 47909

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

CLASS® Product Limited Warranty

LIQUIDSPRING™ LLC
3416 RASCAL DRIVE
LAFAYETTE, IN 47909
PH: 765-474-7816, FAX: 765-474-7826
WWW.LIQUIDSPRING.COM

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

Coverage

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

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

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

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

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

Labor – 12 Months

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

Claims

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

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

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

Limitations and Exclusions

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

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

CLASS® Product Limited Warranty

LIQUIDSPRING™ LLC
3416 RASCAL DRIVE
LAFAYETTE, IN 47909
PH: 765-474-7816, FAX: 765-474-7826
WWW.LIQUIDSPRING.COM

Warranty Labor Coverage

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

(FOR ANY COMPONENT(s) NOT LISTED ABOVE, THE ALLOWABLE LABOR HOURS MUST BE APPROVED BY **LIQUIDSPRING LLC.** PRIOR TO THE WORK BEING PREFORMED.)

*LABOR HOURS BASED ON $85.00 PER HOUR.

*LABOR FOR DIAGNOSIS WILL NOT BE COVERED WITHOUT PRIOR CONSENT FROM **LIQUIDSPRING LLC.**

**0.50hr. FOR FIRST VALVE REMOVAL 0.25hr. FOR EACH ADDITIONAL

Obtaining Warranty Parts

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

Contact LiquidSpring LLC

Customer Service Dept. - Phone: 765-474-7816 (option #1) Email: Service@liquidspring.com

Installation Check List

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

FRAME PREPARATION:
☐Battery Disconnected
☐Upper Strut Mount, Volume, and Power Module Mount holes drilled.

FRONT HANGER INSTALLATION:
☐Front Hangers are level with framerail.
☐M20-2.5 Nuts torqued to **364-445 ft-lbs**.

AXLE CLAMP INSTALLATION:
☐7/8”-14 U-Bolts torqued in stages up to **450 ft-lbs**.
☐3/4”-16 U-Bolts torqued in stages up to **300 ft-lbs**. (DS135F650SR-SHR)
☐Re-attached OEM bolts and brake lines.

CONTROL ARMS INSTALLATION:
☐Control Arms correctly orientated.
☐1-1/8”-7 Nuts torqued to **800-850 ft-lbs**, at ride height.
☐1”-8 Nuts torqued to **600 ft-lbs**, at ride height.
☐7/8”-9 Nuts torqued to **491-600 ft-lbs**, at ride height.

UPPER STRUT MOUNT/ CROSSMEMBER/TRACK ROD FRAME MOUNT*:*
☐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**.
☐Lower Cross Member oriented correctly.
☐Lower Cross Member shimmed as needed.
☐1/2”-13 Nuts torqued to **86-105 ft-lbs**.
☐M10-1.5 Jounce Bumper bolts torqued to **35 ft-lbs**.

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

AXLE PREPARATION:
☐Axle is centered with respect to frame.
☐Track Rod Mount Welded to Axle

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

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

POWER MODULE/SECONDARY VOLUME INSTALLATION:
☐3/8”-16 Screws torqued to **35 ft-lbs**, manifold.
☐3/8”-16 Bolts torqued to **35-43 ft-lbs**, Power Module Mount.
☐Reservoir Mount Self Tapping Screws tightened to **snug only**.
☐M12 bolts, volume mounts, torqued to **75-92 ft-lbs**. (DS190F650SR-SHB)

☐1/2”-13 bolts, volume mounts, torqued to **86-105 ft-lbs**. (DS135F650SR-SHR)
☐3/8”-16 bolts, volume mounts, torqued to **35-43 ft-lbs**. (DS135F650SR-SHF)
☐5/16”-24 T-bolt Clamp Fasteners torqued to **240 in-lbs**.

HOSE INSTALLATION:
☐-4 Fittings torqued to **12 ft-lbs.**
☐-10 Fittings torqued to **36-63 ft-lbs.** (DS135F650SR)
☐-16 Fittings torqued to **65-88 ft-lbs.** (DS190F650SR)
☐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:
☐M10 Nuts torqued to **42-52 ft-lbs**.
☐5/16”-18 screws tightened to **14-17 in-lbs**.
☐Linkage Locks 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 dash harness connected under dash to Blue/Orange Upfitter Wire.
☐Speed signal from dash harness connected under dash to Violet/Orange Upfitter Wire.
☐Ignition signal from dash harness connected under dash to Yellow/Grey Upfitter Wire.
☐Power from dash harness connected under dash to Brown/Red Upfitter Wire.
☐Park signal from dash harness connected under dash to Grey/Brown Upfitter Wire.
☐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.